SightLine APPLICATIONS

ICD-1500-OEM

PN: ICD-1500-OEM

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Alerts

The following notifications are used throughout the document to help identify important safety and setup information to the user:

⚠ **CAUTION:** Alerts to a potential hazard that may result in personal injury, or an unsafe practice that causes damage to the equipment if not avoided.

ⓘ **IMPORTANT:** Identifies specific information that will assist with setup and configuration procedures and/or prevents damage to the hardware components.

Contents

List of Figures

List of Tables

Revision History

Date	Description
12/20/17	Updated Thermal Management section.
12/5/17	Updated document to new format and edited for clarity. Created new ICD document for 1500-OEM adapter boards. See ICD-1500-Adapters.
10/5/17	Split document into ICD-1500-OEM and ICD-1500-ADAPTERS. Minor diagrams, text, and tables syntax edits.
8/24/17	Cross reference power definitions, added clarification to Serial Port # and Pin names as well a cross references for easy lookup.
7/18/17	Updated power input requirements.
4/12/17	Fixed J4 pinout. Added more details regarding the serial port.
8/15/16	Schematics moved to separate files, added REV E information.
10/19/15	Added 1500-mAB section
9/17/15	Updated 1500-AB connectors, added 1500-Sony table captions, added illustrations for 1500-Sony J3 Pin 1
9/15/15	Updated hardware overview, added IO block diagram, added accessories summary section, updated connector details for 1500-Sony, corrected copyright.
5/11/15	Formatting, minor text and table edits, fix 1500-AB J3 table, Copyright dates, added Revision History, Figures and Table indexes.

1 Overview

Describes power requirements, thermal management, interface specifications, and connector pin-outs for the 1500-OEM video processing board.

1.1 Associated Documents

EAN-Startup Guide 1500-OEM: Describes steps for connecting, configuring, and testing the 1500-OEM video processing board on the 1500-AB accessory board.

EAN-Basic File Recording: Describes how to record video or snap shots to either the onboard MicroSD card or to an external FTP drive.

Interface Command and Control (IDD): Describes the native communications protocol used by the SightLine Applications product line. The IDD is also available as a local download on the Software Download page.

ICD-1500 Adapter Boards: Describes power requirements, thermal management, interface specifications, and connector pin-outs for the 1500-OEM associated camera interface boards.

EAN-Panel Plus User Guide: Provides descriptions of all the settings in the Panel Plus application. (Located in the Panel Plus application in the *Help* menu.)

1.2 Sightline Software Requirements

ⓘ **IMPORTANT:** The Panel Plus software version should match the firmware version running on the board.

2 Safe Device Handling

△ **CAUTION:** To prevent damage to hardware boards, use the following Electro Static Discharge (ESD) guidelines:

- Use a conductive wrist strap attached to a good earth ground.
- Before picking up an ESD sensitive electronic component, discharge built up static by touching a grounded bare metal surface or approved antistatic mat.

3 1500-OEM Overview

The 1500-OEM from SightLine Applications is a very small, low power, single-channel on-board video processor for unmanned airborne or ground vehicles in ISR applications.

The system is capable of processing and streaming HD video outputs up to 720P. This product is designed to add advanced capabilities to camera systems. It operates on video right at the source, which is key for low latency performance and best video quality.

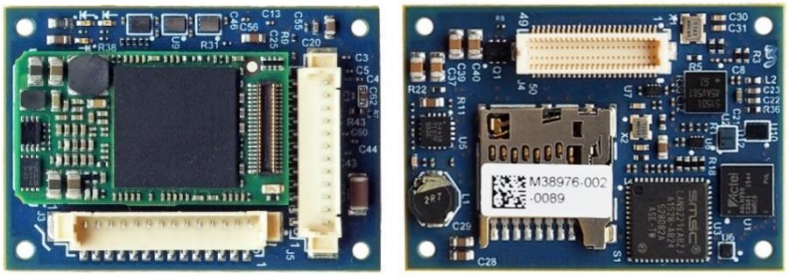

Figure 1: 1500-OEM Overview

3.1 1500-OEM Specifications

Dimensions:	1.48 in x 1.04 in (26.5 mm x 37.7 mm)
Weight:	7.6 grams
Power:	4.5 - 6.0 VDC (5 VDC nom). 350 mA to 450mA
Component Temp Range:	-40°C to 85°C[1]
Operating Temperature:	-40°C to 55°C
Current Revision:	E

