AC370 • *Embedded Blue*®

DIN Rail ARM® v8 Microcomputer • Marvell® Armada® 3700 Family SoC

Overview

The AC370 is a DIN Rail boxed microcomputer for general industrial applications, equipped with a low power Marvell® ARMADA® 3700 SoC (ARM® v8 Cortex™-A53).

Networking is provided through wireless (WiFi 6, Bluetooth), and by cable (RJ45 GbE). External devices can be attached to the USB3 receptacle. As an option, an isolated UART interface is available, either RS-232 or RS-485. The AC370 has a wide-range 9-57VDC power input, via either an M12-A style or terminal block power connector (option).

Customer programming is hardware supported by means of the USB Type-B receptacle and the MicroSD card slot. Typical applications of the AC370 are router, gateway, data conversion, device controller, fog computing.

The AC370 has an internal mezzanine interface (SerDes 2.5GbE, MDIO) which can be used for mounting an Ethernet switch PCB. This allows switch management and/or protocol stacks e.g AVB/TSN, by the ARMADA® CPU.

Technical Features

General

▸ Microcomputer box, for DIN rail mount or wall mount
▸ Marvell® ARMADA® 3700 SoC family
▸ 88F3710 single-core
▸ 88F3720 dual-core
▸ Low power consumption under different workloads
▸ Optimal performance-per-Watt in the embedded markets
▸ Box dimensions 30mm (W) x 140mm (H) x 90mm (D) w/o DIN rail brackets
▸ Option 45mm (W) as assembly with eight port GbE switch (AL210, AL230)
▸ Metal case, DIN rail bracket or wall mount plate
▸ M12 and/or terminal block power connector
▸ Wide input voltage range 9-57VDC

Front Panel I/O

▸ RJ45 Gigabit Ethernet connector 1000BASE-T, 100BASE-TX, 10BASE-T compliant
▸ Micro SDHC Card slot
▸ SMA antenna connectors Wi-Fi 6 & Bluetooth® 5
▸ USB 3.0 Type-A connector 5Gbps maximum speed
▸ USB 2.0 Type-B receptacle (diagnostic & programming I/F)
▸ M12-A 5-pin male connector DC power input
▸ Optional terminal block 3.5mm pitch 4-position screw lock (bottom of box) power input

Option

▸ Isolated RS-232 or RS-485 I/F, RJ45 jack (replaces Type-B receptacle)

Technical Features

CPU

▸ Marvell® Armada® 88F3720 dual-core SoC

▸ ARM® v8 Cortex™-A53

▸ Up to 1GHz for industrial temperature range

▸ 32 KB-instruction / data (4-way) set associative L1 cache with parity/ECC protection

▸ Integrated power switches for dynamic shut down of CPU cores and unused functions

▸ Optimal performance-per-Watt

▸ High-performance security offload engine including IPSec, SSL, DTLS, and IKE

▸ Hardware compliance with ARM Trustzone® architecture for DRM

▸ Enhanced Secure-Boot flow using integrated one time programmable (OTP) memory

▸ FIPS-140 certified

▸ DDR4 512Mb x 16 (1GB) soldered DRAM

▸ e•MMC 5.1 Flash 16GB (up to 64GB)

▸ SPI Flash 64Mb

▸ 1 x 2.5 Gigabit Ethernet (SERDES) in use for mezzanine connector (switch host management)

▸ 1 x 1 Gigabit Ethernet (RGMII PHY) front panel I/O usage 1000BASE-T

▸ 1 x USB 3.0 front panel I/O

▸ 1 x PCIe Gen2 & USB 2.0 in use for M.2 socket (2230 Wi-Fi/BT)

▸ 1 x SDIO 3.0 for Micro SDHC card front I/O

▸ 2 x UART for Debug/Programming and optional RS-232 or RS-485

Technical Features

Networking

Connectivity

▸ RJ45 front port w. integrated magnetics, triple speed 1000BASE-T, 100BASE-TX, 10BASE-T, Energy Efficient Ethernet (EEE)
▸ Optional isolated RS-232 or RS-485 interface RJ45 front panel jack (mezzanine modules SUG or SUH)

Wireless

▸ Wi-Fi 6 IEEE 802.1ax up to 2.4Gbps dual band 2x2 160MHz (SMA antenna front connectors)
▸ Bluetooth® 5 (SMA antenna front connectors)

