



# KANIS

Ihr Partner für perfekte Mikroprozessortechnik

## HARDWARE MANUAL

### OAK\_EMUF

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W. Bals

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## Edition history

Date	Changes	Name	Comment
981125	Transferred from version 1_00	WB	
990703	Released V1.10	WKANIS	Header...
010225	Released V2.00	WB	Transferred from OAK_EMUF
011124	Preliminary V2.01	WB	NV-RAM
020407	Corrections from KANIS	WB	
020528	Add Configuration Informations	WB	Reset Configuration

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## **Preface and Warnings**

### **Preface**

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### **Warning**

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the manual, may cause interference to radio communications.

## **Scope of delivery**

### **Content:**

Description	Order No.	comments
Hardware, Freeware OAK_EMUF 2MB RAM, 4MB ROM	Tbd.	

### **Options:**

Description	Order No.	comments
Native Software	SFT-99959-000	
OS-9 BSP Software	SFT-99958-000	
Complete Development Tools	SFT-99964-000	

## **General description**

### **General**

The OAK\_EMUF Board is a single Euro-format board with Motorola Power-PC 555 Processor. The main features are:

- ◆ POWER PC CPU from Motorola (40 MIPS)
  - 32 32bit integer., 32 64bit floating point register
  - incl. I/O, Timer, Counter, IRQ-handling
  - incl. Chipselect
- ◆ Single Europe Board
- ◆ 1 to 4 MB Burst-Ram (0 Wait States,2-1-1-1 burst cycle)
- ◆ up to 8 MB Flash Eprom
- ◆ CAN interface
- ◆ Ethernet interface
- ◆ I/O-expansion bus

This Board is based on the very popular Power-PC Processor family of Motorola. The On-Board 555-Processor includes Chipselect,, Timer, Counter and IRQ-Management. In Addition to the great integer performance a floating-point unit is included. The Processor runs at 40Mhz. Speed can be changed by software and increased, if faster versions will be available.

The Design with fast synchronous BURST-Rams guaranties a overall bigger performance also with larger programs.