Note: *See Thermal Management section for instructions on managing the operating temperature of the 1500-OEM board.*

3.2 Hardware Revisions

Board Revision	Changes
Rev E	• Fixed USB connectivity (J5) • Added 2 GPIO (J5) • Onboard FPGA programming no longer requires external JTAG emulator hardware • Improved boot-time by 3 seconds • Replaced MicroSD card with smaller version • Added 4th mounting hole

1 Available in most configurations.

3.3 Interface Protocol

The 1500-OEM shares the same interface protocol as other SLA video processing boards. The protocol is a packet-based command and control interface and the protocol document is available from our website.

The ARM core on the DM8148 is only lightly utilized in the SLA implementation. This provides customers with a processor to implement other processing functions or protocol conversions (to allow communications via a customer's proprietary protocol).

3.4 Primary Input / Output

- 4.5 - 6.0 VDC [5 VDC nominal] (see below)
- Analog Video In (x2)
- 10/100Base-T Ethernet
- 6 GPIO
- USB 2.0
- Digital Video Input (16-bits + clocks)
- 3.3V TTL Serial Ports (x3)
- I2C (3.3V)
- On-board FPGA for advanced video signal processing
- MicroSD Card

3.5 Functional Block Diagram

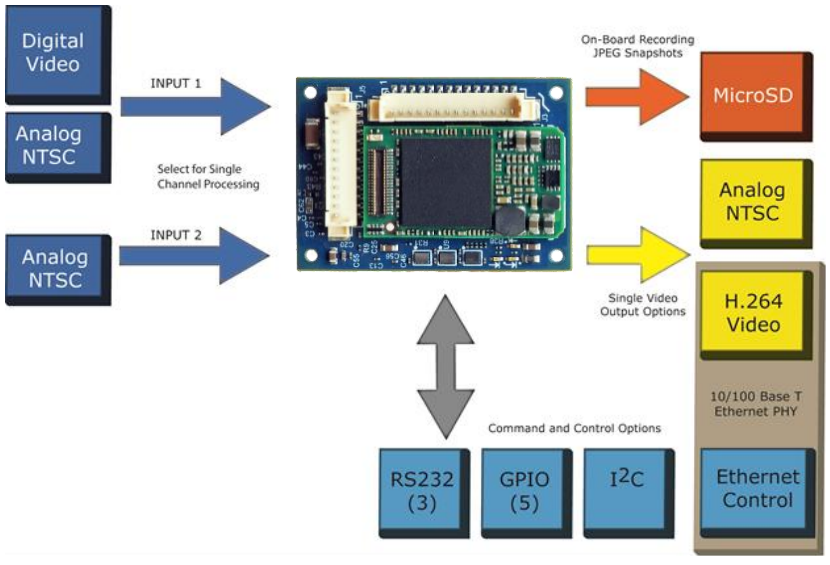

Figure 2: 1500-OEM Functional Block Diagram

3.6 Board Dimensions and Mounting Holes

REV C 1500-OEM Drawing

REV E 1500-OEM Drawing

All mounting holes shall support M1.6 screws. See also the ICD-1500-ENC for more mounting options.

3.7 1500-SOM

The image below shows orientation of 1500-SOM board relative to 1500-OEM board.

ⓘ **IMPORTANT:** Do not remove the 1500-SOM from the 1500-OEM board.

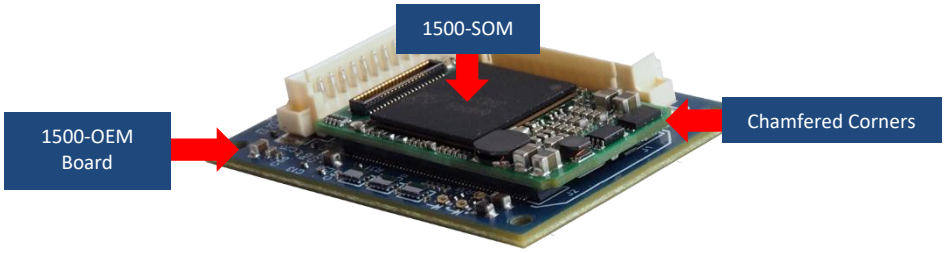

Figure 3: 1500-SOM Orientation

4 Thermal Management

4.1 Heatsink Guidelines

- All hardware uses some form of mechanical heatsink.
- The 1500-OEM consumes approximately 2.5 watts of power. Most of the power used is by the DSP + memory PoP on the SOM.
- A blue stick-on heatsink to facilitate bench and early testing is provided by SightLine. It supports convective cooling when there is airflow.

