YASKAWA

ANTAIOS
Frequently Asked Questions

ANT1000/1001 | Revision 1.11

Liability Exclusion

We have tested the contents of this document regarding agreement with the hardware and software described. Nevertheless, there may be deviations and we do not guarantee complete agreement. The data in the document is tested periodically, however. Required corrections are included in subsequent versions. We gratefully accept suggestions for improvements.

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1 Software

1.1 General

1.1.1 How big is the processing power of the ARM Cortex A5 processor?

The processing power is 461 DMIPS (Dhrystone MIPS).

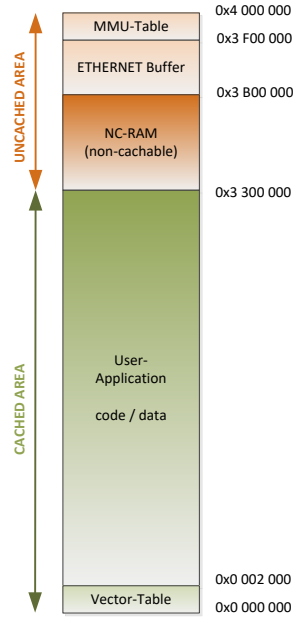
1.1.2 QSPI Flash Layout

Table 1-1 QSPI Flash layout

Description	Size (kB)	4kB Sectors	Sector	Address Range	
				Start	End
Bootheader Flash Config Boot Loader 2	8	2	0	0x000000	0x001FFF
Boot Loader 3	16	4	2	0x002000	0x005FFF
Mx File - MAC addresses - …	4	1	6	0x006000	0x006FFF
Remanent Data	60	15	7	0x007000	0x015FFF
Firmware Backup	1940	485	22	0x016000	0x1FAFFF
Firmware	1940	485	507	0x1FB000	0x3DFFFF
File System (JFFS 2)	128	32	992	0x3E0000	0x3FFFFF

1.1.3 DDR2-Memory Layout (64Mbyte)

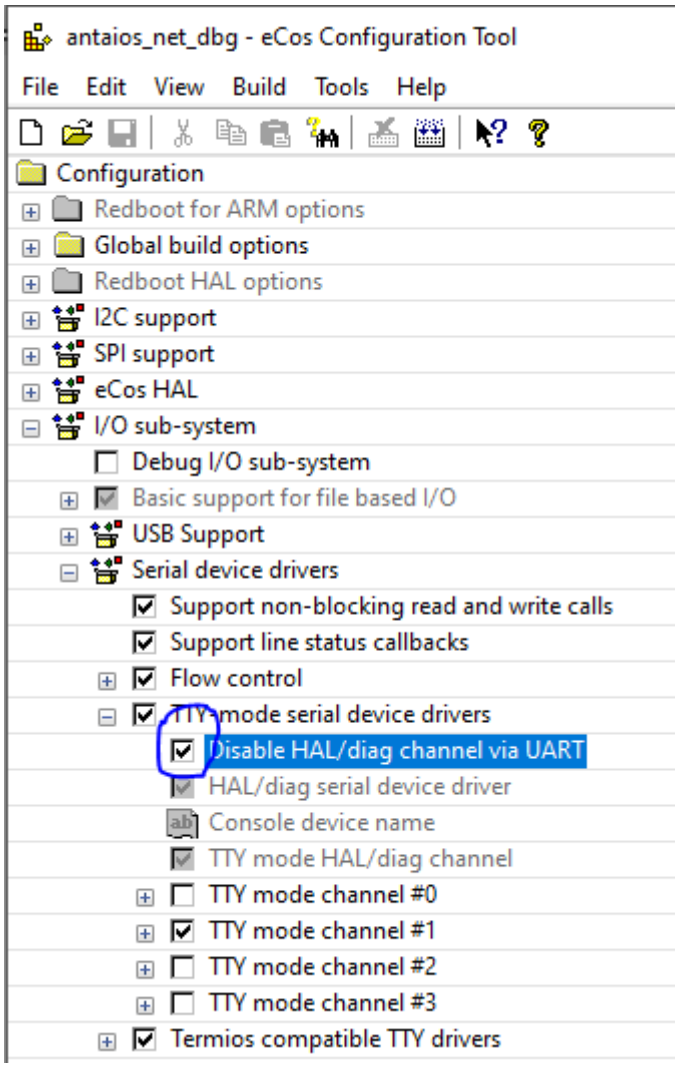
Figure 1-1 DDR2-Memory Layout



1.2 eCos

1.2.1 How to disable eCos diag channel via UART?

Figure 1-2 eCos disable HAL/diag channel via UART



1.3 PROFINET

1.3.1 PROFINET Device

1.3.1.1 Is the PROFINET Device software stack free of charge?

Yes, profichip is allowed to provide a binary library of the Molex PROFINET Device SDK.

Table 1-2 PROFINET Device software packages

Order-Code	Product description	Price
PAAS1121	PROFINET IO RT/IRT device functions, binary, limitation: 12 slots	free
PAAS1122	PROFINET IO RT/IRT device functions, source code	licence

1.3.1.2 Is Dynamic Frame Package (DFP) supported?

The ANTAIOS is ready to support this functionality, but the current software version doesn't support it.

1.3.1.3 Occupied Flash memory size?

Table 1-3 PROFINET Occupied Flash memory size

Block	Used Size	Size (kB)	4kB Sectors	Sector	Address Range	
					Start	End
Boot Loader	**24 kB**	24	6	0	0x000000	0x005FFF
Mx File	**< 512 byte**	4	1	6	0x006000	0x006FFF
Remanent Data	**3 kB**	60	15	7	0x007000	0x015FFF
Firmware Backup	**1 MB**	1940	485	22	0x016000	0x1FAFFF
Firmware	**1 MB**	1940	485	507	0x1FB000	0x3DFFFF
File System	**not used**	128	32	992	0x3E0000	0x3FFFFF

1.3.1.4 Occupied DDR2 memory size?

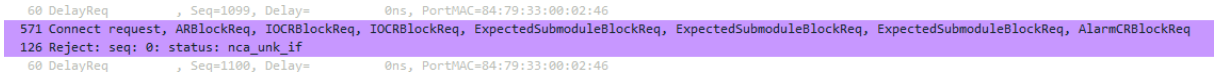
Table 1-4 PROFINET Occupied DDR2 memory size

Block	Used Size	Size (kB)	Address Range	
			Start	End
User - Application	**< 2,5 MB**	53477376	0x0 000 000	0x3 2FF FFF
NC - RAM	**< 150 kB**	8388608	0x3 300 000	0x3 AFF FFF
Ethernet Buffer	**1 MB**	4194304	0x3 B00 000	0x3 EFF FFF
MMU-Table	**16 kB**	1048576	0x3 F00 000	0x3 FFF FFF

1.3.1.5 Connect.req answers with Reject (nca_unk_if)

The Connect.req telegram is answered with Reject (nca_unk_if: unknown interface).

Figure 1-3 Wireshark: Reject (nca_unk_if)



Please check the Object UUID from Connect.req and the settings of Vendor-Id, Device-Id in the PROFINET Device Software and gsdml-file.

Figure 1-4 Wireshark: Connect.req, Object UUID

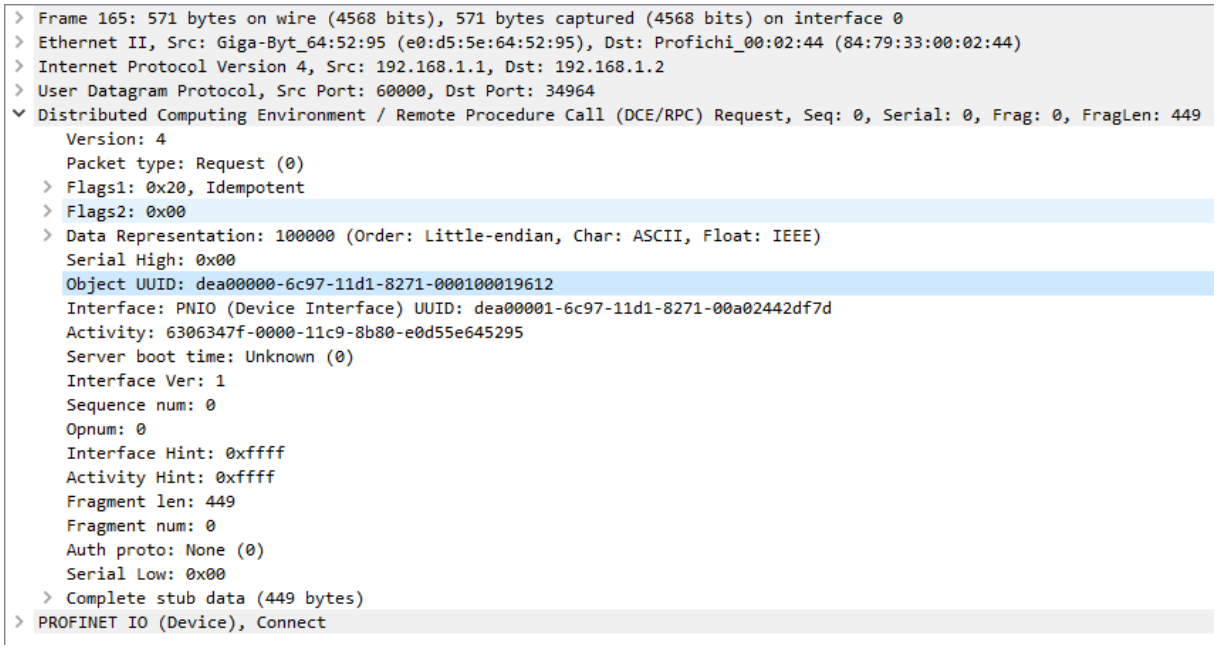


Table 1-5 Structure of Object UUID

Substitution name	Substitution name	Value
PROFINETIOConstantValue		0xDEA00000 0x6C97 0x11D1 0x82 0x71
	PROFINETIOConstantValue Data1	0xDEA00000
	PROFINETIOConstantValue Data2	0x6C97
	PROFINETIOConstantValue Data3	0x11D1
	PROFINETIOConstantValue Data4	0x82 0x71
InstanceID		0x0001
DeviceIdentNumber		0x00019612
	DeviceID	0x0001
	VendorID	0x9612

1.4 EtherCAT

1.4.1 EtherCAT slave

1.4.1.1 Is the EtherCAT slave firmware free of charge?

Yes, the EtherCAT slave stack doesn't generate additional cost. The customer has to register at ETG (EtherCAT User Organization) and can download the EtherCAT slave stack from their webpage. Profichip provides the script to adapt the EtherCAT slave stack to ANTAIOS (see PAAS1120_ECS_Getting_Started.pdf, chapter 1.5 Generating EtherCAT Slave Stack).