Switching

▸ 1 x 2.5 Gigabit Ethernet (SERDES) in use for mezzanine connector
▸ Switch host management for unmanaged Embedded Blue® GbE switch solutions
▸ Option AVB/TSN protocol stacks (AVNU certified) available

▸ Available as stacked assembly in a common box e.g.:
▸ AL110 (5 port M12-X GbE switch with AC370)
▸ AL210 (8 port GbE switch with AC370)
▸ AL230 (8 port PoE+ switch with AC370)

Technical Features

Ecosystem

▸ OS: Ubuntu 22.04 LTS or newer
▸ Kernel: 6.1.26 LTS or newer
▸ Webserver: AC370 1.0.3 or newer
▸ RS-485 Driver (AC370 w. RS-485 port)

Options

▸ AVB/TSN support for AC370 controlled Ethernet switch boxes e.g. AL210, AL230
▸ OpenWRT (replaces Ubuntu OS, AL210, AL230)
▸ AVB/TSN w. OpenWRT (AL210, AL230)
▸ AP (restriction w. Intel AX210 Wi-Fi 6 - requires other active APs detected/scanned)
▸ EdgeFarm (Ci4Rail, WiP)

Developers

▸ JTAG port (on-board pin header) suitable for deep hardware/software debugging
▸ UART1 wired to USB Type-B front receptacle via FT234XD for diagnosis and programming
▸ USB UART drivers suite (FTDI website)

Applications

▸ Industrial networks - IIoT
▸ Industrial, factory and building automation
▸ Rugged environments
▸ Edge and fog computing
▸ Transportation
▸ AP routers
▸ Multi-protocol gateways
▸ Host management for networking (AVB/TSN)
▸ AC370 can be combined with unmanaged Embedded Blue® switch solutions via 2.5GbE I/F

Technical Features

Power Requirements

▸ DC Input, 9V-57VDC (12/24/48VDC)
▸ Rated power consumption 15W
▸ Fast acting chip fuse (PCB soldered type - no replacement on-site)
▸ Protected against reverse polarity
▸ ESD protection (TVS)
▸ Common mode input filter
▸ M12 front power connector
▸ Option 4-position terminal block 3.50mm pitch screw locked for DC power input

Environmental, Regulatory

▸ Designed & manufactured in Germany
▸ ISO 9001 certified quality management
▸ Long term availability
▸ Rugged solution
▸ RoHS compliant
▸ Operating temperature 0°C to +70°C (commercial temperature range)
▸ Operating temperature -40°C to +85°C (industrial temperature range) on request
▸ Storage temperature -40°C to +85°C, max. gradient 5°C/min
▸ Humidity 5% ... 95% RH non condensing
▸ Altitude -300m ... +3000m
▸ Shock 15g 0.33ms, 6g 6ms
▸ Vibration 1g 5-500Hz
▸ EC Regulatory EN55035, EN55032, EN62368-1 (CE)
▸ International Protection EN60529 IP20
▸ MTBF 78.0 years (MIL-HDBK-217F, SN29500 @+40°C)

all items may be subject to technical changes w/o further notice

Front Panel
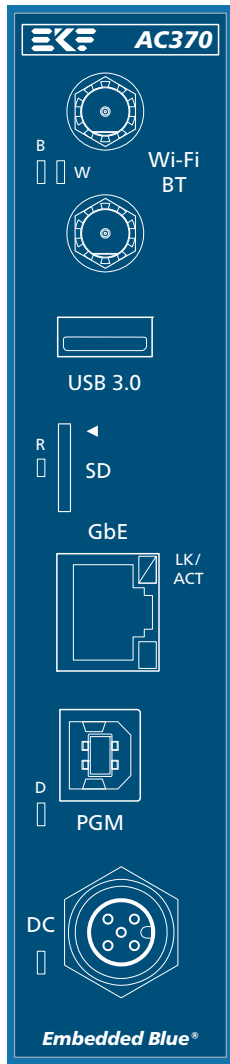
Regular
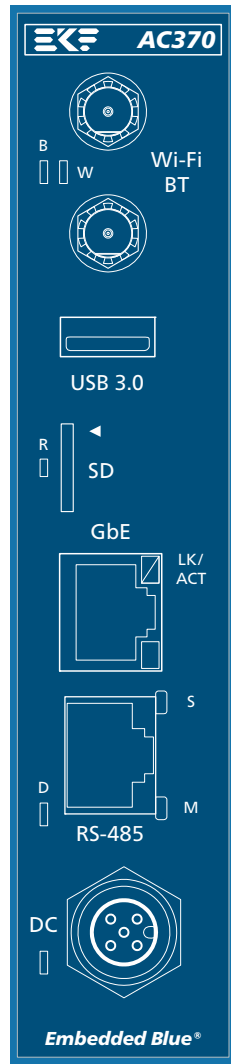
RS-485