ⓘ **IMPORTANT:** The blue stick-on heatsink is not intended for long term vehicle integration use.

- The majority of customers design a heatsink in conjunction their system integration effort, providing a direct conducted path to a significant thermal mass (typically the wall of a gimbal or housing).
- If there is enough airflow, there are multiple finned options available; including thermal epoxy for mounting. Fin design should be selected based on airflow and available space.
- There is no automatic thermal processor shutdown on the 1500-OEM. The operating temperature of the unit can be read through the *SLAGetVersionNumbe*r command.
- Operating temperature specifications can be found in 1500-OEM Specifications.

4.2 Gap Filler (Thermal Grease)

When possible use some form of thermally conductive liquid gap filling material such as Arctic Silver rather than an adhesive. Do not use thermal grease in conjunction with gap pads.

4.3 Gap Pads

Use some form of thermally conductive material for filling gaps between the hot components and the heat sink. Examples such as the Bergquist VO Ultra Soft are recommended. Do not use gap pads in conjunction with thermal grease.

5 Accessory Boards

Adapter boards for cameras:

- 4.5 - 6.0 VDC [5 VDC nominal]
- Analog Video In (x2)
- 10/100Base-T Ethernet
- 6 GPIO
- USB 2.0

Adapter board for IR cameras:

- Digital Video Input (16-bits + clocks)
- Serial Ports (x3)
- I2C (3.3V)
- On-board FPGA for advanced video signal processing
- MicroSD Card

System Interfaces:

- Round-wire and board-to-board interfaces supported
- Support boards provide easy connection for system use and laboratory, with standard RJ-45, serial, and coaxial video connectors
- Small enclosed solution option

Figure 4: 1500-OEM with 1500-Sony Interface Board to Sony FCB-EV7 Camera

6 Connector Summary

Table 1: Connector Summary

Label	MFG Part Number	Function	Mates with:
J3	Molex 53398-1471	Analog video in/out, power, serial, Ethernet	Molex 51021-1400
J4	Hirose DF12B(5.0) 50DP-0.5V(86)	Serial, digital video, I2C, etc.	Hirose DF12B-50DS-0.5V(86)
J5	Molex 53398-1271	FPGA JTAG, USB, GPIO	Molex 51021-1200
S1	JEA ST9S008V4AR1500	J Micro SD socket	Any Micro SD card

6.1 Connector J3: Analog Video, Power, Serial, Ethernet

Table 2: 1500-OEM J3 Pinout

Pin	Signal	Description	Pin	Signal	Description
1	Video In 0	Analog video input	8	Vin	Input 4.5 - 6.0 VDC
2	AGND		9	Vin	
3	Video Out	Analog video output	10	DGND	
4	AGND		11	RX-	10/100BaseT Ethernet
5	TX0	Serial port 0	12	RX+	
6	RX0		13	TX+	
07	DGND		14	TX-	

6.2 Analog Video Input

Supports the following analog video formats:

- NTSC-J, M
- PAL-B, D, G, H, I
- PAL-M
- Converts luminance and chrominance channels to 8-bit ITU−R BT.656 interface with embedded sync output and extended coding range of values
- Y, U, and V range from 1 to 254

6.3 Analog Video Out (Composite TV Out)

Supports composite DC coupled output full-scale voltage output: minimum 1.2 Vpp with a 75-Ω parallel termination.

The following video standards are supported:

- NTSC-J, M
- PAL-B, D, G, H, I
- PAL-M

Note: *A 75 Ohm parallel resistor (to ground) is required on the TV-out for proper signal quality. Video traces should be routed with 75 Ohm characteristic impedance.*

6.4 Connector J4 (Digital camera, serial, power default)

This connector is designed to allow the 1500-OEM to mate with the FLIR TAU 640 or other SLA accessory boards. This is a generic camera input supporting up to 12-bits video data. The 1500-SOM can accept many types of digital video input. For optimal processing performance, the height and width of the image should be a multiple of 16.

