Crystal Technology, Inc.

Octal Channel AOTF Controller Integration Guide

Revision 1.1

2010/08/10

Document #60-00108-01

Crystal Technology, Inc.
A Group Company of TDK-EPC Corporation

Crystal Technology, Inc. reserves the right to make changes to its products or to discontinue any product or service without notice, and advises its customers to obtain the latest version of relevant information to verify, before placing orders, that the information being relied on is current and complete.

Crystal Technology, Inc. warrants the performance of its products and related software to the specifications applicable at the time of sale in accordance with Crystal Technology's standard warranty. Testing and other quality control techniques are utilized to the extent Crystal Technology, Inc. deems necessary to support this warranty. Specific testing of all parameters is not necessarily performed, except those mandated by government requirements.

Certain applications using semiconductor products may involve potential risks of death, personal injury, or severe property or environmental damage ("Critical Applications").

Crystal Technology, Inc. products are not designed, intended, authorized, or warranted to be suitable for use in life support applications, devices, systems, or other critical applications.

Inclusion of Crystal Technology, Inc. products in such applications is understood to be fully at the risk of the customer. Use of Crystal Technology, Inc. products in such applications requires the written approval of an appropriate Crystal Technology, Inc. officer. Questions concerning potential risk applications should be directed to Crystal Technology, Inc. at the address listed below.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards should be provided by the customer to minimize inherent or procedural hazards.

Crystal Technology, Inc. assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein. Nor does Crystal Technology, Inc. warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of Crystal Technology, Inc. covering or relating to any combination, machine, or process in which such products or services might be or are used.

This document has been prepared with the greatest care regarding its contents. However, in the event that it contains omissions, errors or any other misinformation, please feel free to direct comments to Crystal Technology, Inc. at the address listed below.

You are also welcome to call Crystal Technology, Inc. at (650) 856-7911, or you may FAX inquiries to (650) 354-0173.

Crystal Technology, Inc.
1040 East Meadow Circle
Palo Alto, CA 94303-4230

Revision History			
Revision	**Date**	**Who**	**Comments**
1.0	2009/01/05	Dale Gifford	Genesis. Derived from Octal Channel Technical Specifications.
1.1	2010/08/10	Dale Gifford	Updated logo, fixed typos. Release 2010-08.

Table of Contents

List of Tables

List of Figures

This Page Intentionally Left Blank

1. Introduction

1.1. Purpose

This document is a guide for how to integrate the *Octal Channel Acousto-Optic Tunable Filter (AOTF) Controller* into host environments. The *Octal Channel AOTF Controller* provides eight Direct Digital Synthesis (DDS) chips with the ability to adjust each DDS to a separate frequency from 20Mhz to 200Mhz. The *Octal Channel AOTF Controller* communicates with a desktop or notebook PC or PDA environment via an RS232 serial interface, a USB interface, or a Bluetooth interface.

1.2. Compatibility

The *AOTF Controller* is compatible with the following standards:

- Electronic Industries Association RS232 communication standard (EIA232). www.eia.org.
- Universal Serial Bus standard (USB). www.usb.org.
- Bluetooth Specification, Bluetooth Special Interest Group (SIG), www.bluetooth.org.

1.3. Related Documents

The following references may be useful in fully understanding and utilizing the *AOTF Controller*:

- Quad Channel AOTF Controller Integration Guide, Revision 1.1, 2010/08/10, www.CrystalTechnology.com, Crystal Technology, Inc. 1040 East Meadow Circle, Palo Alto, CA 94303-4230.
- Single Channel AOTF Controller Integration Guide, Revision 1.1, 2010/08/10, www.CrystalTechnology.com, Crystal Technology, Inc. 1040 East Meadow Circle, Palo Alto, CA 94303-4230.
- AOTF Controller Command Reference, Revision 1.3, www.CrystalTechnology.com, Crystal Technology, Inc. 1040 East Meadow Circle, Palo Alto, CA 94303-4230.
- AOTF Controllers and Temperature Compensation, Revision 1.2, www.CrystalTechnology.com, Crystal Technology, Inc. 1040 East Meadow Circle, Palo Alto, CA 94303-4230.
- AOTF Controllers and FSK Operation, Revision 1.3, www.CrystalTechnology.com, Crystal Technology, Inc. 1040 East Meadow Circle, Palo Alto, CA 94303-4230.
- AOTF Controllers and Light Intensity Tracking, Revision 1.2, www.CrystalTechnology.com, Crystal Technology, Inc. 1040 East Meadow Circle, Palo Alto, CA 94303-4230.

- AotfManager User's Guide, Revision 1.1, www.CrystalTechnology.com, Crystal Technology, Inc. 1040 East Meadow Circle, Palo Alto, CA 94303-4230.

- AotfCmd User's Guide, Revision 1.1, www.CrystalTechnology.com, Crystal Technology, Inc. 1040 East Meadow Circle, Palo Alto, CA 94303-4230.

1.4. Notation

- Numbers with an "h" suffix or "0x" prefix are hexadecimal. All other numbers are decimal.
- Register and bit names ending in "**[#]**" and "**[#:#]**" signify selection of a subset of the register (e.g. **I2CS[0]** represents bit 0 of the **I2CS** register, and **I2CS[5:3]** represents bit 5 through 3 of the **I2CS** register).
- Signal names ending with '#' (e.g. **INT0#**) indicates an active low signal.
- N/A is an abbreviation for Not Applicable.
- Register bits are either set (1) or cleared (0).

2. *AOTF Controller* Architecture Overview

The *AOTF Controller* is composed of these three separate PCB assemblies:

- The *AOTF Controller* PCB
- The *Daughter Board* PCB
- The *Temperature Sensor Board* PCB

To accommodate various applications, the *AOTF Controller PCB* contains the components of a system that are unlikely to change because of interface requirements, whereas the *Daughter Board PCB* contains the components of a system that are most likely to require custom interfaces. The *Temperature Sensor Board* is a separate PCB that travels with the AOTF Crystal. The *AOTF Controller PCB* contains the DDS chips and the microcontroller, while the various *Daughter Board PCBs* contain the Amplitude Modulation, FSK, and Blanking control. The *Temperature Sensor Board* contains a temperature sensing circuit and a serial EEPROM that identifies the AOTF Crystal.

These are the current *Daughter Board* designs:

- The *Analog Daughter Board* (ADB) contains analog inputs for controlling the Amplitude Modulation.
- The *Digital Daughter Board* (DDB) contains Digital to Analog Converter (DAC) chips for controlling the Amplitude Modulation.
- An OEM customer specific *Daughter Board*.

The architecture of the three board design is shown in *Figure 1, on page 4*, and a typical system that utilizes the *AOTF Controller* is shown in *Figure 2*, on *page 5*.

