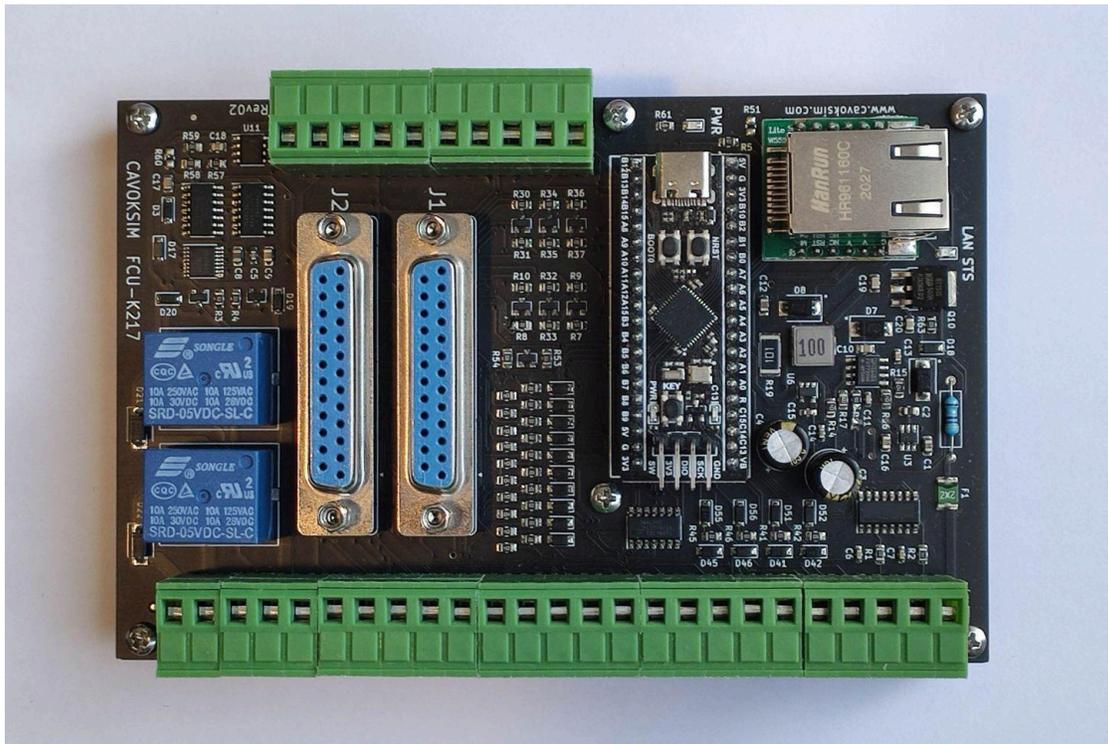




CAVOK

Simulations

Manual
for
Arinc Interface Board
ARC-FCU-217



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- Please read this manual carefully before installing your product
- Please follow all Precautions to safely install your product. When these guidelines are not followed the product or the aircraft component to be interfaced might be damaged. This damage will then not be covered by warranty.

General Precautions

- **The Cavoksim Arinc board is a static sensitive device. Observe the following precautions to reduce the possibility of electrostatic discharge:**
 - Handle the board carefully, holding it only by its edges.
 - Do not touch solder joints, pins, or bare circuitry.
 - The use of a grounding system improves safety. Wear an electrostatic-discharge wrist strap, if one is available. If you do not have a ESD wrist strap, first touch a grounded metal object to discharge static electricity before touching the board
 - Take extra care when you handle the board in a low humidity environment. Dry air increases the conditions that cause static electricity to accumulate.
- **Take extra care when connecting the main supply voltage to the board. Applying a voltage that is too high or has reversed polarity or applying the voltage to the wrong board terminals can damage the board or the FCU. Do not connect or disconnect wires to the board while the power is switched on.**
- **Keep the FCU board and the QuickConnect adapters away from metal objects or conductive surfaces that might touch the boards and create short circuits with exposed solder joints and components of the boards. Install the FCU board in a protective enclosure.**

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1 Introduction

The ARC-FCU-217 Arinc Interface board is designed to interface an original A320 series FCU (Flight Control Unit, Part number starting with K217) with several Windows PC based flight simulations. The interface board is only suitable for FCUs with this part number. Physical A330/A340 type FCUs are not supported with this board. However, A340 FCUs look similar to A320 series FCUs and the Arinc Interface board allows connecting a K217 A320 FCU to the ToLiss A340-600 aircraft with only some small restrictions.

This board offers a number of advanced features that makes the interfacing with the PC fast and convenient:

- “Plug and Play” connections via the CAVOKSIM Quick Connect system. This allows for an easy and fast connection of the FCU to the board. It is also safe way of connecting the board because it reduces the risk of wiring errors which could potentially damage the FCU
- The board uses a Lan/Ethernet connection to the PC which is more reliable than an USB connection. It also electrically isolates the PC from the rest of the system and helps avoiding interference problems.
- Onboard power converters generate all necessary supply voltages from the same single 24-28V power source which is also used to power the FCU. No need for an additional 5V power supply to power the logic board
- An onboard 400hz AC inverter circuit supplies the FCU annunciators. This ensures that the annunciator lights illuminate with the same brightness as in the aircraft. If they were powered by a DC supply, only half of the annunciator LEDs would illuminate.
- Modern ARM Cortex M4 Microcontroller for high performance real time Arinc decoding. High speed signal sampling via DMA. The Arinc decoding algorithm uses the same timing specifications as aircraft avionics. It provides advanced error correction and high reliability.
- On board protections against reverse polarity of the supply voltage and a dedicated safety circuit to protect the FCU in case of power supply malfunctions. On board self-resetting electronic fuse.

2 Required parts list

2.1 Parts included with the ARC-FCU-K217 Kit

- 1x ARC-FCU-K217 Interface board
- 1x FCU Quick Connect Adapter for FCU connector J1
- 1x FCU Quick Connect Adapter for FCU connector J2
- 2x Flat ribbon cable with DB25 connectors

2.2 Additional parts required

A320 series aircraft FCU

Only FCUs with the part number (P/N) beginning with K217 are supported (for example K217ABM11). A placard with the P/N can be found on the back of the FCU. These FCUs have 2 connectors on the back labeled J1 and J2. Newer A320 FCU that have a P/N starting with the letter C have not been tested with this board. A330/A340 FCUs are not supported. A330/A340 FCUs can be identified by having a different P/N and have four connectors on the back instead of two.

1x Regulated power supply with an output voltage between 24V and 28V DC and a minimum current of 2A (60W output minimum)

The nominal supply voltage for the FCU when installed in an aircraft is 28V. However it will operate normally with a voltage as low as 24V DC. The voltage converter of the FCU board is designed for a voltage up to 28V DC. **Do not exceed this voltage to avoid damage!** The absolute maximum rated voltage is 30V DC. The steady state current required for board and FCU is about 700mA at 28V. However, a minimum of 2A is required for the FCU to start up.

1x Power supply with an adjustable voltage between 0 and 5V DC and a minimum current of 5.3A. (30W output minimum)

The voltage is directly supplied to the bulbs installed inside the FCU for the backlighting and is completely independent from the main power supply. It is recommended to use a regulated variable DC power supply for this purpose. It is not recommended to use a fixed 5V DC supply in combination with a pulse width

modulation (PWM) dimmer to regulate the voltage. PWM is creating electromagnetic interference (EMI) that can interfere with the FCU itself and the Arinc interface board. If you want to use a PWM dimmer, please monitor the Arinc error rate in the FCU diagnosis software to check if the Arinc interface is affected by interference.

Wires for the power supplies

For the 28V supply a minimum wire size of AWG22/0.7mm² is recommended for a wire length up to 3m. For the 5V backlight a minimum size of AWG20/0.85mm² is recommended due to the larger current. Longer wires require larger wire sizes. Wires that are too thin will cause a voltage drop and dim the maximum backlight brightness.

