

Zodiac FX

USER GUIDE

Feb 2016

Important Information

Limited warranty:

Northbound Networks warrants that the Zodiac FX will be free from defects in material or workmanship for a period of 12 months from the date of shipment to you, the Customer. In the event of a defect covered by this limited warranty, Northbound Networks will, at its option and free of charge to Customer, repair, replace or refund the purchase price paid. Only the physical product is covered under this limited warranty and there is no cover, either expressed or implied, for any software or firmware that may be installed into the device either by Northbound Networks, the Customer or any other third party. NORTHBOUND NETWORKS MAKES NO OTHER EXPRESS WARRANTIES EXCEPT AS PROVIDED HEREIN, AND ANY AND ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE SHALL ONLY BE IN EFFECT DURING THE 12 MONTH WARRANTY PERIOD PROVIDED HEREUNDER. NORTHBOUND NETWORKS'S LIABILITY ON ANY WARRANTY CLAIM SHALL BE LIMITED TO THE ACTUAL PURCHASE PRICE PAID. NORTHBOUND NETWORKS SHALL NOT BE RESPONSIBLE TO CUSTOMER OR ANY THIRD PARTY FOR ANY CONSEQUENTIAL, INCIDENTAL OR INDIRECT DAMAGES, INCLUDING BUT NOT LIMITED TO LOSS OF PROFITS, LOSS OF DATA, REVENUES, SALES, BUSINESS, GOODWILL OR USE. This limited warranty does not cover the cost of shipping the defective Zodiac FX to Northbound Networks for repair, however the cost of shipping the repaired or replacement Zodiac FX to you will be paid for by Northbound Networks in the event that the defect is covered under this limited warranty.



WARNING: This product, like all micro-controller products, uses semiconductors that can be damaged by electrostatic discharge (ESD). When handling, care must be taken so that the device is not damaged. Damage due to inappropriate handling is not covered by the limited warranty.

Compliance Information

FCC Compliance

This device has been tested and verified to comply with Part 15, Class B, of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

IC Compliance

This Class B device has been tested and verified to comply with **Industry Canada ICES-003**.

EU Conformity Statement



This product is labelled with the CE Mark in accordance with the related European Directives, Low Voltage Directive 2006/95/EC and EMC Directive 2004/108/EC. The product has been assessed against standards EMC: EN 55022 and EN 55024.