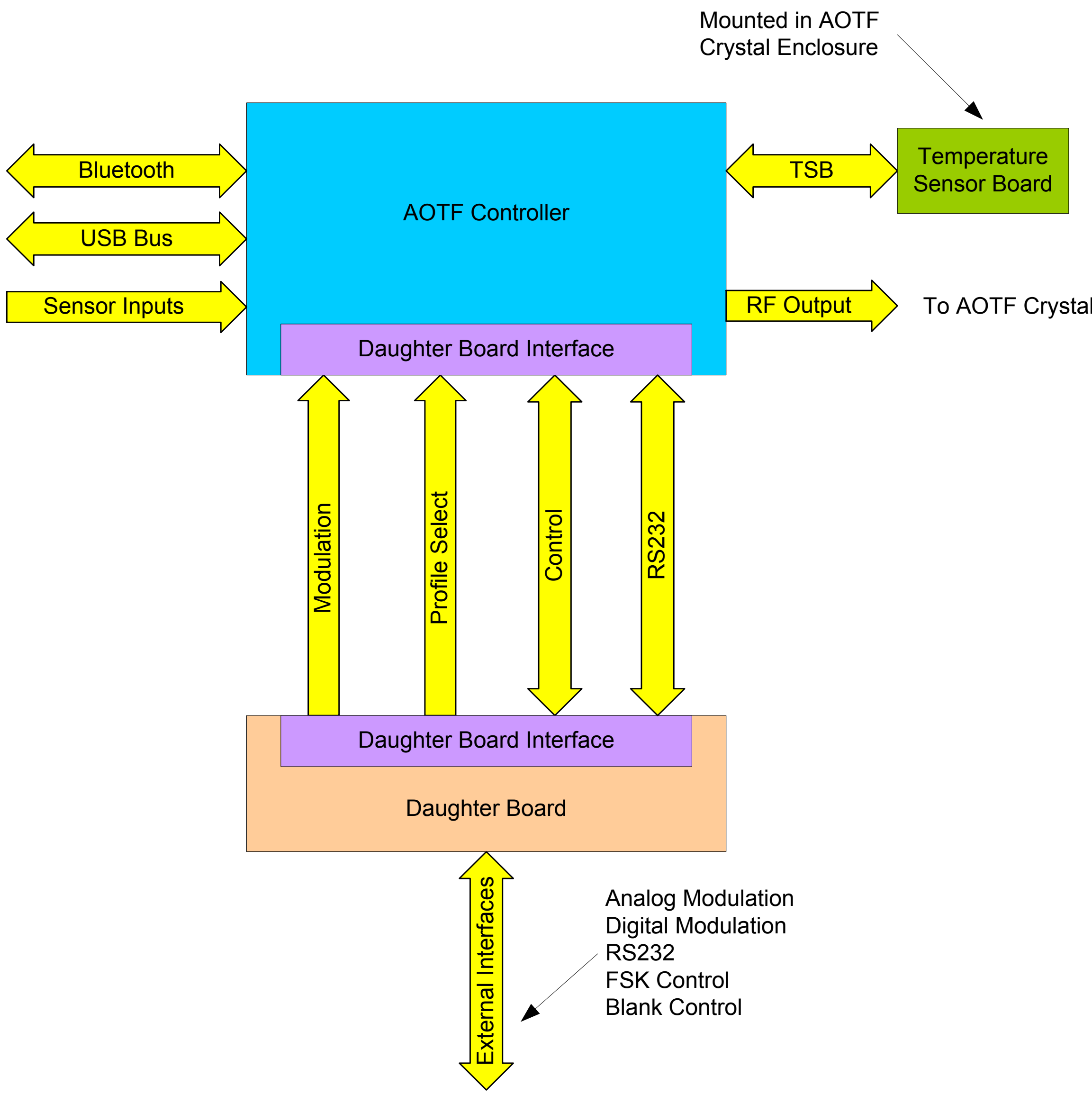

Figure 1: AOTF Controller, Daughter Board, and Temperature Sensor Board

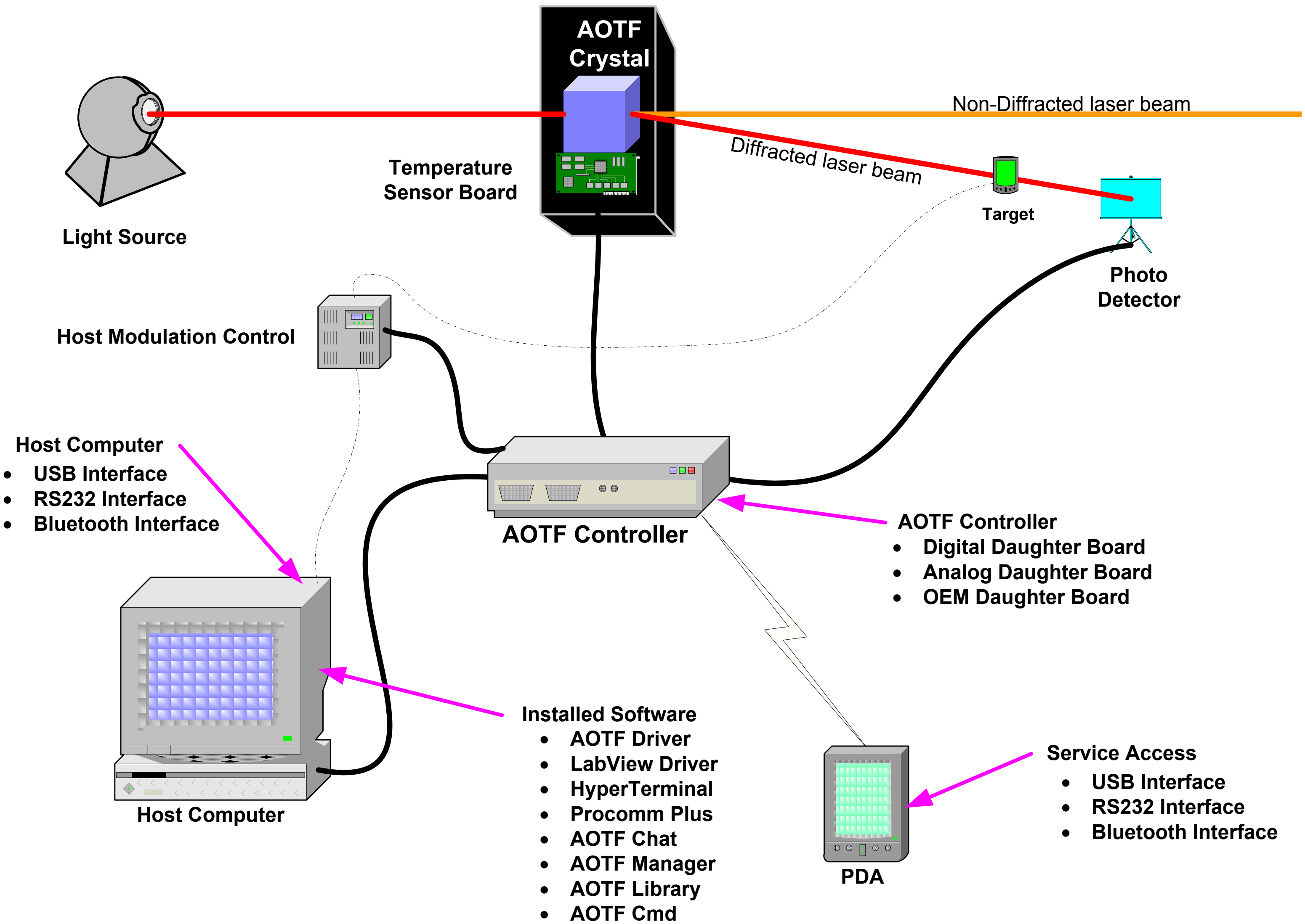

Figure 2: Typical System Utilizing the AOTF Controller

2.1. AOTF Controller Architecture

A simplified block diagram of the *AOTF Controller* is shown in *Figure 3 on page 7*. The *AOTF Controller* consists of the following major architectural blocks:

- **Daughter Board**
  The Daughter Board provides the interface for the host environment. The primary functions are host modulation input conversion, profile selection, and RS232.

