The FIFO Data Format in the WFD

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This document describes the data format used by a FIFO in terms of the A/D data and the time word when the WFD is operated in the triggered mode.

In the triggered mode, a trigger signal causes at least two 64 bit sample words (16 consecutive A/D samples) to be written to a FIFO. The total number of 64 bit words written to the FIFO per input trigger is equal to the data block count, a parameter having a range of 2 to 15. When a trigger occurs, a 32 bit time word is latched, the time corresponding to the first A/D sample to be stored.

Referring to Fig. 1, each pair of sample words is written to the FIFO as eight 20-bit words, each word consisting of two adjacent A/D samples plus four bits of the latched time word. Additional writes of 20-bit words may occur, but the correct time word value only resides in the first eight words written for each trigger input. A word count, readable over VMEbus indicates the number of 64 bit words that are available for readback over VMEbus. This word count also includes the time word. Thus, if the data block count is 7 and a single data block of 7 words has been written to a FIFO, the word count for that FIFO will be read as 8, 7 data words plus a time word.

Data is read from the FIFO as 40-bit words, each consisting of two of the 20-bit words that were written. Fig. 2 shows how the data from the 40-bit words is interpreted and returned to VMEbus. As each 40-bit FIFO word is read, the eight bits of the time word are shifted into a storage register, hence after four FIFO words have been read, the complete 32-bit time word has been recovered.

After reading the first two FIFO words, eight A/D sample values will have been read, and these are then output to VMEbus as a 64 bit word. A
second read of two FIFO words will result in a second 64 bit word returned to VMEbus. If the value of the data block count was 2, then the next word returned to VMEbus will be the recovered time word, but for higher data block counts, additional A/D sample words will be sent to VMEbus prior to outputting the time word. The time word is always output after the number of sample words equal to the data block count have been returned to VMEbus. For example, if the data block count is 7, then the 8th word returned to VMEbus will be the time word.

As words are read to VMEbus, the word count is decremented so as to indicate the number of remaining words to be read, including the time word. For example if a single data block of 7 words has been written to a FIFO and these 7 words have been read back to VME bus, then the word count will be 1 because the time word has yet to be read.

Data written to a FIFO in the test or oscilloscope mode uses the same storage format, but the readout procedure does not recover or return a time word.

Note that the word count for each FIFO may indicate slightly fewer words than are actually available for readback because new data may have been written since the word count was last read. Only if the WFD is in its stopped state can the word count be assumed to exactly match the available number of words.
Fig. 1 Storage of A/D samples and time word
Fig. 2 Readout of FIFO data and time word