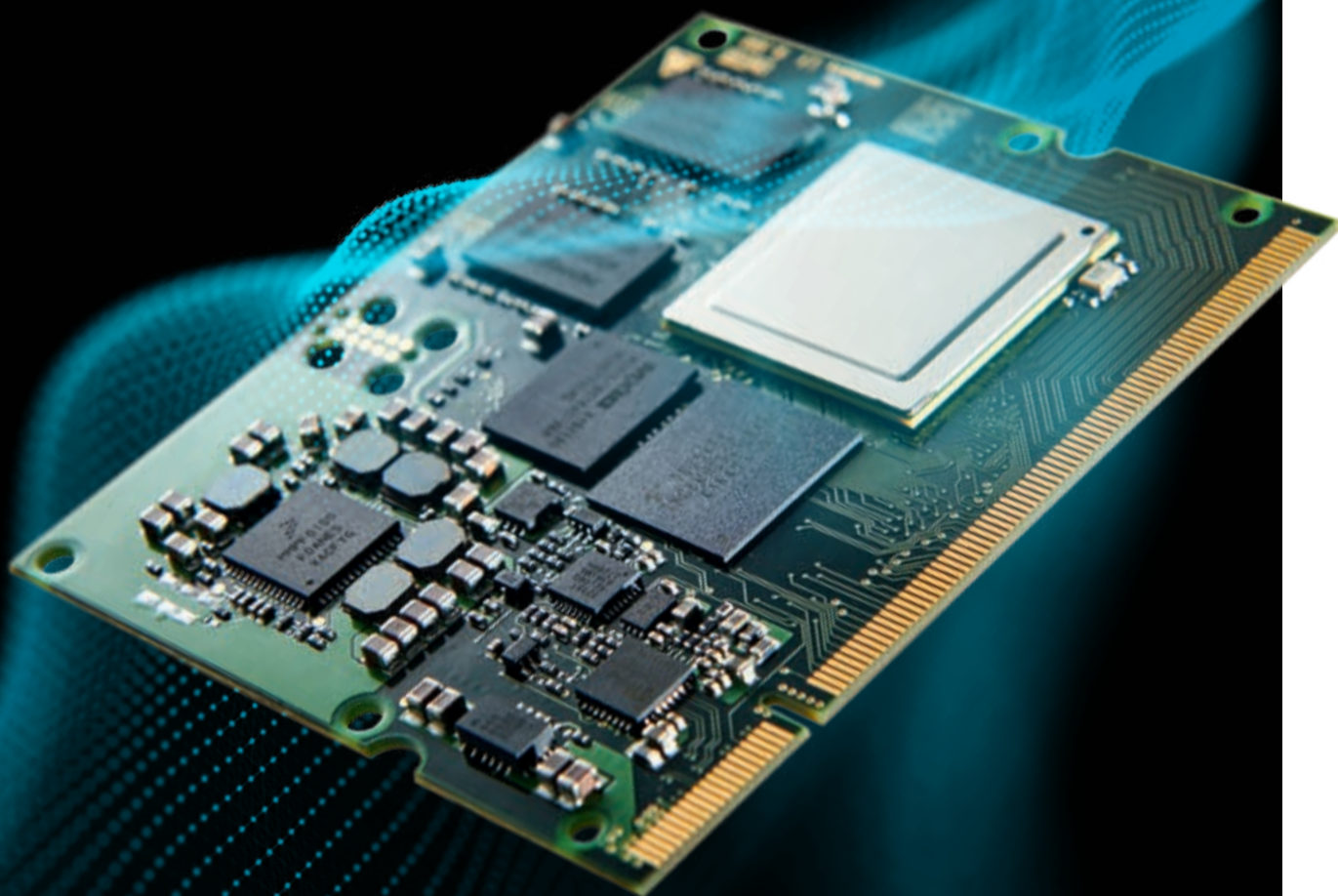


# ECU

Embedded Control Units from RAFI



# RAFI ECU AT A GLANCE

Depending on customer requirements, we equip our GLASSCAPE touch displays and control panels with complete processor units. These Embedded Control Units (ECU) take care of control and visualization tasks. From **RAFI** you get your customized control solution comprising touch technology, housing, processor, software and drivers from a single source.