| Wireless LEDs	
B green	Bluetooth active
W blue	Wi-Fi active
Push Button Switch	
R	CPU manual reset (pin tool required)
CPU LED	
D blue	CPU active
DC LED	
blue	DC input power present, internal power good
red	internal power not yet ready or external DC power out of range
off	DC input power faulty (reverse connection, wrong pins, external power supply off?)

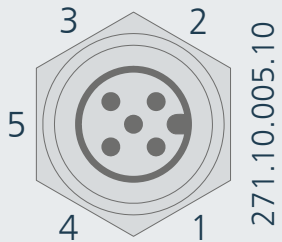AC370 w. AL100 5-Port GbE Switch
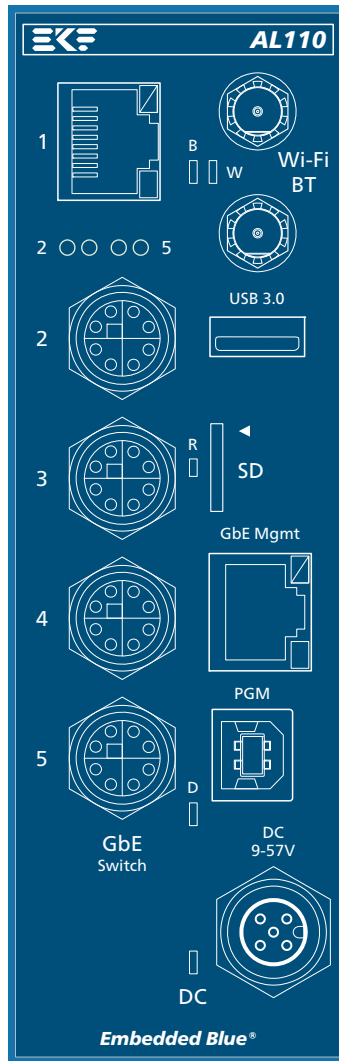
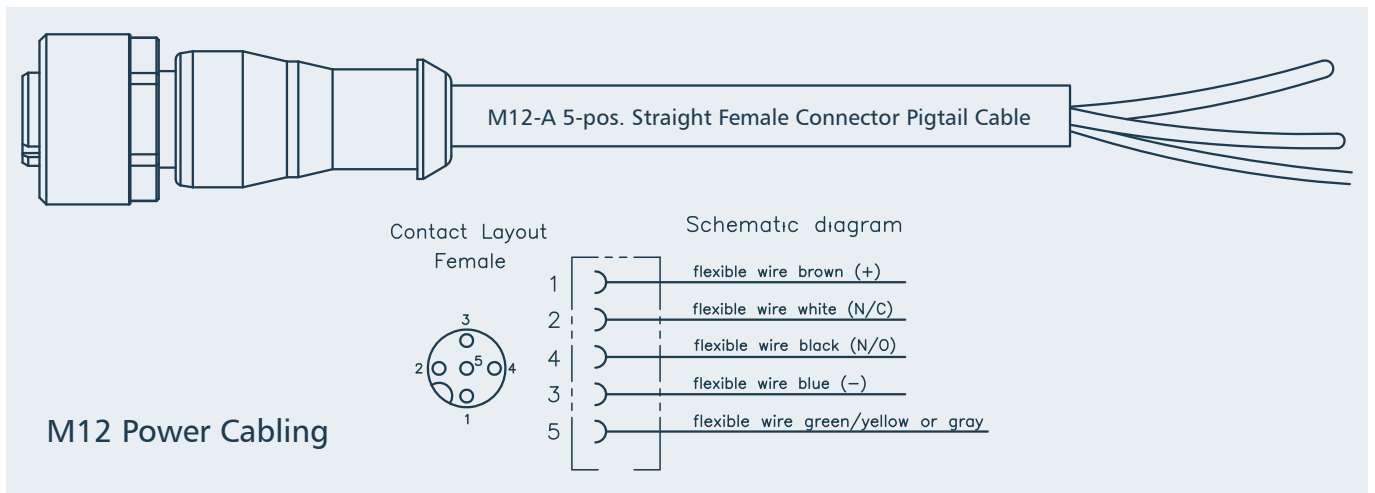## AC370 w. AL200 8-Port GbE Switch
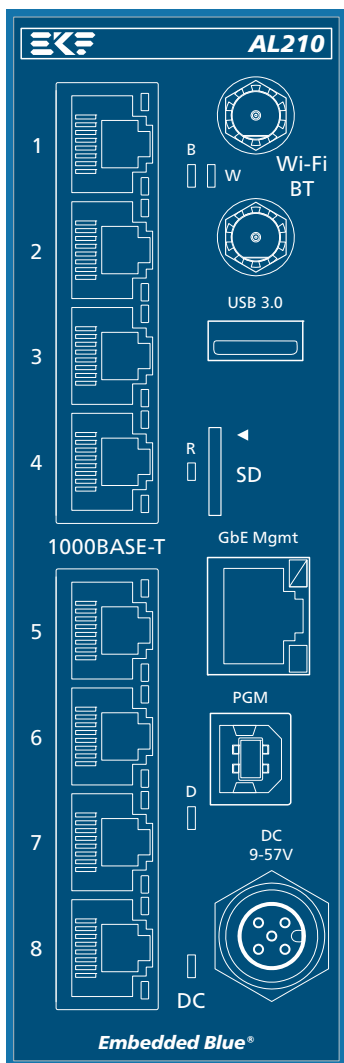
AL210 (Front)
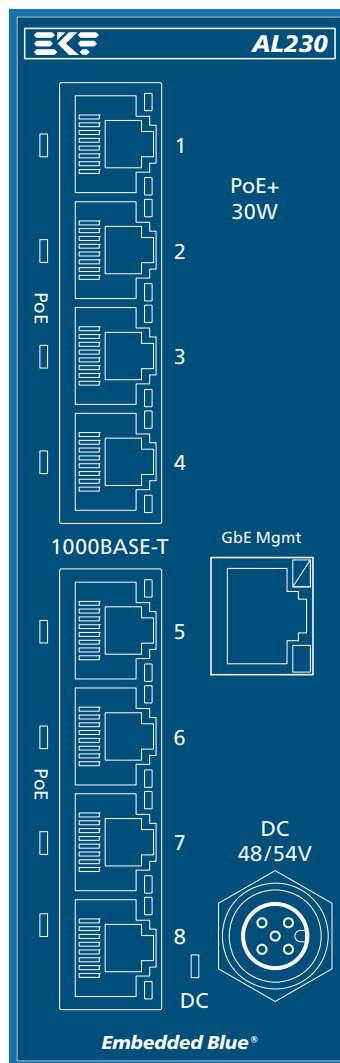
AL230 (Front)

