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1 Introduction

The CANflight interface system offers 2 optically isolated CAN 2.0B interfaces according to ISO 11898, an IRIG-B time code input and a 10/100/1000 BaseT Ethernet interface. To minimize CPU load on host computers, the CANflight uses an onboard Xilinx Spartan-3 FPGA with dual Microblaze processors and 8 MByte SRAM to process and store CAN messages. The CAN bus interfaces are accessible via two 9 pin D-Sub connectors in the rear. Figure 1.1 shows the CANflight hardware.



Figure 1.1: CANflight Hardware

The CANflight features are:

- Laptop-ready, Dual Core Processor Based Embedded Realtime Control System for Ground and Airborne Use
- Two isolated, fully independent Controller Area Network (ISO 11898), ARINC825 and CANaerospace protocol compliant interfaces
- Integrated µSDHC card-based Flight Data Recording Option available
- IRIG-B Time Code Input for High Precision Data Synchronization
- Auto-negotiating 10/100/1000 BaseT Ethernet interface with CANaerospace over Ethernet (CoE) and ARINC825 over Ethernet (A825oE) protocol and Application Programmer Interface (API)
- IEEE 802.11 Wireless LAN Option with CANaerospace over Wireless (CoW) and ARINC825 over Wireless (A825oW) protocol available
- Frontpanel Activity LEDs for CAN and Ethernet
- Power Supply using USB cable or EN2282 Aircraft Power (9-36VDC)
- Mechanical Dimensions 80mm x 47mm x 132mm, weight 320g
- CAN/ARINC825/CANaerospace toolbox for Linux, MacOS and Windows
- Custom Software Options available on request

The CANflight is a standalone computer system that utilizes its processing power to relieve external computer systems from the tasks of transmitting, receiving, buffering and pre/postprocessing low, medium or high-speed CAN, CANaerospace and ARINC 825 messages. It can handle up to 100% bus load at the maximum CAN data rate of 1MBit/s on both channels without data loss. The driver software provides an easy-to-handle function call interface for CAN bus message transmission and reception including support for the CANaerospace and ARINC 825 higher layer protocols. The CANflight software consists of host drivers for various operating systems and platforms, sample "C" source code and the XCT toolbox connected to the CANflight via Ethernet/UDP/IP. Figure 1.2 shows the CANflight block diagram.