For many years, leading companies in various industries have been counting on **RAFI**.

HMI and controls for coffee machines



Mobile HMI for industrial robots

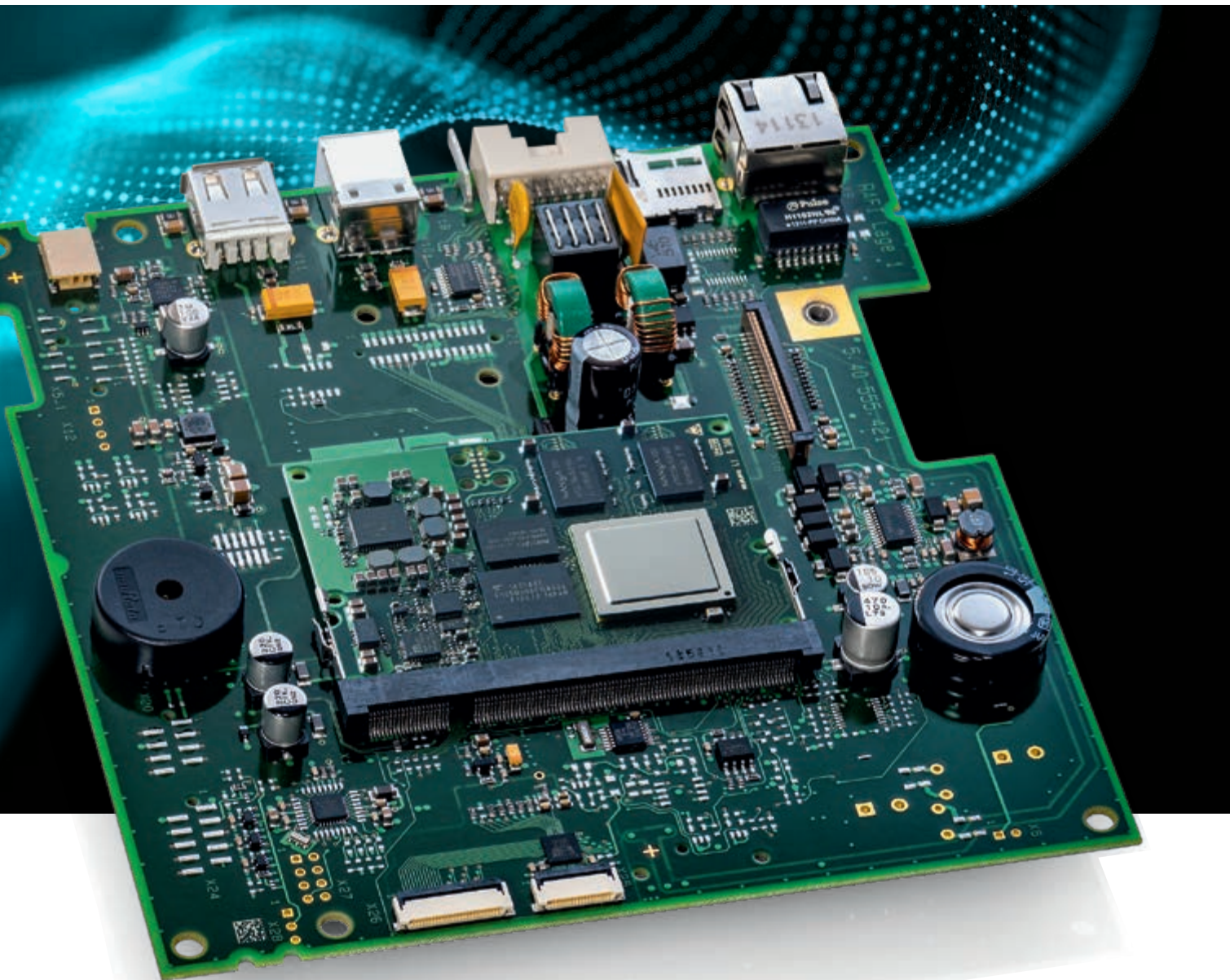


iTerminal for the Pistenbully



HMI for breathing apparatus





## YOUR ADVANTAGES

- Five power classes
- Single-board-computers as plug-in modules and integrated solutions
- Pin-compatible connector system
- Low power draw and fan-less design
- Fast and flexible adjustment to customer-specific design
- Continuous platform development and servicing
- Low development costs
- Industrial compatibility and long-term availability



Processor unit for simple control and visualization tasks. Our customized, integrated solutions optimize unit costs. We use cost-effective 8, 16, and 32-bit controllers with and without operating systems.



