ANET1553-x

Avionics Databus Solutions

Single or Dual Stream MIL-STD-1553A/B Test & Simulation Module for Standard Ethernet

Users Manual

V01.35 Rev. A
September 2024

www.aim-online.com

ANET1553-x

User's Manual for Single/Dual Stream
MIL-STD-1553 Ethernet-Interface

Users Manual

V01.35 Rev. A
September 2024

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TABLE OF CONTENTS

Section Title Page

LIST OF FIGURES

Table **Title** **Page**

LIST OF TABLES

Figure Title Page

1 INTRODUCTION

1.1 General

This document comprises the Hardware User's Manual for the ANET1553-1/-2 standalone Ethernet based module. The document covers the hardware and software installation, the board connections, the technical data and a general description of the hardware architecture. For programming information please refer to the documents listed in the 'Applicable Documents' section.

The ANET1553 modules are members of AIM's family of advanced Ethernet connected standalone modules for analysing, simulating, monitoring and testing of avionic data bus systems.

The ANET1553 modules are used to simulate, monitor and inject protocol errors of MIL-STD-1553A/B based data bus systems. The ANET1553 offers an interface for up to two dual-redundant MIL-STD-1553 bus channels. Furthermore the interface implements trigger IN/OUT functions, as well as 8 user definable Discrete I/O signals.

An freewheeling IRIG-B-122 compatible time code Encoder/Decoder allows the user to synchronize to either the self-generated time code or the time code of an external board with a resolution of 1µsec, to satisfy the requirements of 'multi-channel time tag synchronization' on system level.

The ANET1553 module is designed as a standalone module connected with an Ethernet link to a host computer. An external power supply (wall adapter) is used to power the ANET module.

Different coupling modes such as "Transformer Coupling", "Network Emulation" and "Direct Coupling" are available for each MILBus channel and can be programmed using the on board relays. The MILBus Signals are connected to Twinax connectors.

The hardware architecture provides ample resources (i.e. processing capability and memory) to guarantee, that all specified interface functions are available concurrently and to full performance specifications.

The key components of the ANET1553 are the FPGA (which includes the 1553 core, the Processor-I/F, the Global RAM I/F), the BIU-Processor and the on board Application Support Processor (ASP) which is based on a System-On-Chip (SOC) hardware and running under an embedded LINUX Operating System.
The SOC hardware offers a built-in 10/100Mbit/s Ethernet interface, which is used for the implementation of the host connection via a Standard Ethernet RJ-45 connector.
Furthermore the SOC also offers a built-in USB interface, which has been made available to the user for mounting external mass data storage devices or use an optional WLAN stick for wireless Ethernet operation.

With 128MB Global RAM (shared between BIU, HOST and ASP) and 256MB of ASP Local RAM plus 1GB of ASP Flash memory, the ANET1553 Design offers enough memory resources for various use cases and applications.

1.2 Applicable Documents

The following documents shall be considered to be a part of this document to the extent that they are referenced herein. In the event of conflict between the documents referenced and the contents of this document, the contents of this document shall have precedence.

1.2.1 Industry Documents

[1] MIL-STD-1553B, Department of Defence Interface Standard for Digital Time Division Command/Response Multiplex Data Bus, Notice 1-4, January 1996

1.2.2 Product Specific Documents

[2] AIM - MIL-STD-1553 Reference Manual -
Detailed description of the programming interface (API).

2 INSTALLATION

The ANET1553 is a stand-alone module with an Ethernet connection to a Host PC.

This section contains the procedures used to install the Board Support Package (BSP) and to setup the ANET1553 hardware. The latest BSP versions are also available on the AIM download area (www.aim-online.com).

2.1 BSP Installation

The BSP contains a set of documents (User's Manual, Reference Manual), the Application Interface Library (API) files, the Import Library (.LIB) with the C Header-Files, some software samples, the compressed on board software/firmware update file and add-ons (e.g. the AIM Network Detection Tool).

These files are automatically copied to the system (e.g. HOST PC) by installing the BSP software package.

The software is available on DVD from AIM or via a download from AIM-Online, instructions how to obtain the BSP via a download from AIM-Online are:

▶ **To install the BSP software from the AIM provided DVD or a download from AIM-Online (www.aim-online.com)**

1. If using the AIM provided DVD, insert the DVD into the DVD ROM drive.
   The HTML Navigator will automatically start after a few seconds.

   If the HTML Navigator does not start after a few seconds, the Navigator has to be started manually. Navigate to the DVD ROM drive and double click the index.html icon.

2. Choose the latest MIL-STD-1553 Windows or Linux BSP for your OS and copy it to your system.

2.1.1 BSP Installation for Windows

Please follow the following steps to install the previously downloaded Setup.exe on a Windows PC.

1. Start the Setup.exe by double click.

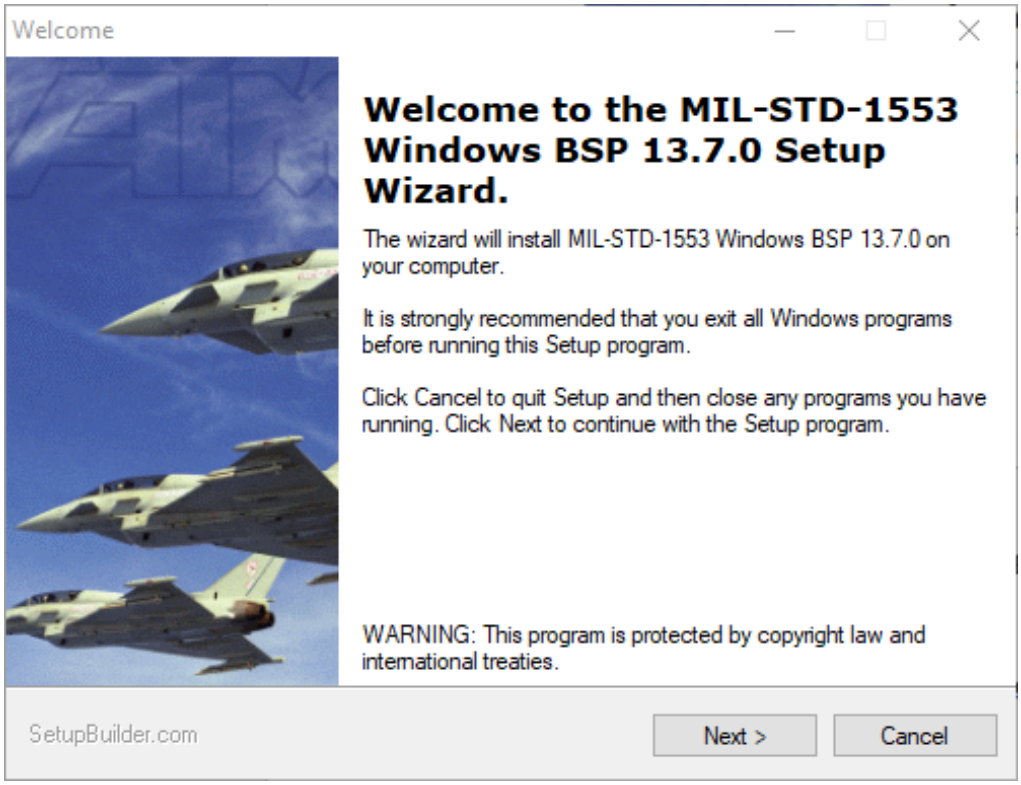

Figure 2.1-1 BSP Setup

2. Once the Setup Application has been started, step through the install wizard to complete the installation.

   You will be given the opportunity to choose the directory where the BSP is to be installed. Default locations can also be used.

3. At the end of the Setup, you have the option to install the Firmware, Drivers and the API Library (DLL).

   It is recommended to keep this option checked so that the setup copies the API Library (DLL) into the Windows system32 folder.

   Please note that for ANET1553 no device driver is used.

   Please note that the automatic Firmware update is not performed for the ANET1553 devices and needs to be done manually, by following the instructions in Chapter “3.6 Updating the ANET1553”.

The BSP installation will result in the creation of the following Program Folder icon:
Start | All Programs | AIM GmbH | MIL-STD-1553 Windows BSP x.y.z

The AIM GmbH sub-directory will be located by default in the directory C:\Program Files\. The Program Files directory is located on the drive which was chosen during BSP installation.

The directories contain the following (Among others):

Add-Ons	Additional software or source code distributed with the BSP (e.g. the AIM Network Detection Tool).
Lib32, lib64	Application Programming Interface DLL-Files and Libraries required to develop an application for Windows systems.
Include	Application Programming Interface headers required to develop an application for Windows systems.
Onboard-SW	A compressed on board software/firmware update file.
Doc	A set of reference- and user-manuals.
Sample	Sample project and source files for Microsoft Visual Studio 2013 or newer.

2.1.2 BSP Installation for Linux

To install the MIL-STD-1553 Linux BSP software from the AIM provided DVD or a download from AIM Online perform the following steps:

1. Change into the directory where you want the BSP and examples to be installed, e.g. your home directory. Then copy the file mil-std-1553-linux-bsp.tar.gz to it.

2. Unpack it with 'tar xfz mil-std-1553-linux-bsp.tar.gz'

3. Change into the subdirectory ./mil-std-1553-linux-bsp-VERSION/

4. Run 'sudo ./install.sh' to compile and install the BSP as superuser.
   - When asked to update the on-board firmware it is recommended to choose yes to update your locally installed modules (E.g. PCI or USB). Please note that the automatic Firmware update is not performed for the ANET1553 devices and needs to be done manually, by following the instructions in Chapter "3.6 Updating the ANET1553

5. The installation will create these files on your system.
   - **/lib/modules/<kernel>/extra/aim_mil.ko**
     The AIM PCI kernel module (unused for ANET1553)
   - **/lib/modules/<kernel>/extra/aim1553usb.ko**
     The AIM USB kernel module (unused for ANET1553)
   - **/usr/local/lib/libaim_mil.***
     The AIM MIL-STD-1553 API library
   - **/usr/local/include/aim_mil***
     The AIM MIL-STD-1553 API header files
   - **/usr/local/bin/sample**
     The AIM MIL-STD-1553 sample executable

The extracted BSP folder contains the following (Among others):

Add-Ons	Additional software or source code distributed with the BSP (e.g. the AIM Network Detection Tool).
Onboard-SW	A compressed on board software/firmware update file.
Doc	A set of reference- and user-manuals.
Sample	Sample Makefile and source files. (This directory is created when the install.sh script is executed.)

2.2 Hardware Installation

Connect the external power supply (wall adapter) to the DC-power IN plug, than push the power on-off button for powering on the ANET1553 module.

2.2.1 Connectors

The external interface of the ANET1553 consists of the following connectors:

- Front panel
  - Up to four TWINAX connectors at the front side providing the MIL-STD-1553 channels.
- Back panel
  - Auxiliary 15-pin High Density DSUB connector for the Trigger IN/OUT signals, IRIG IN/OUT for multi-channel time tag synchronization and the eight Discrete IN/OUT signals.
  - A RJ45 Ethernet plug, for connecting the ANET1553 with a Network/ Host.
  - USB Type A host connector e.g. for connecting an external storage device or an optional WLAN stick.

Figure 2.2-1 Front panel

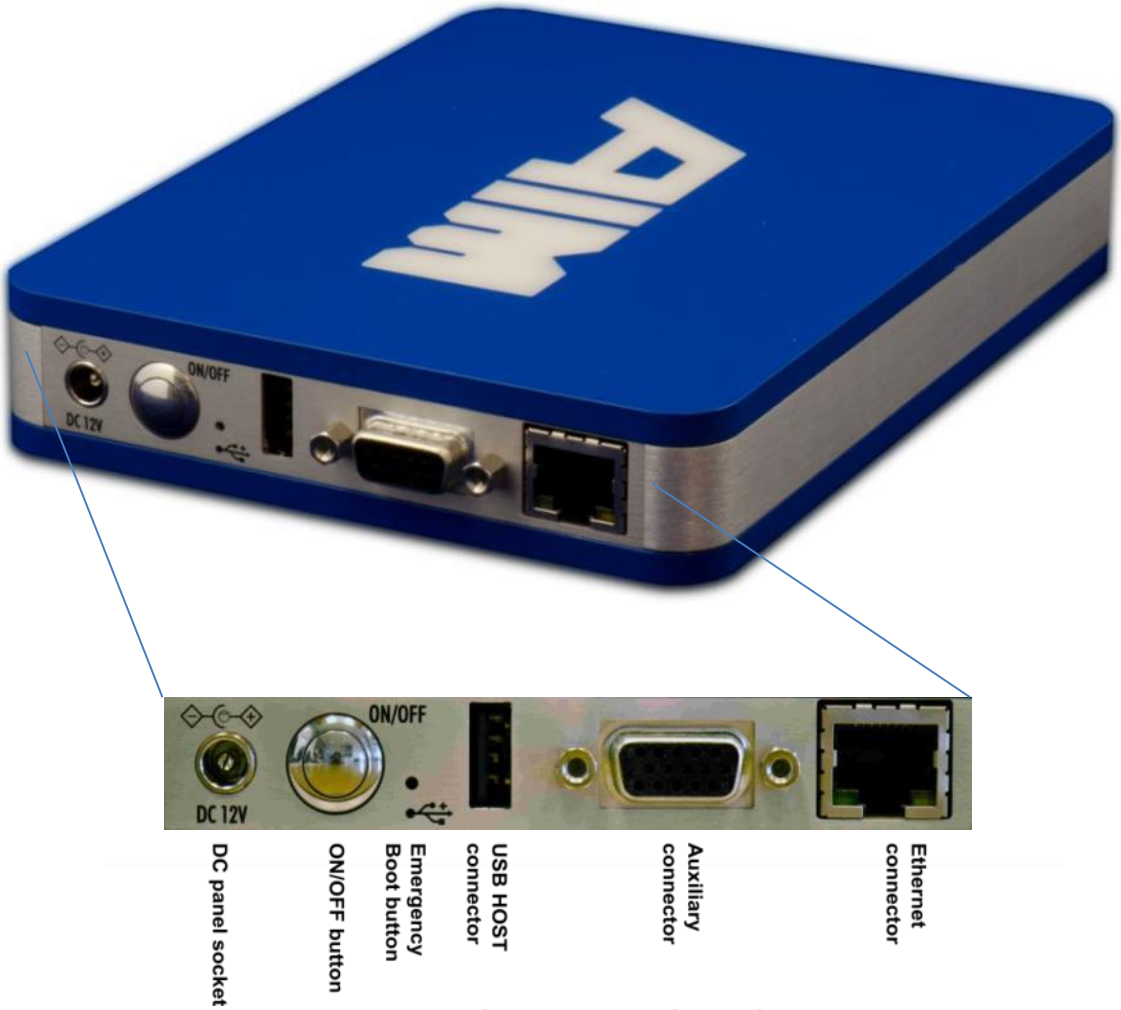

Figure 2.2-2 Back panel

2.2.1.1 MIL-STD-1553 Interface Connectors

For connecting to the external MILBus up to four TWINAX connectors (respectively two TWINAX connectors for a single channel ANET1553-1 Module) are provided at the front panel. The figure at the right side shows the pin out from the TWINAX connector.

