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# Pixie-4 Express

## Software Manual

### - IEC63047 list mode converter -

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# Manual Conventions

The following conventions are used throughout this manual

Convention	Description	Example
»	The » symbol leads you through nested menu items and dialog box options.	The sequence <b>File»Page Setup»Options</b> directs you to pull down the <b>File</b> menu, select the <b>Page Setup</b> item, and choose <b>Options</b> from the sub menu.
<b>Bold</b>	Bold text denotes items that you must select or click on in the software, such as menu items, and dialog box options.	...click on the <b>MCA</b> tab.
<b>[Bold]</b>	Bold text within [ ] denotes a command button.	<b>[Start Run]</b> indicates the command button labeled Start Run.
monospace	Items in this font denote text or characters that you enter from the keyboard, sections of code, file contents, and syntax examples.	Setup.exe refers to a file called “setup.exe” on the host computer.
“window”	Text in quotation refers to window titles, and quotations from other sources	“Options” indicates the window accessed via <b>Tools»Options</b> .
<i>Italics</i>	Italic text denotes a new term being introduced , or simply emphasis	<i>peaking time</i> refers to the length of the slow filter.  ...it is important first to set the energy filter Gap so that SLOWGAP to <i>at least one unit greater than</i> the preamplifier risetime...
<Key> <Shift-Alt-Delete> or <Ctrl+D>	Angle brackets denote a key on the keyboard (not case sensitive). A hyphen or plus between two or more key names denotes that the keys should be pressed simultaneously (not case sensitive).	<W> indicates the W key <Ctrl+W> represents holding the control key while pressing the W key on the keyboard
<b><i>Bold italic</i></b>	Warnings and cautionary text.	<b><i>CAUTION: Improper connections or settings can result in damage to system components.</i></b>
CAPITALS	CAPITALS denote DSP parameter names	SLOWLEN is the length of the slow energy filter
SMALL CAPS	SMALL CAPS are used for panels/windows/graphs in the GUI.	...go to the MCADISPLAY panel and you see...

# 1 Introduction

The Pixie-4 Express is designed, among other things, to acquire list mode data from radiation detectors. The methods to set up and acquire such data, and basic functions to view results, are described in the Pixie-4 Express User's Manual.

A new international standard IEC 63047 "Nuclear Instrumentation – Data format for list-mode digital data acquisition used in radiation detection and measurement" is currently under development by experts “appointed by IEC/TC 45 "Nuclear Instrumentation" and with input from EU Member States laboratories participating in the EMPIR 14SIP07 Project "DigitalStandard". The pre-normative research has been performed by the JRC ERNCIP Thematic Group on Radiological and Nuclear Threats to Critical Infrastructure, after the prioritisation performed by CEN/TC 391 "Societal and Citizen Security" in the frame of mandate M/487”<sup>1</sup>

The following describes XIA's implementation of the IEC standard for the Pixie-4 Express. It is based on the encoding and decoding software (Codec) developed by JRC. Pixie-4 Express list mode data files can be converted into IEC 63047 standard files (“IEC files”) by executing a command line Windows executable that formats and packs the data according to the standard. It can then be read by any other tool supporting the standard.

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## 1.1 Requirements and Limitations

- Currently only list mode data acquired by a Pixie-4 Express in mode 0x400 can be converted into the IEC standard
- Based on JRC version 1.0.0.1 of the Codec, which supports standard IEC 63047, draft CD1.
  - The Codec consists of the following files: CodecDLL.dll, CodecDLL.lib, CodecDLL.h
  - CodecDLL.dll depends on msvcrt120.dll and msvcrt120.dll (32-bit).<sup>2</sup> The three dll's should be accessible by the executable, preferably by placing them in the same folder as the executable
- Based on 32bit code (compatible with 64bit Windows)
- As the Pixie-4 Express is a 4-channel module and (even in multi-module systems) one file is generated per module, the IEC file may contain records from up to 4 channels.

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<sup>1</sup> J. Paepen et al, JRC Technical Report “Encoding and decoding IEC 63047 Committee Draft 1 list-mode data”, 2016

<sup>2</sup> The 32-bit redistributable package for Visual Studio 2013 is available for free on <https://www.microsoft.com/en-us/download/details.aspx?id=40784> (vc\_redist\_x86.exe).

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## 1.2 How the Code works

The Pixie-4 Express IEC 63047 converter is implemented as a command line executable, "Reader\_IEC63047.exe". It is invoked from the command line by typing

```
Reader_IEC63047.exe file_name.b00 maxevents verbose
```

where

`file_name.b00` is the name of a 0x400 list mode data file.

`maxevents` is the maximum number of events from the file to process

`verbose` enables (1) or disables (0) printing of debug messages

Reader\_IEC63047.exe assembles energy (pulse height), timestamp, up to 6 PSA values, up to 32 flags indicating event and system status, and detector waveforms from the 0x400 file into an IEC "event". The IEC file is named `file_name.b00.coer`. If the verbose option is 1, Reader\_IEC63047.exe generates a .dt3 text file with the event data during the extraction of data from the 0x400 file (see Pixie-4 Express user manual) and adds a final error checking stage where the events are again extracted from the IEC file and printed for comparison with the .dt3 file.

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## 1.3 Additional Notes

You can use an online tool to read IEC 63047 data, provided that the files are not too long. I made your file very short for demonstration (attached). The extension has to be oer and not coer. Just rename.

Go to <http://asn1-playground.oss.com/>

Take the asn file in the \data folder and upload it to the site, in the schema box. Click compile and observe the console output.

In the data: decode box, select binary file and upload the encoded data file. Click decode and observe the output.

You can download the decoded values as text with the link "TXT" just above the console output. See attached text file.