Eurosoft

Computer reliability solutions

Pc-Check® UEFI

Test Descriptions

Professional, computer diagnostic software, fully UEFI-native pre-boot

Assuring direct, legacy-free UEFI hardware testing

Eurosoft PC Reliability Solutions

Pc-Check UEFI Test Descriptions

EDFTD V10.8-UEFI

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Introduction

The purpose of the Pc-Check UEFI Test Descriptions manual is to provide you with an understanding of the specifics involved in running Test Modules. The test descriptions include information about each of the tests, test settings (parameters), error codes that may be returned and possible causes of failure.

This document is provided separately as the test modules are an independent deliverable to be used as part of a program. These use the same test descriptions: however, they have different user interfaces and functionality.

Not all components may be supplied with every product.

Document Structure

The first table that follows lists each Test Group, number and name, and the tests it can provide. Tests requiring Eurosoft test hardware are indicated with an (L) after the test name. Interactive tests (which must be run in interactive mode) are indicated with an (I).

The next table lists general System Error Codes that may be returned by the tests. i.e. 0x02/3FF.

These Error Codes are made up of two parts; the first part is unique within the Diagnostic Group and is the identifier for the error, this error identifier will never change for a given error within a group. The second part is the Extra Information type that states the format of any extra information associated with an error code when it occurs. The extra information types are listed in the Extra Information Codes section of this document.

The test descriptions in the following sections are arranged numerically by group number and conform to a uniform generic structure. Each section starts with a general overview of the group and the devices it contains. Following this is a table that lists all the tests in the group and summarises the main requirements for the test to run. An '•' in the 'I' column indicates the test must be run in Interactive mode as it requires operator interaction or feedback. An '•' in the 'E' column indicates that specific Eurosoft hardware (i.e. a loopback plug) is required to run the test. An 'M' indicates a media requirement. For UEFI diagnostics the 'T' column is not currently used.

The next table 'Parameters' lists, for each test that has them, the available parameters, their Default, Minimum and Maximum values and any explanatory notes. In order to avoid unnecessary duplication notes are only given against the first occurrence of the parameter in the table. In some parameters the default or limit may depend on the specific system under test, in these cases the value is given as 'SDP' (System Dependant Parameter).

Following Parameters are the individual test descriptions which generally also include an estimate of how long the test will take to run.

Finally for each group there are two tables giving the group specific error codes that the tests may return and a 'Troubleshooting' table that lists possible causes of the errors.

Note: For some parameters the maximum value may be defined as MAX_PATH. This is a system defined value of the maximum length of a file name and path and is normally 260 characters.

Note: For Boolean parameters and relevant system information, 1 represents True and 0 represents False.

Note: Each Group ID for EFI ends with a 2. This differentiates the platform from Windows tests, which use 0 and 1 (32 or 64 bit).

Platforms

The Pc-Check UEFI diagnostics requires 64 bit UEFI of revision 2.31 or greater, SMBIOS version 2.7 or greater.

Test Results

The overall result of each test will be one of five values:

- Passed: the test ran to completion and no error was found.
- Failed: the test ran but an error was found either with the hardware or an operator selected a Fail.
- Skipped: the test was skipped by the operator.
- Aborted: the test was aborted by the operator.
- Not Available: the system has determined the test cannot be run. The hardware is not present or the test parameters are out of scope.

If 'Failed' or 'Not Available' the error code will give details of the cause of the failure or the reason the test was not available.

Note: Some tests will populate extra information when a test completes. Where the extra information returns a completed proportion of the device, the Decimal System is used when converting between multiples of units i.e. a KB is 1000 Bytes. Only in the case of Memory the Binary System is used i.e. a KB is 1024 Bytes.

Test Group	Group Name	Tests
1002	Memory	401 - Seating 402 - Quick 403 - Pseudo Random Data 404 - Pseudo Random Address 405 - Inversion Tree 406 - Stride 407 - Block Rotation 408 - Microtopology 409 - BIOS Fault Detection 410 - Bit Comb
1402	Keyboard	401 - Keyboard Test (I) 402 - Keyboard Lights (I)
1502	Mouse	401 - Mouse Test (I)
2202	Network	401 - Ping 402 - Self Test 403 - ICMP (L)
2602	Hard Drives	401 - S.M.A.R.T. Immediate 402 - Butterfly Seek 403 - Random Read 404 - Linear Read 405 - S.M.A.R.T. Short Self Test 406 - S.M.A.R.T. Extended Self Test 407 - S.M.A.R.T. Conveyance 408 - Standby 409 - Non-Destructive Write 410 - Internal Cache 411 - Intelligent Scan
3102	USB	401 - Quick Test (L) 402 - NRZI Max Bit Stuffing (L) 403 - NRZI Glitch Zero (L) 404 - NRZI Line Oscillation Type 1 (L) 405 - NRZI Line Oscillation Type 2 (L) 406 - NRZI Line Oscillation Type 3 (L) 407 - NRZI Line Oscillation Type 4 (L) 408 - Max Disparity (L) 409 - Random Data (L)
3502	Monitor	401 - Active Panel (I) 402 - Active EDID

Test Group	Group Name	Tests
4502	Serial Ports	401 - Line Control 402 - Handshake (L) 403 - External Loopback (L) 404 - Internal Loopback 405 - FIFO (L) 406 - Divisor Clock 407 - Endurance (L)
5412	System	401 - Stress 402 - Boot Variable Check
5502	Processor	401 - Core Instruction Set 402 - Floating point 403 - SSE (All Revisions) 408 - AVX (All Revisions) 409 - Pairing Symmetry 410 - Execution Symmetry 411 - Cache Coherency 412 - Cache Memory
5612	Audio	401 - Direct PCM (I) 402 - Streamed PCM (I) 403 - DMA Controller
5702	Graphics Card	401 - Display Memory
6202	Optical	401 - Linear Read 402 - Random Read 403 - Butterfly Seek 404 - Deep Read 405 - Laser Refocus
6702	Motherboard	401 - Memory Buses 402 - PCI Buses 403 - Disk Buses 404 - Non-Volatile Storage 405 - Real Time Clock
7002	Solid State Drives	401 - Linear Read 402 - Random Read 403 - S.M.A.R.T. Immediate 404 - S.M.A.R.T. Short Self Test 405 - S.M.A.R.T. Extended Self Test 406 - Internal Cache 407 - S.M.A.R.T. Conveyance 408 - Intelligent Scan 409 - S.M.A.R.T. Wear Levelling
7202	Touch Device	401 - Touch Test (I)
7702	System Block Device	401 - Linear Read 402 - Random Read 403 - Intelligent Scan

Test Group	Group Name	Tests
7802	NVMe Drives	401 - Linear Read 402 - Random Read 403 - Internal Cache 404 - S.M.A.R.T Health 405 - Intelligent Scan
8102	TPM	401 - Basic Functionality

System Error Codes

Error Code	Name
0x30/3FF	Memory Allocation Error
0x31/3FF	Parameter read error
0x32/3FF	Parameter validation error
0x33/3FF	This test is not available on your OS
0x34/3FF	This test requires interactive mode
0x35/3FF	The specified test was not found
0x37/3FF	No testable devices were detected
0x38/3FF	Attribute read error
0x39/3FF	Test run failure
0x3C/3FF	This test is not compatible with the current system

Extra Information Codes

Extra Code	Description
002	Loop-back or Eurosoft hardware Detected during testing
003	Percentage achieved during testing
004	Address location of error
005	Drive position for error
006	Read or Write transfer over or under
009	Core that has failed
00A	Media size returned
00B	Failed transfer speed
010	Serial port specific error
015	S.M.A.R.T. failed attribute
016	Speed that was outside tolerance
017	Time that was outside tolerance
019	Temperature that was out of range
01B	Device number that failed in composite test such as stress
080	Test specific and relevant to error
3FF	No extra information and last error to be used

1002 - Memory

Overview

This is a group that tests physical memory (RAM).

Different testing algorithms are used by which to reveal the faulty behaviour of prone memory modules. Memory testing is a probabilistic process that seeks to discover problems that could lead to data or program corruption in normal operation. The number of possible combinations of data and timing are near infinite, so most test algorithms seek to isolate problems though proven methods and careful design based on the physical characteristics of the manufacturing design - for example physically adjacent bit cells are more likely to show coupling effects.

Note: 1. If testing with a duration, for all tests this should be at least a minute.

Note: 2. In this test group it is possible to combine the duration and coverage parameters. i.e. you can test 50% of memory for 60 minutes.

Note: 3. Identify the failing module by matching the 'handle' value of the device in the system information log with the value given in the test failure code of the result log.