Figure 2.2-3 TWINAX connector

2.2.1.2 Auxiliary Connector HD DSUB15

On the ANET1553 a 15-pin female High Density DSUB auxiliary connector is implemented for the Trigger IN/OUT, IRIG IN/OUT and Discrete I/O signals.
The figure on the right side shows the high density DSUB connector.
The Table below shows the pin assignment.
A description of the Trigger IN/OUT, IRIG IN/OUT and the Discrete IOs can be found later in this document.

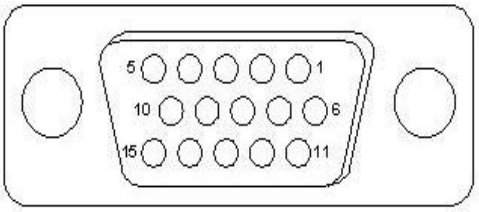

Figure 2.2-4: Auxiliary Connector

Pin	Signal	Pin	Signal	Pin	Signal
1	IRIG In	6	Discrete I/O 1	11	Discrete I/O 4
2	IRIG Out	7	Discrete I/O 2	12	Discrete I/O 5
3	Trigger OUT CH1	8	Trigger OUT CH2	13	Discrete I/O 6
4	Trigger IN CH1	9	Trigger IN CH2	14	Discrete I/O 7
5	GND	10	Discrete I/O 3	15	Discrete I/O 8

Table 2.2.1-1 Pinout Auxiliary Connector

2.2.1.3 USB TYP-A Host connector

A TYP-A host USB connector is provided e.g. for connecting external storage devices or an optional WLAN stick.

2.2.1.4 DC Power IN connector

The DC Power in plug is a DC panel socket with a 2,5mm centre pin.
The nominal input voltage is 12V DC via the centre pin..

Figure 2.2-5: DC panel socket

2.2.1.5 RJ45 Ethernet connector

For the Ethernet connection a standard RJ45 plug is provided at the back panel.

2.2.2 Module-Powering and Status Indication (LED's)

2.2.2.1 Ethernet RJ45 Status Indicator

On the RJ45 connector two status LEDs are implemented. One for Link and Activity status (yellow) and the other one for the speed detection (green).

2.2.2.2 Module Status Indicator

On top of the ANET1553 cover, the transparent AIM Logo is illuminated and indicates the status from the ANET1553 as following:

Power ON/OFF / Normal operation

1) LED = RED illuminated
   Illuminated during power on cycle.

2) LED = BLUE fast pulsing
   Fast pulsing blue during ASP / LINUX boot up.

3) LED = BLUE slow pulsing
   Slow pulsing blue when the on board OS has been boot up (ready for operation).

4) LED = RED fast pulsing
   Fast pulsing red during ASP / LINUX shutdown (power off) cycle and during re-boot commanded via the ANET Web Configuration tool.

Emergency- / Maintenance- Mode (e.g. running an update)

1) LED = RED fast pulsing
   Fast pulsing red during re-boot OS to Maintenance-Mode and during an update cycle is running

2) LED = RED slow pulsing:
   If OS is in Maintenance-Mode

2.2.2.3 Powering the module

In general any external power supply which is providing the specified input voltage (see Technical Data chapter) can be used to power the module.
An external $12V_{DC}$ power supply is recommended and is provided with an ANET1553 module. All onboard voltages are generated from this voltage.

Power Up behaviour:

- when applying external power for the first time, the module will start up without requiring an explicit power button press.

- as long as the external power supply is present, the module can powered down (shutdown) and powered up via pressing the power button.

- Interrupting the external power or pressing the power button longer than 3 seconds, will force a power off without shutdown (power down) of the OS.

Note:
It is recommended, but not mandatory, to shutdown (power down) the module via the power button or the ANET web front (‘maintenance’ page) end or SSH shell command (‘power off’ as user ‘root’) to avoid any user data corruption, especially when having customer applications/scripts active on the module.

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3 GETTING STARTED

This chapter describes the configuration, maintenance and update of the ANET1553 and how to use the ANET1553 from a customer application and with AIMs PBA.pro.

3.1 Requirements

The configuration of the ANET1553 module is via web application hosted by the ANET and therefore Operating System independent. A web browser needed on your system in order to run the ANET configuration application. The ANET configuration has been tested with Microsoft Internet Explorer, Mozilla Firefox and Google Chrome. It is recommended to always use the latest version of the respective browser.

3.2 Integration in a Network

This section describes how to attach ANET1553 modules to your network.
The procedure depends if your network provides a DHCP server or not. How to proceed is described in the following chapters.

3.2.1 The Network provides a DHCP sever

Just plug the ANET1553 module to a free port of an Ethernet switch that is attached to your network. Any standard twisted-pair cable with RJ45 plugs can be used. The DHCP server will automatically assign an IP-Address for each ANET1553 in a network.

3.2.2 The Network doesn’t provide a DHCP sever

Either the ANET1553 has a direct connection between an Ethernet port of a PC or is connected to a Ethernet Network via a Switch.
Both, the ANET1553 module and the configuration system (e.g. PC), should be powered off before the connection is established. Any standard twisted-pair cable with RJ45 plugs can be used for the direct connection.
The network interface of the configuration system connected to the ANET1553 (i.e. a PC or any other System with an Ethernet-Port) must be configured to automatically obtain an IP. The OS will then assign a link-local IP address in the range from 169.254.0.0 to 169.254.255.255 for the configuration system (e.g. a PC).

Now first power on the ANET1553 module, followed by the configuration system (e.g. PC) power on. After the OS has been booted, you should check if the *configuration system* obtained an IP address in the range from 169.254.0.0 to 169.254.255.255.
For example, if Windows is used, open a command console and run *ipconfig.*

For assigning a specific IP-Address see chapter 3.5.1.

3.3 The AIM Network Detection Tool

To detect ANET1553 modules with the “AIM Network Detection Tool”, a PC-based system, running Microsoft Windows Operating System or a LINUX Operating system is necessary.

This section describes how to use the AIM Network Detection Tool to find ANET1553 modules in your network. The AIM Network Detection Tool uses the *Zeroconf* protocol *(for the specification see http://datatracker.ietf.org/wg/zeroconf/charter/)* in order to find any ANET1553 modules in your network.
The AIM Network Detection Tool makes use of *Apple Bonjour,* a freeware *Zeroconf* implementation.

3.3.1 Installing Zero-Configuration Networking

3.3.1.1 Installing Apple Bonjour for Windows

For Windows OS download the Apple Bonjour installation executable from www.support.apple.com

Search on the Support page for “bonjour for windows”. Open the search result “**Download Bonjour Print Services for Windows v*x.y.z***”

Click to the “*Download*“ button to start the software download.

Store the file “*BonjourPSSetup.exe*” to your PC and start installation with a double click with your left mouse button.

Now run the executable and follow the installation instructions. After successful installation, you have to reboot the configuration PC.

3.3.1.2 Installing Avahi for Linux

For Ubuntu distributions install the following packages:

- sudo apt install libavahi-common3
- sudo apt install libavahi-client3

For Red Hat Enterprise Linux (RHEL) distributions install the following packages:

- sudo yum install avahi-libs

3.3.2 Using the AIM Network Detection Tool

The AIM Network Detection Tool is part of the BSP installation.

For Windows and Linux the net detection tool is located in the BSP folder "*add-ons/Net-Detection-Tool*".

Run the `net-detection-tool` executable from the above-mentioned directory of the BSP to start the AIM Network Detection Tool. After some seconds, it will show all ANET modules visible in your network:

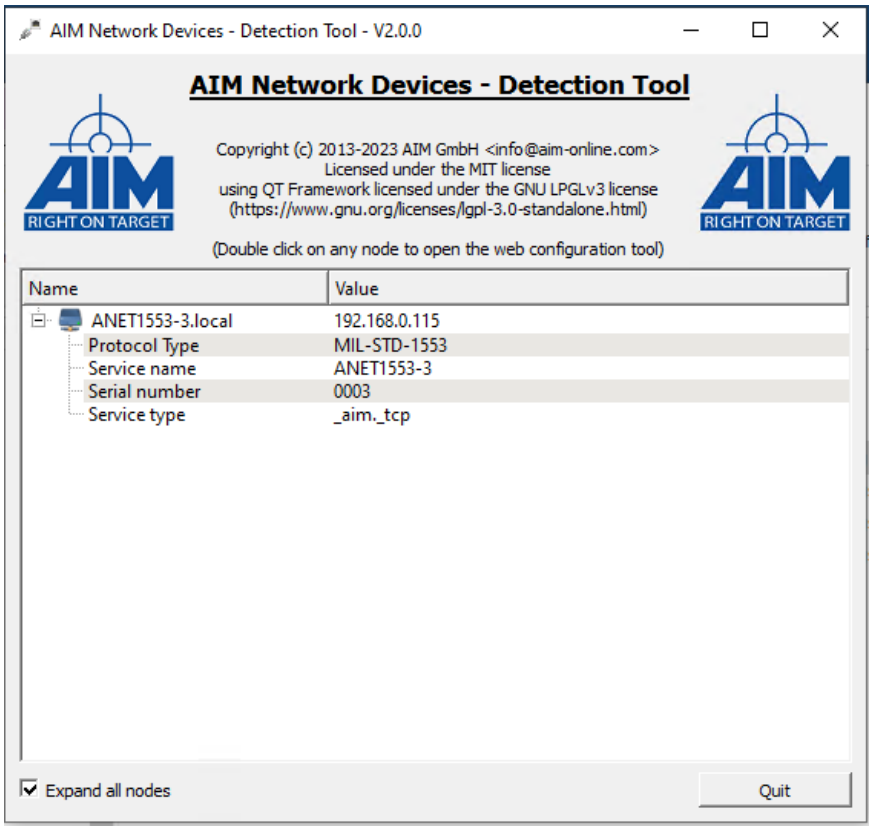

Figure 3.3-1 AIM Network Detection Tool

A double-click on any ANET1553 module in the list will open the default web browser of the system and forward you to the web configuration page of the corresponding ANET1553 module.

The module's IP address can also be resolved by the board's alias which is shown left to the IP address. In this example the alias is ANET1553-3 (ANET1553-<x>
x= Serial Number).
Just enter the alias in the address bar of the Web Browser appended by a ".local" (e.g. *ANET1553-3.local*) to connect to the module's corresponding web configuration page.

3.4 Configuring the ANET1553

Configuration of ANET1553 modules is exclusively performed with a web browser. Enter the IP address or the board alias name in the web browser address bar to configure and connect to the ANET1553.
First of all you have to enter a user name and password on the login screen, the default login is:

User Name: ‘user’
Password: ‘aim’

After a successful login, you will be forwarded to the *System Overview* page. This page shows a summary of the current system status as shown in the figure below.

