



Seagate® Nytro® XF1230 SATA SSD

Product Manual

XF1230-1A0240
XF1230-1A0480
XF1230-1A0960
XF1230-1A1920



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Revision History

| Version and Date | Description of Changes |
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| Rev H, October 2017 | Added new product photo to front cover and updated the following: <ul style="list-style-type: none">■ Section 7, Safety, Standards, and Compliance |
| Rev G, October 2017 | Added new product photo to front cover. |
| Rev F, September 2017 | Updated the following: <ul style="list-style-type: none">■ Section 1, Introduction (Endurance)■ Section 2.6, Endurance■ Section 7, Safety, Standards, and Compliance |
| Rev E, October 2016 | Updated SMART attributes in Section 6.2, SMART Attributes . |
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When referring to drive capacity, one gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes. Your computer's operating system may use a different standard of measurement and report a lower capacity. In addition, some of the listed capacity is used for formatting and other functions, and thus will not be available for data storage. Actual quantities will vary based on various factors, including file size, file format, features and application software. Actual data rates may vary depending on operating environment and other factors. The export or re-export of hardware or software containing encryption may be regulated by the U.S. Department of Commerce, Bureau of Industry and Security (for more information, visit www.bis.doc.gov), and controlled for import and use outside of the U.S. Seagate reserves the right to change, without notice, product offerings or specifications.

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Seagate Technology Support Services

For Nytro Support, visit: <http://www.seagate.com/support/by-product/ssd-and-pcie-flash/>

For information regarding online support and services, visit: <http://www.seagate.com/contacts/>

Available services include:

- Presales & Technical support
- Global Support Services telephone numbers & business hours
- Authorized Service Centers

For information regarding Warranty Support, visit: <http://www.seagate.com/support/warranty-and-replacements/>

For information regarding data recovery services, visit: <http://www.seagate.com/services-software/recover/>

For Seagate Distribution partner and Seagate reseller portal, visit: <http://www.seagate.com/partners>

1. Introduction

The Seagate® Nytro® XF1230 SSDs provide high reliability and sustained performance for enterprise Server and Storage products. The Nytro XF1230 series offers SATA interface, fully compatible with SATA 3.1 6.0Gb/s.

Table 1 Nytro XF1230 Card Features

| Feature | Description | |
|--|--|---|
| Capacity | <ul style="list-style-type: none"> 240, 480, 960, 1920 GB | |
| Certifications, Eco-Compliance | <ul style="list-style-type: none"> CE, UL, FCC, RCM, BSMI, KCC, Microsoft WHQL, SATA-IO China RoHS2, Taiwan RoHS | |
| Dimension | <ul style="list-style-type: none"> (69.85±0.25) x (100±0.25) x (Max. 7) mm | SSD Outer case can support suitable Z-height for various host situations. |
| Endurance | <ul style="list-style-type: none"> 1 Drive Write Per Day (DWPD) for higher lifetime endurance. See Table 10, Endurance, on page 10. | |
| Form | <ul style="list-style-type: none"> 2.5 Inch Standard SSD | |
| Interface Compliance | <ul style="list-style-type: none"> Fully compliant with SATA revision 3.1, compatible with SATA 6.0Gb/s interface rates. Fully compliant with ATA-8/ACS-3 Standard. PIO, DMA, UDMA (up to 6, dependent on host) supported. SATA 6.0Gb/s Native Command Queuing (NCQ): up to 32 commands. SMART command transport (SCT) technology. Data Set Management Command Trim support. | |
| Latency | <ul style="list-style-type: none"> Read: 140 µs (Typ.) Write: 60 µs (Typ.) | Latency measured with transfer size 4 KB and queue depth of 1 on a random workload, and based on high density (1920 GB). |
| NAND | <ul style="list-style-type: none"> 16 nm | |
| Performance Random (Sustained) | <ul style="list-style-type: none"> 4 KB Read: Up to 98K IOPS 4 KB Write: Up to 16.8K IOPS 8 KB Read: Up to 58K IOPS 8 KB Write: Up to 8K IOPS | <p>Actual performance may vary depending on use conditions and environment.</p> <p>See Section 2.2, Performance, on page 8.</p> <p>Typical I/O performance numbers measured with a queue depth of 32, write cache enabled, 6Gb/s SAS chipset port, and the Intel RST driver.</p> |
| Performance Sequential (128 KB Sustained) | <ul style="list-style-type: none"> Read: Up to 560MB/s Write: Up to 505MB/s | <p>Actual performance may vary depending on use conditions and environment.</p> <p>See Section 2.2, Performance, on page 8.</p> <p>Typical I/O performance numbers as measured with a queue depth of 32, write cache enabled, 6Gb/s SAS chipset port, and the Intel RST driver.</p> |
| Power Consumption | <ul style="list-style-type: none"> Active: Up to 5.7 W Idle: Up to 1.0 W | <p>See Section 2.3, Power, on page 9.</p> <p>RMS Average.</p> <p>NOTE This specification is for the 1920 GB drive; smaller capacity drives have lower active power.</p> |
| Power Loss Protection | | |
| Power Management | <ul style="list-style-type: none"> 2.5 inch: 5 V SATA Supply OS-aware hot plug/removal | |
| Power On Ready | <ul style="list-style-type: none"> Normal shut down: 5 s Unsolicited shut down: 21 s | Based on High Density (1920 GB). |

