

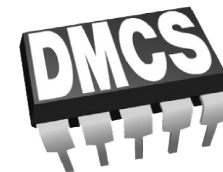


RTM  
Carrier  
Status

# RTM Carrier HW/FW/SW Status

(with strong emphasis on piezo driver application)

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2019-06-26, Rzeszów



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# RTM Carrier Status

Part 1 of 3:  
Hardware



# RTM Carrier Hardware Status

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**STATUS FROM MARCH 2019**

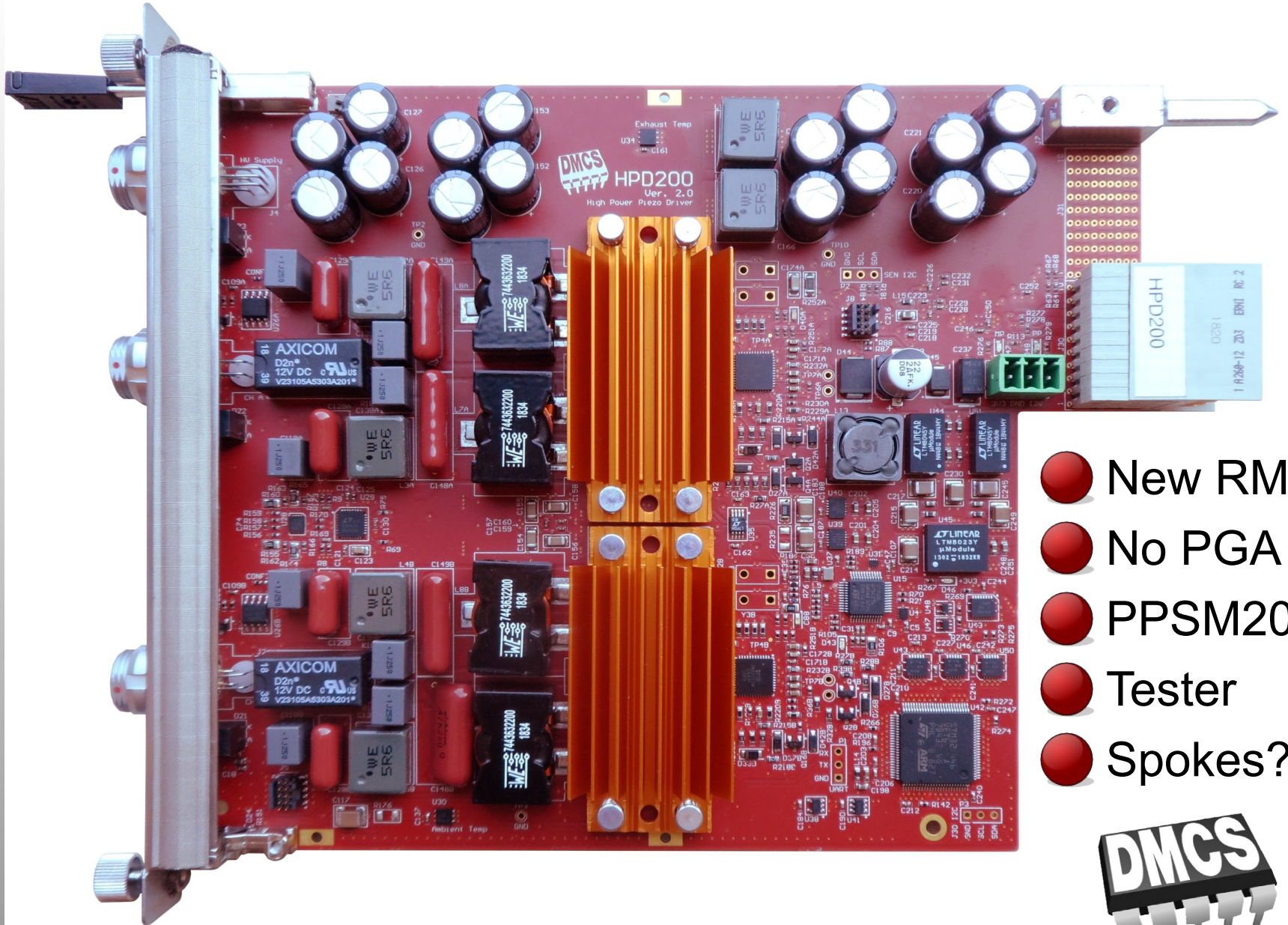
- Evaluated 2 prototype revisions,
- Small improvements in MMC area,
- No changes to FPGA surroundings,
- Prepared production of 50 boards,
- Assembly – next month, 😊
- Major components already at NCBJ.