For specifics regarding video timing and signals see the ICD-1500-FPGA.

Table 3: 1500-OEM J4 Pinout

Pin	Description	Signal Level	Pin	Description	Signal Level
1	RX2	VIOSEL	2	TX2	VIOSEL
3	CAMD14 / CAMXCLKA	VIOSEL	4	CAMD15 / CAMCLKB	VIOSEL
5	DGND		6	DGND	
7	I2C SCL	VIOSEL	8	I2C SDA	VIOSEL
9	GPIO175	VIOSEL	10	CAMFLD	VIOSEL
11	CAMVS	VIOSEL	12	CAMHS	VIOSEL
13	GPIO174	VIOSEL	14	GPIO173	VIOSEL
15	RX1	VIOSEL	16	TX1	VIOSEL
17	DGND		18	TAUDET	
19	GPIO178	3.3V	20	CAMD13	VIOSEL
21	EXTSYNC (Future Use)	VIOSEL	22	CAMD12	VIOSEL
23	CAMD11	VIOSEL	24	CAMD10	VIOSEL
25	CAMD09	VIOSEL	26	CAMD08	VIOSEL
27	DGND		28	DGND	
29	CAMD07	VIOSEL	30	CAMD06	VIOSEL
31	CAMD05	VIOSEL	32	CAMD04	VIOSEL
33	CAMD03	VIOSEL	34	CAMD02	VIOSEL
35	CAMD01	VIOSEL	36	CAMD00	VIOSEL
37	DGND		38	DGND	
39	CAMPCLK	VIOSEL	40	GPIO172	VIOSEL
41	DGND		42	DGND	
43	Analog Video In 1		44	Analog Ground	
45	DGND		46	VIOSEL	below
47	Power Return		48	Alternate Power In/Out	5V
49	Power Return		50	Alternate Power In/Out	5V

Power	Analog Video	Digital Video	12C	Serial	GPIO	Ground

6.5 Internal Pullup

The pullup drive strength is equal to: minimum = 50µA, typical = 100 µA, maximum = 250 µA (unless otherwise specified).

6.6 Connector J5: FPGA JTAG, USB, GPIO

The USB_VBUS connection can supply a maximum of 100mA. Devices that require more than 100mA will need an external power source.

Table 4: 1500-OEM (REV E) J5 Pinout

Pin	Signal	Description	Pin	Signal	Description
1		USB_VBUS	7		FPGA JTAG TMS
2		USB-	8		FPGA JTAG TDI
3		USB+	9		GPIO145
4		USBID	10		FPGA JTAG TRST
5		DGND	11		FPGA JTAG TDO
6		FPGA JTAG TCK	12		GPIO144

6.7 Socket S1: MicroSD

- Push in to place, push out to eject
- 10,000 Mating cycles
- 3.3 mm card eject length
- Works with most MicroSD cards

Note: *On REV E boards use an adhesive to hold the microSD card in place to prevent ejection during hard aircraft landings or other shocks to the board.*

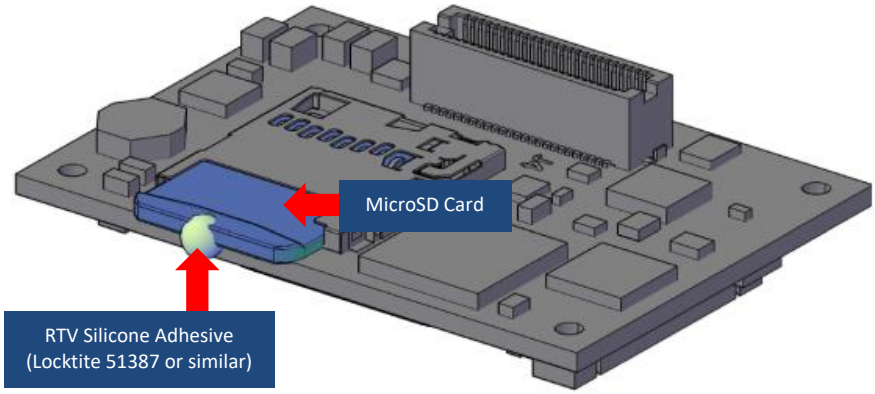

Figure 5: Example - 1500-OEM (REV E) Adhesive Placement on MicroSD Card

6.8 Power

Apply 5V to either J3 (Pin 8 and 9) or J4 (Pin 48 and 50). Do not apply power to both. Do not exceed 3.3V on VIOSEL.

