TeraSci SAS / SCSI / FC Manual

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TeraSci is a provider of leased turnkey test systems. The TeraSci SAS-SCSI-FC test system is a part of our full HDD / SSD test solutions. Our systems are not just hardware platforms but complete software controlled test processes. Our systems emphasize quality controls on all four major components of the test process; the equipment, the software, the operators and the tested units.

All of our test equipment is designed to provide for scalable systems from only a few test ports to a very large test depot. Since all of our solutions are leased our customer do not have any large capital expenditures when launching a project. The amount of test ports can be changed monthly to allow for product volume changes. One of the drivers of volume changes is product migration. For example, the industry is in the middle of the next migration from HDD to Solid State devices. And even the Solid-State products are migrating from SAS, FC and SATA interfaces, to AHCI and NVMe interfaces. TeraSci provides a way to ensure that a large capital expense does not become obsolete before it is amortized, as well as having the ability to change your port counts and interfaces to maximize your cost efficiency.

The software controls built into the system facilitate the management of a high volume low cost screen and yield process using low skilled test operators. Smaller “cells” have all of the same software features and controls of the larger test depot models. This means with a worldwide deployment every Geo will use exactly the same test processes no matter how big or small the tested volumes. Data collection and reporting is the same in all of your Geo’s.

Our data collection and reporting systems are an integral part of our process and we do not provide any test solutions without the database and the software tools. The database supports comprehensive analysis tools for the yielded product, the failed product, the test equipment, and the operators. Using statistical information is a powerful way to maintain the efficiency, quality, and yields for the entire process.

All of our systems are connected to our Central Database at our headquarters in Huntington Beach Ca. Each of our customers and their appointed representatives are given access to all of their data and custom reports via the TeraSci Portal. The portal URL is www.terasci.com/portal. Once you have a username and password you can log into the portal. To receive a username and password or to add representatives for your company to the portal contact: jmeece@terasci.com.

When you log into the Portal your user name will automatically provide you with your specific data. For example, a site representative will see only the data from their site. A corporate representative will see all of the data from all of the sites.

The Portal hosts both the data from all of your sites as well as the documentation to help you understand our data. Each tested commodity provides between 50 and 300 fields of data for each tested unit. Our documentation helps you decide which of those fields are the most useful to you. The documentation also covers: platform descriptions (like this manual), process flows, operator training, test equipment repair, Preventative Maintenance schedules and procedures for the equipment and descriptions of the test reports.

The Portal data reports can be separated into specific categories. For example, the reports can be by: date range, commodity (HDD, SSD, NVMe, Battery, PSU, ODD…), product type (SAS, FC, SATA…), site, Geo, manufacturer, and many other customer specific ranges. The portal has a number of canned reports and customer specific reports that cover all aspects of managing your process. We also provide custom reports for specific customer requirements.

TeraSci has pre-programed alerts that tell us if your process is deviating from the established norms. The software for these preprogrammed alerts runs once a week on Saturday. For example, we automatically run weekly zero yield reports, low and high yield reports, equipment deviation reports and many others. When we see one of these alerts our engineers will automatically data mine the entire database to see what we can do to correct the issue.

Our system was designed with the reality that the high-tech industry changes almost daily. The design of both our hardware and software allows for maximum flexibility. For example, if we receive an alert that a specific model number has an issue we can reconfigure that test process for that specific model number (down to a specific site) to "work around" the issue. We have already implemented 1000's such changes to our processes, and add new ones almost daily. There are dozens of other such flexible parts of our system that form a complete test process with the quality standards that are needed in today's world. This is especially true for managing our customer's Firmware (FW) Updates. A single site may support a multiple OEM's with different FW's for each OEM. Some of these updates require multiple FW downloads especially when going back several FW levels. Our system has a very robust FW update process and matrix.