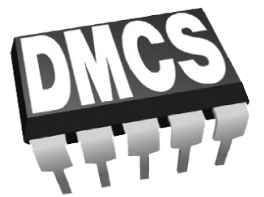


# New Piezo Driver RTM – HPD200

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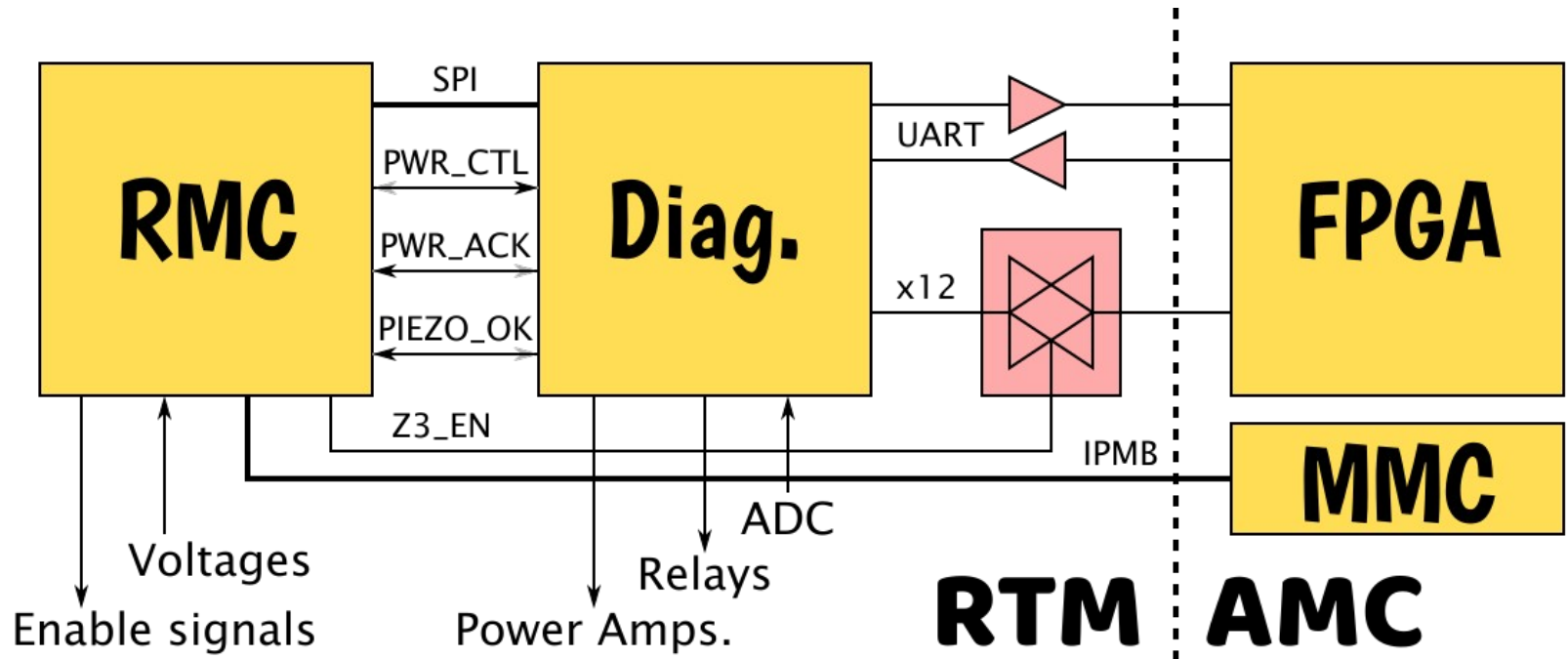
- New RMC
- No PGA
- PPSM200
- Tester
- Spokes?