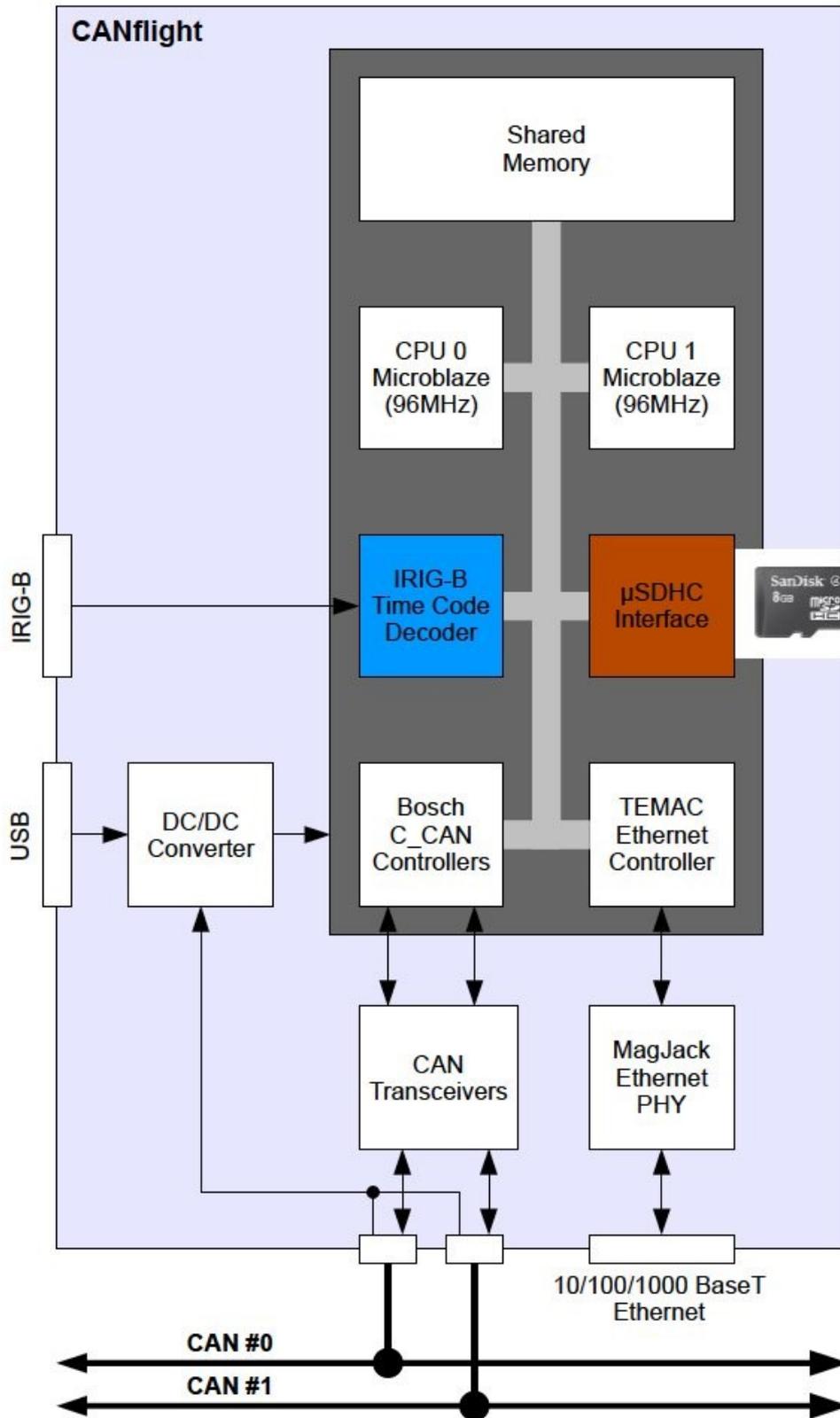


Figure 1.2: CANflight Block Diagram

The CANflight CAN 2.0B interfaces are implemented with licensed Bosch C_CAN controller IP cores to ensure compatibility with the Bosch CAN standard and to allow precise hardware timing and control over the transmission and reception of CAN/ARINC825/CANAerospace messages. The Xilinx FPGAs and the CANflight firmware provide local buffering and 60ns time stamp resolution for all CAN messages and implement ARINC825/CANAerospace specific protocol functions. High precision time synchronization of CAN messages is accomplished through an IRIG-B time code input providing 1µs resolution. An integrated µSDHC interface is used for data acquisition storage, system configuration information and firmware upgrades.

CANflight is integrated into a rugged aluminum box which is powered from 9-36 VDC allowing it to run from standard 14V or 28V DC aircraft power buses according to the EN2282 specification. The power input lines are protected against transient overvoltage and electromagnetic interference. Alternatively, CANflight runs off a USB power connection for direct use with laptop computers. The total power consumption of a CANflight unit is 5W. The CAN and Ethernet interfaces are serviced by different processors so that all interfaces may be used at the same time without any loss of data. CANflight units may be connected to host computers using CANaerospace/ARINC825 and the auto-negotiating 10/100/1000 BaseT Ethernet interface with the CAN over Ethernet protocol standard developed by Stock Flight Systems. The Wireless LAN (IEEE 802.11) option for CANflight provides an integrated DHCP server and a web-based configuration interface. The µSDHC card slot accepts cards with sizes up to 16GBytes.

CANflight units can work as either standalone systems or as intelligent nodes within simple or complex CAN, CANaerospace and ARINC825 networks. The interface between CANflight and host computer applications via Ethernet/UPD/IP, either wired or wireless, is realized through a corresponding Application Programming Interface (API) for a variety of operating systems including Linux, Solaris, MacOS, Windows and VxWorks.

2 Front Panel Connectors and Indicators

The CANflight front panel is shown in Figure 2.1, the usage of the various connectors and LEDs is described in Table 2.1. Note that the CAN channels are numbered CH1 and CH2 for indications and connectors but are referred to as channels 0 and 1 for all software functions including the configuration file (sections 5 CANflight Configuration and 7 CANflight Application Programmer's Interface).



Figure 2.1: CANflight Front Panel

CANflight Front Panel Element	Description
ETHERNET Connector	Standard RJ-45 connector used for the interface between CANflight and other computer systems using 10/100/1000 BaseT Ethernet. The CANflight Ethernet supports auto-negotiating of the bus speed as well as support for ICMP echo requests so that CANflight systems respond to "ping" commands over the network.
9-36VDC Power Supply Connector	Lock-Tab DC Coaxial Connector (Bayonet Lock) with 5.5mm outer diameter to supply 9-36VDC to CANflight if the rear CAN connectors or the USB connector are not used for that purpose. This power connection is diode-decoupled from the Power supply contacts of the CAN-Bus Connectors and electrically isolated from the USB Power Connector.
USB Connector	Type-B USB connector, used to supply +5VDC power from an external computer to the CANflight. The USB data connection is not used. The maximum current drawn by the CANflight over this connector is 0.5A. This USB power connection is isolated from the other CANflight power connectors (9-36VDC Power Connector and CAN-Bus Connectors).
Status LED	Bicolor LED which is illuminated in red during the start of the CANflight firmware or in case of an internal system failure. This LED flashes green during normal operation (with 90% on-time versus 10% off-time).
Left SSM LEDs	These LEDs flash to indicate that the associated CAN channel is recording CAN messages on the μ SDHC card. The longer the respective LED is illuminated in green, the more CAN messages are recorded over time (that is, the higher is the CAN bus load).
Right SSM LEDs	These LEDs indicate that the associated CAN channel is used for data recording by the internal CANflight firmware. Both LEDs should be illuminated continuously when data recording is activated.
TX LEDs	These LEDs flash with a frequency of 2Hz and a duty cycle of 50% to indicate that the CANflight currently transmits CAN messages over the associated channel.
RX LEDs	These LEDs flash with a frequency of 2Hz and a duty cycle of 50% to indicate that the CANflight currently receives CAN messages over the associated channel.
μ SDHC Card Slot	The μ SDHC card slot accepts regular μ SD or μ SDHC cards formatted with a FAT-32 file system. Note that the cards have to be inserted upside down (that is, with the gold contacts facing upwards).

Table 2.1: CANflight Front Panel Elements

The CAN activity LEDs located on the front panel (TX, RX) indicate if a CAN channel transmits and/or receives CAN messages. Every CAN channels has a dedicated RX/TX activity LED which flashes once for every transmitted/received message or continuously at a rate of 2Hz in case of a steady message flow.

If the RX activity LED of a particular CAN channel stays dark in an active network, the physical interface correctness of all network nodes including the used baud rates, sample points and termination resistors should be verified.

The CANflight ETHERNET Connector has a pinout according to the established RJ-45 standard as shown in Figure 2.2. This connector also contains two Status LEDs which indicate the negotiated Ethernet data rate and interface transmit activity.

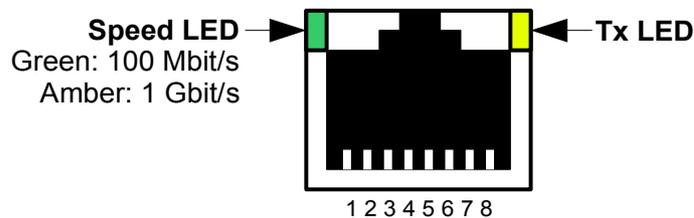


Figure 2.2: RJ-45 Connector with Status LEDs

Table 2.2 shows the corresponding Ethernet signal assignment for the RJ-45 connector.

