FASIT

Future Army System of Integrated Targets

PYROTECHNIC DEVICE INTERFACE CONTROL DOCUMENT

ICD.FASIT.PYRO

RELEASE 2.1

25 May 2007

LIVE TRAINING TRANSFORMATION

LT2

Family of Training Systems

Approved for public release; distribution is unlimited

Release 2.1
25 May 2007

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LIST OF REVISIONS

Revision Log		
Revision/Version No.	Description	Date
Release 1.0	Initial Release This is the initial release of this ICD since NGATS responsibility was moved within PEO STRI from PM ITTS to PM TRADE. It is the first of a new set of ICDs based on the concept of a Common Interface Component. The set now includes the System ICD, containing information common to all device types, and a series of ICDs with the messages and fault codes unique to each device type. This is one of that series Changes from the previous PM-ITTS ICD include: Incorporated comments from the October 2005 Targetry WG meeting. Incorporated comments from industry. Changed project named from New Generation Army Targetry Systems (NGATS) to Future Army System of Integrated Targets (FASIT) and updated all tables and diagrams accordingly Removed "For Official Use Only" designation as this cannot be justified under Army Policy and Freedom of Information Act exemptions. Changed Target Processor to Target Controller Changed TMO to PM TRADE as the responsible lead agency for the document. Removed time and checksum from message headers. Added "Reserved For Future Use" field to header (to fill space formerly occupied by timestamp) Created separate commands and status responses for each device type (Pyro, Smoke, Audio, Illumination).	4-12-06

LIST OF REVISIONS

Revision Log		
Revision/Version No.	Description	Date
Release 2.0	Added text to indicate command IDs corresponding to unsupported capabilities should generate a "Can't Comply" Table VI removed " and cartridge" and changed note to indicate sequential firing order Added Table IX with Pyrotechnic Device fault fields. Table XI added text to indicate that after loading, cartridge count will start at Tube Count and decrement after each firing until Cartridge Count is zero. Added the document number to the document header. Changed the name of Message 100 from Common Bit Request to Device Definition Request. Changed the ICD field in the message header from a Float to two (2) Unsigned Shorts. This has no effect on the overall message length, but provides integers representing the whole number and fractional parts of the ICD release designation. Eliminated the zone detail from Table I to prevent it from being manufacturer or design specific. Changed the name of Message 2005 from Initiated Bit Request to Device ID and Capabilities. Deleted the OEM Fault Field from the Device ID and Capabilities message. This is redundant with reporting status with the Device Status message. Added Section 2.2, Command Behavior, to show device reaction for each possible Command ID. Included Command ID = 1 in Table VI for completeness. Corrected the description for Bit number 4 in the Device Fault Field, Table X. Clarified use of default values in Unit Status (Section 2.3.6, Table XI) when a device does not support a capability.	5-16-06

LIST OF REVISIONS

Revision Log		
Revision/Version No.	Description	Date
Release 2.1	Several uses of the term "BED" were changed to Pyro device or Device for consistency throughout the document. Added Section 2.3.8 to provide an explicit example of the full header message in accordance with a request from the BES program team. Added sentence to Section 1.1 to document exception taken to FASIT System ICD paragraph 3.3.4. Revised Section 2.1.2 to reflect the performance, and sequence of messages between the Target Controller and Pyrotechnic Device. Delineates additional performance requirements on the Target Controller. Revised Table V to reflect each Command ID permutation and to provide unambiguous response message information. Revised Section 2.3.2 to reflect applicability to both Command ID 3 and 4; and stipulate that the zones must match to discharge to take place.	23 May 2007

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1.0 Scope

The Target Controller (TC) to Future Army System of Integrated Targets (FASIT) Pyrotechnic Device Interface Control Document (ICD) describes the data message definitions and sequencing and OEM fault codes used in two-way communication between the FASIT Target Controller and the FASIT Pyrotechnic Device. This ICD is one of a set of documents that specifies the FASIT component interfaces required for each device type to support the FASIT system architecture. The physical and electrical characteristics of the interfaces as well as data types and requirements common to all device types are contained in the System Devices ICD, ICD.FASIT.SYS. In this document, the terms pyrotechnic and pyro are used interchangeably, and Device means a FASIT compliant pyro or pyrotechnic device.