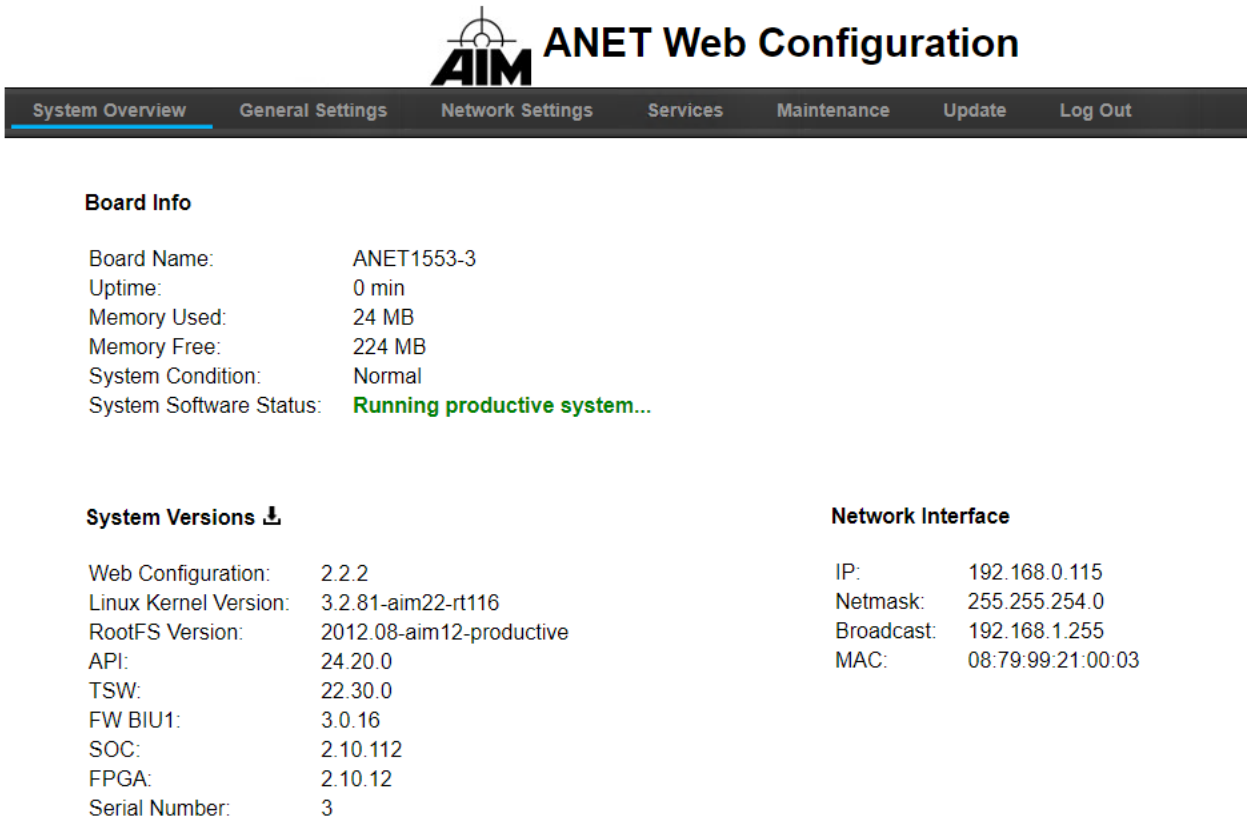

Figure 3.4-1 ANET Web Configuration Tool “System Overview”

3.5 Configuring basic properties

Click on the ‘General Settings’ tab in the navigation bar. You can now set an alias name for the device or change the password for configuration access:

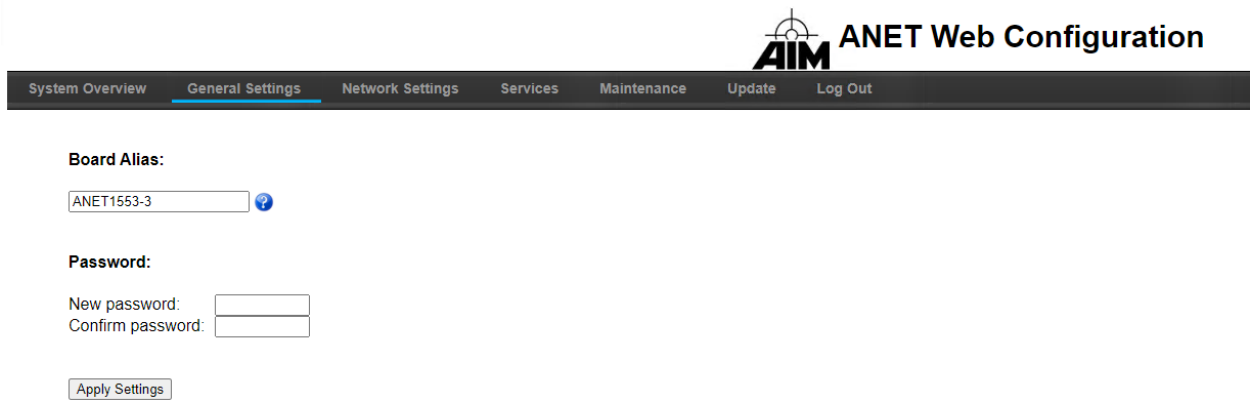

Figure 3.5-1 ANET Web Configuration Tool “General Settings”

Note: When changing the alias name the ANET1553 can’t be accessed by the former alias name anymore. Make sure to adapt your applications to the new alias name.
The default alias is ANET1553-<x>, x= Serial Number.

Note: It is recommended to change the password (default = “aim”) when using the ANET1553 module the first time.

3.5.1 Setting the IP-Address

Click on the *Network Settings* tab in the navigation bar. You will now see a page where you can set either a static or dynamic (DHCP) IP address and choose a board alias. When selecting static configuration, you will also be able to enter the subnetmask and default gateway for your network:

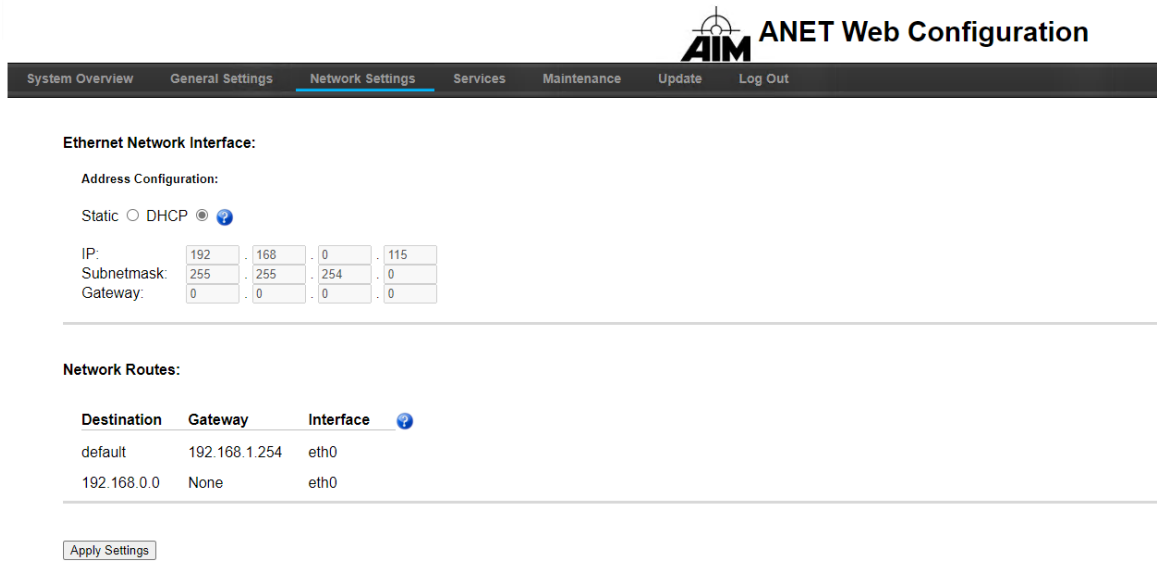

Figure 3.5-2 ANET Web Configuration Tool “Network Settings”

3.5.2 Configuring Wireless Network Interfaces

The ANET1553 device offers support for an USB based Wi-Fi network device in order to connect the ANET1553 to a wireless network.
From the time when the Wi-Fi USB device is attached to the USB port of the ANET1553, the *Network Settings* tab will show an additional section that allows configuring the Wi-Fi device (See figure 3.5-3).

The checkbox '*Enable Interface'* can be used to enable/disable the Wi-Fi device.

'*Link Status'* section displays if the Wi-Fi device is currently connected to a wireless access point (AP) and if it this, the quality of the link. Please note, that in *Ad-Hoc* mode no link status is available, as no central connection to an AP is established.

'*Available Networks'* section displays the wireless network in reach of the ANET1553 device.

The '*Address Configuration'* section can be used to assign an IP address to the Wi-Fi device. Proceeding is the same as for the Ethernet interface device of the ANET1553.

At last, there are following Wi-Fi specific settings, which have to be configured:

- *Mode*: Set to '*Managed'* if you want to connect to a network with a central wireless access point. Use '*Ad-Hoc'* (also called IBSS), if you want to join a peer-to-peer network without central access point.
- *ESSID*: This is the alphanumeric ID of the wireless network, the ANET1553 device shall connect to. In '*Managed'* mode, the AP defines this ID. In '*Ad-Hoc'* mode, all participants of the peer-to-peer network must agree on the same ESSID.
- *Security*: Wireless networks use different security methods to protect against unauthorized access. Use *'Unsecure'* if the network you want to join does not use any security mechanism. Choose *'WEP'* if the wireless network is protected with Wired Equivalent Privacy (WEP). Last supported security method of the ANET1553 device is Wi-Fi Protected Access II using a pre-shared key, which can be configured by using '*WPA2-PSK'*. Please note that WPA is not supported in Ad-Hoc mode.
- *Password/Key:* If the wireless network uses any of the security methods mentioned above, except *Unsecure*, it is necessary to enter the password/key for the network. In *WEP* mode, the key can be in ASCII (5 or 13 characters) or Hexadecimal format (10 or 26 digits). *WPA* uses only passwords in ASCII format which must contain at least 8 characters.

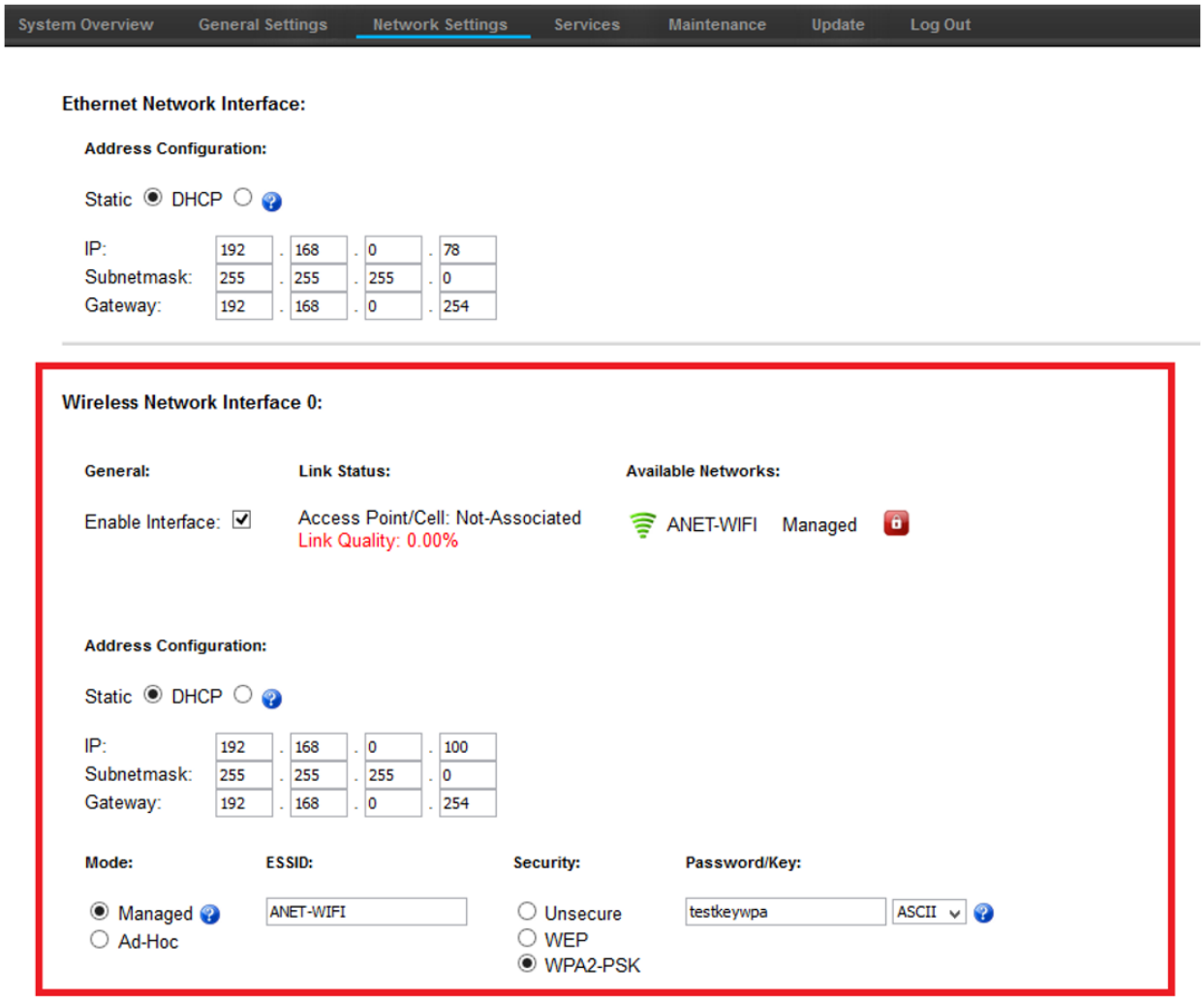

Figure 3.5-3 ANET Wireless Network Device Configuration

3.5.3 Configure System Services

Click on the *Services* tab in the navigation bar. You will see now a page where you can configure the services that shall be running on your ANET1553 module and also the services that are currently running.