Pin	Signal Name	Signal Description
1	TX+	Transmit Data +
2	TX-	Transmit Data -
3	RX+	Receive Data +
4	N.C.	Not Connected
5	N.C.	Not Connected
6	RX-	Receive Data -
7	N.C.	Not Connected
8	N.C.	Not Connected

Table 2.2: RJ-45 Connector Signal Definition

CANflight offers a μ SD card slot that supports FAT-32 formatted μ SD and μ SDHC cards. All standard μ SD and μ SDHC cards with sizes ranging vom 2GB to 16GB maybe used with CANflight if they support the Serial Peripheral Interface (SPI) mode and are capable of operating under a sustained SPI data rate of 25 Mhz.

The standard pinout of μ SDHC cards is shown in Figure 2.4, the corresponding signal assignment in Table 2.3. Figure 2.3 shows a standard μ SDHC card as an example. All standard μ SD and μ SDHC cards with sizes ranging vom 1GB to 16GB maybe used with CANflight. The μ SD card interface is fully compatible with the μ SD/HC specification of the SD Card Organization (www.sdcard.org).

The MicroSD card interface is used to configure the CANflight during startup using a dedicated configuration file (see section 5 CANflight Configuration) and to perform firmware upgrades (see section 6 CANflight Firmware Upgrades). Options for CAN data recording on μ SDHC card are available on request.

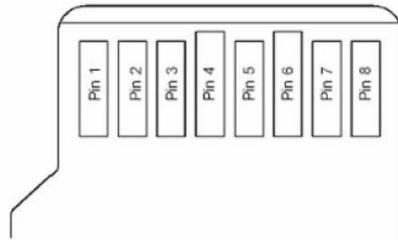


Figure 2.4: μSDHC Pinout



Figure 2.3: Typical μSDHC Card

Pin	Signal Name	Signal Description
1	RSD	Reserved
2	CS*	Chip Select (active low)
3	DI	Data In
4	VDD	Supply Voltage
5	SCK	System Clock
6	VSS	Supply Voltage Ground
7	DO	Data Out
8	RSD	Reserved

Table 2.3: μSDHC Connector Signal Definition

Figure 2.6 shows the pinout of the 9-36VDC Lock-Tab DC Coaxial Connector. This connector requires a mating 2.5mm/5.5mm plug with the supply on the center contact and the Power Ground connection on the outer ring. A mating (non-locked) plug is shown in Figure 2.5.

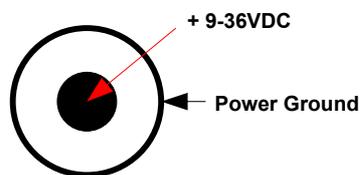


Figure 2.6: Lock-Tab DC Coaxial Connector Pinout



Figure 2.5: Mating DC Coaxial Plug

Figure 2.7 and Table 2.4 describe pinout and signals of the CANflight USB connector which is used for power supply only.

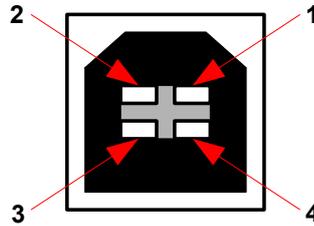


Figure 2.7: Type B USB Connector Pinout

Pin	Signal Name	Signal Description
1	Vcc	+ 5VDC/500mA
2	D-	Data – (Not used on CANflight)
3	D+	Data + (Not used on CANflight)
4	GND	Ground

Table 2.4: USB Connector Signal Definition

3 Rear Panel Connectors

The CANflight rear panel is shown in Figure 3.1. The CAN1/CAN2 Sub-D rear panel connectors combine the CAN interfaces and the power supply as shown in Figure 3.2, the usage and pin assignment of the connectors is described in Table 3.1.



Figure 3.1: CANflight Rear Panel

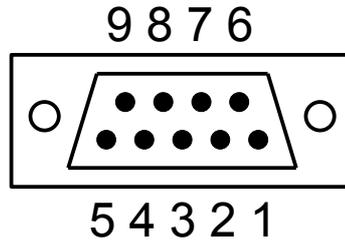


Figure 3.2: CAN1/CAN2 D-Sub Connector Pinout

Pin	Signal Name	Signal Description
1	9 - 36VDC	Power Supply
2	CAN-L	CAN Low
3	Unused	Do not connect
4	Unused	Do not connect
5	DC Ground	Power Supply Ground
6	Unused	Do not connect
7	CAN-H	CAN High
8	Unused	Do not connect
9	Unused	Do not connect

Table 3.1: CAN1/CAN2 Connector Signal Definition

The CANflight IRIG-B SMA connector accepts a signal according to IRIG Standard 200-04 on the center contact with the reference ground on the outer thread. The mating SMA plug is shown in Figure 3.3.



Figure 3.3: Mating IRIG-B SMA Plug

4 Ethernet Interface

CANflight uses its Ethernet interface for the communication between a (theoretically) unlimited number of other CANflight systems and/or host computers as shown in Figure 4.1. The Ethernet interface auto-negotiates its data rate with switches, routers or other network nodes between 10 and 1000 Mbit/s. To support smooth integration into standard Ethernet networks, CANflight responds to Internet Control Message Protocol (ICMP) echo requests ("ping") as well as to Address Resolution Protocol (ARP) requests. The CANflight IP address assignment may be either static or dynamic. CANflight contains a DHCP client to support dynamic IP address assignment.