- **Analog to Digital Converter (ADC)**
  The ADC provides the ability for the Microcontroller to read the temperature of the AOTF Crystal and the power from the Optical Power Sensor. The Microcontroller uses the information to implement temperature compensation and light intensity algorithms.

- **Microcontroller**
  The microcontroller executes the firmware that implements the AOTF functions such as RS232 communication, USB communication, and DDS control.

- **Direct Digital Synthesis (DDS)**
  The DDS chips synthesize the RF frequency and create the RF signal that will be modulated and amplified for driving the AOTF Crystal.

- **Modulator**
  The Modulator combines the modulation input from the host environment with the output from the DDS to produce the RF signal that will drive the AOTF Crystal.

- **Combiner**
  The Combiner merges the RF signals from all of the channels into a single RF Output and provides the final amplification.

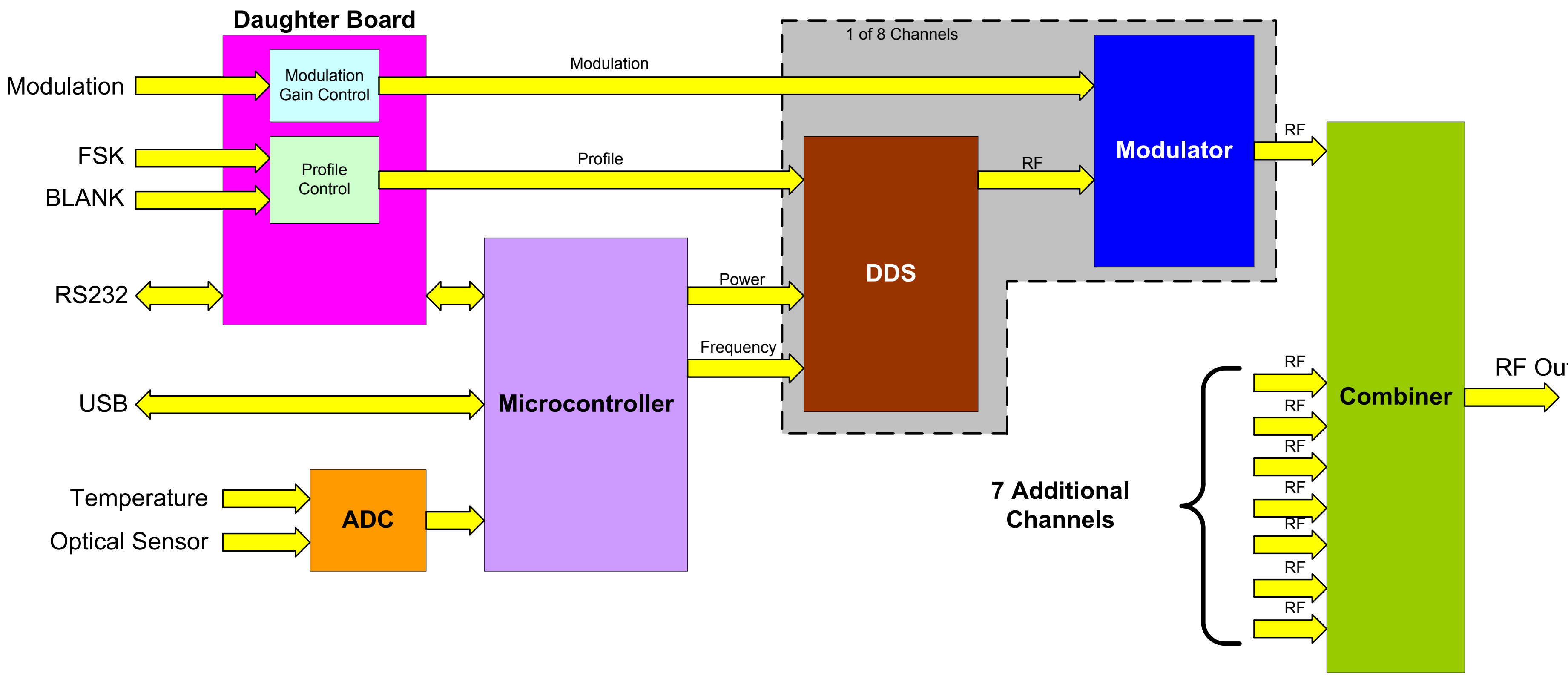

Figure 3: AOTF Controller Block Diagram

2.2. Typical Daughter Board Architecture

A simplified block diagram of a typical *Daughter Board* is shown in *Figure 4 on page 9*. A typical *Daughter Board* consists of the following major architectural blocks:

- **Amplitude Modulation**
  All *Daughter Boards* provide amplitude modulation to the *AOTF Controller*. The various *Daughter Boards* provide host interfaces for either analog or digital modulation inputs. The *Analog Daughter Board* provides gain control to accommodate different host environment drive capabilities. The *Digital Daughter Cards* support various host interfaces, such as CMOS and LVDS, and provide the Digital to Analog Conversion (DAC) capability.

- **Profile Selection**
  All *Daughter Boards* provide profile selection via the FSK and BLANK inputs. The profile selection capability provides the host environment with a way to rapidly change frequencies.

- **RS232 Interface**
  All *Daughter Boards* provide an RS232 interface to the *AOTF Controller*. Some of the *Daughter Boards* integrate the RS232 interface into the Host Modulation Connector, while others have a standard DB9 connector.

