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Macintosh: Sad Mac Error Code Meaning (11/95)

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Macintosh: "Sad Mac" Error Code Meaning (11/95)

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TOPIC ---

When I turn on my Macintosh, I get a black screen with a "sad Macintosh" face
and the numbers 020016. There is no listing for this error code in any of my
manuals. What does it mean?

DISCUSSION --

The particular error code that appears with the "sad Macintosh" is not as
important as WHEN it occurs. If the Macintosh can start up from a different
system diskette, then the problem is probably with the system software on the
other disk. System problems are usually identified when you get a "happy
Macintosh" face and the "Welcome to Macintosh" screen before the "sad
Macintosh."

If the "sad Macintosh" face appears immediately at power up, that usually
suggests an issue with the logic board or memory. Try starting up from a floppy
disk before assuming it's a hardware problem.

Sad Mac Error Codes Description
==============================

On the Original ROMs (Macintosh 128k, 512k, 512ke, Plus):

When you press the interrupt button on the side of your Macintosh when starting
up, you should get a sad Mac icon with '0F000D' and some bits cycling under the
icon indicating it is performing a memory test.

This numeric code is in two parts:
• The first two characters are the class code. The class code tells what
  part of the diagnostic program found the error.
• The second four are the sub code. The sub class code tells what the error

was. In the case of a bad RAM chip, the sub class identifies the bad chip
(this was very helpful to homegrown upgraders).

Begin_Table

```
Class Code                            Sub Code
----------                            --------
1 = ROM test failed                   Meaningless
2 = Memory test - bus subtest         identifies bad chips
3 = Memory test - byte write          identifies bad chips
4 = Memory test - Mod3 test           identifies bad chips
5 = Memory test - address uniqueness  identifies bad chips
```


Single Chip Identification

```
Data Bit    Location    Sub Code Bits
--------    --------    -------------
  0            F5           0001
  1            F6           0002
  2            F7           0004
  3            F8           0008
  4            F9           0010
  5            F10          0020
  6            F11          0040
  7            F12          0080
  8            G5           0100
  9            G6           0200
 10            G7           0400
 11            G8           0800
 12            G9           1000
 13            G10          2000
 14            G11          4000
 15            G12          8000
```


```
Class Code        Sub Code
----------        --------
F = Exception     0001 Bus error
                  0002 Address error
                  0003 Illegal instruction
                  0004 Zero divide
                  0005 Check instruction
                  0006 Traps instruction
                  0007 Privilege violation
                  0008 Trace
                  0009 Line 1010
                  000A Line 1111
                  000B Other exception
                  000C Nothing
                  000D NMI (normal indication)
                  0064 Couldn't Read System File into Memory
```

```
Macintosh SE & Macintosh II ROMs:
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```

The Sad Mac error codes have been changed to incorporate additional power for testing and to support the 32-bit world. Generally, the same codes are used for 68000 exceptions as the Macintosh, however they are displayed differently.

The traditional Macintosh error codes are displayed like this:

```
            0F0003
```

Where "F" indicates an exception occurred, and "3" indicates an illegal instruction occurred. On the Macintosh SE and II, the display would appear:

```
            0000000F
            00000003
```

```
     *Please note that 00000003 is a hex number.*
```

The new power-on error codes have the following format:

```
            XXXXYYYY
            ZZZZZZZZ
```

Where XXXX is internal test manager state information (ignore this), YYYY contains codes that indicate either an exception code, or the test number for a power on test failure. The ZZZZZZZZ code contains additional failure information to help track down the problem.

```
YYYY Error Codes:
-----------------
```

$0001   The ROM checksum test failed. Ignore the Z field.

$0002   The first small chunk of RAM to be tested failed. The Z field
         indicates which RAM Bit(s) failed. This small chunk of RAM is
         always in Bank B.

```
         Example:    $AABBCCDD
                     AA=8 bit mask for bits 31-24
                     BB=8 bit mask for bits 23-16
                     CC=8 bit mask for bits 15-8
                     DD=8 bit mask for bits 7-0
```

$0003   The RAM test failed while testing bank B, after passing the chunk
         tested for code $0002. The Z field indicates which bits failed as
         in code $0002.
$0004   The RAM test failed while testing bank A. The Z field indicates
         which bits failed as in code $0002.
$0005   The RAM External addressing test failed. The Z field indicates a
         failed address line.
$0006   Unable to properly address the VIA1 chip. The Z field is not
         applicable.