Tests

Test	Name	I	E	M	T
401	Seating				
402	Quick				
403	Pseudo Random Data				
404	Pseudo Random Address				
405	Inversion Tree				
406	Stride				
407	Block Rotation				
408	Microtopology				
409	BIOS Fault Detection				
410	Bit Comb				

Parameters

Test	Parameter	Name	Default	Min	Max	Note(s)
401	1	Duration	0	0	604800	How long to run the test in seconds or specify zero if testing by coverage alone (default).
	2	Coverage	100	1	100	Percentage of available memory to test.
	5	Use bootstrap processor only	FALSE	FALSE	TRUE	Test only with the bootstrap processor thread.
402	1	Duration	0	0	604800	
	2	Coverage	100	1	100	
	4	Data Pattern	0xCCCCCCCCCCCCCCCC	0x0	0xFFFFFFFFFFFFFFFF	Data pattern used for test (Hexadecimal value).
	5	Use bootstrap processor only	FALSE	FALSE	TRUE	
403	1	Duration	0	0	604800	
	2	Coverage	100	1	100	
	3	Pseudo Random Seed	0x0	0x0	0xFFFFFFFFFFFFFFFF	Seed for the pseudo random number generator. Use zero for a different seed every lap (time).
	5	Use bootstrap processor only	FALSE	FALSE	TRUE	
404	1	Duration	0	0	604800	
	2	Coverage	100	1	100	
	3	Pseudo Random Seed	0x0	0x0	0xFFFFFFFFFFFFFFFF	
	5	Use bootstrap processor only	FALSE	FALSE	TRUE	
405	1	Duration	0	0	604800	
	2	Coverage	100	1	100	
	5	Use bootstrap processor only	FALSE	FALSE	TRUE	

Test	Parameter	Name	Default	Min	Max	Note(s)
406	1	Duration	0	0	604800	
	2	Coverage	100	1	100	
	5	Use bootstrap processor only	FALSE	FALSE	TRUE	
407	1	Duration	0	0	604800	
	2	Coverage	100	1	100	
	5	Use bootstrap processor only	FALSE	FALSE	TRUE	
408	1	Duration	0	0	604800	
	2	Coverage	100	1	100	
	3	Pseudo Random Seed	0x0	0x0	0xFFFFFFFF FFFFFFFF	
	5	Use bootstrap processor only	FALSE	FALSE	TRUE	
410	1	Duration	0	0	604800	
	2	Coverage	100	1	100	
	5	Use bootstrap processor only	FALSE	FALSE	TRUE	

Descriptions

401 - Seating

Exercises the address and data lines to ensure proper seating of memory modules in a quick to execute test.

Test Time: Approx 1.5s per GB

402 - Quick

Writes user specified fixed pattern into memory (default 0xC repeated across 64 bits) and verifies that it was stored correctly.

Test Time: Approx 0.5s per GB

403 - Pseudo Random Data

Writes pseudo-random patterns into memory and verifies that they were stored correctly.

Test Time: Approx 1s per GB

404 - Pseudo Random Address

Writes pseudo-random data to pseudo-random addresses using a sequence generated with the start seed value. After memory is filled with data, the sequence is repeated to verify memory stored the values correctly.

Test Time: Approx 3s per GB

405 - Inversion Tree

Set blocks of bits to 1 or 0 with increasing frequency such that over time they would form a tree pattern.

Test Time: Approx 7s per GB

406 - Stride

Writes a test pattern across memory with a variable stride, then tries to disrupt the stored pattern with writes to other memory not included in the first pass.

Test Time: Approx 36.5s per GB

407 - Block Rotation

Writes a test pattern to blocks of memory, each time rotated in respect to each other. Checks that these values are correctly stored.

Test Time: Approx 10s per GB

408 - Microtopology

Uses an advanced mathematical principle to manipulate physically adjacent cells even if the true topology of the memory modules is unknown. This test can also detect timing and noise issues in the memory system as a whole. The longer this test can run, the greater the probability of finding a fault.

Test Time: Approx 7.5m per GB

409 - BIOS Fault Detection

Check to see if the BIOS has disabled any memory as unusable during POST. Disabled memory will not be available to the other tests, so running this test ensures these potential failures are not masked.

Test Time: 1s

410 - Bit Comb

Set alternating bits to 1 and 0 at a range of different frequency and polarity.

Test Time: Approx 10s per GB

Error Codes

Error Code	Name
0x00/004	Mismatch of memory value.
0x01/3FF	Memory allocation failure.
0x02/3FF	The application processor timed out.
0x03/3FF	Core synchronisation failed.
0x04/3FF	Memory marked unusable by BIOS.
0x05/3FF	1 or more application processors failed to start.
0x06/3FF	Unexpected algorithmic failure, parasitic memory corruption?

Troubleshooting

Error Code(s)	Potential Reason
0x00/004 0x04/3FF 0x06/3FF	The memory appears to be faulty. Try re-seating or swapping out modules.
0x01/3FF 0x02/3FF 0x03/3FF 0x05/3FF	There was an internal error. The test was inconclusive. Check for BIOS updates.

1402 - Keyboard

Overview

This group tests the computer keyboard. The group includes template (layout) editing features.

Note: UEFI firmware compatibility issues may exist on some systems in template edit mode.

Tests

Test	Name	I	E	M	T
401	Keyboard Test	•			
402	Keyboard Lights	•			

Parameters

Test	Parameter	Name	Default	Min	Max	Note(s)
401	1	Template Name	""	0	0	Name of the desired keyboard layout template
	2	Time-out	10	5	300	Time in seconds to press the next indicated key
	3	Ignore Shift Keys	FALSE	FALSE	TRUE	Ignore and skip over all shift keys
	4	Template Edit Mode	FALSE	FALSE	TRUE	Start the test in template edit mode

Descriptions

401 - Keyboard Test

Tests the keyboard switches can detect being pressed by the operator. The test proceeds in an ordered manner from the top left key to the bottom right key in rows. If a highlighted key is not detected within a short time-out period, the operator is asked if the test should either be failed, if the key should be ignored (for example the keyboard layout is not a perfect match for the unit under test) or to continue (the operator left and has now returned to the test).

Enable the template edit mode parameter to customise the test to a specific keyboard layout. A mouse or functional trackpad is required to operate the editor.

Note: Some special keys ('FN' or media controls) cannot be tested in the UEFI environment.

Note: Due to an issue affecting some UEFI BIOS handling of keyboard events, some systems are unable to determine when shift keys (Shift, Ctrl, Alt/Alt Gr, Logo/Win, Menu or Sys Req/Print Screen) are individually pressed. Should one of these keys be subject of a time-out, the test will offer an additional choice to skip all such keys. A test parameter is also provided for where the unit under test is already known to exhibit this issue.

Test Time: 30s to 2m

402 - Keyboard Lights

Cycle the keyboard lights if present.

Error Codes

Error Code	Name
0x00/3FF	The test cannot be executed because something is not supported.
0x01/3FF	The test timed out.
0x02/3FF	The template file failed to load.
0x03/3FF	The test was failed by the the operator.

Troubleshooting

Error Code(s)	Potential Reason
0x00/3FF	It is not possible to run the test because of a system limitation, such as missing BIOS features. Check for BIOS updates.
0x01/3FF 0x03/3FF	The operator failed the keyboard. Try the keyboard again in a full operating system, prior to replacement.
0x02/3FF	Check that program media is inserted correctly.

1502 - Mouse

Overview

This group tests the mouse or trackpad (touchpad). A relative pointing device that reports changes in the position of the device as a vector.

Note: Some UEFI laptops (especially earlier models) may not provide trackpad support in pre-boot.

Tests

Test	Name	I	E	M	T
401	Mouse Test	•			

Parameters

Test	Parameter	Name	Default	Min	Max	Note(s)
401	1	Time-out	90	10	600	Time in seconds allowed to complete the test
	2	Number of buttons	2	1	2	Number of buttons (1 or 2)

Descriptions

401 - Mouse Test

Tests the ability of the mouse or trackpad to respond to movement in all directions and to register pressing of the two main buttons (usually designated left and right).

Test Time: 8s

Error Codes

Error Code	Name
0x00/3FF	The test cannot be executed because something is not supported.
0x01/3FF	The test timed out.

Troubleshooting

Error Code(s)	Potential Reason
0x00/3FF	It is not possible to run the test because of a system limitation, such as missing BIOS features. Check for BIOS updates.
0x01/3FF	The device was failed because the test time ran out before the operator completed the required actions. Some BIOS support only one button, if this is the case, modify the test parameters.

2202 - Network

Overview

This is a test group for Network Interface Cards. A Network Interface Card (NIC, also known as a Network Interface Controller, network adapter, LAN adapter, and by similar terms) is a computer hardware component that connects a computer to a computer network such as Ethernet, WIFI or Token Ring. This provides a base for a full network protocol stack, allowing communication among small groups of computers on the same local area network (LAN) and large-scale network communications through routable protocols, such as Internet Protocol (IP).

NIC diagnostics are done through self testing as well as packet send and receive sequence verification through standard NIC tests known as Ping tests. Self tests and simple Ping tests are hardware internal tests, simple Ping is done through PHY loopback. ICMP Ping test is an IP based ICMP Ping test which can be configured to run a loop back ping on same NIC or an external ICMP to a remote machine.