PC with Windows 10 or higher

PC with Windows 10 build 1903 or higher and a LAN connection to the router. There are no particular hardware requirements to run the Cavoksim FCU diagnosis software or the Cavoksim drivers. It is not recommended to connect the PC to the router via WIFI as this might increase the lag when data is transmitted from the FCU to the simulator software and make the connection more unreliable.

3 Board Overview

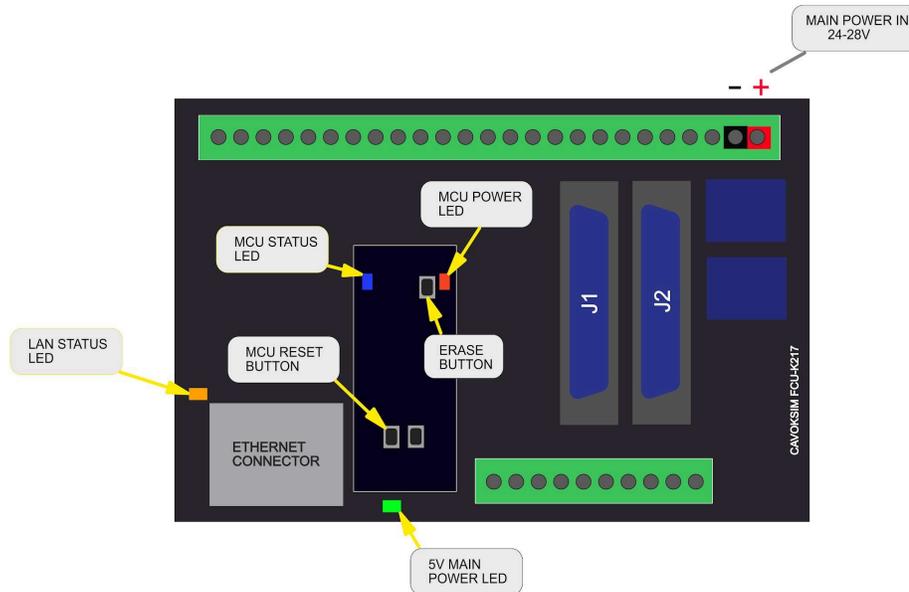


Figure 1- Board Layout

Main Power LED (green)	Indicates that the Arinc board is powered (28V to 5V onboard converter operating normally)
MCU power LED (red)	Indicates that the microcontroller is powered
LAN status LED (orange)	Steady on: LAN cable not connected or connection to interface software on PC can not be established Light off: connected to PC, normal operation
MCU status LED (blue)	Short flashes every few seconds means that there is no LAN communication to the PC software. The board is trying to connect. Blinking rapidly during settings erase sequence (see “Restore default LAN settings”)
MCU reset button	Resets Board
Erase button	Used to restore default Board settings

4 Recommended Installation and Wiring

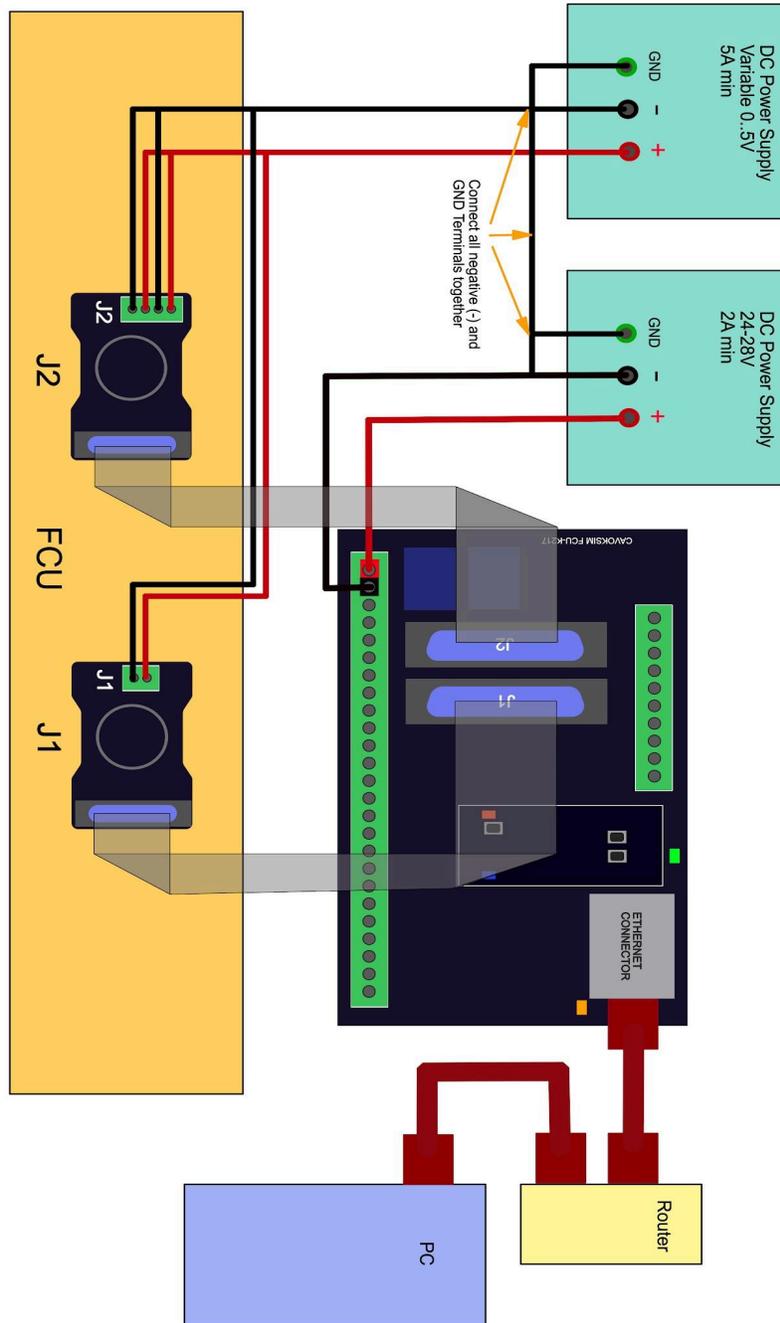


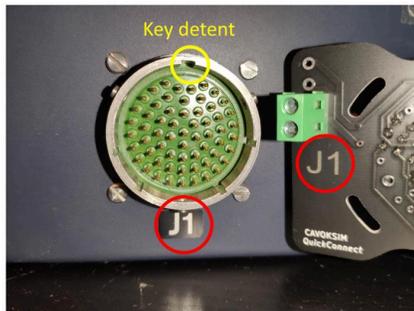
Figure 2 - Overview of the board connections

4.1 Installation of the QuickConnect adapters

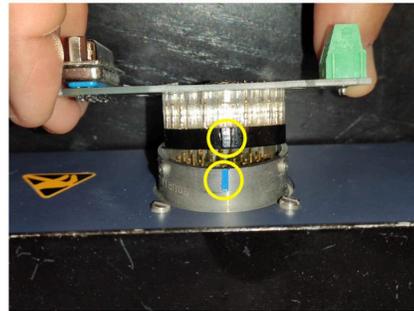
Two 61 pin circular male connectors are located on the back of the FCU, labeled J1 and J2. The FCU board kit contains two matching QuickConnect adapters, also labeled J1 and J2. The connectors have key detents and the QuickConnect adapters will only fit into their matching connectors.

Before installing the boards make sure that the pins of the circular connectors are not bent and free of any debris. Carefully align the QuickConnect adapters with their matching connectors.

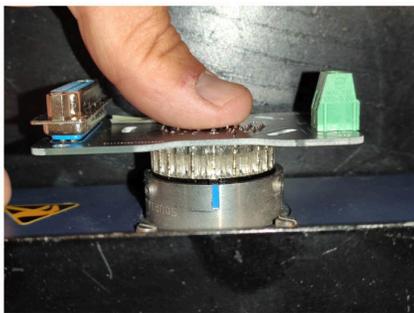
Check that the boards are upright, aligned and parallel to the connector surface. Apply pressure only to the center of the QuickConnect adapter with your thumb to insert it into the connector. Steady medium pressure is sufficient to insert the board. If you feel an increasing resistance during insertion or the board can not be fully inserted, remove the board again, check the proper alignment of the board and verify that no pins are bent. **Do not apply excessive force to insert the adapters.** Only apply pressure to the center and make sure that that board stays aligned and parallel to the FCU.