```
$0007    Unable to properly address the VIA2 chip (Macintosh II only). The Z
         field is not applicable.
$0008    Unable to properly access the Front Desk Bus. The Z field is not
         applicable.
$0009    Unable to properly access the MMU. The Z field is not applicable.
$000A    Unable to properly access NuBus. The Z field is not applicable.
$000B    Unable to properly access the SCSI Chip. The Z field is not
         applicable.
$000C    Unable to properly access the IWM chip. The Z field is not
         applicable.
$000D    Unable to properly access the SCC Chip. The Z field is not
         applicable.
$000E    Failed Data Bus test. The Z field indicated the bad bit(s) as a
         32-bit mask for bits 0-31. This may indicate either a bad SIMM or
         data bus failure.
$000F    Reserved for Macintosh compatibility.

$FFxx    A 680xx exception occurred during power on testing.
         The xx indicates the exception:

         $01 — Bus Error
         $02 — Address Error
         $03 — Illegal Instruction Error
         $04 — Zero Divide
         $05 — Check Instruction
         $06 — cpTrapCC, Trap CC, Trap V
         $07 — Privilege violation
         $08 — Trace
         $09 — Line A
         $0A — Line F
         $0B — unassigned
         $0C — CP protocol violation
         $0D — Format exception
         $0E — Spurious interrupt
         $0F — Trap 0-15 exception
         $10 — Interrupt Level 1
         $11 — Interrupt Level 2
         $12 — Interrupt Level 3
         $13 — Interrupt Level 4
         $14 — Interrupt Level 5
         $15 — Interrupt Level 6
         $16 — Interrupt Level 7
         $17 — FPCP bra or set on unordered condition
         $18 — FPCP inexact result
         $19 — FPCP divide by zero
         $1A — FPCP underflow
         $1B — FPCP operand error
         $1C — FPCP overflow
         $1D — FPCP signalling NAN
         $1E — PMMU configuration
         $1F — PMMU illegal operation
         $20 — PMMU access level violation
```

```
Macintosh Portable ROMs:
------------------------
```
The bootup code in the Macintosh Portable contains a series of startup tests
that are run to ensure that the fundamental operations of the machine are
working properly. If any of those tests fail, a Sad Mac icon appears on the
screen with a code below that describes what failure occurred. Here is a typical
example of a Sad Mac display with an error code below it:

```
              SAD MAC CODE


        05460203   =   (D7.L)
        000OB6DB   =   (D6.L)
```

The two codes are actually the contents of the two CPU data registers D6 and D7.
The upper word (upper 4 hex digits, in this case 0546) of D7 contains
miscellaneous flags that are used by the start-up test routines and are
unimportant to just about everybody except a few test engineers within Apple.
The lower word of D7 is the major error code. The major error code identifies
the general area the test routines were in when a failure occurred. D6 is the
minor error and usually contains additional information about the failure,
something like a failed bit mask.

```
              SAD MAC CODE BROKEN DOWN


        Test Flags    Major Error
        ----------    -----------
        0546          0203


        Minor Error   Minor Error
        -----------   -----------
        0000          B6DB
```

The major error is further broken into the upper byte that contains the number
of any 68000 exception that occurred ($00 meaning that no exception occurred),
and the lower byte that usually contains the test that was being run at the time
of failure. If an unexpected exception occurred during a particular test, then
the exception number is logically ORed into the major error code. This way both
the exception that occurred as well as the test that was running can be decoded
from the major error code:

```
            SAD MAC CODE FURTHER BROKEN DOWN


        68000 Exception    Test Code
        ---------------    -----------
        02                   03
```

In this example, the code says that an address error exception ($0200) occurred
during the RAM test for Bank A ($03); $0200 ORed with $03 = $0203.