M12 Power Connector Pin Assignment

PCB Connector M12-A 5-Position Male 4A/Pin			
3 2 5 271.10.005.10 4 1	+V=9-57VDC	1	+V
		2	RSV
		3	GND
		4	RSV
		5	FE (Shield)

Mating Pigtail Cable Assemblies 1.5m w. Female Straight Plug	
EKF	271.10.505.22.015
Phoenix Contact	1669822
Tyco (TE)	2273035-1

M12-A 5-pos. Straight Female Connector Pigtail Cable

Contact Layout
Female

Schematic diagram

1	flexible wire brown (+)
2	flexible wire white (N/C)
4	flexible wire black (N/O)
3	flexible wire blue (−)
5	flexible wire green/yellow or gray

M12 Power Cabling

pre-assembled standard pigtail cables - wires #2 and #4 not in use (reserved)

M12 Pigtail Cable

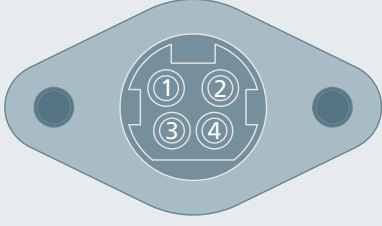## Option Terminal Block Power Connector Pin Assignment

3.50mm 4-Position Terminal Block 8A/Contact			
245.35.04.00	+V=9-57VDC	1	+V
		2	GND
1 2 3 4		3	RSV
		4	FE (Shield)