Table 1 Nytro XF1230 Card Features (continued)

| Feature | Description | |
|--------------------------------------|--|---|
| Quality of Service | <ul style="list-style-type: none"> ■ Read/Write: 0.2 ms/0.9 ms (99.9%) | Based on Random 4 KB, queue depth=1, and 1920 GB Density. |
| Reliability | <ul style="list-style-type: none"> ■ MTBF: 2 million hours ■ BER: 1 error in 10^{17} bits read ■ End-to-End data-path protection | |
| Shock | <ul style="list-style-type: none"> ■ Operating: 1500G, duration 0.5ms ■ Non-Operating: 1500G, duration 0.5ms | |
| Temperature Range (Operating) | <ul style="list-style-type: none"> ■ 0°C to 70°C ■ Temperature Sensor (SMART Attribute ID 194) | |
| Vibration | <ul style="list-style-type: none"> ■ Operating: 20 G_{RMS}, 10~20 KHz ■ Non-Operating: 20 G_{RMS}, 10~20 KHz | |
| Voltage | <ul style="list-style-type: none"> ■ 5V±5% | |
| Warranty | <ul style="list-style-type: none"> ■ Five years limited Warranty with Media Usage, based on the shorter of term or endurance usage of the drive. | |
| Weight | <ul style="list-style-type: none"> ■ up to 85g ±5% | |

2. Specifications

2.1 Models and Capacity

Table 2 Nytro XF1230 Card Models

| Device Name | Model Names | Usable Capacity | LBAs |
|--------------|---------------|-----------------|---------------|
| Nytro XF1230 | XF1230-1A0240 | 240 GB | 468,862,128 |
| Nytro XF1230 | XF1230-1A0480 | 480 GB | 937,703,088 |
| Nytro XF1230 | XF1230-1A0960 | 960 GB | 1,875,385,008 |
| Nytro XF1230 | XF1230-1A1920 | 1920 GB | 3,750,748,848 |

2.2 Performance

Table 3 Random Read/Write Input/Output Operations Per Second (IOPS)

| Parameter | 240 GB | 480 GB | 960 GB | 1920 GB |
|--------------------------|--------|--------|--------|---------|
| Random 4 KB Read (IOPS) | 96,700 | 98,000 | 98,000 | 98,000 |
| Random 4 KB Write (IOPS) | 8,700 | 15,800 | 16,800 | 16,000 |
| Random 8 KB Read (IOPS) | 58,000 | 58,000 | 58,000 | 58,000 |
| Random 8 KB Write (IOPS) | 4,000 | 8,000 | 8,000 | 8,000 |

Table 4 Sequential Read/Write Throughput

| Parameter | 240 GB | 480 GB | 960 GB | 1920 GB |
|------------------------------|---------|---------|---------|---------|
| Sequential Read (Sustained) | 560MB/s | 560MB/s | 560MB/s | 560MB/s |
| Sequential Write (Sustained) | 306MB/s | 505MB/s | 490MB/s | 445MB/s |

NOTE

Information on performance:

- Performance measured with queue depth set to 32.
- 4 KB = 4,096 bytes, 8 KB = 8,192 bytes.
- Drive write cache enabled.
- Measurements performed on Full Logical Block Address (LBA) range, sustained for 2x Drive Capacity.
- Set to 4 KB alignment.
- Performance test precondition: Drive is preconditioned with 2x drive capacity 128 KB write IOs.
- Measured on system with Intel Xeon E5-2640v3 and C610 chipset with on-board AHCI controller running Microsoft Windows® 2012 R2 DC. System variations may affect measured results.
- MB/s = 1,000,000 bytes/second.

2.3 Power

The 2.5" drive uses 5 V DC power.

Table 5 Operating Voltage

| | 240 GB | 480 GB | 960 GB | 1920 GB |
|-------------------------|----------|----------|----------|----------|
| Operating Voltage range | 5 V ± 5% | 5 V ± 5% | 5 V ± 5% | 5 V ± 5% |
| Inrush Current | 0.91 A | 1.10 A | 1.20 A | 1.60 A |

2.3.1 Power Consumption

Table 6 Power Consumption

| | 240 GB | 480 GB | 960 GB | 1920 GB |
|-------------------------------------|--------|--------|--------|---------|
| Active Read – Average | 2.1 W | 2.2 W | 2.2 W | 2.8 W |
| Active Write – Average | 2.8 W | 4.2 W | 4.2 W | 4.3 W |
| Active Read – Burst 500 μS Average | 2.2 W | 2.4 W | 2.4 W | 3.0 W |
| Active Write – Burst 500 μS Average | 3.2 W | 4.8 W | 5.1 W | 5.7 W |
| Idle | 0.8 W | 0.8 W | 0.8 W | 0.9 W |

2.4 Environmental Conditions

Table 7 Temperature, Humidity, Shock

| Specification | Nytro XF1230 |
|--|------------------|
| Temperature | |
| Operating (case temperature at specific airflow) | 0°C to 70°C |
| Non-Operating | - 40°C to 95°C |
| Humidity | |
| Operating and Non-Operating | 5 to 95% |
| Shock | |
| Operating and Non-Operating | 1500 G at 0.5 ms |

NOTE

Operating, as measured by temperature sensor, SMART Attribute ID 194.

- Measured without condensation.
- The Shock specification assumes that the SSD is mounted securely with the input vibration applied to the drive mounting. Stimulus may be applied in the X, Y or Z axis.
- Operating Shock: The drive, as installed for normal operation, operates error-free while subjected to intermittent shock not exceeding specification. Shock may be applied in the X, Y, or Z-axis. Shock must not be repeated more than once every 2 seconds.

- **Non-Operating Shock:** The limits of non-operating shock applies to all conditions of handling and transportation. This includes isolated and integrated drives. Shock may be applied in the X, Y, or Z-axis.

Table 8 Vibration

| Specification | Nytro XF1230 |
|--------------------|------------------------------------|
| Maximum Vibrations | |
| Operating | 20 G _{RMS} (10 to 20 KHz) |
| Non-Operating | 20 G _{RMS} (10 to 20 KHz) |

NOTE The Vibration specification assumes that the SSD is mounted securely with the input Vibration applied to the drive mounting screws. Stimulus may be applied in the X, Y or Z axis.

- **Operating Vibration:** The drive, as installed for normal operation, shall operate error free while subjected to specified vibration not exceeding specification. Vibration may be applied in the X, Y, or Z-axis.
- **Non-Operating Vibration:** The limits of non-operating vibration shall apply to all conditions of handling and transportation. This includes both isolated drive and integrated drives. Vibration may be applied in the X, Y, or Z-axis.