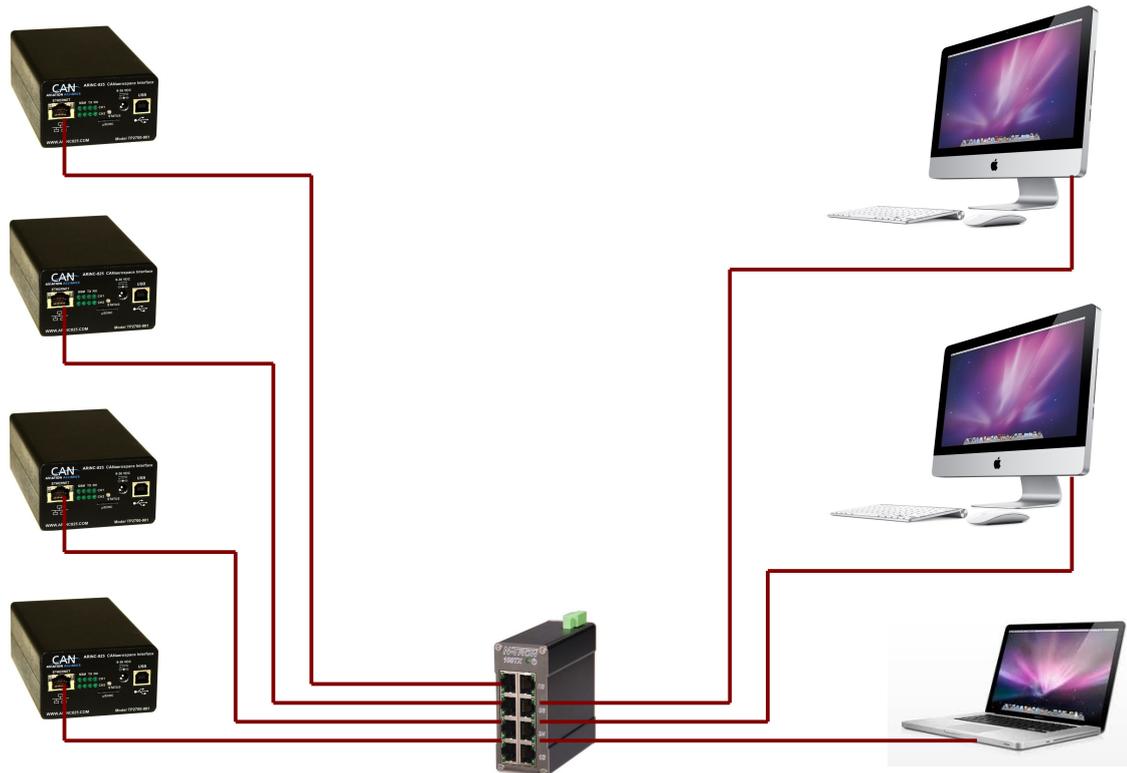


Figure 4.1: CANflight/Host Computer Communication Network

CANflight employs the User Datagram Protocol (UDP) for the communication with host computers. IP addresses and UDP port numbers used by CANflight may be assigned for each CAN channel individually. This maximizes flexibility for the integration of CANflight systems into already configured networks. On power up, CANflight obtains required Media Access Control (MAC) addresses from remote hosts using ARP request messages.

Note that delays introduced through switches/routers or through network traffic generated by other network nodes may adversely affect the CANflight communication speed. If response times are vital, point-to-point Ethernet connections between CANflight and host computers should be preferred.

CANflight comes with an Application Programmer Interface (API) for the CANflight Ethernet link supporting various operating systems (Linux, Solaris, MacOS, VxWorks, Windows). For a detailed description of the API refer to section 7 CANflight Application Programmer's Interface.

5 CANflight Configuration

The CANflight configuration is accomplished through a human readable ASCII configuration file that is stored on a µSD card which is inserted in the CANflight µSD card slot. The configuration file has to have the case-sensitive name "CANFLITE.CFG" to be recognized by the firmware. This file is read by the CANflight firmware from the µSD card slot each time power is applied. The content is used to configure the CAN baud rate, the local Ethernet interface and the board "name" used by XCT for additional reference and display of the board it is connected to.

The settings made through the configuration file are used on power-up but may be changed at any time using the corresponding Application Programmer Interface (API) system calls.

Additionally, the configuration file allows to specify default settings for the IP addresses, MAC addresses and port numbers for the communication with XCT (or the Ethernet API) on a per-CAN-channel-basis. The configuration file format uses the case-sensitive tags shown in Table 5.1. No spaces are allowed between the tag, the "=" and the following letters. All data in the configuration file that does not begin with a recognized tag will be ignored. This allows user comments in the file if caution is taken that no tag letters are used.

Note that all numbers for the tags "LMA=", "LIP=", "Urx=", "MAx=", "IPx=", "LPx=" and "RPx=" must use the corresponding fixed length format (i.e. "IP0=192.009.200.003", not "IP0=192.9.200.3")

Tag	Meaning	Format Example	Description
NME=	CANflight Name	NME=CANflight # 1	A string of up to 32 bytes consisting of a human readable ASCII text that gives the CANflight unit a name. This name can be read from the module via the GET_MODULE_INFO system call at any time. All characters exceeding 32 bytes will be ignored.
LMA=	Local MAC Address	LMA=00:01:02:03:04:05	MAC address of the CANflight unit, consisting of six two-digit hexadecimal numbers from 00 to FF, separated by colons. All Letters (A-F) have to be capital. Note that the first byte has to be "00", otherwise the Ethernet interface will not work!
LIP=	Local IP Address	LIP=192.009.200.003 LIP=DHCP	IP address of the CANFlight unit, consisting of four three-digit decimal numbers in the range of 000-255, separated by dots. Alternatively, CANflight may be directed to obtain its IP address from a DHCP server by specifying the IP address as the four letter acronym "DHCP" in capital letters.
CB0= CB1=	CAN Baud Rate	CB1=250	Baud rate of the specified CAN channel. The following settings are valid and specify the baud rate in kbit/s: CBx=83 CBx=125 CBx=250 CBx=500 CBx=1000