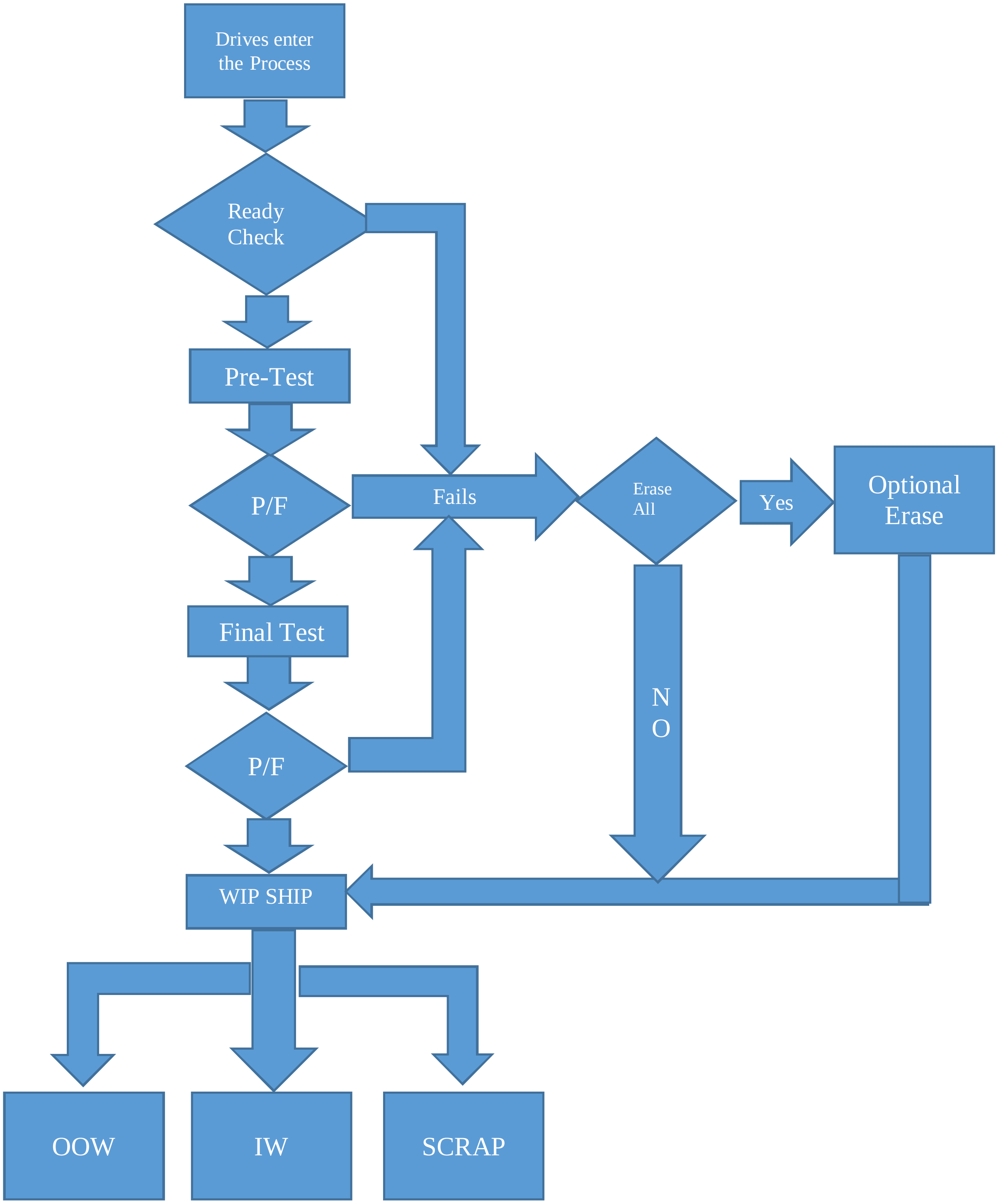
Our remote engineering and analysis tools are also mandatory parts of all of the systems we deliver. By using the Internet to connect to each site TeraSci can monitor the performance of the equipment and software to provide data on operator efficiency and training. When problems or trends occur (and they will) the remote access tools permit us to bring assets to solve problems ASAP. These assets include the engineering talents of our customer, the system integrators, application engineering for the products, as well as TeraSci engineering. We have successfully used this approach for 17 years and it is not an "idea" but a working solution.

Cost and quality is a factor is all test processes. The ability to have "remote" low cost tests site can only be achieved if each site is not burdened with the overhead of expensive engineers. The TeraSci system takes advantage of the communication capability of the Internet to immediately bring the best available engineering assets to that site. To be effective those engineers must have the data necessary to analyze any problems quickly. The TeraSci system already collects 100's of data points and additional data can be collected almost immediately. We solve problems for our customers on a regular basis without the time consuming and costly trips to the site that use to be common in our industry.

1. Test Methodology and Flow

The SAS-SCSI-FC drive test process is divided into four steps, with each step covering different test issues. The four steps are called Ready Check, Pre-Test, Final Test and WIP Ship. Each of these steps performs different functions that add to the overall efficiency and quality of the process.

see the chart below for a quick over view of the flow:



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Ready Check

Ready Check is the point where the drive to be tested first enters the process. Ready Check normally requires about 1 to 2 minutes per drive. This step is designed to permit a seated operator to: collect tracking data, perform a visual checkout of the drive to be tested, listen to the drive for any unusual sounds (and to reject drives with excessive noise), allow the software to quickly determine the functional capability of the drive, identify the drive and make the drive ready for testing. All of the information collected at Ready Check as well as the drive configuration and functional state are passed to the Site Server and its database.

The system is designed to support very flexible data entry at the Ready Check point. The operator must scan the drive bar code (mandatory) and enter any other data points as required. Many sites collect additional information (this is optional) such as the OEM specific part number, RMA number, and other tracking information. The system is designed to accommodate as little or as much information as required.

The TeraSci Ready Check station is unique in that it performs this operation away from a multi-port test station, and therefore the operator is much closer to the individual drive to be tested. This facilitates a much better visual and auditory check of the drive. With most systems, the drive is connected to the system in close proximity to the other drives under test. The noise of the system obscures the noise of the drive being connected.

The software will power up the drive and wait for a drive ready indication. If the drive fails to come ready in a specific amount of time the drive is rejected. If the drive comes ready within the allocated time the software will issue the SCSI Inquiry command to read the drive model number. This model number is used to look up a file name. This file can be unique to the model number or a more generic test file. For example, HDD’s and SSD’s have different files. Because our customers can have different requirements these files can be customer specific.

There are several data sets within the file. First is the test script, second is the test parameters, third is the configuration for the mode pages, vital product pages, and log sense pages for this model number. It is this scheme of mapping a drive model number to a specific file that provides most of the flexibility to the TeraSci SAS-SCSI-FC system. We can alter the script steps (even add model unique steps), change test parameters, and verify the mode, vital product and log sense page activity.