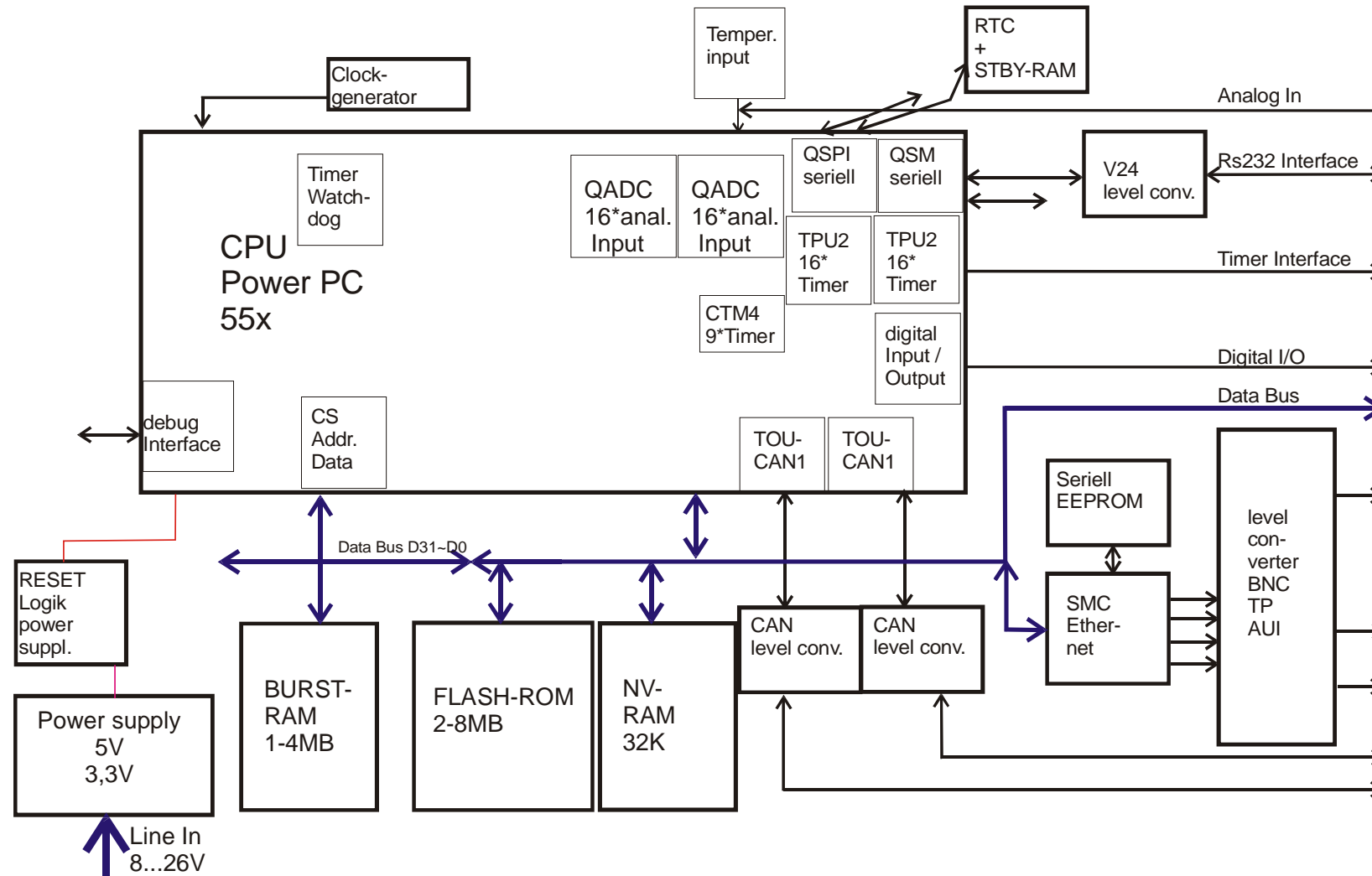
Most of the input/output-features are built around former 68376-IO-interfaces, which is avalibale on the MPC555 as a peripheral chip. This brings the full use of all of the well known I/O-features of the 68376 together with the calculating power of the MPC555.

The high-speed input/output is driven by an SMC-Ethernet-Chip 9432 and supports BNC and Twisted-pair interfaces.

The I/O-structure helps also to start with this board with the same software as later used in MPC55x-Processor-versions.

Debug can be done completely over BDM-interface to MPC555 processor.

**Block-Diagram**



**Figure 1, Blockdiagram complete**

## **RAM / ROM**

The standard Version of OAK\_EMUF comes with 4MB Burst Ram. The Burst RAM devices are synchronous SRAM's with 32bit width in/output and support a synchronous burst transfer with 2-1-1-1 burst cycle and. The burst rams are connected to CS1 of MPC555 SIU and can be located to every address in the PowerPC address space.. For more details look in description of BURST-Ram and also SIU of MPC555.

The Flash-ROM is built with standard flash devices 16bit devices. On OAK\_EMUF the onboard flash is always 32bit accessible to increase access speed. External flash is connected to CS0 of MPC555 SIU to enable booting out of this flash.

NVRAM is connected to CS2 of the MPC555-SIU. NVRAM can only be accessed by 8bit transfer.

For the bus interface between 3V3 and 5V devices a bus-driver (IC13) is used.

## **Inputs / Outputs**

The Input / Output of the OAK\_EMUF can be separated in 3 groups:

- ◆ MPC555 Onboard-Peripherals like QSM, CAN, TPU, MIOS
- ◆ SMC 9432 Ethernet Controller
- ◆ CS3-connected external devices

## **MPC555 Onboard Peripherals**

The OAK\_EMUF uses MPC555 onboard peripherals. The base-address of all internal devices can be SW-controlled via Base Address register.