1.4.1.2 Occupied Flash memory size?

Table 1-6 EtherCAT Occupied Flash memory size

Block	Used Size	Size (kB)	4kB Sectors	Sector	Address Range	
					Start	End
Boot Loader	**24 kB**	24	6	0	0x000000	0x005FFF
Mx File	**< 512 byte**	4	1	6	0x006000	0x006FFF
Remanent Data	**< 512 byte**	60	15	7	0x007000	0x015FFF
Firmware Backup	**< 700 kB**	1940	485	22	0x016000	0x1FAFFF
Firmware	**< 700 kB**	1940	485	507	0x1FB000	0x3DFFFF
File System	**not used**	128	32	992	0x3E0000	0x3FFFFF

1.4.1.3 Occupied DDR2 memory size?

Table 1-7 EtherCAT Occupied DDR2 memory size

Block	Used Size	Size (kB)	Address Range	
			Start	End
User - Application	**< 1,5 MB**	53477376	0x0 000 000	0x3 2FF FFF
NC - RAM	**< 150 kB**	8388608	0x3 300 000	0x3 AFF FFF
Ethernet Buffer	**not used**	4194304	0x3 B00 000	0x3 EFF FFF
MMU-Table	**16 kB**	1048576	0x3 F00 000	0x3 FFF FFF

1.5 MECHATROLINK-III

1.5.1 Occupied Flash memory size?

Table 1-8 M-III Occupied Flash memory size

Block	Used Size	Size (kB)	4kB Sectors	Sector	Address Range	
					Start	End
Boot Loader	**24 kB**	24	6	0	0x000000	0x005FFF
Mx File	**< 512 byte**	4	1	6	0x006000	0x006FFF
Remanent Data	**not used**	60	15	7	0x007000	0x015FFF
Firmware Backup	**< 256 kB**	1940	485	22	0x016000	0x1FAFFF
Firmware	**< 256 kB**	1940	485	507	0x1FB000	0x3DFFFF
File System	**not used**	128	32	992	0x3E0000	0x3FFFFF

1.5.2 Occupied DDR2 memory size?

Table 1-9 M-III Occupied DDR2 memory size

Block	Used Size	Size (kB)	Address Range	
			Start	End
User - Application	**< 600 kB**	53477376	0x0 000 000	0x3 2FF FFF
NC - RAM	**not used**	8388608	0x3 300 000	0x3 AFF FFF
Ethernet Buffer	**not used**	4194304	0x3 B00 000	0x3 EFF FFF
MMU-Table	**16 kB**	1048576	0x3 F00 000	0x3 FFF FFF

1.6 PROFIBUS

1.6.1 Occupied Flash memory size?

Table 1-10 PROFIBUS Occupied Flash memory size

Block	Used Size	Size (kB)	4kB Sectors	Sector	Address Range	
					Start	End
Boot Loader	**24 kB**	24	6	0	0x000000	0x005FFF
Mx File	**< 512 byte**	4	1	6	0x006000	0x006FFF
Remanent Data	**< 512 byte**	60	15	7	0x007000	0x015FFF
Firmware Backup	**< 256 kB**	1940	485	22	0x016000	0x1FAFFF
Firmware	**< 256 kB**	1940	485	507	0x1FB000	0x3DFFFF
File System	**Not used**	128	32	992	0x3E0000	0x3FFFFF

1.6.2 Occupied DDR2 memory size?

Table 1-11 PROFIBUS Occupied DDR2 memory size

Block	Used Size	Size (kB)	Address Range	
			Start	End
User - Application	**< 512 kB**	53477376	0x0 000 000	0x3 2FF FFF
NC - RAM	**not used**	8388608	0x3 300 000	0x3 AFF FFF
Ethernet Buffer	**not used**	4194304	0x3 B00 000	0x3 EFF FFF
MMU-Table	**16 kB**	1048576	0x3 F00 000	0x3 FFF FFF

2 Hardware

2.1 What are the required external parts?

- Crystal Oscillator 32MHz (fixed frequency, <=50ppm)
- DDR2 SDRAM
- Serial NOR Flash Memory
- Voltage Converter 3V3 (I/O)
- Voltage Converter 1V8 (DDR2 SDRAM)
- Voltage Converter 1V2 (Core)
- Reset Generator

2.2 Crystal oscillator

2.2.1 Remarks

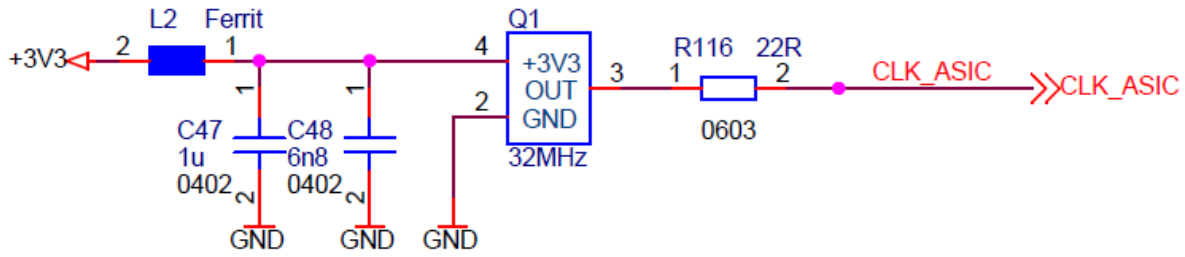
- Use a crystal oscillator for a fixed frequency instead of a programmable one, because of the lower jitter value.

2.2.2 Which Crystal oscillators are specified?

- Seiko Epson SG-310 SCF

2.2.3 Example

Figure 2-1 Example Crystal Oscillator



2.3 Which DDR2 – Memories are qualified?

- Alliance Memory AS4C16M16D2-25BIN (256 Mbit, 1.8 V)
- Intelligent Memory IM5116D2DABG-25I (512 Mbit, 1.8 V)
- Micron MT47H64M16NF-25E:M (1024 Mbit, 1.8 V)
- Nanya Technology NT5TU32M16EG-ACI (512 Mbit, 1.8 V)
- Winbond W9751G6NB-25I (512 Mbit, 1.8 V)
- Winbond W9751G6KB-25I (512 Mbit, 1.8 V), EoL
- Integrated Silicon Solution Inc. IS43DR16640C-25DBLI (1024 Mbit, 1.8 V)

2.4 Which QuadSPI NOR Flash are qualified?

- Adesto AT25SF321B-MHB (32 Mbit, 2.5 V – 3.6 V)
- Cypress (Spansion) S25FL132K0XMFI01 (32 Mbit, 2.7 V – 3.6 V)
- Integrated Silicon Solution IS25LP032D (32 Mbit, 2.3 V – 3.6 V)
- Integrated Silicon Solution IS25LP064A (64 Mbit, 2.3 V – 3.6 V)
- Integrated Silicon Solution IS25LP128-JBLE (128 Mbit, 2.3 V – 3.6 V)
- Macronix MX25L3233FZNI-08G (32 Mbit, 2.65 V – 3.6 V)
- Macronix MX25L6433F (64 Mbit, 2.65 V – 3.6 V)
- Micron N25Q032A13EF640 (32 Mbit, 2.7 V – 3.6 V)
- Winbond W25Q32FVZPIG (32 Mbit, 2.7 V – 3.6 V)

Qualified, but not recommended for new designs:

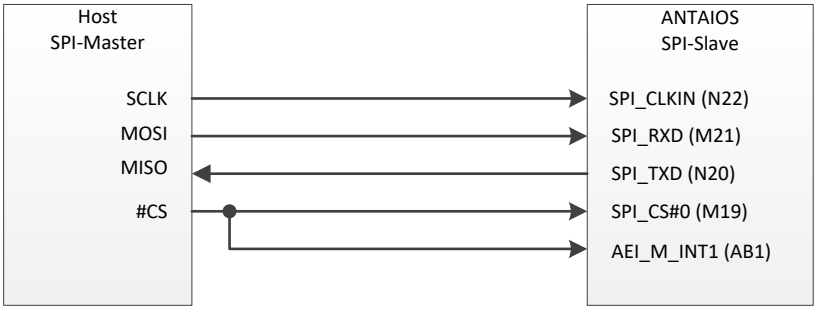
- Adesto AT25SF321-MHD (32 Mbit, 2.5 V – 3.6 V), EoL
- Micron N25Q064A13EF640 (64 Mbit, 2.7 V – 3.6 V), EoL