The ANS1553 basically offers an ‘endpoint’ or ‘service’ for applications which use the AIM 1553 ApiConnectToServer” call in order to establish a connection to an ANET1553. That API function can either use the alias name or the IP address of an ANET1553.

Note:
If the ANS1553 has been switched off, the 1553 API is no more able to connect to the ANET1553 !

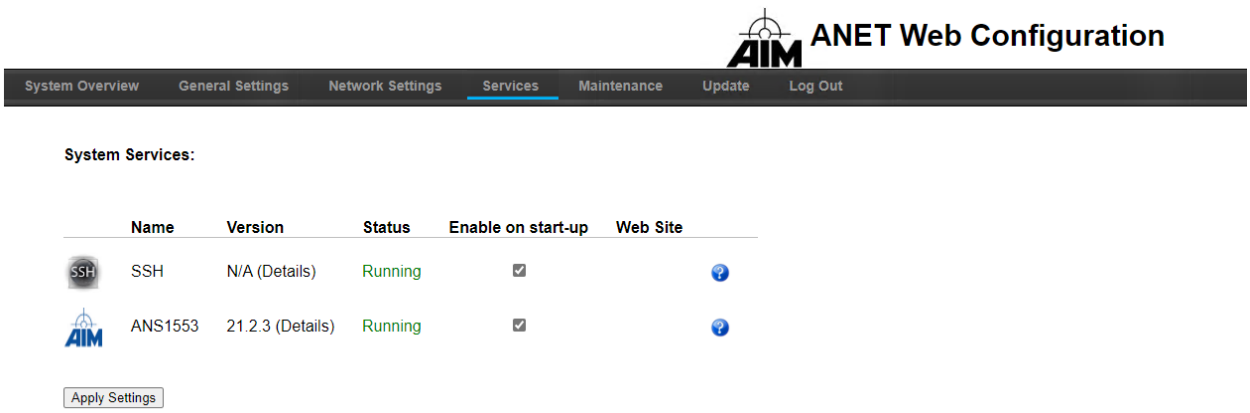

Figure 3.5-4 ANET Web Configuration Tool "Services"

3.5.4 Check System Log-File

Click on the *Maintenance* tab in the navigation bar (see the figure below).

"System Logs" provides the system Log-Files in different file formats. The System Status Log-Files are available in the HTML-, Plain- (ASCII-Text file) or XML-Format.
Note: For viewing the XML Log-Files a XML-Editor is necessary.

3.5.5 Re-Boot or Shutdown over Ethernet

Click on the *Maintenance* tab in the navigation bar (see the figure below).

It is possible to reboot or shutdown (power down) the module over Ethernet using the Reboot or Shutdown function in this Tab.

3.5.6 Reset Settings to Factory default

Click on the *Maintenance* tab in the navigation bar (see the figure below).

"Reset To Factory Defaults" allows to reset all settings to the factory defaults.
To do this first go to the Update Tab and re-boot the ANET1553 to Maintenance mode by a mouse click to the "Reset to maintenance system" button. Then wait until the ANET1553 is in Maintenance mode. Log-In again and go back to the Maintenance Tab to press the OK button on "Reset all settings now".

After resetting the settings, the password will be set to the factory default ("aim"), the Network Settings will be set to DHCP mode and the services SSH and ANS1553 will be enabled.

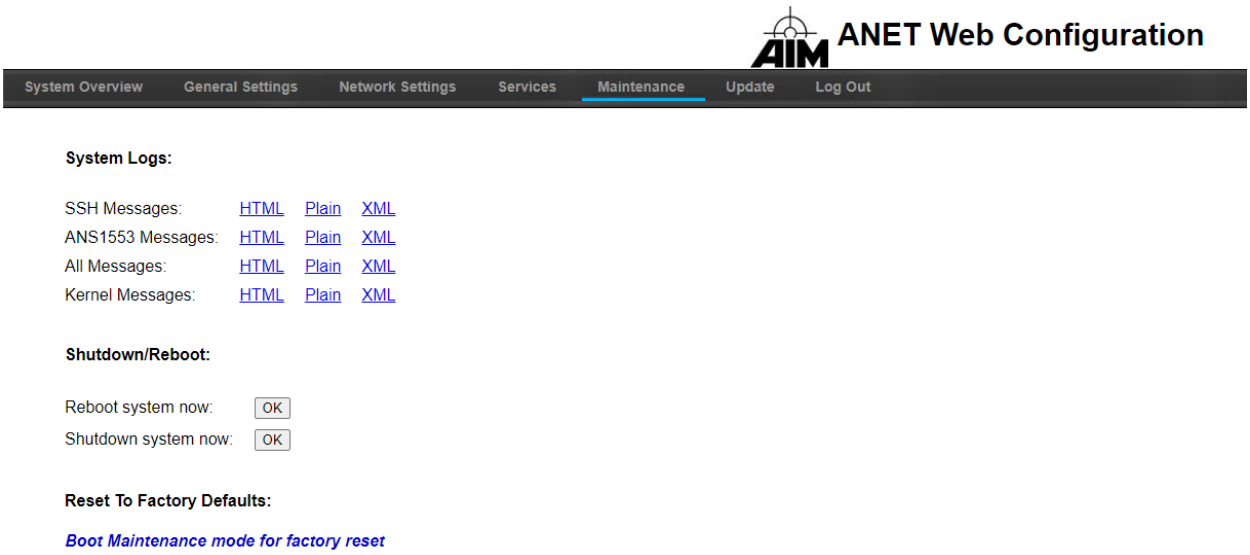

Figure 3.5-5 ANET Web Configuration Tool “Maintenance”

3.6 Updating the ANET1553 module

Click on the "*Update"* tab in the navigation.

Re-boot the ANET1553 to switch to maintenance mode.
Wait until the re-boot has been finished, then log-in (re-connect) to the ANET1553 again. Click again on the "*Update"* tab in the navigation bar and choose the update-file anet1553-update.tar.gz and start the update. The default location of the update file in the BSP is /Onboard-SW/update-components/.

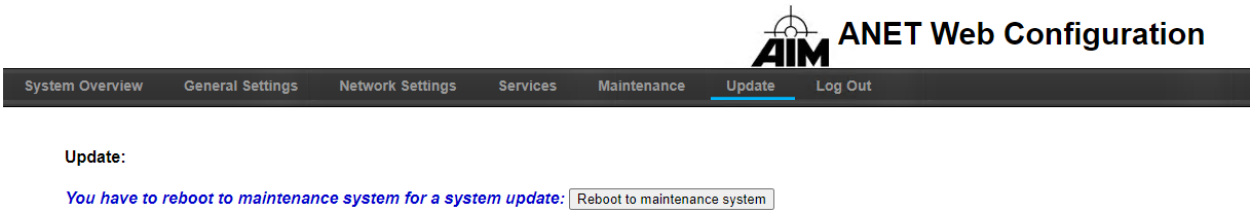

Figure 3.6-1 ANET Web Configuration Tool "Update tab"

Status is shown during update, don't close the browser.

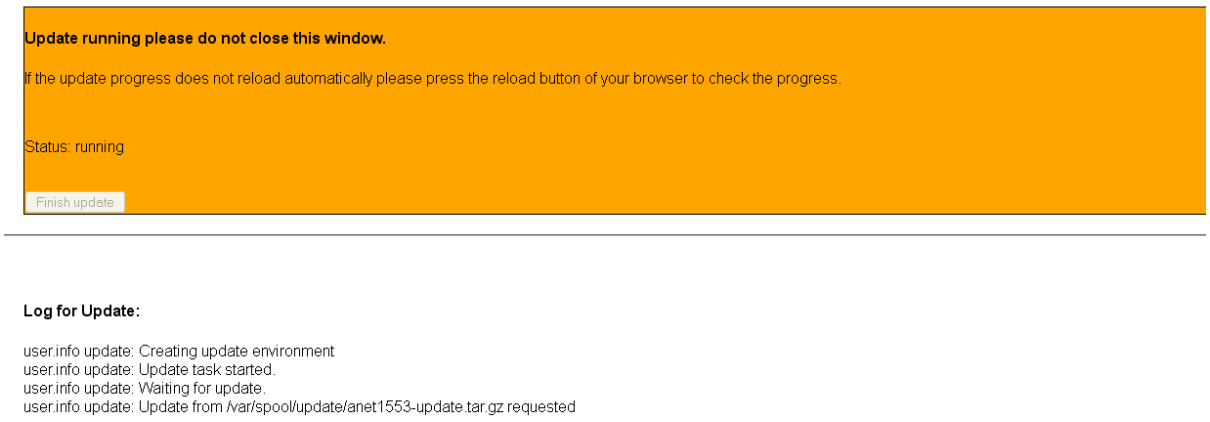

Figure 3.6-2 ANET Web Configuration Tool "Update is running"

When the update completes successfully the status should look like Figure 3.6-3. Click the Finish Update button to wrap up and to have the option of downloading the log file. The log file will be useful for investigation if an error occurred during the update.

Figure 3.6-3 ANET Web Configuration Tool “Update finished”

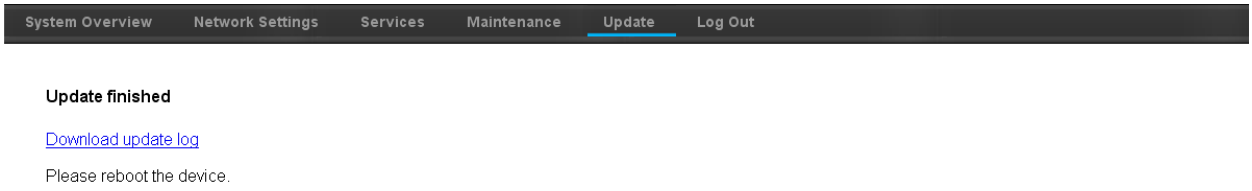

Figure 3.6-4 ANET Web Configuration Tool “Update Log-File”

3.7 Booting the device into emergency mode

The ANET1553 device offers an ‘Emergency Boot Button’ on the back panel of the device:

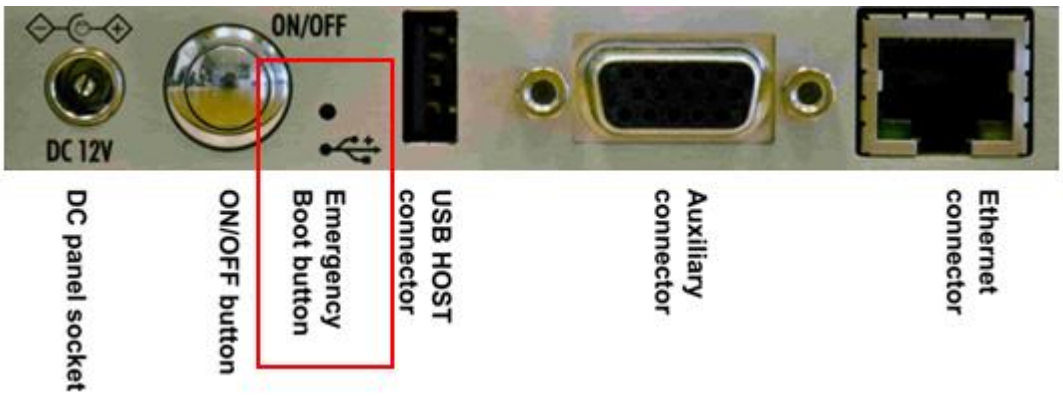

Figure 3.7-1 Emergency Boot Button

The emergency system can be used to start up the device whenever the normal system start up does not work. It can be used to reset the device to factory settings or perform software updates.

Press the emergency button while powering on the device, e.g. with a paper-clip, in order to boot the ANET1553 into the emergency mode. The emergency mode boot is indicated by a red blinking LED. When booting into the emergency mode, the device will start up with its default factory settings, e.g. user name, password and IP address. You are able to connect to the ANET1553 device with your web browser now.

3.8 How to connect Applications to the ANET1553

The following chapters describe how to connect an ANET1553 with PBA.pro or any customer specific application using the AIM Application Programming Interface Library (API-Library).

3.8.1 Connect to a ANET1553 with PBA.pro

Open the “Help\About\Settings” tab in PBA.pro and setup the “servers_ppmil” setting to the alias name or IP address used for your ANET1553, e.g. “ANET1553-3.local” (see Figure 3.8-1 below) and re-start the PBA.pro.

