asammdf Documentation

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Contents

asammdf is a fast parser/editor for ASAM (Associtation for Standardisation of Automation and Measuring Systems) MDF (Measurement Data Format) files.

asammdf supports both MDF version 3 and 4 formats.

asammdf works on Python 2.7, and Python >= 3.4

CHAPTER 1

Project goals

The main goals for this library are:

- to be faster than the other Python based mdf libraries
- to have clean and easy to understand code base

CHAPTER 2

Features

- create new mdf files from scratch
- append new channels
- read unsorted MDF v3 and v4 files
- filter a subset of channels from original mdf file
- cut measurement to specified time interval
- convert to different mdf version
- export to Excel, HDF5, Matlab and CSV
- merge multiple files sharing the same internal structure
- read and save mdf version 4.10 files containing zipped data blocks
- split large data blocks (configurable size) for mdf version 4
- disk space savings by compacting 1-dimensional integer channels (configurable)
- full support (read, append, save) for the following map types (multidimensional array channels):
  - mdf version 3 channels with CDBLOCK
  - mdf version 4 structure channel composition
  - mdf version 4 channel arrays with CNTemplate storage and one of the array types:
    - 0 - array
    - 1 - scaling axis
    - 2 - look-up
- add and extract attachments for mdf version 4
- files are loaded in RAM for fast operations
- handle large files (exceeding the available RAM) using *load_measured_data* = *False* argument

- extract channel data, master channel and extra channel information as *Signal* objects for unified operations with v3 and v4 files
- time domain operation using the *Signal* class
  - Pandas data frames are good if all the channels have the same time based
  - usually a measurement will have channels from different sources at different rates
  - the *Signal* class facilitates operations with such channels

CHAPTER 3

Major features not implemented (yet)

- for version 3
  - functionality related to sample reduction block (but the class is defined)
- for version 4
  - handling of bus logging measurements
  - handling of unfinnished measurements (mdf 4)
  - full support for remaining mdf 4 channel arrays types
  - xml schema for TXBLOCK and MDBLOCK
  - partial conversions
  - event blocks

CHAPTER 4

Dependencies

asammdf uses the following libraries

- numpy : the heart that makes all tick
- numexpr : for algebraic and rational channel conversions
- matplotlib : for Signal plotting
- wheel : for installation in virtual environments

optional dependencies needed for exports

- pandas : for DataFrame export
- h5py : for HDF5 export
- xlsxwriter : for Excel export
- scipy : for Matlab .mat export

CHAPTER 5

Installation

asammdf is available on

- github: https://github.com/danielhrisca/asammdf/
- PyPI: https://pypi.org/project/asammdf/

```
pip install asammdf
```

CHAPTER 6

API

6.1 Package level

`asammdf.configure`(*integer_compacting=None*, *split_data_blocks=None*, *split_threshold=None*)

configure asammdf parameters

Parameters **integer_compacting** : bool

enable/disable compacting of integer channels on append. This has the potential to greatly reduce file size, but append speed is slower and further loading of the resulting file will also be slower.

split_data_blocks : bool

enable/disable splitting of large data blocks using data lists for mdf version 4

split_treshold : int

size of splitted data blocks, default 2MB; if the initial size is smaller then no data list is used

Enabling compacting of integer channels on append the file size of the resulting file can decrease up to a factor of ~0.5. Splitting the data blocks is usefull for large blocks. The recommended maximum threshold by ASAM is 4MB. *asammdf* uses a default of 2MB

6.2 MDF

This class acts as a proxy for the MDF3 and MDF4 classes. All attribute access is delegated to the underlying *_file* attribute (MDF3 or MDF4 object). See MDF3 and MDF4 for available extra methods.

An empty MDF file is created if the *name* argument is not provided. If the *name* argument is provided then the file must exist in the filesystem, otherwise an exception is raised.

Best practice is to use the MDF as a context manager. This way all resources are released correctly in case of exceptions.

```
with MDF(r'test.mdf') as mdf_file:
    # do something
```

class `asammdf.mdf.MDF` (*name=None*, *load_measured_data=True*, *version='4.10'*)

Unified access to MDF v3 and v4 files.

Parameters **name** : string

mdf file name, if provided it must be a real file name

load_measured_data : bool

load data option; default *True*

- if *True* the data group binary data block will be loaded in RAM
- if *False* the channel data is read from disk on request

version : string

mdf file version ('3.00', '3.10', '3.20', '3.30', '4.00', '4.10', '4.11'); default '4.10'

Methods

`convert`	
`cut`	
`export`	
`filter`	
`iter_to_pandas`	
`merge`	
`select`	This module supports asynchronous I/O on multiple file descriptors.

convert (*to*, *load_measured_data=True*)

convert MDF to other versions

Parameters **to** : str

new mdf version from ('3.00', '3.10', '3.20', '3.30', '4.00', '4.10', '4.11')

load_measured_data : bool

load data option; default *True*

- if *True* the data group binary data block will be loaded in RAM
- if *False* the channel data is stored to a temporary file and

read from disk on request

Returns **out** : MDF

new MDF object

cut (*start=None*, *stop=None*, *whence=0*)

convert MDF to other versions

Parameters **start** : float

start time, default None. If *None* then the start of measurement is used

stop : float

stop time, default . If *None* then the end of measurement is used

whence : int

how to search for the start and stop values

- 0 : absolute
- 1 : relative to first timestamp

Returns **out** : MDF

new MDF object

`export` (*fmt*, *filename=None*)

export MDF to other formats. The *MDF* file name is used is available, else the *filename* aragument must be provided.

Parameters **fmt** : string

can be one of the following:

- *csv* : CSV export that uses the ";" delimiter. This option

will generate a new csv file for each data group (<MDF-NAME>_DataGroup_<cntr>.csv)

- *hdf5* : HDF5 file output; each *MDF* data group is mapped to

a *HDF5* group with the name 'DataGroup_<cntr>' (where <cntr> is the index)

- *excel* : Excel file output (very slow). This option will

generate a new excel file for each data group (<MDF-NAME>_DataGroup_<cntr>.xlsx)

- *mat* : Matlab .mat version 5 export, for Matlab >= 7.6. In

the mat file the channels will be renamed to 'DataGroup_<cntr>_<channel name>'. The channel group master will be renamed to 'DataGroup_<cntr>_<channel name>_master' (*<cntr>* is the data group index starting from 0)

filename : string

export file name

`filter` (*channels*)

return new *MDF* object that contains only the channels listed in *channels* argument

Parameters **channels** : list

list of channel names to be filtered

Returns **mdf** : MDF

new MDF file

`iter_to_pandas` ()

generator that yields channel groups as pandas DataFrames

static **`merge`** (*files*, *outversion='4.10'*, *load_measured_data=True*)

merge several files and return the merged MDF object. The files must have the same internal structure (same number of groups, and same channels in each group)

Parameters **files** : list | tuple

list of MDF file names

outversion : str

merged file version

load_measured_data : bool

load data option; default *True*

- if *True* the data group binary data block will be loaded in RAM
- if *False* the channel data is stored to a temporary file and

read from disk on request

Returns **merged** : MDF

new MDF object with merged channels

Raises **MdfException** : if there are inconsistances between the files

merged MDF object

select(*channels*)

return the channels listed in *channels* argument

Parameters **channels** : list

list of channel names to be filtered

Returns **signals** : list

lsit of *Signal* objects based on the input channel list

6.2.1 MDF3 and MDF4 classes

MDF3

asammdf tries to emulate the mdf structure using Python builtin data types.

The *header* attibute is an OrderedDict that holds the file metadata.

The *groups* attribute is a dictionary list with the following keys:

- data_group : DataGroup object
- channel_group : ChannelGroup object
- channels : list of Channel objects with the same order as found in the mdf file
- channel_conversions : list of ChannelConversion objects in 1-to-1 relation with the channel list
- channel_sources : list of SourceInformation objects in 1-to-1 relation with the channels list
- chanel_dependencies : list of ChannelDependency objects in a 1-to-1 relation with the channel list
- data_block : DataBlock object
- texts : dictionay containing TextBlock objects used throughout the mdf
  - channels : list of dictionaries that contain TextBlock objects ralated to each channel
    - long_name_addr : channel long name
    - comment_addr : channel comment
    - display_name_addr : channel display name

  - channel group : list of dictionaries that contain TextBlock objects ralated to each channel group
    * comment_addr : channel group comment
  - conversion_tab : list of dictionaries that contain TextBlock objects ralated to VATB and VTABR channel conversions
    * text_{n} : n-th text of the VTABR conversion
- sorted : bool flag to indicate if the source file was sorted; it is used when *load_measured_data = False*
- size : data block size; used for lazy laoding of measured data
- record_size : dict of record ID -> record size pairs

The *file_history* attribute is a TextBlock object.

The *channel_db* attibute is a dictionary that holds the *(data group index, channel index)* pair for all signals. This is used to speed up the *get_signal_by_name* method.

The *master_db* attibute is a dictionary that holds the *channel index* of the master channel for all data groups. This is used to speed up the *get_signal_by_name* method.

API

class `asammdf.mdf3.`**`MDF3`**(*name=None*, *load_measured_data=True*, *version='3.30'*)

If the *name* exist it will be loaded otherwise an empty file will be created that can be later saved to disk

Parameters **name** : string

mdf file name

load_measured_data : bool

load data option; default *True*

- if *True* the data group binary data block will be loaded in RAM
- if *False* the channel data is read from disk on request

version : string

mdf file version ('3.00', '3.10', '3.20' or '3.30'); default '3.30'

Attributes

name	(string) mdf file name
groups	(list) list of data groups
header	(OrderedDict) mdf file header
file_history	(TextBlock) file history text block; can be None
load_measured_data	(bool) load measured data option
version	(str) mdf version
channels_db	(dict) used for fast channel access by name; for each name key the value is a list of (group index, channel index) tuples
masters_db	(dict) used for fast master channel access; for each group index key the value is the master channel index

Methods

add_trigger
append
close
get
get_master
info
iter_get_triggers
save

add_trigger (*group*, *timestamp*, *pre_time=0*, *post_time=0*, *comment=''*)

add trigger to data group

Parameters **group** : int

group index

timestamp : float

trigger time

pre_time : float

trigger pre time; default 0

post_time : float

trigger post time; default 0

comment : str

trigger comment

append (*signals*, *acquisition_info='Python'*, *common_timebase=False*)

Appends a new data group.

For channel depencies type Signals, the *samples* attribute must be a numpy.recarray

Parameters **signals** : list

list on *Signal* objects

acquisition_info : str

acquisition information; default 'Python'

common_timebase : bool

flag to hint that the signals have the same timebase

Examples

```
>>> # case 1 conversion type None
>>> s1 = np.array([1, 2, 3, 4, 5])
>>> s2 = np.array([-1, -2, -3, -4, -5])
>>> s3 = np.array([0.1, 0.04, 0.09, 0.16, 0.25])
>>> t = np.array([0.001, 0.002, 0.003, 0.004, 0.005])
>>> names = ['Positive', 'Negative', 'Float']
>>> units = ['+', '-', '.f']
>>> info = {}
>>> s1 = Signal(samples=s1, timstamps=t, unit='+', name='Positive')
```

```
>>> s2 = Signal(samples=s2, timstamps=t, unit='-', name='Negative')
>>> s3 = Signal(samples=s3, timstamps=t, unit='flts', name='Floats')
>>> mdf = MDF3('new.mdf')
>>> mdf.append([s1, s2, s3], 'created by asammdf v1.1.0')
>>> # case 2: VTAB conversions from channels inside another file
>>> mdf1 = MDF3('in.mdf')
>>> ch1 = mdf1.get("Channel1_VTAB")
>>> ch2 = mdf1.get("Channel2_VTABR")
>>> sigs = [ch1, ch2]
>>> mdf2 = MDF3('out.mdf')
>>> mdf2.append(sigs, 'created by asammdf v1.1.0')
```

close()

if the MDF was created with load_measured_data=False and new channels have been appended, then this must be called just before the object is not used anymore to clean-up the temporary file

get(*name=None*, *group=None*, *index=None*, *raster=None*, *samples_only=False*, *data=None*)

Gets channel samples. Channel can be specified in two ways:

- using the first positional argument *name*
  - if there are multiple occurances for this channel then the

  group and *index* arguments can be used to select a specific group. * if there are multiple occurances for this channel and either the *group* or *index* arguments is None then a warning is issued
- using the group number (keyword argument *group*) and the channel

number (keyword argument *index*). Use *info* method for group and channel numbers

If the *raster* keyword argument is not *None* the output is interpolated accordingly.