Note: The network stack MUST be enabled from UEFI BIOS Setup to run tests from this group.

Note: The Self test and simple Ping testing does not require any configuration, or additional cabling. ICMP Ping requires either a loopback plug (internal Ping) or suitable cabling to connect a network (external ping). To ping a remote system, both the tested and remote systems should be on same subnet else the reply will time-out. A gateway address should also be specified in the test attributes, even if there is no gateway machine present, as this is required for configuration.

Tests

Test	Name	I	E	M	T
401	Ping				
402	Self Test				
403	ICMP		•		

Parameters

Test	Parameter	Name	Default	Min	Max	Note(s)
403	1	Source IP	"0.0.0.0"	0	0	Source IP address
	2	IP Subnet mask	"255.255.255.0"	0	0	Network subnet mask
	3	Destination IP	"0.0.0.0"	0	0	Destination IP address
	4	Gateway IP	"0.0.0.0"	0	0	Gateway address
	5	ICMP Send Count	0	1	100	How many times to retry send

Descriptions

401 - Ping

The Ping Test is a loopback ping test which does not require any configuration. The Ping test is carried through internal PHY loopback if it is supported by the built in NIC card and firmware driver.

Test Time: 1s

The ICMP Ping Test uses the IP stack and is based on ICMP protocol. The test uses network ping to test NIC internally, or can ping an external machine to test send and receive. It requires loop back plug to ping NIC itself and a common network cable to ping an external remote machine.

The ICMP Ping Test assigns the test machine an IP address which should be provided through test parameters. For loopback ping, the source and destination IP must be the same address. To ping a remote machine, the source IP must be from the same subnet as that of the remote machine. A gateway IP must be provided in configuration file even if a gateway is present or not in the network.

Test Time: 1s

402 - Self Test

The Self Test uses firmware provided test routines which do not require additional configuration. Although the specific behaviour is determined by the vendor, important hardware registers and components should typically be checked.

Test Time: 1s

403 - ICMP

The ICMP Ping Test uses the IP stack and is based on ICMP protocol. The test uses network ping to test NIC internally, or can ping an external machine to test send and receive. It requires loop back plug to ping NIC itself and a common network cable to ping an external remote machine.

The ICMP Ping Test assigns the test machine an IP address which should be provided through test parameters. For loopback ping, the source and destination IP must be the same address. To ping a remote machine, the source IP must be from the same subnet as that of the remote machine. A gateway IP must be provided in configuration file even if a gateway is present or not in the network.

Test Time: 1s

Error Codes

Error Code	Name
0x00/3FF	The test cannot be executed because a required feature is not supported.
0x01/3FF	Loopback plug or cable not attached.
0x02/3FF	IP v4 conversion error. IP address in configuration file is not in correct format.
0x03/3FF	IP instance creation error. Test failed to initialize due to a general failure.
0x04/3FF	ICMP receive error detected.
0x05/3FF	ICMP send error detected. NIC failed to send data.
0x06/3FF	Event timer error. Failed to create timer due to a general error.
0x07/3FF	Parsing error while trying to read test parameters.
0x08/3FF	Network card has a permanent address, which can't be changed.
0x09/3FF	Network card failed to configure. General Error.
0x0A/3FF	Network reply timed out. Something is wrong with the network card, plug or network cable.

Troubleshooting

Error Code(s)	Potential Reason
0x02/3FF 0x03/3FF 0x04/3FF 0x05/3FF 0x06/3FF 0x08/3FF 0x09/3FF 0x0A/3FF	The device may be faulty. Check that all prerequisites were met correctly.
0x00/3FF 0x01/3FF	Either the loopback plug is not attached, or if using remote ICMP ping, the cable is not attached or has a fault.
0x07/3FF	A configuration parameter was incorrect. The test was inconclusive. Please go back and make correction.

2602 - Hard Drives

Overview

This group tests Hard Drives. Hard Drives consist of one or more rigid (hence "hard") rapidly rotating discs, coated with magnetic material and with magnetic heads arranged to write data to the surfaces and read it from them.

Tests are available to verify the head actuator mechanism, reliability of the recording medium, report the S.M.A.R.T. status, and possibility of imminent drive failure. You can also run the manufacturer's built in self tests.

Note: Hard Drives offer large storage capacities. A coverage of 100% will exhaustive test all parts of the media, but will also take a long time to complete.

Tests

Test	Name	I	E	M	T
401	S.M.A.R.T. Immediate				
402	Butterfly Seek				
403	Random Read				
404	Linear Read				
405	S.M.A.R.T. Short Self Test				
406	S.M.A.R.T. Extended Self Test				
407	S.M.A.R.T. Conveyance				
408	Standby				
409	Non-Destructive Write				
410	Internal Cache				
411	Intelligent Scan				

Parameters

Test	Parameter	Name	Default	Min	Max	Note(s)
401	5	S.M.A.R.T Diagnostic Threshold	100	1	10000	Specifies the maximum permitted error count in the comprehensive S.M.A.R.T error log
	6	Ignore S.M.A.R.T Error Log	FALSE	FALSE	TRUE	Specifies any error count in the comprehensive S.M.A.R.T error log will be ignored
402	1	Duration	0	0	604800	How long to run the test in seconds
	2	Coverage	100	1	100	Percentage of total capacity to test
	3	Maximum Errors	1	1	50	Continues to test until the maximum number of errors is reached, only errors directly associated with reading the drive
403	1	Duration	300	1	604800	
	3	Maximum Errors	1	1	50	
404	1	Duration	0	0	604800	
	2	Coverage	100	1	100	
	3	Maximum Errors	1	1	50	
409	1	Duration	0	0	604800	
	2	Coverage	100	1	100	
	3	Maximum Errors	1	1	50	
411	1	Duration	0	0	604800	
	7	Intelligent Scan Speed	1	1	3	Specifies the speed setting for the intelligent scan test, (3 is fastest)

Descriptions

401 - S.M.A.R.T. Immediate

A "threshold exceeded" value is intended to indicate that there is a relatively high probability that the drive will not be able to honour its specification in the future: that is, it's "about to fail". The predicted failure may be catastrophic, or may be something as subtle as inability to write to certain sectors, or slower performance than the manufacturer's minimum.

Test Time: 2s to 10s

402 - Butterfly Seek

Each Butterfly Seek test iteration consists of two seeks: one seek is lower than (below) the middle sector and one seek is higher than (above) the middle sector. After each iteration, the lower seek position increases and the higher seek position decreases by the same amount.

Test Time: 8m to 12m per GB

403 - Random Read

Each Random Seek test iteration is one seek to a pseudo random sector position. The purpose of this test is to test the head actuator mechanism, not the read head mechanism; so the actual sectors that are read, and even the accuracy of the data found, are not necessarily relevant. For this reason, it does not matter if the pseudo-random generator produces the same sector to check each time the test is run.

Test Time: 7m to 11m minutes per GB

404 - Linear Read

Each Read Verify test iteration is one seek and verify. Each iteration, the seek position increases by one sector increment.

Test Time: 1.5m to 6m per GB

405 - S.M.A.R.T. Short Self Test

This test launches and monitors a S.M.A.R.T. Short Self-Test.

This test checks the electrical and mechanical performance as well as the read performance of the disk.

Electrical tests might include a test of buffer RAM, a read-write circuitry test, or a test of the read-write head elements.

Mechanical test includes seeking and servo on data tracks. Scans small parts of the drive's surface. Checks the list of pending sectors that may have read errors.

Test Time: 2m

406 - S.M.A.R.T. Extended Self Test

This test launches and monitors a S.M.A.R.T. Extended Self-Test.

A longer and more thorough self-test which scans the entire disk surface, with no time limit.

This test may take many hours to complete.

Test Time: Hundreds of minutes, this is device dependent

407 - S.M.A.R.T. Conveyance

This test launches and monitors a S.M.A.R.T. Conveyance Self-Test

Intended as a quick test to identify damage incurred during transporting of the device from the drive manufacturer to the computer manufacturer.

Test Time: Several minutes, this is device dependent

408 - Standby

This test puts the drive into low power mode in which the spinning disk media is brought to a stop. The drive is then 'spun up' and accessed for data. This process is monitored for problems.

409 - Non-Destructive Write

Tests the drives ability to reliably write data. Each Non-Destructive Write test iteration first reads the existing data from the disk region to be tested. The disk region is then over written with test data, verified and finally the original data is restored. In the event of failure, the test will always try to restore the original data many times over before ending. Each iteration, the seek position increases by one sector increment.

Test Time: 6m to 24m per GB

410 - Internal Cache

Tests the Hard Drive Internal Cache or Buffer Memory.

Test Time: 10s

411 - Intelligent Scan

The Intelligent Scan algorithm is a unique alternative to traditional Linear Read testing that provides a big time saving benefit when scanning large media for issues such as bad sectors, with little to no loss of test accuracy.

