

Enhancement in Project Execution using Automated Instrument Loop Checking Tools¹

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Abstract

One of the most critical activities during pre-commissioning of major oil and gas projects is instrument loop checks. Conventionally, these loop checks are done manually and are time consuming and prone to human errors. Currently, there are automated instrument loop checking solutions available which offer improved accuracy and reduction in project execution time. This paper describes the challenges faced with conventional methods and highlights significant benefits of utilizing automation tools in mega projects to achieve key project management objectives of reducing project execution time and improved resources utilization while maintaining the required quality and integration of these tools with process control systems as part of digitalization drive.

Introduction

Instrument loop checking primarily involves checking and ensuring that field devices are wired to applicable process control system correctly, properly calibrated and provide desired functionality.

In large-scale projects, this process involves thousands of instrument loops and traditionally requires extensive manual intervention, including field verification, data logging, and report generation. These manual methods are not only labor-intensive but also susceptible to delays, human errors, and inconsistencies.

In today's state-of-the-art complex oil and gas capital projects, timely and reliable project execution is a critical factor for successful project delivery. Instrument loop checking is not only a technical requirement but also a project management imperative. Manual methods of loop checking usually affect the quality of workmanship and have potential of delaying project schedule, which will eventually impact the project cost adversely. Hence, it is necessary to explore alternate and innovative ways to reduce risk of increased cost, schedule delays and poor quality.

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Based on latest technological advancements in the industry, various automated tools have been developed which are capable of completing conventional manual tasks automatically and thereby reducing manual errors and enhancing the quality of work. These tools can perform loop checks through applications installed in the control system which are integrated with instrument asset management system.

Below are some of the key benefits of utilizing these automation tools:

- **Improvement in project schedule timeline:** Instrument loop checking is usually very critical activity and has direct impact on project schedule timeline. Automated loop checking tools reduce execution time and remove manual errors, thereby minimizing risk of missing project milestone deadlines.
- **Better quality control:** Since manual data entry and verification are eliminated, high quality, error-free results can be achieved using automated tools which is of paramount importance for any project execution.
- **Optimization of resources:** Automatic tools help reducing the personnel required for field verification and simulation, and in turn, cost saving can be realized. This supports lean project execution strategy as part of Operational excellence.
- **Digitalization:** As per current trends, these tools represent digitalization which is one of the key components in modern day projects execution, which supports paperless workflow, real-time data visibility and digital twin models.

This paper seeks to illustrate that automated instrument loop checking tools not only provide innovative technical solution to challenges associated with conventional methods but also a catalyst for improving project performance and managerial decision making in cost and schedule driven mega projects.

1. Challenges faced with Traditional Instrument Loop Checking Methods

Checking loops in traditional way generally involves below steps:

- A technician will manually simulate signal from the field input device by using hand pump or simulator and from faceplate in HMI (Human Machine Interface) inside control room for field output device.
- A board/field operator will monitor response in the control room HMI (Human Machine Interface) and/or in the field and provides feedback if the response is satisfactory.
- Final test result is recorded manually and hard copy is signed off.

Following are the main challenges faced due to this conventional method:

- **Time-consuming:** Depending on the location of a field device, each loop takes several minutes to hours in verification process which results in sluggish progress
- **Human errors:** Since manual intervention is involved, there are chances of human errors and mistakes which results in poor productivity
- **Hard copy documentation:** Hard copy documentation may be lost or misplaced resulting in re-work.
- **Audit traceability:** Hard copy documentation is difficult to retrieve and inconvenient for audit trail.

2. Salient features of Automated Instrument Loop Checking Tools

Automated instrument loop checking tools provide software-based solutions integrated with various process control systems such as Distributed Control System (DCS), Emergency Shutdown System (ESD) and Instrument Asset Management Systems (IAMS).