Mating Plugs w. Screw Lock	
EKF	245.35.04.20
FCI Amphenol	20020000-C041B01LF
Molex	39504-0004
Phoenix Contact	1847071
Tyco	284510-4

Option Terminal Block Plug Power Cabling

245.35.04.20
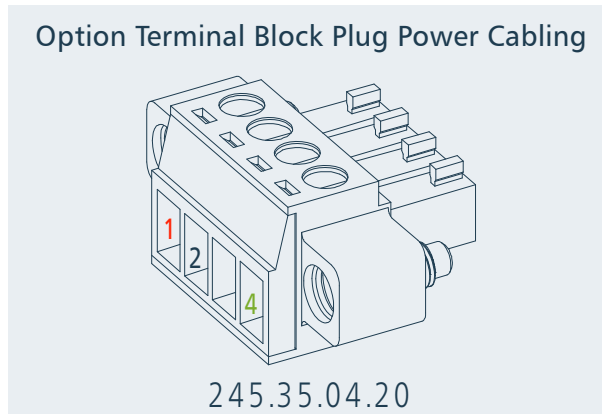
Mating DIN Rail Power Supply	
EKF	352.1.075.24.1
Meanwell	NDR-75-24, 75W 24VDC/3.2A

Option Rear Power Connector

Circular 4-Position Power Receptacle (7.5A/Pin)			
271.04.004.10	+V=9-57VDC	1	+V
		2	+V
		3	-V (GND)
		4	-V (GND)
		Shield	Reserved *

* power supply cable harness may connect GND to Shield

Mating Desktop Power Adapter w. Cable Assy	
EKF	353.1.120.24.1
FSP Technology	FSP120-AAAN3, 120W 24VDC/5A

Block Diagram

Wi-Fi/BT

Wi-Fi-6 802.11AX
Wi-Fi/Bluetooth Module

M.2 WiFi 2230 Socket 1 Key A-E

M.2 E-Key

Wi-Fi 6
BT 5

PCIe Gen2

USB 2.0

USB 3.0

USB 3.0

SD

Micro SDHC

SDIO

GbE

1000BASE-T

MagJack

Marvell 88E1510

1000 BASE-T PHY

RGMII

P

FT234XD

USB 2.0 D+/D-

Diagnostic/Programming

USB UART

RX/TX

PK1

UART

SK101

for RS-485 or RS-232
isolated transceiver
SU* mezzanine module

DC
9V-
57V

Embedded Blue®

Armada 3720 SoC

HS1 - PCIe

USB 2.0 #1

HS2 - USB 3.0

SDIO

RGMII

UART1

UART2

JTAG

HS0 - SGMII 1
SMI
(MDC/MDIO)

e•MMC

SPI

SDRAM

JTAG

PI1

Simplified Block Diagram
AC370 R.1

bottom mount
mezzanine expansion
connector

2.5Gbps

P0

up to 64GB

e•MMC

e.MMC
16GB

SPI

Flash
64Mb

P1

16

DDR4

SDRAM

1GByte

© EKF
ekf.com

DC IN

Chipfuse

CMC

100V
10A

+VIN

V1/V0

SiC466

DC/
DC

+5V

Option

TVS
58V

Dimensions

Attach

Detach

AC370
ARM® V8
Industrial Controller

ekf.com

3 -

DC
9-57V

1 +

AC370 (Right Side)

44.3mm

70.0mm

34.0mm

140.0mm

61.7mm

70.0mm

90.0mm

DIN Rail Mounting Option (Picture Similar)

Wall Mount Plate Option (Picture Similar)