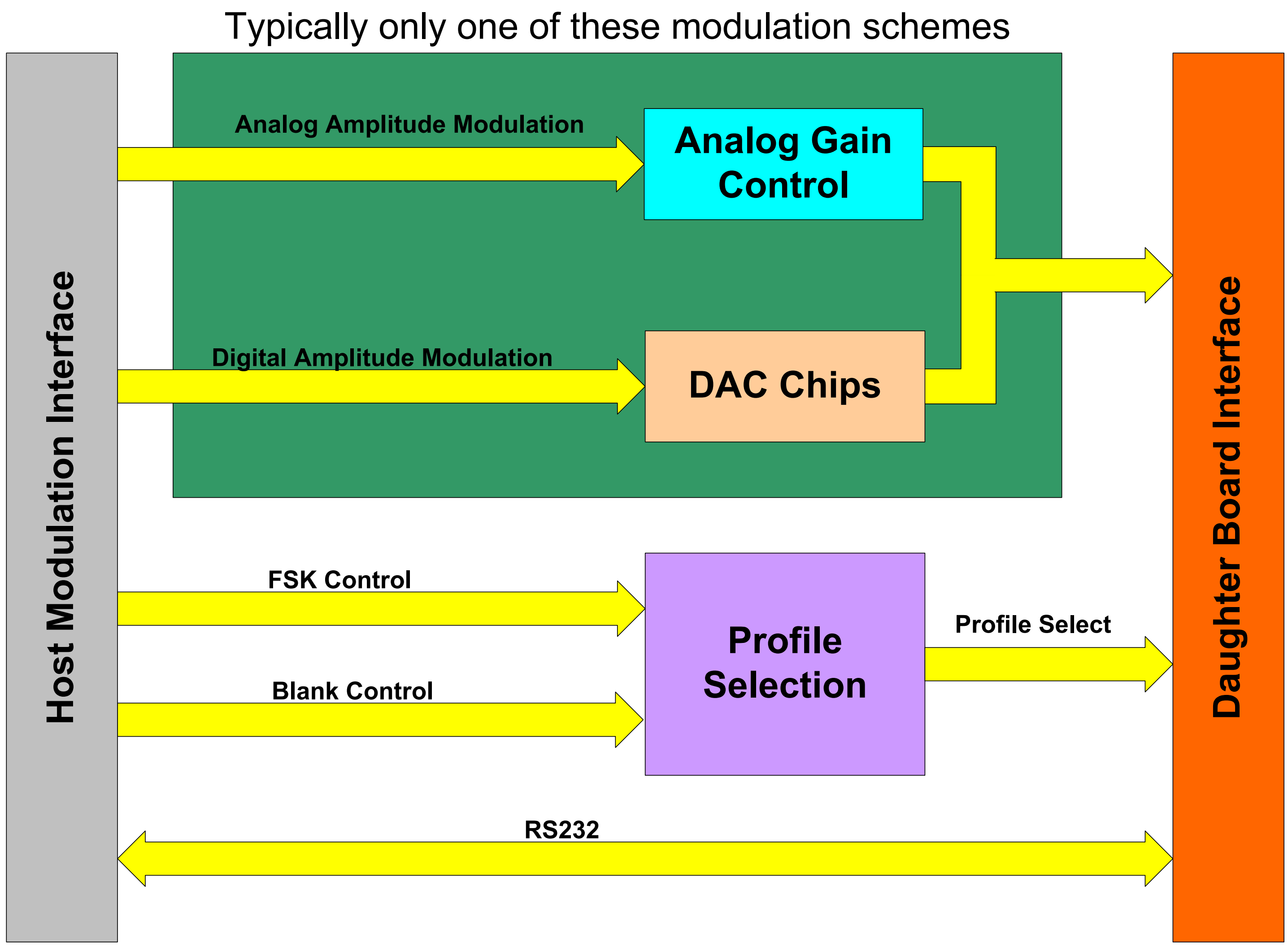

Figure 4: Typical Daughter Board

2.3. Temperature Sensor Board

The *Temperature Sensor Board* (TSB) provides two functions:

- Temperature sensing capability at the AOTF Crystal.
- AOTF Crystal Identification and calibration.

The TSB is mounted in the enclosure that contains the AOTF Crystal. The temperature sensing element is mounted such that it is in contact with the AOTF Crystal, to provide an accurate temperature reading of the AOTF Crystal. *Figure 5 on page 10* shows a block diagram of the *Temperature Sensor Board*.

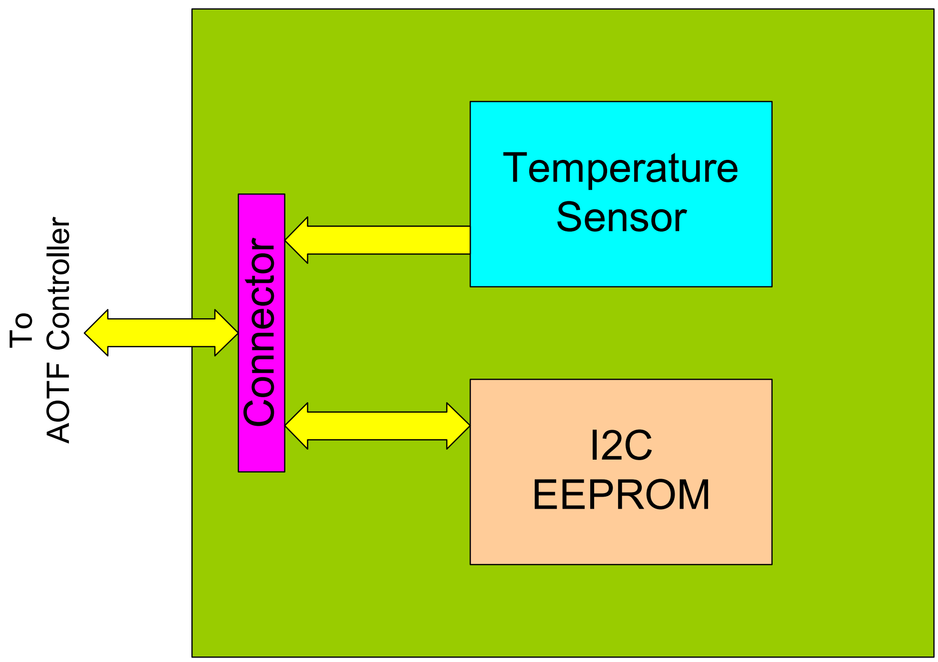

Figure 5: Temperature Sensor Board (TSB)

The TSB is connected to the *AOTF Controller* via the Temperature Sensor Connector on the front panel of the *AOTF Controller*. See *Section 3.5*, on *page 27* for a description of the Temperature Sensor Board Connector.

3. Connectors

The front panel of the *AOTF Controller* is shown in *Figure 6 on page 12*. The front panel elements are:

- **+24VDC Power Input**
  This is the power supply input. Connect a +24VDC @ 2 Amps. See *Section 3.1,Power Supply Connector, on page 13* for more details.

- **Host Modulation**
  This is the connector where the host provides the amplitude modulation, either analog or digital, depending on the type of daughter board. See *Section 3.2, Host Modulation Connector, on page 14* for more details.

- **Power Supply Status LEDs**
  The Power Supply Status LEDS provide status for the various internal power supply regulators. All of the LEDs should be ON and Green when the *AOTF Controller* is operating. If any of the LEDs are OFF then the internal power supply regulator has failed.

- **Optical Power Sensor Input**
  This is the Optical Power Sensor Input. Connect an Optical Power Meter to this input for use with firmware algorithms such as peak diffracted light efficiency optimizations and light intensity tracking. The input impedance is 100K Ohms and the maximum input voltage is 3.3V. See *Section 3.3, Optical Power Sensor Connector, on page 25* for more details.

- **Host USB Interface**
  This is the USB connection for host communication. Software applications on the host can use the USB for communication. See *Section 3.4, USB Connector, on page 26* for more details.

- **Temperature Sensor Input**
  This is the connection to the Temperature Sensor Board (TSB). The TSB is located in the housing with the AOTF Crystal and contains the temperature sensor and the calibration EEPROM. The EEPROM contains important calibration information related to the AOTF Crystal. See *Section 3.5, Temperature Sensor Board Connector, on page 27* for more details.

- **Bluetooth**
  The optional Bluetooth antenna is directly behind this portal.

- **Power ON LED**
  The Power ON LED should be ON and Green when the *AOTF Controller* is operating. If the LED is OFF then the +24VDC input is not present or has failed.

- **RF Output**
  The RF Output provides the signal to the AOTF Crystal. See *Section 3.6, RF Output Connector, on page 28* for more details.

