ANNEX A-4

Asynchronous Recorder Multiplexer Output Re-Constructor (ARMOR)

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Acronyms

ARMOR	Asynchronous Recorder Multiplexor Output Re-constructor
ASCII	American Standard Code for Information Interchange
HF	high frequency
LF	low frequency
LSB	least significant bit
Mb	megabit
NRZ-L	non-return-to-zero-level
PCM	pulse code modulation

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ANNEX A.4

Asynchronous Recorder Multiplexer Output Re-Constructor

1. General

This standard defines the recommended multiplexer format for single-channel data recording on small-format (1/2 in.) media. This format is recognized as the Asynchronous Recorder Multiplexer Output Re-constructor (ARMOR). This format is software-reconfigurable for each data acquisition or reproduction. The ARMOR format configuration information is stored in a data structure called a "setup" that contains all the information necessary to define a particular record or play configuration. This annex describes the format and content of the ARMOR setup.

1.1. Setup on Tape

When the ARMOR setup is written to tape, it is preceded by a preamble with a unique setup sync pattern that allows the identification of the setup. Three duplicate setup records, each with its own preamble, are written at the beginning of each recording. The format of the preamble is defined in Table A.4-1.

Table A.4-1. ARMOR Setup Preamble

Field	Length	Description
Setup sync	4 tape blocks	The sync pattern consists of two bytes. The high byte is 0XE7; the low byte is 0X3D. The sync pattern is written high byte first. For the DCRSI, a tape block is a single scan (4356 bytes). For the VLDS, a tape block is a principle block (65,536 bytes).
End of sync	3 bytes	The three bytes immediately following the sync pattern are: 0X45, 0X4F, 0X53 (American Standard Code for Information Interchange [ASCII] "E", "O", "S" for "End of Sync").

2. Setup Organization

An ARMOR setup is divided into three sections: the header section, the channel section, and the trailer section. The overall organization of a setup is summarized in Table A.4-2.

Table A.4-2. Setup Organization

Content	Number of Bytes
Header section	70
Channel 1 information	51 - 61
Channel 2 information	51 - 61
" "	"
" "	"

Trailer section	0 - 44 + saved scanlist size

2.1. Header Section

The header section is the first 70 bytes of a setup. It contains information about the setup as a whole, including clock parameters, frame parameters, and the numbers of input and output channels (see Table A.4-3).

NOTE 	In Tables L-3 through L-12, fields noted with an asterisk (*) require user input per Section 2.5.

Table A.4-3. Header Section Format

Field	Bytes	Format	Description
*Setup Length	2	Binary	Total bytes in setup, including this field
Software Version	12	ASCII	Version of the ARMOR setup and control software that wrote the setup
Pre-scalers	1	Binary	The bottom four bits contain the bit rate clock pre-scaler; the top four bits contain the pacer clock pre-scaler.
Reserved	26	N/A	N/A
*Setup Keys (Bit 0)	1	Binary	If bit 0 (least significant bit [LSB]) set, setup contains setup description in trailer.
*Setup Keys (Bits 1, 2, & 3)			If bit 1 set, setup contains checksum in trailer. If bit 2 set, setup is scan-aligned. If bit 3 set, then a scan list is saved.
Pacer Divider	2	Binary	Pacer divider value
Bit Rate	4	Binary	Aggregate bit rate for all enabled channels
BRC Divider	2	Binary	Bit rate clock divider value
Master Oscillator	4	Binary	Frequency of the master oscillator in bits per second
Bytes Overhead	4	Binary	Total sync bytes plus filler bytes per frame
Pacer	4	Binary	Frequency of the pacer clock in cycles per second
Frame Rate	4	Binary	Number of frames per second
*Input Count	2	Binary	Number of input channels in setup
Output Count	2	Binary	Number of output channels in setup

2.2. Channel Section

The channel section contains one channel entry for every channel in the multiplexer chassis configuration, including those channels that are not enabled or recorded. The content and length of the channel information vary depending on the channel type. The lengths of the channel entries for each channel type are presented in Table A.4-4. Table A.4-5 through Table A.4-15 describe the channel entry fields for each module type. Links to the tables are provided below.