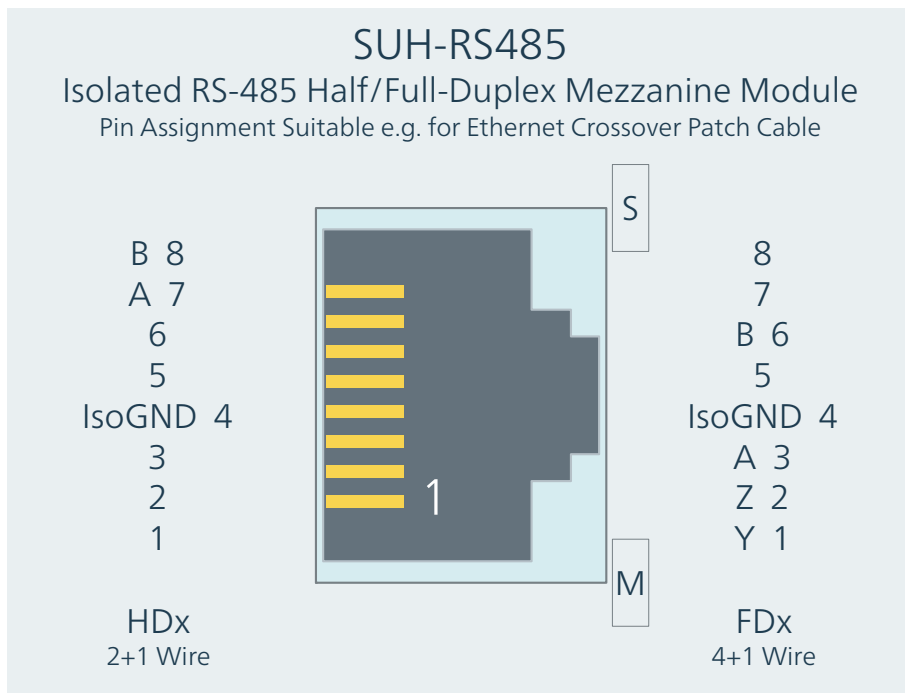| Ordering Information |
| --- |
| For popular AC370 SKUs please contact sales@ekf.de |

Related Products	
AC370	ARM® V8 Industrial Microcontroller
AL100	5 port M12-X unmanaged GbE switch
AL110	5 port M12-X GbE switch w. AC370 ARM® V8 CPU
AL200	8 port RJ45 unmanaged GbE switch
AL210	8 port RJ45 GbE switch w. AC370 ARM® V8 CPU
AL220	8 port RJ45 unmanaged PoE+ GbE switch
AL230	8 port RJ45 PoE+ GbE switch w. AC370 ARM® V8 CPU
AL600	7 port Single Pair Ethernet switch 100BASE-T1 (IP20)
AL610	7 port SPE switch 100BASE-T1 w. AC370 ARM® V8 CPU
AL700	5 port Single Pair Ethernet switch 100BASE-T1 (M8 Hybrid)
AL710	5 port SPE switch 100BASE-T1 w. AC370 ARM® V8 CPU
SUG-RS232	Mezzanine module, isolated RS-232, AC370 option
SUH-RS485	Mezzanine module, isolated RS-485, AC370 option

Option RS-485

The AC370 box can be equipped with an isolated RS-485 port. Due to space limitations, the USB Type-B connector of a regular AC370 will be replaced by the SUH-RS485 mezzanine module, which provides isolated transceivers connected to the UART2 of the ARMADA® SoC.
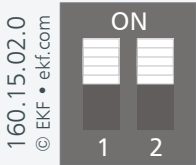
The SUH-RS485 can be ordered for either half-duplex operation (2+1 wire) or full-duplex (4+1 wire). The RJ45 front connector may be used together with a common Ethernet cable or any twisted pair wires. With respect to FDx mode (4+1 wire point-to-point) a 100BASE-T crossover cable (but not a 1000BASE-T crossover cable) can be used for direct connection SUH to SUH, e.g. the 'LogiLink CQ2029X CAT6 S/FTP Crossover Patch Cable'. In HDx mode (2+1 wire PartyLine) regular 1000BASE-T cables are suitable as well and available for up to 100m cable length.

RS-485 drivers are included in the AC370 software support package.

SUH-RS485
Isolated RS-485 Half/Full-Duplex Mezzanine Module
Pin Assignment Suitable e.g. for Ethernet Crossover Patch Cable

B 8			8
A 7			7
6			B 6
5			5
IsoGND 4			IsoGND 4
3			A 3
2			Z 2
1			Y 1
HDx			FDx
2+1 Wire			4+1 Wire

| SUH Transceiver Modules LED			
Front Connector	Status LED S (top)	Mode LED M (bottom)	Ordering No.
RJ45 8-pos. RS-485	Week Red (ISOPWR ok) Green (Receive Data) Blue (Transmit Data)	Yellow (2W) Magenta (4W)	SUH-P5177-RS485 SUH-P5187-RS485

RS-485 transmission lines should be terminated on both cable endings via 120R. This can be done externally, or by means of a DIP switch provided internally on the SUH module. By default the internal termination is active. The AC370 however can be ordered also with deactivated line termination, since changing the switch settings by the customer would require to open the box and remove the SUH mezzanine from the carrier PCB.