Parameters **name** : string

name of channel

group : int

0-based group index

index : int

0-based channel index

raster : float

time raster in seconds

samples_only : bool

if *True* return only the channel samples as numpy array; if *False* return a *Signal* object

Returns **res** : (numpy.array | Signal)

returns *Signal* if *samples_only*=*False* (default option), otherwise returns numpy.array. The *Signal* samples are:

- numpy recarray for channels that have CDBLOCK or BYTEARRAY

type channels * numpy array for all the rest

Raises **MdfError :**

*** if the channel name is not found**

*** if the group index is out of range**

*** if the channel index is out of range**

get_master(*index*, *data=None*)

returns master channel samples for given group

Parameters **index** : int

group index

data : bytes

data block raw bytes; default None

Returns **t** : numpy.array

master channel samples

info()

get MDF information as a dict

Examples

```
>>> mdf = MDF3('test.mdf')
>>> mdf.info()
```

iter_get_triggers()

generator that yields triggers

Returns **trigger_info** : dict

trigger information with the following keys:

- comment : trigger comment
- time : trigger time
- pre_time : trigger pre time
- post_time : trigger post time
- index : trigger index
- group : data group index of trigger

save(*dst=''*, *overwrite=False*, ***kargs*)

Save MDF to *dst*. If *dst* is not provided the the destination file name is the MDF name. If overwrite is *True* then the destination file is overwritten, otherwise the file name is appened with '_<cntr>', were '<cntr>' is the first conter that produces a new file name (that does not already exist in the filesystem).

Parameters **dst** : str

destination file name, Default ''

overwrite : bool

overwrite flag, default *False*

compression : int

does nothing for mdf version3; introduced here to share the same API as mdf version 4 files

MDF version 3 blocks

The following classes implement different MDF version3 blocks.

Channel Class

class `asammdf.mdf3.Channel`(***kargs*)

CNBLOCK class derived from *dict*

The Channel object can be created in two modes:

- using the *file_stream* and *address* keyword parameters - when reading

from file * using any of the following presented keys - when creating a new Channel

The keys have the following meaning:

- id - Block type identifier, always "CN"
- block_len - Block size of this block in bytes (entire CNBLOCK)
- next_ch_addr - Pointer to next channel block (CNBLOCK) of this channel

group (NIL allowed) * conversion_addr - Pointer to the conversion formula (CCBLOCK) of this signal (NIL allowed) * source_depend_addr - Pointer to the source-depending extensions (CEBLOCK) of this signal (NIL allowed) * ch_depend_addr - Pointer to the dependency block (CDBLOCK) of this signal (NIL allowed) * comment_addr - Pointer to the channel comment (TXBLOCK) of this signal (NIL allowed) * channel_type - Channel type

- 0 = data channel
- 1 = time channel for all signals of this group (in each channel group,

exactly one channel must be defined as time channel). The time stamps recording in a time channel are always relative to the start time of the measurement defined in HDBLOCK.

- short_name - Short signal name, i.e. the first 31 characters of the

ASAM-MCD name of the signal (end of text should be indicated by 0) * description - Signal description (end of text should be indicated by 0) * start_offset - Start offset in bits to determine the first bit of the signal in the data record. The start offset N is divided into two parts: a "Byte offset" (= N div 8) and a "Bit offset" (= N mod 8). The channel block can define an "additional Byte offset" (see below) which must be added to the Byte offset. * bit_count - Number of bits used to encode the value of this signal in a data record * data_type - Signal data type * range_flag - Value range valid flag * min_raw_value - Minimum signal value that occurred for this signal (raw value) * max_raw_value - Maximum signal value that occurred for this signal (raw value) * sampling_rate - Sampling rate for a virtual time channel. Unit [s] * long_name_addr - Pointer to TXBLOCK that contains the ASAM-MCD long signal name * display_name_addr - Pointer to TXBLOCK that contains the signal's display name (NIL allowed) * aditional_byte_offset - Additional Byte offset of the signal in the data record (default value: 0).

Parameters **file_stream** : file handle

mdf file handle

address : int

block address inside mdf file

Examples

```
>>> with open('test.mdf', 'rb') as mdf:
...     ch1 = Channel(file_stream=mdf, address=0xBA52)
>>> ch2 = Channel()
>>> ch1.name
'VehicleSpeed'
>>> ch1['id']
b'CN'
```

Attributes

name	(str) full channel name
address	(int) block address inside mdf file
dependencies	(list) lsit of channel dependencies

Methods

`clear`	
`copy`	Generic (shallow and deep) copying operations.
`fromkeys`	
`get`	
`items`	
`keys`	
`pop`	
`popitem`	
`setdefault`	
`update`	
`values`	

ChannelConversion Class

class `asammdf.mdf3.`**`ChannelConversion`**(***kargs*)

CCBLOCK class derived from *dict*

The ChannelConversion object can be created in two modes:

- using the *file_stream* and *address* keyword parameters - when reading

from file * using any of the following presented keys - when creating a new ChannelConversion

The first keys are common for all conversion types, and are followed by conversion specific keys. The keys have the following meaning:

- common keys
  - id - Block type identifier, always "CC"
  - block_len - Block size of this block in bytes (entire CCBLOCK)
  - range_flag - Physical value range valid flag:
  - min_phy_value - Minimum physical signal value that occurred for this

signal * max_phy_value - Maximum physical signal value that occurred for this signal * unit - Physical unit (string should be terminated with 0) * conversion_type - Conversion type (formula identifier) * ref_param_nr - Size information about additional conversion data

- specific keys
  - linear conversion
    - b - offset
    - a - factor
    - CANapeHiddenExtra - sometimes CANape appends extra information;

    not compliant with MDF specs
  - ASAM formula conversion
    - formula - ecuation as string
  - polynomial or rational conversion
    - P1 .. P6 - factors
  - exponential or logarithmic conversion
    - P1 .. P7 - factors
  - tabular with or without interpolation (grouped by *n*)
    - raw_{n} - n-th raw integer value (X axis)
    - phys_{n} - n-th physical value (Y axis)
  - text table conversion
    - param_val_{n} - n-th integers value (X axis)
    - text_{n} - n-th text value (Y axis)
  - text range table conversion
    - lower_{n} - n-th lower raw value
    - upper_{n} - n-th upper raw value
    - text_{n} - n-th text value

Parameters **file_stream** : file handle

mdf file handle

address : int

block address inside mdf file

Examples

```
>>> with open('test.mdf', 'rb') as mdf:
...     cc1 = ChannelConversion(file_stream=mdf, address=0xBA52)
>>> cc2 = ChannelConversion(conversion_type=0)
>>> cc1['b'], cc1['a']
0, 100.0
```

Attributes

address	(int) block address inside mdf file

Methods

`clear`	
`copy`	Generic (shallow and deep) copying operations.
`fromkeys`	
`get`	
`items`	
`keys`	
`pop`	
`popitem`	
`setdefault`	
`update`	
`values`	

ChannelDependency Class

class `asammdf.mdf3.`**`ChannelDependency`**(***kargs*)

CDBLOCK class derived from *dict*

Currently the ChannelDependency object can only be created using the *file_stream* and *address* keyword parameters when reading from file

The keys have the following meaning:

- id - Block type identifier, always "CD"
- block_len - Block size of this block in bytes (entire CDBLOCK)
- dependency_type - Dependency type
- sd_nr - Total number of signals dependencies (m)
- for each dependency there is a group of three keys:
  - dg_{n} - Pointer to the data group block (DGBLOCK) of signal dependency *n*
  - cg_{n} - Pointer to the channel group block (DGBLOCK) of signal dependency *n*
  - ch_{n} - Pointer to the channel block (DGBLOCK) of signal dependency *n*
- there can also be optional keys which decribe dimensions for the N-dimensional dependencies:
  - dim_{n} - Optional: size of dimension *n* for N-dimensional dependency

Parameters **file_stream** : file handle

mdf file handle

address : int

block address inside mdf file

Attributes

address	(int) block address inside mdf file

Methods

`clear`	
`copy`	Generic (shallow and deep) copying operations.
`fromkeys`	
`get`	
`items`	
`keys`	
`pop`	
`popitem`	
`setdefault`	
`update`	
`values`	

ChannelExtension Class

class `asammdf.mdf3.`**`ChannelExtension`**(***kargs*)

CEBLOCK class derived from *dict*

The ChannelExtension object can be created in two modes:

- using the *file_stream* and *address* keyword parameters - when reading from file
- using any of the following presented keys - when creating a new ChannelExtension

The first keys are common for all conversion types, and are followed by conversion specific keys. The keys have the following meaning:

- common keys
  - id - Block type identifier, always "CE"
  - block_len - Block size of this block in bytes (entire CEBLOCK)
  - type - Extension type identifier
- specific keys
  - for DIM block
    - module_nr - Number of module
    - module_address - Address
    - description - Description
    - ECU_identification - Identification of ECU
    - reserved0' - reserved
  - for Vector CAN block
    - CAN_id - Identifier of CAN message
    - CAN_ch_index - Index of CAN channel

* message_name - Name of message (string should be terminated by 0)
* sender_name - Name of sender (string should be terminated by 0)
* reserved0 - reserved

Parameters **file_stream** : file handle

mdf file handle

address : int

block address inside mdf file

Attributes

address	(int) block address inside mdf file

Methods

`clear`	
`copy`	Generic (shallow and deep) copying operations.
`fromkeys`	
`get`	
`items`	
`keys`	
`pop`	
`popitem`	
`setdefault`	
`update`	
`values`	

ChannelGroup Class

class `asammdf.mdf3.`**`ChannelGroup`**(***kargs*)

CGBLOCK class derived from *dict*

The ChannelGroup object can be created in two modes:

- using the *file_stream* and *address* keyword parameters - when reading from file
- using any of the following presented keys - when creating a new ChannelGroup

The keys have the following meaning:

- id - Block type identifier, always "CG"
- block_len - Block size of this block in bytes (entire CGBLOCK)
- next_cg_addr - Pointer to next channel group block (CGBLOCK) (NIL allowed)
- first_ch_addr - Pointer to first channel block (CNBLOCK) (NIL allowed)
- comment_addr - Pointer to channel group comment text (TXBLOCK) (NIL allowed)
- record_id - Record ID, i.e. value of the identifier for a record if the DGBLOCK defines a number of record IDs > 0

- ch_nr - Number of channels (redundant information)
- samples_byte_nr - Size of data record in Bytes (without record ID), i.e. size of plain data for a each recorded sample of this channel group
- cycles_nr - Number of records of this type in the data block i.e. number of samples for this channel group
- sample_reduction_addr - only since version 3.3. Pointer to first sample reduction block (SRBLOCK) (NIL allowed) Default value: NIL.