The process also supports drive DQ, by model number and serial number range. Once Ready Check pulls the Inquiry Data the model number and the electronic serial number are available. These are checked against the DQ file for both model number and serial number. If there is match in the DQ file the drive automatically fails Ready Check.

The test process is controlled by a Log written to the drive. This log contains the progress of each test step (Ready Check, Pre-Test, and Final Test) indicated by a Pass, Fail, or Ready. It also contains the error and statistical counters, the test parameter limits, the text of the comment and status fields, the location of the hard and soft error tables, the duration table, and the name of the file on the TeraSci server that holds the test results (TRK Log). The Log on the drive is created at Ready Check and updated at each point in the test process.

When the operator finishes the Ready Check step the software has set the log to “Ready for Pre-Test”. The Operator will see a “Ready” message. If the drive failed the operator will see the “Fail” message. They then sort the drives into these 2 categories. The fails typically go directly to WIP Ship. The “Ready” drives go into the test ports.

Historically the Ready Check step will reject between 10% and 30% of all the incoming drives. If a drive fails Ready Check (DNR, DQ, FW fails, SMART trip, or limit checks) it has normally completed the test process and exits the process via WIP Ship. In this way Ready Check will fail drives quickly leaving the test ports for drives that have a better chance of passing. This optimizes the use of the test ports (you only pay for test ports) and provides a more cost efficient test system.

A significant number of data points (at least 100) are sent to the TeraSci database to aid in Failure Analysis and to monitor the yield. The reject rate will vary according to the source of the product, but this is a typical number for normal field returned product. When the Ready Check failure rate exceeds the expected rate we get an exception alert from the DB Central Reports as outlined above. This will cause us to start mining the data to see why the rate is low (or high).

Pre-Test

After Ready Check the “Ready Drives” can then be connected to a 4 or 16 port test station. The software will power up the drive, read in the log, tables and test code. The Pre-Test sequence will be executed. Pre-Test can take a variable amount of time to complete (this is capacity dependent). As a rule of thumb we use 15 seconds per GB for older legacy drives below 100GB. For drives from 100GB to 1.5TB we use 10 seconds per GB. For drives above 2TB we use 8 seconds per GB.

The purpose of this test step is to eliminate from the process any drives that have failures that can be quickly identified. These include, Smart failures, Power Cycle timeouts (too long before ready), Seek and Servo errors, and grown defects (not repairable). A full pack read is performed in Pre Test. Section 5 below will describe the Pre-Test script steps in more detail.

The model number is also used (in most cases) to get the Firmware Revision for this model. Occasionally we use the customer ID number (Part number, CT code, FRU, PPID, G-code…) to lookup the FW revision. Firmware Updates are performed at Pre-Test. Our FW control system is very flexible. It supports: checking for more than one of permitted FW Revision, standard one step FW update, multi-step FW updates (update to FW-A then to FW-B then to FW-C), DQ certain FW revisions, and offline FW updates. TeraSci manages the FW revision files and the process for our customers. WIP Ship will also verify that the FW is at the correct FW level.

Historically the Pre-Test step will reject an additional 10% to 15% of the drives. Again the TeraSci test process will provide a large number of data points to provide failure analysis information.

Final Test

The drives that pass Pre-Test are then set “Ready for Final Test” and automatically link from Pre-Test to Final Test. Drives that fail Pre-test do not continue testing.

Final Test is a comprehensive Write Read test that accesses every user block on the drive, in addition to a several other functional tests.

Drive Erase: The write test is the step that erases all of the customer data on the drive. It consists of a single write pass, using either the Write Same command, a Format command with Security Initialize, or the Sanitize command. These type of erase is set by the file that was loaded at Ready Check using the drive model number as a reference. The reason for the multiple erase options is that not all drives support all of these options. Our system will always find one supported option to erase the drive.

Because drives can and are audited by outside audit firms we always leave the drive in the industry standard erased state of all zero's. This is the same state as brand new drives. The TeraSci erase process is compliant with NIST800-88 Guidelines for Media Sanitation. NIST800-88 is called out for HIPPA erase compliance, in Green Recycling standards, Department of Homeland Security media sanitation, and other erase standards.

There is also support for multiple write pass testing. Typically the multi write pass test is three patterns. The first write pass is an all ones pattern, the second a random data pattern, and the third pass an all zeros pattern. This is legacy test and is no longer recommended by NIST800-88 Guidelines for Media Sanitation. But it is still called out by a few of our customers so it is an included option.

Final test requires a variable amount of time to complete (capacity dependent). Final test erases all of the users blocks on the drive. Then it does a second full pass read of every block on the drive. So with 2 full passes of the drive it takes about twice as long as Pre-Test to complete. As a rule of thumb for Final test we use 30 seconds per GB for older legacy drives below 100GB. For drives from 100GB to 1.5TB we use 20 seconds per GB. For drives above 2TB we use 16 seconds per GB. Keep in mind if you are attempting to gage the full test time the Pre-test time must be added to the Final test time.

Section 5 below provides a more detailed description of each of the test steps in Final test.

NOTE: Since drives take a significantly different amount of time to process, you should always keep drives of the same capacity together in a 4 Port system. If you were to mix a 143GB drive (about 1 hour and 10 minutes to test) in the same system with a 6TB drive (about 40 hours to test) the 143GB will not compete until the 6TB finishes. This not an efficient way to run the system.