Test Time: Variable

Error Codes

Error Code	Name
0x00/3FF	Device ID unknown (exceeds array depth).
0x01/3FF	Device is too small to test.
0x02/005	Device read failed.
0x03/3FF	S.M.A.R.T. interface not supported.
0x04/3FF	S.M.A.R.T. disabled or not supported by device.
0x05/3FF	S.M.A.R.T. failed.
0x06/3FF	Requested S.M.A.R.T. test not supported by device.
0x07/3FF	Standby immediate command failed.
0x08/3FF	Device write failed.
0x09/005	Read written data mismatch.
0x0A/015	A S.M.A.R.T. attribute reached or below the acceptable threshold value.
0x0B/3FF	A S.M.A.R.T. comprehensive log error count at or exceeding the acceptable limit.
0x0C/3FF	Internal error, undersized buffer.
0x0D/080	S.M.A.R.T. self test failed.

Troubleshooting

Error Code(s)	Potential Reason
0x01/3FF 0x02/005 0x07/3FF 0x08/3FF 0x09/005	The disk appears to be faulty. Disk errors can sometimes be caused by power loss.
0x05/3FF 0x0A/015 0x0B/3FF 0x0D/080	S.M.A.R.T. testing has failed. A fault or imminent fault is detected with the disk.
0x03/3FF 0x04/3FF 0x06/3FF	The disk does not appear to support this kind of test. Check to see if S.M.A.R.T. feature has been disabled in the BIOS.
0x00/3FF 0x0C/3FF	A program error, such as a memory allocation failure. Check for BIOS updates. The test was inconclusive.

3102 - USB

Overview

This group is for Universal Serial Bus (USB). USB is a specification for the cables, connectors and protocols that provide convenient and flexible serial communication with connected devices at a variety of speeds. It is typically used to connect external peripheral devices ranging from a mouse to a back-up storage solution.

This group is only available if Eurosoft USB hardware is detected when the program initialises. It will not be available if there are no suitable USB devices connected to the USB ports.

Each device identified by this group corresponds to a Eurosoft USB Test Device or Eurosoft Program Device. It is not however this device which is tested, but the connectivity to it, comprising of controllers, traces, cabling and port.

Note: This test group requires enhanced Eurosoft USB Test or Program Devices, earlier Eurosoft USB Test Devices are not recognised in the UEFI product. The required plug type can be recognised by the presence of a file system partition.

Note: Devices should not be removed or inserted while diagnostics are running.

Tests

Test	Name	I	E	M	T
401	Quick Test		•		
402	NRZI Max Bit Stuffing		•		
403	NRZI Glitch Zero		•		
404	NRZI Line Oscillation Type 1		•		
405	NRZI Line Oscillation Type 2		•		
406	NRZI Line Oscillation Type 3		•		
407	NRZI Line Oscillation Type 4		•		
408	Max Disparity		•		
409	Random Data		•		

Parameters

Descriptions

401 - Quick Test

A short test providing a rapid means to assess basic USB port functionality. Use the other tests provided to test port reliability.

Test Time: 5s to 10s

402 - NRZI Max Bit Stuffing

NRZI Max Bit Stuffing Test. Hi-speed data transfers self-clock using transitions contained within the data transmitted. The encoding method is called non-return-to-zero-inverted (NRZI) encoding. To ensure sufficient transitions, additional bits are added, known as bit stuffing. This test creates the conditions where the maximum use of bit stuffing is required.

Test Time: 1m to 3m

403 - NRZI Glitch Zero

NRZI Glitch Zero Test. Hi-speed data transfers self-clock using transitions contained within the data transmitted. The encoding method is called non-return-to-zero-inverted (NRZI) encoding. To ensure sufficient transitions, additional bits are added, known as bit stuffing. This test uses a stable stream of maximum bit stuffed data with randomly occurring zeros.

Test Time: 1m to 3m

404 - NRZI Line Oscillation Type 1

NRZI Line Oscillation Type 1 Test. Hi-speed data transfers self-clock using transitions contained within the data transmitted. The encoding method is called non-return-to-zero-inverted (NRZI) encoding. This test uses a data pattern to set up a square wave oscillation within the data encoding. This tests for susceptibility to capacitive, inductive or conductive crosstalk. Each test type exploits a different frequency of oscillation.

Test Time: 1m to 3m

405 - NRZI Line Oscillation Type 2

NRZI Line Oscillation Type 2 Test. Hi-speed data transfers self-clock using transitions contained within the data transmitted. The encoding method is called non-return-to-zero-inverted (NRZI) encoding. This test uses a data pattern to set up a square wave oscillation within the data encoding. This tests for susceptibility to capacitive, inductive or conductive crosstalk. Each test type exploits a different frequency of oscillation.

Test Time: 1m to 3m

406 - NRZI Line Oscillation Type 3

NRZI Line Oscillation Type 3 Test. Hi-speed data transfers self-clock using transitions contained within the data transmitted. The encoding method is called non-return-to-zero-inverted (NRZI) encoding. This test uses a data pattern to set up a square wave oscillation within the data encoding. This tests for susceptibility to capacitive, inductive or conductive crosstalk. Each test type exploits a different frequency of oscillation.

Test Time: 1m to 3m

407 - NRZI Line Oscillation Type 4

NRZI Line Oscillation Type 4 Test. Hi-speed data transfers self-clock using transitions contained within the data transmitted. The encoding method is called non-return-to-zero-inverted (NRZI) encoding. This test uses a data pattern to set up a square wave oscillation within the data encoding. This tests for susceptibility to capacitive, inductive or conductive crosstalk. Each test type exploits a different frequency of oscillation.

Test Time: 1m to 3m

408 - Max Disparity

Max Disparity Test. SuperSpeed transfers self-clock using transitions contained within the data transmitted. The encoding method is 8b/10b encoding. For every 8 bits of original data, 10 bits are transmitted so as to ensure that sufficient transitions occur for the clock to be recovered and that the electrical properties of the signal are optimal. This test randomly combines data those bit patterns that produce the most running disparity in the encoded signal.

Test Time: 1m to 3m

409 - Random Data

Random Data Test. Transfers random data and ensures that the transfers complete accurately without data corruption.

Test Time: 1m to 3m

Error Codes

Error Code	Name
0x00/3FF	The test cannot be executed because something is not supported.
0x01/3FF	The specific test is unavailable.
0x02/3FF	A read error occurred.
0x03/3FF	The USB test failed.

Troubleshooting

Error Code(s)	Potential Reason
0x00/3FF 0x01/3FF	Ensure the proper Test Device is inserted to the USB port. Try re-plugging the device. Some BIOS require for Test Devices to be inserted prior to booting the diagnostics while power is off.
0x02/3FF	An error occurred while reading the Test Device. There may be a hardware fault. You can try re-plugging the device. Some BIOS require for Test Devices to be inserted prior to booting the diagnostics while power is off.
0x03/3FF	The port appears to be faulty. You can try re-plugging the Test Device. Some BIOS require for Test Devices to be inserted prior to booting the diagnostics while power is off.

3502 - Monitor

Overview

This group tests the video display panel or monitor.

Displays a series of images to assist in determining the correct operation of the display panel or monitor. Look for issues such as dead pixels and faulty colour channels.

Note: UEFI pre-boot supports only one monitor which is the default monitor at boot.

Tests

Test	Name	I	E	M	T
401	Active Panel	•			
402	Active EDID				

Parameters

Test	Parameter	Name	Default	Min	Max	Note(s)
401	1	Maximum Horizontal Resolution	0	0	32000	Maximum horizontal resolution for display of test patterns. Use this to limit resolution if BIOS offers modes beyond capability of the panel.

Descriptions

401 - Active Panel

This test is an interactive test which presents various screen test patterns. The operator must assess carefully the display to identify dead pixels or poor colour representation. The operator must press a key to proceed to the next test pattern. If no input is received for approximately one minute, the test will end automatically. At the end of the test, the operator shall be asked if the display seemed correct.

Test Time: Approx 1m

402 - Active EDID

This test looks for the presence of and performs basic verification of the Extended Display Identification Data (EDID) published by the attached display device.

Test Time: Approx 10s

Error Codes

Error Code	Name
0x00/3FF	The test cannot be executed because something is not supported.
0x01/3FF	Display panel declared faulty by operator.
0x02/3FF	Failed so set graphics mode selected from resolutions.
0x03/3FF	Failed to restore original video mode.
0x04/3FF	EDID test failed, likely due to compulsory checksum error.

Troubleshooting

Error Code(s)	Potential Reason
0x01/3FF 0x04/3FF	The display panel is faulty. Consider replacement.
0x00/3FF 0x02/3FF 0x03/3FF	An internal error prevented proper test operation. The test was inconclusive. It may be a firmware error or limitation. Check for BIOS updates.