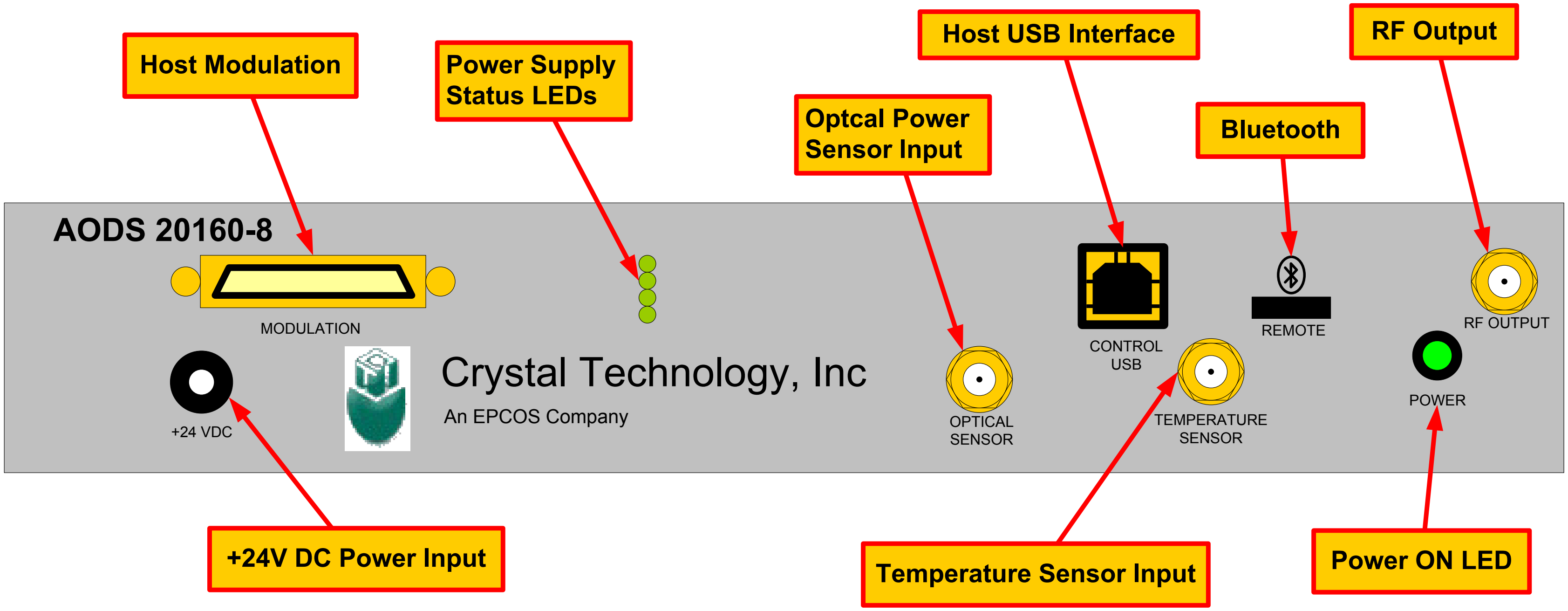

Figure 6: Front Panel

3.1. Power Supply Connector

The Power Supply Connector is a circular right angle PCB mounted connector.

Power Supply Connector		
Pin	**Direction**	**Description**
1 (center)	-	+24VDC @ 2 Amps
2 (shield)	-	GND

Table 1: Power Supply Connector

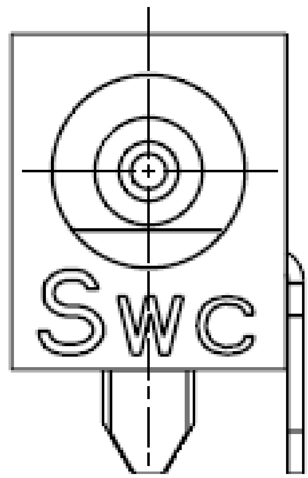

Figure 7: Power Supply Connector

3.2. Host Modulation Connector

There are two daughter boards available, each with a different interface for the Host Modulation:

- Analog Modulation
- Digital Modulation

The connector signals for both types are described in the following sections.

3.2.1. Analog Daughter Board

The Host Modulation connector, as viewed looking at the front of the *AOTF Controller* is shown in *Figure 8*.

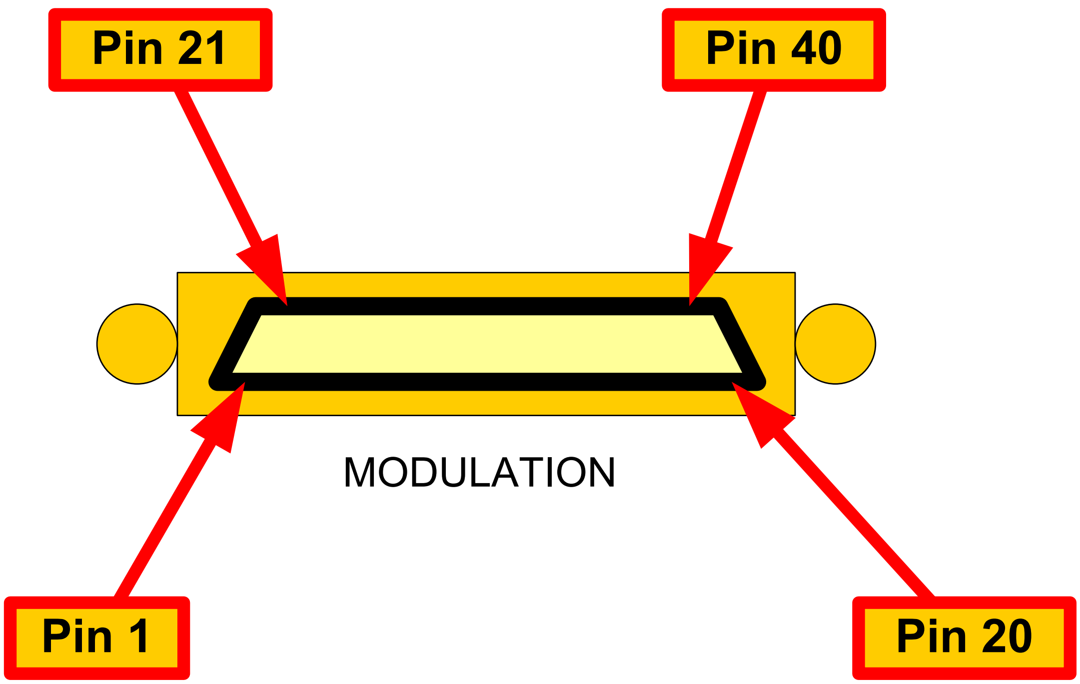

Figure 8: Analog Modulation Connector

The pin assignments for the Host Modulation connector are outlined in *Table 2*.

Host Modulation Analog Daughter Board			
Pin	**Direction**	**Name**	**Description**
1	IN/OUT	VCC24	VCC24 is connected directly to the +24VDC power supply. These VCC24 pins can be used to supply power to the AOTF Controller instead of supplying power through the +24VDC connector. Alternatively, these VCC24 pins can supply a small amount of power to drive interface circuits, such as the Application Specific Adaptors.
2	IN/OUT	VCC24	
3	-	GND	Ground Reference.
4	-	GND	
5	-	GND	
6	-	GND	
7	-	GND	
8	-	GND	
9	-	GND	
10	-	GND	
11	-	GND	
12	-	GND	
13	IN	MOD0-	The MOD[#]+/- signals provide each channel with a differential analog modulation input for the host environment. The analog voltage can swing from 0V to +10V. The input impedance is 4.3K Ohm.
14	IN	MOD1-	
15	IN	MOD2-	
16	IN	MOD3-	
17	IN	MOD4-	
18	IN	MOD5-	
19	IN	MOD6-	
20	IN	MOD7-	
21	IN/OUT	VCC24	VCC24 is connected directly to the +24VDC power supply. These VCC24 pins can be used to supply power to the AOTF Controller instead of supplying power through the +24VDC connector. Alternatively, these VCC24 pins can supply a small amount of power to drive interface circuits, such as the Application Specific Adaptors.
22	-	GND	Ground Reference.
23	IN	FSK0	The FSK[#] signals provide each channel with a CMOS 3.3V