Historically Final Test will reject another 1% to 5% of the drives. At this point the failures are mostly grown defects that were not detected by the quicker Pre-Test. Our experience has shown that typical field return SAS drives have an overall NTF of 40% to 50%. The variation has a number of different components not the least of which is packaging and handling issues.

Log Out

Once a drive completes the process the operator will check the disposition of the drive. We refer to this as Log Out. The system will automatically upload all of the test information to the Database at Log Out. The system will display the Pass or Fail status (and optional DQ Erase status).. The operator should then separate the drives into Pass and Fail bins and send them to WIP Ship (or for DQ Erase to Erase All).

WIP Ship

The final step in our process is called WIP (Work-In-Process) Ship. This step is run on any standard PC with a Browser. WIP Ship is a TeraSci software package running on the TeraSci Site Server. It is presented as a Web Page.

This step is the Quality Audit for each drive. The operator scans the drive serial number into a dialog box and clicks the WIP Ship button. The software will look up the serial number in the Database and opens the current test record for that drive. The software will then run a script called a CSR (Customer Specific Requirements). By using a script TeraSci can customize the final audit check for each customer. A site can have a number of different CSR's for different processes. For example we can have a CSR's for: standard field return testing, new product buys, Gray Market buys, Audited QA Testing of FGI…. In this way the criteria for the final quality audit can be customized.

One of the first priorities of WIP Ship is to insure the drive has completed the test process. If not, WIP Ship tells the operator to route the drive back to test. Second it verifies that the drive has passed the erase process, if not it sets the drive to Scrap Disposition (for destruction). Third it verifies the FW level and checks to see if the model number or serial number is a DQ. Forth it checks for any customer specific Fail criteria. Finally in many sites we have a way to determine Date of Manufacturing and so the CSR can differentiate between In Warranty and Out Of Warranty drives.

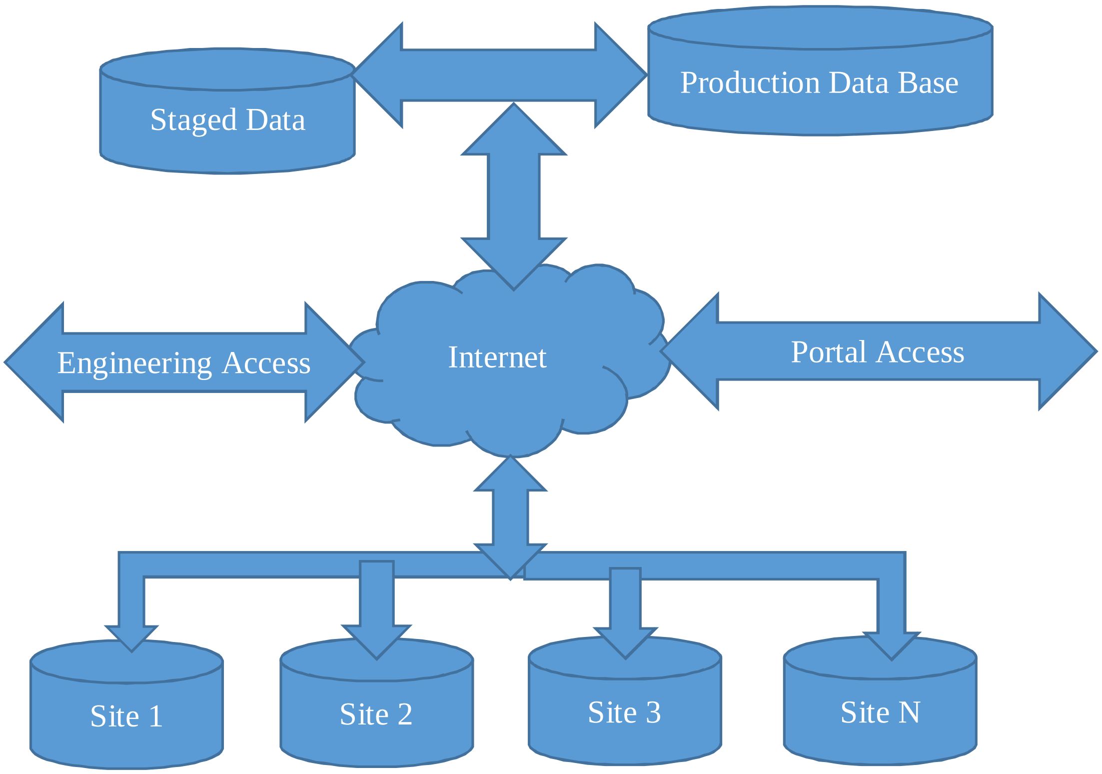
Once the CSR has completed the disposition of the drive is determined. Generally we have at least 4 disposition: In Warranty Fails, Out Of Warranty Fails, Scrap, and Passed drives for FGI. We also have customers that have other unique dispositions.

Optional Erase All Process

Because of the concern for Data Sanitation some customers require that the failed drives attempt an erase step. We have implemented this as a separate step. If a drive fails the process at any step (and it is not DNR) the system will set the Pre-Test flag to DQ. The Log Out for these drives will show “Ready for DQ Erase”. The operator can then separate these drives into totes. They can put these Fails in batches of 4 into the systems. The System will automatically run an erase only script on these drives. Our experience tells us about 40% to 60% of these drives can be erased. Once they complete they can go to WIP Ship. In Warranty drives that pass the erase process can be Returned-To-Vendor all other drives can scrapped (sent to degaussing). By erasing or degaussing all drives it insures only drives without customer data will leave the processing center.