2.5 Reliability

Table 9 Reliability

| Specification | Nytro XF1230 |
|-----------------------------------|--|
| Mean time between failures (MTBF) | 2 million hours |
| Uncorrectable Bit Error Rate | <1 error in 10 ¹⁷ bits read |

2.6 Endurance

Table 10 Endurance

| Specification | 240 GB | 480 GB | 960 GB | 1920 GB |
|-------------------------|---------|---------|----------|----------|
| Endurance Rating | 1 DWPD | 1 DWPD | 1 DWPD | 1 DWPD |
| Terabytes Written (TBW) | 375 TBW | 750 TBW | 1500 TBW | 3000 TBW |

NOTE Information on endurance:

- 1 DWPD is tested based 100% random write workload with the assumption that the user does not exceed 90% of the total usable space. DWPD is drive write per day.
- SSD Endurance is lifetime on finite amount of writes.
- Limited Warranty with Media Usage provides coverage for the warranty period or the endurance usage of the drive.

3. Mechanical Information

3.1 Dimensions and Weight

Weight: 0.187 lbs, 85 g

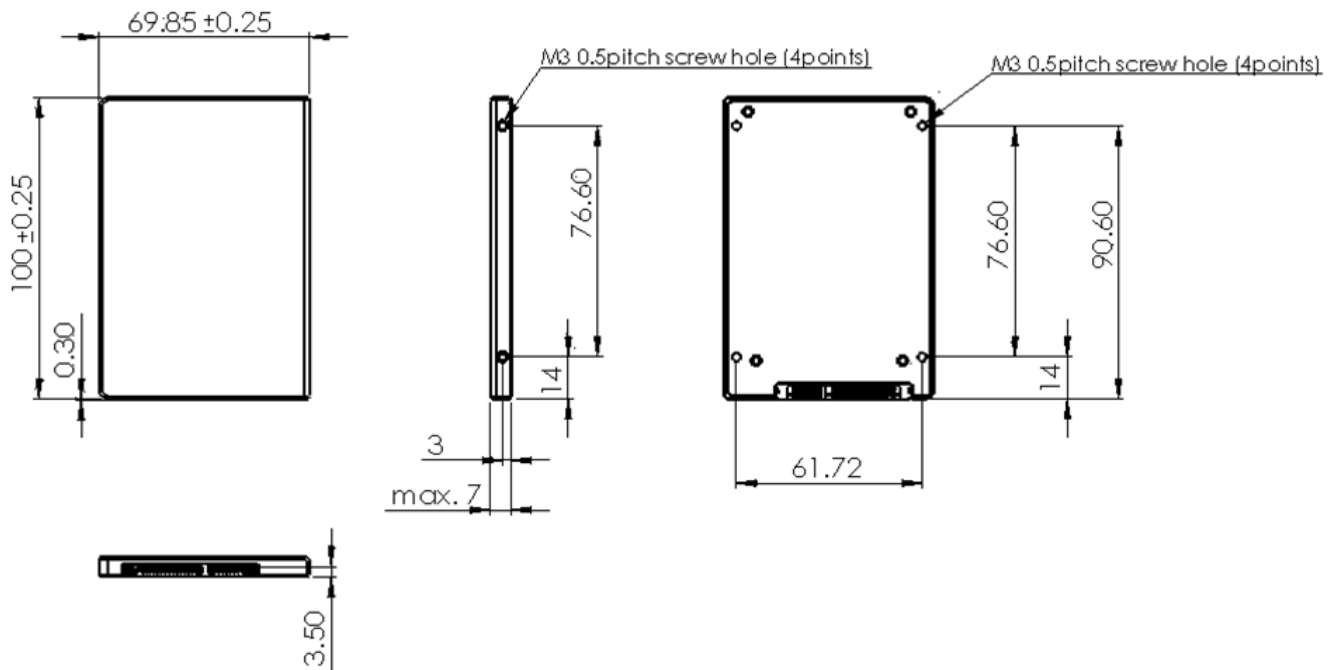
Height: Maximum 7 mm

Width: 69.85±0.25

Length: 100±0.25

NOTE All dimensions are in millimeters.