Host Modulation Analog Daughter Board			
Pin	**Direction**	**Name**	**Description**
24	IN	FSK1	input for the host environment. The FSK signal is used to select the profile.
25	IN	FSK2	
26	IN	FSK3	
27	IN	FSK4	
28	IN	FSK5	
29	IN	FSK6	
30	IN	FSK7	
31	IN	BLANK	The BLANK signal provides a common CMOS 3.3V input for the host environment. The BLANK signal is used to select the profile.
32	-	GND	Ground Reference.
33	IN	MOD0+	The MOD[#]+/- signals provide a differential analog modulation input for the host environment. The analog voltage can swing from 0V to +10V. The input impedance is 4.3K Ohm.
34	IN	MOD1+	
35	IN	MOD2+	
36	IN	MOD3+	
37	IN	MOD4+	
38	IN	MOD5+	
39	IN	MOD6+	
40	IN	MOD7+	

Table 2: Host Modulation Pin Assignment

3.2.2. Analog Amplitude Modulation

The MOD[#]+/- signals form differential pairs that are used for analog control of the RF amplitude for each channel.

When MOD[#]+ and MOD[#]- have a relative difference of zero volts, the RF output is at zero. When MOD[#]+ is at +10V greater than MOD[#]- the RF output is at maximum. The maximum voltage for the differential pair is 10V. The minimum voltage for the differential pair is -5V.

The *AOTF Controller* has gain control for the analog inputs to accommodate various host environments. Using the gain control, the host environment could supply analog voltage in any of the following forms:

- **0V to 1V**
  This provides a 1V range. The host environment would connect the MOD[#]- signal to GND and drive the MOD[#]+ signal with the 1V analog voltage, where 0V would be minimum RF output and 1V would be the maximum RF output.
- **0V to 3.3V**
  This provides a 3.3V range. The host environment would connect the MOD[#]- signal to GND and drive the MOD[#]+ signal with the 3.3V analog voltage, where 0V would be minimum RF output and 3.3V would be the maximum RF output.
- **0V to 5V**
  This provides a 5V range. The host environment would connect the MOD[#]- signal to GND and drive the MOD[#]+ signal with the 5V analog voltage, where 0V would be minimum RF output and 5V would be the maximum RF output.
- **-5V to +5V**
  This provides a 10V range. The host environment would drive the MOD[#]- and MOD[#]+ signals with equal magnitude in opposite directions. When both signals are at 0V would be minimum RF output and when MOD[#]- is at -5V and MOD[#]+ is at 5V would be the maximum RF output.
- **0V to 10V**
  This provides a 10V range. The host environment would connect the MOD[#]- signal to GND and drive the MOD[#]+ signal with the 10V analog voltage, where 0V would be minimum RF output and 10V would be the maximum RF output.

Figure 9 shows the analog RF amplitude modulation controls.

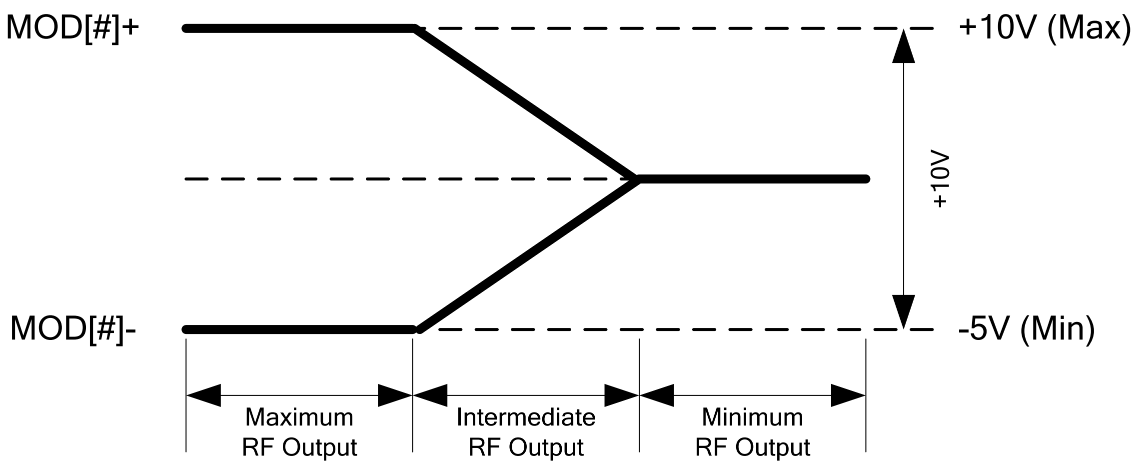

Figure 9: Analog Amplitude Modulation Waveforms

3.2.3. Digital Daughter Board

The Host Modulation connector, as viewed looking at the front of the *AOTF Controller* is shown in *Figure 8*.

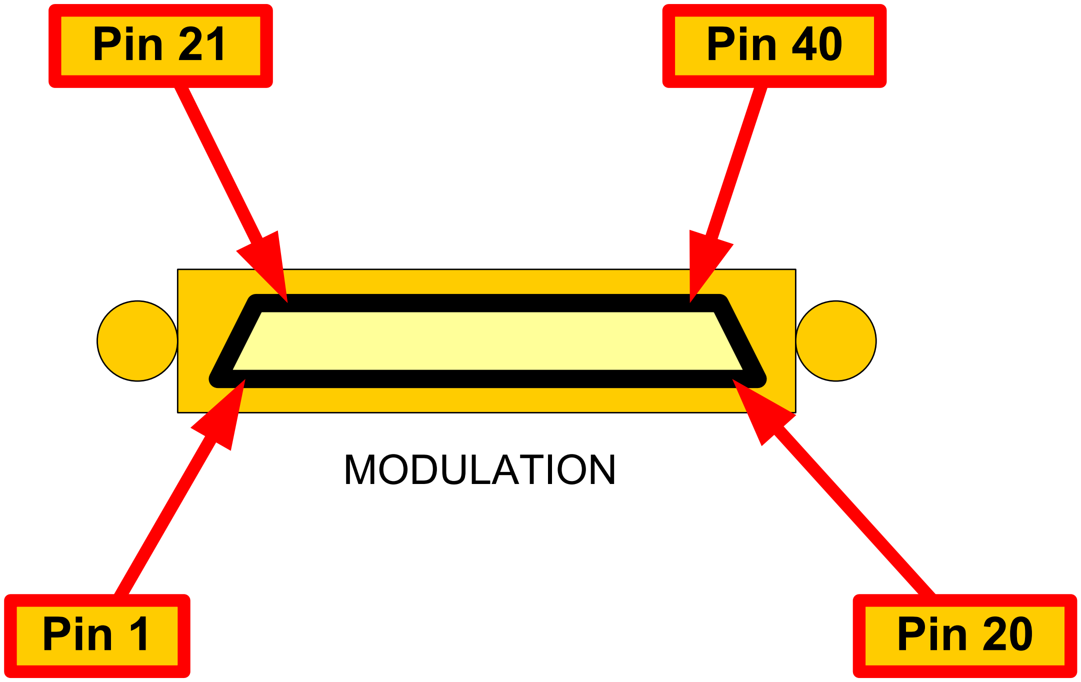

Figure 10: Digital Modulation Connector

The pin assignments for the Host Modulation connector are outlined in *Table 2*.

