

HANDBOOK OF CONSTRUCTION MANAGEMENT FOR INSTRUMENTATION AND CONTROLS

K. SRINIVASAN • T.V. VASUDEVAN
S. KANNAN • D. RAMESH KUMAR



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**Handbook of Construction Management
for Instrumentation and Controls**

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K. Srinivasan, T.V. Vasudevan, S. Kannan, and D. Ramesh Kumar

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About the Authors

K. Srinivasan



Advisor, Mentor and Contributor

Main sections contributed:

- Section 1: Preface and Edits
- Section 2: Construction Management – Site Operations
- Section 3: Analysers Overview
- Section 6: Non-Technical Forms

Educational Qualifications:

K. Srinivasan has an Honours degree in Physics, followed by a Post-Graduate diploma in Instrumentation from the Madras Institute of Technology Anna University, Chennai, Tamilnadu (MIT-AU), graduating in 1959.

Industrial Experience:

K. Srinivasan worked for 23 years with Imperial Chemical Industries (India). During this period he was Group Head on design, maintenance, construction and commissioning of chemical, explosive and fertilizer plant instrumentation. Then he moved to Australia and worked with the Foxboro and Leeds & Northrup companies for 22 years before retirement. During this period, he supervised the implementation of digital computer control in steel, power and cement plants. A pleasing aspect to him during this period was that the company started making profits on their bids.

a) Papers Presented:

- i) *Intelligent Automation*, at the University of Sydney; ii) *Is Advanced Control Relevant Only for Large Plants?* at the University of New South Wales; iii) *Advanced Control of Distillation Plants*, at IIT Chennai.

b) Papers Published:

A series of articles on Advanced Control of Unit operations.

c) Teaching:

After retirement, he taught at the TAFE (Technical and Further Education) Sydney for four years on Instrumentation – measurement, installation, testing and commissioning. An extended course on flow meter engineering was given.

T.V. Vasudevan

Chief Editor and Contributor

Main sections contributed, besides all fill-ins:

- Section 1: Introduction
- Section 3: Site Operations Manual – I&C (part)
- Section 4: Bulk Construction Material Specifications (part)
- Section 5: Appendix – Standards and Engineering Information (part)
- Section 6: Technical Forms

T.V. Vasudevan has a BSc in Physics followed by a Post-Graduate Diploma in Instrumentation Engineering (DMIT), graduating in 1975 from Madras Institute of Technology, Anna University, Chennai, Tamilnadu (MIT-AU).

Now retired, he moderates an online technical forum of Alumni of MIT-AU for I&C engineers. He had served with Engineers India Ltd., New Delhi; Kuwait National Petroleum Co., Kuwait; Stork Comprimo, Singapore; and as I&C Engineer on contract / consultancy in several Middle Eastern and S.E.A. companies. His professional experience is mainly in Design and Detailed Engineering of Oil and Gas, Refinery and Petrochemical Projects, Power plants, Cement plants, Pharmaceutical plants, Sugar plants, etc.

D. Ramesh Kumar

Contributor – Field Installations

Main sections contributed:

- Section 3: Field Installations (part)
- Section 3: Flow Instrument Installations (part)
- Section 3: Level Instrument Installations (part)
- Section 3: Temperature Instrument Installations (part)
- Section 4: Bulk Construction Material Specifications (part)

D. Ramesh Kumar has a B.Tech in Instrumentation Engineering, graduating in 2001 from Madras Institute of Technology, Anna University, Chennai, Tamilnadu (MIT-AU).

Currently, he is with OQ, Oman Oil Refineries and Petroleum Industries Company in Oman as Lead Instrumentation & Control System Engineer. He has over 21 years' experience in the field from feasibility studies, FEED, detailed engineering, etc. to Project Management, Installation, Commissioning of Oil and Gas, Refinery and Petrochemical Projects.

Among other major oil and gas, refinery and petrochemical companies, he worked for are Chennai Petroleum Corporation Limited (CPCL), India; Indian Oil Corporation Limited (IOCL), India; Petroleum Development Oman (PDO), Oman; Saudi Aramco, Saudi Arabia; SABIC, Saudi Arabia, etc.

S. Kannan

Contributor and Sub-Editor

Main sections contributed:

- Section 2: Instrument Construction Tender Specifications
- Section 3: Edits & Research: I&C Construction and Site Operations
- Section 5: Appendix – Standards and Engineering Information (part)
- Section 6: Technical forms – Manpower Trade skills, Installation and Calibration, Loop Check, etc. Information

S. Kannan is a BSc (Physics) graduate and has a Post-Graduate Diploma (D.M.I.T) in Instrument Technology from Madras Institute of Technology, Anna University, Chennai,

Tamilnadu (MIT-AU), graduating in 1976. He has 40 years' experience in execution of Field Instrument Installation, Pre-commissioning works and Project Management of various Instrumentation Projects of Refineries, Petrochemicals, Power and Sugar plants, etc. He is associated with Alkan Engineering, Bombay; NRC Engineers (Madras); Sical Yamatake Limited; SABIC, Saudi Arabia; CEGELAC, Abu Dhabi; and BAPCO, Bahrain, and finally retired in 2016.

Grateful Acknowledgement to Other Information Contributors

T.C. Chandrasekar has a BTech in Instrumentation Engineering, graduating in 1994 from Madras Institute of Technology, Anna University, Chennai, Tamilnadu (MIT-AU). He is currently a Manager (E&I) at M/S Petrofac, Sharjah.

- Analyser
- Analyser shelter
- FAT & SAT
- Change management

G.R. Omprakash has a BTech in Instrumentation Engineering, graduating in 1993 from Madras Institute of Technology, Anna University, Chennai, Tamilnadu (MIT-AU). He is currently with M/S Deepak Group, Pune, India.