Tag	Meaning	Format Example	Description
LS0= LS1=	CAN Channel Ethernet Link Switch	LS0=1	Activates/deactivates the Ethernet link of the CAN specified channel. The following settings are valid and specify the state of the link (0 = inactive, 1 = active): LSx=0 LSx=1 Note that disabled Ethernet links will continue to transmit CAN status packets once per second and respond to IMCP packets.
UR0= UR1=	CAN Channel Ethernet Update Rate	UR1=0100	Sets the gap between subsequent emissions of UDP/IP packets containing received CAN messages for the specified CAN channel in milliseconds, as a 4-digit decimal number in the range of 0001-9999. Note that this setting does not affect the continuous transmission of CAN status packets (every 100ms and once per second as broadcast) and the ability of the CANflight to respond to IMCP packets.
RB0= RB1=	CAN Channel Readback Switch	RB0=0	Activates/deactivates the readback of CAN messages on the same channel as they are transmitted. The following settings are valid and specify the state of the readback (0 = inactive, 1 = active): RBx=0 RBx=1
MA0= MA1=	Remote MAC Address	MA1=00:14:4F:C3:B9:A2	MAC address of the remote host for communication with the specified CAN channel, consisting of six two-digit hexadecimal numbers from 00 to FF, separated by colons. All Letters (A-F) have to be capital.
IP0= IP1=	Remote IP Address	IP0=192.009.200.051	IP address of the remote host for communication with the specified CAN channel, consisting of four three-digit decimal numbers in the range of 000-255, separated by dots.
LP0= LP1=	Local UDP Port Number	LP0=34567	UDP port number of the CANflight unit used to receive Ethernet/UDP/IP packets from, as a 5-digit decimal number in the range of 03000-65535. Note that port numbers below 3000 will create problems in many networks.
RP0= RP1=	Remote UDP Port Number	RP0=34568	UDP port number of the CANflight unit used to send Ethernet/UDP/IP packets to, as a 5-digit decimal number in the range of 03000-65535. Note that port numbers below 03000 will create problems in many networks.

Tag	Meaning	Format Example	Description
BR0= BR1=	CAN Channel Bridge Switch	BR1=0	<p>Activates/deactivates the bridge function of the specified CAN channel. If both channels have the bridge function activated, all CAN messages are transferred between the channels in both directions. The following settings are valid and specify the state of the readback (0 = inactive, 1 = active):</p> <p>BRx=0 BRx=1</p> <p>Note that the bridge function is currently not implemented in the CANflight firmware.</p>
FDR=	Flight Data Recording Mode	FDR=RUN	<p>Activates the Flight Data Recording Mode. The following settings are valid:</p> <p>FDR=RUN FDR=CAN FDR=ETH</p> <p>If RUN is selected, the data recording starts immediately after power-on and stops on power-off. A new recording file is created each time when the seconds specified through the "RFT=" tag have elapsed.</p> <p>If CAN is selected, the recording process is controlled through the TOP_MARKER CANaerospace message, either on CAN channel 1 or 2.</p> <p>If ETH is selected, the recording process is controlled through the Ethernet interface. Note that this mode is currently not implemented in the CANflight firmware.</p>
DRC=	CAN Channel Recording Switch	DRC=3	<p>Specifies which CAN channels are recorded when the Flight Data Recording Mode is active:</p> <p>DRC=1 (Channel 1 only) DRC=2 (Channel 2 only) DRC=3 (Channel 1 + 2)</p>
RFT=		RFT=0060	<p>Specified the time after which a new data recording file is generated when the Data Recording is active in the RUN mode, in seconds, as a 4-digit decimal number in the range of 0001-9999.</p>

Table 5.1: CANflight Configuration File Tags

A sample CANflight configuration file is shown below:

```
# CANflight Configuration File
# (C) Stock Flight Systems 2011

# Board name (max. 32 bytes).
NME=CANflight # 1

# This CANflight's MAC and IP address.
LMA=00:01:02:03:04:05
LIP=192.009.200.033

# CAN interface baud rates (1000, 500, 250, 125 or 83).
CB0=1000
CB1=125
# MAC/IP addresses and local/remote port numbers for CAN channel 0.
MA0=00:14:4F:C3:3C:DE (SUN)
IP0=192.009.200.051
LP0=34567
RP0=34568
LS0=1
UR0=0010
RB0=0

# MAC/IP addresses and local/remote port numbers for CAN channel 1.
IP1=192.009.200.051
LP1=34569
RP1=34570
LS1=0
UR1=0100
RB1=1

# Flight Data Recording Settings.
#
FDR=RUN
DRC=1
RFT=0060

# End of CANflight Configuration File
```

For CAN channels which are not accessed via the Ethernet/UDP/IP interface, the corresponding entries in the configuration file for MAC/IP addresses and port numbers may be omitted. All CAN channels that have no baud rate tag in the configuration file will be initialized to be "bus-off" by default. Specifying "255" as the last digit of an "IPx=" tag sets up the corresponding interface for broadcast communication. In this case, multiple instances of XCT may connect to the same CAN channel of a CANflight unit (port numbers are still relevant in this case). The MAC address for broadcast channels is automatically set to FF:FF:FF:FF:FF:FF by the CANflight firmware.

If the "LIP=" tag is set to "DHCP", CANflight attempts to contact a DHCP server in the network and tries to

obtain a valid IP address from it. Once this process has been completed successfully, the CANflight unit will transmit a status message for CAN channel 0 once per second as a broadcast UDP packet. Reception of this packet allows host computers in the network to determine the IP address of a CANflight based on its module name.