1.1 Document Overview

This document is divided into two sections. Section 1.0 provides the scope of the document and a short overview of the document content. Section 2.0 discusses the specific communication message structures and OEM fault codes used between the Target Controller and the FASIT Pyrotechnic Device. This document is intended to supplement the System Device ICD referenced above with the exception of section 2.1.2 which describes particular implementation details of the exception over the System ICD, paragraph 3.3.4.

2.0 Interface Description

2.1 Messages

The set of messages used by a pyrotechnic device includes Command, Command Acknowledgement, Device ID and Capabilities, and Device Status messages. Each of these is documented below and the set is followed by the descriptions of the message fields. The Message Header and Device Definition Request (message 100) are described in the System Devices ICD, ICD.FASIT.SYS.

2.1.1 Pyro Command Message

The Event Command message is sent from the Target Controller to inform the pyrotechnic Device to perform a Pyro operation based on the Command Identifier (ID). Pyrotechnic device Command IDs are 0 – 4. All commands require the pyrotechnic device to return an acknowledgement and/or status. Device command behaviors are shown in Section 2.2, Table V.

Table I. Message Number 2000 - Pyrotechnic Command

Field Size	Message fields	
Bits 0 – 127	Message Header	Message Number – Unsigned short
		ICD Version Number – 2 Unsigned short
		Sequence ID – Unsigned integer
		Reserved For Future Use - 32 bits, all zeros
		Length of Message – Unsigned short
Bits 128 – 135	Command ID (Table VI)	8-bit enumeration
Bits 136 – 151	Fire Location Parameters (Table VII)	Zone to Fire From (1-n) – unsigned short Number of zones (n) and positions per zone are defined via the Device Status Message (2006). Zone 0 or > n – Future. Ignored by the device.

2.1.2 Event Command Acknowledgement Message

This message is sent from the Pyrotechnic Device to the Target Controller in response to Command IDs (0, 1, 3, and 4) inside the Command message to inform the Target Controller that the Device has received a command and whether or not it can perform the requested command. Only a single command at a time may be issued to the Device and the Target Controller must wait until all responses have been received from the Device before sending out the next message. Subsequent messages sent to the Device must be based upon the responses provided back to the previous message. If the Target Controller command was the Set Fire command (Command ID (3)), upon receipt of this acknowledgement message "S" (Received and Complied) from the Device, the Target Controller must send a Fire Command (Command ID (4)) message within 3.0 seconds or the Pyrotechnic Device must disarm its trigger. If the Device Acknowledgement was

"F" (Received, Can't Comply) then the Target Controller must not send a Fire Command (Command ID (4)).

In the case where message connectivity is lost, but network connectivity is not (i.e., a lost message on the network), the target controller shall implement a three second time-out from the last message sent to the pyrotechnic device, and then issue a Device Status Message (Command ID (2)). Only upon receipt of a valid status response, the Target controller will resume normal operations. If the Pyrotechnic Device does not respond to the status request, the target controller shall assume the network connection is lost or compromised, and shall terminate communication and the network connection with the Pyrotechnic Device.

Table II. Message Number 2004 - Event Command Acknowledge

Field Size	Message fields	
Bits 0 – 127	Message Header	Message Number – Unsigned short
		ICD Version Number – 2 Unsigned short
		Sequence ID – Unsigned integer
		Reserved For Future Use - 32 bits, all zeros
		Length of Message – Unsigned short
Bits 128 - 175	Response ID (Table VIII)	Response Message Number – Unsigned short
		Response Sequence ID – Unsigned Integer
Bits 176 - 183	Acknowledge Response (Table IX)	Char

2.1.3 Device ID and Capabilities Message

This message is sent from the Pyro Device to the Target Controller in response to a Device Definition Request (Message Number 100) to inform the Target Controller of the device ID, type and capability.

Table III. Message Number 2005 – Device ID and Capabilities

Field Size	Message fields	
Bits 0 – 127	Message Header	Message Number – Unsigned short
		ICD Version Number – 2 Unsigned short
		Sequence ID – Unsigned integer
		Reserved For Future Use - 32 bits, all zeros
		Length of Message – Unsigned short
Bits 128 – 175	Response ID (Table VIII)	Response Message Number – Unsigned short
		Response Sequence ID – Unsigned Integer
Bits 176-239	Device ID	64 bit globally unique identifier field. This field shall contain the MAC address for Ethernet interfaces. (MSB shall be padded with zeroes)
Bits 240-247	Device Capabilities	8 bit field. 0=Legacy, 1=Pyrotechnic Device, 2 – 7 = used for other devices or reserved.