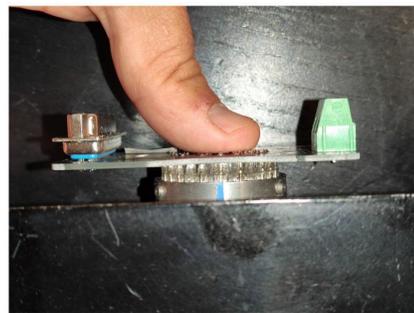
1. Check that connector and adapter type match



2. Align key detents of adapter and FCU



3. Apply pressure to the center and parallel to FCU



4. Photo shows adapter in fully inserted position

Figure 3 - Adapter installation

Note that the key detent of J2 connector is rotated 90 degrees compared to the J1 connector.

To remove an adapter, grab the adapter with two fingers at the top and button and pull it out slowly with even pressure while keeping it parallel to the FCU.

To minimize wear of the QuickConnect adapters and protect the sensitive circular FCU connectors it is recommended to leave the QuickConnect adapters permanently attached to the FCU and disconnect the DB25 connectors instead when a disconnection between the FCU board and FCU is required. When connecting or disconnecting the DB25 connectors be careful not to bend or tilt the adapters..

4.2 Connection of the Flat Ribbon cables

The FCU board kit contains 2 identical ribbon cables with male DB25 connectors on each end. Connect the DB25 connectors to the FCU board first as shown on the photos below. The ribbon cable should both point outwards away from each other as shown on the second photo to leave enough space between the connectors and avoid bending the cables too much. If a cable is pointing in the wrong direction (inward towards the other board connector) use the connector on the other end of the ribbon cable instead. The red markings on the ribbon cables have no significance.

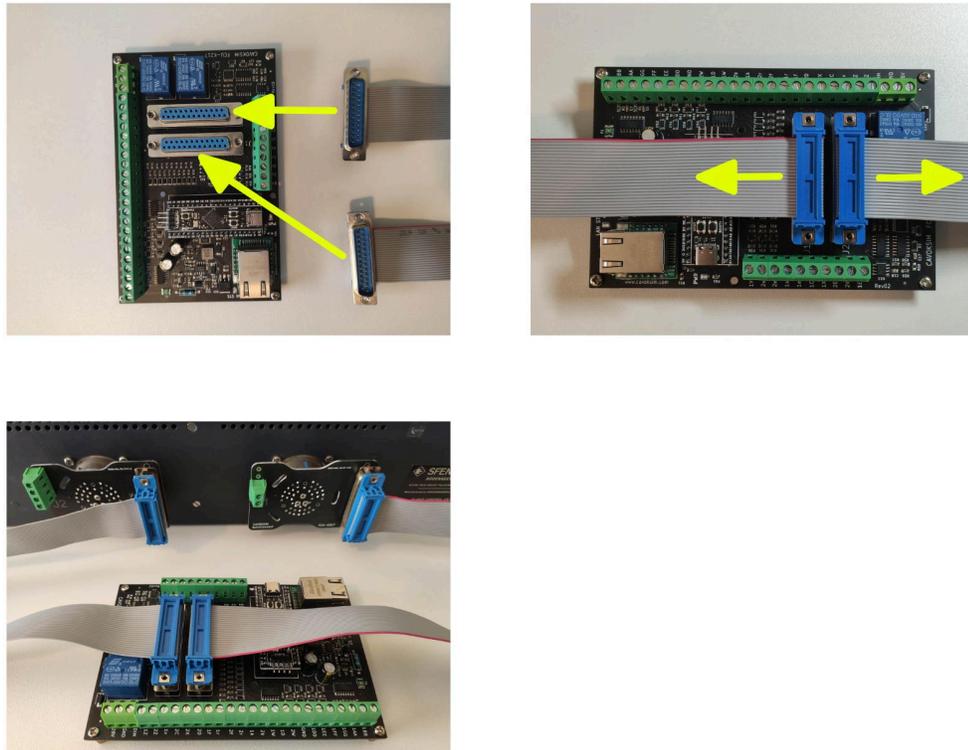


Figure 4 - Ribbon cable connection

After connecting the ribbon cables to the board connect the other ends to the J1 and J2 QuickConnect Adapters. Check the matching J1/J2 Labels on the board to connect the cables to the correct adapters. The correct connection is also shown on the connection diagram (Figure 2)

4.3 Connection of the Power wires

Be careful not to damage screw terminals by excessive force when fastening the screws. It is recommended to crimp ferrules to the wire ends or tin them with solder for a reliable contact.

Connect the main 28V power supply wires to the power supply and to the terminals of the FCU board as shown on the first 2 photos (red and black wires). **The board terminals are clearly labeled on the back of the board. Switch the power supply off before connecting or disconnecting the wires. Be careful to connect the power supply to the correct terminals and check that the power supply voltage is correct!**

WARNING: Connecting the +28V wire to the wrong terminal or supplying a voltage of more than 28V might damage the FCU board or the FCU itself.

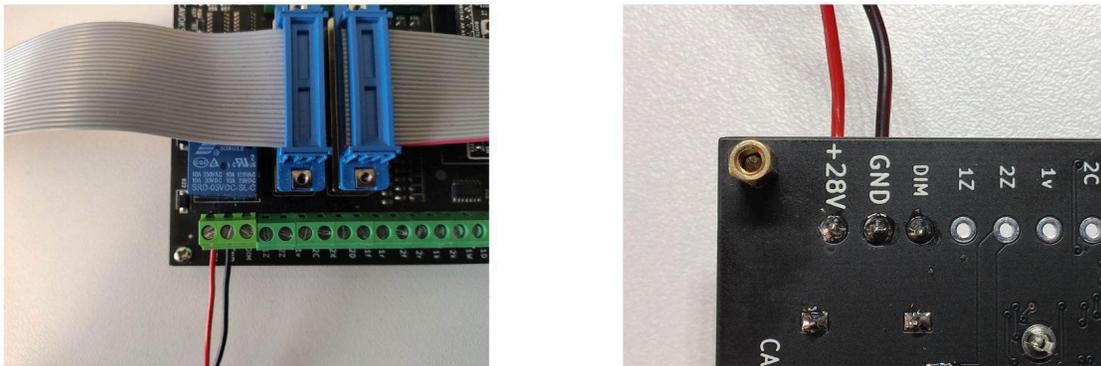


Figure 5 - Wiring of the Power supply

The Quickconnect adapter board J1 has two terminals and the board J2 has four terminals for the FCU backlight supply. There are 3 independent backlight circuits of the FCU powered by these terminals. The pinout of the terminals is shown on the following photos:

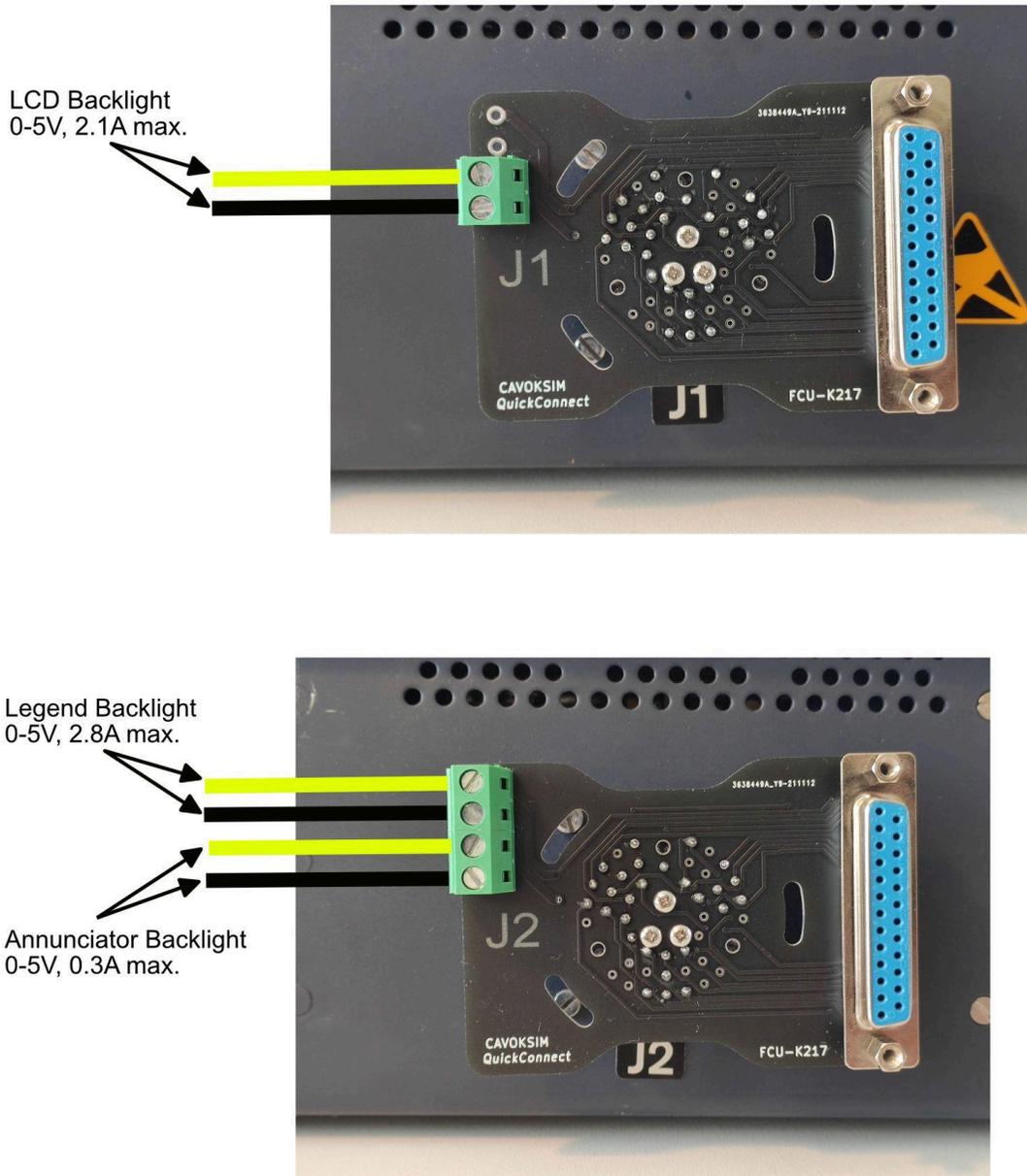


Figure 6 - Adapter terminals

The polarity of the supplied voltage is not important because the FCU backlight circuits are designed for AC voltage. However it is recommended to connect the power supply terminals as shown in Figure 2.

Each backlight circuit is isolated and independent from other FCU circuits. The 3 backlight circuits can be wired in parallel as shown in Figure 2. They can all be supplied by the same power supply. However, if the circuits are wired in parallel the current in the remaining wires will be higher, so they need to have a sufficient diameter (at least AWG20/0.85mm²).

WARNING: Do not apply a voltage higher than 5V AC or DC to any of the lighting terminals as this can damage the light bulbs of the FCU

4.4 Avoiding Interference problems

To avoid interference of the Arinc communications between FCU and FCU board it is very important to connect the negative pole of the backlight supply and the negative pole of the 28V supply together as shown in Figure 2. Without this connection the Arinc error rate can be very high and the communication between board and FCU might be disrupted.

As a general good practice for safety and to minimize interference it is also recommended to connect the Ground/Earth terminals of the power supplies to a conductive metal part of the FCU chassis. Normally this can be done via the mounting screws when the FCU is installed to a metal structure of the simulator. The metal structure of the simulator should always be connected to earth/ground potential.

It is also recommended to keep a distance of at least 1m between the power supplies and the FCU and FCU board. In case of interference problems it can help when the FCU board is protected by some metal shielding or enclosure. The backlight voltage should be supplied as a regulated 0-5V DC voltage. In the aircraft the backlight supply is 0-5V AC 400Hz sinodial and therefore this kind of power supply can also be used. However it is not recommended to supply the backlight via a fixed 5V supply in combination with a DC PWM dimmer module to regulate the brightness. PWM can create a large amount of high frequency interference (EMI) that can interfere with the Arinc communication.

4.5 Connecting of the LAN cable

Connect the LAN cable from your router to the standard RJ45 connector on the FCU board (see Figure 2). The PC hosting the simulator software and the FCU need both be connected via a router. Do not connect the LAN cable directly from the PC to the FCU board without a router as this will not work. The FCU board communicates via UDP with the PC. The default LAN configuration is DHCP and UDP port 50001. Please make sure that this port is not blocked by your router or your PC (Windows Firewall).

5 First Power up of FCU board

When all connections are completed according to Chapter 3 the 28V main power supply can be switched on. Before powering up the FCU board, check again that no parts of the board or the QuickConnect adapters will touch any metal objects. After switching on the supply, the following LEDs should come on:

- Power supply LED (green)
- LAN status LED (orange) to indicate that there is no connection to the PC software yet

If the green LED does not come on, switch the power supply off without delay and check your wiring.

The FCU will be unpowered at this stage because its power supply is controlled by the FCU board and it has to be switched on via a software command.

6 Installation of Drivers

6.1 General Information

The Cavoksim Link Plugin is a software driver that communicates with the Interface board via LAN on one side and X-Plane and the aircraft plugin via the 'datarefs' API on the other side.

There is one version of this plugin for FF A320 and another one that works with all ToLiss Aircraft (A319/A321/A340-600). These plugins have to be installed separately for each aircraft that needs to access the FCU interface board.

The plugin is automatically loaded together with the aircraft plugin when X-plane is started and will immediately begin to communicate with the FCU Arinc Board and X-Plane. No user action is necessary. A small status window will open automatically to show the status of the plugin and FCU board. This window can be closed anytime if not needed while the plugin will continue to run in the background. The Picture below shows the status window of the plugin in normal operation (example for ToLiss A340):



The status window provides various status information. In normal operation, all text should be in green. Yellow text indicates warnings and red text indicates failures.

Here is a description of possible messages that can be displayed:

Status: Connected to Simulator

The plugin has access to all needed datarefs

FCU switched on by simulation

This indicates that the virtual FCU is switched on in the simulation and the plugin will switch on the physical FCU accordingly.

Network Status: connected to FCU board

LAN communication with Arinc board normal.

FCU Board UDP Port: xxx:

Shows the LAN UDP port that the plugin is using for communication with the Arinc port. The port number is loaded from the config.ini text file and can be edited there.

FCU switched off by simulation!

This indicates that the virtual FCU is switched off in the simulation and the plugin will switch off the physical FCU accordingly.

Network Status: not connected

No LAN communication with Arinc board. This can have many reasons: LAN cable not connected, no power to Arinc board, Arinc board and plugin not using the same UDP port, UDP port blocked by Windows, etc.

ERROR: Some DataRefs missing

This error occurs when some needed datarefs can not be accessed. The reason could be that the installed versions of X-Plane, FF A320 or ToLiss are not as expected. Check the installed software and contact Cavoksim for support if the problem persists.

FCU default settings added to config.ini

This message appears once when the plugin can not find the entry '[FCU_K217]' in the config.ini file. It will add the entry automatically to the file and set the FCU UDP port to its default value (50001).

ERROR: Could not read config.ini, ERROR: Could not find config.ini

The configuration file is missing or could not be opened. Default settings will be used.

WARNING: FCU UDP Port in config.ini file invalid

FCU port value number is invalid. The default value will be used.

Additional Messages for the ToLiss plugin only:

ToLiss A340-600 mode active

The plugin has been configured via the config.ini text file to be used with the ToLiss A340-600 aircraft. This means that the function of the EXPED button of the physical A320 FCU will be different, since the A340 FCU has an ALT button instead of the EXPED button. The default ToLiss mode when this message is not displayed is A319/A321 mode.