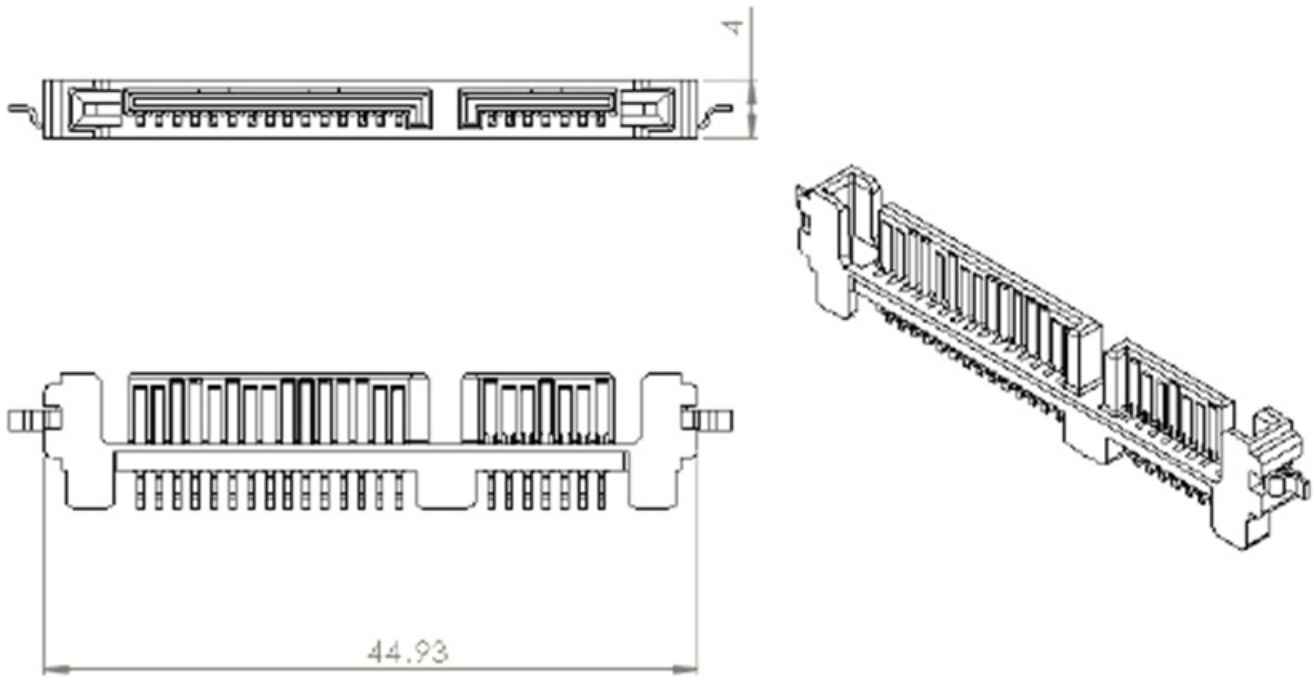
Figure 1 Nytro XF1230 Dimensions



4. Pin and Signal Descriptions

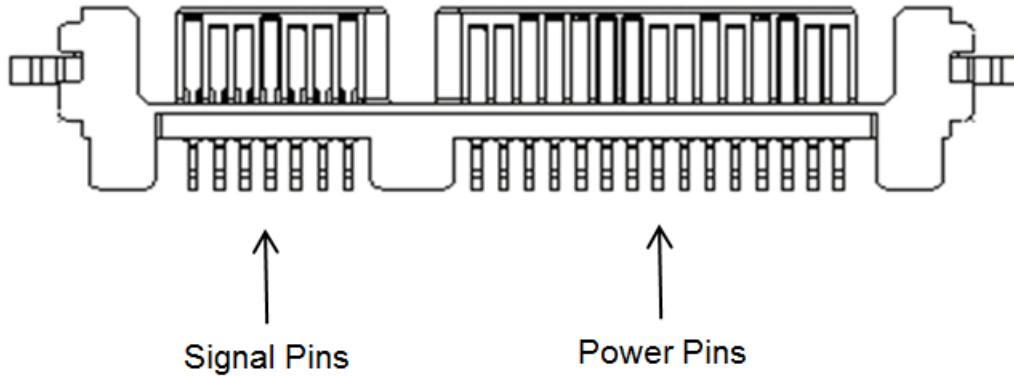
4.1 Serial ATA Interface Connector

Figure 2 Connector Physical Dimension and Connector Assembly



4.2 Pin Locations

Figure 3 Layout of 2.5-inch Signal and Power Segment Pins



NOTE The 2.5-inch connector supports built in latching capability.

4.3 Connector Pin Signal Definitions

Table 11 Serial ATA Connector Pin Signal Definitions—2.5-inch Form Factors

| Pin | Name | Definition |
|-----|--------|-----------------------------------|
| S1 | Ground | Ground |
| S2 | A+ | Differential signal pair A and A- |
| S3 | A- | |
| S4 | Ground | Ground |
| S5 | B- | Differential signal pair B and B- |
| S6 | B+ | |
| S7 | Ground | Ground |

NOTE Key and spacing separate the signal and power segments.

4.4 Power Pin Signal Definitions

Table 12 Serial ATA Power Pin Signal Definitions—2.5-inch Form Factors

| Pin | Function | Definition |
|-----|----------|------------------------|
| P1 | V33 | 3.3 V Power; not used |
| P2 | V33 | 3.3 V Power; not used |
| P3 | V33 | 3.3 V Power; not used |
| P4 | GND | Ground |
| P5 | GND | Ground |
| P6 | GND | Ground |
| P7 | V5 | 5 V Power |
| P8 | V5 | 5 V Power |
| P9 | V5 | 5 V Power |
| P10 | GND | Ground |
| P11 | DAS | Device Activity Signal |
| P12 | GND | Ground |
| P13 | V12 | 12 V Power; not used |
| P14 | V12 | 12 V Power; not used |
| P15 | V12 | 12 V Power; not used |

NOTE

Key and spacing separate the signal and power segments.

- Uses 5 V power only, 3.3 V (P1-P3) and 12 V (P13-P15) power are not used.
- Pins P1, P2, and P3; Pins P13, P14, and P15 are connected together. They are not connected internally to the device, and the host may apply voltage on these pins.
- Ground pins are P4, P5, P6, P10, P12.
- Signal pins and the rest of the 5V power pins are P8,P9.
- Power pins P7, P8, and P9 are internally connected to one another within the device

4.5 SSD Activity LED Indicator (Optional)

The Nytro XF1230 can support DAS Control function from the SSD module to indicate LED activity of host side.

The device includes a physical pin P11 for connecting device activity LEDs.

The signal provided to indicate activity of the device is a low-voltage and low-current driver intended for efficient integration into current and future IC manufacturing processes. The signal is not suitable for directly driving an LED and is first buffered using a circuit external to the device before driving an LED.