Table A.4-4. Channel Entry Lengths

Channel Type	Bytes
PCM input and output	51
Analog input and output	53
Parallel input	53
Parallel output	56
Timecode input and output	61
Voice input and output	61
Bit sync input	61

Table A.4-5. PCM Input Channels

Field	Bytes	Format	Description
*Channel Type	2	Binary	1 = 8 bit PCM input 8 = 20-megabit (Mb) PCM input
Mapped Channel	2	Binary	Index of the channel to which this channel is mapped. If the channel is not mapped, the index is -1.
*Enabled	1	ASCII	If enabled, the channel is recorded (“Y” or “N”)
Actual Rate	4	Binary	Actual word rate in words per second
Words Per Frame	4	Binary	Number of words per frame
Input Modes	1	Binary	If bit 0 (LSB) set, source B data; Else source A. If bit 1 set, NRZ-L; else bi-phase-level. If bit 2 set, 0 degree clock; else 90 degree clock.
Reserved	3	N/A	N/A
Bits Per Word	2	Binary	16 bits
Bits Preceding	4	Binary	Number of bits in the frame that must precede this channel
*Channel Number	2	Binary	Channel on module (0-3)
*Module ID	1	Binary	Module ID = HEX 11
Reserved	1	N/A	N/A
*Requested Rate	4	Binary	Requested bits per second (integer)
Description	20	ASCII	Channel description

Table A.4-6. PCM Output Channels

Field	Bytes	Format	Description
Channel Type	2	Binary	2 = 8 Mb PCM output 9 = 20 Mb PCM output
Mapped Channel	2	Binary	Index of the channel to which this channel is mapped. If the channel is not mapped, the index is -1.
Enabled	1	ASCII	If enabled, the channel is recorded (“Y” or “N”)
Actual Rate	4	Binary	Actual word rate in words per second
Words Per Frame	4	Binary	Number of words per frame
Output Modes	1	Binary	If bit 0 (LSB) set, burst mode. If bit 1 set, bi-phase; else NRZ-L.
Reserved	3	N/A	N/A
Bits Per Word	2	Binary	Number of bits per word
Bits Preceding	4	Binary	Number of bits in the frame that must precede this channel
Channel Number	2	Binary	Channel on module (0-3)
Module ID	1	Binary	Module ID = HEX 21
Reserved	1	N/A	N/A
Requested Rate	4	Binary	Requested bits per second
Description	20	ASCII	Channel description

Table A.4-7. Analog Input and Output Channels

Field	Bytes	Format	Description
*Channel Type	2	Binary	5 = LF analog input 6 = HF analog input 7 = analog output
Mapped Channel	2	Binary	Index of the channel to which this channel is mapped. If the channel is not mapped, the index is -1.
*Enabled	1	ASCII	If enabled, the channel is recorded (“Y” or “N”).
Actual Rate	4	Binary	Actual sample rate in samples per second
Samples Per Frame	4	Binary	Number of samples per frame
Filter Number	1	Binary	0 = filter 1 1 = filter 2 2 = filter 3 3 = filter 4
Reserved	3	N/A	N/A
*Bits Per Sample	2	Binary	Number of bits per sample (8 or 12)
Reserved	4	N/A	N/A

Table A.4-7. Analog Input and Output Channels

Field	Bytes	Format	Description
*Channel Number	2	Binary	Channel on module (0-3)
*Module ID	1	Binary	Module ID = 34 HEX (LF) or 33 HEX (HF)
Reserved	1	N/A	N/A
*Requested Rate	4	Binary	Requested samples per second
Reserved	2	N/A	N/A
Description	20	ASCII	Channel description

Table A.4-8. Parallel Input Channels

Field	Bytes	Format	Description
*Channel Type	2	Binary	13 = new parallel input
Mapped Channel	2	Binary	Index of the channel to which this channel is mapped. If the channel is not mapped, the index is -1.
*Enabled	1	ASCII	If enabled, the channel is recorded (“Y” or “N”).
Actual Rate	4	Binary	Actual words per second
Words Per Frame	4	Binary	Number of words per frame
Reserved	4	N/A	N/A
Bits Per Word	2	Binary	Number of bits per word
Words Preceding	4	Binary	Number of words in the frame that must precede this channel
*Channel Number	2	Binary	Channel on module (0-3)
*Module ID	1	Binary	Module ID = HEX 92
Reserved	1	N/A	N/A
*Requested Rate	4	Binary	Requested words per second
Input Mode	1	Binary	0 = four 8-bit channels 1 = one 16-bit, two 8-bit (currently unavailable) 2 = two 16-bit (currently unavailable) 3 = one 32-bit (currently unavailable) 4 = one 24-bit, one 8-bit (currently unavailable)
Reserved	1	N/A	N/A
Description	20	ASCII	Channel description