EXPED Pb is functions as ALT Pushbutton

Used in A340 mode only. The plugin has been configured via the config.ini text file to handle the EXPED Pushbutton as it would be the ALT pushbutton. If this message is not displayed, the default setting in the A340 mode is to deactivate the EXPED Push Button and light completely.

6.2 Installation of the FlightFactor A320 Ultimate Plugin

The driver is provided in the form of a zip file named "plugins". Two separate plugins will be installed when this file is extracted, "Cavoksim FFA320driver" and "CavoksimLink FFA320". For installation, locate your X-Plane 11 (or higher version) main folder with Windows File Explorer first. Then follow this instructions:

- Navigate to the folder "X-Plane 11\Aircraft\FlightFactor A320 ultimate"
- Copy the file "plugins.zip" into this folder
- Unzip the "plugins.zip" file (Right click on file -> Extract All -> Extract)
- Check that two new subfolders in the plugins folder named "Cavoksim FFA320driver" and "CavoksimLink FFA320" appear
- Delete the "plugins.zip" file in the FF A320 main folder

Port 50001 is the default value for the FCU K217 Arinc board. If you have changed the default port setting of your FCU board via the diagnostic software, you also have to change it in the config.ini file. The file can be found in the folder "..\FlightFactor A320 ultimate\plugins\CavoksimLink FFA320". It can be edited with any text editor, for example Windows Notepad.

Additional information and limitations for FF A320

Currently it is not possible to load FF A320, then change to another aircraft and after that reload FF A320 again as it will cause X-Plane to crash. This is likely a FF A320 bug. In this case it is necessary to restart X-Plane.

The time that the physical FCU needs to restart after a power loss (i.e. simulated electric failure) or cold start is not the same time as that of the virtual FCU in the FF A320 simulation. The actual time might vary depending on your hardware version of the FCU. Also after a cold start (power loss more than a few minutes), the physical FCU will open the HDG and ALT windows for about 1 minute (it will display numbers, not "---"). During this time, the FCU can not display dashed ("---") HDG or ALT indications independent of what the simulated FCU is showing.

6.3 Installation of ToLiss A319, A321 and A340-600 Plugin

All Toliss aircraft are using a common plugin. The plugin has to be installed in each applicable aircraft folder separately.

The plugin is provided in the form of a zip file named "plugins". When extracted, a new folder "Cavoksim FCU ToLiss" will appear in the plugins folder. For installation, locate your X-Plane 11 (or higher version) main folder with Windows File Explorer first. Then follow this instructions:

- Navigate to the aircraft folder "`X-Plane 11\Aircraft\ToLiss+xxx`" (xxx depends on the aircraft, for example "`\ToLissA321_V1p4p1`")
- Copy the file "plugins.zip" into this folder
- Unzip the "plugins.zip" file (Right click on file -> Extract All -> Extract)
- Check that a new subfolder in the plugins folder named "Cavoksim FCU ToLiss" appears
- Delete the "plugins.zip" file in the Toliss aircraft main folder

Port 50001 is the default value for the FCU K217 Arinc board. If you have changed the default port setting of your FCU board via the diagnostic software, you also have to change it in the config.ini file. The file can be found in the folder "`\Aircraft\ToLiss+xxx\plugins\CavoksimLink ToLiss`". It can be edited with any text editor, for example Windows Notepad.

Additionally, if you are using the plugin with ToLiss A340-600, you have to edit the following lines in the config.ini text file. First set A340 mode to YES.

```
A340_Mode = YES
A340_EXPED_is_ALT_button = YES
```

Next choose the EXPED/ALT Push button status (YES or NO) depending on your preference. The physical K217 FCU is from A320 series aircrafts, which all have an EXPED push button. The A330/A340 FCUs have an ALT push button at the same place instead. You can choose if you want to treat the EXPED Pb as if it were an ALT Pb (set YES) or deactivate the physical EXPED Pb and ignore it (set NO).

Background

In A320 series aircraft you need to push the V/S selector to archive the ALT hold function. This will also work in the A340. The ALT push button has a similar effect. It was added to the A330/A340 FCU to make it more convenient to access this frequently used function. The EXPED function on the other hand is rarely used, so it was removed on the A330/A340.

6.4 Installation of Jeehell FMGS driver

Locate the main folder of your Jeehell FMGS installation. Then navigate to the subfolder "Hardware Modules". Copy the file "CavokLinkConnect.dll" that is included in your FCU-K217 driver package into the "Hardware Modules" folder.

The driver will be automatically recognized by Jeehell FMGS when it is located in the correct folder upon startup. To verify that the driver is working normally, open the "Hardware Connect" window of Jeehell FMGS. The status window should show "CavokLink: FCU LAN Connected" when the connection to the FCU board is normal. The orange light of the FCU board should be extinguished.

The only information from the CavokLinkConnect driver that will be displayed in the Hardware modules status window is "FCU LAN connected" and "FCU LAN connection Lost".

Currently the UDP port of the Jeehell FMGS driver is always 50001 and the port can not be changed. This will be updated with a later driver version.

The CavokLinkConnect driver needs Jeehell FMGS version GREATER THAN B57.2 to be fully functional. When running with an older version of Jeehell, the vertical speed sync function is not supported. That means that when certain V/S mode changes occur (for example from managed to selected mode), the FCU V/S window will revert to show zero instead of showing the current actual aircraft V/S. This is the only restriction when using an older Jeehell version.

6.4 ProSim A322 driver

The ProSim driver is an independent exe file type application that can simply be copied and started from any PC folder without the need for an installation. It needs to be running on the same PC where ProSimA322-HardwareConnector.exe is running.

The Cavoksim FCU diagnostics application can not be run together with the Cavoksim driver. It would interfere with the driver's LAN communication.

ProSimA322-HardwareConnector.exe and ProSimA322-System.exe should be started before running the Cavoksim ProSim driver. The driver will display a command line style window and show status messages. It will show the message:

Connected to ProSim System

when connection to the ProSim software is successful. It will show the message:

Connected to FCU interface

when it is connected to the Cavoksim K-217 interface board via UDP. When it loses connection to ProSim or the board it will show similar disconnect messages.

The program is using the UDP port 50001 by default. It is possible to change this port by creating a simple text file in the same folder where the Cavoksim ProSim driver exe file is located. The file must have the name port.ini and it should contain only one text line in the format 'port=50001'. The port number can be in the range from 1024-65535. The port must also be changed for the board firmware by using the FCU diagnostics software. It is not recommended to change the port when not absolutely necessary.

7 FCU diagnostics Software

7.1 Introduction

The diagnostics software is a powerful tool that can help to quickly identify the health status and any defects of a FCU. It is a standalone tool that does not need a flight simulator software to function. It contains an advanced scanning tool to monitor the activity of the FCU Arinc buses.

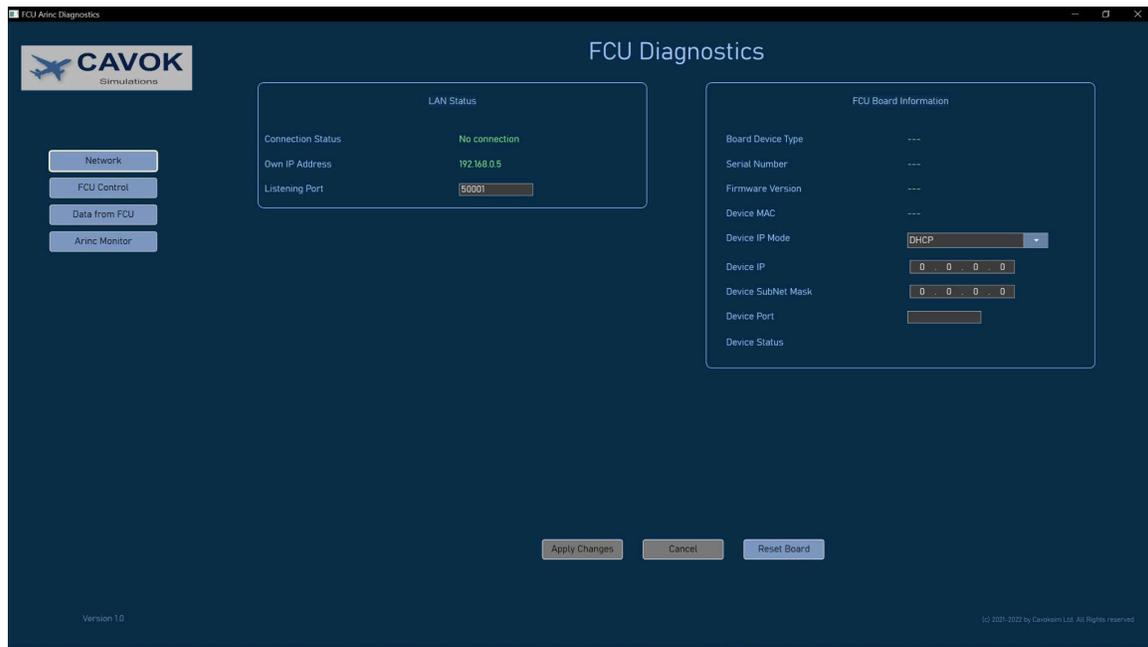
The tool can also be used to modify the LAN settings of the FCU K217 Arinc board.