# Piezo Driver RTM Management

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- UART communication was used for switching channel modes between sensor and actuator.
- It would be more reliable to move to simple voltage-level signalization using dedicated hard-wired lines (e.g. for each channel: **actuator\_not\_sensor**, **soft\_fault**, **hard\_fault**, **clear\_fault**).



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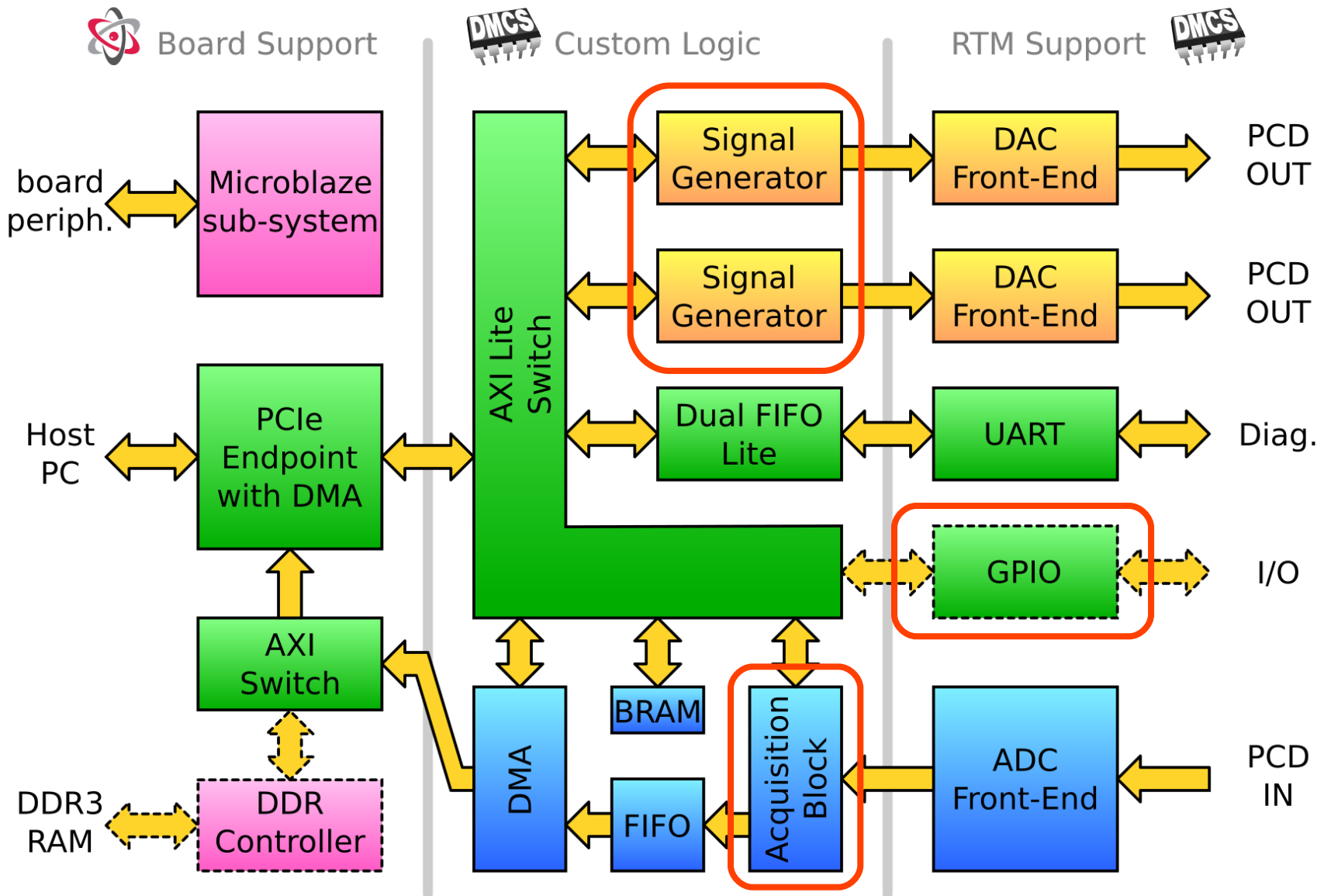
# RTM Carrier Status