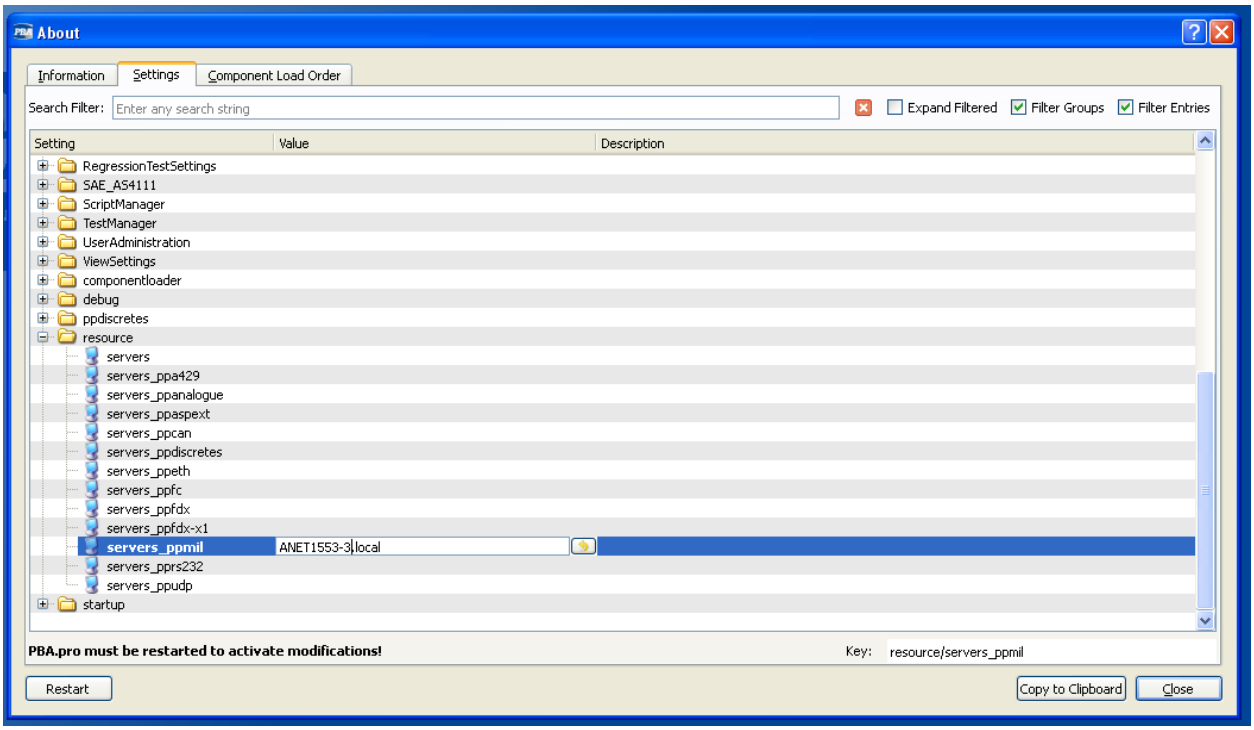

Figure 3.8-1 Connect to ANET1553 with PBA.pro

After a re-start, PBA.pro should show the available ANET1553 MIL-Resources.
The figure below shows how it looks like for an ANET1553-2. For an ANET1553-1 only the MIL-Resource is shown.

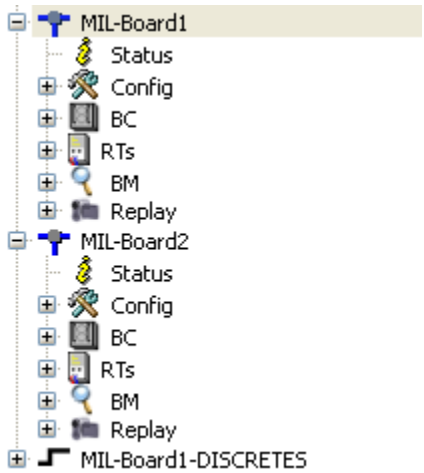

Figure 3.8-2 Connect to ANET1553 with PBA.pro

3.8.2 Connect to a ANET1553 using the AIM API-Library

To connect to an ANET1553 via customer specific applications using the AIM Application Programming Interface Library (API-Library), the following steps are necessary.

a) To establish a network connection to a ANET1553, with the AIM Network Server (ANS) running , the API function “ApiConnectToServer” has to be called. As already mentioned above, the alias name or IP Address must be passed as a parameter for proper initialisation of the API network connection.

b) The API function “ApiOpenEx” has to be called to initialize the Application Interface for the specified module, before any other API S/W Library function is used for the specified module. This function establishes connectivity between the Application Interface and the AIM board by calling operating system routines to open the AIM board and initialize a shared memory area for host-to-target communication.

For further informations see the AIM Software “Reference Manual”.

3.9 Connecting the ANET1553 to the MIL-STD-1553 Bus

The MIL-STD-1553 Specification clearly defines the process of coupling subsystems to the MIL-STD-1553 Bus.

This connection, called a stub, has the following two coupling options:
1) Direct coupled
2) Transformer coupled

In addition to these two standard methods of connecting to the bus as specified in the MIL-STD-1553 specification, an AIM ***Network Emulation Coupling*** mode is provided, which allows a direct connection between a MIL-STD-1553 Remote Terminal and the ANET1553 if the Remote Terminal is transformer coupled.

To physically suspend the ANET1553 MILBus signal-lines from the frontend TWINAX connectors an AIM ***Isolated Coupling*** mode is provided.
Further information about the coupling modes can be found in chapter 4.4.

All methods are described in these following sections.

3.9.1 Direct Coupling

Direct Coupling connects the subsystem/terminal device directly to the bus and can only be used in connections under one foot in length.

Since a Direct Coupled stub provides only limited isolation in the event of a device (subsystem or terminal) short, Transformer Coupling is normally the recommended method of connecting to the bus.

AIM provided Pigtail Connector

Figure 3.9-1 Pigtail Connector

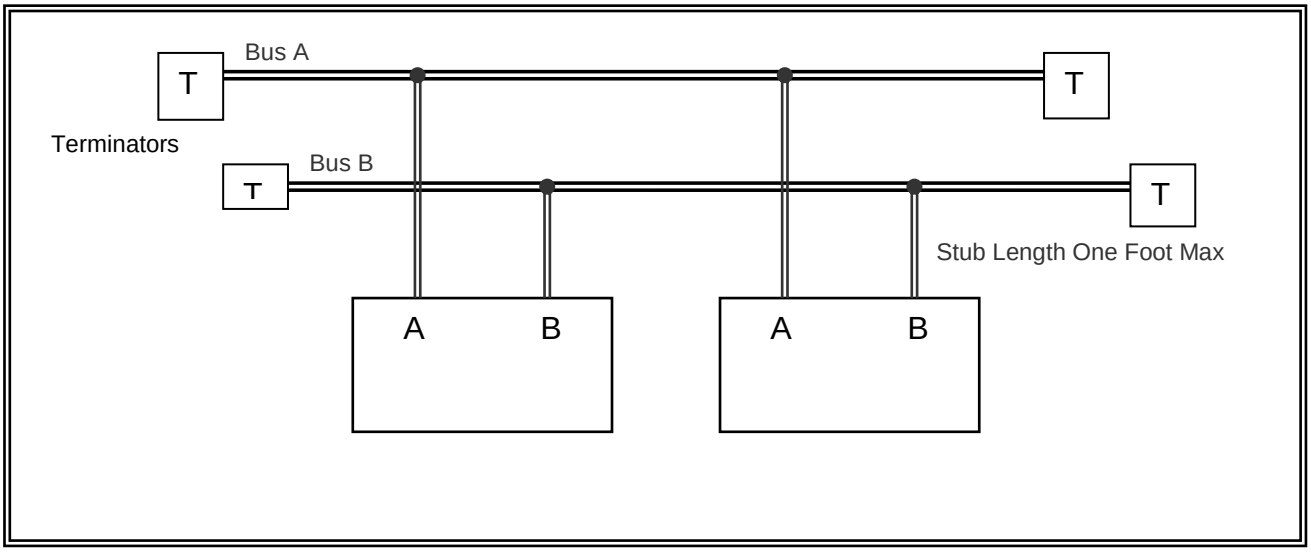

Figure 3.9-2 Direct Coupling

3.9.2 Transformer Coupling

Transformer Coupling utilizes a bus coupler that contains an isolation transformer and isolation resistors. Transformer Coupling extends the stub length to 20 feet and provides electrical isolation, better impedance matching and higher noise rejection characteristics than Direct Coupling. The electrical isolation prevents a terminal fault or stub impedance mismatch from affecting bus performance.

Figure 3.9-3 Stub Coupler

Connecting to the bus using Transformer Coupling requires a Coupler for each subsystem/terminal device and proper termination on the bus.

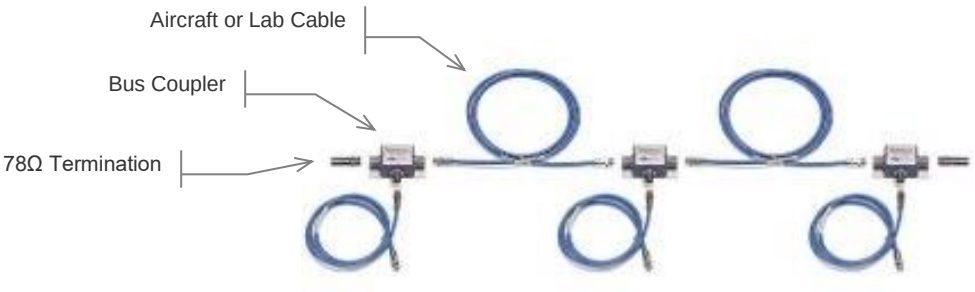

Figure 3.9-4 Transformer Coupling

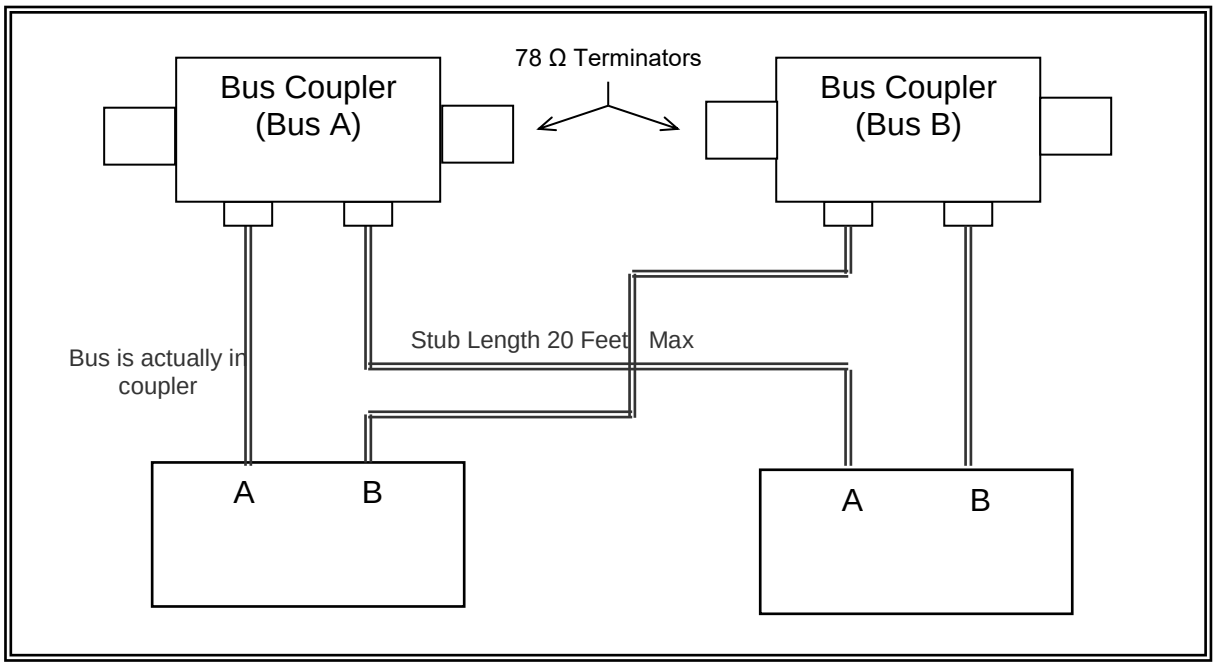

Figure 3.9-5 Transformer Coupling

3.9.3 Network Emulation Coupling

Network Emulation Coupling is a special option for the ANET1553.
The AIM design includes on-board Bus Network circuitry that is software selectable. This allows the user to connect directly to a single terminal device without the need for any bus coupling. The Network Coupling mode, selected by the user via software controls, provides a terminated MILbus network simulation on the ANET1553 to allow a direct connection between the ANET1553 and the external terminal.

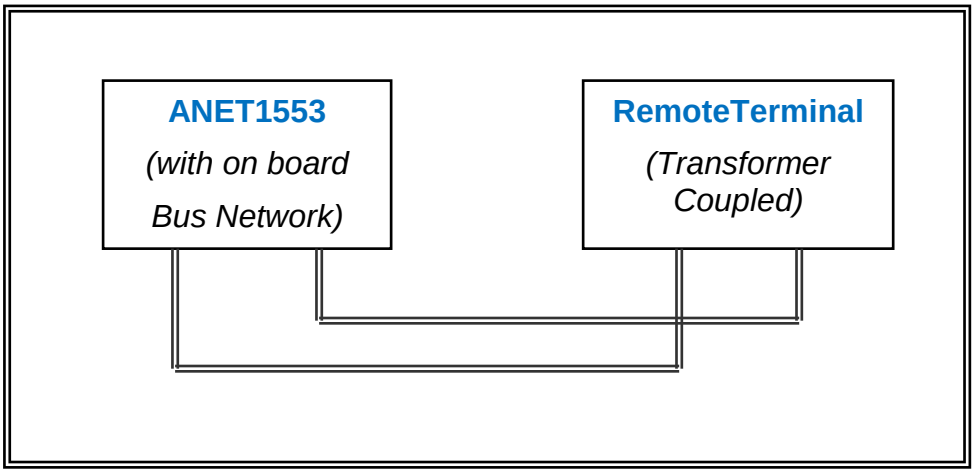

Figure 3.9-6 Network Emulation Coupling

3.9.4 Isolated Coupling

In **Isolated Coupling** mode the ANET1553 MIL-STD-153 frontend is physically suspended from the ANET1553 TWINAX frontend connectors via relays.