2.5 Which EEPROMs are qualified?

- CAT24WC64 (64 Kbit, 1.8 V – 6 V)

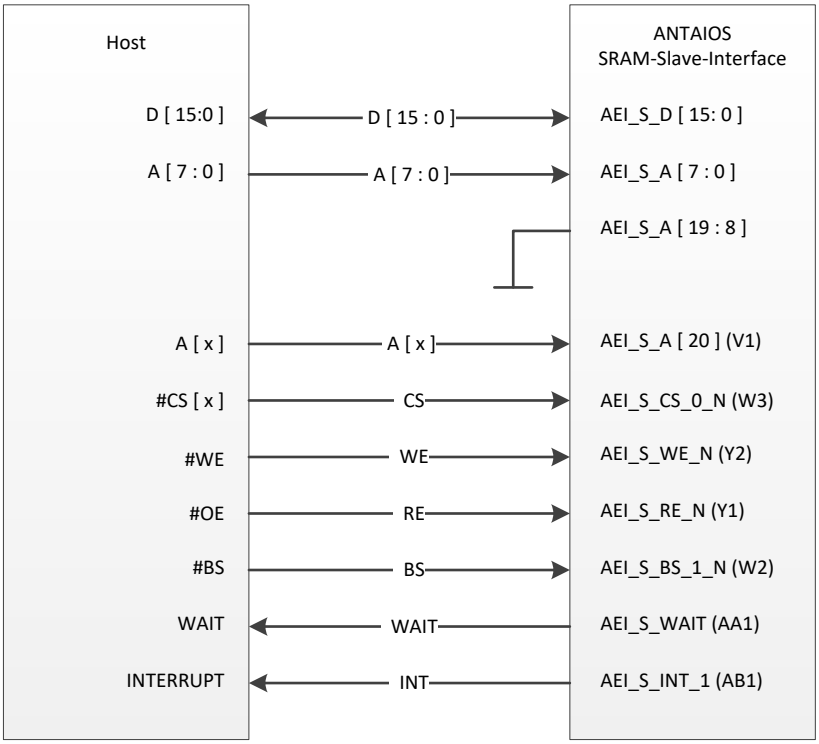
2.6 How to interface Host-Processor with ANTAIOS SPI-Slave interface

Figure 2-2 SPI Host System



2.7 How to interface Host-Processor with ANTAIOS AEI-SRAM Slave interface?

Figure 2-3 SRAM-Slave Host System



AEI_S_A[20]: is used to switch between CI (Consistemcy interface and FIFO (First In, First Out) interface.

- AEI_S_A[20] = 0 → Data_FIFO/IRQ/ Service_Channel;
- AEI_S_A[20] = 1 → CI

2.7.1 AEI slave: read

Figure 2-4 AEI slave – read (word access)

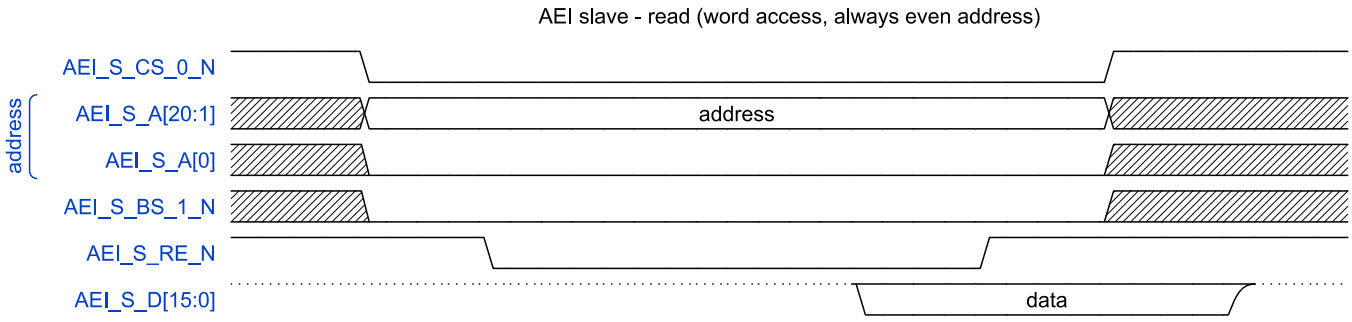


Figure 2-5 AEI slave – read (byte access, even address)

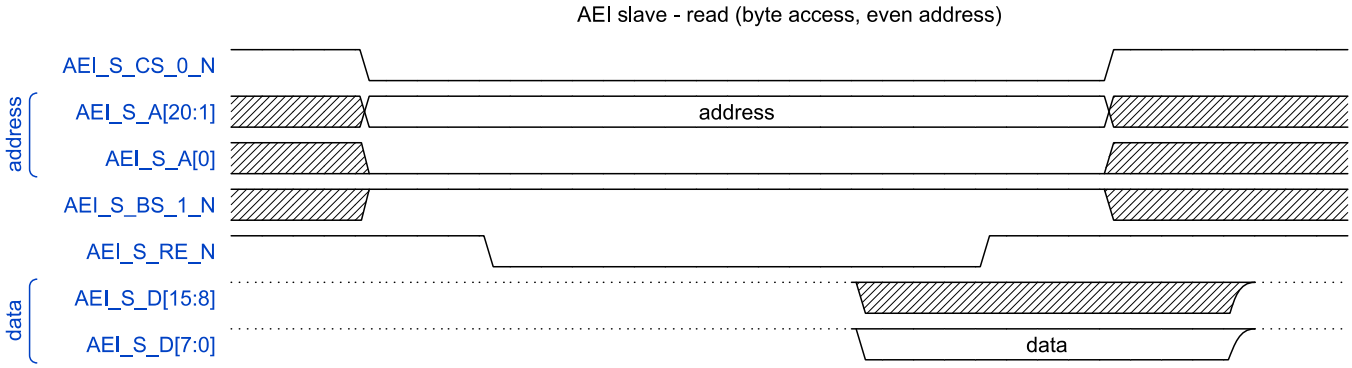
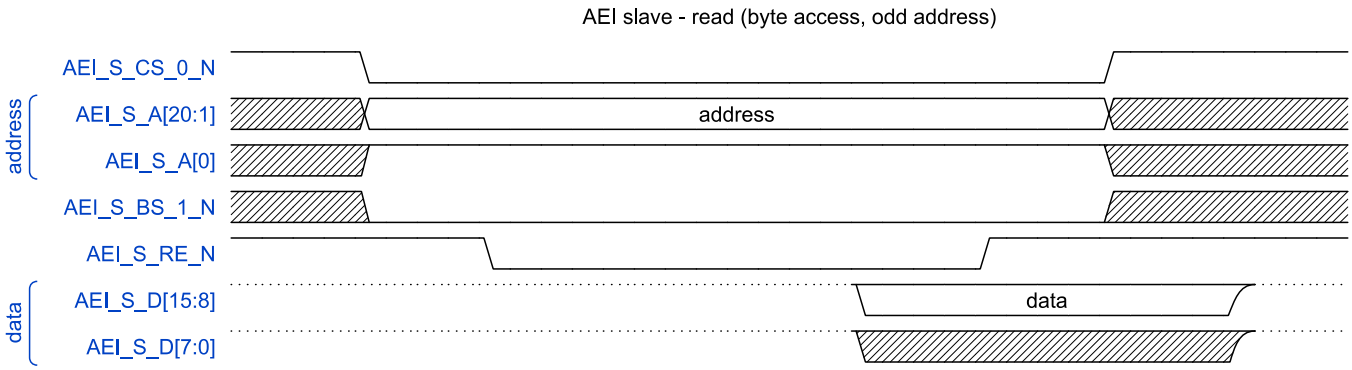


Figure 2-6 AEI slave – read (byte access, odd address)



2.7.2 AEI-slave: write

Figure 2-7 AEI slave – write (word access)

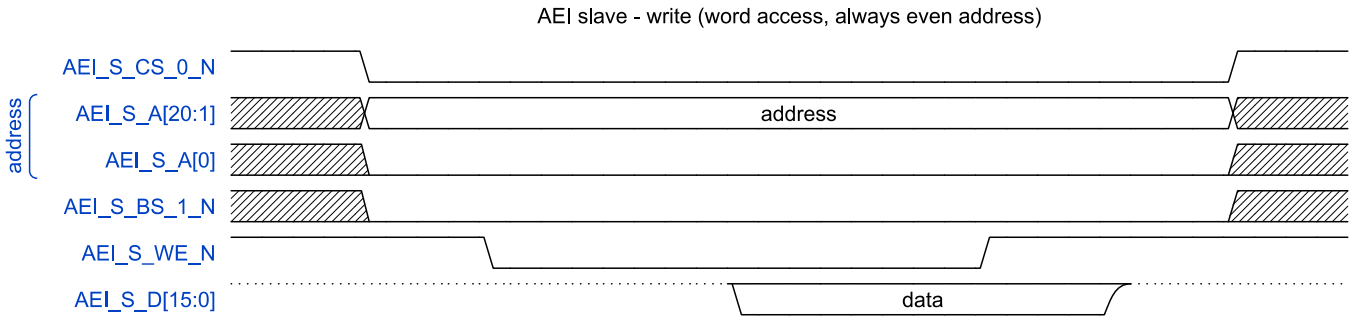


Figure 2-8 AEI slave – write (byte access, even address)