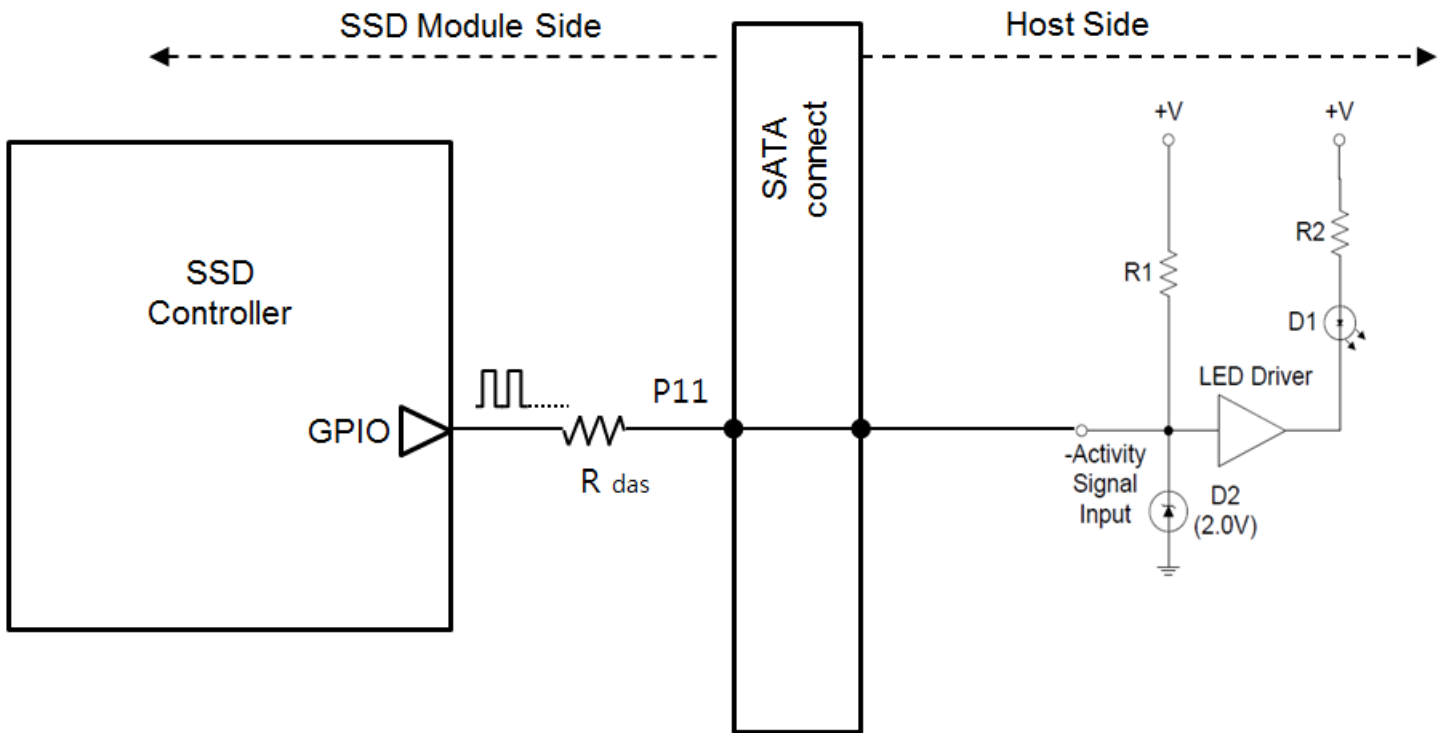
For DAS function operation, a Firmware function feature and R das are included as an option.

The DAS function firmware feature generates a Low/High toggle Activity signal input when the SSD is in a busy state and generates a high Activity signal input when the SSD is in idle mode (Low level: GND, High level: 3.3V).

Using DAS function increases current because of the Activity LED operation.

The DAS Firmware feature is disabled and the R das is opened when the DAS function is not in use.

Figure 4 Circuit of SSD Activity LED indication



5. Supported ATA Command List

The Nytro XF1230 complies with ATA-8/ACS-4. All mandatory and many optional commands and features are supported.

5.1 ATA Feature Set

The following table shows the ATA feature set and commands that the Nytro XF1230 supports.

Table 13 ATA Feature Set

| Feature | Supported |
|--|-----------|
| 48-Bit Address feature set | Yes |
| General feature set | Yes |
| Native Command Queuing (NCQ) feature set | Yes |
| Power Management feature set | Yes |
| Security feature set | Yes |
| SMART feature set | Yes |

5.2 ATA Command Description

The following table shows the ATA commands supported.

Table 14 ATA Command Description

| Command | Code (Hex) | Command | Code (Hex) |
|------------------------------|------------|---------------------------|------------|
| CHECK POWER MODE | E5h | SMART DISABLE OPERATION | B0h/D9h |
| DATA SET MANAGEMENT | 06h | SMART ENABLE/DISABLE | B0h/D2h |
| DOWNLOAD MICROCODE | 92h | SMART ENABLE OPERATION | B0h/D8h |
| EXECUTE DEVICE DIAGNOSTIC | 90h | SMART EXECUTE OFFLINE | B0h/D4h |
| FLUSH CACHE | E7h | SMART READ DATA | B0h/D0h |
| FLUSH CACHE EXT | EAh | SMART READ LOG | B0h/D5h |
| IDENTIFY DEVICE | ECh | SMART READ THRESHOLD | B0h/D1h |
| IDLE | E3h | SMART RETURN STATUS | B0h/DAh |
| IDLE IMMEDIATE | E1h | SMART SAVE ATB VALUES | B0h/D3h |
| INITIALIZE DEVICE PARAMETERS | 91h | SMART WRITE LOG | B0h/D6h |
| NOP | 00h | STANDBY | E2h |
| READ BUFFER | E4h | STANDBY IMMEDIATE | E0h |
| READ DMA | C8h | WRITE BUFFER | E8h |
| READ DMA EXT | 25h | WRITE DMA | CAh |
| READ DMA W/O RETRIES | C9h | WRITE DMA EXT | 35h |
| READ FPDMA QUEUED | 60h | WRITE DMA FUA EXT | 3Dh |
| READ LOG DMA EXT | 47h | WRITE DMA WITHOUT RETRIES | CBh |
| READ LOG EXT | 2Fh | WRITE FPDMA QUEUED | 61h |
| READ MULTIPLE | C4h | WRITE LOG DMA EXT | 57h |
| READ MULTIPLE EXT | 29h | WRITE LOG EXT | 3Fh |