If the MAC address of a remote host is not known, the corresponding “MAx” tag may be omitted. In this case, the CANflight will use ARP requests ten times per second to determine the remote hosts MAC address in order to establish communication with this host. Specifying the remote hosts MAC address in the configuration file avoids this process and speeds up the link initialization.

The continuous transmission of Ethernet/UDP/IP packets with received CAN messages can be enabled or disabled using the “LSx=” tag for each CAN channel individually. Likewise, the time between subsequent packets can be adjusted through the “URx=” tag. The minimum time gap between CAN receive packets is 1ms, the maximum time gap is 9999ms. Be aware that specifying large gap times may lead to data loss depending on the traffic on the corresponding CAN channel.

The “LSx=” and “URx=” tag settings do not affect the transmission of CAN status packets (every 100ms and once per second as broadcast) and the ability of the CANflight to respond to Internet Control Message Protocol (ICMP) echo requests (“ping”) as well as to Address Resolution Protocol (ARP) requests. For communication with XCT, the local and remote port numbers specified in the XCT setup have to match the CANflight configuration. The default values are shown in Table 5.2. These values have to be specified correctly to enable communication between CANflight and XCT.

Depicted CAN Channel	Logical CAN Channel	Local (CANflight) Port Number (“LPx=”-Tag)	Remote (Host) Port Number (“RPx=”-Tag)
CH1/CAN1	0	34567	34568
CH2/CAN2	1	34569	34570

Table 5.2: Local and Remote Port Numbers for Communication with XCT (Default Settings)

6 CANflight Firmware Upgrades

CANflight allows firmware upgrades to be made through the µSD card interface. The CANflight binary firmware upgrade files have to be stored on a µSD card which is inserted in the CANflight µSD card slot. The files must have the case-sensitive name “mb0.srd” and “mb1.srd” to be recognized by the CANflight firmware which checks for these files each time power is applied. When these files are detected, the content is automatically programmed into FLASH memory and the new firmware is started.

On success, the CANflight firmware deletes the upgrade files from the µSD card and writes a log file (“INSTALL.LOG”) to the card which provides information about the upgrade. The content of this log file will typically look as follows:

```
MB0 Software Update File 'mb0.srd' found:
  MB0 Software Update Programming Successful.
  MB0 Software Update Verification Successful.
  MB0 Software Update File Deleted.
MB1 Software Update File 'mb1.srd' found:
  MB1 Software Update Programming Successful.
  MB1 Software Update Verification Successful.
  MB1 Software Update File Deleted.
```

Firmware upgrades using the µSD card are possible for Microblaze0, Microblaze1 or both CANflight processors at the same time. The current CANflight firmware is available online from:

www.arinc825.com

7 CANflight Application Programmer's Interface

The CANflight Application Programmer's Interface is a Socket Interface Library consisting of a set of functions which provide the interface between applications written in "C" and the CANflight resources using 4.3 BSD datagram sockets. It is provided in source code and allows to be compiled and linked for various operating systems. The Interface Library has successfully been tested with SUN/Solaris, SuSE/RedHat Linux, MacOS, VxWorks and MS Windows. Compilation for other Unix derivatives including realtime operating systems like LynxOS, QNX or Integrity 178 should require only minor code changes, if any at all.

Example programs coming with the library show how applications make use of the library calls to attach to CANflight channels, read and write CAN messages, perform control functions and detach from a CANflight channel. All relevant interface structures and definitions are contained in just three include files (`pmc825.h`, `can_as.h`, `arinc825.h`) to minimize integration effort. The current version of the library may be downloaded anytime from www.arinc825.com. Compatibility of new versions to previous versions is ensured so that upgrading to a new library version does not require changes in already existing applications.

The functions provided by the CANflight Socket Interface Library are listed below. The calls are not multithread safe. Any application accessing the CANflight has to call `Pmc825StartInterface()` once before using any other Socket Interface Library call. Good practice is to call `Pmc825StopInterface()` once the CANflight resource is not needed by the application anymore. Failing to do so will prevent the CANflight from freeing resources by shutting down the open UDP/IP socket.

The PMC825 Socket Interface Library provides the following user-callable routines:

- *Pmc825StartInterface()* - Establish a communication path to a PMC825 CAN channel
- *Pmc825StopInterface()* - Release a communication path to a PMC825 CAN channel
- *Pmc825RawCanRead()* - Read unformatted CAN messages
- *Pmc825RawCanWrite()* - Write unformatted CAN messages
- *Pmc825CanAerospaceRead()* - Read CANaerospace formatted CAN messages
- *Pmc825CanAerospaceWrite()* - Write CANaerospace formatted CAN messages
- *Pmc825Arinc825Read()* - Read ARINC 825 formatted CAN messages
- *Pmc825Arinc825Write()* - Write ARINC 825 formatted CAN messages
- *Pmc825CtrlRead()* - Read a PMC825 control response packet
- *Pmc825CtrlWrite()* - Write a PMC825 control command packet

7.1 Pmc825StartInterface()

Synopsis:

```
#include "pmc825.h"
```

```
int Pmc825StartInterface(PMC825_IF *intf, unsigned int pm825_ip, unsigned int host_ip, int rx_port, int tx_port, int channel)
```

Description:

The `Pmc825StartInterface()` function establishes the connection between the specified channel of a CANflight unit and the host by the means of UDP/IP sockets. It initializes a `PMC825_IF` interface structure that refers to the CAN channel. The interface structure is used by other I/O functions to refer to that CAN channel.

Return Values:

Upon successful completion, `Pmc825StartInterface()` returns `PMC825_OK`. Otherwise, one of the following codes is returned:

`PMC825_MEM_ALLOC_ERR`: The memory required to establish communication could not be obtained.