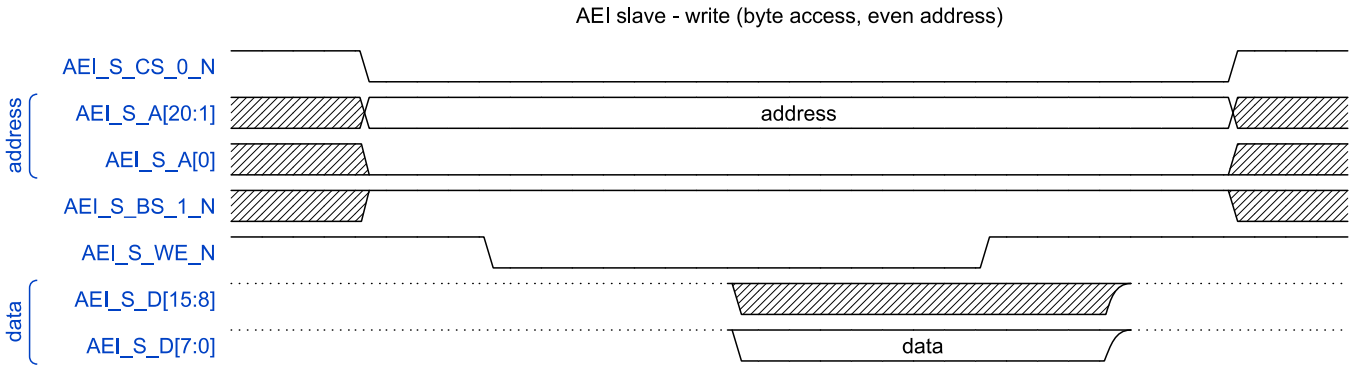
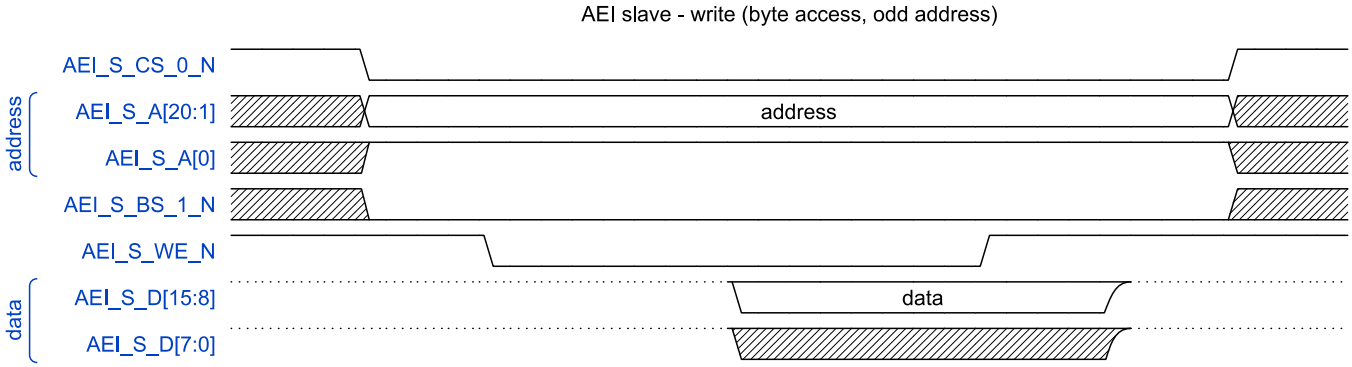


Figure 2-9 AEI slave – write (byte access, odd address)



2.8 Power Consumption

Test Conditions (Very heavy workload, similar to extreme EtherCAT master usage):

- 128 MB DDR-SDRAM
- 2 internal Ethernet PHYs (full utilization)
- 5 PPUs (100 % CPU load)
- ARM (100 % CPU load)

Table 2-1 Power Consumption

Parameter	Ambient Temperature	Voltage Supply	Symbol	Value	Unit
max. chip power dissipation, measured (conditions: w/o air flow and w/o heat sink)	T_A = 85 °C	+5% Voltage	P	1.95	W
max. chip power dissipation, simulated (conditions: junction temperature 125 °C)	worst case process		P	2.2	W

Table 2-2 Current Consumption (measured values)

Parameter	Ambient Temperature	Voltage Supply	Value	Unit
core power supply	T_A = 85 °C	1.26 V	988	mA
IO (LVTTL) power supply		3.47 V	114	mA
SSTL_18 (DDR2) power supply		1.89 V	159	mA

The following chapters give an overview of power consumption depending on different application cases.

2.8.1 PROFINET Device

The PROFINET Device reference platform is specified as follows:

- cycle time 250 µs
- communication via 2 Ethernet ports (PHYs in 100BASE-TX mode)
- PROFINET network with 1 PROFINET Controller and 5 PROFINET Devices
- w/o USB communication
- w/o SliceBus communication
- w/o CAN communication
- w/o PROFIBUS communication
- w/o MMC/SD

Table 2-3 Power Dissipation (PROFINET Device Application)

Parameter	Ambient Temperature	Voltage Supply	Symbol	Value	Unit
chip power dissipation (conditions: w/o air flow and w/o heat sink)	T_A = 85 °C	+5% Voltage	P_{max}	1.62	W
		nominal Voltage	P_{typ}	1.44	W

Additional power dissipation of DDR-SDRAM needs to be considered.

Table 2-4 Current Consumption

Parameter	Ambient Temperature	Voltage Supply	Value	Unit
core power supply	T_A = 85 °C	1.26 V	894	mA
		1.2 V	820	mA
IO (LVTTL) power supply		3.47 V	121	mA
		3.3 V	119	mA
SSTL_18 (DDR2) power supply		1.89 V	37	mA
		1.8 V	34	mA

2.8.2 EtherCAT Slave

The EtherCAT Slave reference platform is specified as follows:

- cycle time 50 µs
- communication via 2 Ethernet ports (PHYs in 100BASE-TX mode)
- EtherCAT network with 1 EtherCAT Master and 4 EtherCAT Slaves
- w/o USB communication
- w/o SliceBus communication
- w/o CAN communication
- w/o PROFIBUS communication
- w/o MMC/SD

Table 2-5 Power Dissipation (EtherCAT Slave Application)

Parameter	Case Temperature	Voltage Supply	Symbol	Value	Unit
chip power dissipation (conditions: with air flow and heat sink)	T_C = 35 °C	+5% Voltage	P_{max}	1.53	W
		nominal Voltage	P_{typ}	1.39	W

Additional power dissipation of DDR-SDRAM needs to be considered.

Table 2-6 Current Consumption

Parameter	Case Temperature	Voltage Supply	Value	Unit
core power supply	T_C = 35 °C	1.26 V	767	mA
		1.2 V	718	mA
IO (LVTTL) power supply		3.47 V	141	mA
		3.3 V	139	mA
SSTL_18 (DDR2) power supply		1.89 V	39	mA
		1.8 V	36	mA

2.9 How to make an own hardware?

2.9.1 Install ANTAIOS documents

Load and install from ftp-server: PAAS1100_BSP_yymmdd.xxxxx.exe

Figure 2-10 Select components

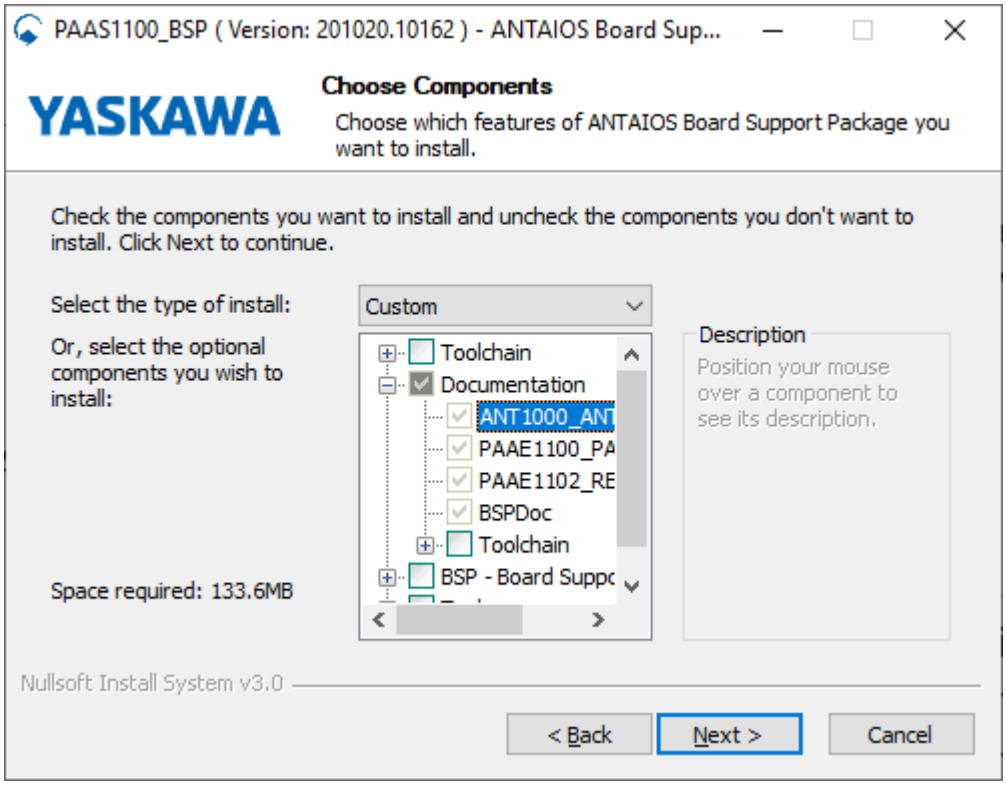
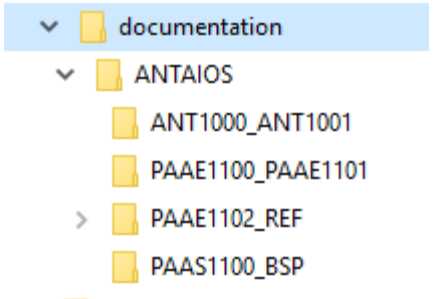


