



Market Central[®]

www.secureswitch.com

500 Business Center Drive Pittsburgh, PA 15205 USA
412.494.2800 **CAGE 1BGJ7**

Reliability at the Edge[®]: **Reliability Assurance Methods and** **Mean Time Between Failures**

The fundamental concept of reliability in manufactured products of all kinds recognizes that the reliability of any assembly of components depends on the reliabilities of the individual components that constitute a completed assembly. This concept focuses on several aspects of each assembly, including the number of components used to create it, the manner in which reliability is measured or calculated and the suitability of the product for its intended application.

Considerable effort and attention have been applied to reducing the cost of achieving high reliability in manufactured products by taking performance measurements to confirm the success of the total manufacturing process, from the acquisition of raw materials or components to the completed products. Modern reliability measurements generally rely on standardized, statistical methods. Estimates of product failures are based on the performance of samples of finished products. The acceptable failure rate determines the sampling method to be used.

The cost of product failures increases as the product approaches its point of use and products that fail in use obviously are the most expensive. The acceptable failure rate (those units expected to fail in use) has an associated cost that can be assessed against the costs of analyzing samples. Minimizing the sample size to the equivalent cost of replacing failed units is the equally obvious motivation for statistical sampling methods that are applied to reliability assurance.

Many costs associated with the failure of a product at the point of use are difficult for a manufacturer to define. Manufacturers of industrial products, including information technology appliances, learn of field failures when significant numbers of them arise, when a critical system or network is compromised or when disappointed customers abandon them. The costs of such events represent risk that is inherent in any reliability assurance process that includes an acceptable threshold of field failures above zero.

High quality begins with the design philosophy of enhancing reliability by coupling the minimum number of components with established techniques that yield reliable long-term performance. Unique components that simplify product functions can greatly increase reliability when they reduce the overall number of parts in a product.

Reliable solutions begin with the selection of an appliance that is suitable for its intended use. Inaccurate assumptions during selection can produce a result with poor reliability in use and potentially large expenses from product repair or replacement.

All manufacturers strive for optimized processes that balance economy with yield and programs of standards have been developed to certify those who demonstrate

compliance with them. However, it is also a common experience to purchase a product that does not operate at all from a large, well-known manufacturer who promotes its Six Sigma-certified process. This problem confirms the limitations of processes that depend on statistical analyses to assure reliability in manufactured products.

Users also attempt to balance their risks and their costs when making product selections, though no individual user expects a product to fail. The cost of failure is often unrecognized by the user who is focused primarily on lowest cost until a failure has occurred. The only way to assure the reliable initial performance of assembled products is to increase the sample size to 100%. The combination of a well-selected product built with the minimum number of components and individual functional tests assures the routine delivery of a reliable product to the user.

Details above suggest that overall manufacturing costs escalate rapidly as a consequence of field failures that require product repairs or replacements, and the added costs impact every unit produced. Direct and overhead transactions are well known and can be included in cost estimates. Other risk-associated expenses are difficult to estimate and but are potentially large: failures of systems or networks that support wide area communications, critical health care facilities or financial institutions can provoke crises on every scale and are not considered with respect to sample size selection. The only sample size that can establish proper operation of any appliance at the time of its shipment is 100%. Decades of experience have shown that most failures arise at the time of installation. Individual functional tests virtually eliminate such failures and serve users who expect and deserve products that work when they are installed.

About Market Central

Market Central does not use statistical sampling in its process. Every product is tested in a functional environment that is typical of the application into which the product will be installed. Appropriate software applications are used to test it. When a product switches 1000Base-T Ethernet connections, 1000Base-T Ethernet data streams are passed through it and accuracy of those data streams are verified after they pass through the switch.

Market Central delivers many of its products to users through qualified representatives and provides depot repair of all field returns to those representatives. This supports the analysis of each unit that is returned by an user. Returns to other manufacturers typically amount to 8% of units shipped. Returns to Market Central are well under 0.1% and those returns, when re-tested, typically still meet their performance specifications. Most returns, though they are few, typically fall into to one of three categories:

- Mis-specification by the buyer who ordered the incorrect product
- The product was used for a demonstration and was returned to the reseller absent accessories like power supplies and cables, or the enclosure was defaced and the reseller has requested refurbishment
- Failure of an active component

Infant mortality of active components has generally been reduced to one part in eight million as evidenced by data published by semiconductor manufacturers. 100% testing of each lot of products at Market Central screens out those components that fail during their first use.

Market Central quotes a mean time between failures (MTBF) of 100,000 hours for all of its products. They are designed to be operated continuously and therefore the quoted MTBF is equivalent to more than eleven years of service. Many systems into which the products are installed become obsolete or are upgraded in much less than ten years. The products typically use industry-standard interfaces that usually do not become obsolete for many years, reducing the cost to customers of the replacement of Market Central's switches and switching systems when other system components are upgraded. R5000 and R6000 Series switching systems support 1000Base-T Ethernet for both cabled and optical networks. Customers who upgrade their 10/100Base-T networks to 1000Base-T Ethernet speeds continue to use their R5000 and R6000 Series switching systems in their original form, saving the costs of replacing them when upgrading other system components. The MTBF of 100,000 hours is therefore an important benefit of using Market Central's switching systems.

Many customers who specify and use Market Central's switches and switching systems install them in critical applications, including classified information networks, aircraft ground control systems, Television-over-Internet-Protocol systems and stock exchange data networks. Reliable performance is crucial in each of these and in many other applications served by these appliances. Careful matching of product performance to customer requirements is combined with features like power supply redundancy that serve customers' needs for reliability. Unique micro-mirror optical movements used in Market Central's fiber optic switches greatly increase their reliability by reducing complexity. Reliable delivery of every unit produced is assured by establishing a test sample of 100%.

Market Central's data switches and switching systems are used to enhance the security and reliability of the networks and systems into which they are installed. Highly reliable products have been delivered for more than two decades through by a process that includes accurate performance specifications, minimal component usage and 100% production line functional tests. Field failures arising from limited sampling processes and statistical analyses are non-existent. Depot repair of products that are returned from the field provides the opportunity to identify failure modes.

Many of the world's best-known entities specify Market Central's products for their reliability and ease of installation. Products that are suitable for use in international markets are certified under applicable regulations and have been delivered to more than 100 countries. Commercial applications include transportation switching systems, financial networks and others where system failures create intolerable losses.

Market Central's products are used at the edges of networks and systems where connections are made, adding ***Reliability at the Edge***[®].

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