Part 2 of 3:  
Firmware



# RTM Carrier Firmware – Block Diagram

## RTM Carrier Status





# RTM Carrier Firmware – Progress

## RTM Carrier Status

● Use the external trigger in place of the “oscilloscope trigger” **DONE**

● Integrate with current development branch **DONE**

● Use DDR3 memory for samples storage **NOT DONE**

● Add GPIO for communication with diag. MCU **NEW IDEA**

● Requests to NCBJ:

● Provide working memory controller

● Fix the M-LVDS signal receiver





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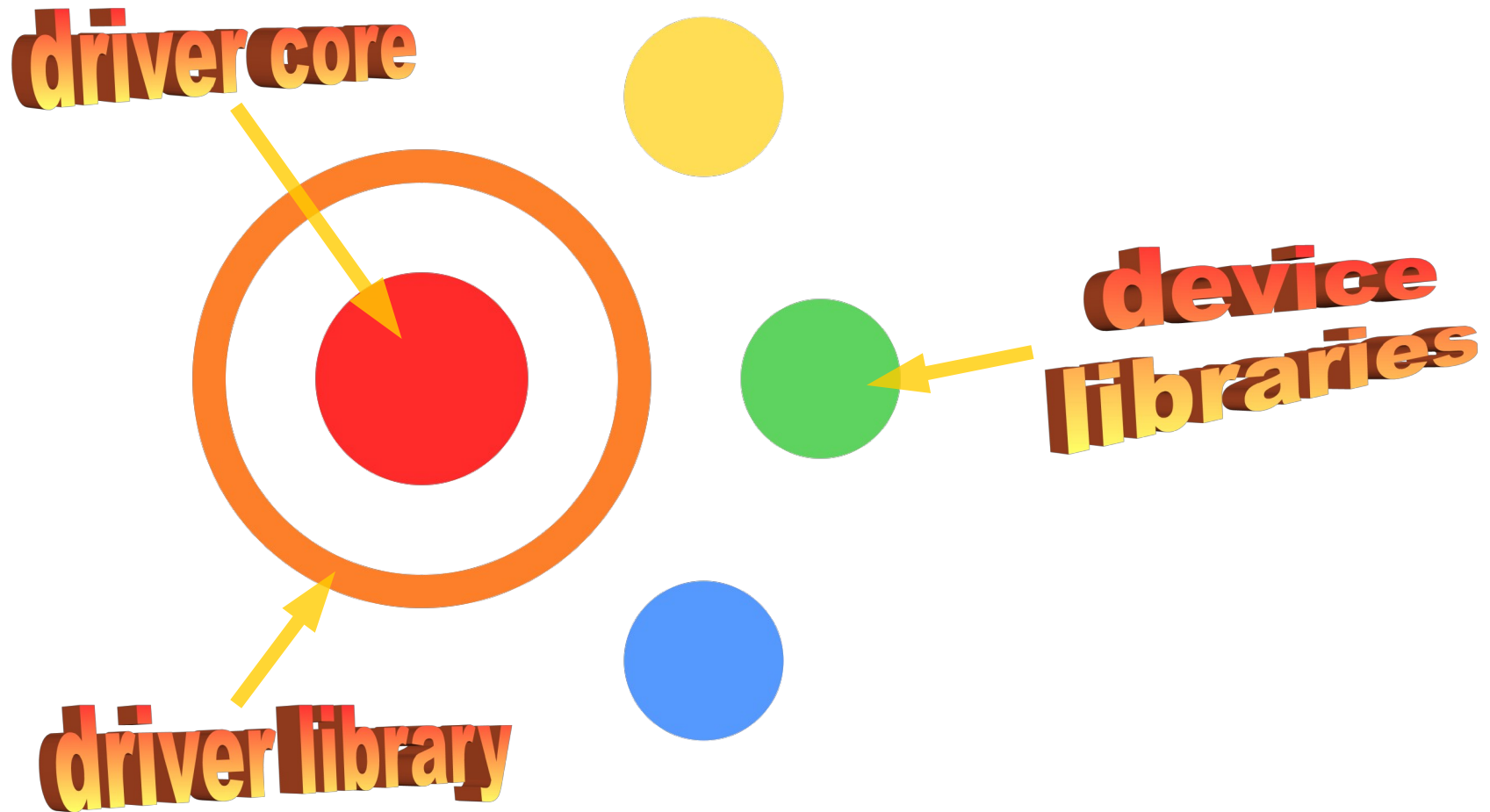
# RTM Carrier Status