Figure 2-11 Structure of the documentation



2.9.2 Useful documents

ANTAIOS documents:

- .\ANT1000_ANT1001\ANT1000_ANT1001_Datasheet.pdf
- .\ANT1000_ANT1001\ANT1000_ANT1001_User_Manual.pdf
- .\ANT1000_ANT1001\ANTAIOS_FAQ.pdf

ANTAIOS EvaluationBoard:

- .\PAAE1100_PAAE1101\PAAE1100_PAAE1101_EVB_Evaluation_Kit.pdf
- .\PAAE1100_PAAE1101\PAAE1100_5992V10_Mainboard.pdf
- .\PAAE1100_PAAE1101\PAAE1000_5998V10_Coreboard_15x15.pdf
- .\PAAE1100_PAAE1101\PAAE1001_5999V10_Coreboard_19x19.pdf

ANTAIOS reference design:

- .\PAAE1102_REF\proficonnETH.pdf
- .\PAAE1102_REF\BOM_proficonnETH.pdf

2.9.3 Steps

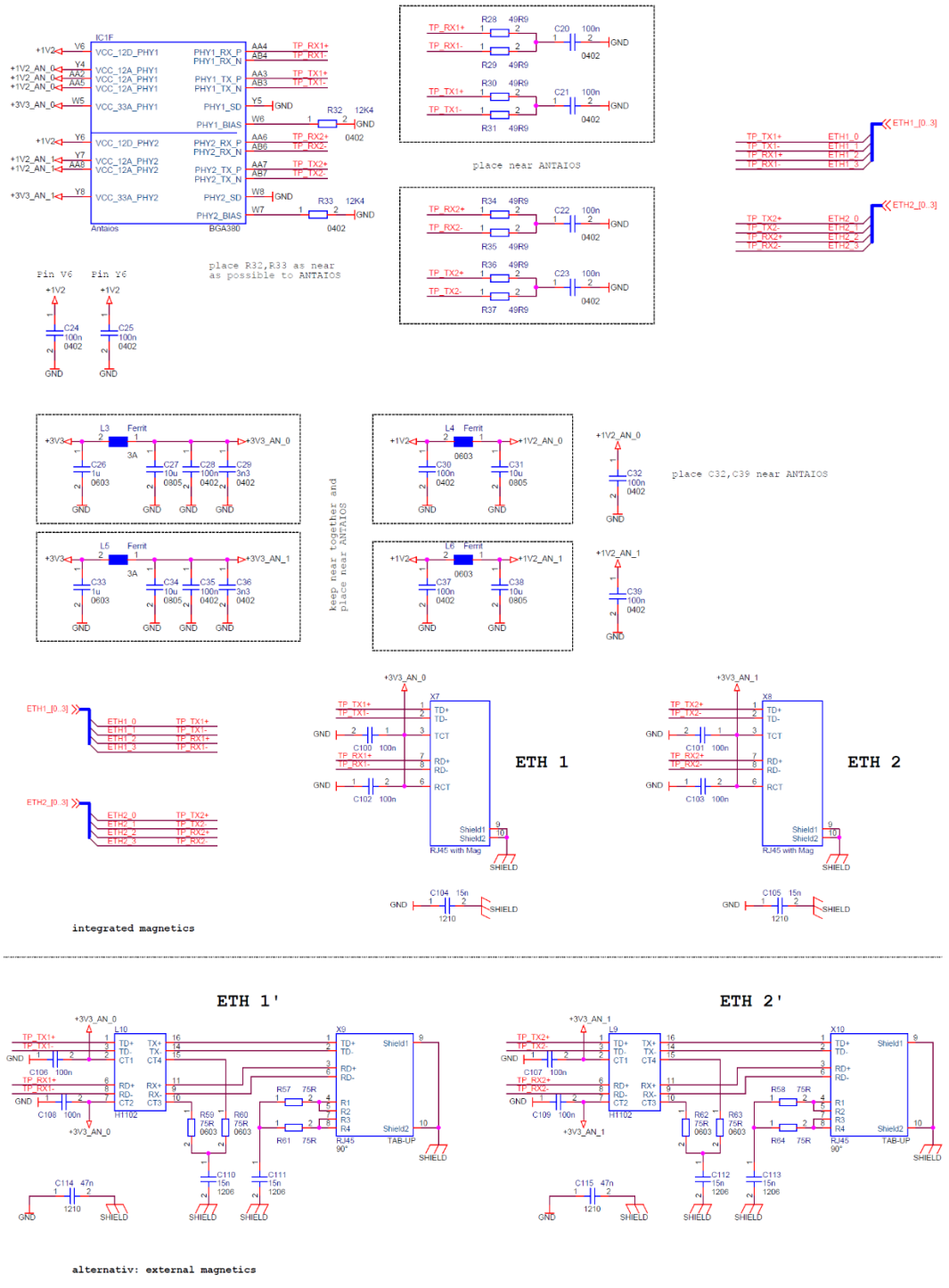
- follow proficonnEth.pdf
    - qualified DDR2 memories – see chapter 2.3
    - qualified QSPI Nor Flash – see chapter 2.4
- orcad/allegro design available (contact: support.profichip@yaskawa.eu.com)
- schematic review possible
- pcb design – follow ANT1000_ANT1001_Datasheet.pdf / chapter 9
- pcb design review possible

2.10 ANTAIOS Real-Time-Ethernet – Interface

2.10.1 How to connect the pins of the Real-Time-Ethernet Interface if both interfaces are used?

See ANTAIOS reference design: .\PAAE1102_REF\proficonnETH.pdf

Figure 2-12 Schematic of Real-Time-Ethernet-Interface



2.10.2 How to connect the pins of the Real-Time-Ethernet Interface if it's not used?

Table 2-7 Real-Time-Ethernet Interface

Ball 380	Ball 385	Pin Name	Type	Connect to GND via serial resistor 0R	Floating
AA2	AB5	VCC12A_PHY1	VCC_CORE		✓
AA5	AC2	VCC12A_PHY1	VCC_CORE		✓
Y4		VCC12A_PHY1	VCC_CORE		✓
V6	AA5	VCC12D_PHY1	VCC_CORE		✓
AA8	AB8	VCC12A_PHY2	VCC_CORE		✓
Y7		VCC12A_PHY2	VCC_CORE		✓
Y6	AA7	VCC12D_PHY2	VCC_CORE		✓
W5	AA4	VCC33A_PHY1	VCC_IO	✓	
Y8	AA8	VCC33A_PHY2	VCC_IO	✓	
W6	Y5	PHY1_BIAS	Analog OUT		✓
AB4	AC4	PHY1_RX_N	PHY IN		✓
AA4	AB4	PHY1_RX_P	PHY IN		✓
Y5	Y4	PHY1_SD	Analog IN		✓
AB3	AC3	PHY1_TX_N	PHY OUT		✓
AA3	AB3	PHY1_TX_P	PHY OUT		✓
W7	Y6	PHY2_BIAS	Analog OUT		✓
AB6	AC6	PHY2_RX_N	PHY IN		✓
AA6	AB6	PHY2_RX_P	PHY IN		✓
W8	Y7	PHY2_SD	Analog IN		✓
AB7	AC7	PHY2_TX_N	PHY OUT		✓
AA7	AB7	PHY2_TX_P	PHY OUT		✓

2.10.3 How to connect the pins of the Real-Time-Ethernet Interface 2 if only Real-Time-Ethernet Interface 1 is used?

Table 2-8 Real-Time-Ethernet Interface 2

Ball 380	Ball 385	Pin Name	Type	Connect to GND via serial resistor 0R	Floating
AA8	AB8	VCC12A_PHY2	VCC_CORE		✓
Y7		VCC12A_PHY2	VCC_CORE		✓
Y6	AA7	VCC12D_PHY2	VCC_CORE		✓
Y8	AA8	VCC33A_PHY2	VCC_IO	✓	
W7	Y6	PHY2_BIAS	Analog OUT		✓
AB6	AC6	PHY2_RX_N	PHY IN		✓
AA6	AB6	PHY2_RX_P	PHY IN		✓
W8	Y7	PHY2_SD	Analog IN		✓
AB7	AC7	PHY2_TX_N	PHY OUT		✓
AA7	AB7	PHY2_TX_P	PHY OUT		✓

2.10.4 How to connect the pins of the Real-Time-Ethernet Interface 1 if only Real-Time-Ethernet Interface 2 is used?

Table 2-9 Real-Time-Ethernet Interface

Ball 380	Ball 385	Pin Name	Type	Connect to GND via serial resistor 0R	Floating
AA2	AB5	VCC12A_PHY1	VCC_CORE		✓
AA5	AC2	VCC12A_PHY1	VCC_CORE		✓
Y4		VCC12A_PHY1	VCC_CORE		✓
V6	AA5	VCC12D_PHY1	VCC_CORE		✓
W5	AA4	VCC33A_PHY1	VCC_IO	✓	
W6	Y5	PHY1_BIAS	Analog OUT		✓
AB4	AC4	PHY1_RX_N	PHY IN		✓
AA4	AB4	PHY1_RX_P	PHY IN		✓
Y5	Y4	PHY1_SD	Analog IN		✓
AB3	AC3	PHY1_TX_N	PHY OUT		✓
AA3	AB3	PHY1_TX_P	PHY OUT		✓