Host Modulation Digital Daughter Board			
Pin	**Direction**	**Name**	**Description**
1	IN/OUT	VCC24	VCC24 is connected directly to the +24VDC power supply. These VCC24 pins can be used to supply power to the AOTF Controller instead of supplying power through the +24VDC connector. Alternatively, these VCC24 pins can supply a small amount of power to drive interface circuits, such as the Application Specific Adaptors.
2	IN/OUT	VCC24	
3	-	GND	Ground Reference.
4	IN/OUT	ONEWIRE	The ONEWIRE signal provides access to the One Wire EEPROM located on the daughter board.
5	OUT	TXD	Serial Transmit Data. The serial signals are CMOS 3.3V level signals for interfacing to a UART.
6	OUT	RTS	Serial Request To Send. The serial signals are CMOS 3.3V level signals for interfacing to a UART.

Host Modulation Digital Daughter Board			
Pin	**Direction**	**Name**	**Description**
7	-	GND	Ground Reference.
8	IN/OUT	SDA	I2C Data provides the host with access to the I2C bus on the AOTF Controller. The I2C signals are CMOS 3.3V level signals.
9	IN	RESET#	Provides the host with a mechanism for resetting the interface logic. Active low, CMOS 3.3V.
10	IN	BLANK-	The BLANK+/- are an LVDS pair that provide the host with the ability to blank the RF output. The common BLANK signal is used to select the profile.
11	-	GND	Ground Reference.
12	IN	DIN7-	The DIN[#]+/- are LVDS pairs that provide the data for the digital modulation.
13	IN	DIN6-	
14	IN	DIN5-	
15	IN	DIN4-	
16	IN	DIN3-	
17	IN	DIN2-	
18	IN	DIN1-	
19	IN	DIN0-	
20	IN	CLK-	The CLK+/- are an LVDS pair that provide the clock for the digital modulation.
21	IN/OUT	VCC24	VCC24 is connected directly to the +24VDC power supply. These VCC24 pins can be used to supply power to the AOTF Controller instead of supplying power through the +24VDC connector. Alternatively, these VCC24 pins can supply a small amount of power to drive interface circuits, such as the Application Specific Adaptors.
22	-	GND	Ground Reference.
23	-	GND	Ground Reference.
24	-	GND	Ground Reference.
25	IN	RXD	Serial Receive Data. The serial signals are CMOS 3.3V level signals for interfacing to a UART.
26	IN	CTS	Serial Clear To Send. The serial signals are CMOS 3.3V level signals for interfacing to a UART.
27	-	GND	Ground Reference.

Host Modulation Digital Daughter Board			
Pin	**Direction**	**Name**	**Description**
28	IN/OUT	SCL	I2C Clock provides the host with access to the I2C bus on the AOTF Controller. The I2C signals are CMOS 3.3V level signals.
29	-	GND	Ground Reference.
30	IN	BLANK+	The BLANK+/- are an LVDS pair that provide the host with the ability to blank the RF output. The common BLANK signal is used to select the profile.
31	-	GND	Ground Reference.
32	IN	DIN7+	The DIN[#]+/- are LVDS pairs that provide the data for the digital modulation.
33	IN	DIN6+	
34	IN	DIN5+	
35	IN	DIN4+	
36	IN	DIN3+	
37	IN	DIN2+	
38	IN	DIN1+	
39	IN	DIN0+	
40	IN	CLK+	The CLK+/- are an LVDS pais that provide the clock for the digital modulation.

Table 3: Host Modulation Pin Assignment

The format of the Digital Modulation data is shown in *Figure 11*. The Digital Modulation format uses a serial data stream (DIN[#]) for each channel, along with a clock (CLK) that is common to all of the channels.

The host transfers Digital Modulation data to the *AOTF Controller* by using a sequence of 17 clocks as shown in *Figure 11*. Each rising edge of the CLK signal is used as a chip select for the DAC chips, and each negative edge of the CLK signal provides a data bit. Each of the negative edges transfers a bit of data as shown in *Table 4*.

Digital Modulation		
CLK #	**Positive Edge**	**Negative Edge**
0	1 Indicates no transfer.	Ignored
1	0 Indicates a transfer is starting.	BLANK Profile Select 1
2	0 Indicates a transfer in progress.	FSK Profile Select 0
2	0 Indicates a transfer in progress.	DAC Data bit 14, MSB
3	0 Indicates a transfer in progress.	DAC Data bit 13
4	0 Indicates a transfer in progress.	DAC Data bit 12
5	0 Indicates a transfer in progress.	DAC Data bit 11
6	0 Indicates a transfer in progress.	DAC Data bit 10
7	0 Indicates a transfer in progress.	DAC Data bit 9
8	0 Indicates a transfer in progress.	DAC Data bit 8
9	0 Indicates a transfer in progress.	DAC Data bit 7
10	0 Indicates a transfer in progress.	DAC Data bit 6
11	0 Indicates a transfer in progress.	DAC Data bit 5
12	0 Indicates a transfer in progress.	DAC Data bit 4

Digital Modulation		
CLK #	**Positive Edge**	**Negative Edge**
13	0 Indicates a transfer in progress.	DAC Data bit 3
14	0 Indicates a transfer in progress.	DAC Data bit 2
15	0 Indicates a transfer in progress.	DAC Data bit 1
16	0 Indicates a transfer in progress.	DAC Data bit 0
17	0 Indicates the end of a transfer.	Ignored

