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colour inside

Guide for computer-based control for hydroelectric power plant automation

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CONTENTS

Guide for Computer-Based Control for Hydroelectric Power Plant Automation

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Abstract: The application, design concepts and implementation of computer-based control systems for hydroelectric power plant automation is addressed. Functional capabilities, performance requirements, interface requirements, tradeoffs, and hardware considerations and operator training are discussed, including typical application examples.
Keywords: 62270, applications, computer-based control systems, functional capabilities, hardware considerations, hydroelectric power plant automation, hydroelectric power station, IEEE 1249™, interface requirements, operator training, performance requirements, recommendations

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IEEE INTRODUCTION

This introduction is not part of IEEE Std 1249, Guide for Computer-Based Control for Hydroelectric Power Plant Automation

This document is a guide for the power industry for the automation of hydroelectric power plants using computer-based controls. The document was prepared by the Working Group on Computer-Based Control for Hydroelectric Power Plant Automation of the Hydroelectric Power Subcommittee of the Energy Development and Power Generation Committee of the IEEE Power and Energy Society (PES).

Automation of hydroelectric generating plants has been a proven technology for many years. However due to the relative simplicity of the control logic for hydroelectric power plants, the application of computer-based control on hydro power plants lagged, as compared to applications on thermal generating stations. With the advent of economic, computer-based control systems in the 1980s, installations of these systems in hydroelectric power plants has proceeded at a rapid pace worldwide, for both new installations and rehabilitation of control systems in existing plants. Since preparation of the original guide, significant changes in technology and application criteria have occurred. The purpose of this revision is to address these changes and to harmonize this guide with a companion document, IEEE Std 1010™, IEEE Guide for the Control of Hydroelectric Power Plants.

The guide is directed to the practicing engineer who has some familiarity with computer-based control systems. It contains references and definitions for use with the guide. Clauses addressing functional capabilities, software, security, system integration, system architecture, data bases, user and plant interfaces, system performance, back-up capabilities, support systems, testing and acceptance criteria and system management are contained in the guide.

GUIDE FOR COMPUTER-BASED CONTROL FOR HYDROELECTRIC POWER PLANT AUTOMATION

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This second edition cancels and replaces the first edition published in 2004. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) update of system architecture aspects, with different process control system configurations;

b) update of communications, user and plant interfaces aspects;

c) suppression of case studies, because of the quickness of evolution of the technology;

d) complete review of the bibliography, making mention of many IEC and IEEE standards as new references;

e) addition of a new informative Annex B on legacy control systems.

This publication is published as an IEC/IEEE Dual Logo standard.

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FDIS	Report on voting
4/284/FDIS	4/287/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

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GUIDE FOR COMPUTER-BASED CONTROL FOR HYDROELECTRIC POWER PLANT AUTOMATION

1 Overview

The automation of control and data logging functions has relieved the plant operator of these tasks, allowing the operator more time to concentrate on other duties. In many cases, the plant's operating costs can be significantly reduced by automation (primarily via staff reduction) while still maintaining or increasing the plant reliability.

Automatic control systems for hydroelectric units based on electromechanical relay logic have been in general use for many years and, in fact, were considered standard practice for the industry. Within the past few decades, microprocessor-based controllers have been developed that are suitable for operation in a power plant environment. These computer-based systems have been applied for data logging, alarm monitoring, and unit and plant control. Advantages of computer-based control include use of graphical user interfaces, the incorporation of sequence of events and trending and automatic archiving and reporting into the control system and the incorporation of artificial intelligence and expert system capabilities.

1.1 Scope

This guide addresses the application, design concepts, and implementation of computer-based control systems for hydroelectric plant automation. It addresses functional capabilities, performance requirements, interface requirements, hardware considerations, and operator training. It includes recommendations for system testing and acceptance. The electrical protective system (generator and step-up transformer) is beyond the scope of this guide.

1.2 Purpose

This guide is directed to the practicing engineer who has some familiarity with computer-based control systems and who is designing or implementing hydroelectric unit or plant control systems, either in a new project or as a retrofit to an existing one. Although this guide is aimed primarily towards large hydroelectric power plants, many of the concepts are applicable for small hydroelectric power plants (i.e. unit size 5 MVA or smaller). Further details on small hydroelectric power plant control concepts can be found in IEEE Std 1020™ [B46].[1, 2] Typical hydroelectric system control logic upon on which this guide is based can be found in companion guide IEEE Std 1010™ [B45] or IEC 61362 [B22].[3]

2 Terms and definitions

The terms and definitions provided here reflect common industry usage as related to automation of hydroelectric power plants, and may not in all instances be in accordance with IEEE Standards

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