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4 STRUCTURE OF THE ANET1553

The structure of the ANET1553-2 (dual channel) module is shown in the block diagram below. An ANET1553-1 only provides one MIL-STD-1553 channel.

The ANET1553 comprises the following main sections:

- **System FPGA**
- **Global RAM**
- **BIU Section**
- **Physical I/O Interface with up to two Dual redundant MIL-STD-1553B channels with programmable output Amplitude and Coupling Network**
- **IRIG-B-122 – Time Code Processor with Free Wheeling Function**
- **ASP Section with local ASP RAM**

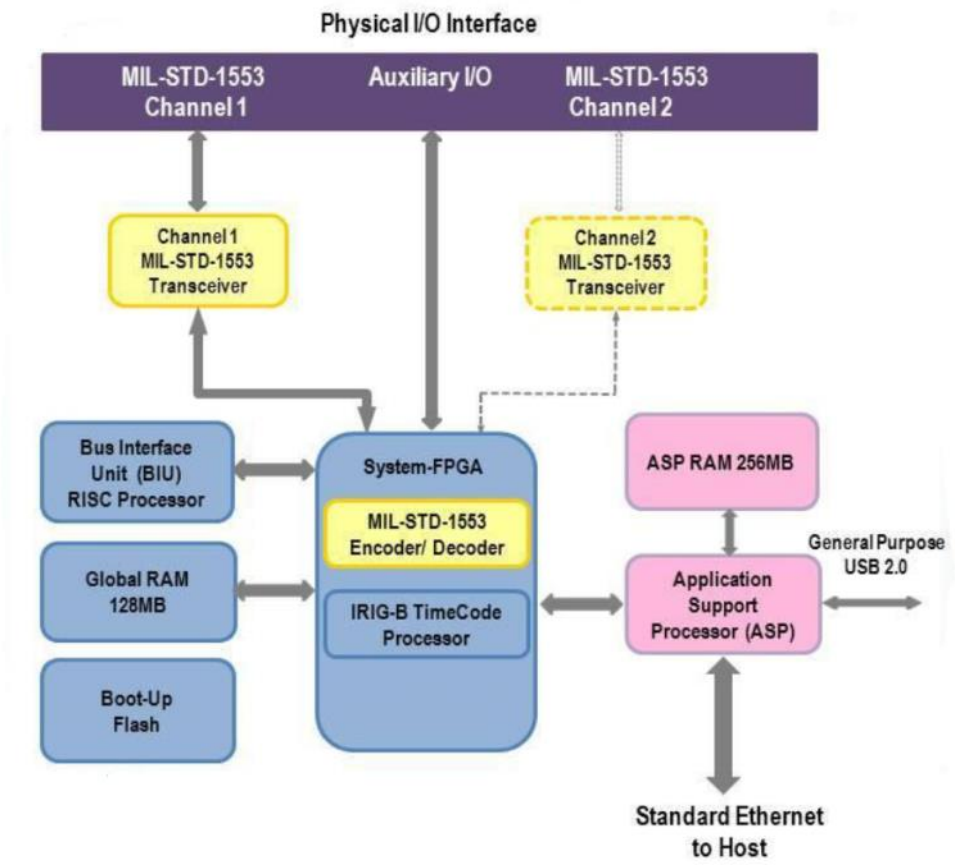


Figure 3.9-1 Block Diagram ANET1553-2

4.1 System FPGA

The System FPGA includes the ASP processor Interface logic, the Interface Logic for the BIU processor and the MIL-STD-1553 Encoder / Decoder Logic.

The following features are implemented in the System FPGA:

- Global RAM interface and arbitration
- SPI controller for updating the on board SPI-Flashes
- MIL-STD-1553 Encoder / Decoder
- IRIG-B Logic
- Time Code Processor Function
- µMon-Software
- Trigger-I/O Logic
- Discrete-I/O Logic
- ASP & BIU processor Interface

4.2 Global RAM

128MByte RAM, shared between the ASP-, BIU-Processor and the FPGA internal Microcontroller.

4.3 BIU Section

The BIU consist of the BIU processor, the MIL-STD-1553 Encoder/Decoder logic to handle up to two MIL-STD-1553 channels, the Trigger-Logic to handle the Trigger-I/O signals in BC, RT and BM operating modes and a SPI-Flash for BIU-Processor Boot, all implemented in the FPGA.

4.3.1 MIL-STD-1553 Encoder

The MIL-STD-1553 encoder comprises a Manchester Encoder with full error injection capability as required by the 'Remote Terminal Production Test Plan'.

4.3.2 MIL-STD-1553 Decoder

The MIL-STD-1553 Manchester decoder samples the incoming serial data stream.
The decoder detects the synchronization pattern (Command/Status and Data Sync.), converts 16 bit Manchester encoded serial data to parallel and receives the parity bit. The decoder indicates the synchronization pattern and error information (parity error, Manchester error, framing error) via dedicated bits in an error status register.

4.3.3 External Trigger Inputs and Outputs

One common Trigger Input and one common Trigger Output line is provided for the following operating modes Bus Controller (BC), Remote Terminal (RT) and Bus Monitor (BM).

Trigger-OUT
Because only one Trigger OUT and one Trigger IN are available for each MILBus Channel, the Trigger Output of the ANET is a logical OR function of the BC-, BM- and the RT-Trigger signals.

Trigger-IN
The LVTTL (3.3V) external Trigger-Inputs are high active and +5.0V tolerant. The external Trigger IN is passed (provided) to the BC, BM and RT FPGA internal trigger logic simultaneously and is caught by the operating mode (BC, RT, BM) where the trigger mode is activated.
The external Trigger-IN pulse length must be at least 75 nanoseconds.

4.4 Physical MIL-STD-1553B I/O Interface, MILBus Coupling Modes

Up to two dual redundant MIL-STD-1553A/B channels are available. Each channel comprises a dual-redundant transceiver, transmitter amplitude control circuitry, a dual bus coupling transformer and the coupling relays with the MILBus network emulation circuitry.

The MIL-STD-1553 trapezoidal dual transceivers offer the capability to control the output amplitude on the MILBus via the voltage control pins. The output amplitude of the MILBus transceiver can be adjusted by the software on the primary and secondary channel simultaneously.

The MILBus coupling network consists of sophisticated relay circuitry which offers various coupling capabilities. The different coupling modes can be programmed by the software:

- Transformer coupled
- Direct coupled
- Transformer coupled with resistive network emulation
- Isolated (Internal termination)

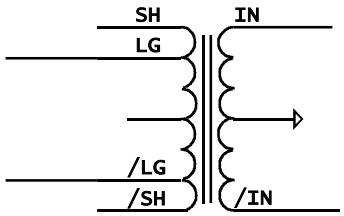
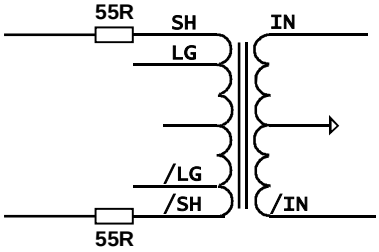
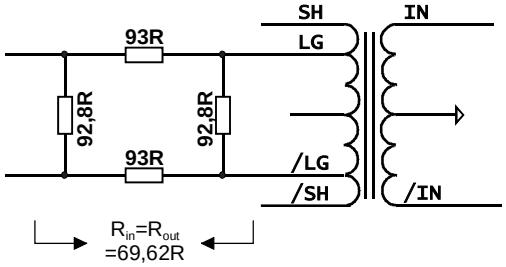
MILBus Coupling	Representation
MIL-BUS Isolated (Default)	No connection to the MILBus
MIL-BUS Transformer Coupled	
MIL-BUS Direct Coupled	
MIL-BUS Transformer Coupled with Network Emulation	

Figure 4.4-1 Different Coupling for MILBus channels

In network emulation mode, the MILbus emulation circuitry emulates a transformer-coupled network without the use of MILbus couplers (using a resistor network). Thus, an external dual-redundant MIL-STD-1553 Terminal can be directly connected to the module.

The MILBus output amplitude has a nearly linear dependency on the voltage on the Vcontrol Input. The Vcontrol input follows the following formula.

$V_{outA/B} = 2 \cdot V_{ref} \cdot \frac{N}{256}$ where N is the 8 bit input value, and V_{ref} the voltage on the Ref pin

The **Input Value** in this formula is the digital eight bit value (0..255) written to the on-board digital to analogue converters. The 100% value depends on the transceiver type, the coupling mode and the bus termination. The output value is app. 20 Volts for a transformer coupled stub terminated with 70 Ohm.

4.5 ASP Section

The low power onboard Application Support Processor (ASP) is based on a System-On-Chip (SOC) hardware and running under an embedded LINUX Operating System. The SOC hardware offers a built-in Ethernet interface, which is used for the implementation of the host connection via a Standard Ethernet RJ-45 connector. Furthermore, the also SOC built-in USB interface has been made available to the user for mounting external mass data storage devices or e.g. a WLAN stick for wireless.

4.6 Discrete I/Os

The ANET1553 module provides eight user programmable Discrete-I/O signals.
Discrete input signals are always active whereas the discrete output signals are per default inactive. An open collector circuitry is used for the discrete output with approximately 4V provided by default. An external voltage from 0 to 35V can be supplied externally for switching higher voltages.

Note: The discrete outputs don't provide a series resistor for over current protection.
In case a discrete input is used, make sure that the output-mode for that discrete is disabled, before connecting an external voltage, otherwise a high short circuit current to GND can damage the output transistor.

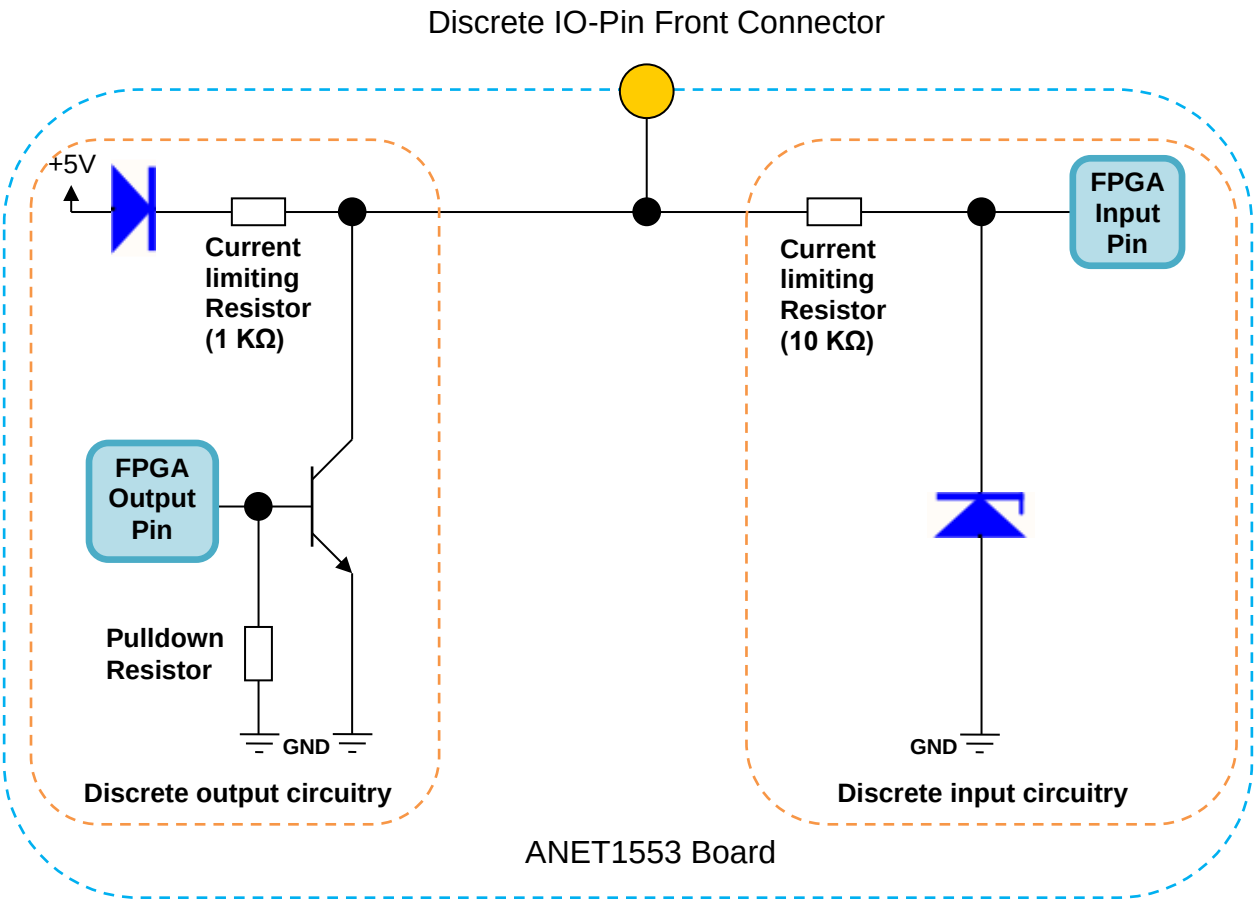


Figure 4.6-1 Discrete I/O circuitry

Be aware that a series resistor must be provided when a user voltage is used (4.6-2 Discrete I/O-Pin off board user series resistor).
This serial resistor must limit the current through the open collector transistor to max. current (see technical data chapter for details). Otherwise the open collector transistor can be damaged. EMC aspects are covered by filter circuitry.