```
Major Error Codes
-----------------
```
Below is a brief description of the various test codes that might appear in the

major error code:

  Warning: Some of these codes may mean slightly different things in
Macintosh models other than the Macintosh Portable. These descriptions describe
specifically how they are used in the Macintosh Portable.

$01   - ROM test failed. Minor error code is $FFFF, means nothing.
$02   - RAM test failed. Minor error code indicates which RAM bits failed.
$05   - RAM external addressing test failed. Minor error code indicates a
        failed address line.
$06   - Unable to properly access the VIA 1 chip during VIA
        initialization. Minor error code not applicable.
$08   - Data bus test at location eight bytes off of top of memory failed.
        Minor error code indicates the bad bits as a 16-bit mask for bits
        15-00.
        This may indicate either a bad RAM chip or data bus failure.
$0B   - Unable to properly access the SCSI chip. Minor error code not
        applicable.
$0C   - Unable to properly access the IWM (or SWIM) chip. Minor error code
        not applicable.
$0D   - Not applicable to Macintosh Portable. Unable to properly access the
        SCC chip.
        Minor error code not applicable.
$0E   - Data bus test at location $0 failed. Minor error code indicates
        the bad bits as a 16-bit mask for bits 15-00. This may indicate
        either a bad RAM chip or data bus failure.
$10   - Video RAM test failed. Minor error code indicates which RAM bits
        failed.
$11   - Video RAM addressing test failed. Minor error code contains the
        following: upper word   =   failed address (16-bit)
                     msb of lower word =   data written
                     lsb of lower word =   data read
        Data value written also indicates which address line is being
        actively tested.
$12   - Deleted
$13   - Deleted
$14   - Power Manager processor was unable to turn on all the power to the
        board. This may have been due to a communication problem with the
        Power Manager. If so, the minor error code contains a Power Manager
        error code, explained in the next section.
$15   - Power Manager failed its self-test. Minor error code contains the
        following: msw = error status of transmission to power manager.
                    lsw = Power Manager self-test results (0 means it
                           passed, non-zero means it failed)
$16   - A failure occurred while trying to size and configure the RAM.
        Minor error code not applicable.

Minor error codes—Power Manager Processor Failures

If a communication problem occurs during communication with the Power Manager,
the following error codes will appear somewhere in the minor error code (usually
in the lower half of the code, but not always):

```
        $CD38   Power Manager was never ready to start handshake.
        $CD37   Timed out waiting for reply to initial handshake.
        $CD36   During a send, Power Manager did not start a handshake.
        $CD35   During a send, Power Manager did not finish a handshake.
        $CD34   During a receive, Power Manager did not start a handshake.
        $CD33   During a receive, Power Manager did not finish a handshake.


Diagnostic Code Summary
-----------------------
Below is a summarized version of the Sad Mac error codes:


Test Codes
        $01     ROM checksum test.
        $02     RAM test.
        $05     RAM addressing test.
        $06     VIA 1 chip access.
        $08     Data bus test at top of memory.
        $0B     SCSI chip access.
        $0C     IWM (or SWIM) chip access.
        $0D     Not applicable to Macintosh Portable. SCC chip access.
        $0E     Data bus test at location $0.
        $10     Video RAM test.
        $11     Video RAM addressing test.
        $14     Power Manager board power on.
        $15     Power Manager self-test.
        $16     RAM sizing.



Power Manager Communication Error Codes
---------------------------------------
        $CD38   Initial handshake.
        $CD37   No reply to initial handshake.
        $CD36   During send, no start of a handshake.
        $CD35   During a send, no finish of a handshake.
        $CD34   During a receive, no start of a handshake.
        $CD33   During a receive, no finish of a handshake.



CPU Exception Codes (as used by the startup tests)
--------------------------------------------------
        $0100   Bus error exception code
        $0200   Address error exception code
        $0300   Illegal error exception code
        $0400   Zero divide error exception code
        $0500   Check inst error exception code
        $0600   cpTrapcc,Trapcc,TrapV exception code
        $0700   Privilege violation exception code
        $0800   Trace exception code
        $0900   Line A exception code
        $0A00   Line F exception code
        $0B00   Unassigned exception code
        $0C00   CP protocol violation
        $0D00   Format exception
```

```
        $0E00    Spurious interrupt exception code
        $0F00    Trap inst exception code
        $1000    Interrupt level 1
        $1100    Interrupt level 2
        $1200    Interrupt level 3
        $1300    Interrupt level 4
        $1400    Interrupt level 5
        $1500    Interrupt level 6
        $1600    Interrupt level 7
```

End_Table

Article Change History
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20 May 1992 - Reviewed for technical accuracy.

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