Parameters **file_stream** : file handle

mdf file handle

address : int

block address inside mdf file

Examples

```
>>> with open('test.mdf', 'rb') as mdf:
...     cg1 = ChannelGroup(file_stream=mdf, address=0xBA52)
>>> cg2 = ChannelGroup(sample_bytes_nr=32)
>>> hex(cg1.address)
0xBA52
>>> cg1['id']
b'CG'
```

Attributes

address	(int) block address inside mdf file

Methods

`clear`	
`copy`	Generic (shallow and deep) copying operations.
`fromkeys`	
`get`	
`items`	
`keys`	
`pop`	
`popitem`	
`setdefault`	
`update`	
`values`	

DataGroup Class

class `asammdf.mdf3.`**`DataGroup`**(***kargs*)

DGBLOCK class derived from *dict*

The DataGroup object can be created in two modes:

- using the *file_stream* and *address* keyword parameters - when reading from file
- using any of the following presented keys - when creating a new DataGroup

The keys have the following meaning:

- id - Block type identifier, always "DG"
- block_len - Block size of this block in bytes (entire DGBLOCK)
- next_dg_addr - Pointer to next data group block (DGBLOCK) (NIL allowed)
- first_cg_addr - Pointer to first channel group block (CGBLOCK) (NIL allowed)
- trigger_addr - Pointer to trigger block (TRBLOCK) (NIL allowed)
- data_block_addr - Pointer to the data block (see separate chapter on data storage)
- cg_nr - Number of channel groups (redundant information)
- record_id_nr - Number of record IDs in the data block
- reserved0 - since version 3.2; Reserved

Parameters **file_stream** : file handle

mdf file handle

address : int

block address inside mdf file

Attributes

address	(int) block address inside mdf file

Methods

`clear`	
`copy`	Generic (shallow and deep) copying operations.
`fromkeys`	
`get`	
`items`	
`keys`	
`pop`	
`popitem`	
`setdefault`	
`update`	
`values`	

FileIdentificationBlock Class

class `asammdf.mdf3.`**`FileIdentificationBlock`**`(`***kargs*`)`

IDBLOCK class derived from *dict*

The TriggerBlock object can be created in two modes:

- using the *file_stream* and *address* keyword parameters - when reading from file

- using the classmethod *from_text*

The keys have the following meaning:

- file_identification - file identifier
- version_str - format identifier
- program_identification - program identifier
- byte_order - default byte order
- float_format - default floating-point format
- mdf_version - version number of MDF format
- code_page - code page number
- reserved0 - reserved
- reserved1 - reserved
- unfinalized_standard_flags - Standard Flags for unfinalized MDF
- unfinalized_custom_flags - Custom Flags for unfinalized MDF

Parameters **file_stream** : file handle

mdf file handle

version : int

mdf version in case of new file

Attributes

address	(int) block address inside mdf file; should be 0 always

Methods

`clear`	
`copy`	Generic (shallow and deep) copying operations.
`fromkeys`	
`get`	
`items`	
`keys`	
`pop`	
`popitem`	
`setdefault`	
`update`	
`values`	

HeaderBlock Class

class `asammdf.mdf3.`**`HeaderBlock`**`(`***kargs*`)`

HDBLOCK class derived from *dict*

The TriggerBlock object can be created in two modes:

- using the *file_stream* - when reading from file
- using the classmethod *from_text*

The keys have the following meaning:

- id - Block type identifier, always "HD"
- block_len - Block size of this block in bytes (entire HDBLOCK)
- first_dg_addr - Pointer to the first data group block (DGBLOCK)
- comment_addr - Pointer to the measurement file comment text (TXBLOCK) (NIL allowed)
- program_addr - Pointer to program block (PRBLOCK) (NIL allowed)
- dg_nr - Number of data groups (redundant information)
- date - Date at which the recording was started in "DD:MM:YYYY" format
- time - Time at which the recording was started in "HH:MM:SS" format
- author - author name
- organization - organization
- project - project name
- subject - subject

Since version 3.2 the following extra keys were added:

- abs_time - Time stamp at which recording was started in nanoseconds.
- tz_offset - UTC time offset in hours (= GMT time zone)
- time_quality - Time quality class
- timer_identification - Timer identification (time source),

Parameters **file_stream** : file handle

mdf file handle

Attributes

address	(int) block address inside mdf file; should be 64 always

Methods

`clear`	
`copy`	Generic (shallow and deep) copying operations.
`fromkeys`	
`get`	
`items`	
`keys`	
`pop`	
`popitem`	
`setdefault`	
`update`	

Continued on next page

Table 6.10 – continued from previous page

values

ProgramBlock Class

SampleReduction Class

TextBlock Class

class `asammdf.mdf3.`**`TextBlock`**`(`***kargs*`)`

TXBLOCK class derived from *dict*

The ProgramBlock object can be created in two modes:

- using the *file_stream* and *address* keyword parameters - when reading from file
- using the classmethod *from_text*

The keys have the following meaning:

- id - Block type identifier, always "TX"
- block_len - Block size of this block in bytes (entire TXBLOCK)
- text - Text (new line indicated by CR and LF; end of text indicated by 0)

Parameters **file_stream** : file handle

mdf file handle

address : int

block address inside mdf file

text : bytes

bytes for creating a new TextBlock

Examples

```
>>> tx1 = TextBlock.from_text('VehicleSpeed')
>>> tx1.text_str
'VehicleSpeed'
>>> tx1['text']
b'VehicleSpeed'
```

Attributes

address	(int) block address inside mdf file
text_str	(str) text data as unicode string

Methods

clear	
copy	Generic (shallow and deep) copying operations.
fromkeys	
get	
items	
keys	
pop	
popitem	
setdefault	
update	
values	

TriggerBlock Class

class `asammdf.mdf3.`**`TriggerBlock`**`(`***kargs*`)`

TRBLOCK class derived from *dict*

The TriggerBlock object can be created in two modes:

- using the *file_stream* and *address* keyword parameters - when reading from file
- using the classmethod *from_text*

The keys have the following meaning:

- id - Block type identifier, always "TX"
- block_len - Block size of this block in bytes (entire TRBLOCK)
- text_addr - Pointer to trigger comment text (TXBLOCK) (NIL allowed)
- trigger_events_nr - Number of trigger events n (0 allowed)
- trigger_{n}_time - Trigger time [s] of trigger event *n*
- trigger_{n}_pretime - Pre trigger time [s] of trigger event *n*
- trigger_{n}_posttime - Post trigger time [s] of trigger event *n*

Parameters **file_stream** : file handle

mdf file handle

address : int

block address inside mdf file

Attributes

address	(int) block address inside mdf file

Methods

clear	
copy	Generic (shallow and deep) copying operations.

Continued on next page

Table 6.12 – continued from previous page

`fromkeys`
`get`
`items`
`keys`
`pop`
`popitem`
`setdefault`
`update`
`values`

MDF4

asammdf tries to emulate the mdf structure using Python builtin data types.

The *header* attibute is an OrderedDict that holds the file metadata.

The *groups* attribute is a dictionary list with the following keys:

- data_group : DataGroup object
- channel_group : ChannelGroup object
- channels : list of Channel objects with the same order as found in the mdf file
- channel_conversions : list of ChannelConversion objects in 1-to-1 relation with the channel list
- channel_sources : list of SourceInformation objects in 1-to-1 relation with the channels list
- data_block : DataBlock object
- texts : dictionay containing TextBlock objects used throughout the mdf
  - channels : list of dictionaries that contain TextBlock objects ralated to each channel
    - name_addr : channel name
    - comment_addr : channel comment
  - channel group : list of dictionaries that contain TextBlock objects ralated to each channel group
    - acq_name_addr : channel group acquisition comment
    - comment_addr : channel group comment
  - conversion_tab : list of dictionaries that contain TextBlock objects related to TABX and RTABX channel conversions
    - text_{n} : n-th text of the VTABR conversion
    - default_addr : default text
  - conversions : list of dictionaries that containt TextBlock obejcts related to channel conversions
    - name_addr : converions name
    - unit_addr : channel unit_addr
    - comment_addr : converison comment
    - formula_addr : formula text; only valid for algebraic conversions
  - sources : list of dictionaries that containt TextBlock obejcts related to channel sources
    - name_addr : source name

* path_addr : source path_addr
* comment_addr : source comment

The *file_history* attribute is a list of (FileHistory, TextBlock) pairs .

The *channel_db* attibute is a dictionary that holds the *(data group index, channel index)* pair for all signals. This is used to speed up the *get_signal_by_name* method.

The *master_db* attibute is a dictionary that holds the *channel index* of the master channel for all data groups. This is used to speed up the *get_signal_by_name* method.

API

class `asammdf.mdf4.MDF4` (*name=None*, *load_measured_data=True*, *version='4.10'*)

If the *name* exist it will be loaded otherwise an empty file will be created that can be later saved to disk

Parameters **name** : string

mdf file name

load_measured_data : bool

load data option; default *True*

- if *True* the data group binary data block will be loaded in RAM
- if *False* the channel data is read from disk on request

version : string

mdf file version ('4.00', '4.10', '4.11'); default '4.10'

Attributes

name	(string) mdf file name
groups	(list) list of data groups
header	(HeaderBlock) mdf file header
file_history	(list) list of (FileHistory, TextBlock) pairs
comment	(TextBlock) mdf file comment
identification	(FileIdentificationBlock) mdf file start block
load_measured_data	(bool) load measured data option
version	(str) mdf version
channels_db	(dict) used for fast channel access by name; for each name key the value is a list of (group index, channel index) tuples
masters_db	(dict) used for fast master channel access; for each group index key the value is the master channel index

Methods

`append`
`attach`
`close`
`extract_attachment`

Continued on next page

Table 6.13 – continued from previous page

get
get_master
info
save

append(*signals*, *source_info='Python'*, *common_timebase=False*)

Appends a new data group.

For channel depencies type Signals, the *samples* attribute must be a numpy.recarray

Parameters **signals** : list

list on *Signal* objects

source_info : str

source information; default 'Python'

common_timebase : bool

flag to hint that the signals have the same timebase

Examples

```
>>> # case 1 conversion type None
>>> s1 = np.array([1, 2, 3, 4, 5])
>>> s2 = np.array([-1, -2, -3, -4, -5])
>>> s3 = np.array([0.1, 0.04, 0.09, 0.16, 0.25])
>>> t = np.array([0.001, 0.002, 0.003, 0.004, 0.005])
>>> names = ['Positive', 'Negative', 'Float']
>>> units = ['+', '-', '.f']
>>> info = {}
>>> s1 = Signal(samples=s1, timstamps=t, unit='+', name='Positive')
>>> s2 = Signal(samples=s2, timstamps=t, unit='-', name='Negative')
>>> s3 = Signal(samples=s3, timstamps=t, unit='flts', name='Floats')
>>> mdf = MDF3('new.mdf')
>>> mdf.append([s1, s2, s3], 'created by asammdf v1.1.0')
>>> # case 2: VTAB conversions from channels inside another file
>>> mdf1 = MDF3('in.mdf')
>>> ch1 = mdf1.get("Channel1_VTAB")
>>> ch2 = mdf1.get("Channel2_VTABR")
>>> sigs = [ch1, ch2]
>>> mdf2 = MDF3('out.mdf')
>>> mdf2.append(sigs, 'created by asammdf v1.1.0')
```

attach(*data*, *file_name=None*, *comment=None*, *compression=True*, *mime='application/octet-stream'*)

attach embedded attachment as application/octet-stream

Parameters **data** : bytes

data to be attached

file_name : str

string file name

comment : str

attachment comment

compression : bool

use compression for embedded attachment data

mime : str

mime type string

close()

if the MDF was created with load_measured_data=False and new channels have been appended, then this must be called just before the object is not used anymore to clean-up the temporary file

extract_attachment(*index*)

extract attachemnt *index* data. If it is an embedded attachment, then this method creates the new file according to the attachemnt file name information