SUH Termination DIP Switch 1		
160.15.02.0 © EKF • ekf.com ON 1 2	1=ON	Y/Z Termination 120R Active (Full-Duplex Only)
	2=ON	A/B Termination 120R Active

For PartyLine mid-span configurations (2+1W, half-duplex) there are RJ45 T-adapters available from several manufacturers, e.g. 'Renkforce RF-4538140' (picture below), with an 1:1 wiring scheme.

SUH Related Information	
SU* UART Mezzanine Modules	https://www.ekf.de/s/sue-suj/sue-suj.html
SU* Product Information	https://www.ekf.de/s/sue-suj/sue-suj_pi.pdf
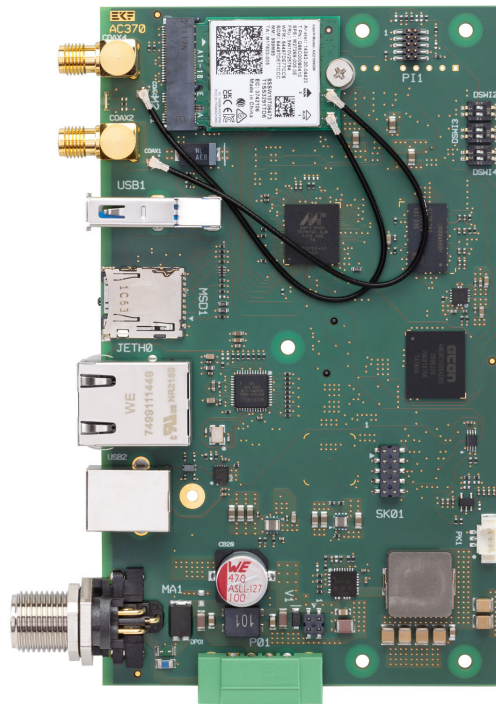
AC370 Regular PCB
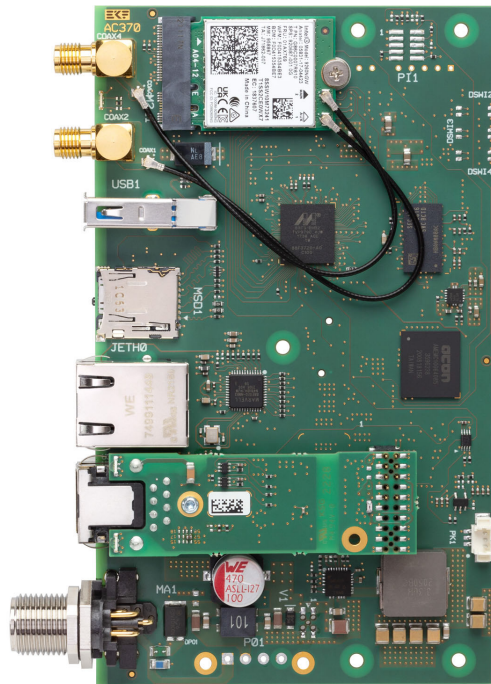
AC370 w. SUH-RS485 Mezzanine

https://www.ekf.com/a/DIN_Rail_on_off_500x280.mp4

Webserver

The AC370 is provided with a HTML webserver, available via the front panel MGMT RJ45 connector. As of current, the AC370 in its default state must be directly connected to your local computer, and must not be attached to the corporate network, due to potential IP address conflicts (DHCP implementation planned). After changing the AC370 RJ45 management port IP according your needs (be careful to avoid misconfiguration) the webserver is also remote available.

The webserver can be reached by default via the IP **10.0.0.2** using either HTTP or HTTPS. After successfully logging in, the webserver presents the user landing page. Please note that the webserver itself is part of the AC370 firmware by default, but not the AVB stack, which must be separately licenced.

The *user landing page* includes the following features:

▸ The *Update* function, which is split into two parts, updating the AVB software, and updating the webserver itself.
  ▸ When choosing to update the AVB software, the user must upload a file with the name "xl4avb-armada_arm64.deb". This file will then be checked for its author and contents, determining its authenticity. If it is deemed authentic, the software will be updated.
  ▸ When choosing to update the webserver, the user must upload a file with the name "WebserverAC370.tar.gz". The file contents will be extracted to the directory of the webserver, overwriting existing files. To ensure that all scripts are still executable, the install script is re-run. Afterwards the webserver service gets restarted.