DO NOT RUN THE DIAGNOSTICS SOFTWARE AND A FLIGHT SIMULATOR WITH FCU DRIVERS/PLUGINS INSTALLED AT THE SAME TIME. THIS MIGHT CAUSE CONFLICTS WHICH CAN LEAD TO ERRATIC FCU BEHAVIOR OF THE FCU K217 BOARD.

7.2 Installation

There is no installation for this tool required. Unzip the folder `fcu_diag` to a directory of your choice. Then locate the file `fcu_diag.exe` in the folder and run it.

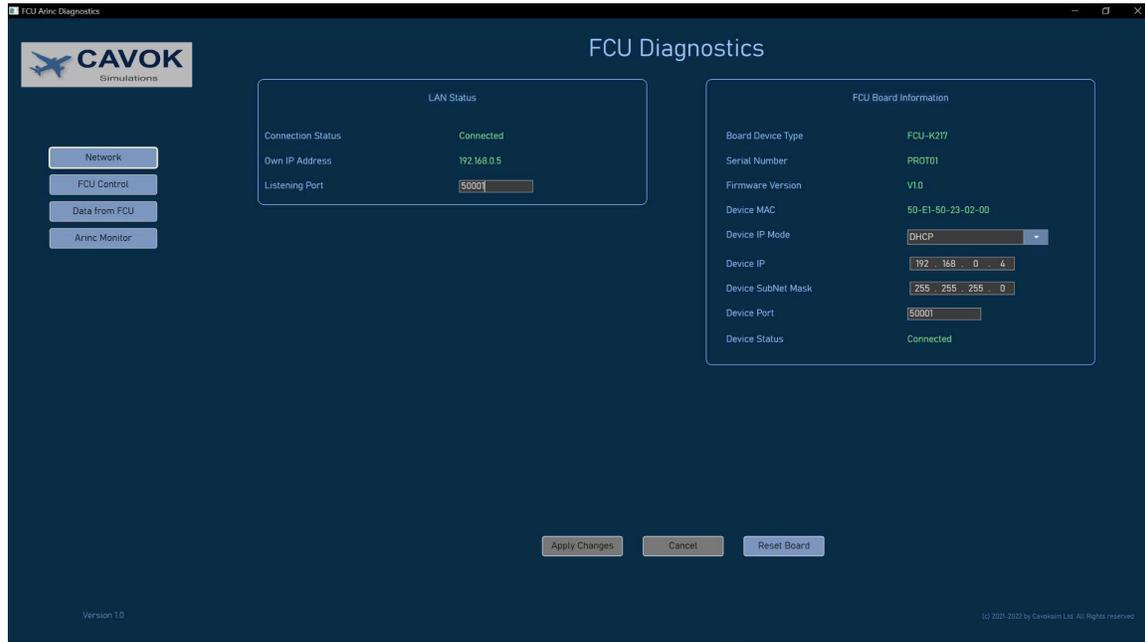
Initially the Network page of the tool will be shown. Without a connection the the FCU board it will look initially like on the following screenshot:



The software will now try to find and establish communication with the FCU board via the LAN network and the UDP port shown in the field “Listening Port”. The default port for the FCU board is 50001.

7.3 Description of the diagnostics software

NETWORK page



The network page shows the current status of the LAN connection and allows you to change the LAN settings of the FCU board. As soon as the device is connected and recognized, the device status changes to connected and all current settings are displayed. All gray boxes can be changed by the user.

Unless absolutely necessary, it is not recommended to change any of the default Network settings.

To change a board LAN settings, change the desired value in the gray field and then press Enter. The field will change its color to magenta and the 'Apply Changes' button will be highlighted. You can modify several fields before writing the changes to the board. Press the 'Apply Changes' button to write the changes to the FCU board flash memory. After that the board will automatically reset. It might be necessary to restart the diagnostics software as well to reset the connection.

If you change the UDP Device Port of the FCU Board, it is also necessary to change the Listening Port of the diagnostic software to the same port. Apply the port change to the FCU board first. After the board Reset, enter the new port as a 'Listening port' and press 'Apply changes' again. After that, close and restart the diagnostics software.

Changing the UDP listening port via the Lan status/Listening port setting will only affect the FCU diagnostics software. To change the UDP port of the Cavoksim Link X-Plane plugins, edit the config.ini file of these plugins (see [‘Installation of Drivers’](#))

Description of the user changeable settings on the Network page:

‘Listening Port’ is the UDP port that the diag tool and the flight simulator drivers are using. **This port has always to be the same as the ‘Device Port’ of the board.**

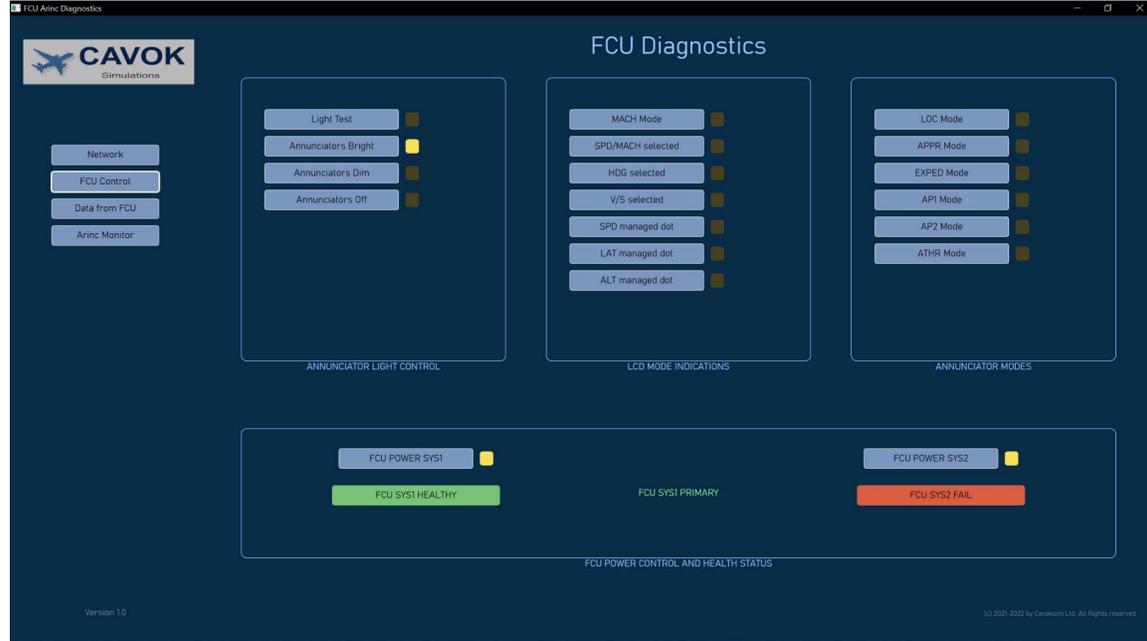
‘Device Port’ is the UDP port the FCU board is using. **Listening port and device port have to be the same, or the communication will be interrupted.** In case the FCU board port has accidentally changed and communications with the board have been lost, refer to the Chapter ‘Reset the FCU board settings’.

