XGA

ARINC 818

ADVB Interface Control Document

Great River Technology

www.greatrivertech.com

Standard ICD

- *XGA at 60 Hz*
- *24-bit color*
- *Progressive scan*
- *2.125 Gbps link rate*

Standard ICD

ARINC 818
ADVB Interface Control Document

- **XGA at 60 Hz**
- **24 bit color**
- **Progressive scan**
- **2.125 Gbps link rate**

Document:
ADVB_REF_ICD_XGA_24RGB_60H_2G_P_lsync.pdf

Revision 1.0
Release date: March 10, 2010

Revision History

Date	Revision	Sections	Description
3/10/2010	1.0	-	Initial Release

Disclaimer:

This document along with other standard ICDs are provided to support design groups in their implementations of ADVB interfaces. Great River Technology maintains this document, provides unlimited access to copies, and places no restrictions on its use. Great River reserves the right to make revisions or additions to this document, as they are needed, without notice, at any time in the future. Great River may choose to remove this document and/or particular revisions of this document from its website without notice.

Great River makes no representations that particular revisions of this document are complete and free from error. Great River makes every effort to ensure that the content of this document is accurate and up to date. Great River assumes no legal responsibility for the accuracy of this document and makes no warranty, express or implied, related to the use of this document in the design or development of electronic equipment or systems.

Purpose - Standard ICDs

GRT's Standard ICDs provide public domain specifications for ARINC 818 interfaces that can be shared among equipment providers in the interest of achieving interoperability among products.

The Standard ICDs offer ADVB implementation solutions for commonly encountered video resolutions, frame rates, and color schemes. The intended benefits are to accelerate the development cycle of equipment with ADVB interfaces, and more importantly, to achieve interoperability among supplier equipment.

In larger military/aerospace development programs, where two or more contractors supply subsystems connected by ADVB, these Standard ICDs can reduce risk of system integration delays, and added cost, due to ADVB incompatibilities.

For equipment providers intending to introduce ADVB enabled products targeting multiple mil/aero programs, compliance to one or more standard ICDs increases product value by increasing the likelihood of interoperability with existing (or future) ADVB enabled equipment and thereby eliminating additional costs for modification.

Adapting Standard ICDs

GRT's reference ICDs offers a particular ADVB implementation for common video types. However many alternative implementations are possible and the ICDs in no way define the limits of what is achievable with ARINC 818.

As such, this ICD is a reference that can be used without modification, or can be adapted to meet the special needs of a particular ADVB implementation. Required changes may include such things as Object 0 frame data definition, timing constraints on of ADVB packets, or changes to the desired physical media.

Please contact Great River Technology (jalexand@greatrivertech.com) with all errata and/or needed additions.

Table of Contents

1 General

This Interface Control Document (ICD) is to be used in Conjunction with ARINC Specification 818 for the implementation of an ADVB link. This ICD will place additional constraints over the ADVB implementation for several parameters such as link speed, packetization, and video timing.

This ICD is intended for engineers sufficiently familiar with the ARINC 818 protocol who need to develop a particular ARINC 818 implementation. For engineers unfamiliar with ARINC 818, it is best to review the ARINC 818 specification.

1.1 References

The following ARINC documents are relevant to the ADVB link described in this ICD:

- ARINC Specification 818: Avionics Digital Video Bus
- ARINC Specification 801: Fiber Optic Connectors
- ARINC Specification 802: Fiber Optic Cable
- ARINC Specification 803: Fiber Optic System Design Guidelines
- ARINC Specification 804: Fiber Optic Active Device Specification

All standards for which ARINC Specification 818 relies, namely The Fibre Channel family of ANSI standards also apply. These include:

- Fibre Channel – Audio Video (FC-AV) (ANSI INCITS 356-2002, 25 Nov 2002)
- Fibre Channel – Framing and Signaling Interface (FC-FS) (ANSI / INCITS 373-2003)
- Fibre Channel – Physical Interfaces (FC-PI) (INCITS 352-2002)

1.2 Document precedence

Where requirements are not stated explicitly within this ICD, the requirements set forth in ARINC Specification 818 will govern.

2 ADVB Requirements

2.1 Physical Media

The physical media used shall be 850nm multi-mode fiber.

Optical transceivers shall be 850nm multi-mode.