3 Evaluation-Kit

3.1 What is the difference between PAAE1100 and PAAE1101?

The difference is the interface on the Real-Time-Ethernet:

- PAAE1100: Copper - RJ45
- PAAE1101: Fiber Optic Interface

Figure 3-1 PAAE1100 Evaluation-Board

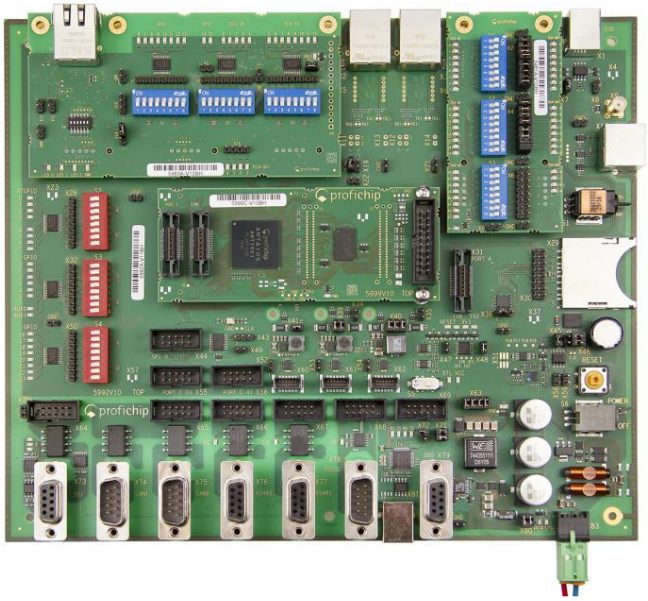
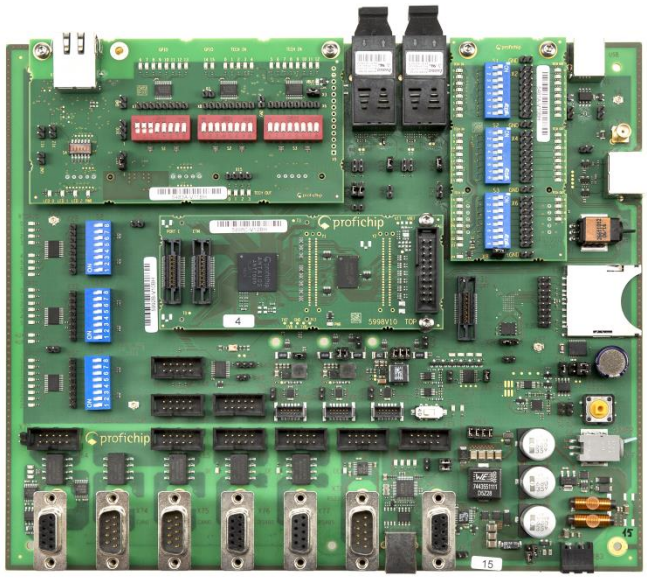
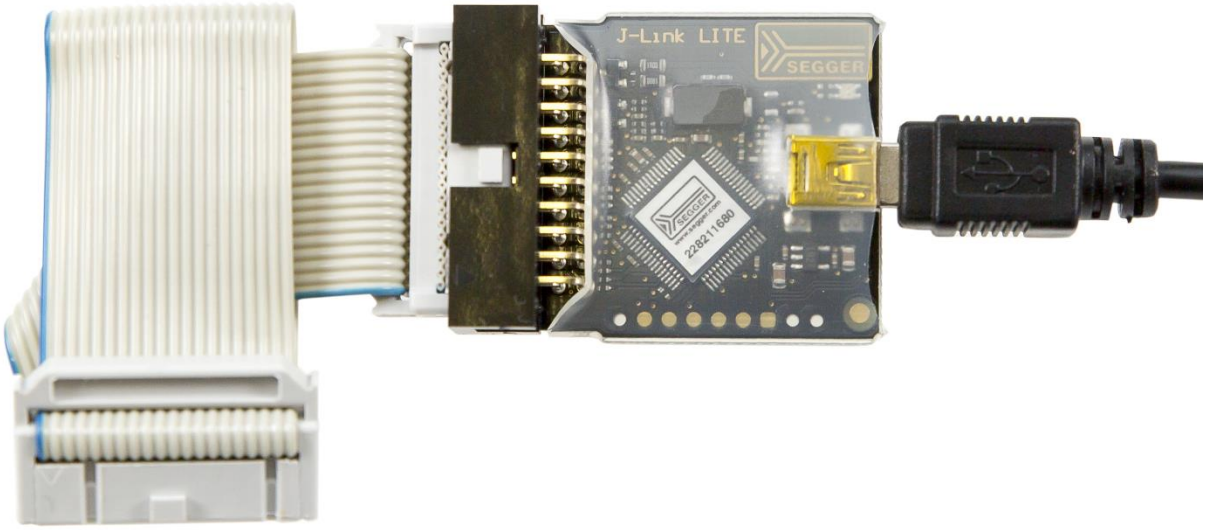
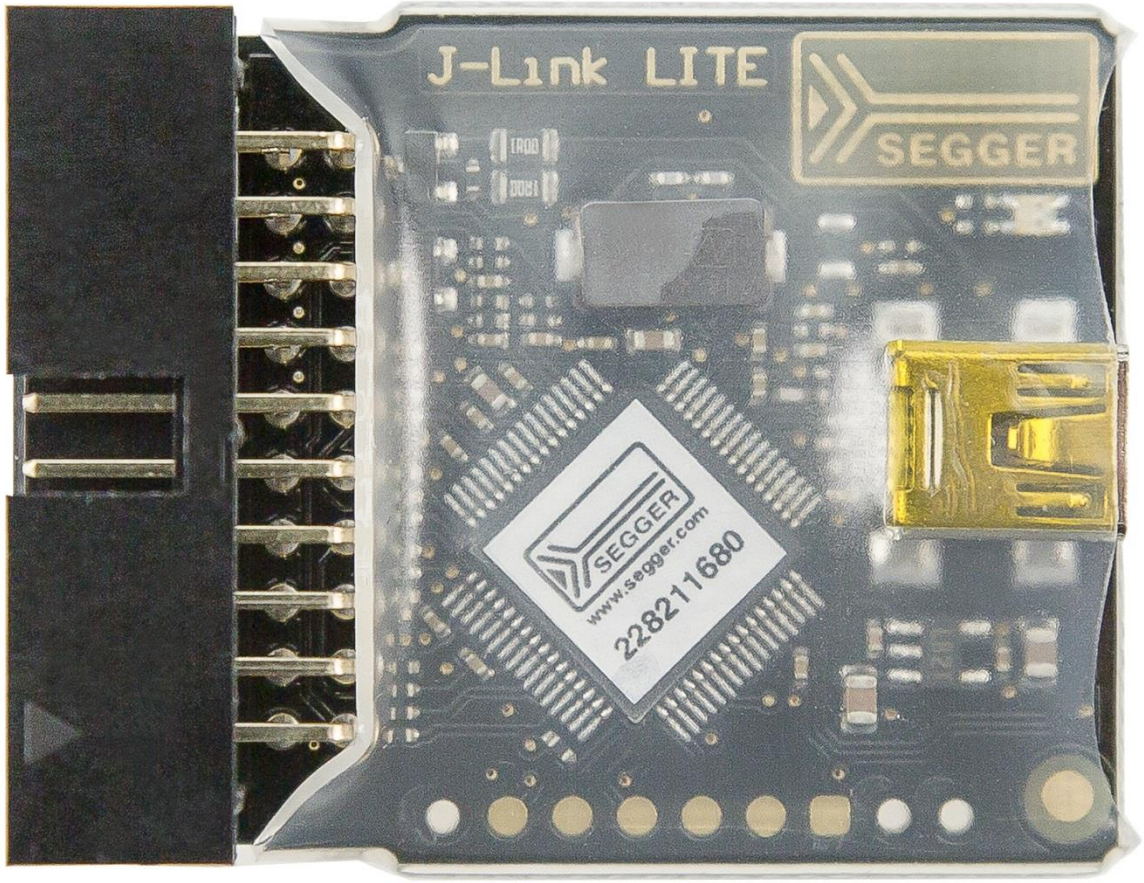