▸ The *Version* function, which returns information about the current version of the AVB services, the kernel, and the webserver.

▸ The The Settings function, which allows configuration of the switch. This allows you to switch between AVNU and MILAN specifications, set up VLANs, change the IP addresses and switch the speed of the SERDES mezzanine I/F (SFP speed) between 1 and 2.5Gbit/s.

▸ The *Reboot* function, which prompts an alert that needs to be confirmed by the user to reboot the AC370 device.

▸ The *Logout* function, which logs the user out.
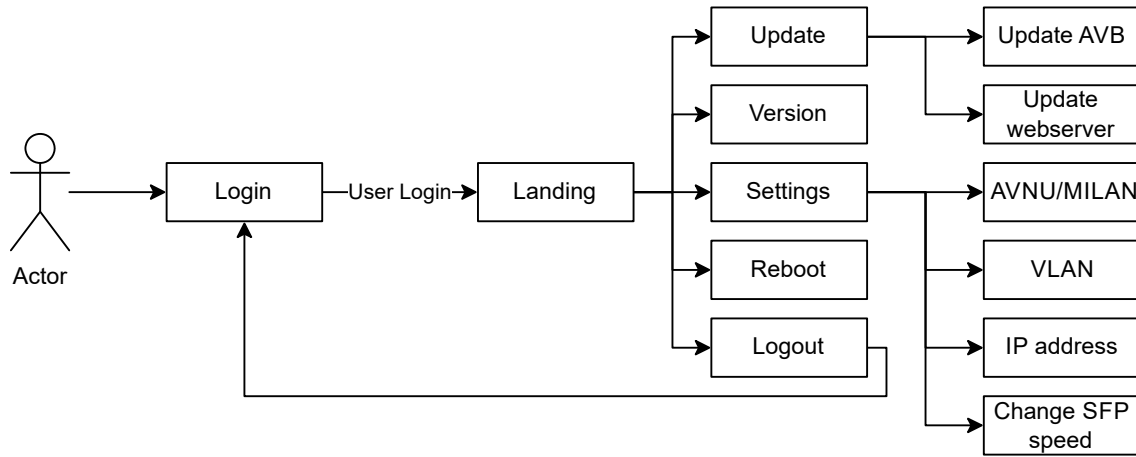
Flowchart User Login

Login

Username:

Password:

Login

Default: https://10.0.0.2 User: admin Password: admin

UPDATE

VERSION

SETTINGS

REBOOT

LOGOUT

Landing Page

AVNU/MILAN

VLAN

IP ADDRESS

CHANGE SFP SPEED

BACK

Settings Menu

☰	**WEBSERVER UPDATE**
🔧	**AVB UPDATE**
←	**BACK**

Update Selection Webserver Firmware or AVB Software Stack

No file chosen

📄	**SELECT FILE**	**UPDATE**
←	**BACK**	

Update File Selection

Shell

Developers can login to the AC370 Ubuntu Linux in order to open a shell by either one of two connection methods:

1. Remote - connection to a PC established via the RJ45 Gigabit Ethernet management port
2. Local - connection to a PC established across the USB 2.0 Type-B diagnostic/programming port

Remote (Windows and Linux similar): 'ssh root@10.0.0.2' (password '2023hdim').
The IP address entered must match the current AC370 IP. The default address above should be changed to match your enterprise network, either manually or by DHCP (can be ignored if the AC370 management port is directly connected to your PC via an Ethernet patch cable).

Local - the AC370 USB Type-B jack is wired via an USB to UART controller FT234XD to the Armada UART1 port. A controller driver software must be installed on your PC before a connection can be established, available here for several OS: https://ftdichip.com/drivers/. Attach the AC370 by means of a common USB2 Type-A to Type-B cable to your PC. For login to the AC370 (username: 'root', password: '2023hdim' you can use e.g. 'putty' with respect to Windows, and 'minicom' for Linux. Setup the UART interface for 115200 Baud, 8 data bits, no-parity bit, 1 stop bit, and no additional hardware/software flow control.

Embedded Blue®

50 Years
1972 - 2022
Years
boards. systems. solutions.

Document No. 9474 • © EKF • 8 August 2023

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