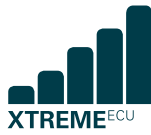
Plug-in module with single-core processor for medium control and visualization tasks. Fast and flexible adjustment to your demands using modular solutions. The BalanceECU module is available with embedded Linux.



Plug-in module with Dual-Core or Quad-Core processor for challenging control tasks, HMI with FullHD video playback and multi-touch. Fast and flexible adjustment to your demands using the platform base board. The PowerECU module is available with embedded Linux.



Processor unit for high-performance control and visualization tasks. The UltimateECU is designed for highest performance requirements in the embedded environment and is available as an integrated solution with embedded Linux.



Plug-in module with X86 architecture for high-end applications. Based on the Intel® Atom® x6000E series, this module enables a powerful but fanless design. The XtremeECU is available as a SMARC module with various standard operating systems.

# THE RIGHT UNIT FOR YOUR PROJECT



## RAFI ECU

	Touch	Multi-Touch	-	Multi-Touch	Multi-Touch
	Max. resolution	800 x 600; 24 BPP	-	1280 x 800; 24 BPP	2048 x 2048; 24 BPP
Grafic	Interface	parallel 24 Bit RGB	-	LVDS (optional: Parallel 24 Bit RGB)	parallel 24 Bit RGB
	Special features	OpenVG™ 1.1 2D (GC355)	-	OpenGL® ES 2.0 3D OpenVG™ 1.1 2D	PowerVR SGX530 3D Graphics Engine
Controller	Core	ARM Cortex-A5 + Cortex M4	ARM Cortex-M3/M4	ARM Cortex-A9 / ARM Cor- tex-M4	ARM Cortex-A8
	Typ	NXP Vybrid	STM32F2 / F4	NXP i.MX6SoloX	TI Sitara AM3354
	Clock rate	450 MHz (A5), 166 MHz (M4)	up to 180 MHz	792 MHz	600 MHz
Memory	RAM	up to 2 MB internal; 256 MB DDR3	up to 384 KB internal	1 GB DDR3 SDRAM	512 MB DDR3 SDRAM
	Flash	128 MB NAND-Flash	up to 2 MB internal	8 GB eMMC (optional: 1 GB SLC NAND-Flash) 16 MB Boot-NOR-Flash	4 GB eMMC
	EEPROM	32 kByte	-	4 KB	4 KB
RealTime Clock	Typ	NXP PCF2123	-	MCS RV-3029-C3 (temperature compensated)	possible
Temperature range	Operation	0 °C to +70 °C (optional -40 °C to +85 °C)	-40 °C to +85 °C (optional -40 °C to +105 °C)	-40 °C to +85 °C	-0 °C to 70 °C (storage -20 °C to +85 °C)
Interfaces	Ethernet	2 x 10/100 Mbps incl. Phy	1 x 10/100 Mbps incl. Phy	1 x 10/100 Mbps inkl. Phy	2 x 10/100 Mbps/1GBps (IEEE1588)
	USB	2 x USB 2.0 High-Speed (480 Mbps) OTG incl. Phy	1 x USB 2.0 High-Speed (480 Mbps) OTG incl. Phy 1 x USB 2.0 Full-Speed (12 Mbps) Host incl. Phy	2 x USB 2.0 High-Speed (480 Mbps) OTG incl. Phy	2 x USB 2.0 High-Speed (480 Mbps) Dual-Role incl. Phy
	CAN	up to 2 x CAN	up to 2 x CAN	up to 2 x CAN	up to 2 x CAN
	UART	up to 6 x UART	up to 4 x UART	up to 5 x UART	up to 6 x UART
	I2C	up to 4 x I2C	up to 3 x I2C	up to 3 x I2C	up to 3 x I2C
	SPI	up to 4 x SPI and up to 2 x QSPI	up to 3 x SPI	up to 4 x SPI	up to 2 x SPI
	Audio	I2S + ESAI + SPDIF	-	2 x serial audio	-
	Camera	up to 4 analog camera inputs (not simultaneous)	-	parallel CSI	-
	SD/MMC	up to 2 x SD/MMC	1 x SDIO	up to 2 x SD/MMC	up to 3 x SD/MMC
Analog / Digital Converter	ADC: up to 16 channels @ 12 Bit DAC: up to 2 channels @ 12 Bit	ADC: up to 24 channels @ 12 Bit DAC: up to 3 channels @ 12 Bit		ADC: 2 x 4-channel @ 12 Bit	ADC: 8 channels @ 12 Bit
Plug-in system	integrated solution	integrated solution	1 x 200-pin SO-DIMM (contact baseboard TYCO (AMP) 1717254-1)	integrated solution	
Dimensions	integrated solution	integrated solution	67.6 mm x 55.0 mm	integrated solution	
Operating system	MQX 4.1.2	-	Linux Kernel 5.15 (LTS) Yocto Kirkstone 4.0	Linux Kernel 4.1.18 Yocto 2.1 Krogoth	
Visualization	Embedded Wizard, Easy GUI more on request	-	Qt 5.15 (LTS) more on request	Qt 5.6.3	