2. Database and Reporting

The flow chart below provides an overview of the layout between the sites and TeraSci Headquarters via the Internet.



The Internet access between the sites and HQ is used to provide data replication from each worldwide site back to HQ DB Central. DB Central consists of several servers: a file server that contains our Portal access documentation, a Staged Database to facilitate replication, and a Production Database that serves up the Portal Reports. There are currently 2 types of Site Servers, Windows based and Linux based. We are transitioning all of the site servers to Linux. Windows servers replicate by sending differential updates every night and full backups once a week. Linux servers replicate by using linked MySQL servers between the sites and the Staged Database. So they are almost real time.

The difference between the two methods affects the data “freshness” on the Portal. Since MySQL replicates in almost real time it can provide data less than a day old. Windows replicates every Saturday Night (Huntington Beach Ca time).

The Internet access to each Site Server also provides TeraSci engineering direct access to all of the equipment on each site and to the local Site Server DB. In this way we can log into any site and see real time data and observe in real time the operators. All of our test platforms are Linux based and therefore we can use SSH to access the testers. SSH means Secure Shell, and that means we have can perform the same functions remotely that an operator can do on the tester. We can also share a session, meaning we can see everything the operator sees on their screen while they ae working. We use this to both observe operators and to train them.

The Internet connection also allows us to access the TeraSci FTP to transfer new code and other files to each site for updates. It also allows us to do remote troubleshooting.

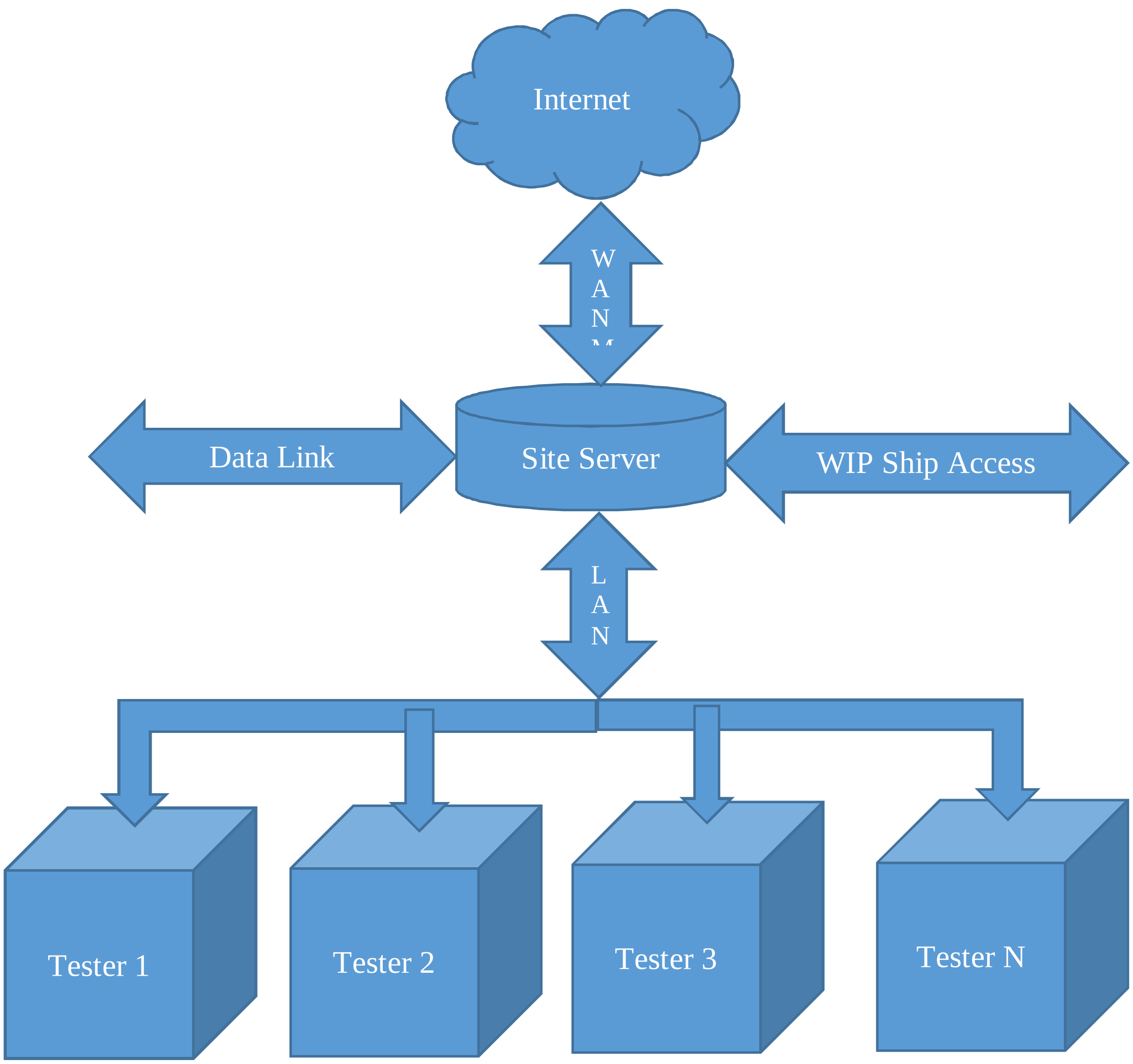
High volume, low cost recertification of hard disk drives requires constant monitoring of the yield data and failure analysis to spot problems in real time. Problem areas can occur from operator training issues, test equipment issues, handling issues, and model specific problems. Quickly identifying these issues and taking the corrective action is the key to a high-quality process. Yield analysis at the back end can be deceiving. When a large number of different models are analyzed as a whole, the overall yield may not indicate a problem. However, a variation in the failure rate at different points in the TeraSci process, or by isolating model numbers can show a significant difference. For example, a large increase in the failure rate at Ready Check of a specific parameter, can be useful in isolating a problem, like operator training. It is the ability to spot these variations and to address the issues that provide a comprehensive test system and maintain a high quality process.

