1. Identification of the Proposed Change

1.1 Title

Output Time Out

1.2 MDC Proposer and Sponsor

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1.3 Motion

SC12 moves that the MDC accept this proposal with Type A status. This document supersedes X11/SC12/TG9/96–10.

1.4 History

22 Mar 1997	X11/SC12/97–6	This document.
13 Oct 1996	X11/SC12/TG9/96–10	Accepted by SC12 as Type A, 8:2:4.
28 Sep 1996	X11/SC12/TG9/96–4	Accepted by SC12 as Type B, 10:0:2.
22 Mar 1996	X11/SC12/TG9/95–14	Initial WRITE time out proposal by Gregory Vail and Frederick Hiltz accepted by SC12 as Type B, 6:0:5.

1.5 Dependencies

This proposal modifies ANSI/MDC X11.1–1995.

Proposals that depend on this proposal: none.

2. Justification of the Proposed Change

2.1 Needs

M processes need to detect when output to a device has blocked, and to recover from the blocked condition. The condition occurs most commonly on a serial communication device that uses XOFF for flow control. A protocol failure can block the process with no possibility of recovery short of operator intervention.

A similar phenomenon occurs in the Open/VMS operating system when an M process writes to a mailbox some data that another process reads. If the other process fails, the M process goes into a "resource wait" state forever.

Some printers stall when out of paper or jammed, rather than generate an error. The printing program cannot notify the operator while it is blocked on output to the printer.

2.2 Existing Practice in Area of the Proposed Change

Timeout on the READ command answers this need for input from a device. Some implementations reveal the XOFF condition in Z–extensions to the language.

3. Description of the Proposed Change

3.1 General Description of the Proposed Change

This proposal specifies a device parameter, "output time out." The value of the parameter is a positive number of seconds that denotes the maximum time for any output — from a WRITE command's argument or from a format argument of a READ command — to execute. If the output time out interval expires before execution of the argument completes, an error condition results. A node in ^$DEVICE retains this value. Another node in ^$DEVICE indicates the time out status, by which programs may learn which of many devices timed out.

3.2 Annotated Examples of Use

```
        OPEN "TTY2":OUTTIMEOUT=5:"X3.64"        ; 5-second time out.
        OPEN "LTP1":OUTTIMEOUT=0                ; Cancels time out.

ERR     I $ECODE[",M100," D
        . I ^$DEVICE("LTP1","OUTSTALLED") D
        . .     ; Printer hung!  Notify the operator...
        . E  I ^$DEVICE("TTY2","OUTSTALLED") D
        . .     ; The SPEC-20 link is down.  Keep trying...
```

3.3 Formalization

3.3.1 Insert the following sub-clause at the end of clause 8 – Commands:

8.3 Device parameters

8.3.1 Output time out

For any mnemonicspace the implementation may define a device parameter that causes an error condition when an output-producing argument of a READ or WRITE command fails to complete execution within a specified time. If it is defined, the device parameter shall conform to this clause and to the related sections of 7.1.3.2.

This device parameter shall have the following form:

```
deviceparam ::= OUTTIMEOUT = numexpr
```

Numexpr shall be interpreted as the value of a timeout (see 8.1.5). Should any subsequent output-producing argument of a READ or WRITE command to the device fail to complete execution within that time, then

a) the OUTSTALLED member of ^$DEVICE, described in 7.1.3.2, shall assume the value 1, and

b) an error with ecode = M100 shall occur.

Output time out shall not apply to a device when

a) no OUTTIMEOUT deviceparam has executed for the device, or

b) the value of numexpr in the most recent OUTTIMEOUT is non-positive.

No more than one output time out shall apply to one device at any time. That is, an OUTTIMEOUT deviceparam shall replace any pre-existing OUTTIMEOUT deviceparam.

Note: output time out applies to the execution of READ or WRITE arguments, not to the delivery of data to a device.