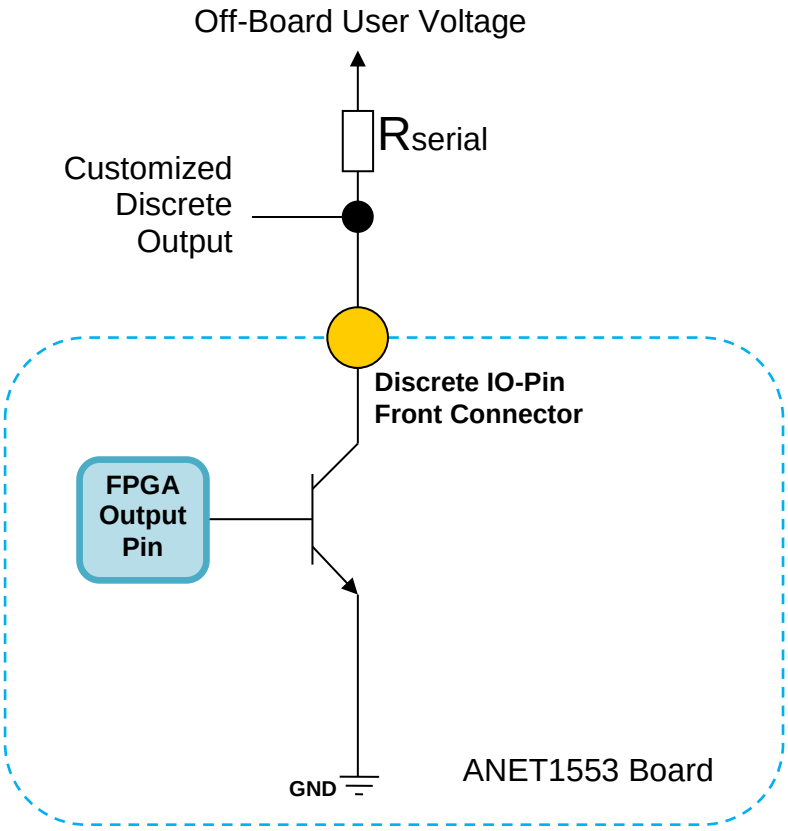


Figure 4.6-2 Discrete I/O-Pin off board user series resistor

4.7 IRIG- and Time Code Section

The main functions of the Time Code Processor (TCP) are:

a. IRIG-B compatible Time Code Decoder function

b. Time Code Encoder – IRIG-B compatible Time Encoder function

4.7.1 Timecode Encoder/Decoder

The generated time code signal is an IRIG-B-122 compatible signal. The time code information can be used for time-tagging and multi-channel synchronization.
On the ANET1553 a freewheeling IRIG function is implemented. If no external IRIG signal is detected, the Time Code Processor (TCP) switches automatically to the freewheeling operation mode. If an external IRIG-B signal is detected in freewheeling mode, the Time Tag is automatically synchronized to this external IRIG-B signal.

The time tag on the board is generated in the format shown in Table 3-1 below.

Time Element	Number of bits
DAYS of year	9
HOURS of Day	5
MINUTES of Hour	6
SECONDS of Minute	6
MICROSECONDS of Second	20
Summary	46 (6 Bytes, stored in two 32bit words)

Table 4.7.1-1 Time Tag Format

4.7.2 Time Tag Methods

The IRIG-IN and IRIG-OUT signals shall be connected depending on the time tag method used as shown below.

a. Single AIM-Module no external IRIG-B source
- No connection required

b. Multiple AIM-Modules with no common synchronization requirement
- No connection required

c. Single or multiple AIM-Module(s) with external IRIG-B source
- Connect external IRIG-B source to IRIG-IN and GND of all modules

d. Multiple AIM-Modules with no external IRIG-B source internally synchronized
- Connect the IRIG-OUT signal and the GND of the module you have chosen as the time master to all IRIG-IN signals (including the time master).

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5 COMPILING AND RUNNING A SAMPLE PROJECT

5.1 Compiling and running a sample project on Windows

The BSP includes a Microsoft Visual Studio 2013 (or newer) sample Workspace that consists of several 1553 application sample programs. The samples are all organized within one main program which handles the board initialization. This section contains the procedure which can be used to compile and run any of the sample programs included in the sample workspace (once the BSP has been installed). For more detailed information on API programming see the included 1553 programmers guide document.

Note: To execute a pre-compiled sample program run 1553_sample_project.exe from within the sample directory :

Start | All Programs | AIM GmbH | PCI-1553-Windows-BSP-Vxxxx | Sample | 1553_sample_project.exe

The 1553_sample_project program opens a board and provides a selection of sample functions to execute .

For further information regarding development of a 1553 application software program to interface to the ANET1553 module see the **MIL-STD-1553 Reference Manual**.

Note: The procedures in this section assume the use of Microsoft Visual Studio 2013. If a different version is used, the procedure may differ slightly.

The processes involved in compiling and running a sample program include:

a. Opening the sample Workspace

b. Adding the proper search paths for the include files

c. Adding the proper preprocessor definition

d. Adding the proper library

e. Adding the proper library path

f. Building and executing the sample program.

▶ **To Open the sample solution which contains all the sample functions**

1. Start Visual Studio, then select **File | Open Project/Solution** and navigate to:

   `C:\Program Files\AIM GmbH\MIL-STD-1553 Windows BSP x.y.z\Sample`

   and open the solution :

   `1553_sample_project.sln`

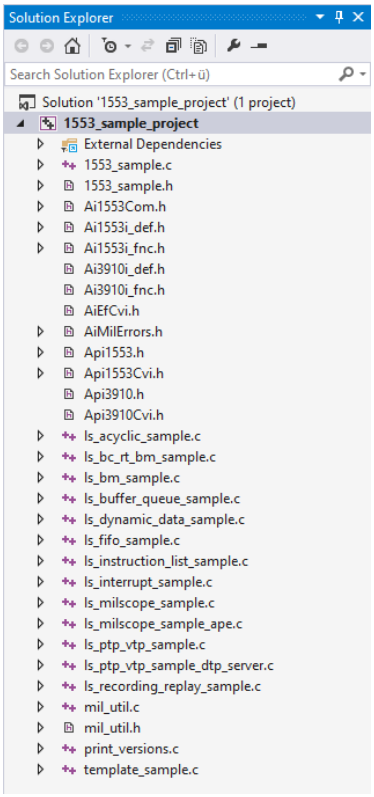

Figure 5.1-1 File Structure Sample project

▶ **To add the proper search paths for the include files**

1. Right click the project and select **Properties**
2. Select the **C++ / General**
3. Additional Include Directories must contain the include directory

   `c:\Program Files\AIM GmbH\ MIL-STD-1553 Windows BSP x.y.z \include`

   Then select the **OK** button

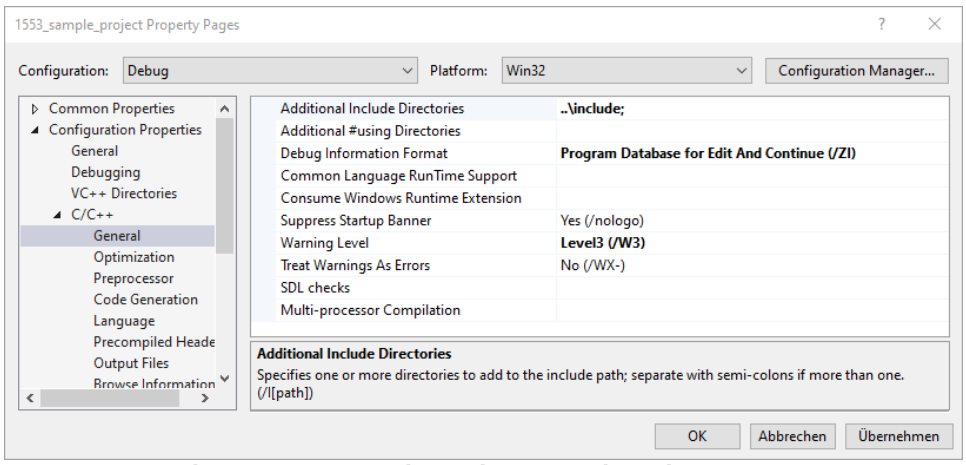

Figure 5.1-2 Sample Project search paths

▶ To add the proper preprocessor definition

1. Right click the project and select **Properties**
2. Select the **C++ / Preprocessor**
3. Under Preprocessor Definitions, if not already included, enter **_AIM_WINDOWS** then select **OK.**

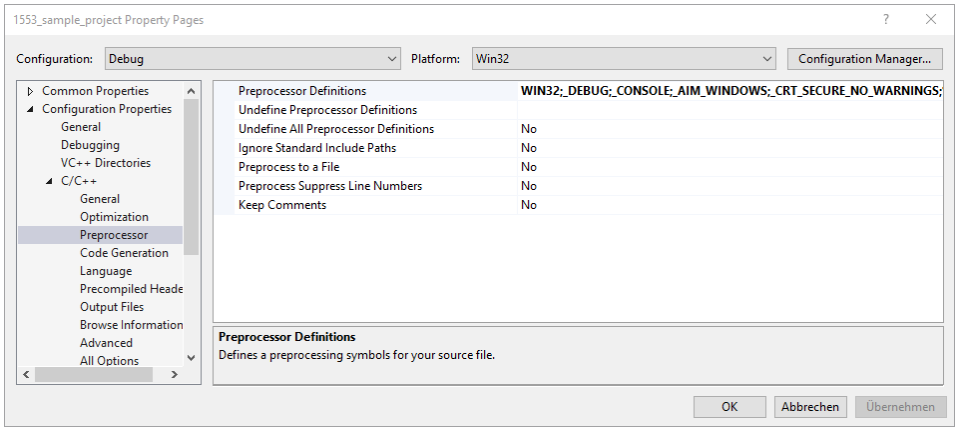

Figure 5.1-3 Sample project preprocessor definitions

▶ To add the proper library

1. Right click the project and select **Properties**
2. Select the **Linker / Input**
3. Under Additional dependencies, if not already included, enter **api_mil.24.lib**

▶ To add the proper library path

1. Right click the project and select **Properties**
2. Select the **Linker / General**
3. Under Additional library directories, if not already included, enter **..\lib32**.

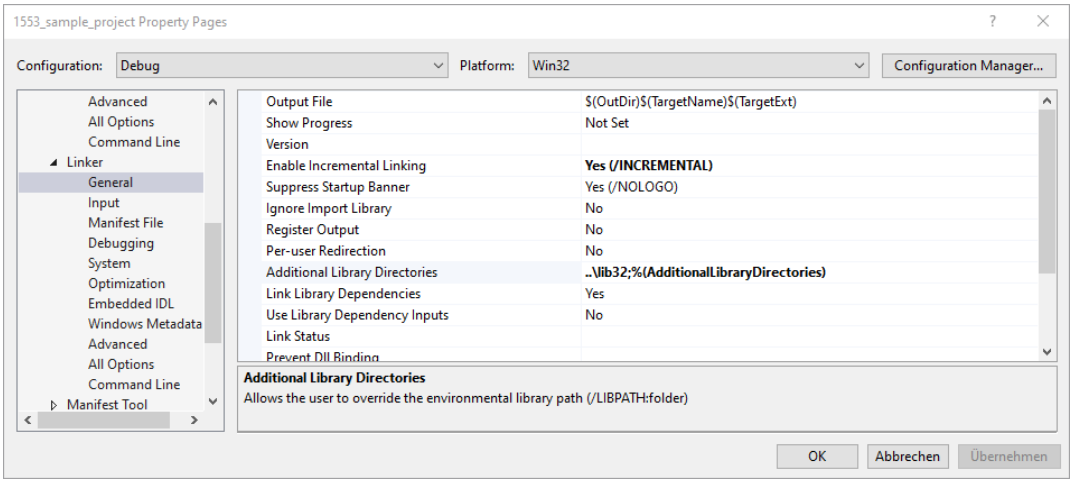

Figure 5.1-4 Sample project library path

▶ **To Build and Execute a Sample Program**

1. **Build | Rebuild Solution**
2. The executable will be stored in the Debug or Release subdirectory
3. The **api_mil.24.dll** will be loaded from the Windows system directory
4. Run the executable

5.2 Compiling and running a sample project on Linux

The BSP installation procedure will install a sample application to /usr/local/bin/sample. This program contains some use cases for the AIM MIL-STD-1553 Application Programming Interface (API).

Sources for this sample application can be found in the BSP subdirectory library/sample. The program consists of several use cases each implemented in a separate source file in the library/sample/src directory.

The source code can be adapted to your own needs. In order to re-build the sample application, change into the subdirectory library/sample and run 'sudo make'. The binary will be located then in library/sample/src. If you want to replace the sample application /usr/local/bin/sample built during BSP installation, run 'sudo make install'.