`PMC825_SOCKET_ERR`: At least one of the communication sockets could not be successfully initialized.

7.2 Pmc825StopInterface()

Synopsis:

```
#include "pmc825.h"
```

```
void Pmc825StopInterface(PMC825_IF *intf)
```

Description:

The `Pmc825StopInterface()` function releases the connection between a CANflight unit and the host by closing the corresponding UDP/IP sockets and releasing the allocated memory.

7.3 Pmc825RawCanRead()

Synopsis:

```
#include "pmc825.h"
```

```
int Pmc825RawCanRead(PMC825_IF *intf, CAN_MSG *msg)
```

Description:

The `Pmc825RawCanRead()` function tries to return one unformatted CAN message from the buffer associated with the CAN channel of the CANflight unit specified through the `PMC825_IF` interface structure.

Return Values:

Upon successful completion, `Pmc825RawCanRead()` returns `PMC825_OK`. Otherwise, one of the following codes is returned:

`PMC825_NO_MSG`: No message could be read from the module.

7.4 Pmc825RawCanWrite()

Synopsis:

```
#include "pmc825.h"
```

*int Pmc825RawCanWrite(PMC825_IF *intf, CAN_MSG *msg, int msg_count)*

Description:

The *Pmc825RawCanWrite()* function tries to write one or more unformatted CAN messages to the buffer associated with the CAN channel of the CANflight unit specified through the PMC825_IF interface structure for transmission. The number of messages to be transmitted is specified by "msg_count".

Return Values:

Upon successful completion, *Pmc825RawCanWrite()* returns PMC825_OK. Otherwise, one of the following codes is returned:

PMC825_BUF_OVERFLOW: The number of messages specified by "msg_count" exceeded the maximum number of MAX_CAN_MSG_COUNT.

7.5 Pmc825CanAerospaceRead()

Synopsis:

```
#include "pmc825.h"
```

```
#include "can_as.h"
```

*int Pmc825CanAerospaceRead(PMC825_IF *intf, CAN_AS_MSG *msg)*

Description:

The *Pmc825CanAerospaceRead()* function tries to return one CANaerospace formatted CAN message from the buffer associated with the CAN channel of the CANflight unit specified through the PMC825_IF interface structure.

Return Values:

Upon successful completion, *Pmc825CanAerospaceRead()* returns PMC825_OK. Otherwise, one of the following codes is returned:

PMC825_NO_MSG: No message could be read from the module.

7.6 Pmc825CanAerospaceWrite()

Synopsis:

```
#include "pmc825.h"
```

```
#include "can_as.h"
```

*int Pmc825CanAerospaceWrite(PMC825_IF *intf, CAN_AS_MSG *msg, int msg_count)*

Description:

The *Pmc825CanAerospaceWrite()* function tries to write one or more CANaerospace formatted CAN messages to the buffer associated with the CAN channel of the CANflight unit specified through the PMC825_IF interface structure for transmission. The number of messages to be transmitted is specified by "msg_count".

Return Values:

Upon successful completion, *Pmc825CanAerospaceWrite()* returns PMC825_OK. Otherwise, one of the following codes is returned:

PMC825_BUF_OVERFLOW: The number of messages specified by "msg_count" exceeded the maximum number of MAX_CAN_MSG_COUNT.

7.7 Pmc825Arinc825Read()

Synopsis:

```
#include "pmc825.h"
```

```
#include "arinc825.h"
```

```
int Pmc825Arinc825Read(PMC825_IF *intf, ARINC825_MSG *msg)
```

Description:

The *Pmc825Arinc825Read()* function tries to return one ARINC 825 formatted CAN message from the buffer associated with the CAN channel of the CANflight unit specified through the PMC825_IF interface structure.

Return Values:

Upon successful completion, *Pmc825Arinc825Read()* returns PMC825_OK. Otherwise, one of the following codes is returned:

PMC825_NO_MSG: No message could be read from the module.

7.8 Pmc825Arinc825Write()

Synopsis:

```
#include "pmc825.h"
```

```
int Pmc825Arinc825Write(PMC825_IF *intf, ARINC825_MSG *msg, int msg_count)
```

Description:

The *Pmc825Arinc825Write()* function tries to write one or more ARINC 825 formatted CAN messages to the buffer associated with the CAN channel of the CANflight unit specified through the PMC825_IF interface structure for transmission. The number of messages to be transmitted is specified by "msg_count".

Return Values:

Upon successful completion, *Pmc825Arinc825Write()* returns PMC825_OK. Otherwise, one of the following codes is returned:

PMC825_BUF_OVERFLOW: The number of messages specified by "msg_count" exceeded the maximum number of MAX_CAN_MSG_COUNT.

7.9 Pmc825CtrlRead()

Synopsis:

```
#include "pmc825.h"
```

```
int Pmc825CtrlRead(PMC825_IF *intf, CTRL_MSG *ctrl_msg)
```

Description:

The *Pmc825CtrlRead()* function tries to return one PMC825 control message from the buffer associated with the CAN channel of the CANflight unit specified through the PMC825_IF interface structure.

Return Values:

Upon successful completion, *Pmc825CtrlRead()* returns PMC825_OK. Otherwise, one of the following codes is returned:

PMC825_NO_MSG: No message could be read from the module.

7.10 Pmc825CtrlWrite()

Synopsis:

```
#include "pmc825.h"
```

```
int Pmc825CtrlWrite(PMC825_IF *intf, CTRL_MSG *msg)
```

Description:

The *Pmc825CtrlWrite()* function tries to write a PMC825 control messages to the buffer associated with the CAN channel of the CANflight unit specified through the PMC825_IF interface structure for transmission.

