



Fault Isolation Manuals Are Failing

Troubleshooting is the step-by-step process by which the causes of equipment problems are identified so that proper repairs can be performed. Traditionally, the troubleshooting process has been guided by manuals and documents with names like: Troubleshooting Guide (TSG), Troubleshooting Manual (TSM) and Fault Isolation Manual (FIM).

This paper is about troubleshooting technology and is intended to help explain why traditional FIMs are no longer effective and why a new generation of fully-integrated product support tools (with diagnostics and troubleshooting) is now replacing them.

The manufacturer's FIM provides troubleshooting guidance—the logical sequence of observations and decisions that will (or should) identify the source of equipment problems. Some FIMs describe the actions needed to repair equipment, but in most cases those instructions are in a separate Equipment Maintenance Manual (EMM), which is referenced by the FIM. Troubleshooting guidance is a form of decision logic where each step depends on the results of all previous steps and observations. That key characteristic—decision logic based on known conditions—sets the FIM apart from all other equipment manuals in a library of technical publications.

To be fully effective, a Fault Isolation Manual must:

- Identify the cause of any potential equipment problem
- Ensure the most efficient troubleshooting path, regardless of equipment configuration
- Isolate the correct source of the problem, from all other possible causes
- Direct the user to information about subsequent actions (parts, tests, repairs, etc.)

Recognizing that equipment failure modes, symptoms and causes are constantly changing and that diagnostic processes are constantly improving, the official FIM quickly becomes out-of-date.

More specifically, keeping a FIM up-to-date has its challenges:

• **It is difficult to create.**

FIM authors must consider all possible failure modes and symptoms and define the most efficient/logical sequence for troubleshooting equipment that exhibits multiple problems.

• **It is difficult to be consistent.**

Multiple authors are involved in producing a complete FIM and each uses slightly different strategies and descriptions for troubleshooting similar problems.

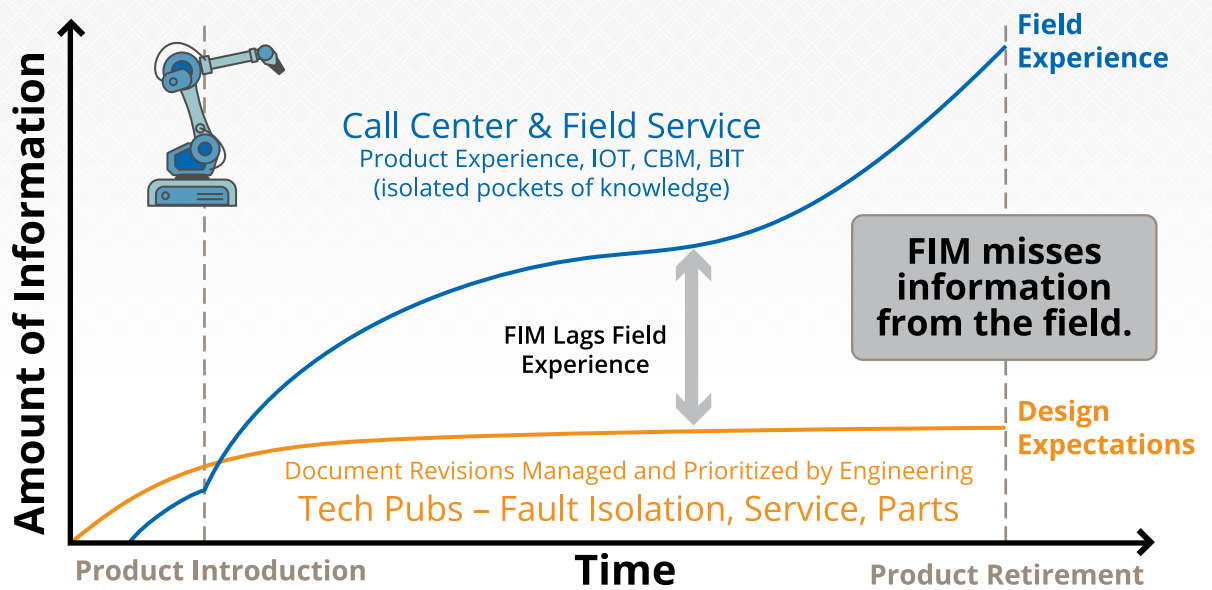
• **It is intentionally incomplete.**

A page-based FIM has practical size limitations and it is typically not possible to fit all troubleshooting knowledge into it. Since many procedures become too long (and convoluted) for practical use in a time-pressured repair environment the FIM is typically limited to consider only the most common or easy to diagnose problems.