‘Device IP Mode’, ‘Device IP’ and **‘Device Subnet Mask’** show the current configuration of the FCU board and can be modified as required.

If you change the IP address you are overriding the board IP address obtained via DHCP with a static address. This means the Device IP mode field also needs to be changed to ‘STATIC IP’ before writing the new IP address to the board to be able to use this new static address. If you change the IP address but leave the IP mode in ‘DHCP’, the changed IP address will be overwritten by DHCP after the board is reset and therefore ignored.

If it is necessary to restore the board default settings, press the ‘Reset board’ button of the diagnostics software. This will send the command to the board to restore the default settings and reset. The button will only work when communication with the FCU board is still possible. In case that the connection with the board is lost, refer to [‘Reset the FCU board settings’](#) to restore the board default settings and the connection.

FCU CONTROL page



The FCU Control page lets you switch the FCU on or off for testing and send commands to the FCU to test all major functions. A yellow square beside the buttons indicates if a function is currently active.

FCU power control and health status

The physical FCU contains two independent systems called system 1 and system 2. For redundancy in the real aircraft, each of the two systems alone can operate all FCU functions. Only one system is active at a time, the other system is on standby. The two systems can be separately switched on and off via the buttons 'FCU POWER SYS1/2' for testing. Normally both systems are powered on together in the aircraft. The status of the respective system is indicated below the button. This status is reported from the FCU to the board via electric signals. Normally the status of a system that is switched on should be shown in green as 'HEALTHY'. If the FCU reports a system as unhealthy, the status will change to red and show 'FAIL'. This indicates a hardware failure of the respective FCU system. A logic board inside the FCU will automatically select one of the two systems to operate the FCU. The system that is currently selected to operate the FCU is shown between the power buttons as 'PRIMARY'. For flight simulator purposes only one functioning FCU system is sufficient. **It is not a problem if one of the two systems of your FCU is showing 'FAIL'.** One working system is enough to provide all FCU functions.

Annunciator light control panel

FCU annunciator LED lights are supplied from the FCU board via its onboard 400 hz AC inverter circuit. The voltage/brightness can be changed via the software buttons for testing. The light test function can also be tested here.

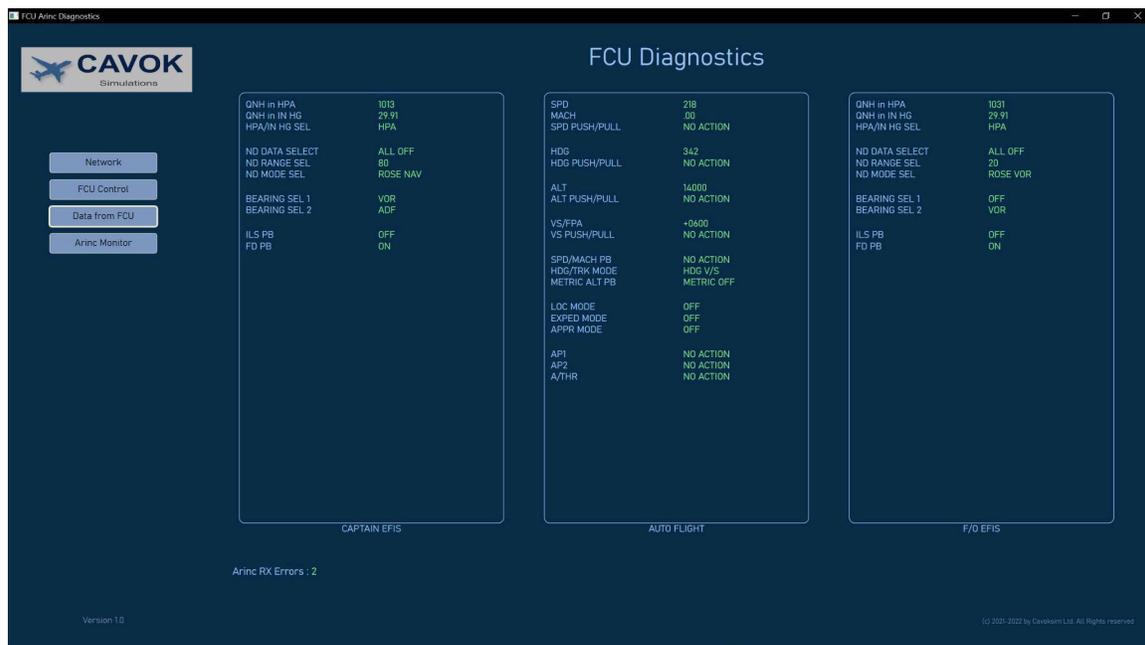
LCD mode indications

These software buttons change the indications on the FCU LCD display for testing purposes. Please note that the FCU firmware will not allow some combinations of indications to be active at the same time.

Annunciator Modes

These software buttons can switch the annunciator lights of the FCU on or off for testing purposes. Not all combinations are allowed by the FCU firmware.

DATA FROM FCU page

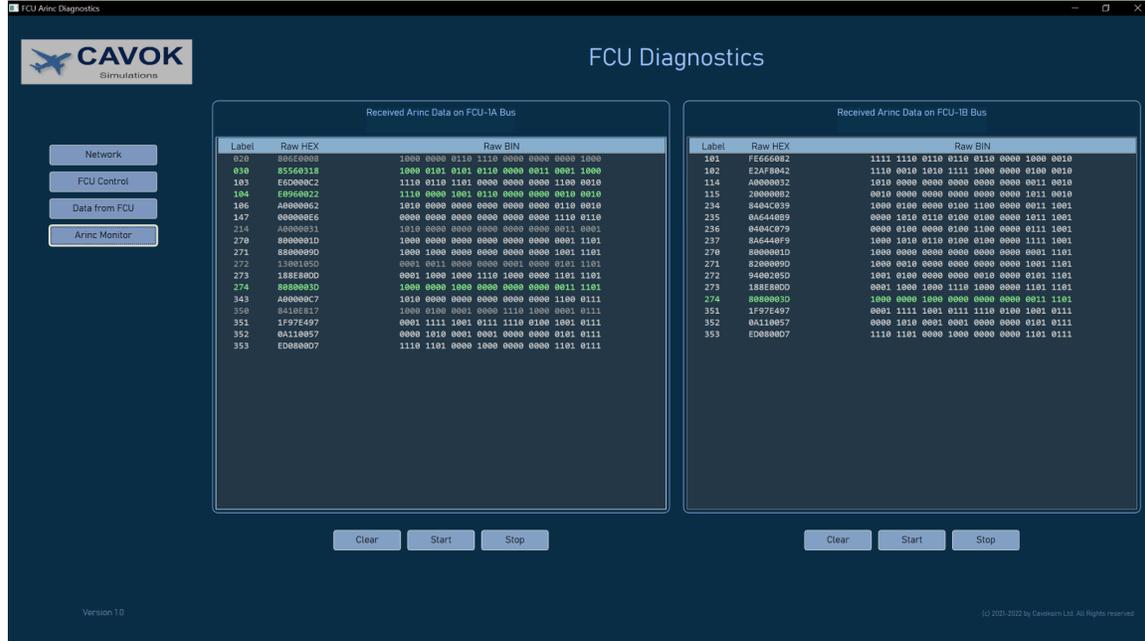


Mode	Parameter	Value/State
CAPTAIN EFIS	QNH in HPA	1013
	QNH in IN HG	29.91
	HPA/IN HG SEL	HPA
	ND DATA SELECT	ALL OFF
	ND RANGE SEL	80
	ND MODE SEL	ROSE NAV
	BEARING SEL 1	VOR
	BEARING SEL 2	ADF
	ILS PB	OFF
	FD PB	ON
AUTO FLIGHT	SPD	218
	MACH	.00
	SPD PUSH/PULL	NO ACTION
	HDG	342
	HDG PUSH/PULL	NO ACTION
	ALT	14000
	ALT PUSH/PULL	NO ACTION
	VS/FPA	+0400
	VS PUSH/PULL	NO ACTION
	SPD/MACH PB	NO ACTION
	HDG/TRK MODE	HDG V/S
	METRIC ALT PB	METRIC OFF
	LOC MODE	OFF
	EXPED MODE	OFF
	APPR MODE	OFF
AP1	NO ACTION	
AP2	NO ACTION	
A/TRR	NO ACTION	
F/O EFIS	QNH in HPA	1031
	QNH in IN HG	29.91
	HPA/IN HG SEL	HPA
	ND DATA SELECT	ALL OFF
	ND RANGE SEL	20
	ND MODE SEL	ROSE VOR
	BEARING SEL 1	OFF
	BEARING SEL 2	VOR
	ILS PB	OFF
	FD PB	ON

This page shows all decoded data that is received from the FCU via Arinc messages and electric signals. It allows you to quickly test the function of all buttons, switches and rotary encoders of the FCU.