2.1.4 Pyro Device Status Message

This message is sent from the Pyro device to the Target Controller in response to Command ID (2, 4) inside the Command message to inform the Target Controller of the operational status of the device and to provide firing device information.

Table IV. Message Number 2006 - Pyro Device Status

Field Size	Message fields	
Bits 0 – 127	Message Header	Message Number – Unsigned short
		ICD Version Number – 2 Unsigned short
		Sequence ID – Unsigned integer
		Reserved For Future Use - 32 bits, all zeros
		Length of Message – Unsigned short
Bits 128 – 175	Response ID (Table VIII)	Response Message Number - Unsigned short
		Response Sequence ID – Unsigned Integer
Bits 176 – 199	Unit Status (Table XI)	Battery Status – unsigned char
		OEM Fault Field
Bits 200 – 215	Zone Count	Number of zones – unsigned short, n
Bits 216 – (215+ 48n)	Zone Records (Table XII)	Zone 1 – Record
		Zone 2 – Record
		Zone 3 – Record
		Zone (n) – Record

2.2 Command Behavior

2.2.1 Command IDs and Responses

The table below specifies the fields from the Event Command message (2000) that are to be read and applied by the Pyro Device for each command ID, and the type of message with which the Pyro Device shall respond.

Table V. Command Behavior

Command ID	Command Fields Applied	Pyro Response Message
0 – No Event (default)	NONE	Command Ack (2004)
1 – Reserved for Future Use	NONE	Command Ack (2004) with Response = F
2 – Device Status Request	NONE	Device Status (2006)
3 – Set Fire	Fire Location (Zone Number)	Command Ack (2004)
4 – Fire	Fire Location (Zone Number)	Command Ack (2004) Device Status (2006)
5 – Reserved for Future Use	NONE	Command Ack (2004) with Response = F
6 – Reserved for Future Use	NONE	Command Ack (2004) with Response = F
7 – Reserved for Future Use	NONE	Command Ack (2004) with Response = F

2.2.2 Device Messaging Responses

Command messages and coordinating responses are in accordance with the System ICD, Section 3.1.4.4. Figure 1 below shows the corresponding messages and responses for the situation where the Fire command is not provided in a timely manner.

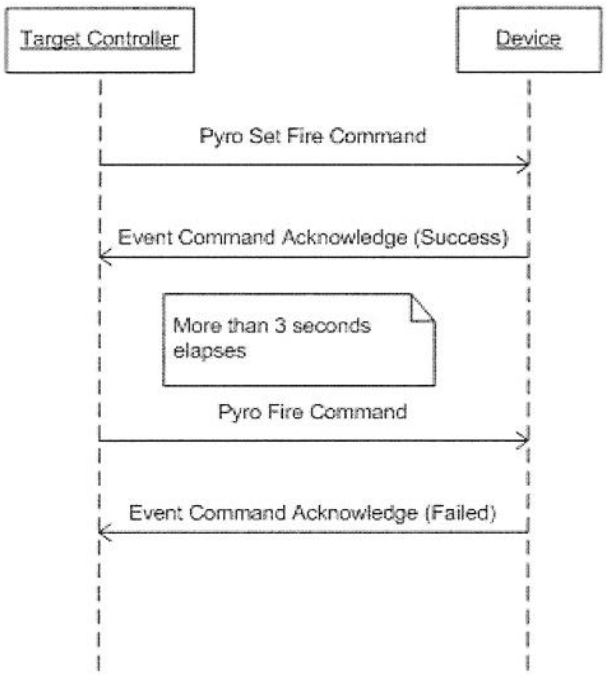

Figure 1. Pyro Timeout

2.3 Battlefield Effects Device Message Components

This paragraph specifies the data types and records that will be contained in the message set described above.

2.3.1 Command ID

The Command ID is sent in the command message from the Target Controller to inform the Pyro Device which operation is to be performed. All commands require the device to respond. Note: If a device receives a command ID corresponding to a capability it does not support, it shall send an Event Command Acknowledgement Message with an Acknowledge Response (see Table IX) field value of 'F' (Can't Comply).