Table A.4-9. Parallel Output Channels

Field	Bytes	Format	Description
Channel Type	2	Binary	14 = new parallel output

Table A.4-9. Parallel Output Channels

Field	Bytes	Format	Description
Mapped Channel	2	Binary	Index of the channel to which this channel is mapped. If the channel is not mapped, the index is -1.
Enabled	1	ASCII	If enabled, the channel is recorded ("Y" or "N").
Actual Rate	4	Binary	Actual word rate in words per second
Words Per Frame	4	Binary	Number of words per frame
Reserved	4	N/A	N/A
Bits Per Word	2	Binary	Number of bits per word
Words Preceding	4	Binary	Number of words in the frame that must precede this channel
Channel Number	2	Binary	Channel on module (0-3)
Module ID	1	Binary	Module ID = HEX A2
Reserved	1	N/A	N/A
Requested Rate	4	Binary	Requested words per second
Output Mode	1	Binary	0 = four 8-bit channels 1 = one 16-bit, two 8-bit 2 = two 16-bit channels 3 = one 32-bit channel 4 = one 24-bit, ONE 8-bit 7 = two 8-bit DCRSI mode
Reconstruct Mode	1	Binary	0 = data is from module other than parallel input 1 = data is from parallel input Valid only for output mode.
DCRSI Output	1	Binary	0 = header and data 1 = header only 3 = data valid only for output mode 7.
Burst Select	1	Binary	0 = constant 1 = burst
Handshake Select	1	Binary	0 = disable handshaking 1 = enable handshaking
Description	20	ASCII	Channel description

Table A.4-10. Time Code Input Channels

Field	Bytes	Format	Description
*Channel Type	2	Binary	Time code must appear as a group of three channels, even though the user interface only displays a single channel. The respective types are 15, 19, and 20.

Table A.4-10. Time Code Input Channels

Field	Bytes	Format	Description
Mapped Channel	2	Binary	Index of the channel to which this channel is mapped. If the channel is not mapped, the index is -1.
*Enabled	1	ASCII	"Y" or "N"
Actual Rate	4	Binary	1
Samples Per Frame	4	Binary	1
Reserved	4	N/A	N/A
*Bits Per Word	2	Binary	24 for channel type 15 24 for channel type 19 16 for channel type 20
Reserved	4	N/A	N/A
*Channel Number	2	Binary	0 for channel type 15 1 for channel type 19 2 for channel type 20
*Module ID	1	Binary	Module ID = HEX B1
Reserved	1	N/A	N/A
*Request Sample Rate	4	Binary	1
*Bits Per Sample	2	Binary	24 for channel type 15 24 for channel type 19 16 for channel type 20
Description	20	ASCII	Channel description
Reserved	4	N/A	N/A
TCI Mode	1	Binary	0 = generate time 1 = use external IRIG source
Reserved	3	N/A	N/A

Table A.4-11. Time Code Output Channels

Field	Bytes	Format	Description
Channel Type	2	Binary	Time code must appear as a group of three channels, even though the user interface only displays a single channel. The respective types are 17, 21, and 22.
Mapped Channel	2	Binary	Index of the channel to which this channel is mapped. If the channel is not mapped, the index is -1.
Enabled	1	ASCII	"Y" - enabled, or "N" - disabled
Actual Rate	4	Binary	1
Samples Per Frame	4	Binary	1
Reserved	4	N/A	N/A

Table A.4-11. Time Code Output Channels

Field	Bytes	Format	Description
Bits Per Word	2	Binary	24 for channel type 17 24 for channel type 21 16 for channel type 22
Reserved	4	N/A	N/A
Channel Number	2	Binary	0 for channel type 17 1 for channel type 21 2 for channel type 22
Module ID	1	Binary	Module ID = HEX B1
Reserved	1	N/A	N/A
Requested Sample Rate	4	Binary	1
Bits Per Sample	2	Binary	24 for channel type 17 24 for channel type 21 16 for channel type 22
Description	20	ASCII	Channel description
Reserved	4	N/A	N/A
TCO Mode	1	Binary	0 - generate time 1 - use time from recorded tape
Reserved	3	N/A	N/A