Australia / New Zealand

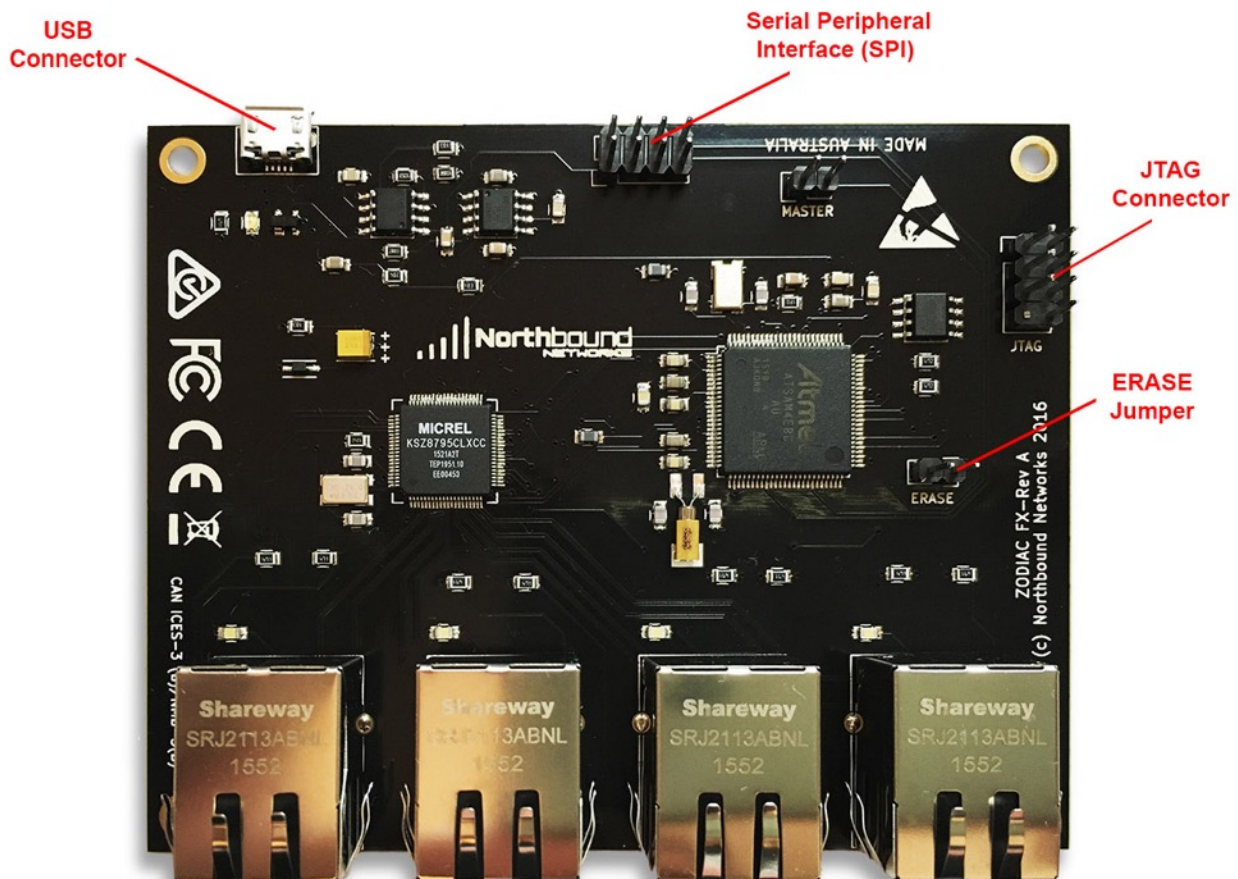


This device has been tested and verified to comply with **AS/NZS CISPR 22**.

1. Overview

The Zodiac FX is a 4 port network development board designed for hobbyists, students, researchers, embedded developers or anyone who requires a low cost network development platform. Even though it was initially designed to allow affordable access to OpenFlow enabled hardware it's open source firmware it can be used in any number of other applications. By providing the firmware source code users are free to not only create their own versions but also use it as a basis for a completely different type of device. Some such applications may include:

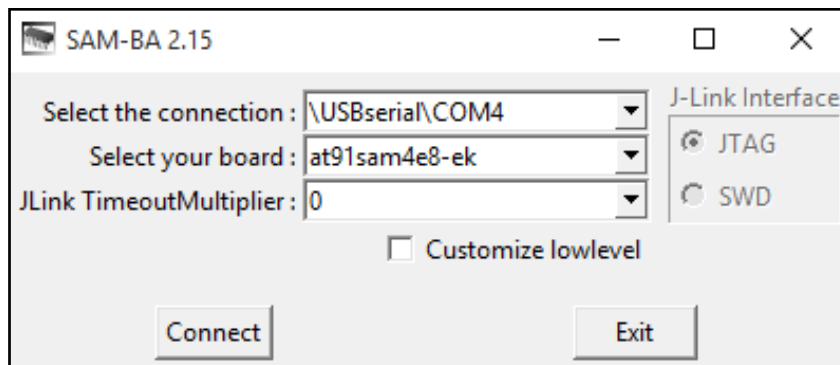
- Router
- Bridge
- Load Balancer
- Web server
- VPN concentrator
- TOR client
- and many more.



2. Updating Firmware

The Zodiac FX firmware is stored within the flash memory of the Atmel processor and is easily updated via the USB port. To update the firmware the existing code must first be erased which will allow the CPU to boot in USB mode ready to receive the update. The flashing procedure is as follows:

1. Download the required version of the firmware bin file which is available from the Zodiac FX forum (see appendix B). Alternately you can build your own version from the source code using Atmel Studio.
2. Disconnect the USB cable from the device.
3. While the device is powered off, *CLOSE* the **ERASE** jumper.
4. Reconnect the USB power source, wait 5 seconds and then disconnect it again. This will erase the firmware and reset the boot flag to allow the flash utility to communicate with the device.
5. Move the **ERASE** jumper back to the OPEN position. Be careful not to loose the jumper!
6. Connect the USB cable to power to the device again and open the SAM-BA utility (see list of links in appendix B).
7. Ensure the correct COM port is displayed and that the board type is “at91sam4e8-ek”, see figure below. Press the connect button. If the “Select the Connection” is blank then the existing firmware was not erased correctly, repeat steps 2-6.



8. In the “Download / Upload File” section click the folder icon for the “Send File Name” field and select the appropriate bin file.
9. Click the “Send File” button to upload the firmware to the device.
10. When the “Lock region(s)” pop-up window appears select “No”.
11. Under the “Scripts” section, select “Boot from Flash (GPNVM1)” from the drop down list and press the “execute” button.
12. Disconnect and reconnect the USB cable again to restart the device. The device will now load the updated firmware.

3. Command Line Interface (CLI)

The Command Line Interface provides the ability to configure setting and monitor the operation of the Zodiac FX. To simplify operations the CLI uses the concept of a “context”, this limits the available commands to only those available in the currently selected context. There are currently 3 available contexts:

- Base
 - Config
 - OpenFlow
 - Debug

To enter the required context simply type the name of the context on the command line while at the base level. To return to the base level type “exit”. The current context is shown in bracket between the device name and the prompt. For example **Zodiac_FX (config)#**.

The following sections describe the commands available within each context, please note that all commands are lowercase only.

3.1. Base

config - Enter the “config” context.

openflow - Enter the “openflow” context.

debug - Enter the “debug” context.

show status - Displays the current device status.

show ports - Displays information about each ethernet port including state, VLAN membership and traffic statistics.

show version - Display the firmware version.

help - Display a list of available commands.