Table 14 ATA Command Description (continued)

| Command | Code (Hex) | Command | Code (Hex) |
|---------------------------------|------------|-----------------------------|------------|
| READ SECTOR(S) | 20h | WRITE MULTIPLE | C5h |
| READ SECTOR(S) EXT | 24h | WRITE MULTIPLE EXT | 39h |
| READ SECTOR(S) W/O RETRY | 21h | WRITE MULTIPLE FUA EXT | CEh |
| READ VERIFY SECTOR(S) | 40h | WRITE SECTOR(S) | 30h |
| READ VERIFY SECTOR(S) W/O RETRY | 41h | WRITE SECTOR(S) EXT | 34h |
| READ VERIFY SECTOR(S) EXT | 42h | WRITE SECTORS WITHOUT RETRY | 31h |
| RECALIBRATE | 10h | WRITE UNCORRECTABLE EXT | 45h |
| REQUEST SENSE DATA EXT | 0Bh | | |
| SECURITY DISABLE PASSWORD | F6h | | |
| SECURITY ERASE PREPARE | F3h | | |
| SECURITY ERASE UNIT | F4h | | |
| SECURITY FREEZE LOCK | F5h | | |
| SECURITY SET PASSWORD | F1h | | |
| SECURITY UNLOCK | F2h | | |
| SEEK | 70h | | |
| SET FEATURES | EFh | | |
| SET MULTIPLE MODE | C6h | | |
| SLEEP | E6h | | |

5.3 Security

The user/master password is supported.

When the device receives a normal SECURITY ERASE UNIT command, the device erases all data blocks including unallocated (hidden) blocks.

You can download firmware regardless of the security state.

5.3.1 Password Loss

If you lose the user password, you can access the device using the master password. If both passwords are lost, there is no way to access the device.

6. SMART Support

The Nytro XF1230 supports the SMART Command Set.

6.1 SMART Command Set

The Nytro XF1230 supports the SMART Command Set shown in the following table.

Table 15 SMART Commands

| Feature Field Values | Command |
|----------------------|---|
| D0h | SMART READ DATA |
| D1h | SMART READ ATTRIBUTE THRESHOLDS |
| D2h | SMART ENABLE/DISABLE ATTRIBUTE AUTOSAVE |
| D3h | SAVE ATTRIVUTE VALUES |
| D4h | SMART EXECUTE OFF-LINE IMMEDIATE |
| 00h* | Execute SMART Off-Line routine |
| 01h* | Execute SMART Short Self-test routine (Off-Line) |
| 02h* | Execute SMART Extended Self-test routine (Off-Line) |
| 03h* | Execute SMART Conveyance self-test routine in off-line mode |
| 04h* | Execute SMART Selective self-test routine in off-line mode |
| 7Fh* | Abort Off-Line routine |
| 81h* | Execute SMART Short Self-test routine (Captive) |
| 82h* | Execute SMART Extended Self-test routine (Captive) |
| 83h* | Execute SMART Conveyance self-test routine in captive mode |
| 84h* | Execute SMART Selective self-test routine in captive mode |
| D5h | SMART READ LOG |
| D6h | SMART WRITE LOG |
| D8h | SMART ENABLE OPERATIONS |
| D9h | SMART DISABLE OPERATIONS |
| DAh | SMART RETURN STATUS |
| *Low LBA values | |

6.2 SMART Attributes

The Nytro XF1230 supports the SMART attributes shown in the following table.

Table 16 SMART Attributes

| ID | Attribute ID | Description |
|-----|---|--|
| 1 | Raw Read Error Rate | Rate of hardware read errors that occurred when reading data from a device |
| 5 | Retired Block count | Count of number of blocks that have been reallocated, excluding pending sectors |
| 9 | Power on hours | The time accumulated while the power is on and operating |
| 12 | Power Cycle Count | Count of number of Power Cycles, excluding power mode commands |
| 174 | Unexpected Power Loss Count | Number of Issue on Unexpected Power Loss |
| 175 | Program Fail Count (Worst Case Component per die) | Maximum number of Program Error Events per die |
| 176 | Erase Fail Count (Worst Case Component per die) | Maximum number of Erase Error Events per die |
| 177 | Endurance Limit Met | Indicates the number of NAND wear |
| 178 | Used Reserved Block Count (Worst Case Component) | Number of used reserved blocks |
| 179 | Used Reserved Block Count (SSD Total) | Number of used reserved blocks in SSD |
| 180 | End to End Error Detection / Correction Rate | Number of error detection of the data path between host and NAND in SSD during last power-on |
| 181 | Program Fail Count | Number of Error Events on Program (Lifetime) |
| 182 | Erase Fail Count | Number of Error Events on Erase (Lifetime) |
| 183 | SATA Downshift Count | Number of times that SATA interface speed reduced |
| 184 | End to End Error Detection Count | Number of error detection of the data path between host and NAND in SSD of lifetime |
| 187 | Reported Uncorrectable Errors | Uncorrectable Error Count |
| 188 | Command Timeout Count | Number of total uncompleted commands |
| 189 | SSD Health Flags | Indicates PLP health status and Thermal Throttling status |
| 190 | SATA Error Counter | Number of encountered SATA error |
| 194 | Temperature (Celsius) | Temperature of the SSD |
| 195 | ECC On the Fly Rate | Hardware read error rate that occurred when reading data |
| 199 | Ultra DMA CRC Error Count | Number of Ultra DMA CRC error count (Lifetime) |
| 201 | Read Error Rate | Number of soft read errors (Count of UECC Error) |
| 204 | Soft ECC Correction Rate | Count of errors corrected by software ECC[citation needed] |
| 231 | SSD Life Left (%) | Indicates the approximate SSD life left, in terms of program/erase cycles or Flash blocks currently available for use. |
| 234 | Lifetime NAND programs in GB | Lifetime NAND programs in GB |

Table 16 SMART Attributes (continued)

| ID | Attribute ID | Description |
|-----|-------------------------------------|--|
| 241 | Lifetime Writes From The Host in GB | Track the number of user data in GB written by the host |
| 242 | Lifetime Reads From The Host in GB | Track the number of user data in GB read by the host |
| 245 | SSD Life Left | Indicates the approximate SSD life left, in terms of program/erase cycles or Flash blocks currently available for use. |
| 250 | Total Number of NAND Read Retries | Indicates the total number of NAND read retires. |

6.3 SMART Trip

SMART trip (threshold exceeded condition) indicates impending degradation or fault condition. The host can issue a SMART return status command (B0h/DAh) to communicate the reliability status of the drive. The threshold-exceeded condition is also checked during drive self tests.