Table 5: 1500-OEM Power Supply Pins

Connector/Pin	Name	Range	Tolerance
J4 Pin 46	VIOSEL	1.8, 2.5V, 3.3V	± 0.1V
J4 Pin 48 & 50	P5V	4.5 – 5.5V	
J3 Pin 8 & 9	P5V	4.5 – 5.5V	

6.9 VIOSEL

Pin 46 VIOSEL powers and sets the voltage level of the signals with names starting with CAM, as well as the GPIOs, RXB, TXB, RXC and TXC. VIOSEL can be set to 1.8V, 2.5V, or 3.3V. Do not exceed 3.3V. All signals besides the CAM signals use the bidirectional level converter TXB0108, which has a weak steady state drive strength.

6.10 LEDS

Table 6: 1500-OEM LED Status

Label	Description	LED Color
D1	Power Indicator	Green
D2	GPIO179	Green
D3	Network Status	Green

6.11 UARTS

In order to user for Serial Port 1 and Serial Port 2, external power must be applied to VIOSEL to set the IO voltage level. Serial Port 0 operates at 3.3V. If an application requires a different IO voltage for Serial Port 0, it is important to use a level shifter that is not a bidirectional, automatic direction sensing type of level shifter (such as the TXB0104).

Table 7: 1500-OEM Serial Ports

Serial Port	Reference Voltage	Connector	Linux	Common Use
0	3.3V	J3:P5/6	/dev/ttyO0	Command and Control, DEBUG
2	VIOSEL (J4:P46)	J4:P1/2	/dev/ttyO2	Camera Control Passthrough
1	VIOSEL (J4:P46)	J4:P15/16	/dev/ttyO1	Generic Passthrough

The Torpedo SOM hardware uses a different nomenclature in the documentation. The SOM serial port (A, B, C) maps to the SLA serial port (0, 1, 2) as follows:

SLA Port Number	SOM Port Number
0	A
1	C
2	B

6.12 Test Points

Table 8: 1500-OEM Test Points

Label	Description	Label	Description
TP1	Ground	TP3	FPGA Pin B9
TP2	3.3V	TP4	FPGA Pin C8

6.13 General Purpose Input / Output (GPIO)

Table 9: 1500-OEM Generic (Optional) GPIO

Label	Reference Voltage	Description/Location	Label	Reference Voltage	Description/Location
GPIO127	GROUND	MicroSD	GPIO174	VIOSEL	J4 Pin 13 May toggle on startup
GPIO129	1.8V	LAN9221 Pin 43	GPIO175	VIOSEL	J4 Pin 9
GPIO171	1.8V	FPGA A9	GPIO178	3.3V	J4 Pin 19
GPIO172	VIOSEL	J4 Pin 40	GPIO179	3.3V	LED D2
GPIO173	VIOSEL	J4 Pin 14	GPIO144	1.8V	J5 Pin 12
			GPIO145	1.8V	J5 Pin 9

7 Questions and Additional Support

If you are still having issues and require additional support, please contact Technical Support. Additional support, documentation and Engineering Application Notes (EANs) can be found on the Support pages of the SightLine Applications website.

Appendix

A.1 Missing Driver Chip

Some REV C boards were shipped without the U7 driver chip installed will not have I2C capability on J4. This was done to allow to direct connection to the back of a FLIR Tau 640. See EAN-FLIR Cameras for alternative solutions.

The board on the left has the chip installed, the board on the right does not. If the chip is not installed, contact Support for more information.