Table A.4-12. Voice Input Channel

Field	Bytes	Format	Description
*Channel Type	2	Binary	16
Mapped Channel	2	Binary	Index of the channel to which this channel is mapped. If the channel is not mapped, the index is -1.
*Enabled	1	ASCII	“Y” - enabled, or “N” - disabled
Actual Rate	4	Binary	Actual sample rate in samples per second
Samples Per Frame	4	Binary	Number of samples per frame
Reserved	4	N/A	N/A
*Bits Per Word	2	Binary	8
Reserved	4	N/A	N/A
*Channel Number	2	Binary	3
*Module ID	1	Binary	Module ID = HEX B1
Reserved	1	N/A	N/A
*Requested Sample Rate	4	Binary	2K, 5K, 10K, 20K, 50K, OR 100K
*Bits Per Sample	2	Binary	8
Description	20	ASCII	Channel Description
Reserved	1	N/A	N/A

Table A.4-12. Voice Input Channel

Field	Bytes	Format	Description
Voltage Gain	2	Binary	0 - gain of 1 1 - gain of 2 2 - gain of 4 3 - gain of 8
Reserved	5	N/A	N/A

Table A.4-13. Voice Output Channels

Field	Bytes	Format	Description
Channel Type	2	Binary	18
Mapped Channel	2	Binary	Index of the channel to which this channel is mapped. If the channel is not mapped, the index is -1.
Enabled	1	ASCII	"Y" - enabled, or "N" - disabled
Actual Rate	4	Binary	Actual sample rate in samples per second
Samples Per Frame	4	Binary	Number of samples per frame
Reserved	4	N/A	N/A
Bits Per Word	2	Binary	8
Reserved	4	N/A	N/A
Channel Number	2	Binary	3
Module ID	1	Binary	Module ID = HEX B1
Reserved	1	N/A	N/A
Request Sample Rate	4	Binary	Number of samples per second
Bits Per Sample	2	Binary	8
Description	20	ASCII	Channel description
Reserved	8	N/A	N/A

Table A.4-14. Bit Sync Input Channels

Field	Bytes	Format	Description
Channel Type	2	Binary	23
Reserved	2	N/A	N/A
Enabled	1	ASCII	"Y" - enabled, or "N" - disabled
Actual Rate	4	Binary	Actual word rate in words per second
Words Per Frame	4	Binary	Number of words per frame
Reserved	4	N/A	N/A
Bits Per Word	2	Binary	16
Reserved	4	N/A	N/A
Channel Number	2	Binary	Channel on module (0-3)
Module ID	1	Binary	Module ID = hexadecimal 13
Reserved	1	N/A	N/A
Requested Rate	4	Binary	Bits per second

Table A.4-14. Bit Sync Input Channels

Field	Bytes	Format	Description
Description	20	ASCII	Channel description
Installed	1	Binary	0 = daughter board not installed 1 = daughter board installed
PCM geographical address	1	Binary	Geographical address of the associated PCM input channel
Source Clock	1	Binary	0 = source A 1 = source B
Reserved	7	N/A	N/A

2.3. Trailer Section

The trailer section contains the setup description and the checksum (see Table A.4-15). Early versions of the setup do not contain this information. The "Setup Keys" field in the header indicates the content of the trailer section.

Table A.4-15. Trailer Section Format

Field	Bytes	Format	Description
Setup Description	40	ASCII	Description of the setup
Saved Scanlist	Varies	Binary	Number of bytes depends on the number of channels being recorded.
Checksum	4	Binary	Sum of all setup bytes

2.4. Saved Scanlist Structure

This is an array of enabled input channels that make up the calculated scan-list. Each element of the array is made up of two fields, an index field and a count field. The length of the index field is one byte, and the length of the count field is two bytes.

a. The index field, which is 1-based, is determined by the position of the channel's module in the ARMOR system. The first input channel found in the ARMOR system is assigned an index of one (1), the next input channel is assigned a two (2), and so on. The search for input modules starts at slot 1. Filler bytes are assigned an index value of 255.

b. The count field is the number of words/samples per frame that is assigned to that input channel.

2.5. Creating a Setup Block

Creating a setup block involves two steps. In the first step, the user creates an "input" setup block file as described below in this section. Most of the fields in the input setup block file are unspecified (filled with zeros). In the second step, the input setup block file is read by the ARMOR compiler program that produces a new setup block file with all the unspecified fields initialized to the appropriate values. In other words, a setup block has two types of fields, user specified and compiler generated. Note that all compiler-generated fields must be provided in the

input setup block file and initialized with zeros prior to executing the ARMOR compiler program.