4502 - Serial Ports

Overview

This group tests serial ports. A serial port (sometimes called a COM port) is a physical interface through which information transfers in or out one bit at a time according to the RS-232 standard. Tests are provided to verify the functionality of the serial ports as they transmit data and receive data, manipulate various control signals or set different transmission (baud) rates.

Each device identified by this group is a serial port.

Note: Serial port hardware is available in almost every PC system, but external connections are often missing. Similarly, multi-port extender cards may feature internal headers for additional backplates that may not be installed. It is not possible for software to detect if ports have external connections.

Note: UARTs with higher input base clocks will be tested at correspondingly higher rates. For instance, a doubled base clock will mean that 9,600 baud will be doubled to 19,200 for the same register settings, while the highest rate will become 230,400 baud instead of 115,200.

Tests

Test	Name	I	E	M	T
401	Line Control				
402	Handshake		•		
403	External Loopback		•		
404	Internal Loopback				
405	FIFO		•		
406	Divisor Clock				
407	Endurance		•		

Parameters

Test	Parameter	Name	Default	Min	Max	Note(s)
402	3	Promote missing loopback to fail	FALSE	FALSE	TRUE	Promote the status of a port with a missing loopback to failed
403	3	Promote missing loopback to fail	FALSE	FALSE	TRUE	
405	3	Promote missing loopback to fail	FALSE	FALSE	TRUE	
407	1	Duration	300	1	604800	How long to run the test in seconds
	2	BAUD	57600	300	115200	BAUD rate at which to test, if the UART being tested is overclocked the BAUD rate will be increased proportionally.
	3	Promote missing loopback to fail	FALSE	FALSE	TRUE	

Descriptions

401 - Line Control

Test the serial port line control. The line control register determines the number of data, stop and parity bits. A loopback plug is not required for this test.

Test Time: 20s

402 - Handshake

Test the serial port flow control. Tests the hardware handshake CTS, RTS, DSR and DTR signals. A loopback plug is required for this test.

Test Time: 5s

403 - External Loopback

Transmits and receives data externally to the UART (at the port, TX and RX signals) using various rates. The received data is checked against the transmitted data. A loopback plug is required for this test.

Test Time: 10s

404 - Internal Loopback

Transmits and receives data internally to the UART (within the device) using various rates. The received data is checked against the transmitted data. A loopback plug is not required for this test.

Test Time: 10s

405 - FIFO

Tests the serial port FIFO (First In, First Out) buffers at various speeds. Data is transmitted and received using the FIFO buffer. The received data is checked against the transmitted data. A loopback plug is required for this test.

Test Time: 8s

406 - Divisor Clock

Test of the serial port clock divisor. Data is transmitted and received using an internal loopback configuration while accurately timed to ensure the correct relative rate is obtained for the speed divisor setting. A loopback plug is not required for this test.

Test Time: 25s

407 - Endurance

Test the serial port endurance. Transmits and receives randomised data externally (at the port) for an extended period. The received data is checked against the transmitted data. A loopback plug is required for this test.

Test Time: Specified by Duration parameter (5m)

Error Codes

Error Code	Name
0x00/3FF	The test cannot be executed because something is missing.
0x01/3FF	The serial test failed.

Troubleshooting

Error Code(s)	Potential Reason
0x00/3FF	Most likely a loopback plug was not detected at the port.
0x01/3FF	The serial port has failed the test. Check for correct connection to internal port headers.

5412 - System

Overview

The tests in this group reference the computer as a system rather than to focus on any single device. Tests may access multiple components simultaneously, so as to invoke issues that might only be seen under those conditions, for example those issues which occur with the associated increase in power or thermal load. They may also be concerned with the detection of system wide configuration issues.

Tests

Test	Name	I	E	M	T
401	Stress				
402	Boot Variable Check				

Parameters

Test	Parameter	Name	Default	Min	Max	Note(s)
401	1	Use bootstrap processor only	FALSE	FALSE	TRUE	Test only the bootstrap processor thread.
	2	Duration	300	30	604800	How long to run the test in seconds
	3	Include Processor	TRUE	FALSE	TRUE	Include processor for stress testing
	4	Include Memory	TRUE	FALSE	TRUE	Include memory for stress testing
	5	Include Video	TRUE	FALSE	TRUE	Include graphics card for stress testing
	6	Include Hard Drives	TRUE	FALSE	TRUE	Include hard drives for stress testing
	7	Include Solid State Drives	TRUE	FALSE	TRUE	Include solid state drives for stress testing
	8	Include NVMe Drives	TRUE	FALSE	TRUE	Include NVMe drives for stress testing
	9	Include System Block Devices	TRUE	FALSE	TRUE	Include system block devices for stress testing

Descriptions

401 - Stress

This test simulates a heavy system load. It utilises all available processor sockets, threads, hard drives, solid state drives, system and video memory.

Note: If the system is found to restart during this test, it is likely to have suffered an unrecoverable error. Possible causes are firmware triggered protective thermal shutdown, insufficient or unstable power supply and memory corruption. The results log will show that the test was started as the last entry.

Note: Since testing occurs in the pre-boot environment without drivers, graphics card testing is restricted to operations on the frame buffer. For more sophisticated graphics card testing with 3D objects, please use our Windows diagnostic.

Test Time: Specified by Duration parameter (5m)

402 - Boot Variable Check

Checks the system boot variables reference valid devices and paths.

Test Time: 1s

Error Codes

Error Code	Name
0x00/3FF	There are no testable system components selected or available.
0x01/3FF	Memory allocation failure.
0x02/3FF	The application processor timed out.
0x04/3FF	One or more application processors failed to start.
0x05/3FF	A diagnostic group failed to initialise for stress testing.
0x06/01B	A hard drive failed during stress testing.
0x07/01B	A solid state drive failed during stress testing.
0x08/01B	An NVMe drive failed during stress testing.
0x09/01B	A system block device failed during stress testing.
0x0A/3FF	Graphics card failed during stress testing.
0x0B/004	Memory failed during stress testing.
0x0C/009	Processor failed during stress testing.
0x0D/3FF	A boot variable mentioned in the system boot order points to an invalid location.
0x0E/3FF	Non-Specific test failure.

Troubleshooting

Error Code(s)	Potential Reason
0x00/3FF	Check the system configuration or test parameters to ensure that testable components exist.
0x02/3FF	A processor core management error was reported. A hardware fault may exist. Check first for BIOS updates.
0x01/3FF 0x04/3FF 0x05/3FF 0x0E/3FF	There was an internal error. The test was inconclusive. Check for BIOS updates.
0x06/01B 0x07/01B 0x08/01B 0x09/01B 0x0A/3FF 0x0B/004 0x0C/009	A device has failed during system testing. More specific failure information may be possible by running tests of the device diagnostic group. If the device only fails during system stress testing, consider causes such as insufficient or unstable power supply and thermal instability.
0x0D/3FF	The invalid boot entry number is given in the result extra data. Check boot settings in the system Setup utility and ensure all connected disk devices are functional.

5502 - Processor

Overview

This group tests the processor or processors. The tests confirm the correct operation of both the base, or core, behaviour and the various instruction set extensions supported such as SSE.

The tests are designed to look for anomalous behaviour while processing test sequences and data that are assembled on the fly. The testing approach ensures availability of all register and instruction combinations using a large volume of test data. There are tests for the integer and floating point instructions, plus tests for vector instructions.

The group also includes tests for symmetric behaviour, such as ensuring cores execute at similar speeds or that local cache content can remain synchronised during heavy loading from all cores.

Note: Each device identified by this group represents a physical processor package (socket).

Note: Each set of tests when selected are executed on every applicable processor core / hardware thread (SMT).

Tests

Test	Name	I	E	M	T
401	Core Instruction Set				
402	Floating point				
403	SSE (All Revisions)				
408	AVX (All Revisions)				
409	Pairing Symmetry				
410	Execution Symmetry				
411	Cache Coherency				
412	Cache Memory				

Parameters

Test	Parameter	Name	Default	Min	Max	Note(s)
401	1	Test bootstrap processor only	FALSE	FALSE	TRUE	Test only the bootstrap processor thread.
	2	Duration	30	1	604800	Time to run the test for, in seconds
402	1	Test bootstrap processor only	FALSE	FALSE	TRUE	
	2	Duration	30	1	604800	
403	1	Test bootstrap processor only	FALSE	FALSE	TRUE	
	2	Duration	30	1	604800	
408	1	Test bootstrap processor only	FALSE	FALSE	TRUE	
	2	Duration	30	1	604800	
409	1	Test bootstrap processor only	FALSE	FALSE	TRUE	
410	1	Test bootstrap processor only	FALSE	FALSE	TRUE	
411	1	Test bootstrap processor only	FALSE	FALSE	TRUE	
412	1	Test bootstrap processor only	FALSE	FALSE	TRUE	

Descriptions

401 - Core Instruction Set

This test performs certain processor operations and checks the results against expected results. The Core Test is made up of the following categories:

General: Loads registers with patterns, performs operations that affect certain flags, and then checks to see that everything is operating correctly.