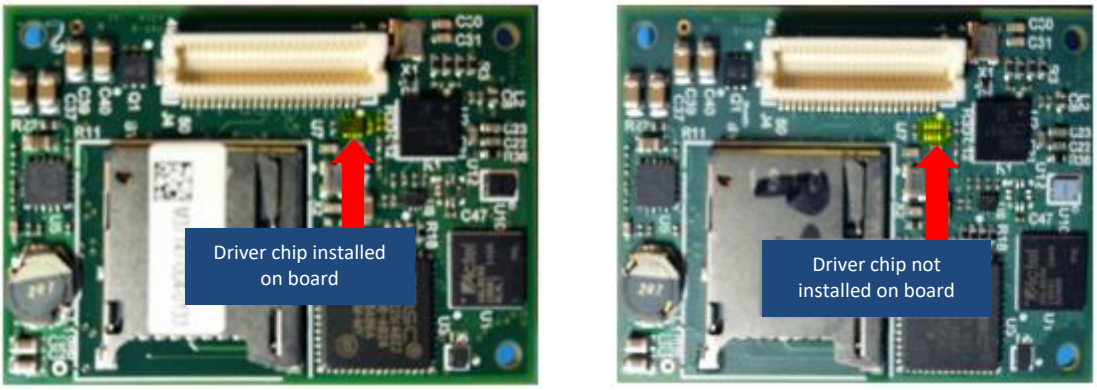

Figure 6: U7 Driver Chip Location

A.2 Anti-Alias Filter

An anti-alias filter should be added to each analog video input to help improve video quality. Recommended location of anti-aliasing filter input circuit. This filter is not present on the 1500-OEM.

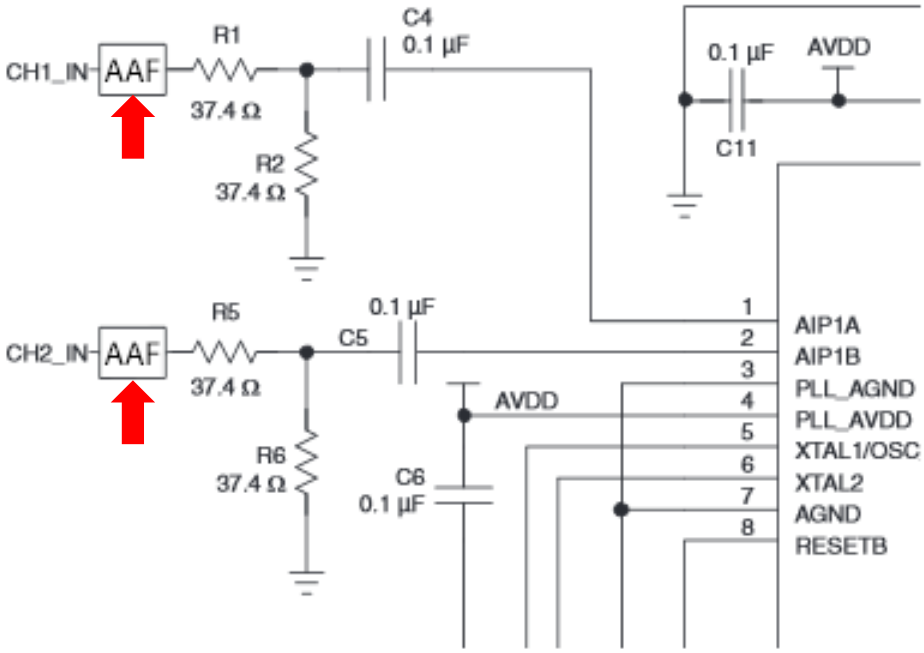

Figure 7: Anti-Aliasing Filter Input Circuit

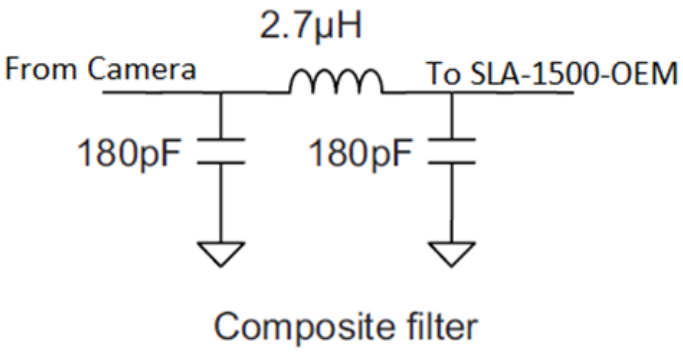

Figure 8: Recommended Anti-Aliasing Filter for Analog Inputs