Parameters **index** : int

attachment index

Returns **data** : bytes | str

attachment data

get(*name=None*, *group=None*, *index=None*, *raster=None*, *samples_only=False*, *data=None*)

Gets channel samples. Channel can be specified in two ways:

- using the first positional argument *name*
  - if there are multiple occurances for this channel then the

  group and *index* arguments can be used to select a specific group. * if there are multiple occurances for this channel and either the *group* or *index* arguments is None then a warning is issued
- using the group number (keyword argument *group*) and the channel

number (keyword argument *index*). Use *info* method for group and channel numbers

If the *raster* keyword argument is not *None* the output is interpolated accordingly

Parameters **name** : string

name of channel

group : int

0-based group index

index : int

0-based channel index

raster : float

time raster in seconds

samples_only : bool

if *True* return only the channel samples as numpy array; if *False* return a *Signal* object

Returns **res** : (numpy.array | Signal)

returns *Signal* if *samples_only*=*False* (default option), otherwise returns numpy.array The *Signal* samples are:

- numpy recarray for channels that have composition/channel

array address or for channel of type BYTEARRAY, CANOPENDATE, CANOPENTIME * numpy array for all the rest

Raises MdfError :

*** if the channel name is not found**

*** if the group index is out of range**

*** if the channel index is out of range**

get_master(*index*, *data=None*)

returns master channel samples for given group

Parameters index : int

group index

data : bytes

data block raw bytes; default None

Returns t : numpy.array

master channel samples

info()

get MDF information as a dict

Examples

```
>>> mdf = MDF4('test.mdf')
>>> mdf.info()
```

save(*dst=''*, *overwrite=False*, *compression=0*)

Save MDF to *dst*. If *dst* is not provided the the destination file name is the MDF name. If overwrite is *True* then the destination file is overwritten, otherwise the file name is appened with '_<cntr>', were '<cntr>' is the first conter that produces a new file name (that does not already exist in the filesystem)

Parameters dst : str

destination file name, Default ''

overwrite : bool

overwrite flag, default *False*

compression : int

use compressed data blocks, default 0; valid since version 4.10

- 0 - no compression
- 1 - deflate (slower, but produces smaller files)
- 2 - transposition + deflate (slowest, but produces the smallest

files)

MDF version 4 blocks

The following classes implement different MDF version3 blocks.

AttachmentBlock Class

class `asammdf.mdf4.`**`AttachmentBlock`**`(`***kargs*`)`

ATBLOCK class

When adding new attachments only embedded attachemnts are allowed, with keyword argument *data* of type bytes

Methods

`clear`	
`copy`	Generic (shallow and deep) copying operations.
`extract`	
`fromkeys`	
`get`	
`items`	
`keys`	
`pop`	
`popitem`	
`setdefault`	
`update`	
`values`	

Channel Class

class `asammdf.mdf4.`**`Channel`**`(`***kargs*`)`

CNBLOCK class

Methods

`clear`	
`copy`	Generic (shallow and deep) copying operations.
`fromkeys`	
`get`	
`items`	
`keys`	
`pop`	
`popitem`	
`setdefault`	
`update`	
`values`	

ChannelConversion Class

class `asammdf.mdf4.`**`ChannelConversion`**`(`***kargs*`)`

CCBLOCK class

Methods

`clear`	
`copy`	Generic (shallow and deep) copying operations.
`fromkeys`	
`get`	
`items`	
`keys`	
`pop`	
`popitem`	
`setdefault`	
`update`	
`values`	

ChannelGroup Class

class `asammdf.mdf4.`**`ChannelGroup`**`(`***kargs*`)`

CGBLOCK class

Methods

`clear`	
`copy`	Generic (shallow and deep) copying operations.
`fromkeys`	
`get`	
`items`	
`keys`	
`pop`	
`popitem`	
`setdefault`	
`update`	
`values`	

DataGroup Class

class `asammdf.mdf4.`**`DataGroup`**`(`***kargs*`)`

DGBLOCK class

Methods

clear	
copy	Generic (shallow and deep) copying operations.
fromkeys	
get	
items	
keys	
pop	
popitem	
setdefault	
update	
values	

DataList Class

class asammdf.mdf4.**DataList**(***kargs*)

DLBLOCK class

Methods

clear	
copy	Generic (shallow and deep) copying operations.
fromkeys	
get	
items	
keys	
pop	
popitem	
setdefault	
update	
values	

DataBlock Class

class asammdf.mdf4.**DataBlock**(***kargs*)

DTBLOCK class

Parameters **address** : int

DTBLOCK address inside the file

file_stream : int

file handle

Methods

clear	
copy	Generic (shallow and deep) copying operations.

Continued on next page

Table 6.20 – continued from previous page

fromkeys	
get	
items	
keys	
pop	
popitem	
setdefault	
update	
values	

FileIdentificationBlock Class

class asammdf.mdf4.**FileIdentificationBlock**(***kargs*)

IDBLOCK class

Methods

clear	
copy	Generic (shallow and deep) copying operations.
fromkeys	
get	
items	
keys	
pop	
popitem	
setdefault	
update	
values	

HeaderBlock Class

class asammdf.mdf4.**HeaderBlock**(***kargs*)

HDBLOCK class

Methods

clear	
copy	Generic (shallow and deep) copying operations.
fromkeys	
get	
items	
keys	
pop	
popitem	
setdefault	
update	

Continued on next page

Table 6.22 – continued from previous page

values	

SourceInformation Class

class asammdf.mdf4.**SourceInformation**(**kargs)

SIBLOCK class

Methods

clear	
copy	Generic (shallow and deep) copying operations.
fromkeys	
get	
items	
keys	
pop	
popitem	
setdefault	
update	
values	

FileHistory Class

class asammdf.mdf4.**FileHistory**(**kargs)

FHBLOCK class

Methods

clear	
copy	Generic (shallow and deep) copying operations.
fromkeys	
get	
items	
keys	
pop	
popitem	
setdefault	
update	
values	

TextBlock Class

class asammdf.mdf4.**TextBlock**(**kargs)

common TXBLOCK and MDBLOCK class

Methods

`clear`	
`copy`	Generic (shallow and deep) copying operations.
`fromkeys`	
`get`	
`items`	
`keys`	
`pop`	
`popitem`	
`setdefault`	
`update`	
`values`	

6.2.2 Notes about *load_measured_data* argument

By default when the *MDF* object is created the raw channel data is loaded into RAM. This will give you the best performance from *asammdf*.

However if you reach the physical memmory limit *asammdf* gives you the option use the *load_measured_data* flag. In this case the raw channel data is not read.

MDF defaults

Advantages

- best performance

Disadvantages

- higher RAM usage, there is the chance the file will exceed available RAM

Use case

- when data fits inside the system RAM

MDF with *load_measured_data*

Advantages

- lowest RAM usage
- can handle files that do not fit in the available physical memory

Disadvantages

- slow performance for getting channel data
- must call *close* method to release the temporary file used in case of appending.

Note: it is advised to use the MDF context manager in this case

Use case

- when *default* data exceeds available RAM

- it is advised to avoid getting individual channels when using this ioption.

Instead you can get performance close to load_measured_data=True if you use the *select* method with the list of target channels.

Note: See benchmarks for the effects of using the flag

6.3 Signal

class `asammdf.signal.`**`Signal`**(*samples=None*, *timestamps=None*, *unit=''*, *name=''*, *info=None*, *comment=''*)

The Signal represents a signal described by it's samples and timestamps. It can do aritmethic operations agains other Signal or numeric type. The operations are computed in respect to the timestamps (time correct). The integer signals are not interpolated, instead the last value relative to the current timestamp is used. *samples*, *timstamps* and *name* are mandatory arguments.

Parameters **samples** : numpy.array | list | tuple

signal samples

timestamps : numpy.array | list | tuple

signal timestamps

unit : str

signal unit

name : str

signal name

info : dict

dict that contains extra information about the signal , default *None*

comment : str

signal comment, default ''

Methods

`astype`
`cut`
`extend`
`interp`
`plot`

`astype`(*np_type*)

returns new *Signal* with samples of dtype *np_type*

`cut`(*start=None*, *stop=None*)

Cuts the signal according to the *start* and *stop* values, by using the insertion indexes in the signal's *time* axis.

Parameters **start** : float

start timestamp for cutting

stop : float

stop timestamp for cutting

Returns **result** : Signal

new *Signal* cut from the original

Examples

```
>>> new_sig = old_sig.cut(1.0, 10.5)
>>> new_sig.timestamps[0], new_sig.timestamps[-1]
0.98, 10.48
```

extend(*other*)

extend signal with samples from another signal

Parameters **other** : Signal

interp(*new_timestamps*)

returns a new *Signal* interpolated using the *new_timestamps*

plot()

plot Signal samples

6.4 Examples

6.4.1 Working with MDF

```
from __future__ import print_function, division
from asammdf import MDF, Signal, configure
import numpy as np

# configure asammdf to optimize disk space usage
configure(integer_compacting=True)
# configure asammdf to split data blocks on 10KB blocks
configure(split_data_blocks=True, split_threshold=10*1024)


# create 3 Signal objects

timestamps = np.array([0.1, 0.2, 0.3, 0.4, 0.5], dtype=np.float32)

# unit8
s_uint8 = Signal(samples=np.array([0, 1, 2, 3, 4], dtype=np.uint8),
                 timestamps=timestamps,
                 name='Uint8_Signal',
                 unit='u1')
# int32
s_int32 = Signal(samples=np.array([-20, -10, 0, 10, 20], dtype=np.int32),
                 timestamps=timestamps,
                 name='Int32_Signal',
                 unit='i4')
```

```
# float64
s_float64 = Signal(samples=np.array([-20, -10, 0, 10, 20], dtype=np.int32),
                   timestamps=timestamps,
                   name='Float64_Signal',
                   unit='f8')

# create empty MDf version 4.00 file
mdf4 = MDF(version='4.10')

# append the 3 signals to the new file
signals = [s_uint8, s_int32, s_float64]
mdf4.append(signals, 'Created by Python')

# save new file
mdf4.save('my_new_file.mf4', overwrite=True)

# convert new file to mdf version 3.10 with load_measured_data=False
mdf3 = mdf4.convert(to='3.10', load_measured_data=False)
print(mdf3.version)

# get the float signal
sig = mdf3.get('Float64_Signal')
print(sig)

# cut measurement from 0.3s to end of measurement
mdf4_cut = mdf4.cut(start=0.3)
mdf4_cut.get('Float64_Signal').plot()

# cut measurement from start of measurement to 0.4s
mdf4_cut = mdf4.cut(stop=0.45)
mdf4_cut.get('Float64_Signal').plot()

# filter some signals from the file
mdf4 = mdf4.filter(['Int32_Signal', 'Uint8_Signal'])

# save using zipped transpose deflate blocks
mdf4.save('out.mf4', compression=2)
```