7. Safety, Standards, and Compliance

7.1 Agency and Safety Certifications

Each Hard Drive and Solid State Drive ("drives") has a product label that includes certifications that are applicable to that specific drive. The following information provides an overview of requirements that may be applicable to the drive.

7.1.1 Safety certification

These products are certified to meet the requirements of UL/cUL 60950-1, EN 60950-1, and may also include, IEC 62368, UL 62368 and EN 62368.

7.1.2 European Union (EU) CE Marking Requirements

Drives that display the CE mark comply with the European Union (EU) requirements specified in the Electromagnetic Compatibility Directive (2014/30/EU) put into force on 20 April 2016. Testing is performed to the levels specified by the product standards for Information Technology Equipment (ITE). Emission levels are defined by EN 55032:2012, Class B and the immunity levels are defined by EN 55024:2010.

The drives also meet the requirements of The Low Voltage Directive (LVD) 2014/35/EU.

Seagate drives are tested in representative end-user systems. Although CE-marked Seagate drives comply with all relevant regulatory requirements and standards for the drives, Seagate cannot guarantee that all system-level products into which the drives are installed comply with all regulatory requirements and standards applicable to the system-level products. The drive is designed for operation inside a properly designed system (e.g., enclosure designed for the drive), with properly shielded I/O cable (if necessary) and terminators on all unused I/O ports. Computer manufacturers and system integrators should confirm EMC compliance and provide CE marking for the system-level products.

For compliance with the RoHS "Recast" Directive 2011/65/EU (RoHS 2), [Section 7.2.1.1, Restriction of Hazardous Substances in Electrical and Electronic Equipment](#).

7.1.3 Australian RCM Compliance Mark

If these models have the RCM marking, they comply with the Australia/New Zealand Standard AS/NZ CISPR32 and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Australian Communication and Media Authority (ACMA).

7.1.4 Canada ICES-003

If this model has the ICES-003:2016 marking it complies with requirements of ICES tested per ANSI C63.4-2014.

7.1.5 South Korean KC Certification Mark

The South Korean KC Certification Mark means the drives comply with paragraph 1 of Article 11 of the Electromagnetic Compatibility control Regulation and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Radio Research Agency (RRA) Communications Commission, Republic of Korea. These drives have been tested and comply with the Electromagnetic Interference/Electromagnetic Susceptibility (EMI/EMS) for Class B products. Drives are tested in a representative, end-user system by a Korean-recognized lab.

| 기종별 | 사용자안내문 |
|------------------------|--|
| B급 기기 (가정용 방송통신기자재) | 이 기기는 가정용(B급) 전자파적합기기로서 주로 가정에서 사용하는 것을 목적으로 하며, 모든 지역에서 사용할 수 있습니다. |

7.1.6 Morocco Commodity Mark

Seagate drives are tested for compliance and complies with the European Union (EU) Electromagnetic Compatibility (EMC) Directive 2014/30/EU and the Low Voltage Directive (LVD) 2014/35/EU. Accordingly, the drives also meets the requirements of Morocco's Order of the Minister of Industry, Trade, Investment and Digital Economy No. 2574-14 of 29 Ramadan 1436 (16 July 2015) on electromagnetic compatibility of equipment.

For drives with the Morocco Mark, Seagate has added the Moroccan Commodity Mark to the drives provided to the OEM for the sale of Customer Kits produced by our OEM customers that are intended to be incorporated into the OEM's finished system-level product by an end user. The Customer Kits are considered 'devices' under Morocco's Order of the Minister of Industry, Trade, Investment and Digital Economy No. 2574-14 of 29 Ramadan 1436 (16 July 2015) on electromagnetic compatibility of equipment.

7.1.7 Taiwanese BSMI

Drives with the Taiwanese certification mark comply with Chinese National Standard, CNS13438.

For compliance with the Taiwan Bureau of Standards, Metrology and Inspection's (BSMI) requirements, [Section 7.2.3, Taiwan Requirements — Taiwan RoHS](#).

7.1.8 FCC verification

These drives are intended to be contained solely within a personal computer or similar enclosure (not attached as an external device). As such, each drive is considered to be a subassembly even when it is individually marketed to the customer. As a subassembly, no Federal Communications Commission verification or certification of the device is required.

Seagate has tested this device in enclosures as described above to ensure that the total assembly (enclosure, disk drive, motherboard, power supply, etc.) does comply with the limits for a Class B computing device, pursuant to Subpart J, Part 15 of the FCC rules. Operation with noncertified assemblies is likely to result in interference to radio and television reception.

Radio and television interference. This equipment generates and uses radio frequency energy and if not installed and used in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception.

This equipment is designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television, which can be determined by turning the equipment on and off, users are encouraged to try one or more of the following corrective measures:

- Reorient the receiving antenna.
- Move the device to one side or the other of the radio or TV.
- Move the device farther away from the radio or TV.
- Plug the computer into a different outlet so that the receiver and computer are on different branch outlets.

If necessary, users should consult a dealer or an experienced radio/television technician for additional suggestions. Users may find helpful the following booklet prepared by the Federal Communications Commission: *How to Identify and Resolve Radio-Television Interference Problems*. This booklet is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Refer to publication number 004-000-00345-4.

7.1.9 Japan VCCI

この装置は、情報処理装置等電波障害自主規制協議会（VCCI）の基準に基づくクラス B 情報技術装置です。この装置は、家庭環境で使用することを目的としていますが、この装置がラジオやテレビジョン受信機に近接して使用されると、受信障害を引き起こすことがあります。
取扱説明書に従って正しい取り扱いをして下さい。

This is a Class B product based on the standard of the Voluntary Control Council for Interference from Information Technology Equipment (VCCI). If this is used near a radio or television receiver in a domestic environment, it may cause radio interference. Install and use the equipment according to the instruction guide.