2.2 Link Characteristic

The ADVB shall be a single channel, 2.125 Gbps interface.

2.3 Video Format

The ADVB shall have the following video format:

- Resolution – 1024 pixels x 768 lines
- Scan – Progressive (left to right, starting at top)
- Frame rate – 60 Hz
- Pixel format – 24-bit RGB 8:8:8

2.4 Audio capabilities

The ADVB will not include capabilities for transporting Audio (Container Object 1)

2.5 Ordered Sets

The ADVB will use Class1 Ordered Sets. All Idle Ordered Sets will be OS Normal (rather than Arbff)

2.6 ADVB Frames - Segmentation

All transmitted ADVB frames shall conform to the following segmentation rules for Object 0 and Object 2 video payload:

- Single video stream (single container)
- Object 0 segmented in the first transmitted ADVB frame in each Video frame
- Object 2 frames
    - 1536 ADVB Frames total
    - All frames shall contain exactly one half line (512 pixels)

Table 2.5 indicates the image payload size and the number of ADVB frames per container.

BYTES PER VIDEO LINE	3072
NUMBER OF LINES PER ADVB FRAME	0.5
ADVB FRAME PAYLOAD SIZE (BYTES)	1536
NUMBER OF ADVB OBJ2 IMAGE PAYLOAD FRAMES	1536

Table 2.5 - Object2 payload segmentation.

2.7 ADVB Frames – Delivery timing

The transmitter shall deliver ADVB frames with line synchronous timing.
The 32bit character time shall be:

32 BIT CHARACTER TIME (ns)	18.8235294

Object 2 ADVB frame pairs, carrying the payload of one image line, shall be delivered within the minimum and maximum timings shown in table 2.6a.

The Object 2 horizontal line time will be measured from the leading SOFn on one ADVB frame pair to the SOFn to the next frame pair.

For the time from EOFt to SOFi, which corresponds to a vertical blanking period, the transmitter shall insert inactive line periods per the maximum and minimum values indicated in Table 2.6a.

	Minimum	Typ	Maximum
HORIZONTAL TIMING LIMITS			
HORIZONTAL LINE TIME (us)	20.63	20.93	21.23
HORIZONTAL LINE RATE (kHz)	48.473	47.778	47.103
VERTICAL TIMING LIMITS			
TOTAL INACTIVE LINES (VERT. BLANKING)	20	27	34
INACTIVE LINES Pre - Obj 0	6	9	10
INACTIVE LINES Post - Obj 0	14	18	24
RESULTING FRAME RATE(Hz)	**61.514**	**60.098**	**58.732**

Table 2.6a – Horizontal and Vertical timing limits.

Figure 2.6 shows the entire sequence of ADVB frames representing one ADVB container (video frame). based on the typical values of Table 2.6a.

Table 2.6b shows the calculated time values for the entire sequence of ADVB frames based on the typical values of Table 2.6a.