If the application in the samples directory fails to load because libaim_mil.so can't be found, then either 'export LD_LIBRARY_PATH=${LD_LIBRARY_PATH}:/usr/local/lib/' needs to be entered on the shell before the application is launched or a line '/usr/local/lib/' must be added to /etc/ld.so.conf and then 'sudo ldconfig' be called. Then try again.

▶ **To Build and Execute a Sample Program**

1. **$ cd sample**
2. **$ sudo make**
3. **$ export LD_LIBRARY_PATH=$LD_LIBRARY_PATH:/usr/local/lib/**
4. **$ ./src/sample**

▶ **Install a modified Sample Program**

1. **$ cd sample**
2. **$ sudo make install**

6 SINGLE OR SIMULATOR ONLY FUNCTIONS

The ANET1553 is available in a full function version and with a reduced set of functionality (Single Function or Simulator Only).

6.1 Simulator Only Versions

The “Simulator Only” functionality is intended for applications which are focused for simulating purposes (e.g. simulation of BC to RT, RT to RT and RT to BC transfers).
This version provides a BC- and Multi RT Simulator with Mailbox Monitor functionality, but doesn’t include the “Chronological Monitor” function.

6.2 Single Function Version

The “Single Function” functionality is intended for applications where all functions should be available but they don’t need to be available concurrently.
In general all functions are available but they are not available simultaneously, that means only one function can be used at a time e.g. the application can use either the Chronological Monitor and Mailbox Monitor *OR* Bus Controller *OR* Multi-RT and Mailbox Monitor function.

This has to be selected in the application software at runtime.

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7 FREQUENTLY ASKED QUESTIONS

- **I do not know the IP address assigned to my ANET1553 device:**

  Use the Network detection tool delivered with the NET1553 BSP. This will show any ANET1553 devices reachable in your local Network and also their current IP address. Please note, that on MS Windows platforms, the zero-config implementation ‘Bonjour’ and on Linux ‘Avahi’ has to be installed, before the Network detection tool can be used.

- **The ANET1553 is not visible in my network, even it does not show up in the Network detection tool:**

  Verify that your ANET1553 device is properly connected to your network. Also verify that the ANET1553 device is connected to the same network segment, as your host device. No routers or gateways that need particular configuration should be between them.

- **I forgot the password to log into the Web Configuration Tool:**

  Do power on the ANET1553 while pressing the Emergency Boot Button on the back panel of your device. This will start the emergency system of the ANET1553 (indicated by red blinking LED). After power up, log into the Web Configuration Tool with your Web Browser. The emergency system accepts the default user ‘user’ and password ‘aim’. Go to the ‘Maintenance’ tab and press the ‘Reset To Factory Defaults’ button. This will reset the user name and password of the device.

- **The ANET1553 device does not finish the boot up process endlessly:**

  Do power on the ANET1553 while pressing the Emergency Boot Button on the back panel of your device. This will start the emergency system of the ANET1553 (indicated by red blinking LED). After power up, log into the Web Configuration Tool with your Web Browser. Go to the ‘Maintenance’ tab and press the ‘Reset To Factory Defaults’ button. Then try to restart the device. If this does not work, repeat the emergency system boot and try to update the device with the software package of the latest Board Support Package.

- **The device is visible in the network, but my application can’t connect to it:**

  Verify that your application uses the correct IP address. If you’re using the board alias name to connect to the device and your application is running on MS Windows platforms, verify you installed the zero-config implementation ‘Bonjour’. If the device is still not accessible, log into the Web Configuration tool of the device with a web browser. Go to the ‘Services’ tab and verify the ‘ANS1553’ is running. If this is not the case, activate the service.

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8 TECHNICAL DATA

Memory:

DDR2 RAM (Global RAM)
- 128MByte

LPDDR RAM (ASP Local RAM)
- 256MByte

SPI-Flash for FPGA Boot
- 8MByte

SPI-Flash for BIU Processor
- 1MByte

NAND Flash for ASP Processor
- 1GByte

BIU-Section: Low power, high performance 32bit RISC Processor;
core voltage 1.0V, core speed 400 MHz, ext. bus speed 100MHz,

Encoder For each BIU, one Manchester Encoder with Parity generator and error injection
Single implementation with bus switching logic (not redundant)
Response time support via eight bit timer with 250ns resolution

Error Injection Parity error on selected word
SYNC pattern definable on half bit basis on selectable word
Manchester stuck at low or high error in selected word and bit
Gap error between selected words for 0.5 to 7.5 µs in 0.5µs steps
Bit count error on selected word +/- 3 bits
Parity error on selected word

Decoder For each BIU, one Manchester Decoder with Parity checker and error detection.
Single implementation with bus switching logic (not redundant).
Full error detection and indication.
inter word gap timer with 250ns resolution (nine bit).

Time Tagging:

IRIG-B Time Tag For absolute time tagging, a special time code processor implements an IRIG-B-122 encoder/decoder. If no external IRIG source is available a time code in IRIG-B-122 format is generated and can be used to synchronize multiple boards or modules.

Decoder

Format	IRIG-B-122
Resolution:	1 µs
Width:	1 Year (46 Bit)
Signal Waveform:	Amplitude modulated sine wave or square wave
Modulation Ratio:	3:1 to 6:1
Input Amplitude:	$0.6V_{p-p}$ to $5V_{p-p}$

Input Impedance:	~ 10k ohm
Coupling:	AC coupled
Time Jitter:	+/- 5µs (depending on the input signal quality)
Lock time:	< 5s Free wheeling accuracy after 10 Minutes < 1ppm (assuming input signal accuracy better than 50ppm)

Encoder

Format:	IRIG-B-122
Absolute Accuracy	+/-25ppm (standard Oscillator)
Signal Waveform:	Amplitude modulated sine wave
Output Amplitude:	~ 4,5V_{p-p}, High voltage level
Output Impedance:	~ 51 ohm
Coupling:	AC coupled
Modulation Ratio:	~ 3 : 1
Carrier Frequency	1kHz +/-50ppm
Gap and Response Time Measurement:	For relative response and inter message gap measurement (<=100µs) an internal timer is used with 250 ns resolution.

MIL-STD-1553 Bus Front End:

The physical I/O Interface with one or two dual redundant MIL-STD-1553 streams. It consists of the MIL-STD-1553B transceiver and a respective transformer.
The output voltage of the transceiver is adjustable

Bus coupling modes:

- Transformer coupled
- Direct coupled
- Network coupled (Transformer coupled with on-board resistor network emulation)
- Isolated

Connectors:

Back panel:

15 pol. high density DSUB, female

- Trigger IN and OUT
- Discrete-I/O
- IRIG-IN and IRIG-OUT

USB Type-A connector
RJ45 Ethernet Connector (female)
DC Power Input (2,5mm centre pin)

Front panel:

2x (ANET1553-1) / 4x (ANET1553-2) Standard Twinax BJ77 male type connectors.

Buttons: Power ON-OFF
Emergency Boot

Trigger In: TTL compatible Input Level, 1KΩ series resistor and fast ESD protection. Rising Edge sensitive, required pulse width > 75 ns

Trigger Out: Output with TTL Level, series resistor of 82Ω and fast ESD protection.
Output-Strobe pulse width: 500ns

Discrete IO: User definable Input/Output selection done by software,
Input High voltage 3.0V … 35.0V.
Input Low voltage max. 0.8V
Output High voltage:
Internally driven: min. 4V default,
Externally supplied: up to 35V max
Output Low voltage: 0.4V max
Maximum Sink Current of each open collector: 50 mA

Please note: When the default 5V for the discrete outputs are not used, provide a serial resistor in line with the open collector transistor. If using a discrete pin as input, make sure that the output mode is set to default before connecting an external voltage. Otherwise the transistor can be damaged.

Voltage Supply:

Input Voltage Range

- V_{IN} : $9V_{DC}$…$15V_{DC}$ ($12V_{DC}$ recommended)

Power Consumption

- Stand by:
  P_{IN} = ≤100mW
- Operational (IDLE):
  P_{IN} = ~2,8W
- Operational (1 channel 100% Bus Load)
  P_{IN} = ~4,5W
- Operational (2 channels 100% Bus Load)
  P_{IN} = ~6,1W

Note: All measurements are done with a V_{IN}=12V.

Temperature:

Standard Temperature Range:	0°C…50°C
Extended Temperature Range:	-15°C…60°C
Storage Temperature Range:	-40°C…+85°C

Humanity: 0…95% non-condensing

Dimensions: Width x Length x High = 120 x 160 x 26mm
(without connectors)

Weight: ~550g

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9 NOTES

9.1 Acronyms

ADC	Analog to Digital Converter
ALBI	ASP Local Bus Interface
ARM	Advanced RISC Machine
ASP	Application Support Processor
BIP	Bus Interface Processor
BIU	Bus Interface Unit
BM	Bus Monitor
BSP	Board Software Package
CCPMC	Conduction Cooled PCI Mezzanine Card
CMC	Common Mezzanine Card Family
DAC	Digital to Analog Converter.
DDRRAM	Double Data Rate Random Access Memory
DRAM	Dynamic Random Access Memory
EEPROM	Electrically Erasable and Programmable Read Only Memory
FLASH	Page oriented electrical erasable and programmable memory.
FPGA	Field programmable gate array
FRU	Field Replaceable Unit
FW	Firmware
GTP	Gigabit Transceiver
GND	Ground
IRIG B	Inter Range Instrumentations Group Time code Format Type B
I/O	Input / Output
JTAG	Joint Test Action Group (IEEE 1149.1 Boundary Scan)
LCA	Logic Cell Array (XILINX - Programmable Gate Array)
LED	Light-emitting Diode
MIL-STD	Military Standard
MILbus	MIL-STD-1553 bus
NTRAM	No Turnaround Random Access Memory
PBI	Physical Bus Interface
PROM	Programmable Read Only Memory
PCI	Peripheral Component Interconnect
PCIe	Peripheral Component Interconnect Express
PMC	PCI Mezzanine Card
PSC	PCI and System Controller
RAM	Random Access Memory
RISC	Reduced Instruction Set Computer
RS232	Hardware Interface Protocols
RTPTP	Remote Terminal Production Test Plan
SMD	Surface Mounted Device
SRAM	Static Random Access Memory
SSRAM	Synchronous Static Random Access Memory
TCP	Time Code Processor
UART	Universal Asynchronous Receiver and Transmitter

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10 APPENDIX

10.1 ANET Table Adapter Panel (for ANET '-D' Variants)

Figure 10.1-1 ANET Table Adapter Pinout

DC panel socket

Auxiliary connector

Mechanical lock screw and Emergency Boot button

ON/OFF button

USB HOST connector

Ethernet connector

10.2 How to connect the ANET Table Adapter

Figure 10.2-1 ANET Docking Connector

Figure 10.2-2 ANET Table Adapter

Step1:
Plug in the ANET Table Adapter to the ANET-Module docking connector at the Backpanel

Step 2
For locking the Table Adapter with the ANET Module, use the screw beside the Power ON/OFF Button

10.3 Certificate of Volatility

Model: ANET1553
Part-Number: 11E2X*) - 0100
Manufacturer: AIM GmbH
Sasbacher Str. 2
D-79111 Freiburg
Germany

Volatile Memory				
Does the item contain volatile memory (i.e., memory whose contents are lost when power is removed)? ☒ Yes ☐ No				
Description of used volatile memory:				
Type: DDR2-RAM	Size: 128 MByte	User Modifiable: ☒ Yes ☐ No	Function: Buffers, Descriptors, Global RAM	Process to Sanitize: Power off / on (Power Cycle)
Type: LPDDR-RAM	Size: 256 MByte	User Modifiable: ☒ Yes ☐ No	Function: ASP Program	Process to Sanitize: Power off / on (Power Cycle)

Non-Volatile Memory				
Does the item contain non-volatile memory (i.e., memory whose contents are retained when power is removed)? ☒ Yes ☐ No				
Description of used non-volatile memory:				
Type: Serial SPI-Flash	Size: 8 Mbit	User Modifiable: ☐ Yes ☒ No	Function: LS-BIU1 Processor Boot	Process to Sanitize: Erase
Type: Serial SPI-Flash	Size: 8 Mbit	User Modifiable: ☐ Yes ☒ No	Function: LS-BIU2 Processor Boot	Process to Sanitize: Erase
Type: Serial SPI-Flash	Size: 64 Mbit	User Modifiable: ☐ Yes ☒ No	Function: FPGA Boot	Process to Sanitize: Erase
Type: NAND-Flash	Size: 1 GByte	User Modifiable: ☐ Yes ☒ No	Function: LINUX Program & Data Firmware	Process to Sanitize: Erase

Media				
Does the item contain media storage capability (i.e., removable or non-removable disk drives, tape drives, memory cards, etc.)? ☐ Yes ☒ No				
Description of used media storage:				
Type: -None-	Size: -	User Modifiable: ☐ Yes ☐ No	Function: -	Process to Sanitize: -
Additional Information:				

Test Engineer		
Name: Frank Scherer	Title: Hardware Engineer	Date of Certification: 11.07.2016

All operating Data for handling the I/O Protocol will be stored in volatile memory only. No Transfer data is stored in Non-Volatile Memory. The Non-Volatile Memory only contains production relevant data for board personalization, FPGA Logic or Firmware Code for the on board Microcontroller.

*) Valid for all ANET1553 modules