Arithmetic: Performs various addition, subtraction, multiplication, and division operations and verify against expected results.

Logic: Tests binary combination logic, shift, and rotate instructions.

Test Time: Specified by Duration parameter (30s)

402 - Floating point

Tests of the numeric coprocessor instructions to check for correct operation. The operation is compared to the expected result. A failure indicates a variance to the expected result.

Test Time: Specified by Duration parameter (30s)

403 - SSE (All Revisions)

This test performs SSE operations (all variants) and checks the results against model results. The test performs following kind of SSE operations: Integer arithmetic; logic, comparison operations, float arithmetic; logic, comparison operations.

Test Time: Specified by Duration parameter (30s)

408 - AVX (All Revisions)

This test performs AVX operations (all variants) and checks the results against model results. The test performs following kind of AVX operations: Arithmetic, logic, broadcast, insert / extract, min / max, permute, shuffle, fused arithmetic, convert operations.

Test Time: Specified by Duration parameter (30s)

409 - Pairing Symmetry

This test evaluates and tests the processor stepping symmetry. It is generally recommended that all processors in a multi-socket system have the same silicon stepping.

410 - Execution Symmetry

This test evaluates and tests the processor execution performance symmetry.

Test Time: 5 seconds.

411 - Cache Coherency

This tests for processor cache coherency. When multiple cores access the same memory areas, their caches must correctly reflect the changes made by the other cores.

Test Time: 5 seconds.

412 - Cache Memory

This test evaluates the processor cache memory using the Microtopology test algorithm. All caches and cache levels are tested across all cores.

Test Time: About a minute.

Error Codes

Error Code	Name
0x00/3FF	The test for this processor cannot be executed because it is not supported.
0x01/3FF	The Enabled processor core is reported as being unhealthy
0x02/009	A logical processor failure.
0x03/3FF	A general test failure.
0x04/3FF	A memory allocation error.
0x05/3FF	The Enabled processor failed a CPUID request.
0x06/3FF	The processor core pairing symmetry failed.
0x07/3FF	The processor core execution symmetry failed.
0x08/3FF	The application processor timed out.
0x09/3FF	The processor cache coherency failed.
0x0B/3FF	Non-Blocking mode does not function correctly.
0x0C/3FF	The processor cache memory failed.

Troubleshooting

Error Code(s)	Potential Reason
0x00/3FF	The test cannot be executed because something is not supported.
0x02/009 0x03/3FF 0x06/3FF 0x07/3FF 0x09/3FF 0x0C/3FF	Possible processor silicon failure.
0x01/3FF 0x05/3FF 0x08/3FF 0x0B/3FF	A processor core management error was reported. A hardware fault may exist. Check first for BIOS updates.
0x04/3FF	There was an internal error such as a memory allocation failure. The test was inconclusive.

5612 - Audio

Overview

This group is for HD audio.

Each device identified by this group is an HD audio controller. The tests are for audio controllers that provide analogue output either at jack connections or to internal speakers. Some tests require an operator be present to confirm that the expected output is heard.

Tests

Test	Name	I	E	M	T
401	Direct PCM	•			
402	Streamed PCM	•			
403	DMA Controller				

Parameters

Descriptions

401 - Direct PCM

Tests the audio controller direct PCM output. Audio is output (980Hz sine wave, amplitude 0.5) and the operator shall determine if the audio is correctly heard.

Note: Since testing occurs in the pre-boot environment without drivers, SPDIF, HDMI or DP output is unavailable. For these and other technologies, please use our Windows diagnostic.

Note: The test may produce loud output, please be careful with externally connected equipment and avoid using headphones.

Test Time: 5s to 10s

402 - Streamed PCM

Tests the audio controller streamed PCM output. Audio is output and the operator shall determine if the audio is correctly heard.

Note: Since testing occurs in the pre-boot environment without drivers, SPDIF, HDMI or DP output is unavailable. For these and other technologies, please use our Windows diagnostic.

Note: The test may produce loud output, please be careful with externally connected equipment and avoid using headphones.

Test Time: 10s to 1.5m

403 - DMA Controller

Tests the audio controller DMA.

Test Time: 5s to 10s

Error Codes

Error Code	Name
0x00/3FF	The test cannot be executed because the device number is invalid.
0x01/3FF	The test cannot be executed because device initialisation failed.
0x02/3FF	The test cannot be executed due to a memory allocation fault.
0x03/3FF	The test cannot be executed due to a file read error.
0x04/3FF	The operator has reported that correct audio output was not heard.
0x05/3FF	The DMA test has failed.
0x06/3FF	There are no available analogue outputs on the selected controller.
0x07/3FF	There are no available analogue outputs on the selected controller.

Troubleshooting

Error Code(s)	Potential Reason
0x00/3FF 0x01/3FF 0x02/3FF 0x03/3FF	An internal program error. The test result is inconclusive.
0x04/3FF 0x06/3FF 0x07/3FF	Check any cable connections. No audio will be heard from controllers that output digitally (SPDIF, HDMI or DP), this is normal, for these and other technologies, please use our Windows diagnostic.
0x05/3FF	The audio controller may be faulty - investigate further.

5702 - Graphics Card

Overview

This group is for the graphics card.

This group is for testing of the graphics card. Since testing occurs in the pre-boot environment without drivers, testing is restricted to operations on the frame buffer. For more sophisticated and stress testing, please use our Windows diagnostic.

Note: This group has one device which is the system primary graphics card.

Note: For display patterns such as colour gradients, use the Monitor group.

Tests

Test	Name	I	E	M	T
401	Display Memory				

Parameters

Test	Parameter	Name	Default	Min	Max	Note(s)
401	1	Duration	180	30	604800	How long to run the test in seconds
	2	OSD Region (Top)	0	0	256	Number of pixels to ignore at the top of the screen for on-screen display items
	3	OSD Region (Bottom)	0	0	256	Number of pixels to ignore at the bottom of the screen for on-screen display items

Descriptions

401 - Display Memory

Tests frame buffer video memory with Microtopology algorithm.

Test Time: Specified by Duration parameter (3m)

Error Codes

Error Code	Name
0x00/3FF	The test cannot be executed because something is not supported.
0x01/3FF	A memory allocation error occurred.
0x02/3FF	The video memory test failed.

Troubleshooting

Error Code(s)	Potential Reason
0x00/3FF	It is not possible to run the test because of a system limitation, such as missing BIOS features. Check for BIOS updates.
0x01/3FF	An internal program error. The test result is inconclusive.
0x02/3FF	A memory fault was detected. Try swapping the GPU card or if system has integrated video, swap RAM modules and repeat test.

6202 - Optical

Overview

This group provides tests optical media devices. Optical device that can be tested are CD-ROM, DVD or Blu-ray drives. There are tests to cover both the mechanical and data read capabilities of the drives from the pre-boot environment. If required, data write tests are available in the Windows diagnostics suite.

Note: Requires suitable data disc media appropriate to the drive type and operating mode to be tested (CD, DVD or Blu-ray).

Note: 'ROM' Data Only Media must be used and ideally of near total capacity to ensure full travel of the device head during tests.

Tests

Test	Name	I	E	M	T
401	Linear Read			•	
402	Random Read			•	
403	Butterfly Seek			•	
404	Deep Read			•	
405	Laser Refocus			•	

Parameters

Test	Parameter	Name	Default	Min	Max	Note(s)
401	1	Duration	0	0	604800	Time to run the test for in seconds
	2	Coverage	100	1	100	Percentage coverage
	3	Maximum Errors	1	1	50	Continues to test until the maximum number of errors is reached, only errors directly associated with reading the drive.
402	1	Duration	300	1	604800	
	3	Maximum Errors	1	1	50	
403	1	Duration	0	0	604800	
	2	Coverage	100	1	100	
	3	Maximum Errors	1	1	50	
404	1	Duration	300	1	604800	
	3	Maximum Errors	1	1	50	

Descriptions

401 - Linear Read

Exercises a drive's read capability using linear (incrementally increasing) read addresses. Success or failure of each read is monitored.

402 - Random Read

Exercises a drive's read capability using pseudo-random read addresses (these are randomly generated using a fixed computational process). A quick benchmark is performed on the device to determine a read rate. Success or failure of each read is monitored.

403 - Butterfly Seek

Each Butterfly Seek test iteration consists of two seeks: one seek is lower than (below) the middle sector and one seek is higher than (above) the middle sector. After each iteration, the lower seek position increases and the higher seek position decreases by the same amount.

404 - Deep Read

Utilises a specially crafted optical test disk to perform a Deep Read test for enhanced error detection.

405 - Laser Refocus

Utilises a specially crafted optical test disk to check the ability of the laser to refocus with multi layer disks.