7.2 Environmental protection

Seagate designs its products to meet environmental protection requirements worldwide, including regulations restricting certain chemical substances.

7.2.1 European Union Restriction of Hazardous Substance Law

7.2.1.1 Restriction of Hazardous Substances in Electrical and Electronic Equipment

Seagate drives are designed to be compliant with the European Union RoHS "Recast" Directive 2011/65/EU (RoHS 2) as amended by Directive (EU) 2015/863. The RoHS2 restricts the use of certain hazardous substances such as Lead, Cadmium, Mercury, Hexavalent Chromium, Polybrominated Biphenyls (PBB) and Polybrominated Diphenyl Ether (PBDE), BisBis(2-Ethylhexyl) phthalate (DEHP), Benzyl butyl phthalate (BBP), Dibutyl phthalate (DBP), and Diisobutyl phthalate (DIBP) in electrical and electronic equipment (EEE).

7.2.1.2 Substances of Very High Concern (SVHC)

The European Union REACH (Registration, Evaluation, Authorization and Restriction of Chemicals) Regulation (EC) 1907/2006 regulates chemicals shipped into and used in Europe. A number of parts and materials in Seagate products are procured from external suppliers. We rely on the representations of our suppliers regarding the presence of REACH substances in these articles and materials. Our supplier contracts require compliance with our chemical substance restrictions, and our suppliers document their compliance with our requirements by providing full-disclosure material content declarations that disclose inclusion of any REACH-regulated substance in such articles or materials. Product-specific REACH declarations are available upon request through your Seagate Sales Representative.

7.2.2 China Requirements —China RoHS 2



China RoHS 2 refers to the Ministry of Industry and Information Technology Order No. 32, effective July 1, 2016, titled Management Methods for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products. To comply with China RoHS 2, Seagate determines this product's Environmental Protection Use Period (EPUP) to be 20 years in accordance with the *Marking for the Restricted Use of Hazardous Substances in Electronic and Electrical Products*, SJ/T 11364-2014.

Table 17 China - Hazardous Substances

| 部件名称 Part Name | 有害物质 Hazardous Substances | | | | | |
|-------------------|------------------------------|-----------|-----------|----------------------------|---------------|-----------------|
| | 铅 (Pb) | 汞 (Hg) | 镉 (Cd) | 六价铬 (Cr ⁺⁶) | 多溴联苯 (PBB) | 多溴二苯醚 (PBDE) |
| 印刷电路板组装 PCBA | X | O | O | O | O | O |
| 机壳 Chassis | X | O | O | O | O | O |

本表格依据 SJ/T 11364 的规定编制。
This table is prepared in accordance with the provisions of SJ/T 11364-2014

O: 表示该有害物质在该部件所有均质材料中的含量均在 GB/T 26572 规定的限量要求以下。
O: Indicates that the hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement of GB/T26572.

X: 表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572 规定的限量要求。
X: Indicates that the hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement of GB/T26572.

7.2.3 Taiwan Requirements — Taiwan RoHS

Taiwan RoHS refers to the Taiwan Bureau of Standards, Metrology and Inspection's (BSMI) requirements in standard CNS 15663, Guidance to reduction of the restricted chemical substances in electrical and electronic equipment. Seagate products must comply with the "Marking of presence" requirements in Section 5 of CNS 15663, effective January 1, 2018. This product is Taiwan RoHS compliant.

The following table meets the Section 5 "Marking of presence" requirements.

Table 18 Taiwan - Restricted Substances

| 設備名稱：硬盤設備 /SSD，型號：僅適用於內部使用 Equipment Name: Hard Disk Device/SSD, Type Designation: Internal Use Only | | | | | | |
|--|--|-----------|-----------|----------------------------|---------------|-----------------|
| 單元 Unit | 限用物質及其化學符號 Restricted Substance and its chemical symbol | | | | | |
| | 鉛 (Pb) | 汞 (Hg) | 鎘 (Cd) | 六价铬 (Cr ⁺⁶) | 多溴联苯 (PBB) | 多溴二苯醚 (PBDE) |
| 印刷电路板组装 PCBA | — | 0 | 0 | 0 | 0 | 0 |
| 机壳 Chassis | — | 0 | 0 | 0 | 0 | 0 |
| 備考 1. "0" 係指該項限用物質之百分比含量未超出百分比含量基準值。 Note 1. "0" indicates that the percentage content of the restricted substance does not exceed the percentage of reference value of presence. | | | | | | |
| 備考 2. "—" 係指該項限用物質為排除項目。 Note 2. "—" indicates that the restricted substance corresponds to the exemption. | | | | | | |

7.3 Reference Documents

In case of conflict between this document and any reference document, this document takes precedence.

Table 19 Reference Documents

| | Name |
|-----------|--|
| Apr. 2007 | SATA-IO Commands for ATA-8 |
| Feb. 2011 | Solid-State Drive (SSD) Requirements and Endurance Test Method(JESD218A) |
| Jul. 2011 | Serial ATA Revision 3.1 |
| Jul. 2011 | IDEMA (LBA1-03_standard.doc) |
| Jul. 2012 | SOLID-STATE DRIVE (SSD) Endurance Workload(JESD219A) |
| Jul. 2015 | ATA/ATAPI Command Set -4 (ACS-4) Working Draft |
| Nov. 2011 | ISO/IEC 14776-xxxSCSI Block Commands-3 (SBC-3) Standard (T10/1799-D) |



Seagate Technology LLC

AMERICAS Seagate Technology LLC 10200 South De Anza Boulevard, Cupertino, California 95014, United States, 408-658-1000

ASIA/PACIFIC Seagate Singapore International Headquarters Pte. Ltd. 7000 Ang Mo Kio Avenue 5, Singapore 569877, 65-6485-3888

EUROPE, MIDDLE EAST AND AFRICA Seagate Technology SAS 16-18 rue du Dôme, 92100 Boulogne-Billancourt, France, 33 1-4186 10 00

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