The rules presented in this section must be explicitly followed to create an ARMOR input setup block. Values for fields identified in the previous tables with an asterisk preceding the field name must be provided. In some cases, the values for these required fields are constant and are specified in the tables above. In other cases, the user must provide the desired value. All fields with names not identified with asterisks must be initialized to binary zero. This includes both unused and reserved fields.

Only input channel information entries are required. Output channel information entries are ignored by the ARMOR compiler program.

2.5.1. Header Section

Setup Length:	Count the total numbers of bytes in the created setup block and put the value here.
Setup Keys:	Set bit 0 = 1 if the trailer contains a description. Leave other bits = 0.
Input Count:	Enter the total number of input channel information entries, including both enabled and disabled entries.

2.5.2. Channel Section

PCM, low-frequency (LF) analog, and parallel input channel information entries must be included in the setup block in groups of four entries per type. High-frequency (HF) analog input channel information entries must be included in the setup block in groups of two entries per type. Time code/voice input channel information entries must be included in groups of three time code entries and one voice entry. Specifying an ASCII "N" in the enabled field must disable all unused input channel information entries. For each channel information entry group, the channel number field of the first entry in the group is zero, the second entry is one, the third is two, and the fourth is three. For the time code/voice group, the time code entry channel number fields are 0, 1, and 2, respectively, while the voice entry channel number field is 3. The HF analog entry channel number fields are 0 and 1, respectively.

Description fields are not required and are not specified below; however, it is advisable to include an ASCII description of each channel for future reference.

2.5.2.1. PCM Input Channels

Channel Type:	Binary 8
Enabled:	ASCII "Y" if enabled, "N" if disabled
Channel Number:	Binary 0, 1, 2, or 3 as described in Subsection 2.5.2 above
Module ID:	Hexadecimal 11
Requested Rate:	Binary integer rate in bits per second

2.5.2.2. Analog Input Channels

Channel Type:	Binary 5 for LF (up to 1 megasample/sec), 6 for HF (up to 10 megasamples/sec)

Enabled:	"Y" if enabled, "N" if disabled
Bits per Sample:	8 or 12
Channel Number:	0, 1, 2, or 3 as described in Subparagraph 2.5.2 above
Module ID:	Hexadecimal 34 (LF) or 33 (HF)
Requested Rate:	Binary integer 2K, 5K, 10K, 20K, 50K, 100K, 200K, 500K, 1M (LF, HF) 2.5M, 5M, 10M (HF only)

2.5.2.3. Parallel Input Channels

Channel Type:	Decimal 13
Enabled:	"Y" if enabled, "N" if disabled
Channel Number:	0, 1, 2, or 3 as described in Subparagraph 2.5.2 above
Module ID:	Hexadecimal 92
Requested Rate:	Binary integer 8-bit words (bytes) per second

2.5.2.4. Time Code Input Channels

Channel Type:	Decimal 15 (1st entry), 19 (2nd entry), 20 (3rd entry)
Enabled:	"Y" if enabled, "N" if disabled, all three entries must be the same
Bits per Word:	Decimal 24 (1st entry), 24 (2nd entry), 16 (3rd entry)
Channel Number:	0, 1, or 2 as described in Subparagraph 2.5.2 above
Module ID:	Hexadecimal B1
Requested Rate:	1
Bits per Sample:	Decimal 24 (1st entry), 24 (2nd entry), 16 (3rd entry)

2.5.2.5. Voice Input Channels

Channel Type:	Decimal 16
Enabled:	"Y" if enabled, "N" if disabled
Bits per Word:	8
Channel Number:	3 as described in Subparagraph 2.5.2 above
Requested Rate:	Integer 2K, 5K, 10K, 50K, 100K
Bits per Sample:	8

2.5.3. Trailer Section

The trailer section of the input setup block is not required. The user may include an ASCII text setup description in the trailer section by setting the setup keys bit 0 = 1 in the header section (see Paragraph 2.5.1 above) and adding the setup description field only in the trailer section.

2.5.4. ARMOR Compiler Program

Operational instructions for the ARMOR compiler program are provided in the readme.txt file provided with the compiler.

****** END OF ANNEX A.4 ******