The main I/O-features are:

- asynchronous serial interface (QSM)
- synchronous serial interface (QSPI)
- 10bit A/D-converter (QADC)
- 16 channel timer processor (TPU3)
- 16 I/O with special functions (MIOS)
- CAN interface (TOU-CAN)

## **SMC9432 Ethernet**

The Ethernet-Interface is built around a SMC9432 Peripheral Controller. This Controller is directly connected to the MPC555 with Chipselect CS3. The HW-Layer is realized as BNC, TP and AUI-Interface with all the related specifications.



## **Realtime-Clock**

For Realtime-clock a Motorola MC68HC68 is used and connected to the QSPI-interface on 68376 peripherals with CS PCS2.

## **NV-RAM**

For non volatile memory for data an ZMD NV-Ram device is used and connected to the CS2. This device can only be accessed by 8bit transfer.

## **Power Supply**

The Power Supply is realized with switched regulated circuits. The input voltage can range from 7V...to 16V. All onboard voltages are regulated, especially 3,3V for MPC50x and BURST-SRAM's and 5V for all other peripherals.

The complete board needs maximum 7W, so the power supply input current is about 0.5A at 14V input voltage.

## **Installation**

The installation of the OAK\_EMUF is very easy. The power supply must meet the specification described in the chapter „General description, power supply“.

The serial RS232 interface can be used to connect a serial terminal or a standard serial interface from PC. The standard SW on board configures this interface with:

- 9600 baud
- no parity check
- eight data bits
- one stop bit

These specifications can only be changed by software.

For the pin-assignment of the RS232 connector see chapter „connectors, serial“ .

If the board is supplied with OS9®, then the twisted-pair interface can also be connected and used for communication. Communication parameters on TCP/IP can only be changed by software.

## **Connectors**

OAK\_EMUF has two different ways to be used in industrial environment:

- in a multiboard-environment over backplane with connector
- in a single board environment with power supplied over ST06.

The complete processor peripheral lines are available on connector ST07 and ST08 also as on ST02.

### **Connector locations**

See HW-Documenation of KANIS

### **Power Connector ST06**

This connector only has two lines (+, GND). In a single board environment this connector is used to supply power to OAK\_EMUF.

### **CAN**

CAN is available on both of the expansion connectors. CAN is provided with a standard automotive interface built around a Phillips 82C251 Interface.

CAN is connected on ST01, pin B29 and B28.

### **Serial, ST02**

The serial interface is built on a standard 9 pin SUB-D-connector.

Pin	Direction	Signal	Description
1		NC	Not connected
2	Out	TxD	Transmit Data
3	In	RxD	Receive Data
4		NC	Not connected
5		GND	Ground
6		NC	Not connected
7	Out	Reserved	
8		NC	Not connected
9	In	Reserved	

## Ethernet

### BNC

BNC is not available in current OAKMEUF-versions.

### Twisted Pair

The Twisted Pair interface is built at connector ST03.

Pin	Direction	Signal	Description
1		ETXP	
2		ETXN	
3		ERXP	
4			
5			
6		ERXN	
7			
8			

## **BASE-Connector ST01**

Base-Connector ST01 is used, if OAK\_EMUF is mounted in a rack with backplane. All Signals are fed on this connector except Ethernet-connections.( see also HW-Dokumentation)