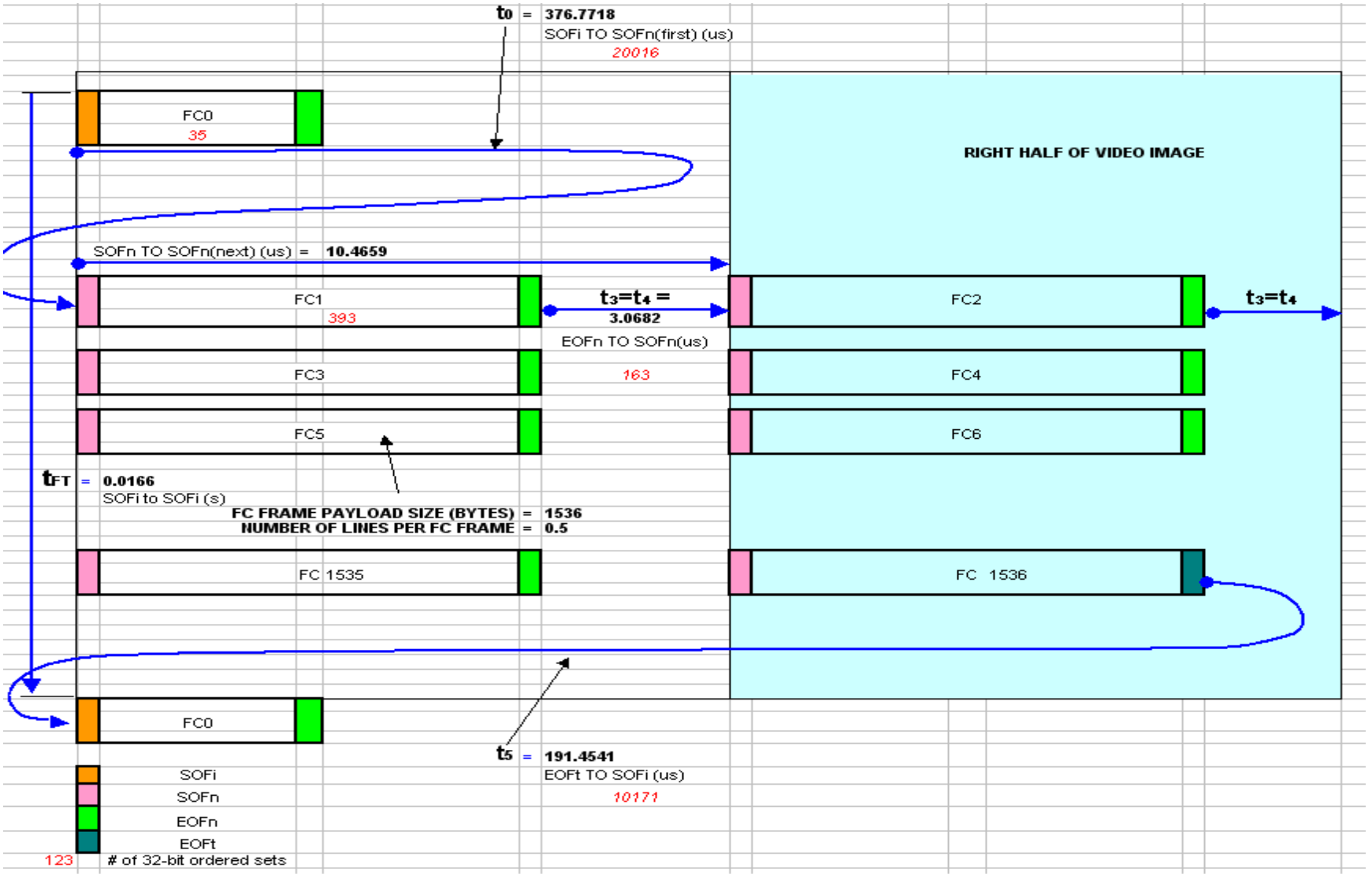

Figure 2.6 - ADVB Frame Sequence

Notes:
1. Time values shown are based on the typical values of Table 2.6a
2. Times t3 and t4 values shown are nominal. These values can vary as long as the total horizontal line time is within the limits set by Table2.6a and a minimum of 7 Idle OS are inserted between frames.

ARINC 818 Reference		TIME	32-bit CHAR COUNT	HORZ. LINES
	Obj0 FC frame time (us)	0.658823529	35	na
	Obj2 FC frame time (us)	7.397647059	393	na
t_{FT}	SOFi TO SOFi (ms)	16.64075294	884040	795
t_0	SOFi TO SOFn(first) (us)	376.7717647	20016	18
	SOFn TO SOFn(next) (us)	10.46588235	556	0.5
	SOFn(first) TO SOFnlast (us)	16075.59529	854016	768
	SOFnlast TO SOFi (us)	198.8517647	10564	9.5
t_{LT}	Video Line time (us)	20.93176471	1112	1
t_3, t_4	EOFn TO SOFn(us)	3.068235294	163	na
t_5	EOFt TO SOFi (us)	191.4541176	10171	na

Table 2.6b - Calculated time values for the entire ADVB Frame sequence.

Notes:
1. Time values shown are based on the typical values of Table 2.6a
2. Times t3 and t4 values shown are nominal. Times t3 and t4 can vary as long as the total horizontal line time is within the limits set by Table2.6a and a minimum of 7 Idle OS is inserted between ADVB frames.