This the value of the TeraSci process with integrated database analysis. The system collects hundreds of data points automatically, in conjunction with operator inputs. The Internet connection to the local server also provides a way for the TeraSci engineering team to quickly assist our customers. We have many years of experience in hard disk testing and millions of units tested. The ability to analyze the data real time via the internet without an on-site visit means much faster problem isolation and corrective action.

The Internet connection allows all of the data to be available on the TeraSci server for access by authorized parties. This information can be displayed in custom reports that fit the needs of different departments. For example there are reports tailored to logistic support managers, operations managers, engineering personal, and program managers.

3. TeraSci Site Configuration

The Flow chart below shows the layout of a typical site.



Each site must provide an Internet access point (WAN). This should be at least at DSL connection speed. The Site Server is either a Windows Server or a Linux Server (we are migrating all sites to Linux and any new sites are Linux based). The LAN provides wired Ethernet between the Site Server and the testers. We prefer that the Site Server is in a computer room with appropriate power and climate controls. The LAN provides access to the testers on the test floor. The LAN can be a 10/100 connection because the data transfers between the testers and the Site Server is in Kilobytes. The site is responsible to provide the LAN infrastructure.

The WIP Ship access is a LAN connection from the Site Server to a PC with a browser. The Site Server will provide a Web page over this connection. The URL for this Web Page is the IP address of the Server.

The Data Link access is a way for the Site Server to send records to the customer Shop Floor and Inventory systems. There are a number of different methodologies used with this function and are customer specific. We have used flat files, SQL and MySQL views, Web services and others. The function of this port is to insure the data from the test system is automatically sent to the customer data system and not transferred manually. This saves time but more important it insures accuracy. Most customers have a rule that no units can go to (or leave) FGI without a TeraSci test record that is a PASS. This insures no customer data escapes from a site.

For very small sites the Site Server and the SAS-SCSI-FC tester can be one 4 port system. In this configuration the 4 port system can also test SATA drives. This system is fully configured with all of the functions outlined in this document. It must have a WAN connection to the Internet. But the LAN side is not needed. The SATA test system and process is outlined in the TeraSci ATA documentation on the Portal.

This is a picture of the 4-port system configured for 2.5-inch drives. We use the adaptors to allow the drives to be inserted into the existing 3.5-inch cage without any modifications. This allows operators to switch between 3.5 inch and 2.5-inch product without any delays.

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This is a picture of a 16 port system. It is a space efficient way to package four 4 Port systems.

We generally control the SAS-SCSI-FC boxes via SSH using a separate TeraSci computer. So one control computer with a keyboard and monitor can handle up to 40 ports.

Most of the components in our system easily maintained by our customer's IT department or line engineers. They are standard PC components with a Linux OS. If our customers are not familiar with Linux we provide training and cheat sheets so that they can get a system to boot and onto the LAN. From that point the TeraSci engineers can access the system remotely and troubleshoot.

The SAS-SCSI-FC test station uses industry standard PCI compatible controllers with Linux drivers. If a SAS-SCSI-FC controller fails it is replaced with an onsite spare. Downtime is kept to a minimum. The test system hardware is built around standard PC's, Ethernet connected, with a stable Linux Debian distribution.

The SAS-SCSI-FC system is packaged in two configurations, a 4 port system (12 inches wide, 18 inches deep, and 8 inches high) and a 16 port system (36 inches wide, 20 inches deep and 10 inches high). These require only 110/220V 50/60HZ power. A 4 PORT system requires about 150W and a 16 Port system about 600 watts. These systems are designed to fit on standard work benches or racks.

The systems can be modified in the field to support SAS, SCSI or FC drives. This is not a quick change (15 minutes per system) and is not meant to be changed daily. But they can be changed to support variations in the incoming product mix to allow for a cost effective way to support all of the interfaces on site.

A 16 port box is actually four 4 Port systems, with one set of UUT power supplies. Each 4 Port system consists of:

- Motherboard and memory
- Boot Drive
- HBA (SAS, SCSI or FC)
- Motherboard PSU
- Units Under Test PSU's (5V and 12V)
- LED Display's
- Cage
    - Backplanes (SAS, SCSI or FC)
    - Drive Clamping
    - Adaptor to support 2.5 Inch drives
    - Cooling Fan

The backplanes are intelligent devices. They provide FET switched control over the drive power on an individual drive basis. They also monitor both the drive 5V and drive 12V power. The system will not test a drive if the voltages are out of range. The backplane also controls the operator LED display. The LED display allows the operators to see the progress of each port without going to the control station. This provides a quick way to see if the ports have finished.

The backplanes have connectors and therefore are a consumable part. The connectors can be damaged or wear out. Spare backplanes are kept onsite. Our experience is that most backplanes will last from 1 to 2 years. With the TeraSci leasing model all consumables and spares are part of the monthly lease price.