Many tasks can be performed automatically without manual intervention using these tools. Some of the major ones are listed below:

- **Remote verification:** Instrument loops can be checked remotely either from the control room or Process Interface Building (PIB), which does not need presence of technician/operator in field.
- **Universal support:** These tools support both Highway Addressable Remote Transducer (HART) and Foundation Fieldbus (FF) analog signals in addition to discrete signals.
- **Automated test:** Pre-configured tests can be performed automatically to check connection integrity, linearization, range, and functional response.
- **Simultaneous loop checks:** Multiple loops can be pre-selected and executed simultaneously, which reduces verification time drastically.
- **Instantaneous analysis:** As part of automatic test, in case the loop test fails, the tool provides immediate feedback regarding the reason for failure and required actions.
- **Exhaustive report:** Tool provides automatically generated detailed reports detailing pass/fail status, test parameters, and timestamp.

3. Control System Integration

To enhance the loop check efficiency, these tools are usually integrated with various control systems such as:

- **IAMS system:** For checking device healthiness and pre-configuring various tests

- **DCS and ESD systems:** As part of automatic loop check, values of various parameters which are configured in these systems are obtained.
- **Document management system:** To generate reports automatically and providing audit trail
- **Project performance monitoring system:** Loop check reports are linked to this system to support a paperless, digitalized environment, to meet the demand of smart project execution and digital twin technologies as per prevailing trends.

4. Anticipated Benefits during Project Execution

Many benefits can be reaped by deploying automatic loop check tools, such as:

- **Time saving:** An instrument loop can be verified in 1-2 minutes using automatic tool compared to hours utilizing conventional methods.
- **Accuracy improvement:** Human errors and manual data entry can be eliminated, which increases accuracy and consistency.
- **Better traceability:** As the data generated and stored digitally, it is easily retrievable and traceable.
- **Resource Optimization:** Helps in reduction of field manpower due to automated process.

In terms of project management, these benefits provide following advantages:

- Reduction of risk in schedule slippage.
- Enhanced quality of workmanship.
- Better resource utilization and cost optimization.
- Support digital transformation drive.

5. Factors for implementation

Following key factors shall be kept in mind while implementing this technology:

- **Compatibility with control system:** The automated tool shall be compatible with control system used for the project.
- **Training:** End user personnel must be trained for proper utilization of the tool
- **Management of change (MOC):** To address the concerns from end users, the tool's capabilities shall be demonstrated as pilot implementation and change shall be well documented via MOC approval process.
- **Cybersecurity:** All precautions and measures must be taken care of to comply with the cybersecurity requirement stipulated by the organization to ensure secure access and data integrity.

6. Conclusion

Automated instrument loop checking tool is an innovative approach and a great technological advancement in modern day project execution. This approach challenges the conventional manual methods and by adopting the automated tool, projects can obtain significant benefits by reducing schedule risks and improving quality of workmanship. Its integration with control systems and asset management system is a valuable feature which fulfils the demand of future mega projects.

Modern organizations which have more focus on innovation, safety, and operational excellence, such tools can be used to advantage in delivering complex mega projects on schedule with excellent quality and within budget.

As the future projects strive for excellence in digitalized, data-centric project execution models, automated loop checking tool will be instrumental not only to engineering team but also for project management team and senior management to deliver highest quality deliverables with reduced risk and improved project execution.

7. Recommendations for Adoption in Future Projects

- In order to gain confidence and user acceptance of the innovative approach and automated instrument loop checking tool, it is recommended to conduct a pilot implementation on a small-scale project or unit.
- Once accepted by all stakeholders, develop templates and procedures and include these as part of project execution plan using MOC process.
- Integrate automatic loop check tool with Project performance monitoring system to track loop check status and provide high level reporting to management
- Explore the possibility of using this tool for predictive maintenance and asset performance monitoring.

About the Authors

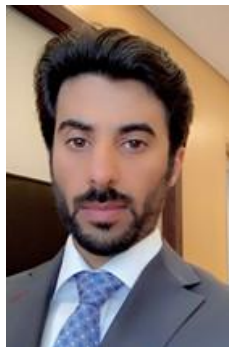


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Hamad Alhajri is a project management professional with 18 years of experience in the oil and gas industry. He holds a bachelor's degree in Electronics and Telecommunications Engineering (2007) and has contributed to several major projects, most recently the Tanajib Gas Plant Project. Hamad is known for his strong technical background, leadership, and consistent delivery in complex project environments.