6.4.2 Working with Signal

```
from __future__ import print_function, division
from asammdf import Signal
import numpy as np


# create 3 Signal objects with different time stamps

# unit8 with 100ms time raster
timestamps = np.array([0.1 * t for t in range(5)], dtype=np.float32)
s_uint8 = Signal(samples=np.array([t for t in range(5)], dtype=np.uint8),
                 timestamps=timestamps,
                 name='Uint8_Signal',
                 unit='u1')

# int32 with 50ms time raster
timestamps = np.array([0.05 * t for t in range(10)], dtype=np.float32)
```

```
s_int32 = Signal(samples=np.array(list(range(-500, 500, 100)), dtype=np.int32),
                 timestamps=timestamps,
                 name='Int32_Signal',
                 unit='i4')

# float64 with 300ms time raster
timestamps = np.array([0.3 * t for t in range(3)], dtype=np.float32)
s_float64 = Signal(samples=np.array(list(range(2000, -1000, -1000)), dtype=np.int32),
                   timestamps=timestamps,
                   name='Float64_Signal',
                   unit='f8')

# map signals
xs = np.linspace(-1, 1, 50)
ys = np.linspace(-1, 1, 50)
X, Y = np.meshgrid(xs, ys)
vals = np.linspace(0, 180. / np.pi, 100)
phi = np.ones((len(vals), 50, 50), dtype=np.float64)
for i, val in enumerate(vals):
    phi[i] *= val
R = 1 - np.sqrt(X**2 + Y**2)
samples = np.cos(2 * np.pi * X + phi) * R
print(phi.shape, samples.shape)
timestamps = np.arange(0, 2, 0.02)

s_map = Signal(samples=samples,
               timestamps=timestamps,
               name='Variable Map Signal',
               unit='dB')
s_map.plot()


prod = s_float64 * s_uint8
prod.name = 'Uint8_Signal * Float64_Signal'
prod.unit = '*'
prod.plot()

pow2 = s_uint8 ** 2
pow2.name = 'Uint8_Signal ^ 2'
pow2.unit = 'u1^2'
pow2.plot()

allsum = s_uint8 + s_int32 + s_float64
allsum.name = 'Uint8_Signal + Int32_Signal + Float64_Signal'
allsum.unit = '+'
allsum.plot()

# inplace operations
pow2 *= -1
pow2.name = '- Uint8_Signal ^ 2'
pow2.plot()

# cut signal
s_int32.plot()
cut_signal = s_int32.cut(start=0.2, stop=0.35)
cut_signal.plot()
```

CHAPTER 7

Benchmarks

asammdf relies heavily on *dict* objects. Starting with Python 3.6 the *dict* objects are more compact and ordered (implementation detail); *asammdf* uses takes advantage of those changes so for best performance it is advised to use Python >= 3.6.

7.1 Intro

The benchmarks were done using two test files (available here https://github.com/danielhrisca/asammdf/issues/14) (for mdf version 3 and 4) of around 170MB. The files contain 183 data groups and a total of 36424 channels.

asamdf 2.6.5 was compared against *mdfreader 0.2.6* (latest versions from PyPI). *mdfreader* seems to be the most used Python package to handle MDF files, and it also supports both version 3 and 4 of the standard.

The three benchmark cathegories are file open, file save and extracting the data for all channels inside the file(36424 calls). For each cathegory two aspect were noted: elapsed time and peak RAM usage.

7.2 Dependencies

You will need the following packages to be able to run the benchmark script

- psutil
- mdfreader

7.3 Usage

Extract the test files from the archive, or provide a folder that contains the files "test.mdf" and "test.mf4". Run the module *bench.py* (see –help option for available options)

7.4 x64 Python results

Benchmark environment

- 3.6.2 (v3.6.2:5fd33b5, Jul 8 2017, 04:57:36) [MSC v.1900 64 bit (AMD64)]
- Windows-10-10.0.14393-SP0
- Intel64 Family 6 Model 94 Stepping 3, GenuineIntel
- 16GB installed RAM

Notations used in the results

- nodata = asammdf MDF object created with load_measured_data=False (raw channel data not loaded into RAM)
- compression = mdfreader mdf object created with compression=blosc
- compression bcolz 6 = mdfreader mdf object created with compression=6
- noDataLoading = mdfreader mdf object read with noDataLoading=True

Files used for benchmark:

- 183 groups
- 36424 channels

7.4.1 Raw data

Open file	Time [ms]	RAM [MB]
asammdf 2.6.5 mdfv3	779	364
asammdf 2.6.5 nodata mdfv3	551	187
mdfreader 0.2.6 mdfv3	2672	545
mdfreader 0.2.6 compress mdfv3	3844	267
mdfreader 0.2.6 compress bcolz 6 mdfv3	3886	1040
mdfreader 0.2.6 noDataLoading mdfv3	1400	198
asammdf 2.6.5 mdfv4	1883	435
asammdf 2.6.5 nodata mdfv4	1457	244
mdfreader 0.2.6 mdfv4	5371	1307
mdfreader 0.2.6 compress mdfv4	6470	1023
mdfreader 0.2.6 compress bcolz 6 mdfv4	6894	1746
mdfreader 0.2.6 noDataLoading mdfv4	4078	943

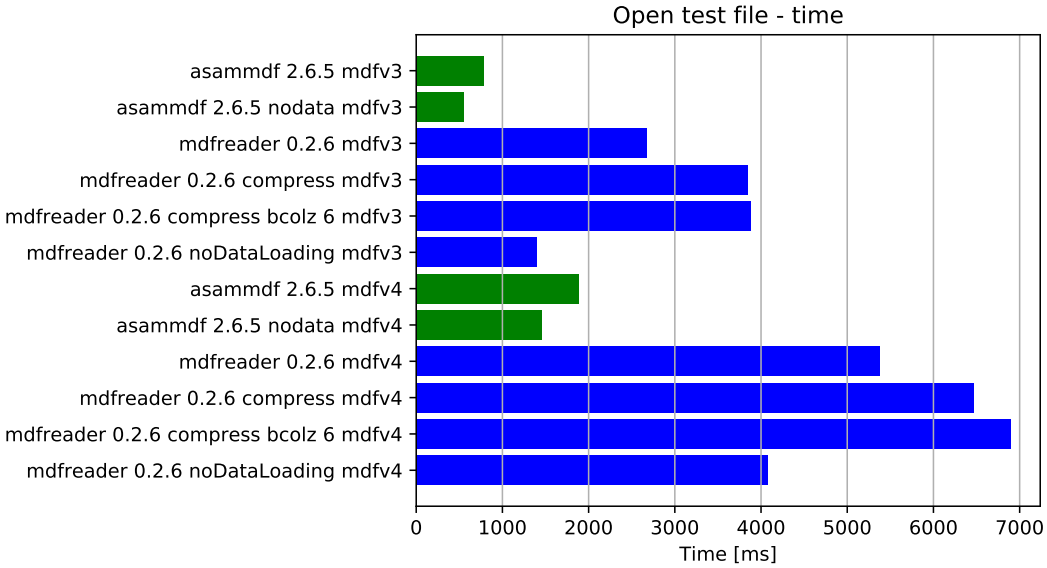
Save file	Time [ms]	RAM [MB]
asammdf 2.6.5 mdfv3	356	366
asammdf 2.6.5 nodata mdfv3	398	195
mdfreader 0.2.6 mdfv3	10164	577
mdfreader 0.2.6 compress mdfv3	12341	542
mdfreader 0.2.6 compress bcolz 6 mdfv3	11427	958
asammdf 2.6.5 mdfv4	805	440
asammdf 2.6.5 nodata mdfv4	522	255
mdfreader 0.2.6 mdfv4	7256	1328
mdfreader 0.2.6 compress mdfv4	7010	1288
mdfreader 0.2.6 compress bcolz6 mdfv4	6688	1763

Get all channels (36424 calls)	Time [ms]	RAM [MB]
asammdf 2.6.5 mdfv3	657	370
asammdf 2.6.5 nodata mdfv3	9647	200
mdfreader 0.2.6 mdfv3	67	544
mdfreader 0.2.6 compress mdfv3	698	270
mdfreader 0.2.6 compress bcolz 6 mdfv3	267	1042
asammdf 2.6.5 mdfv4	736	443
asammdf 2.6.5 nodata mdfv4	13552	254
mdfreader 0.2.6 mdfv4	64	1307
mdfreader 0.2.6 compress mdfv4	631	1031
mdfreader 0.2.6 compress bcolz 6 mdfv4	304	1753

Convert file	Time [ms]	RAM [MB]
asammdf 2.6.5 v3 to v4	3675	823
asammdf 2.6.5 v3 to v4 nodata	4607	379
asammdf 2.6.5 v4 to v3	4442	831
asammdf 2.6.5 v4 to v3 nodata	5105	366

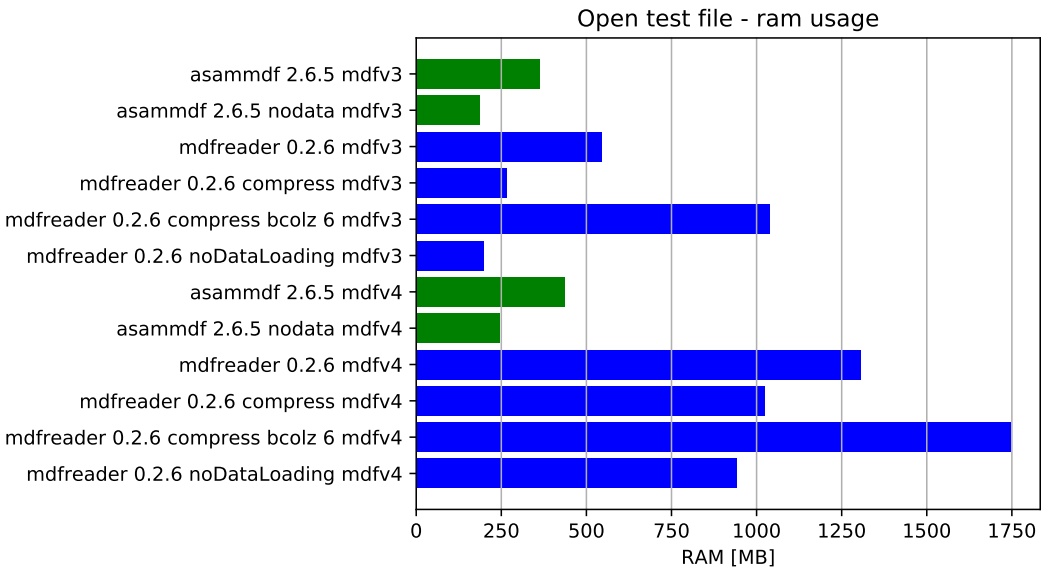
Merge files	Time [ms]	RAM [MB]
asammdf 2.6.5 v3	8605	1449
asammdf 2.6.5 v3 nodata	11089	544
asammdf 2.6.5 v4	13469	1536
asammdf 2.6.5 v4 nodata	15565	600

