Technical Brief No. 44

All Technical Briefs are based on past projects at RH Lyon Division

Improved Product Quality

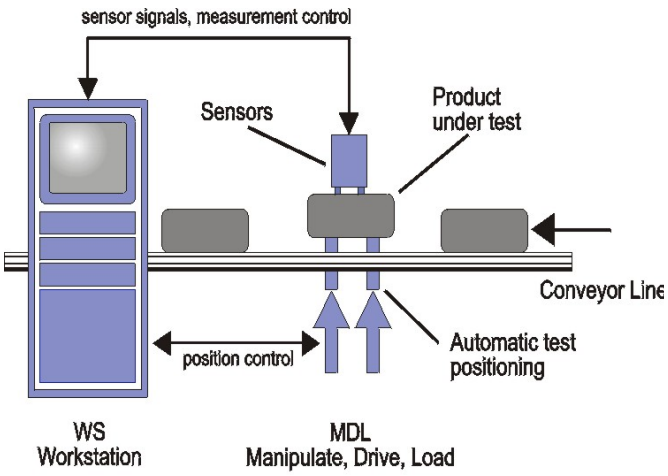
Production Line QA Systems: Planning Overview

SignaTrack™

Introduction

On-line machine diagnostics permit evaluation of product quality during production. Specifically, data from external measurements may be analyzed to "look inside" and evaluate product quality. The system architecture for doing this is called SignaTrack™ and is embodied in an integrated production line diagnostics system.

Production Quality Assurance diagnostic systems bring value to product manufacturers in a number of ways. Principally, with on-line diagnostics, manufacturing yield will increase for a given product design. From the end-user's point of view, this yield increase results in greater customer satisfaction. The manufacturer will have fewer products returned and will see fewer service calls, which, in turn, will lead to significant cost savings. Satisfied customers set the stage for increasing market share and new market penetration. Manufacturers also realize value internally. Higher yield implies that fewer products will be reworked or scrapped, thus increasing effective utilization of raw materials and components. Finally, on-line diagnostics rapidly identify faulty components or processes; these can be addressed and corrected in "real-time." Rapid identification of production-line faults increases effectiveness of the manufacturing process by reducing both remediation cost as well as reducing spoiled work.



Typical Layout of SignaTrack™

Implementation

Hardware required for on-line QA diagnostics includes sensors, front-end signal conditioning, A/D converters, and computation platforms. Sensors are tailored to the specific application and can be microphones, accelerometers, strain gauges, voltage and current probes, hot-wire anemometers, etc. Front-end signal conditioning is specific to the sensor type and prepares the signal for discretization by commercial A/D cards. Computation platforms range from high-end PC workstations to PC104 cards to embedded micro-controllers. This allows the physical and economic requirements of the solution to be tailored to specific production line needs. Finally, interaction with PLCs that control production line and product handling devices is also an integral part of the SignaTrack™ architecture.

To the greatest extent possible, system software is developed using high-level languages such as C or C++. Where needed, micro-code is used for programmable arrays and the like. This approach insures rapid development and long term maintainability. The user interface is a critical piece of the software deliverable. It must be easy to use with little training required, but it must have sufficient capability to exercise the functionality of the diagnostic system. Highly intuitive GUIs for PC workstations, for LCD touch screens, and other devices must be specified and developed for ease of use and to minimize training.

The technical portion of the code is, perhaps, the greatest challenge. This is where physics and signal processing come together to convert external measurements into reliable evaluations of the internal device state. Development of the fundamental physical models, signal processing requirements, and data interpretation are not simple coding tasks. Fortunately, effort for this portion of the system development is non-recurring engineering. It can be reused on many QA diagnostics systems installed on parallel production lines. Software coding for this portion of the system is almost always done in a higher level language.

RH Lyon Division (RHL) typically partners with third party machine design vendors to provide actuators and manipulators for interacting with the product on the assembly line. RHL prefers acting as the prime contractor and subcontracting the machine design portion of the project. However, circumstances will dictate the appropriate arrangement on a case-by-case basis. In like manner, system integration can be handled by RHL or by the machine design vendor. Again, the determination is based on a case-by-case evaluation.

Process

Budgetary estimates for time and cost must be developed through a detailed scoping and data gathering phase. Developing an on-line quality assurance system is, in many ways, much like a product development effort and requires a structured approach for timeliness and cost control. A study to determine the value of an on-line production diagnostic system is an important initial step. Variables in the value assessment include such parameters as volume of product, cost of manufacturing, cost of reworking rejected products, number of production lines, and operating margin for the product. The results of this valuation study provide guidance as to whether a full program for developing an on-line QA diagnostics system is warranted.

Assuming a valuation study indicates that QA diagnostics are appropriate, then an initial specification and scoping effort is the first step. This sets the foundation for each of the subsequent phases. The overall system development must progress through five phases:

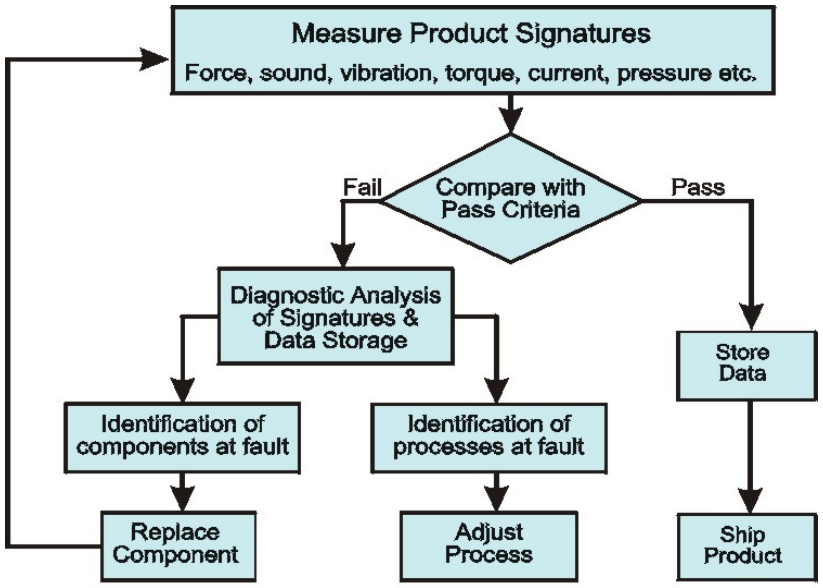
1. Scoping and specification,
2. Data and information gathering,
3. Signature development,
4. Prototype and refinement, and
5. Deployment.

Phases 1-3 are supported on a time and materials contract, with each one beginning only after passing gates and obtaining approval at the conclusion of the previous phase. Phase 4 and 5 are fixed price engineering tasks with milestone dates and specified deliverables. After Phase 5, ongoing software support is provided either by a service agreement or on a time and materials basis.

For typical projects, duration of the scoping task is four to eight weeks with a detailed specification document being provided at the conclusion of the task. The scoping task involves extensive interaction and cooperation between the client company and RHL. It is during this phase that the system functionality, serviceability, operating environment, physical dimensions, and the like are specified. In addition, operator and machine interaction with the diagnostic system is explored. This interaction and integration with workflow is also specified during the scoping phase. Duration of the remaining work after Phase 1 is highly dependent on the nature of the project and can only be determined after completion of the scoping phase.

Contact

For additional information about SignaTrack™ systems and how this technology can be used to increase profitability, contact RH Lyon Division at 617-499-8000 or via e-mail at lyoncorp@lyoncorp.com.



Functions of SignaTrack™