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This is a picture of the three backplanes. Top left is the SCSI, top right the FC and at the bottom the SAS backplane.

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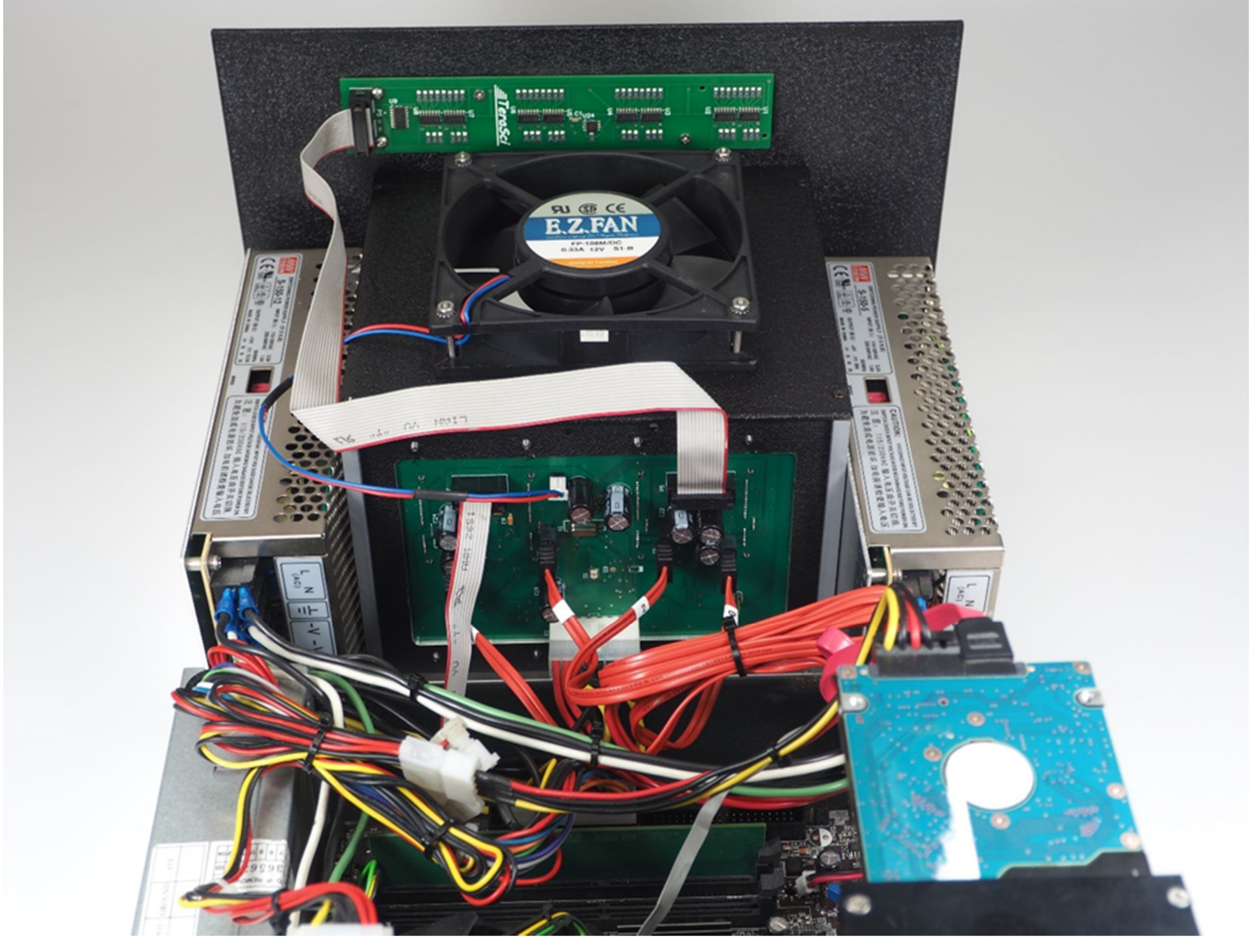

This picture shows the cage with the cooling fan and the backplane. The backplanes can be swapped out.

The hard disk drive industry is constantly changing and that challenges the test equipment providers to stay current. TeraSci has addressed this issue by designing its system to be upgraded in the field. The Internet connection between the TeraSci engineering facility and the server at each test site provides a way to keep all of the system software at the latest revision level. Upgrades and new drive specific packages are added regularly. The revision level of each package is part of the data that is saved in the database for each drive that is tested. When a software upgrade is needed TeraSci notifies the site manager and with their coordination can upgrade to the latest level quickly. In this way all of the test ports are maintained at the same revision level.

The system is designed to accommodate various throughput needs. The number of test ports determines the through put of the system. The capacity can be changed in 4 port increments on a monthly basis.

Given that the industry is migrating from HDD to Solid State the TeraSci leasing model allows our customers to migrate interfaces as needed. ACHI and NVMe are the new migration path. These are not SAS, SATA, SCSI or FC interfaces and require entirely new equipment. We test these new devices using ports but they are a different piece of equipment. If you are starting to encounter these devices contact TeraSci and we can provide a solution.

4. The Keys to High Quality

At the heart of the TeraSci system is the proprietary software. The goal of this part of the system is to achieve highest yield and not compromise the quality. The operator is asked to make a few subjective decisions concerning the visual appearance of the product and the noise level. All of the other issues are controlled by the test software. In this manner the number of subjective decisions are kept to a minimum. Therefore the education and the skill level of the operator is also minimal providing a lower cost process. Each operator has their own login to the test system. We have operator reports that alert us if an operator is failing too few or too many units and we can notify the site to re-train the operator.