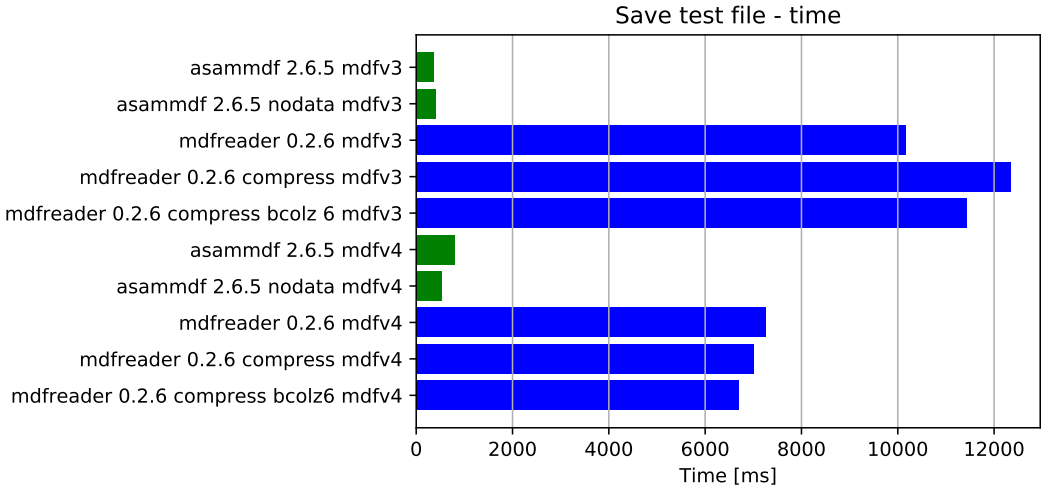
7.4.2 Graphical results

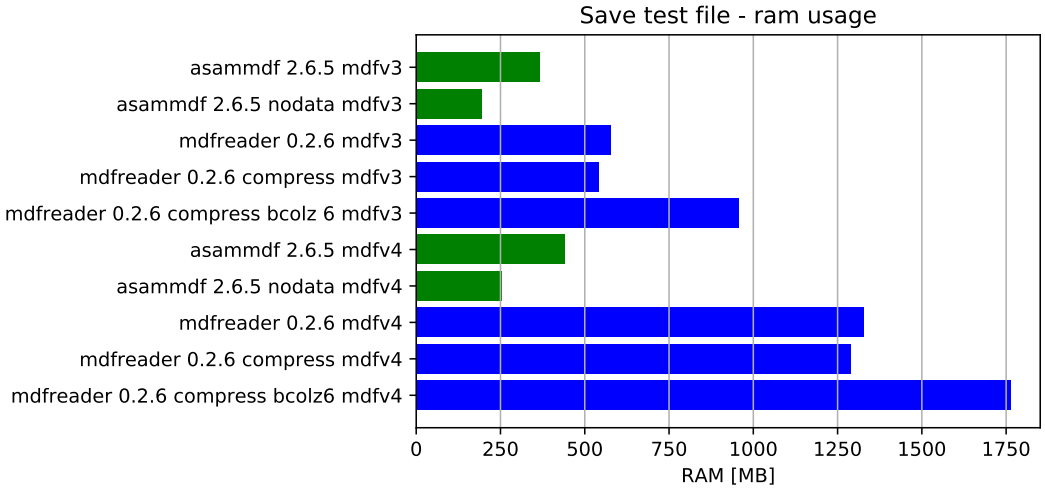


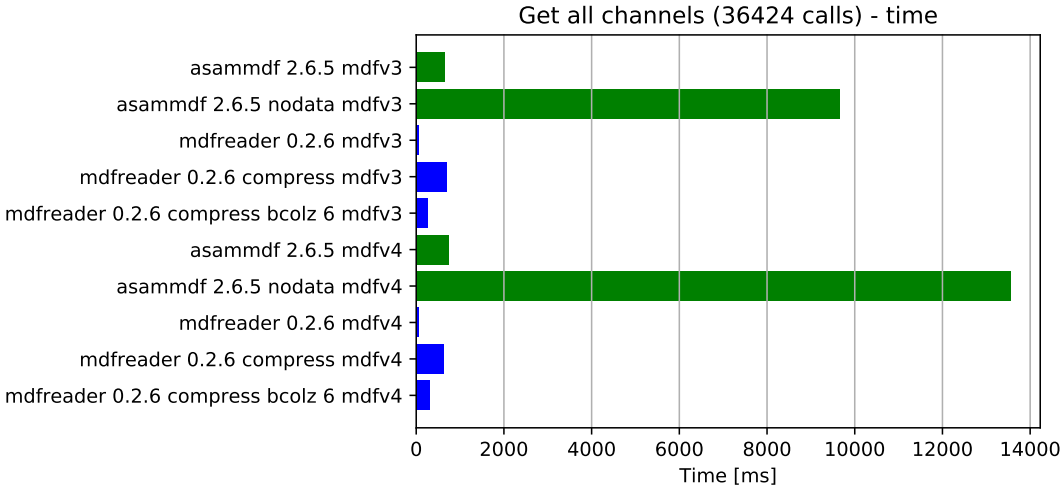
7.5 x86 Python results

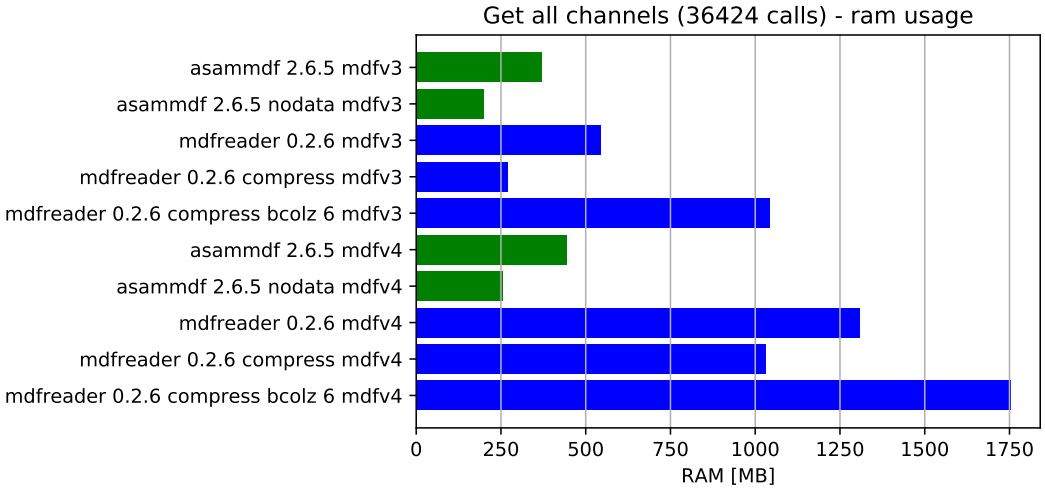
Benchmark environment

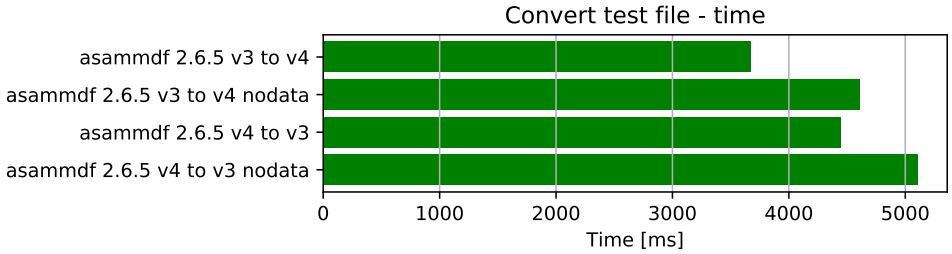

Open test file - ram usage
asammdf 2.6.5 mdfv3
asammdf 2.6.5 nodata mdfv3
mdfreader 0.2.6 mdfv3
mdfreader 0.2.6 compress mdfv3
mdfreader 0.2.6 compress bcolz 6 mdfv3
mdfreader 0.2.6 noDataLoading mdfv3
asammdf 2.6.5 mdfv4
asammdf 2.6.5 nodata mdfv4
mdfreader 0.2.6 mdfv4
mdfreader 0.2.6 compress mdfv4
mdfreader 0.2.6 compress bcolz 6 mdfv4
mdfreader 0.2.6 noDataLoading mdfv4
0
250
500
750
1000
1250
1500
1750
RAM [MB]

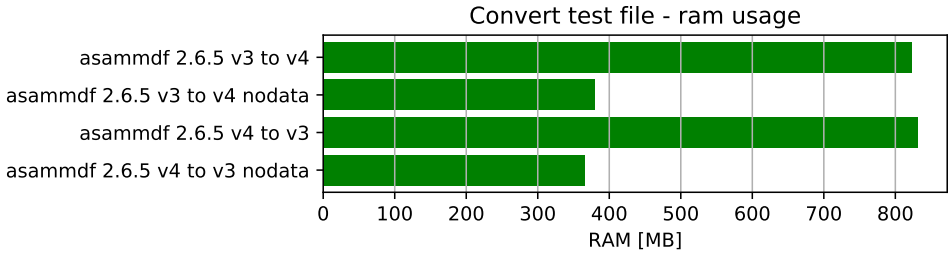

Save test file - time
asammdf 2.6.5 mdfv3
asammdf 2.6.5 nodata mdfv3
mdfreader 0.2.6 mdfv3
mdfreader 0.2.6 compress mdfv3
mdfreader 0.2.6 compress bcolz 6 mdfv3
asammdf 2.6.5 mdfv4
asammdf 2.6.5 nodata mdfv4
mdfreader 0.2.6 mdfv4
mdfreader 0.2.6 compress mdfv4
mdfreader 0.2.6 compress bcolz6 mdfv4
0
2000
4000
6000
8000
10000
12000
Time [ms]

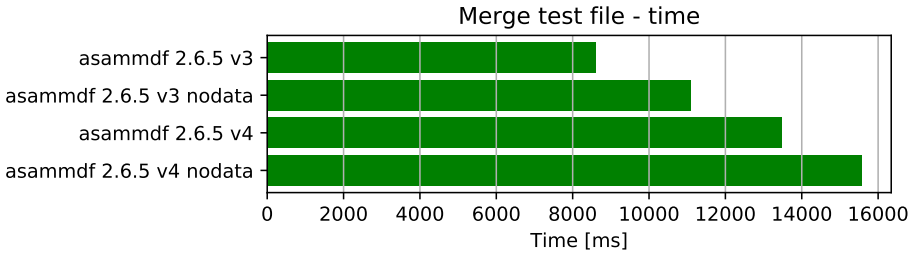

Save test file - ram usage
asammdf 2.6.5 mdfv3
asammdf 2.6.5 nodata mdfv3
mdfreader 0.2.6 mdfv3
mdfreader 0.2.6 compress mdfv3
mdfreader 0.2.6 compress bcolz 6 mdfv3
asammdf 2.6.5 mdfv4
asammdf 2.6.5 nodata mdfv4
mdfreader 0.2.6 mdfv4
mdfreader 0.2.6 compress mdfv4
mdfreader 0.2.6 compress bcolz6 mdfv4
0
250
500
750
1000
1250
1500
1750
RAM [MB]

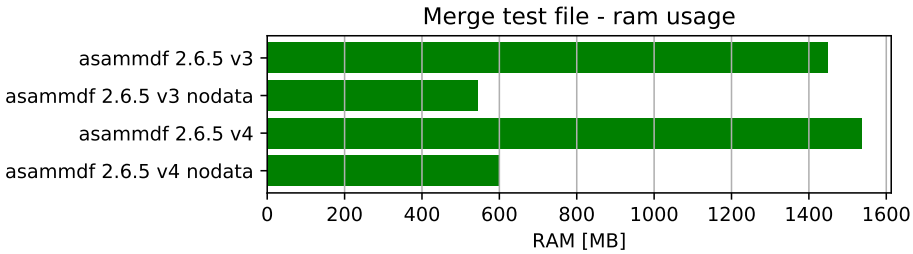

Get all channels (36424 calls) - time
asammdf 2.6.5 mdfv3
asammdf 2.6.5 nodata mdfv3
mdfreader 0.2.6 mdfv3
mdfreader 0.2.6 compress mdfv3
mdfreader 0.2.6 compress bcolz 6 mdfv3
asammdf 2.6.5 mdfv4
asammdf 2.6.5 nodata mdfv4
mdfreader 0.2.6 mdfv4
mdfreader 0.2.6 compress mdfv4
mdfreader 0.2.6 compress bcolz 6 mdfv4
0
2000
4000
6000
8000
10000
12000
14000
Time [ms]