Multi-Touch	Multi-Touch	Multi-Touch	Multi-Touch
1920 x 1200; 24 BPP	1920 x 1200; 24 BPP	1920 x 1080; 24 BPP	4096 x 2160
LVDS	LVDS	LVDS	LVDS (max 1920 x 1200@60 Hz), eDP, MIPI, HDMI (if necessary, converter still required on carrier board)
OpenGL® ES 2.0 3D OpenVG™ 1.1 2D	OpenGL® ES 2.0 3D OpenVG™ 1.1 2D	OpenGL® ES 3.1 3D OpenVG™ 1.1 2D	OpenGL® 4.5 OpenGL® ES 3.2
Dual ARM Cortex-A9	Quad ARM Cortex-A9	Quad ARM Cortex-A35 / Single ARM Cortex-M4	Intel Atom
NXP i.MX6Dual	NXP i.MX6Quad	NXP i.MX8QuadXPlus	X6425RE, X6414RE, X6412RE
852 MHz	852 MHz	1.2 GHz	1.9 GHz
1 GB DDR3 SDRAM	1 GB DDR3 SDRAM	1 GB DDR3 SDRAM or LPDDR4	max. 16 GB LPDDR4x
8 GB eMMC (optional: 1 GB SLC NAND-Flash) 16 MB Boot-NOR-Flash	8 GB eMMC (optional: 1 GB SLC NAND-Flash) 16 MB Boot-NOR-Flash	8 GB eMMC 32 MB Boot-NOR-Flash	up to 64 GB
4 KB	4 KB	8 KB	-
MCS RV-3029-C3 (temperature compensated)	MCS RV-3029-C3 (temperature compensated)	MCS RV-3029-C3 (temperature compensated)	-
-40 °C to +85 °C	-40 °C to +85 °C	-40 °C to +85 °C	-40 °C to +85 °C
1 x 10/100 Mbps inkl. Phy	1 x 10/100 Mbps inkl. Phy	2 x 1 Gbps Ethernet (IEEE1588, AVB)	2 x GbE
1 x USB 2.0 High-Speed (480 Mbps) OTG incl. Phy 1 x USB 2.0 High-Speed (480 Mbps) Host incl. Phy	1 x USB 2.0 High-Speed (480 Mbps) OTG incl. Phy 1 x USB 2.0 High-Speed (480 Mbps) Host incl.	1 x USB 3.0 Super-Speed (5 Gbps) Dual-Role incl. Phy 1 x USB 2.0 High-Speed (480 Mbps) OTG incl. Phy	2 x USB 3.1 Gen2
up to 2 x CAN	up to 2 x CAN	up to 3 x CAN	up to 2 x CAN
up to 3 x UART	up to 3 x UART	up to 6 x UART	up to 2 x UART
up to 3 x I2C	up to 3 x I2C	up to 9 x I2C	up to 2 x I2C
up to 4 x SPI	up to 4 x SPI	up to 4 x SPI	1 x SPI + 1 x eSPI
up to 2 x serial audio	up to 2 x serial audio	up to 4 x serial audio	1 x serial audio
up to 2 x camera	up to 2 x camera	up to 2 x camera	-
up to 2 x SD/MMC	up to 2 x SD/MMC	up to 2 x SD/MMC	eMMC 5.1 interface
-	-	ADC: 6 channels @ 12 Bit	-
1 x 200-pin SO-DIMM (contact baseboard TYCO (AMP) 1717254-1)	1 x 200-pin SO-DIMM (contact baseboard TYCO (AMP) 1717254-1)	integrated solution	SMARC 2.1
67.6 mm x 55.0 mm	67.6 mm x 55.0 mm	integrated solution	82,0 mm x 50,0 mm
Linux Kernel 5.15 (LTS) Yocto Kirkstone 4.0	Linux Kernel 5.15 (LTS) Yocto Kirkstone 4.0	Linux Kernel 5.10 (LTS) Yocto Hardknott 3.3	Linux, Windows, Android
Qt 5.15 (LTS) more on request	Qt 5.15 (LTS) more on request	Qt 5.12 (LTS) more on request	Qt, HTML5, more on request

