ISTITUTO NAZIONALE DI FISICA NUCLEARE
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Abstract

We have implemented a 16-bit parallel data transfer system between a VAX 11/780 and a VME crate. A file transfer protocol for VME memory images was written and tested. The VAX interface we used (DMF-32) turned out to be the limiting element for the transfer speed.

High speed data transfer over short distances is an extremely important problem in modern High Energy Physics experiments. We have implemented a 16-bit parallel link between the parallel port (DR-11) of a DMF-32 interface (see fig. 1) installed on a VAX 11/780 and a VME system driven by a Motorola MVME110 CPU board (see fig. 2).

We have designed an interface board to connect the user port of the DR-11 to the VME bus. The design tried to maximize the speed of the data transfer, avoiding latches and driving the timing signals via hardware instead of using software tests. The result is that the software overhead is minimized, and a single 68000 instruction (MOVE.W) is enough to perform all the necessary handshake protocol to exchange a 16-bit word.

The DMF-32 user port (see fig. 1) consists of two unidirectional 16-bit busses, two pairs of handshake signals (NDR-REQ A for input, DTX-REQ B for output), and two user-controlled signals (CTRL-0 and CTRL-1), which are used to sinchronize the transfer of a block. Block length can be up to 2048 words.

The interface is a single-width VME board including a D16-A24 slave and a VME interrupter. During the transfer, the VME acts as master and the

VAX as slave. Therefore, the VME handshake signal, DTACK, is generated directly by the DR-11 response signals, NDR and DTX. The connection is through two 38-wire flat cables, 20 m in length.

Although the DR-11 is handled by the VAX in DMA, its response speed turned out to be much lower than expected. We measured the time between a request from the VME (REQ A, REQ B) and the VAX answer (NDR,DTX) and obtained an average of 30 microseconds with a wide distribution. Moreover, the VAX turned out to be servicing the DR-11 requests only during an allotted space of time of about 250 microseconds, and to be completely silent for the following interval of about 100 microseconds.

This fact generated a conflict with the MVME110 Bus Time Out (BTO), which is 120 microseconds long. The VME monitor generated a BUS TRAP ERROR when the VAX response was slower than the VME BTO.

This problem was solved via software by replacing the BUS TRAP ERROR service subroutine with a subroutine written by us, which simply restored the stack pointer and returned to the main program.

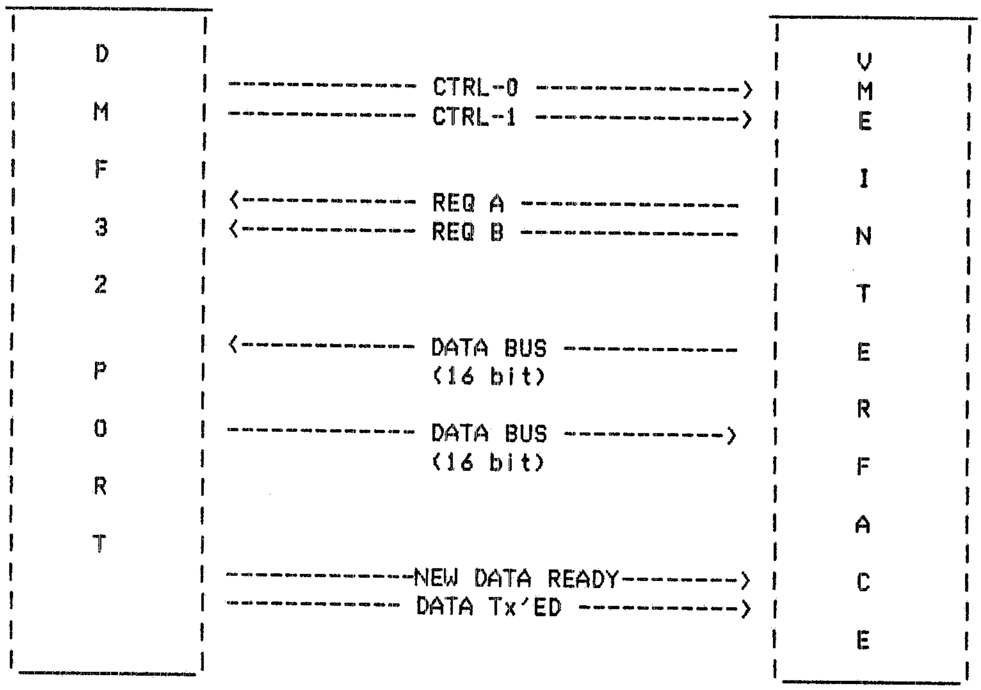
Delays had also to be added to the VME program loop to avoid data losses.