Get all channels (36424 calls) - ram usage
asammdf 2.6.5 mdfv3
asammdf 2.6.5 nodata mdfv3
mdfreader 0.2.6 mdfv3
mdfreader 0.2.6 compress mdfv3
mdfreader 0.2.6 compress bcolz 6 mdfv3
asammdf 2.6.5 mdfv4
asammdf 2.6.5 nodata mdfv4
mdfreader 0.2.6 mdfv4
mdfreader 0.2.6 compress mdfv4
mdfreader 0.2.6 compress bcolz 6 mdfv4
0
250
500
750
1000
1250
1500
1750
RAM [MB]


Convert test file - time
asammdf 2.6.5 v3 to v4
asammdf 2.6.5 v3 to v4 nodata
asammdf 2.6.5 v4 to v3
asammdf 2.6.5 v4 to v3 nodata
0
1000
2000
3000
4000
5000
Time [ms]


Convert test file - ram usage
asammdf 2.6.5 v3 to v4
asammdf 2.6.5 v3 to v4 nodata
asammdf 2.6.5 v4 to v3
asammdf 2.6.5 v4 to v3 nodata
0
100
200
300
400
500
600
700
800
RAM [MB]


Merge test file - time
asammdf 2.6.5 v3
asammdf 2.6.5 v3 nodata
asammdf 2.6.5 v4
asammdf 2.6.5 v4 nodata
0
2000
4000
6000
8000
10000
12000
14000
16000
Time [ms]


Merge test file - ram usage
asammdf 2.6.5 v3
asammdf 2.6.5 v3 nodata
asammdf 2.6.5 v4
asammdf 2.6.5 v4 nodata
0
200
400
600
800
1000
1200
1400
1600
RAM [MB]

- 3.6.1 (v3.6.1:69c0db5, Mar 21 2017, 17:54:52) [MSC v.1900 32 bit (Intel)]
- Windows-10-10.0.14393-SP0
- Intel64 Family 6 Model 94 Stepping 3, GenuineIntel
- 16GB installed RAM

Notations used in the results

- nodata = asammdf MDF object created with load_measured_data=False (raw channel data not loaded into RAM)
- compression = mdfreader mdf object created with compression=blosc
- compression bcolz 6 = mdfreader mdf object created with compression=6
- noDataLoading = mdfreader mdf object read with noDataLoading=True

Files used for benchmark:

- 183 groups
- 36424 channels

7.5.1 Raw data

Open file	Time [ms]	RAM [MB]
asammdf 2.6.5 mdfv3	916	286
asammdf 2.6.5 nodata mdfv3	623	118
mdfreader 0.2.6 mdfv3	3373	458
mdfreader 0.2.6 compress mdfv3	4526	184
mdfreader 0.2.6 compress bcolz 6 mdfv3	4518	940
mdfreader 0.2.6 noDataLoading mdfv3	1833	120
asammdf 2.6.5 mdfv4	2214	330
asammdf 2.6.5 nodata mdfv4	1695	150
mdfreader 0.2.6 mdfv4	6348	870
mdfreader 0.2.6 compress mdfv4	7262	586
mdfreader 0.2.6 compress bcolz 6 mdfv4	7552	1294
mdfreader 0.2.6 noDataLoading mdfv4	4797	522

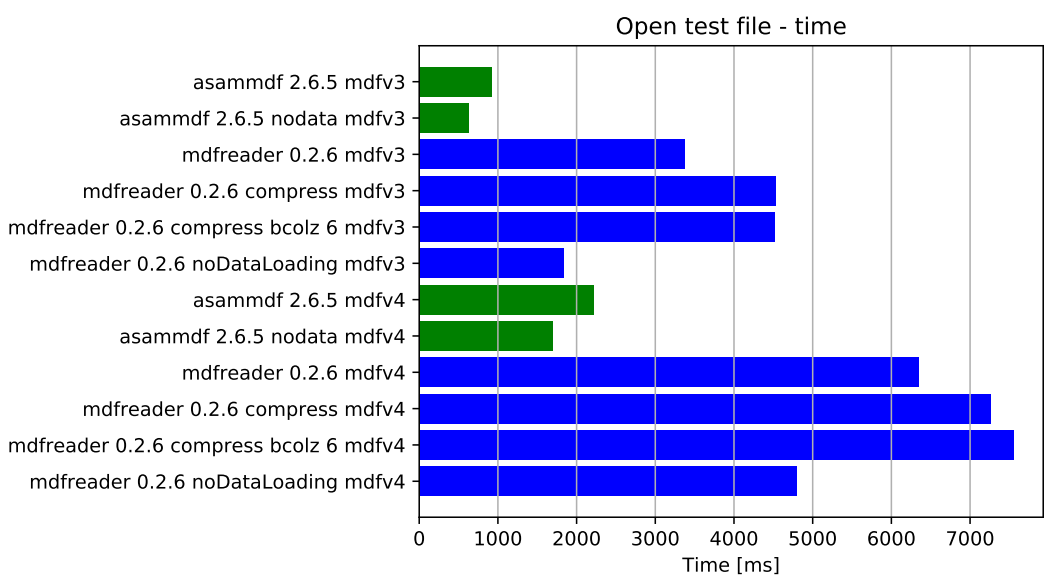
Save file	Time [ms]	RAM [MB]
asammdf 2.6.5 mdfv3	462	290
asammdf 2.6.5 nodata mdfv3	521	125
mdfreader 0.2.6 mdfv3	9175	481
mdfreader 0.2.6 compress mdfv3	9727	452
mdfreader 0.2.6 compress bcolz 6 mdfv3	9284	940
asammdf 2.6.5 mdfv4	657	334
asammdf 2.6.5 nodata mdfv4	710	159
mdfreader 0.2.6 mdfv4	6706	891
mdfreader 0.2.6 compress mdfv4	7030	851
mdfreader 0.2.6 compress bcolz6 mdfv4	6693	1311

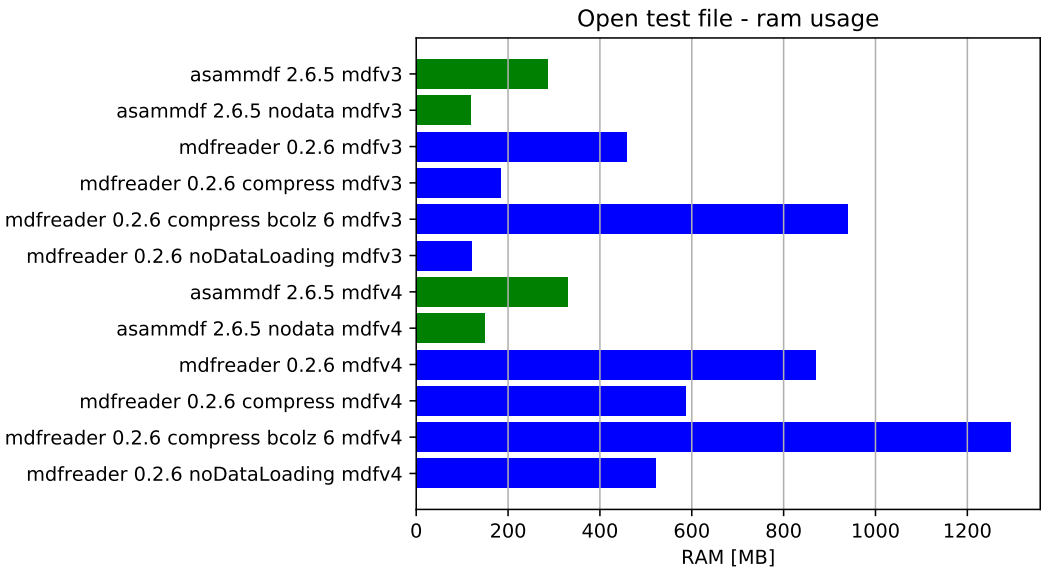
Get all channels (36424 calls)	Time [ms]	RAM [MB]
asammdf 2.6.5 mdfv3	791	291
asammdf 2.6.5 nodata mdfv3	18430	128
mdfreader 0.2.6 mdfv3	78	457
mdfreader 0.2.6 compress mdfv3	738	187
mdfreader 0.2.6 compress bcolz 6 mdfv3	299	941
asammdf 2.6.5 mdfv4	863	334
asammdf 2.6.5 nodata mdfv4	20637	157
mdfreader 0.2.6 mdfv4	77	869
mdfreader 0.2.6 compress mdfv4	653	593
mdfreader 0.2.6 compress bcolz 6 mdfv4	313	1301

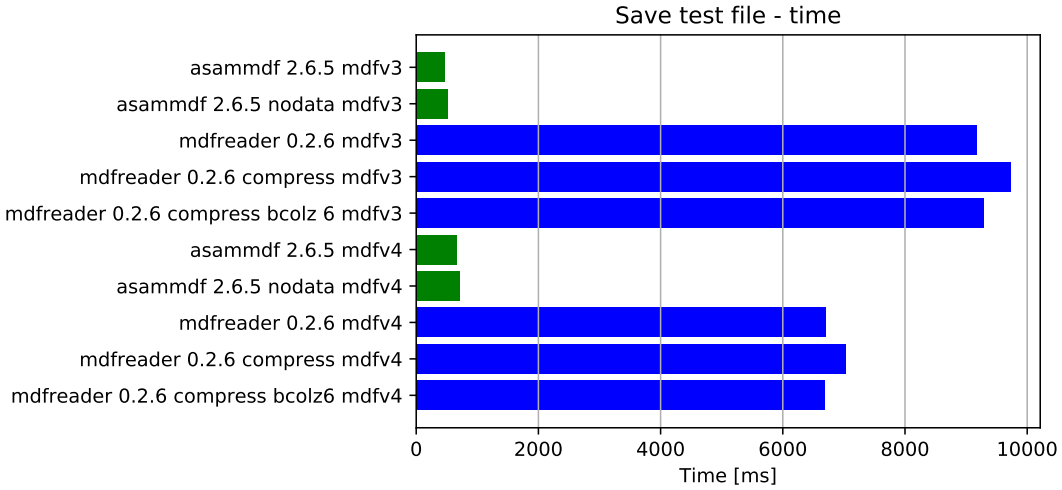
Convert file	Time [ms]	RAM [MB]
asammdf 2.6.5 v3 to v4	3843	680
asammdf 2.6.5 v3 to v4 nodata	4656	242
asammdf 2.6.5 v4 to v3	4261	681
asammdf 2.6.5 v4 to v3 nodata	5231	225

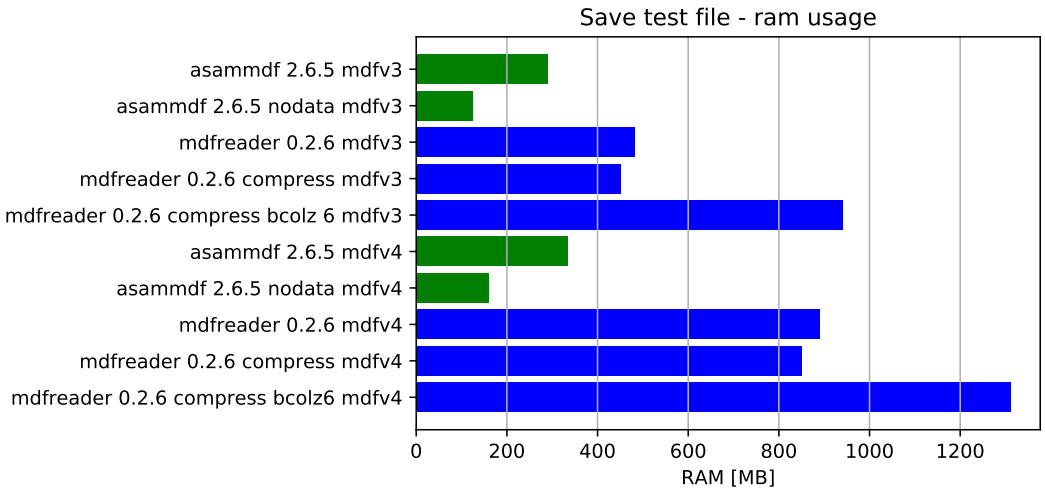
Merge files	Time [ms]	RAM [MB]
asammdf 2.6.5 v3	10058	1248
asammdf 2.6.5 v3 nodata	11174	363
asammdf 2.6.5 v4	14232	1282
asammdf 2.6.5 v4 nodata	14629	380