Additionally the page shows the **Arinc RX Errors** on the bottom of the page. This counts up everytime when an Arinc message received from the physical FCU has been ignored because the data was invalid according to the Arinc429 specifications. The reason for this is usually electromagnetic interference. The error counter is reset every time a FCU system is switched on. A low number of errors (a few per minute) is not a problem. Most Arinc messages repeat the same information over and over and are transmitted frequently. However, a large number of errors indicate severe interference that should be investigated. Refer to this chapter [4.4 Avoiding Interference problems](#) for possible solutions.

Arinc Monitor page



This page can help advanced users to troubleshoot FCU problems. It shows all Arinc messages received from the FCU via the Arinc buses FCU-1A and FCU-1B. The received information is decoded and shown in tables. The tables are automatically updated and sorted according to the Arinc Labels. This makes the data much more readable because most of the messages repeat the same information many times per seconds. Each message is shown with decoded Arinc Label and as 32-bit raw data both in hexadecimal and binary format. It is also color coded according to the last received update:

- Messages shown in green have recently changed.
- Messages shown in light gray are periodically repeating the same data but do not change currently
- Messages shown in dark gray have been transmitted in the past, but have not been repeated for some time

The different formats and color coding make it easy to identify the labels that transmit the changes caused by user inputs. This helps to verify if user inputs from the FCU are actually transmitted via Arinc or not.

8 Using the FCU for your simulator

8.1 General

Difference between physical and virtual FCU

Once the driver of the physical FCU becomes active, the physical FCU becomes the Master FCU which overrides all settings of the simulated software FCU.

This means you should pay no attention during a flight to what is displayed on the virtual FCU and you should not try to change any settings by using the virtual FCU. Use the physical FCU only.

This rule applies during a flight. If the simulator is started or a new situation is loaded into the simulator, it should be checked if the virtual and the physical FCU are synched and show the same settings.

Most settings of the virtual FCU will be immediately overwritten with data received from the physical FCU.

Depending on the version of the firmware installed on your physical FCU, there may be some small differences in the displayed data compared to your flight simulator FCU. Not all FCUs are identical and the firmware has been slightly changed over the years. The FCU version simulated by the software might not be the same as your physical OEM FCU.

Saving and Loading of a Situation

A physical aircraft FCU is different from a virtual one because it has mechanical switches and is controlled by its own microcontrollers and software. The modes and indications that can be displayed are limited by what your FCU firmware version allows.

There are limitations concerning the physical FCU when a situation is saved for later use. Most FCU settings are read only and can not be set by the simulator software. That means that most FCU settings can not be restored when a new situation is loaded. It is recommended to pause the simulation after the loading of a new situation and verify the FCU settings before commencing the flight. This is normal practice for all large flight simulators where many mechanical selectors and switches exist that have to be manually adjusted according to the saved situation before the flight can commence.

8.3 ToLiss A340-600 (X-Plane)

8.3.1 Restrictions when using the K217 FCU with ToLiss A340-600

This driver allows the use of the K217 type FCU with the ToLiss A340-600 simulation. Please note that the K217 type FCU is designed for A320 family aircraft and not for the A330/A340. The A330/A340 FCUs are a little different which is explained below.

From the pilots perspective, there are mainly 2 differences between a A320 family FCU and a A330/A340 FCU. The first is that the A330/A340 has an additional ENG selection for the ND mode selector switch of the FCU EFIS panel. The A320 FCU has only 5 possible selections: ILS,VOR,NAV,ARC and PLAN. The second difference is that the pushbutton below the altitude selector of the FCU has the function EXPED (expedite climb) in the A320 family whereas it is ALT (altitude hold) in the A330/A340.

When the K217 FCU is used with the Toliss A340 simulation, the ND display can not display the ENG parameters. This is not a major issue because it is only a rarely used backup function in case the main Engine ECAM display fails.

The functionality of the physical EXPED push button can be selected via software settings (see [6.3 Installation of ToLiss A319, A321 and A340-600 Plugin](#)). You can choose if you want to treat the EXPED Pb as if it were a ALT Pb or if you want to deactivate it.

The ALT hold function is also available by pushing the Altitude rotary selector button (same as in both A320 and A330/A340).

In summary the K217 FCU can be used with the ToLiss A340-600 without any major restrictions.

9.2 Alternative wiring of annunciator lights dimming control

All cockpit annunciator lights including the ones installed in the FCU have 3 states: DIM, BRIGHT and TEST. In the aircraft these states are controlled by a selector switch on the overhead panel.

Recommended dimming control

It is recommended to control the annunciator lights via the simulator software. In this case, the input from the physical switch on the overhead panel of your physical simulator is read by the simulator software via an I/O card connected to the switch. This input controls the virtual light switch inside the flight simulation software. The FCU board software in turn reads the status of the virtual light switch and controls the onboard 400Hz AC dimming inverter accordingly. In this case no wiring of the DIM terminal is required.

Alternative dimming control

However, in your simulator the physical overhead light switch might be directly wired to a power supply to control the brightness of all physical annunciator lights without passing that signal to the flight simulator software at all. In this case you can wire the positive annunciator light supply voltage directly to the DIM terminal of the FCU board and the board will switch the annunciator brightness according to the input signal. In this case the light switch in the virtual cockpit of the flight simulation has to always stay in DIM position. Now, if a voltage of more than 4V is applied to the DIM terminal input of the FCU board, the FCU annunciator lights will switch from dim to bright. If the voltage is less than 4V it will switch back to dim. The DIM input will work with DC, PWM DC and AC input voltage.

Do not exceed 5.5V input voltage (AC or DC) to the DIM terminal.

10 Reset of the FCU board settings

In case that it is not possible anymore to connect with the board via LAN after changing its settings it is possible to hard reset the board to its default settings (UDP port 50001, DHCP mode). Please refer to Figure 1 to locate the required pushbuttons. Then follow this reset sequence:

1. Power up the board (Red MCU power LED is on)
2. Press and hold the Erase button
3. Press and release the Reset button momentarily while keep pressing the Erase button
4. The blue status LED will start to flash rapidly
5. Release the Erase button to complete the Reset sequence

11 Troubleshooting of network problems

When there is no connection between the FCU board and the SW driver/Diagnosis application consider the following steps to resolve the issue:

- Make sure that both driver and FCU board are using the same UDP port. If you have not manually changed any settings, this should already be the case. The default port is 50001
- **Check that your network is correctly configured. The FCU board has a default Submask setting of 255.255.255.0. If the Submask of your network is configured differently, there might be no connection between PC and FCU board. Once a connection is established, the Submask can be changed with the diagnosis SW as required.**
- Check that the UDP port 50001 is not blocked by the Windows Defender Firewall. There are guides available online to change the Firewall rules to unblock the port if required
- Try to simplify the network connection as much as possible for testing
- Monitor the network traffic with an application like Wireshark. When the FCU board is powered on, you should see UDP broadcasts on port 50001 every 100ms with a length of 39 bytes. This is the case when the driver/diagnosis SW is not running or not connected to the board. As soon as there is a connection, there should be an exchange of short messages every few ms between board and PC SW