Part 3 of 3:  
Software



# RTM Carrier Software

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<https://bitbucket.org/europeanspallationsource/ics-xdriver-core/src/master/>

<https://bitbucket.org/europeanspallationsource/ics-xdriver-lib/src/master/>

<https://bitbucket.org/europeanspallationsource/ics-pcd-lib/src/master/>



# RTM Carrier Software – Driver



## RTM Carrier Status

- Base code – Xilinx XDMA driver:
  - GPL-licensed
- Only two modifications:
  - Getting the address space size (useful for mmap)
  - Support of seeking in the register space



## RTM Carrier Status

- The driver library:
  - Manages open file descriptors
  - Handles register access
    - Using MMAP – in case of modified driver
    - Using IOCTL – in case of the legacy driver
  - Provides file descriptors for DMA channels
  - Includes simple register read/write application



- The PCD library:
  - Provides API for controlling piezo actuator: waveform loading, number of samples to send, trigger type, trigger delay
  - Provides API for controlling piezo sensor: trigger type, trigger delay, number of samples to capture, sample rate, pre-trigger, read data
  - Contains functions for communication with the diagnostic processor on the RTM
  - Basic trigger diagnostics: events counter, trigger pulse length
  - Includes example application



# RTM Carrier Software – PCD Tool



## RTM Carrier Status

```
$ ./pcd-tool -h
```

ESS Piezo Control Device test utility

### General arguments:

- x <xdma\_file> - Use the specified xdma file, default is /dev/xdma0
- h - Print this help
- M <command> - Exchange serial data with the diagnostic MCU
- m <mode> - Switch channel to the desired mode (sen/act)
- p - Print current configuration

### Piezo actuator arguments:

- a <type> - Auto-repeat trigger, type can be: R,F,B,I
- c <channel> - Use specified device channel: A or B
- d <time> - Set the desired delay after trigger (ms)
- w <spec> - Load the selected waveform
- t <type> - Arm the trigger, type can be: R,F,B,I

### Piezo sensor arguments:

- A <type> - Auto-repeat trigger, type can be: R,F,B,I
- C <file\_name> - Use the provided CSV file name, default is out.csv
- D <time> - Set the desired delay after trigger (ms)
- G <count> - Try to read given number of samples from buffer
- N - Try to print captured data using gnuplot
- P <enable> - Enable or disable the pretrigger (on/off)
- R <number> - Set the number of samples to drop between two stored ones
- S <count> - Set the number of samples to capture after trigger
- T <type> - Arm the trigger, type can be: R,F,B,I



# RTM Carrier Software – PCD Tool



## RTM Carrier Status

### Debug options:

- 0 - Print DMA descriptors
- 1 - Print DMA status registers
- 2 - Trigger diagnostics

### Supported trigger types:

- R - rising edge
- F - falling edge
- B - both edges
- I - immediate
- N - none

### Waveform specification:

`<type>[,a=<amplitude>][,o=<offset>][,f=<frequency>][,t=<period>]`

Waveform types: sin, tri, sqr. Other parameters in SI units.

Period and frequency are interchangeable. Avoid spaces.

### Examples:

- Getting diagnostic MCU status:  
`./pcd-tool -M s`
- Getting diagnostic MCU readouts:  
`./pcd-tool -M csv`
- Loading a sine wave of amplitude 5 v, offset 0 v and frequency 1 kHz:  
`./pcd-tool -w sin,a=5,o=0,f=1e3`



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That's it.