Error Codes

Error Code	Name
0x00/3FF	The test cannot be executed because something is not supported.
0x01/3FF	Device ID unknown (Exceeds array depth).
0x02/3FF	Disc is too small to test.
0x03/3FF	Device read failed.
0x04/3FF	Invalid media.
0x05/3FF	Wrong block.
0x06/3FF	Bit walk fail.
0x07/3FF	CRC failure.
0x08/3FF	Corrupt data.

Troubleshooting

Error Code(s)	Potential Reason
0x03/3FF 0x05/3FF 0x06/3FF 0x07/3FF 0x08/3FF	The drive appears to be faulty. Check test media for damage.
0x00/3FF 0x01/3FF	A program error, such as a memory allocation failure. The test was inconclusive. Check for BIOS updates.
0x02/3FF 0x04/3FF	Unsuitable test media supplied. The test was inconclusive. Please select appropriate test media and try again. Some tests require specialist media.

6702 - Motherboard

Overview

This group tests the motherboard, sometimes referred to as the mainboard or logic board.

Usually the largest printed circuit board in a PC, the motherboard provides connections between all the various parts of the system. These connections are collectively known as buses (for example, the PCI bus).

Note: Increasingly the motherboard also provide functions that traditionally would be handled by plug in cards and modules. If you do not see a test for a component that you expected to find in this group, it may have been sophisticated enough to require a group of its own or has been placed within the group of the peripheral it supports.

Tests

Test	Name	I	E	M	T
401	Memory Buses				
402	PCI Buses				
403	Disk Buses				
404	Non-Volatile Storage				
405	Real Time Clock				

Parameters

Test	Parameter	Name	Default	Min	Max	Note(s)
401	1	Duration	15	6	604800	How long to run the test in seconds
402	1	Duration	15	6	604800	
403	1	Duration	15	6	604800	
404	1	Duration	15	6	604800	
405	1	Duration	15	6	604800	

Descriptions

401 - Memory Buses

Tests the memory bus for susceptibility to capacitive, inductive or conductive crosstalk at different transaction frequencies.

Test Time: Specified by Duration parameter (15s)

402 - PCI Buses

Tests the PCI bus for susceptibility to capacitive, inductive or conductive crosstalk at different transaction frequencies.

Test Time: Specified by Duration parameter (15s)

403 - Disk Buses

Tests the disk bus for susceptibility to capacitive, inductive or conductive crosstalk at different transaction frequencies.

Test Time: Specified by Duration parameter (15s)

404 - Non-Volatile Storage

Tests the system non-volatile storage. (UEFI variable and certificate store.)

Test Time: Specified by Duration parameter (15s)

405 - Real Time Clock

Tests the system real time clock.

Test Time: Specified by Duration parameter (15s)

Error Codes

Error Code	Name
0x00/3FF	The test cannot be executed because something is not supported.
0x01/3FF	Memory bus noise and harmonic resilience test failed.
0x02/3FF	Non-Specific motherboard test failure.
0x03/3FF	PCI bus noise and harmonic resilience test failed.
0x04/3FF	Disk bus noise and harmonic resilience test failed.
0x05/3FF	Non-volatile storage test failed.
0x06/3FF	Real time clock did not roll over the year end correctly.
0x07/3FF	Real time clock did not enter next leap year correctly.
0x08/3FF	Real time clock did not exit next leap year correctly.
0x09/3FF	Real time clock test failed while clock was free running.

Troubleshooting

Error Code(s)	Potential Reason
0x00/3FF	The test could not be run because the system does not have a feature or hardware device needed to do so. For example, disk buses cannot be tested if there are no disks that the program can access.
0x02/3FF	An internal program error. Check for BIOS updates. The test was inconclusive.
0x01/3FF 0x03/3FF 0x04/3FF	Data corruption was detected, the motherboard may be faulty. Also continue to check memory and disk devices individually.
0x05/3FF	The Non-Volatile RAM may be faulty.
0x06/3FF 0x07/3FF 0x08/3FF 0x09/3FF	The real time clock appears to be malfunctioning or is corrupted. The Operating System may report inaccurately until it updates from an online source. Check the back-up battery and firmware settings.

7002 - Solid State Drives

Overview

This group is for solid state drives (SSD). A SSD is a data storage device that uses solid state memory to fulfil the role that a hard disk drive (HDD) would traditionally provide in a system.

SSDs are distinguished from traditional magnetic disks, HDDs, which are electromechanical devices containing spinning disks and movable read-write heads. By contrast, SSDs retain data in flash memory chips and so contain no moving parts. Compared to HDDs, SSDs are typically less susceptible to physical shock, are silent, have lower access time and latency, but lower capacity.

To act as drop in replacements for HDDs, many SSDs use the same interfaces as hard disk drives, but higher performance SSDs require dedicated connection types such as NVMe.

Tests

Test	Name	I	E	M	T
401	Linear Read				
402	Random Read				
403	S.M.A.R.T. Immediate				
404	S.M.A.R.T. Short Self Test				
405	S.M.A.R.T. Extended Self Test				
406	Internal Cache				
407	S.M.A.R.T. Conveyance				
408	Intelligent Scan				
409	S.M.A.R.T. Wear Levelling				

Parameters

Test	Parameter	Name	Default	Min	Max	Note(s)
401	1	Duration	0	0	604800	Time to run the test for, in seconds
	2	Coverage	100	1	100	Percentage coverage
	3	Maximum Errors	1	1	50	Continues to test until the maximum number of errors is reached, only errors directly associated with reading the drive
402	1	Duration	300	1	604800	
	3	Maximum Errors	1	1	50	
403	4	S.M.A.R.T Diagnostic Threshold	100	1	10000	Specifies the maximum permitted error count in the comprehensive S.M.A.R.T error log
	5	Ignore S.M.A.R.T Error Log	FALSE	FALSE	TRUE	Specifies any error count in the comprehensive S.M.A.R.T error log will be ignored
408	1	Duration	0	0	604800	
	6	Intelligent Scan Speed	1	1	3	Specifies the speed setting for the intelligent scan test, (3 is fastest)

Descriptions

401 - Linear Read

Exercises a drive's read capability using linear (incrementally increasing) read addresses. Success or failure of each read is monitored.

402 - Random Read

Exercises a drive's read capability using pseudo-random read addresses (these are randomly generated using a fixed computational process). Success or failure of each read is monitored.

403 - S.M.A.R.T. Immediate

This test checks the status of S.M.A.R.T. to ensure that the SSD is in reliable condition. If at least one S.M.A.R.T. attribute is below the threshold, the test fails.

Test Time: 2 to 10s

404 - S.M.A.R.T. Short Self Test

This test launches and monitors a S.M.A.R.T. Short Self-Test.

Test Time: 2m

405 - S.M.A.R.T. Extended Self Test

This test launches and monitors a S.M.A.R.T. Extended Self-Test. A longer and more thorough self-test with no time limit.

Test Time: This test may take many hours to complete

406 - Internal Cache

Tests the SSD Internal Cache or Buffer Memory.

407 - S.M.A.R.T. Conveyance

This test launches and monitors a S.M.A.R.T. Conveyance Self-Test.

Intended as a quick test to identify damage incurred during transporting of the device from the drive manufacturer to the computer manufacturer.

Test Time: Several minutes, this is device dependent

408 - Intelligent Scan

The Intelligent Scan algorithm is a unique alternative to traditional Linear Read testing that provides a big time saving benefit when scanning large media for issues such as bad sectors, with little to no loss of test accuracy.

Test Time: Variable

409 - S.M.A.R.T. Wear Levelling

Performs the wear levelling test.

Test Time: Variable

Error Codes

Error Code	Name
0x00/3FF	Device ID unknown (Exceeds array depth).
0x01/3FF	Device is too small to test.
0x02/005	Device read failed.
0x03/3FF	S.M.A.R.T. interface not supported.
0x04/3FF	S.M.A.R.T. disabled or not supported by device.
0x05/3FF	S.M.A.R.T. failed.
0x06/3FF	Requested S.M.A.R.T. test not supported by device.
0x07/3FF	ATA Pass through identify device failed.
0x08/3FF	ATA device does not support power features.
0x0A/3FF	Standby immediate test failed.
0x0B/005	Device write failed.
0x0C/3FF	Read back data mismatch.
0x0D/015	A S.M.A.R.T. attribute reached or below the acceptable threshold value.
0x0E/3FF	A S.M.A.R.T. comprehensive log error count at or exceeding the acceptable limit.
0x0F/3FF	Internal error, undersized buffer.
0x10/080	S.M.A.R.T. self test failed.

Troubleshooting

Error Code(s)	Potential Reason
0x01/3FF 0x02/005 0x07/3FF 0x0A/3FF 0x0B/005 0x0C/3FF	The disk appears to be faulty.
0x05/3FF 0x0D/015 0x0E/3FF 0x10/080	S.M.A.R.T. testing has failed. A fault or imminent fault is detected with the disk.
0x03/3FF 0x04/3FF 0x06/3FF	The disk does not appear to support this kind of test. Check to see if S.M.A.R.T. feature has been disabled in the BIOS.
0x08/3FF	The disk does not appear to support this kind of test. Check to see if power feature has been disabled in the BIOS.
0x00/3FF 0x0F/3FF	A program error, such as a memory allocation failure. Check for BIOS updates. The test was inconclusive.