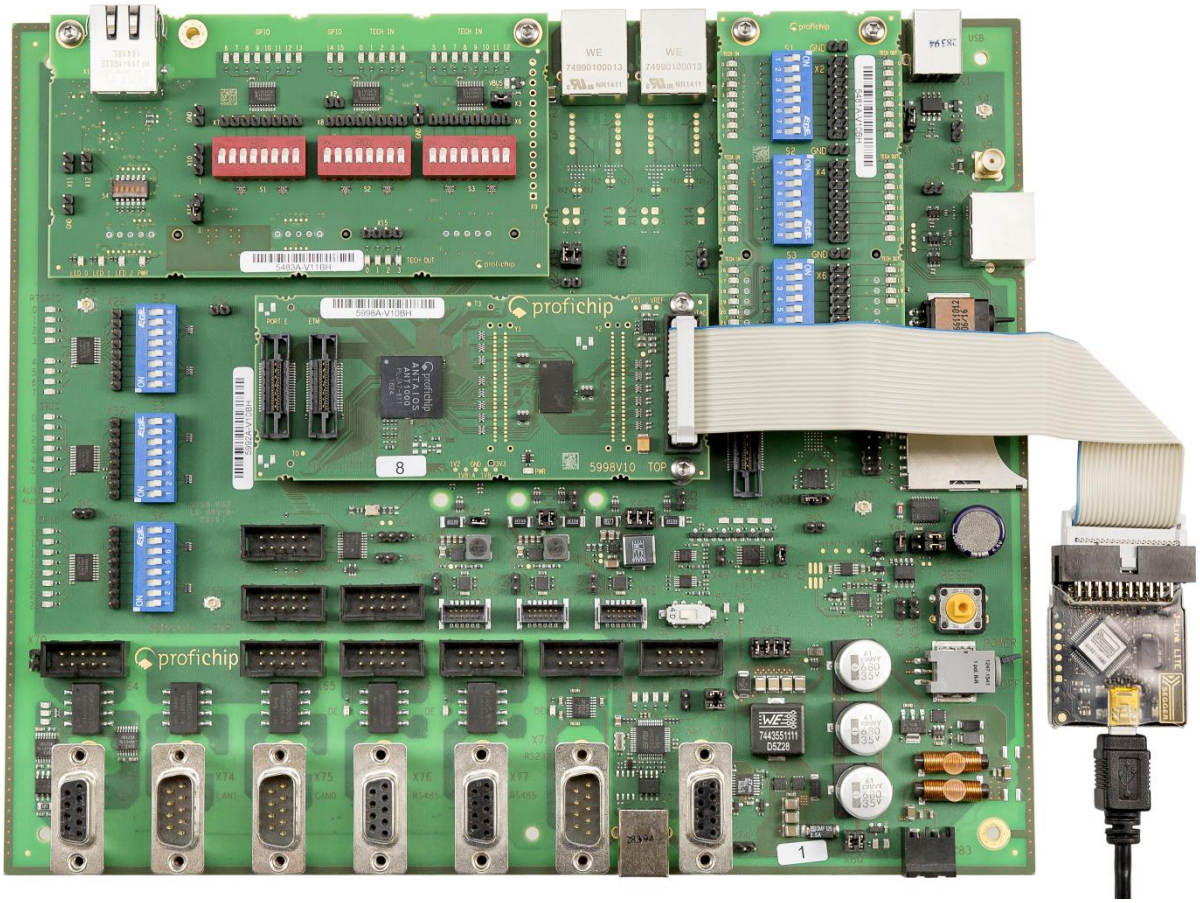
Figure 3-2 PAAE1101 Evaluation-Board

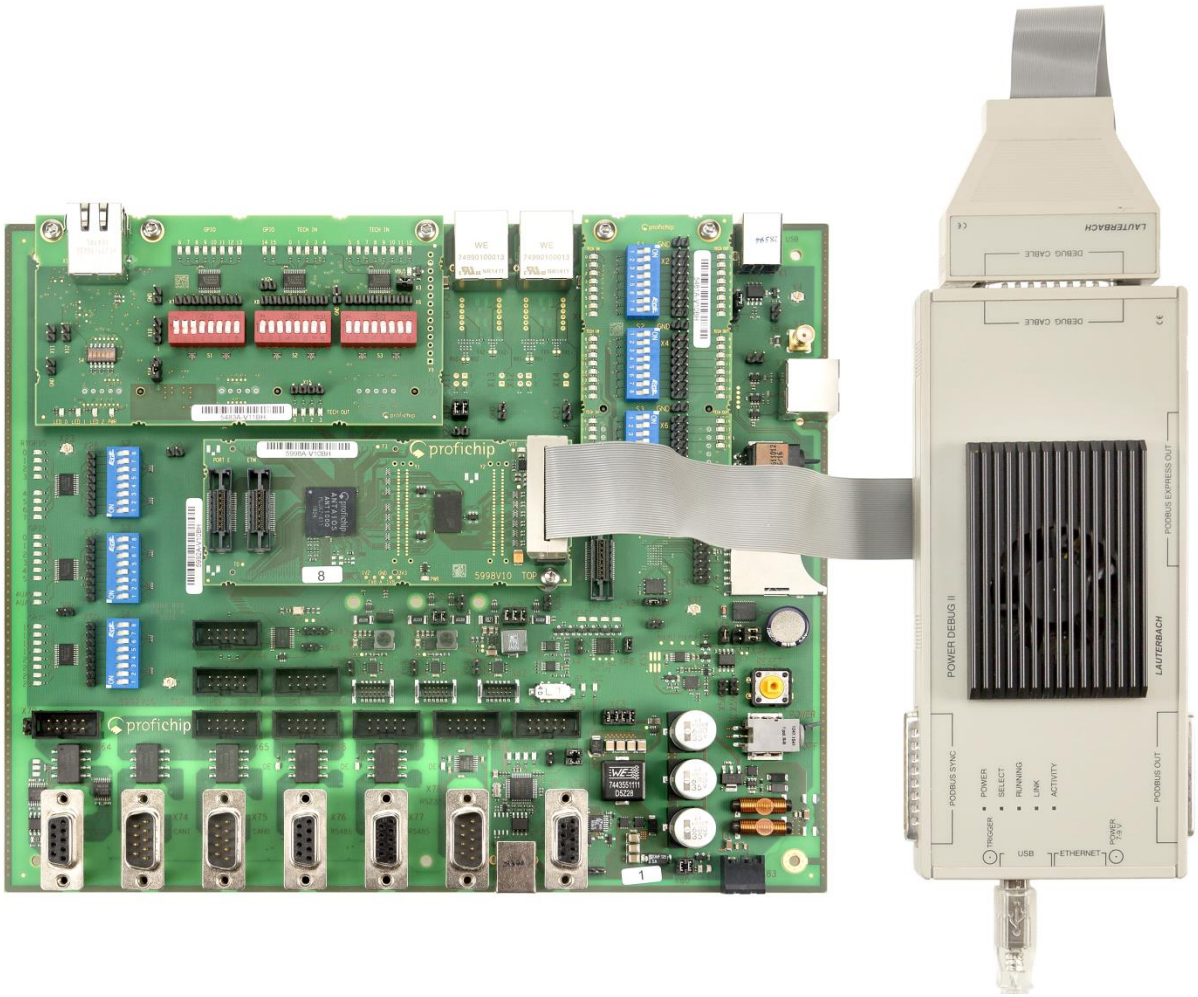


3.2 What is PAAE1160?





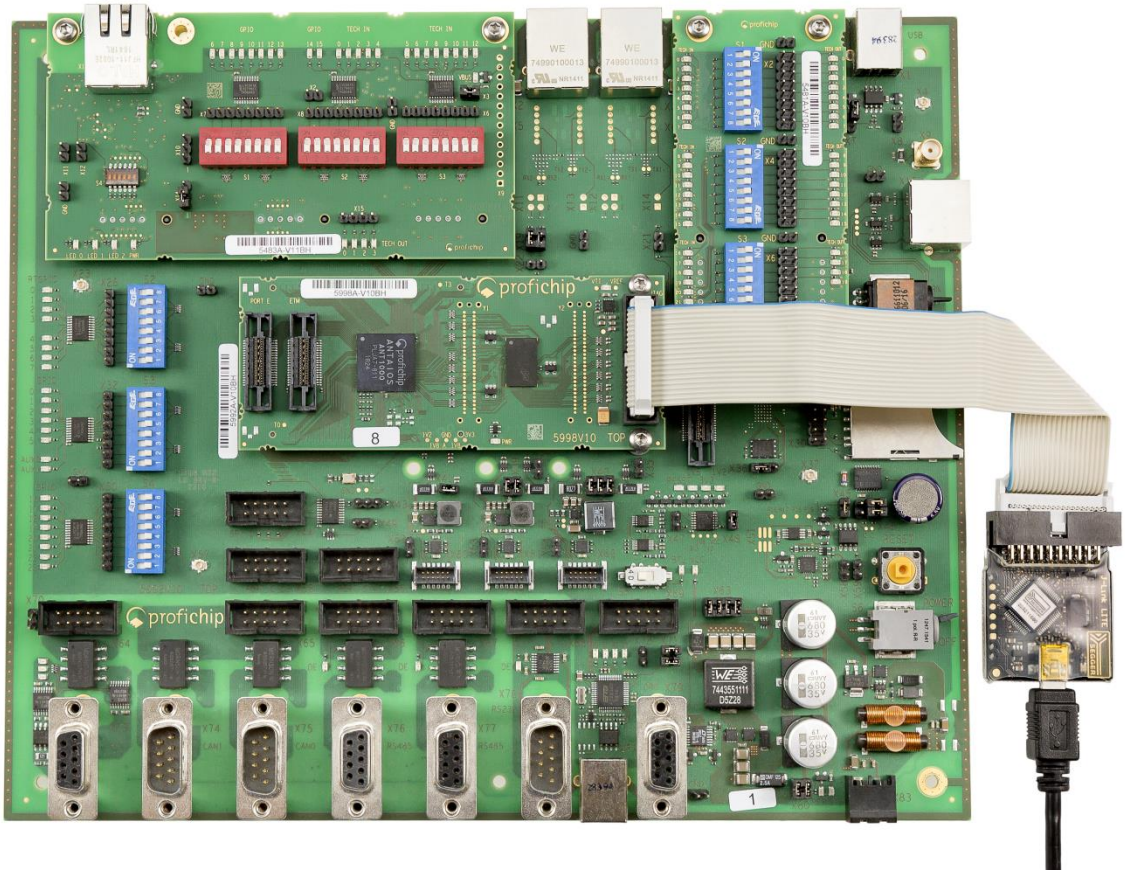




3.3 Which debug environment is used?

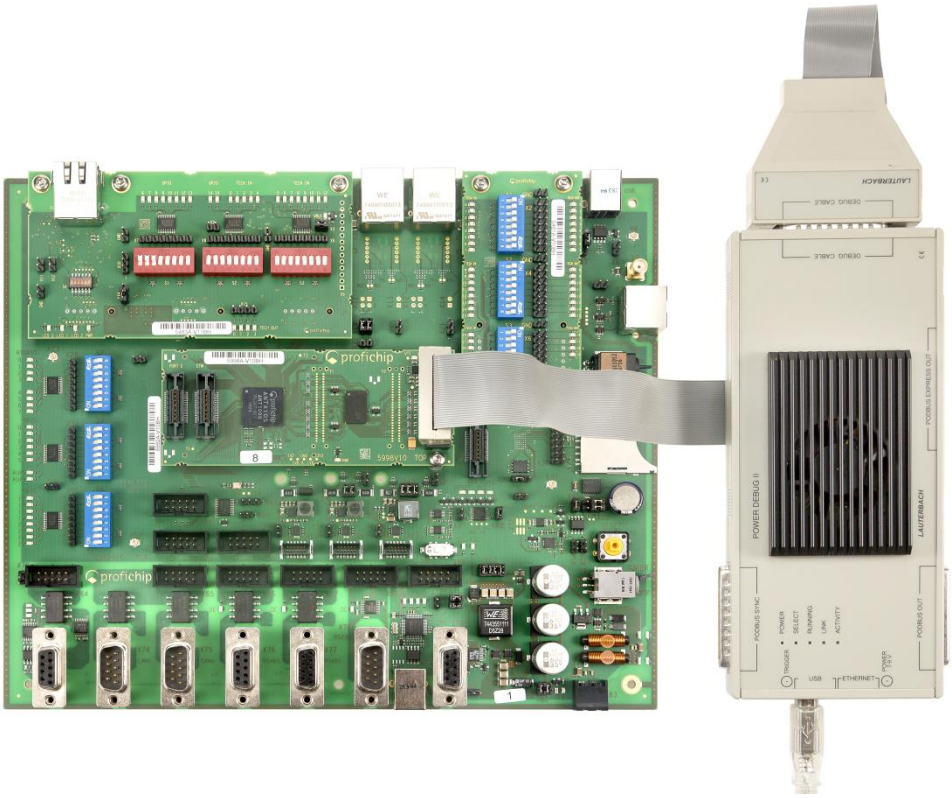
3.3.1 Segger J-Link Debug Probes

Figure 3-3 Connecting the J-Link LITE ARM



3.3.2 Lauterbach Trace32 ICD PowerDebug

Figure 3-4 Connecting the Trace32 ICD PowerDebug



3.3.3 Lauterbach Trace32 ICD PowerTrace II

Figure 3-5 Connecting the Trace32 ICD PowerTrace II

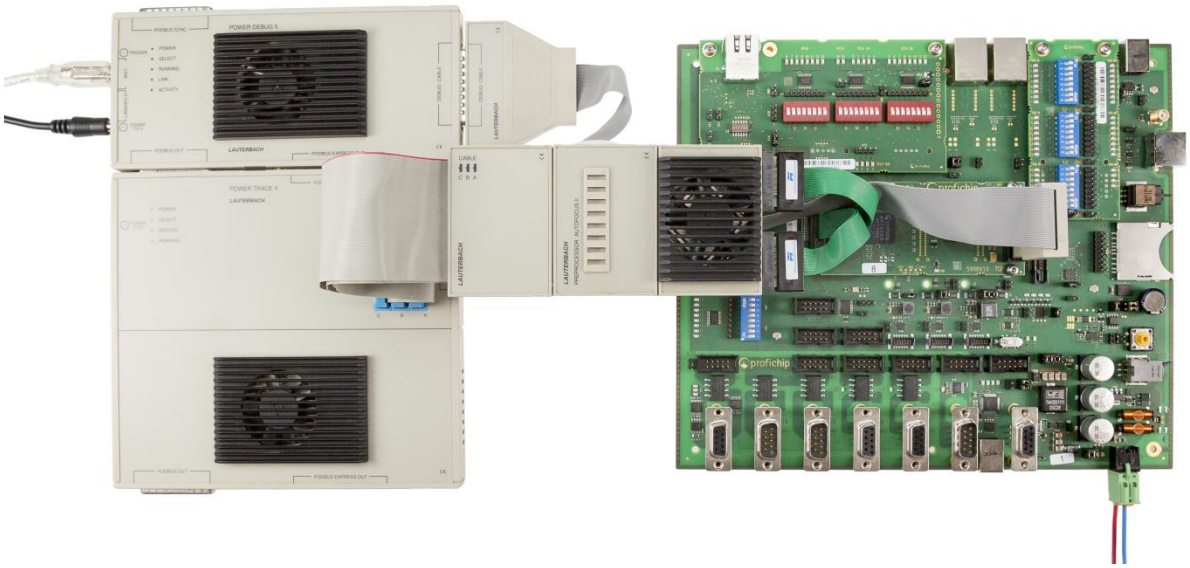
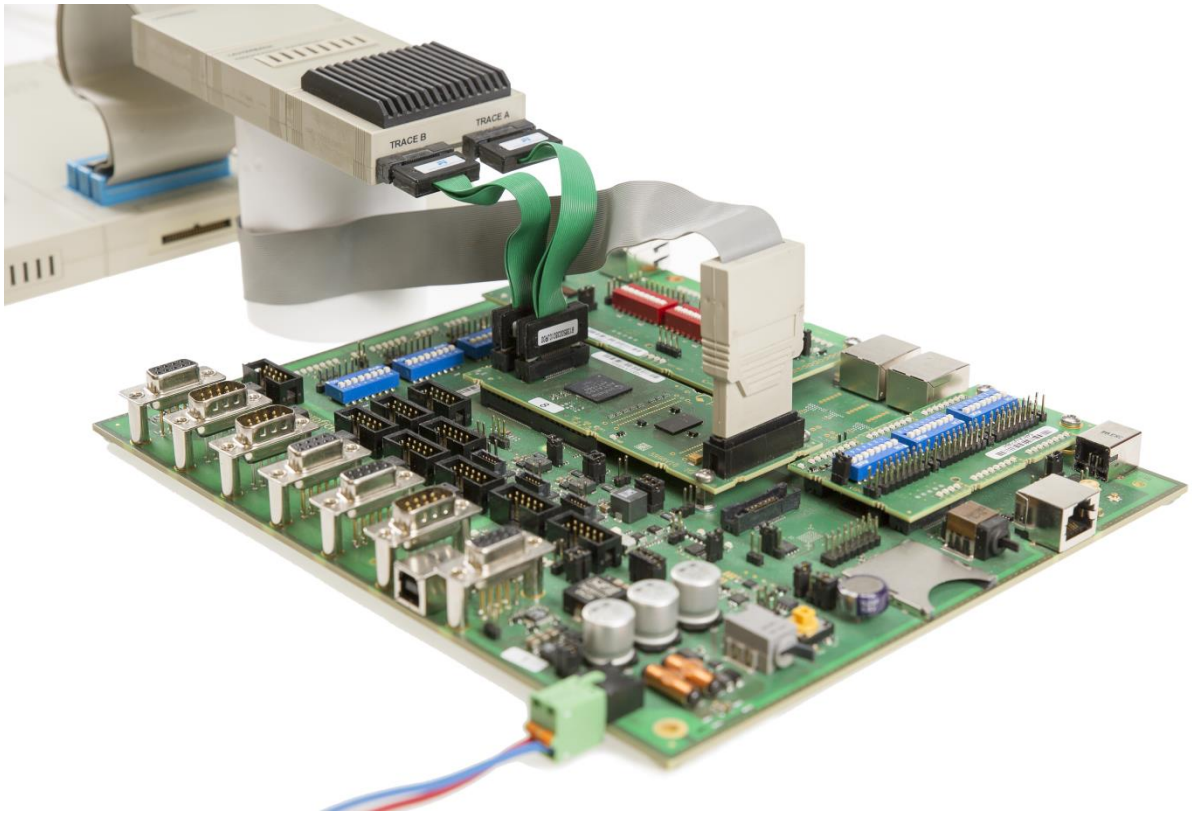


Figure 3-6 Connecting the Autofocus II (detail)



4 Revision History

Table 4-1 Revision history

Version	Date	Remarks
V1.00	17.08.2017	First release
V1.01	13.09.2017	Power Consumption
V1.02	16.02.2018	How to connect Host-Processor to ANTAIOS AEI SRAM Slave Interface and ANTAIOS SPI-Slave interface Update Flash, DDR2-RAM
V1.03	01.10.2019	New document design
V1.04	04.02.2020	New DDR2: Winbond W9751G6NB-25I
V1.05	01.07.2020	New QSPI-Flash: AT25SF321B-MHB-T
V1.06	09.12.2020	New QSPI-Flash: IS25LP032D-JNLE-TR
V1.07	18.01.2021	PROFINET Software: Connect.req answers with Reject (nca_unk_if)
V1.08	25.03.2021	How to make an own hardware
V1.09	01.07.2021	Add new DDR2 (IS43DR16640C-25DBLI) device to list of qualified chips Add chapter ANTAIOS Real-Time-Ethernet
V1.10	17.05.2022	Add DMIPS How to disable eCos diag channel via UART
V1.11	23.07.2024	Changed VCC12x_PHYn pins to floating when Real-Time-Ethernet interface is unused

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