Return Values:

Upon successful completion, *Pmc825Arinc825Write()* returns PMC825_OK. Otherwise, one of the following codes is returned:

PMC825_BUF_OVERFLOW: The number of messages specified by "msg_count" exceeded the maximum number of MAX_CAN_MSG_COUNT.

8 The XCT Toolbox

CANflight is delivered with the eXtended CAN Tool (XCT) software, a powerful CAN, ARINC825 and CANaerospace network toolbox for Linux, MacOS and Windows XP/7. Figure 8.1 shows the main window of XCT.

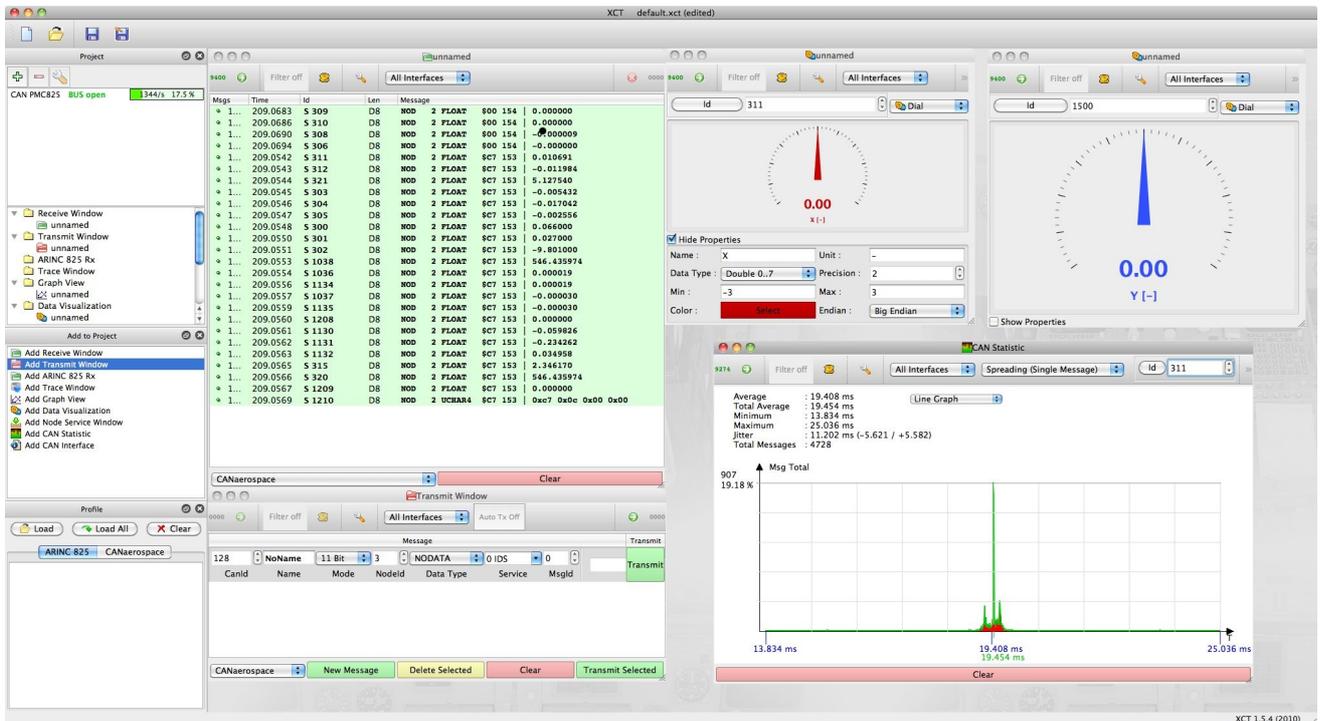


Figure 8.1: XCT Main Window

Among other features, XCT contains an ARINC825 Communication Profile reader and editor, realtime data visualization in raw, ARINC825 and CANaerospace formats, network traffic/error statistics and an interface for CANaerospace/ARINC825 Periodic Health Status Messages and Node Services. XCT may be used also for interfacing to end systems corresponding to the ARINC specifications 812 and 826 which are both based on ARINC825. XCT contains all necessary functions for CAN, CANaerospace and ARINC825 network compatibility verification, end system testing, CAN network timing analysis and ARINC825 communication profile generation and analysis. The User's Manual for XCT is contained in the toolbox itself. The current version for all supported operating systems may be downloaded from:

www.wetzel-technology.com/files/XCT

XCT has a window-oriented interface that communicates with CANflight using an Ethernet/UDP/IP connection. Multiple instances of XCT may connect to any CANflight channel and control transmission and reception of CAN messages. XCT configuration files containing application specific settings ("Project") can be generated and reloaded. XCT project configuration files allow to save and reload XCT configurations and exchange them with other XCT users.

9 CANflight Supplier List

Supplier	Contact	
Innovative Control Systems, Inc.	10801 N 24th Ave. Suite 103 Phoenix, AZ 85029 USA phone: +1-602-861-6984 fax: +1-602-588-9440 e-mail: support@icsaero.com website: www.icsaero.com	
Stock Flight Systems	Schützenweg 8a 82335 Berg/Farchach Germany phone: +49-8151-9607-0 fax: +49-8151-9607-30 e-mail: info@stockflightsystems.com website: www.stockflightsystems.com	
Wetzel Technology GmbH	Hermann-Oberth-Straße 11 85640 Putzbrunn Germany phone: +49-89-460892-62 fax: +49-89-460892-63 e-mail: info@wetzel-technology.com website: www.wetzel-technology.com	
Reiser Systemtechnik GmbH	Oberer Lüßbach 31 85335 Berg/Höhenrain Germany phone: +49-8171-4373-0 fax: +49-8171-4373-30 e-mail: info@wreiser.de web: www.reiser-systemtechnik.de	

10 ARINC825/CANAerospace Websites

www.arinc.com
www.arinc825.com
www.canaerospace.net