7202 - Touch Device

Overview

This group tests touch devices, typically this will be an integrated touch screen. A touch device is an absolute pointing device that reports the position of touch events when they occur as a coordinate.

Note: UEFI pre-boot supports only single touch even though the device supports multiple touch in the host OS. Multiple simultaneous touch will often be averaged to a single point or the most recent touch will register.

Note: Many UEFI systems report support for an absolute (touch) device even though they do not have one.

Tests

Test	Name	I	E	M	T
401	Touch Test	•			

Parameters

Test	Parameter	Name	Default	Min	Max	Note(s)
401	1	Time-out	90	10	600	Time in seconds allowed to complete the test

Descriptions

401 - Touch Test

Test the ability of the touch device to register touches at different positions.

Test Time: 20s

Error Codes

Error Code	Name
0x00/3FF	The test cannot be executed because something is not supported.
0x01/3FF	The test timed out.

Troubleshooting

Error Code(s)	Potential Reason
0x00/3FF	It is not possible to run the test because of a system limitation, such as missing BIOS features. Check for BIOS updates.
0x01/3FF	The device was failed because the test time ran out before the operator completed the required actions. The inability to complete the test may be due to a fault with the touch sensing. Rule out operator error first.

7702 - System Block Device

Overview

Provides testing for block based system storage that has only limited BIOS support during the pre-boot phase. Typically this will be embedded flash memory that does not connect via a traditional disk bus such as SATA, SCSI or USB. A typical examples might be eMMC in systems with a mobile form factor.

Tests

Test	Name	I	E	M	T
401	Linear Read				
402	Random Read				
403	Intelligent Scan				

Parameters

Test	Parameter	Name	Default	Min	Max	Note(s)
401	1	Duration	0	0	604800	Time to run the test for in seconds
	2	Coverage	100	1	100	Percentage coverage
	3	Maximum Errors	1	1	50	Continues to test until the maximum number of errors is reached, only errors directly associated with reading the drive
402	1	Duration	300	1	604800	
	3	Maximum Errors	1	1	50	
403	1	Duration	0	0	604800	
	4	Intelligent Scan Speed	1	1	3	Specifies the speed setting for the intelligent scan test

Descriptions

401 - Linear Read

Exercises a drive's read capability using linear (incrementally increasing) read addresses. Success or failure of each read is monitored.

402 - Random Read

Exercises a drive's read capability using pseudo-random read addresses (these are randomly generated using a fixed computational process). A quick benchmark is performed on the device to determine a read rate. Success or failure of each read is monitored.

403 - Intelligent Scan

The Intelligent Scan algorithm is a unique alternative to traditional Linear Read testing that provides a big time saving benefit when scanning large media for issues such as bad sectors, with little to no loss of test accuracy.

Test Time: Variable

Error Codes

Error Code	Name
0x00/3FF	The test cannot be executed because something is not supported.
0x01/3FF	Device ID unknown (Exceeds array depth).
0x02/3FF	Device is too small to test.
0x03/005	Device read failed.

Troubleshooting

Error Code(s)	Potential Reason
0x02/3FF 0x03/005	The device appears to be faulty.
0x00/3FF 0x01/3FF	A program error, such as a memory allocation failure. Check for BIOS updates. The test was inconclusive.

7802 - NVMe Drives

Overview

This group is for NVMe solid state drives. An NVMe (sometimes NVM Express) drive is a data storage device that uses solid state memory to fulfil the role that a hard disk drive (HDD) would traditionally provide in a system. NVMe drives use direct connection to the system PCI Express bus to achieve higher data transfer speeds than other solid state drives (SSD) that connect via SATA.

NVMe drives are distinguished from traditional magnetic disks, HDDs, which are electromechanical devices containing spinning disks and movable read-write heads. By contrast, NVMe drives retain data in flash memory chips and so contain no moving parts. Compared to HDDs, NVMe drives are typically less susceptible to physical shock, are silent, have lower access time and latency, but lower capacity.

Lower capacities mean NVMe drives are often fitted alongside a regular HDD to provide a boot volume for rapid OS start times.

Note: Pre-boot NVMe drive tests require system BIOS support.

Tests

Test	Name	I	E	M	T
401	Linear Read				
402	Random Read				
403	Internal Cache				
404	S.M.A.R.T Health				
405	Intelligent Scan				

Parameters

Test	Parameter	Name	Default	Min	Max	Note(s)
401	1	Duration	0	0	604800	Time to run the test for, seconds, maximum 1 week
	2	Coverage	100	1	100	Percentage coverage
	3	Maximum Errors	1	1	50	Continues to test until the maximum number of errors is reached, only errors directly associated with reading the drive
402	1	Duration	300	1	604800	
	3	Maximum Errors	1	1	50	
404	4	Check Read Only State	TRUE	FALSE	TRUE	When specified, the test shall fail if the device has been demoted to read only status
	5	Maximum Data Integrity Errors	5000	1	0xffffffff	Data integrity threshold
	6	Life Threshold	90	1	255	Remaining life threshold
405	1	Duration	0	0	604800	
	7	Intelligent Scan Speed	1	1	3	Specifies the speed setting for the intelligent scan test, (3 is fastest)

Descriptions

401 - Linear Read

Exercises a drive's read capability using linear (incrementally increasing) read addresses. Success or failure of each read is monitored.

402 - Random Read

Exercises a drive's read capability using pseudo-random read addresses (these are randomly generated using a fixed computational process). Success or failure of each read is monitored.

403 - Internal Cache

Tests the NVMe drive internal cache or buffer memory.

404 - S.M.A.R.T Health

This test checks the S.M.A.R.T. health status to ensure that the NVMe drive is in reliable condition. If at least one S.M.A.R.T. attribute is below the threshold, the test fails.

405 - Intelligent Scan

The Intelligent Scan algorithm is a unique alternative to traditional Linear Read testing that provides a big time saving benefit when scanning large media for issues such as bad sectors, with little to no loss of test accuracy.

Test Time: Variable

Error Codes

Error Code	Name
0x00/3FF	Device ID unknown (Exceeds array depth).
0x01/3FF	Device is too small to test.
0x02/005	Device read failed.
0x03/3FF	Pass through identify device failed.
0x04/3FF	Device does not support power features.
0x05/3FF	Standby immediate test failed.
0x06/005	Device write failed.
0x07/3FF	Read written data mismatch.
0x08/3FF	S.M.A.R.T. Health data is unavailable.
0x09/3FF	S.M.A.R.T. Health check failed with critical warnings.
0x0A/080	S.M.A.R.T. estimated life outside of tolerance.
0x0B/080	S.M.A.R.T. data integrity errors outside of tolerance.
0x0C/3FF	S.M.A.R.T. NVMe reliability failure detected.
0x0D/3FF	S.M.A.R.T. volatile memory failure detected.
0x0E/080	S.M.A.R.T. drive capacity failure detected.
0x0F/3FF	S.M.A.R.T. temperature failure detected.
0x10/3FF	S.M.A.R.T. drive read only state detected.
0x11/3FF	Internal error, undersized buffer.

Troubleshooting

Error Code(s)	Potential Reason
0x01/3FF 0x02/005 0x03/3FF 0x05/3FF 0x06/005 0x07/3FF	The drive appears to be faulty.
0x09/3FF 0x0A/080 0x0B/080 0x0C/3FF 0x0D/3FF 0x0E/080 0x0F/3FF 0x10/3FF	Health (S.M.A.R.T.) testing has failed. A fault or imminent fault is detected with the drive.
0x08/3FF	The drive does not appear to support this kind of test. Check to see if health (S.M.A.R.T.) feature has been disabled in the BIOS.
0x04/3FF	The drive does not appear to support this kind of test. Check to see if power feature has been disabled in the BIOS.
0x00/3FF 0x11/3FF	A program error, such as a memory allocation failure. The test was inconclusive. Check for BIOS updates.

8102 - TPM

Overview

This group is for TPM device. TPM stands for Trusted Platform Module, a device that provides hardware based security features such as digital key storage and encryption in a tamper proof package.

A system will contain a single TPM device.

Note: This group is for the Trusted Computing Group TPM 2 standard.

Tests

Test	Name	I	E	M	T
401	Basic Functionality				

Parameters

Descriptions

401 - Basic Functionality

Trusted Platform Module basic functionality test.

Test Time: 1s

Error Codes

Error Code	Name
0x00/3FF	The test cannot be executed because something is not supported.
0x01/3FF	The module failed.

Troubleshooting

Error Code(s)	Potential Reason
0x00/3FF	It is not possible to run the test because of missing BIOS support. Check for BIOS updates.
0x01/3FF	If the TPM module is not an integrated part, ensure the proper seating of the module to the motherboard connector.

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