3.2. Config

save - Saves the current configuration to non-volatile memory.

show config - Display the current device configuration.

show vlans - Displays a list of the currently configured VLANs.

set name <name> - Sets the device name. Maximum of 16 characters, entries will be truncated.

set mac-address <mac address> - Sets the MAC address of the device. The MAC address assigned to the device is located on a label on the underside of the device.

set ip-address <ip address> - Sets the device IP address

set netmask <netmask> - Set the device netmask

set gateway <ip address> - Sets the default gateway of the device

set of-controller <ip address> - Sets the IP address the OpenFlow controller

set of-port <tcp port> - Sets the TCP port of the OpenFlow Controller

set of-version <version> - Sets the device to only connect to an controller using the OpenFlow version specified. A value of 0 disables this function and allows the device to negotiate the version.

add vlan <vlan id> <vlan name> - Creates a new vlan. Valid IDs are 1-4096 and names must be less than 16 characters.

delete vlan <vlan id> - Deletes an existing vlan.

set valn-type <type> - Set the vlan to either openflow or native.

add vlan-port <vlan id> <port> - Assigns a ethernet port to the designated vlan. A port can only be a member of one vlan.

delete vlan-port <port> - Remove the named Ethernet port from a vlan.

factory reset - Configures and saves the configuration back to the factory test configuration, see appendix A for details. *Note: the MAC address is not reset and will remain at it's current value and a restart is required to apply the changes.*

exit - Return the context back the base level.

3.3. OpenFlow

show status - Displays the OpenFlow status.

show flows - Displays a list of the currently installed flows.

enable - Enables the Openflow functionality.

disable - Disables the OpenFlow functionality. Disabling Openflow will clear the flow tables and

exit - Return the context back the base level.

3.4. Debug

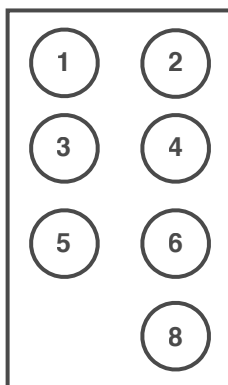
read <register> - Display the value of the KSZ8795 register.

write <register> <value> - Writes the value into the defined KSZ8795 register.

exit - Return the context back the base level.

4. JTAG Debugger

The following table describe the pin-outs of the Zodiac FX JTAG header and the ATMEL-ICE debugger SAM connector. If using the 10 pin squid cable that comes with the full ATMEL-ICE kit then the wires can be connected to the pins as shown below. Alternatively a Zodiac FX Developer kit can be purchased from the Northbound Networks store which includes the debugger and a specifically designed cable.



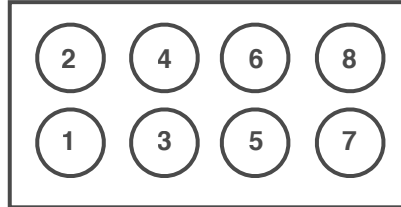
JTAG Pinouts

Zodiac JTAG PIN	Function	ATMEL-ICE SAM JTAG PIN	Function
1	+3.3v	1	VCC
2	TMS	2	TMS
3	GND	3	GND
4	TCK	4	TCK
5	GND	5	GND
6	TDO	6	TDO
7	-	7*	KEY
8	TDI	8	TDI
-	-	9*	GND
-	-	10*	nReset

***NOTE: If using the Atmel ICE 10 pin squid cable then the pins highlighted in the table (7,9,10) are not required.**

5. SPI Connector

The SPI connector allows the Zodiac FX to connect to other devices using the industry standard Serial Peripheral Interface (SPI). Information on the SPI standard can be found at https://en.wikipedia.org/wiki/Serial_Peripheral_Interface_Bus



SPI Pinouts

Zodiac SPI PIN	Function
1	+5.0v (200mA MAX)
2	-
3	IRQ 1*
4	GND
5	MISO
6	NPCS0
7	SCK
8	MOSI

****IRQ 1 is connected to a GPIO pin on the MCU to allow for a SLAVE devices to request access to the bus.***

Appendix A.

The factory configuration set the following values:

Device Name: Zodiac_FX
IP Address: 10.0.1.99
Netmask: 255.255.255.0
Default Gateway: 10.0.1.1
OpenFlow Controller: 10.0.1.8
OpenFlow port: 6633

Vlans

ID	Name	Type	Ports
100	"OpenFlow"	openflow	1,2,3
200	"Controller"	native	4

Appendix B.

The following is a list of links the relevant web pages and utilities:

Northbound Networks / Zodiac FX Support Forum: forums.northboundnetworks.com

SAM-BA programming utility: <http://www.atmel.com/tools/ATMELSAM-BAIN-SYSTEMPROGRAMMER.aspx>

ATMEL-ICE Debugger: <http://www.atmel.com/tools/ATATMEL-ICE.aspx>

Atmel SAM4E MCU information: <http://www.atmel.com/products/microcontrollers/arm/sam4e.aspx>

Micrel KSZ 8795 Ethernet Switch chip: <http://www.micrel.com/index.php/products/lan-solutions/switches/article/1-ksz8795clx.html>

OpenFlow Specification: <https://www.opennetworking.org/sdn-resources/technical-library>