Table VI. Command ID

	Variable Type	Definition	Comments
1	Enumerated Type	Unique identifier of this command	0 – No Event (default) 1 – Reserved for Future Use 2 – Device Status Request 3 - Set Fire 4 – Fire

2.3.2 Fire Location Parameters

The Fire Location Parameters are sent in the command messages from the Target Controller to inform a pyrotechnic device of which zone should be fired. This information is only relevant for Command ID (3 and 4). The Fire Location Parameters included in the set_fire (Command ID (3)) and fire (Command ID (4)) commands must match, else the Pyrotechnic device shall not fire or discharge an effect, and shall respond to the fire command with a Command Acknowledge (2004) with Response = F.

Table VII. Fire Location Parameters

	Variable Type	Definition	Comments
1	Unsigned short	Zone number	This will be the zone that the cartridge will be fired from.

Note: Tubes within a zone are fired sequentially until all tubes have been fired.

2.3.3 Response ID

The Response ID is used by the Target Controller to identify what message the device is responding to.

Table VIII. Response ID

	Variable Type	Definition	Comments
1	Unsigned short	Response Message Number	This number informs the Target Controller what type of message the Device is responding to.
2	Unsigned Integer	Response Sequence ID	This field shall contain the Sequence ID value from the command message that the Device is responding to.

2.3.4 Acknowledge Response

The Acknowledge Response is used to inform the Target Controller that the message sent was received by the Device and, based upon the value returned, whether or not it can or will perform the command requested. This response is used for commands that do not return status parameters requested by other command event IDs.

Table IX. Acknowledge Response

	Variable Type	Definition	Comments
1	Char	Acknowledgement from the Device to the Target Controller of receipt of the command.	This value will inform the Target Controller whether the message was received and whether the device can comply with the

	Variable Type	Definition	Comments
			command. (Default = S) "S" – Received and complied. "F" – Received, can't comply.

2.3.5 Original Equipment Manufacturer (OEM) Fault Field

The OEM fault field is a 16-bit field where each bit is set (1) when a fault/condition is detected, and cleared (0) when there is no fault/condition. Faults/conditions will be documented herein, and will be used consistently for a given device type. The tables below define the established fault fields for the pyro device.

Table X. Pyrotechnic Device Fault Fields

Bit Number	Fault/Condition
0	Set when the device is not armed due to waiting for an arming safety delay.
1	Set when the device cover interlock is opened.
2	Set when an error is detected in the Armed Indicator
3	Set when the device is no longer armed because all cartridges have been fired.
4	Set when an over current condition occurs.
5-15	Reserved for future use. Default = zeros.

2.3.6 Unit Status

The unit status provides the Target Controller information on the operational status of the device. If a device does not support a capability, due to design, specification, or other considerations, the default value will be reported.

Table XI. Unit Status

	Variable Type	Definition	Comments
1	Unsigned char	Battery Status	The value in this field represents the battery status: 0 – Shore Power (default) 1 thru 10 – Remaining Battery Power
2	Bit Field	Error Codes	OEM Fault Field. Default = All zeros All zeros – Fully Operational

2.3.7 Zone Record

The Zone Record describes the characteristics of the zone.

Table XII. Zone Record

	Variable Type	Definition	Comments
1	Unsigned short	Zone Number	This number informs the Target Controller which zone this information pertains to. (Default = 1)
2	Unsigned short	Tube Count	This number identifies how many tubes are allocated for this zone. (Default = 1)
3	Unsigned short	Cartridge Count	This number identifies how many live cartridges are remaining in this zone. After the Device has been fully loaded, the Cartridge Count value shall start at Tube Count and decrement after each firing until Cartridge Count is zero. (Default = 0)

2.3.8 Message 100 Example

Hex Message Representation

Message Number (Unsigned short, 2 bytes): 00 64
ICD whole number portion (Unsigned short, 2 bytes): 00 02
ICD fractional portion (Unsigned short, 2 bytes): 00 00
Sequence Number (Unsigned integer, 4 bytes): 00 00 00 01
Reserved for Future Use (4 bytes, all zeros): 00 00 00 00
Message Length (Unsigned short, 2 bytes): 00 10

Entire Hex Message: 00 64 00 02 00 00 00 00 00 01 00 00 00 00 00 10

Message Field Descriptions

Message Number value is 100 in decimal
ICD whole number portion is 2 in decimal
ICD fractional portion is 0 in decimal (The system software will interpret this as 2.0)
Sequence Number is 1 in decimal. This number will be different (incremented by 1) for every message by the target controller software. Value of 1 given here is just an example.
Reserved for Future Use is all zeros as specified in the ICD
Message Length is 16 in decimal and indicates total length of the message in bytes. Length includes header and body. In this case there is no body, just a header.