Pin row A	Direct.	Signal Description	Pin row B	Direct.	Signal Description	Pin row C	Direct.	Signal Description
1	An. In.	AN58I	1	An. In.	AN56I	1	An. In.	AN54I
2	An. In.	AN59I	2	An. In.	AN57I	2	An. In.	AN53I
3	An. In.	AN51I	3	An. In.	AN55I	3	An. In.	AN52I
4	An. In.	AN48I	4	An. In.	AN50I	4	An. In.	AN49I
5	An. In.	AN1I	5	An. In.	AN3I	5	Dig. Out	PC4
6	Dig. Out	UHR CLK	6	Dig. Out	PC5	6	Dig. Out	PC6
7	In	PC3	7	An. In.	AN2I	7	An.In.	AN0I
8	Out	VREF	8	Dig. In	T2CLK	8	Dig. IO	TPUCH15
9	Dig. IO	TPUCH14	9	Dig. IO	TPUCH12	9	Dig. IO	TPUCH13
10	Dig. IO	TPUCH11	10	Dig. IO	TPUCH10	10	Power	VSTBY
11	Dig. IO	TPUCH5	11	Dig. IO	MISO	11	Dig. IO	TPUCH6
12	Dig. IO	TPUCH1	12	Dig. In	SCK	12	Dig. IO	PCS0
13	Dig. Out	PCS2	13	Dig. IO	CDT10	13	Dig. In	MOSI
14	Dig. Out	PWM5	14		TMS3	14	Dig. IO	TRST
15	Dig. Out	PWM7	15		CTD3	15	Dig. IO	PCS3
16	Dig. Out	TCK	16		CTD4	16	Dig. IO	CTM2C
17	Power	+U	17		PWM8	17	Dig. IO	PWM6
18	Dig. IO	TPUCH13	18	Dig. IO	TPUCH0	18	Dig. In	TDI
19	Dig. Out	TDO	19	Dig. IO	TPUCH2	19	Dig. IO	CTD9
20	Dig. IO	TPUCH9	20	Dig. IO	TPUCH4	20	Power	GND
21		n.c.	21	Dig. IO	TPUCH7	21	Dig. IO	PCS1
22		n.c.	22		n.c.	22	Dig. IO	TPUCH8
23		n.c.	23	.	n.c.	23		n.c.
24		n.c.	24		n.c.	24		n.c.
25		n.c.	25		n.c.	25	Power	+12V (Supply In)
26		n.c.	26		n.c.	26	Dig. In	IRQ1_376
27		n.c.	27		n.c.	27	Dig. In	IRQ1_376
28		n.c.	28	CAN	CAN_H	28	Dig. In	IRQ1_376
29		n.c.	29	CAN	CAN_L	29	Dig. In	IRQ1_376
30		n.c.	30		VPLS	30	Dig. In	IRQ1_376
31	Power	VCC	31		VPLS	31	Power	VCC
32	Power	GND	32	Power	GND	32	Power	GND

## **Diagnostic, ST05**

The Diagnostic-Connector is a standard BDM ( Background-Debug-Mode) – Connector for Motorola – Processor Debug Interface. On this connector customer can connect BDM-Interfaces (for example. EBDI-Lite..)

**Connection of BDM-Interface has to be carefully checked on orientation ( no mark for Pin 1) !**

Pin	Direction	Signal	Description
1	Dig.In	VFLSO	Look at rcpurm.pdf on OAK_EMUF-CD
2	Dig.Out	RESETOUT	
3	Power	GND	
4	Dig. In	DSCK	
5	Power	GND	
6	Dig. In	VFLS1	
7	Dig. In	RESETIN	
8	Dig. In	DSDI	
9	Power	3V3	
10	Dig. Out	DSDO	

## **Jumpers and Switches**

The following figure shows position of all jumpers on the OAK\_EMUF Board. A description of all jumpers follows.

### **Jumper locations**

Look in HW-documentation.

### **J01..J04, RESET-Configuration**

The RESET-Configuration Word of the MPC555 Processor is driven by 74LV244 (IC10) and is controlled by Jumper/Resistor R116...R112.

Resistor	Databus line MPC555	Default configuration	Reset Configuration Word	Remark
R116	D1			
R115	D3			
R114	D19			
R113	D20			
R112	D28			

For more details of the RESET-Configuration see MPC555-user manual .

### **J07..J08, Test Power Supply**

During Test of Power Supply J07 and J08 are temporarily used in Position „B“. For Standard use J07 and J08 must always set to position A.

## Address Range

The OAK\_EMUF uses the complete 4GB address range of the MPC555 processor. All external devices are software programmable in the start address, so the figure shown below only gives an example.