Finally, the time necessary to transfer a block of 2048 words turned out to be 125 msec.

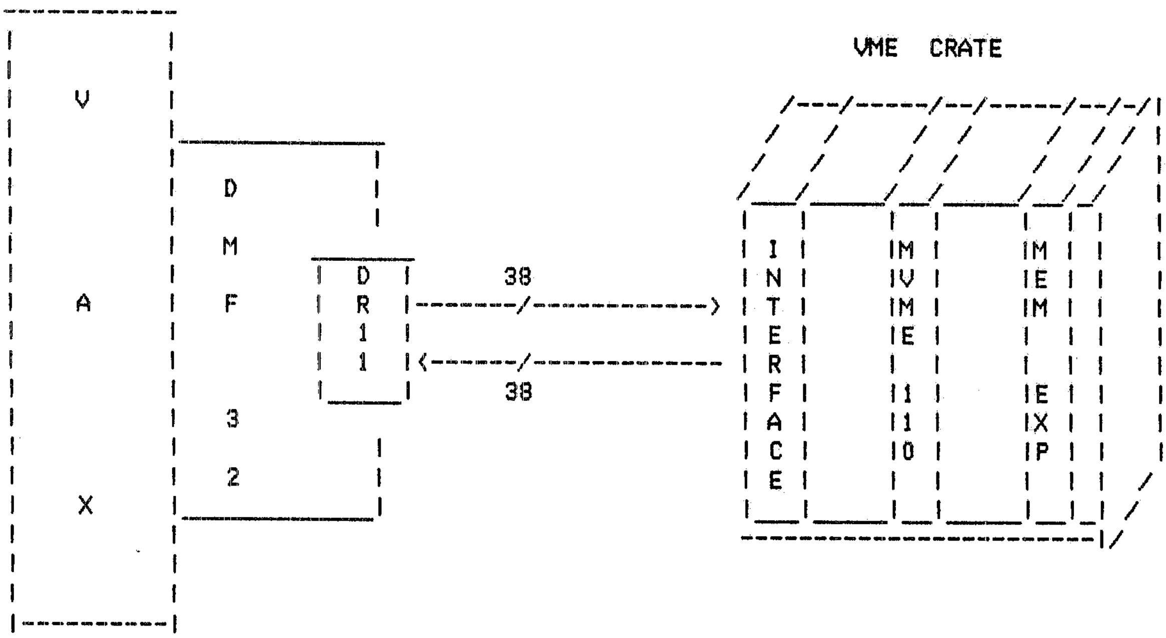
A file transfer program was implemented with the purpose to maximize data transfer speed. For this purpose, the data were formatted in a way similar to the Motorola S-Records, except that the VME memory image was not translated into ASCII characters, to gain a factor of two in speed. The usual checksum algorithm was implemented to guarantee data integrity and an interactive file identification protocol was written for the program initialization.

Since the speed we achieved was not as good as expected, we plan to try to use our interface (with only small changes) and our file exchange protocol on a DRQ-11 parallel interface mounted on a Microvax instead of the DMF-32. This setup should allow us to obtain good results out of the already implemented system.

We thank M.L.Ferrer for extremely useful and stimulating discussions.



<u>Fig. 1:</u> DMF32 DR-11 User Port



<u>Fig. 2:</u> System set up.