# EVALUATION KIT

## YOUR SYSTEM DEVELOPMENT

With the Evaluation Kit for the **POWER<sup>ECU</sup>**, you get a fully functioning system development package for testing your application or fast design of prototypes.

The outside of the Evaluation Kit features all current interfaces for simple connection. The Evaluation Kit is supplied with embedded LINUX, a Qt demo application as well as a virtual machine with SDK and Qt Creator.



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### Processor

i.MX6Dual / i.MX6Quad

### Display

12.1" PCAP touch and TFT display

### Resolution

1280 x 800

### Interfaces

USB, serial, CAN, Ethernet etc.

### Operating system

Embedded LINUX

### Scope of delivery

- Qt demo application
  - Virtual machine with SDK and Qt Creator
  - User Manual
  - LINUX Reference Guide
-

# YOCTO LINUX BSP

## CUSTOMIZED AND FLEXIBLE

The BalanceECU, PowerECU as well as UltimateECU are equipped with a Yocto-based Linux Board Support Package (BSP). Thanks to the high integration of interface drivers, functions and graphics performance, an easy and cost-effective implementation of your application is possible.



### SYSTEM

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#### Kernel

5.15 (LTS)

#### Bootloader

U-Boot 2022.07

#### Distribution

Yocto Kirkstone 4.0

#### File system

Ext4 (UBIFS on request)

#### Init system

systemd

### GRAPHIC

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#### Graphic library

OpenVG 1.1 / OpenGL ES 3.0 / EGL 1.4

#### Window system

Wayland display protocol with Weston compositor

#### GUI Framework

QT 5.15 (LTS) / DRM KMS further on request

### LICENSES

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#### GNU General Public License (GPL)

Version 3, June 2007  
Version 2, June 1991

#### GNU Lesser General Public License (LGPL)

Version 3, June 2007  
Version 2.1, February 1999  
Version 2, June 1991

Depending on the scope of delivery, further licenses may be affected.

### DRIVERS AND INTERFACES

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#### Memories

NAND-Flash / QSPI-NOR-Flash / EEPROM / SD-Card / USB Mass-Storage / eMMC

#### Input devices

Mouse, Keyboard, RAFI-Touch (PCAP)

#### WLAN / Bluetooth

optional

### FUNCTIONS AND SERVICES

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#### Console

Serial consoles / network consoles

#### Shell

Bash

#### Connectivity

OpenSSH (Client & Server) / SFTP

#### Audio

PulseAudio / ALSA (Advanced Linux Sound Architecture)

#### Video

V4L (Video for Linux) mit H.264 Video-Decoding (HW-accelerated)

#### Package Manager

dpkg (Debian Package Manager)

#### Webserver

Apache2 mit PHP7-Support / Lighttpd on request

#### Database

MariaDB v10.7.4 (former MySQL)

#### Script Support

Python v3.10 / Further on request

#### Splashscreen

Adaptable

#### Image Update

Kernel, Bootloader, RootFS, Splashscreen

The information in this brochure contains general descriptions and performance characteristics which may not apply exactly in the concrete application and/or which can change due to further development of the products. The technical data, images and other details of our products are merely the results of individual technical tests. These and other performance characteristics are only binding when they are expressly agreed upon conclusion of the contract.

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