Table 4: Digital Modulation

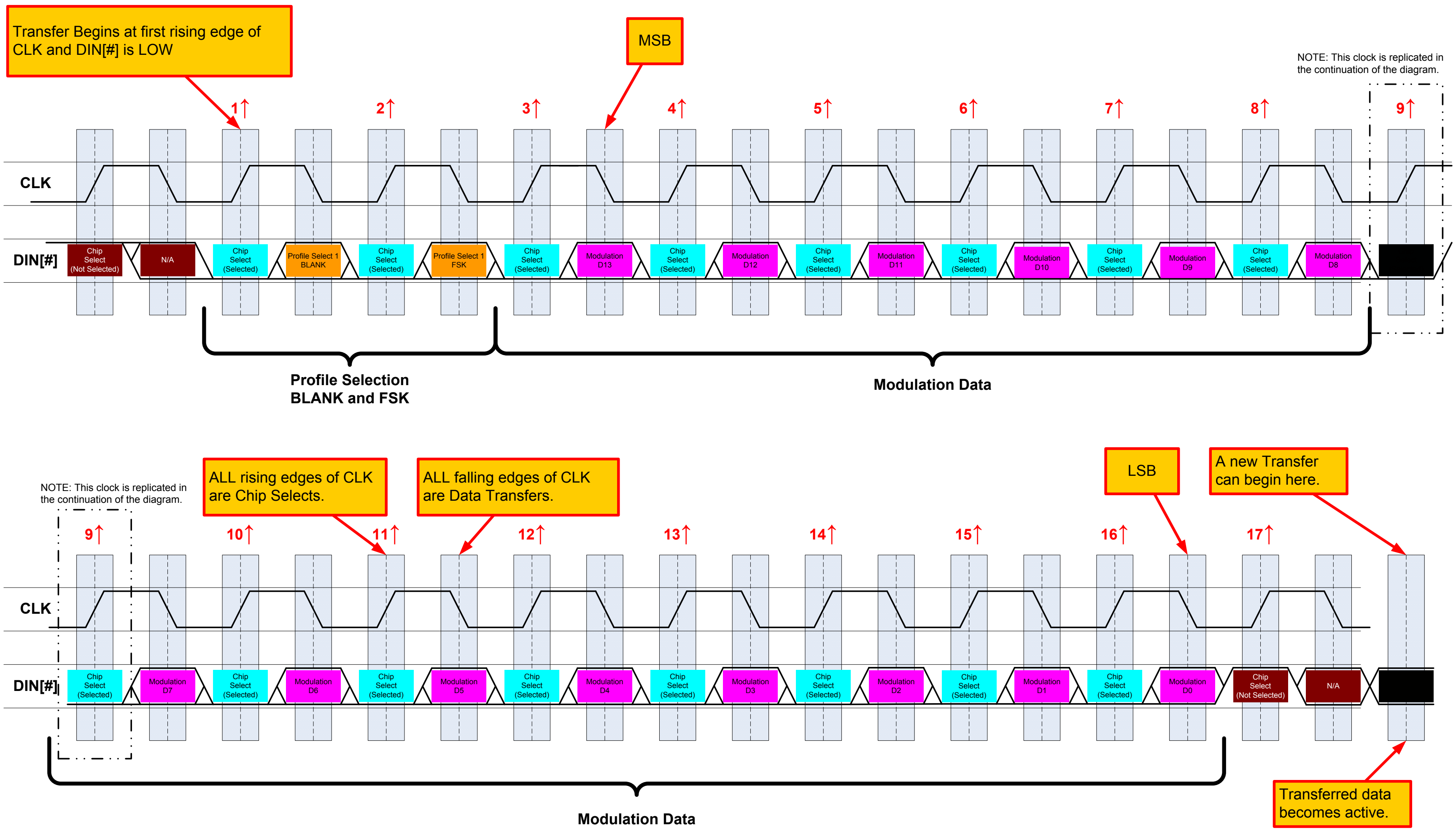

Figure 11: Digital Modulation Format

3.3. Optical Power Sensor Connector

The Light Power Sensor Connector is a right angle PCB Mount SMA Coax connector.

Optical Power Sensor Connector		
Pin	**Direction**	**Description**
1 (center)	Input	Optical Power Sensor Input. Input impedance is 100K Ohms. Voltage should be proportional to light intensity. Maximum Input voltage 3.3V.
2 (shield)	-	GND

Table 5: Optical Power Sensor Connector

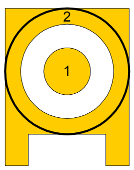

Figure 12: Optical Power Sensor Connector

The AtoD input circuitry has variable gain to accommodate differences in Optical Power Meter output levels. The gain is controlled by digitally controlled potentiometers that can be adjusted by the firmware of the AOTF Controller (the “adc gain” command).

The gain is adjustable according to the following formula:

$$A = (R1 + 100K - Rx) / (R2 + Rx)$$

Where:

A = Gain
R1 = 1K
R2 = 1K
Rx = Potentiometer resistance, which is between 0 and 100K in 256 increments. Each increment represents approximately 408 Ohms.

This gives an approximate gain range between 0.01 and 101. For unity gain Rx should be configured for 50K Ohms (use the command “adc gain 127”).

3.4. USB Connector

The USB Connector is a standard USB-B connector that the USB Specifications calls out for peripheral devices.

USB Connector		
Pin	**Direction**	**Description**
1	-	USB Power
2	Bidirectional	USBDM Differential Data Minus
3	Bidirectional	USBDP Differential Data Plus
4	-	GND

Table 6: USB Connector

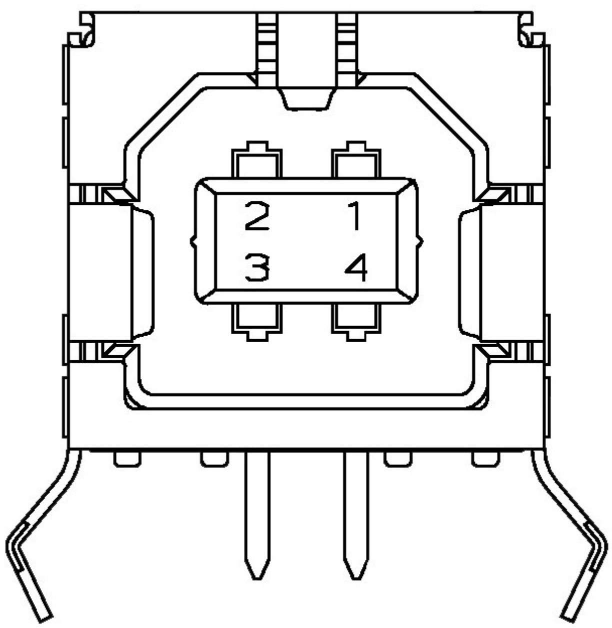

Figure 13: USB Connector

3.5. *Temperature Sensor Board Connector*

The Temperature Sensor Board Connector is a panel mount circular DIN style.

Temperature Sensor Board Connector		
Pin	**Direction**	**Description**
Shield	-	GND
1	Input	Temperature output from LM60
2	Bidir	I2C Data
3	Bidir	I2C Clock
4	-	VCC3.3

Table 7: Temperature Sensor Connector

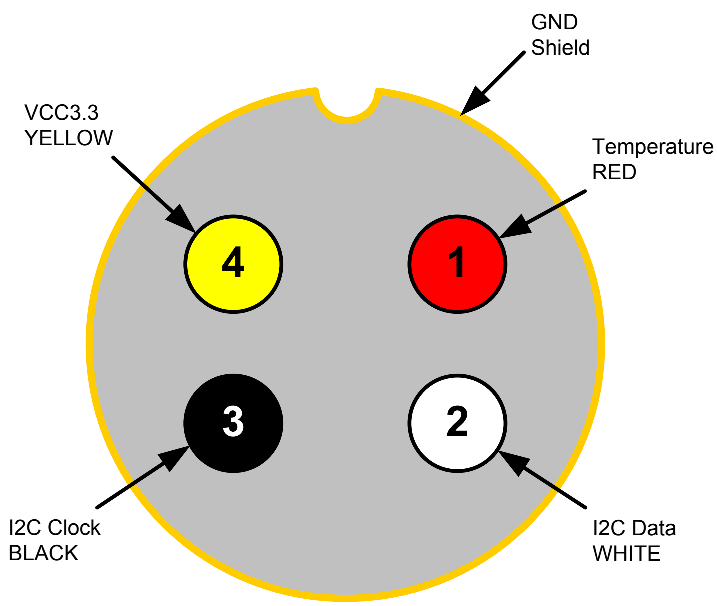

Figure 14: Temperature Sensor Connector

3.6. RF Output Connector

The RF Output Connector is a right angle PCB Mount SMA Coax connector.

RF Output Connector		
Pin	**Direction**	**Description**
1 (center)	Output	RF Output. 50 Ohms impedance.
2 (shield)	-	GND

Table 8: RF Output Connector

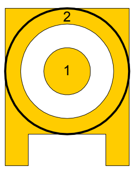

Figure 15: RF Output Connector