• **It is difficult to update.**

New knowledge/ field experience must be evaluated by engineering and then adapted to the existing FIM. New troubleshooting guidance often conflicts with the existing logic/ procedures. As a result, engineering and technical publications personnel must re-validate every change against the affected parts of previous decision trees.

However, the biggest challenge to keeping a FIM up-to-date, which encompasses all of the issues above, is that it cannot be modified as quickly as new information is generated. After the equipment enters service, knowledge about new problems and the best ways to diagnose and repair them accelerates, and gathering/ sharing that information is difficult with traditional FIMs.



CaseBank's SpotLight solution overcomes these challenges. SpotLight is an integrated product support tool comprised of a customizable diagnostic reasoning engine that operates on a database of known equipment issues (i.e., a knowledgebase). CaseBank's knowledgebase technology allows customers to capture all of the symptoms, causes and solutions for every known failure mode for a specific type of equipment.

- **It is straightforward to create.**

SpotLight automates the creation of a knowledgebase that contains information about failure modes, and the diagnostic reasoning engine allows customers to define rules and constraints. When combined, SpotLight dynamically generates the troubleshooting decision logic.

- **It is easy to deploy.**

By separating the knowledgebase from the reasoning engine SpotLight simplifies implementation and accelerates deployment across multiple product lines—just add a new knowledgebase.

- **It is consistent.**

SpotLight ensures all users follow a consistent diagnostic strategy across all scenarios, by tailoring guidance to the similarity of previous symptoms and the time, cost and filtering effect of each troubleshooting step. Regardless of who or when the information was added to the knowledgebase, SpotLight ensures the best path based on customer priorities (time, cost, quality, etc.). Furthermore, service and performance analysis is more accurate as SpotLight utilizes consistent terminology throughout.

- **It is complete.**

SpotLight can consolidate and hold ALL of your troubleshooting knowledge, while still delivering fast, efficient guidance to users.

- **It is easy to update.**

Since SpotLight separates the logical reasoning from symptoms and failure modes, updating the knowledgebase is simply a matter of adding new equipment symptoms, sources and solutions as they are gathered from the field.

However, the biggest advantage to SpotLight, which encompasses all of the issues above, is that it can keep pace with the rapid growth of product knowledge, ensuring all service reps, call centers and maintenance technicians have accurate information. SpotLight can be updated in minutes, if needed, and can easily be maintained on a daily basis.

The process of revising SpotLight is fast and reliable. The original content that goes into a knowledgebase can be converted from page-based FIM documents, and/or it can be imported from engineering data sources. Customer preferences are easily modified and diagnostic reasoning is performed on the fly to deliver real-time decision logic. All maintenance instructions (parts lists, repair instructions, technical specifications, system operations, checkout procedures, 3D models and simulations, etc.) can be managed elsewhere in the PLM/CMS technical publications system and linked directly to SpotLight.

As equipment buyers embrace technologically advanced products, companies are having difficulty supporting their equipment in the field and managing customer expectations for troubleshooting support. Traditional FIMs weren't designed to meet the challenges of troubleshooting complex problems in diverse work environments. By dynamically generating decision logic, SpotLight ensures that service reps, call centers and equipment technicians avoid unnecessary diagnostic steps— quickly identifying the cause of problems and minimizing the time and cost of fault isolation. Companies that rely on CaseBank solutions report better mean-time-to-repair, first-time-fix, unscheduled removal rates, warranty costs, equipment performance and feedback from the field, which has resulted in lower costs and higher customer satisfaction.