3.3.2 Insert the following paragraph at the end of sub-clause 7.1.3.2 ^$DEVICE:

When the mnemonicspace in use for the device defines an output time out as described in 8.3.1, it shall also define the following 2 members of ^$DEVICE:

a) the value of ^$DEVICE (devicexpr , expr V "OUTTIMEOUT") shall equal the value of the most recently executed OUTTIMEOUT deviceparam for the device. It shall equal 0 when no OUTTIMEOUT deviceparam has executed for the device.

b) the value of ^$DEVICE (devicexpr , expr V "OUTSTALLED") shall indicate the output time out status of the device. If the most recently executed output-producing argument of a READ or WRITE command timed out, then this value shall be 1. Otherwise, this value shall be 0.

3.3.3 Insert the following error translation into Annex B – Error code translations:

M100 output time out expired

4. Implementation Effects

4.1 Effect on Existing User Practices and Investments

None. Existing code is not affected.

4.2 Effect on Existing Vendor Practices and Investments

Implementers must add a timer to the execution of write arguments and read arguments that produce output. When the timed interval expires before execution completes, an error condition results.

4.3 Techniques and Costs for Compliance Verification

Verification tests must be extended to provide a blocked condition on a device and to test the behavior of READ and WRITE commands in that condition. This is expected to be a minor extension.

4.4 Legal Considerations

None

5. Closely Related Standards Activities

5.1 Other X11 Proposals Under Consideration

None.

5.2 Other Related Standards Efforts

None.

5.3 Recommendations for Coordinating Liaison

None.

6. Associated Documents

None.

7. Issues, Pros and Cons, and Discussion

7.1 March 1996 MDC meeting

The initial write time out proposal, X11/SC12/TG9/95–14, added a time out to the writeargument, using syntax and semantics parallel to those of the readargument. Discussion in the task group revealed a strong preference for a device parameter, which need be specified only once to protect all output against stalling. The task group considered and rejected a third possibility mentioned in the original proposal: to apply a time out to the WRITE command itself. SC12 accepted the initial proposal and asked the sponsor to prepare a proposal based on a device parameter.

	Pro	Con
1	Needed functionality (2)	
2	User request (1)	

(Number of citations in the vote.)

7.2 Deferred Output

Most M implementations buffer the output data and proceed to execute subsequent M commands while transferring the data to the device, overlapping computation and output. Furthermore, some implementations accumulate the data of several write arguments for a single transmission to the device, reducing the overhead of output.

The output time out pertains to the execution of the M arguments, not to the transfer of data to the device. Output proceeds at full speed, taking advantage of all the vendor's optimizations. However, when the time out expires, the M program cannot determine exactly how much data was transferred before the device stalled and the buffer filled.

7.3 Discussion

The sponsor gratefully acknowledges comments on the initial write time out proposal by David Marcus (published in X11/96-25), as well as thoughtful reviews of an early draft of X11/SC12/TG9/96-24 by Peter Cudhea-Pierce, Rod Dorman, and David Marcus.

7.4 September 1996 MDC meeting

TG9 members suggested several changes, all of which this proposal incorporates:

Deviceattribute name changes from OUTTO to OUTTIMEOUT.
The second subscript of ^$DEVICE changes from OUTTO to OUTSTALLED.
A reference to timeout replaces the time-out semantics.
Examples are expanded.

SC12 accepted the proposal as Type B, 10:0:2.

	Pro		Con
1	Desperately needed functionality (2)	1	Error number should be registered (0)
2	Addresses user need (1)		
3	Can be implemented (1)		

(Number of citations in the vote.)

7.5 March 1997 MDC meeting

TG9 discussed questions submitted by Jon Diamond. The group decided that no changes to the portability section or the conformance clause were needed. The sponsor stated that the sentence in 3.3, "No more than one output time out..." was intended to make explicit the single time out per device implied in the metalanguage. The "execution of read or write arguments" in 3.3 implies nothing beyond the normal execution defined in X11.1 clauses 8.2.17 and 8.3.25.

The task group suggested the addition to 3.3 of the sentence, "If it is defined, the device parameter shall conform to this clause and to the related sections of 7.1.3.2."

SC12 accepted the proposal as Type A, 8:2:4.

Pro	Con
1 User requested (2)	1 Optional for the implementation (4)
	2 Highly implementation specific to result (2)
	(Number of citations in the vote.)