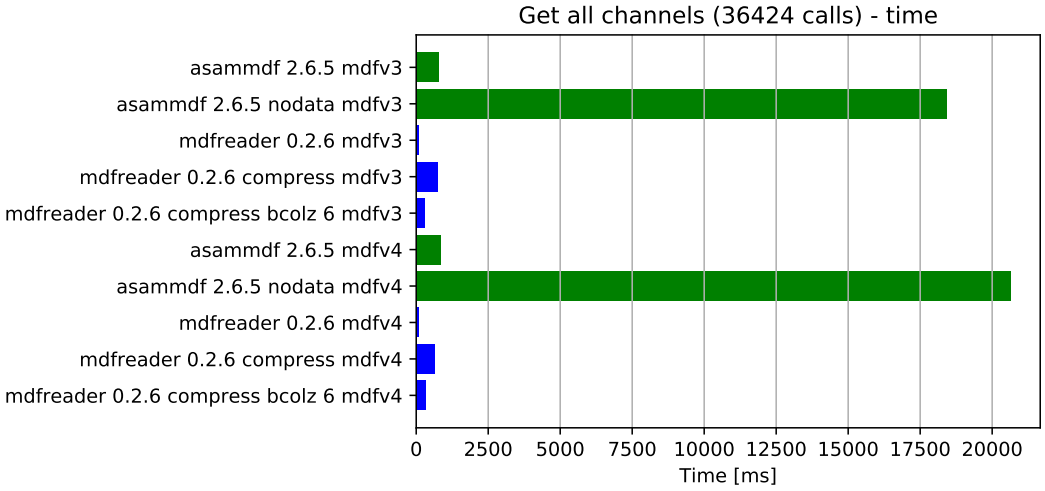
7.5.2 Graphical results

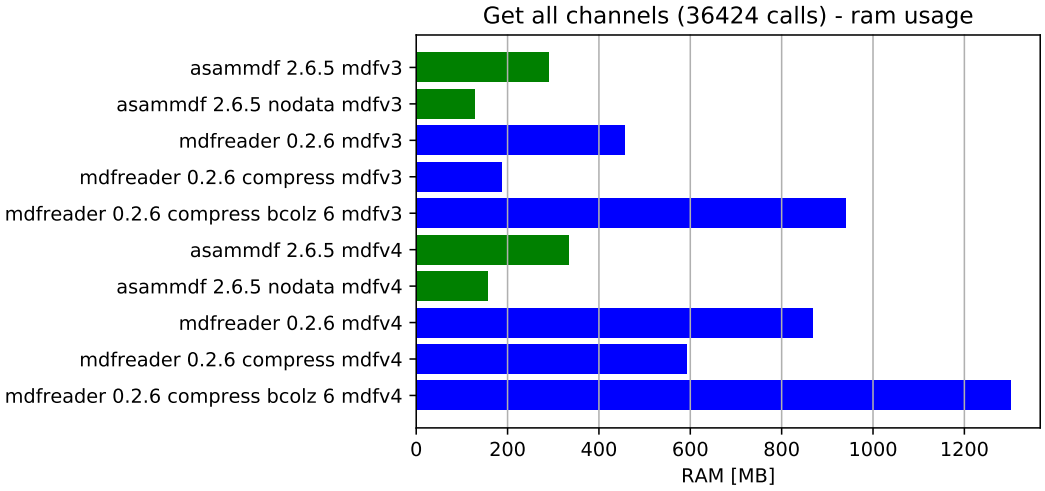


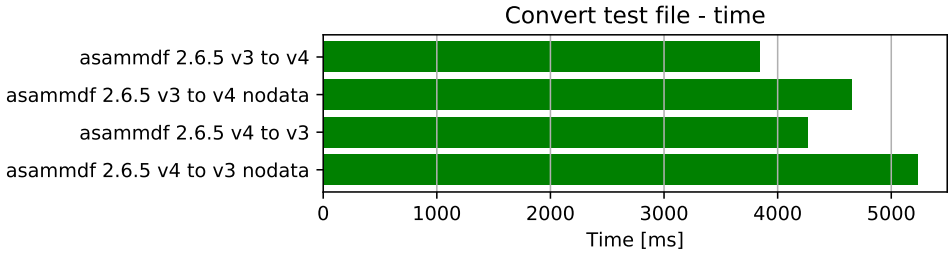

Open test file - ram usage
asammdf 2.6.5 mdfv3
asammdf 2.6.5 nodata mdfv3
mdfreader 0.2.6 mdfv3
mdfreader 0.2.6 compress mdfv3
mdfreader 0.2.6 compress bcolz 6 mdfv3
mdfreader 0.2.6 noDataLoading mdfv3
asammdf 2.6.5 mdfv4
asammdf 2.6.5 nodata mdfv4
mdfreader 0.2.6 mdfv4
mdfreader 0.2.6 compress mdfv4
mdfreader 0.2.6 compress bcolz 6 mdfv4
mdfreader 0.2.6 noDataLoading mdfv4
0
200
400
600
800
1000
1200
RAM [MB]

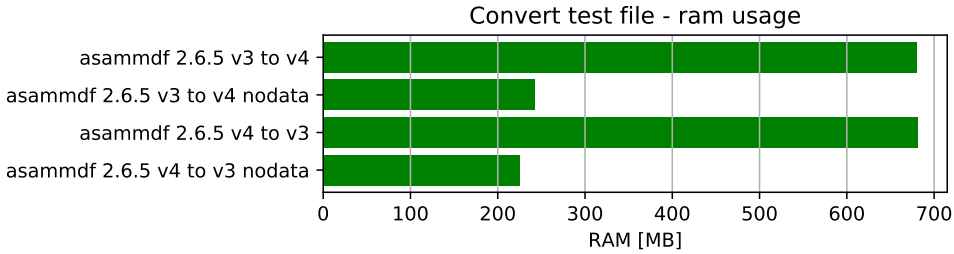

Save test file - time
asammdf 2.6.5 mdfv3
asammdf 2.6.5 nodata mdfv3
mdfreader 0.2.6 mdfv3
mdfreader 0.2.6 compress mdfv3
mdfreader 0.2.6 compress bcolz 6 mdfv3
asammdf 2.6.5 mdfv4
asammdf 2.6.5 nodata mdfv4
mdfreader 0.2.6 mdfv4
mdfreader 0.2.6 compress mdfv4
mdfreader 0.2.6 compress bcolz6 mdfv4
0
2000
4000
6000
8000
10000
Time [ms]

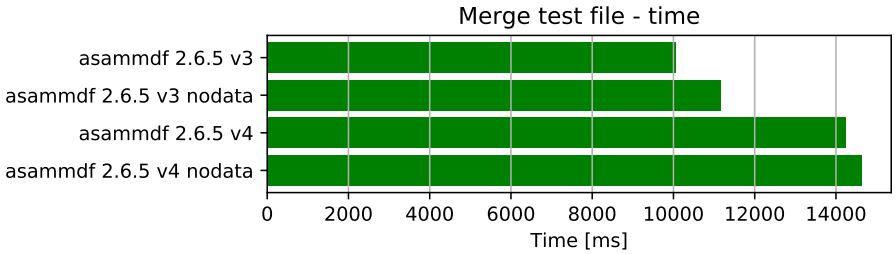

Save test file - ram usage
asammdf 2.6.5 mdfv3
asammdf 2.6.5 nodata mdfv3
mdfreader 0.2.6 mdfv3
mdfreader 0.2.6 compress mdfv3
mdfreader 0.2.6 compress bcolz 6 mdfv3
asammdf 2.6.5 mdfv4
asammdf 2.6.5 nodata mdfv4
mdfreader 0.2.6 mdfv4
mdfreader 0.2.6 compress mdfv4
mdfreader 0.2.6 compress bcolz6 mdfv4
0
200
400
600
800
1000
1200
RAM [MB]

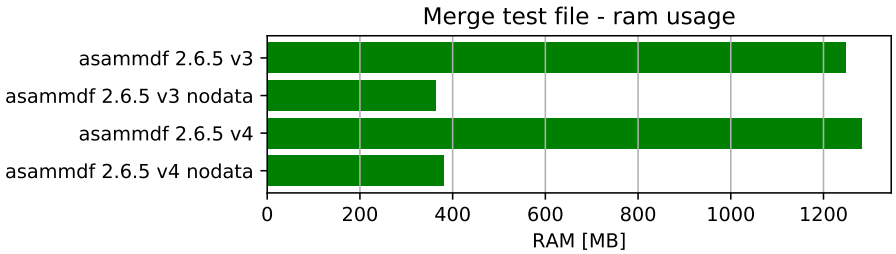

Get all channels (36424 calls) - time
asammdf 2.6.5 mdfv3
asammdf 2.6.5 nodata mdfv3
mdfreader 0.2.6 mdfv3
mdfreader 0.2.6 compress mdfv3
mdfreader 0.2.6 compress bcolz 6 mdfv3
asammdf 2.6.5 mdfv4
asammdf 2.6.5 nodata mdfv4
mdfreader 0.2.6 mdfv4
mdfreader 0.2.6 compress mdfv4
mdfreader 0.2.6 compress bcolz 6 mdfv4
0
2500
5000
7500
10000
12500
15000
17500
20000
Time [ms]


Get all channels (36424 calls) - ram usage
asammdf 2.6.5 mdfv3
asammdf 2.6.5 nodata mdfv3
mdfreader 0.2.6 mdfv3
mdfreader 0.2.6 compress mdfv3
mdfreader 0.2.6 compress bcolz 6 mdfv3
asammdf 2.6.5 mdfv4
asammdf 2.6.5 nodata mdfv4
mdfreader 0.2.6 mdfv4
mdfreader 0.2.6 compress mdfv4
mdfreader 0.2.6 compress bcolz 6 mdfv4
0
200
400
600
800
1000
1200
RAM [MB]


Convert test file - time
asammdf 2.6.5 v3 to v4
asammdf 2.6.5 v3 to v4 nodata
asammdf 2.6.5 v4 to v3
asammdf 2.6.5 v4 to v3 nodata
0
1000
2000
3000
4000
5000
Time [ms]


Convert test file - ram usage
asammdf 2.6.5 v3 to v4
asammdf 2.6.5 v3 to v4 nodata
asammdf 2.6.5 v4 to v3
asammdf 2.6.5 v4 to v3 nodata
0
100
200
300
400
500
600
700
RAM [MB]


Merge test file - time
asammdf 2.6.5 v3
asammdf 2.6.5 v3 nodata
asammdf 2.6.5 v4
asammdf 2.6.5 v4 nodata
0
2000
4000
6000
8000
10000
12000
14000
Time [ms]


Merge test file - ram usage
asammdf 2.6.5 v3
asammdf 2.6.5 v3 nodata
asammdf 2.6.5 v4
asammdf 2.6.5 v4 nodata
0
200
400
600
800
1000
1200
RAM [MB]

CHAPTER 8

Indices and tables

- genindex
- modindex
- search

Index