For detailed information look in the SW-Manual for OAK\_EMUF standard software or in the Board-support-package-description of OS-9 for OAK\_EMUF.

This is the recommended default configuration. All addresses are SW-configurable.

Start address	End address	Description	Comment
0x0000 0000	0x001f ffff	First ram Bank	Burst ram for code and data, prog. CS1
0x0020 0000	0x003f ffff	Second ram bank	Burst ram for code and data, prog. CS2
0x0040 0000	0x007f ffff		Reserved for 8M ram version
0x0080 0000	0x00ff ffff	Free	
0x0100 0000	0x01ff ffff	MPC555 Onboard peripherals And internal flash	Selected by Base register See MPC555 documentation
0xb000 0000	0xb001 ffff	SMC9432	Programmable address on CS3
0xb020 0000	0xb003 ffff	CS3_1	Sub cs on CS3 decoder
0xb040 0000	0xb005 ffff	CS3_1	Sub cs on CS3 decoder
0xb060 0000	0xb007 ffff	CS3_1	Sub cs on CS3 decoder
0xb080 0000	0xb009 ffff	CS3_1	Sub cs on CS3 decoder
0xb0a0 0000	0xb00f ffff	CS3_1	Sub cs on CS3 decoder
0xb0c0 0000	0xb00f ffff	CS3_1	Sub cs on CS3 decoder
0xb0e0 0000	0xb0f ffff	CS3_1	Sub cs on CS3 decoder
0xc000 0000	0xc000 7fff	32K NV-RAM	
0xd000 0000	0xefff ffff	Free	
0xfe00 0000	0xfeff ffff	Flash EPROM	External flash, 1 <sup>st</sup> Megabyte
0xff00 0000	0xffff ffff	Flash EPROM	External flash Boot area, if external boot is used in configuration

**figure 2, address range**

## **Interrupts**

The MPC555 has external interrupt request lines called IRQ0...IRQ6. ( see also application node AN1281/D or related document in the OAK\_EMUF documentation AN1281\_D.pdf). Some of these lines are used for peripherals on the OAK\_EMUF.

### **Local interrupt sources**

IRQ line	Description	Comment
IRQ3	SMC Ethernet controller	

### **External interrupt sources**

All information are customer dependant, all lines are connected to external connector ST08.

IRQ line	Description	Comment
IRQ0		PPIRQ0
IRQ1		PPIRQ2
IRQ2		PPIRQ3
IRQ4		PPIRQ4
IRQ5		PPIRQ5
IRQ6		PPIRQ6



## **Mechanical Specification**

The board is a standard single-Euro-format ( 160\*100 mm).

The exact OAK\_EMUF size over all is 192\*160 mm. Maximum height is 22 mm.

## **Expansions**

Every customer requested expansion board can be designed and manufactured by KANIS.

## **Related Documents:**

OAK\_EMUF-V1\_10\_komplett.pdf      HW-Documentation

Datasheets, Manuals, Technical Summaries

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MPC555um.pdf	MPC555 user manual
74FCT164245.pdf	74FCT164245 Datasheet
74LS244.pdf	74LS244 Datasheet
74LV244.pdf	74LV244 Datasheet
91C94.pdf	91C94 Datasheet
AM29F800.pdf	AM29F800 Datasheet
an1236.pdf	Timing Performance of TPU I/O Hardware
an1281_d.pdf	MCP505 Interrupts
AT24640.pdf	AT24640 Datasheet
DS1305_tss.pdf	DS1305 real time clock Datasheet
DP8392.pdf	DP8392A Datasheet
gpترم.pdf	GPT Reference Manual
Mach211.pdf	MACH211 Datasheet
Mach211SP.pdf	MACH211SP Datasheet
Max1626.pdf	MAX1626 Datasheet
Max233.pdf	MAX233 Datasheet
Max708.pdf	MAX708 Datasheet
PCA82C251.pdf	PCA82C251 Datasheet
rcpurm.pdf	RCPU RISC CPU Reference Man.