2.8 ADVB Frame header

All ADVB frames transmitted shall use the header values indicated in Table 2.7. Values indicated as "VAR" shall be automatically updated by the transmitting hardware as described in ARINC Specification 818. (see notes for the table)

Word	Byte 0	Byte 1	Byte 2	Byte 3
1	44	00	00	00
2	00	00	00	00
3	60	VAR(Note 1)	00	00
4	VAR(Note 2)	00	VAR(Note 3)	VAR(Note 3)
5	00	00	00	00
6	00	00	00	00

Table 2.7 - ADVB frame header values.

Notes:
1. Bit 19 of Word 3 is F_CTL and should be 0 for all ADVB frames (Byte1 = 30H), but set to 1 for the last ADVB frame in the container sequence (Byte1 = 38H).
2. Byte 0 of Word 4 is the SEQ_ID and is an 8 bit rolling count that should match the LS Byte of the Container Count.
3. Bytes 2 and 3 of Word 4 are the 16-bit SEQ_CNT. This count shall be set to 0x0000 for the first ADVB frame of the container and shall increment by one for subsequent frames.

2.9 Object 0 ADVB Frame

2.9.1 Container Header

The Object 0 ADVB frame shall use the values indicated in Table 2.8.1 for the Container header: Values indicated as “VAR” shall be automatically updated by the transmitting hardware as described in ARINC Specification 818. (see notes for the table)

Values indicated as “User Defined” may be used by the transmitter to add additional data about the video source. These fields must be used within the constraints of the ARINC818 Specification.

Word	Identifier	Byte 0	Byte 1	Byte 2	Byte 3
0	Container Count	VAR(note 1)	VAR(note 1)	VAR(note 1)	VAR(note 1)
1	Clip ID	User defined	User defined	User defined	User defined
2	Container Time Stamp	User defined	User defined	User defined	User defined
3	Container Time Stamp	User defined	User defined	User defined	User defined
4	Transmission Type	07	01	00	00
5	Container Type	00	04	00	00
6	Object 0 Class	50	00	D0	00
7	Object 0 Size	00	00	00	10
8	Object 0 Offset	00	00	00	58
9	Object 0 Object Type Defined	00	00	00	00
10	Object 1 Class	40	00	D0	00
11	Object 1 Size	00	00	00	00
12	Object 1 Offset	00	00	00	68
13	Object 1 Object Type Defined	00	00	00	00
14	Object 2 Class	10	00	D0	00
15	Object 2 Size	00	14	00	00
16	Object 2 Offset	00	00	00	68
17	Object 2 Object Type Defined	00	00	00	00
18	Object 3 Class	10	00	D0	00
19	Object 3 Size	00	00	00	00
20	Object 3 Offset	00	00	00	00
21	Object 3 Object Type Defined	00	00	00	00

Table 2.7 - Container header values.

Notes: 1. Word 0 is the 32 bit container count. This is a 32-bit count and increments by 1 for each successive container.

2.9.2 Ancillary Data

The Object 0 Ancillary data shall use the values indicated in Table 2.8.2.

Words indicated as “User Defined” *may* be used by the transmitter to add additional data about the video source. These fields must be used within the constraints of the ARINC818 Specification.

Word	Byte 0	Byte 1	Byte 2	Byte 3
0	0C	00	40	00
1	10	00	77	70
2	User defined	User defined	User defined	User defined
3	User defined	User defined	User defined	User defined

Table 2.8.2 – Ancillary data values.

2.10 Object 2 ADVB Frames

The Object 2 ADVB frame shall insert 24-bit RGB video payload values as shown in table 2.9

Word		Byte 0	Byte 1	Byte 2	Byte 3
1	Frame Header	44	00	00	00
2	Frame Header	00	00	00	03
3	Frame Header	60	VAR	00	00
4	Frame Header	VAR	00	VAR	VAR
5	Frame Header	00	00	00	00
6	Frame Header	00	00	00	00
7	Video payload	R1	G1	B1	R2
8	Video payload	G2	B2	R3	G3
		*			
		*			
		*			
390	Video payload	B511	R512	G512	B512
391	CRC	CRC	CRC	CRC	CRC
		*			

Table 2.9 – Object 2 ADVB Frames

Pixel data shall be loaded into ADVB frames in the normal scanning order for a total of 1536 bytes per frame. Table 2.9 shows the video payload for the left half of the first line of the image.

All subsequent Object 2 ADVB frames shall contain half lines as indicated in table 2.9, for a total of 1536 ADVB frames.