- HVAC
- Control Room works

V. Satis Kumar is with Instrument Group at NPCC, Abu Dhabi.

- QA/QC check forms

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Preface

Instrumentation for process industries is evolving, perhaps faster than most other technologies. The accuracy and speed at which plant data is made available to personnel is way ahead of what it was, even a decade back. The advent of digital technology and advances made in communication have enabled a revolution. Together with associated computers, relevant reports giving details on current production levels, bottlenecks, raw material stocks, finished goods levels, etc. are made available to board members and production executives, enabling them to take appropriate decisions almost on a real-time basis.

Yet, all this depends on one key factor – correct installation and commissioning of the instrumentation system. It is also essential to ensure long-term reliability without frequent breakdowns. For example, any form of analysis instrument, sophisticated or otherwise, is only as effective as its sampling system.

Digital technology and today's communication capabilities have forced changes in office organization structures and office management. Similar changes will start happening in construction management. Traditional management structures, with managers using methods and styles based on their previous experiences at other sites, may be found to be inadequate. In addition, installation, calibration and testing of today's instruments call for different skills and experiences. Experience in installation and testing are not the only skills needed from a site Instrument Installation Manager, whose job calls for man-power planning, recruitment, site safety, attendance in meetings, progress reporting, material management, cost control, change management, database management, delay management, E.O.T. (Extension-Of-Time for reaching completion), managing government regulations / forms and a host of other issues.

Against this background, we come up with a new set of qualifications needed for a site Instrument Installation Manager.

Addressing the above needs, this Handbook provides information on all aspects of site management together with details on the traditional installation, calibration and testing of instruments.

- 1) Section 1 provides a short Introduction and a roadmap to the Handbook.
- 2) Section 2 on "Construction Management" summarises a list of actions to be performed by the site Instrument Installation Manager. It deals with site administration and control, documentation management and cost control. This section also covers sub-contractor management, breach of contract, progress payments, delay claims, extension of time, documentation, site safety reports, and project completion and closeout. Site incidence reporting system is introduced.
- 3) Section 3 discusses details of field installation and provides recommendations on installation of pipes, cables, junction boxes, termination, fibre optic networking, grounding, earthing plans, etc. Impulse line connections to different type of services are discussed. Process analyser installations for different duties are given. Details on the calibration of various types of instruments, including HART & Smart instruments are given.

Control room I&C systems and building management systems and installations are discussed. Also provided are details on special packs such as – Compressor I&C packages, HVAC systems, Tank automation, Product Terminal systems, Meter-proving and custody transfer and VSD. QA/QC plans are also discussed.

Included in this section are Loop check procedures (procedures to be followed for analogue and digital signals). Site Acceptance Tests (SAT), pre-commissioning checks, etc. are described. Guidelines for basic loop tuning are given. Sign-off and handover procedures are discussed.

With change management, even after a detailed design effort, some oversight during design stages may lead to the requirement of additional instrumentation. It is not uncommon that during commissioning stages, such additional requirements may be highlighted. While some of the changes could be minor, others may not be so. All changes require time and personnel to handle them. Changes may also lead to further purchasing. In addition, while changes are being

executed, associated documentation will need to be upgraded. These lead to additional costs. This Handbook provides procedures for handling change management and associated costing.

- 4) Section 4 discusses Bulk Construction Materials. From time to time, some items like sunshades, stanchions and nameplates may need to be manufactured or procured for site use. Drawings and specifications for some common items is given here. Specifications for cables are also given.
- 5) Section 5 is an Engineering Information compilation useful for I&C construction (really an Appendix of Information) that provides a list of standards generally referenced. Also, it has useful engineering standards for thermocouples. An RTD table is provided. Flange and Gaskets standards are provided. Information on Hazardous area classification and Safety Integrity Limits (SIL) are also provided.
- 6) Section 6 is a Compendium of Forms.

Site work essentially moves by approvals, witnesses and authorisations. Entries require authorisation, work on site will need to be permitted, test procedures will need to be authorised, and test results will need to be approved. So, the importance of documentation cannot be over-emphasised. This book has been written by engineers with extensive field experience in installation and commissioning. As such, recommendations made, procedures suggested and tabular forms provided are based on actual practical field experience, rarely, if at all, seen in contemporary literature.

After a satisfactory completion of testing, the plant is ready for commissioning. And commissioning is bringing on “stream” a process plant for production. This job is handled by the commissioning team who have a knowledge of all process operations. Though the job of Instrument Installation is complete by this stage, a small team from the installation group is usually retained to assist the commissioning team.

K. Srinivasan

Abbreviations

Technical Abbreviations

Abbreviations	Description
AWG	American Wire Gauge
BPCS	Basic Process Control System
BOM	Bill Of Material
C&E	Cause and Effect Diagram
CEM	Continuous Environmental Monitoring
DCS	Distributed Control System
EPA	Environmental Pollution Act
ESD	Emergency Shutdown System
FAT	Factory Acceptance Test
FBD	Functional Block Diagram
HMI /MMI	Human Machine Interface / Man Machine Interface
HMT /HMTD	Heat & Mass Transfer (D – Department)
HW or H/W	Hardware
ICS	Integrated Control System
I/O	Input / Output
MC	Mechanical Completion
MTO	Material Take Off
PAS	Process Automation System
PC	Personal Computer
PLC	Programmable Logic Controller
SAT	Site Acceptance Test
SIS	Safety Instrumented System
SIT	Site Integration Test
SW or S/W	Software
QMI	Quality Monitoring Instruments / Quality Measurement Instrumentation