As each new generation of disk drives has emerged the sophistication of the software and the tester has been challenged to “keep up”. The TeraSci engineering group has been in the disk drive field since the introduction of the IBM 2314 disk systems in the late ‘60’s. The 90’s were a particularly challenging era in disk drive testing for field return products. The introduction of very high capacity disk drives with MR heads, PRML read channels, triple ECC correction algorithms, hidden retries, DSP based spin and servo loops, and large uCode based SAS-SCSI-FC interfaces has reduced the ability to easily detect drive problems. The TeraSci process has addressed these issues with some unique approaches.

The test system is designed to dynamically reconfigure itself to support the drive under test. Part of that configuration is a library of SAS (test) files. These SAS files are drive manufacturer, drive family, and SSD unique. At Ready Check when the drive has identified itself the software looks up the model number in the Models.csv file. This file maps the model number to a specific SAS file that is downloaded to the drive. The SAS file contains the script steps for the Pre-Test and Final Test programs, the setup parameters for the test modules and its uCode, and any unique test script steps for that specific family of drives. In this way the tester is dynamically reconfigured to support older technologies and the latest technologies with the same hardware. Unlike many testers the test script and parameters are configured to optimize the test to the technology level. The Specification files also provide a comprehensive way to verify that the drive being tested is at the exact configuration level for the customer part number.

The quality of the tested disk drives is dependent on the detection and if possible removal of grown defects. One of the most difficult problems facing the test system is to find grown defects. The disk drives were completely free of defects following the manufacturing process. The SAS-SCSI-FC interface provides a mode page with error recovery parameters that can be changed at run time. The “Current” error recovery mode page can be altered to improve the detection of errors. There are a number of reasons for grown defects and it is the goal of the test system to differentiate between the causes of the defects. For example, servo problems, contamination, electronics problems, and head parametric problems can cause media errors but these problems cannot be mapped out using a spare. Only real media defects can be mapped and therefore repaired. The software must be able to differentiate between these types of errors. The newer technology drives compound this problem with their error correction and hidden retry software. The TeraSci software uses the drive Mode Page commands to minimize this corrective action.

TeraSci has a proprietary software algorithm that allows us to mimic the drive manufacturers IP. In this way we are able to “measure” the Bit Error Rate of the drive. We use this approach to find drives that are outside of the drive operating specification even if they PASS DST (Drive Self-Test) and other drive test software. It is this TeraSci proprietary software that allows us to achieve a level of quality that is equivalent to a recertified drive from the disk drive manufacturers. At the same time we do not fail an excessive number of units. TeraSci tests millions of drives a year for the major OEM’s. We are held to a high standard of compliance with the disk drive manufacturers RTV (Return-To-Vendor) process. We typically achieve 98% compliance with the drive manufacturers on failed units.

5. Test Sequence Summary

Ready Check

For drives that pass Ready Check they will complete all of the following steps. Drives can fail Ready Check at almost any of the step below.

- Apply Power to drive
- Wait for Spin-up
- Check Drive Status
- Collect the Bar Code and Tracking Information
- Read Inquiry Drive Data
- Read Vital Product Pages
- Read Mode Pages
- Get Drive Model Number
- Get Internal Serial Number
- Get Drive Parameters
- Get SCS file name from Models File
- Create a Service Log & Tables
- Check SMART Threshold
- Check Secondary Map Count
- Check for DQ by model number & serial number
- Set the drive Ready for Pre-Test
- Update the Service Log
- Write the Service Log and Tables to the drive
- Power-Off the Drive

- Write TRK file to the Server

Pre-Test Functions

Drive that enter Pre-Test can fail at almost any of the steps below.

- Power up the drive
- Wait for drive ready & Check Status
- Read the Inquiry Drive data
- Read Vital Product Pages & Mode Pages
- Read Primary & Secondary Map
- Setup the controller configuration
- Read the Service Log & Tables
- Read the SCS file
- Check the Service log is set for Pre-test
- Check the Inquiry drive data
- Check the drive Smart threshold
- Reset Mode Pages to the Default
- Update the drive FW if needed
- Run a Short DST Test
- Do a butterfly seek test (simulated - 2 minutes)
- Do random read and write tests
- Do 6 Pattern R/W test across system blocks
- Scan verify every block on the drive
- Analyze any error in the error table
- Check the drive Smart threshold
- Verify the drive has passed Pre-Test
- Update the Service log
- Auto Link to Final if Pass Pre-Test

Final Test Functions

Drives that enter Final Test can fail almost any of the steps below.

- Check the Service log is set for Final Test
- Check the drive Smart threshold
- Do a butterfly seek test (simulated - 2 minutes)
- Do 6 Pattern R/W test across system blocks
- Erase the drive (write all zeros every block on the drive)
- Do Random Writes
- Scan Drive for defects
- Analyze any error in the error table
- Check the drive Smart threshold
- Reset Mode Pages to the Default
- Update the error tables
- Verify the drive has passed Final Test
- Update the Service log
- Power down the drive

SAS-SCSI-FC TRK Format

The Portal has a separate document that defines the Database Definitions for SAS, SCSI, and FC. Please download:

TeraSci SAS-SCSI-FC Database Field Definitions

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