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Cause and effect matrix

因果矩阵

(English Translation)

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Foreword

This document is in accordance with the provisions of GB/T 1.1-2020 "Guidelines for standardization work Part 1: Structure and drafting rules for standardization documents" Drafting is required.

This document is equivalent to IEC 62881:2018 "Cause and Effect Matrix".

Introduction

Efficient engineering and reliable operation of automated plants depend to a large extent on the clear and unambiguous description of regulatory controls and logical interlocking.

For regulatory control, this description is usually provided by a process flow diagram and P Flowchart and P and plant operators often consider a large number of decentralized logic relationships or function diagrams to be too complex (especially when using fail-safe principles), and Too much detailed information is difficult to handle.

This document describes a simple and widely accepted method for documenting logical interlocks in process and manufacturing industries-"cause and effect" Matrix " (C the functions required by the platform control process can enable people to correctly understand the required relationships from the process perspective without having to understand the platform's Specific detailed knowledge of PLC/DCS program logic.

The cause-effect matrix is essential for describing the functions and consequences of a plant throughout its life cycle (e.g. engineering, commissioning, start-up and operation).

It is very useful for interfacing with plant-related processes and is particularly helpful in meeting some legal or insurance requirements (such as government regulations, fire and Gas Regulations, Machinery Directives such as IEC 62061). Cause and effect matrices are also found in other types of documents, such as fire protection data the table is updated, and the principles of cause-effect determination and the logical relationships defined in the intersection still apply.

In addition, the cause-effect matrix is used to illustrate the consequences of embedded diagnostic functions (e.g. activation of a trip function if a wire break is detected), Functions of installed backup systems (e.g. failure to start a pump and switchover to a backup pump) or operator actions required for process reset after a partial shutdown or safety-related functions.

The information provided by the cause-effect matrix is structured according to individual requirements, such as the information required for process interlocking in electrical switchgear.

The cause-effect matrix describes the relationship between the causal conditions (causes) and the expected consequences or actions (outcomes). In this paper, the causes are represented by the sensors.

The result is an action automatically performed by an actuator (mainly a valve and a motor) or by a shift operator.

Actions that are manually completed by an operator, or alarms and information provided to an operator. Both are linked through a matrix containing relationships.

The basic relationships are documented in an appropriate and structured form, enabling them to be used in process design, electrical engineering, I in the next step of detailed engineering, the cause-effect matrix is developed with more detailed and platform-specific (e.g. fail-safe the starting point of PLC logic.

During plant operation, the cause-effect matrix can be used as a functional description, for example for the training of plant operating personnel.

Causal matrices are not usually used to specify functional sequences (e.g. batch operation modes) or functional details that other methods might provide, e.g.

Logical description in IEC 61131-3.

Cause and Effect Matrix

1 Scope

This document describes the setup and implementation of a cause-effect matrix for consistent use in engineering practice.

The cause-effect matrix is a format used to support the consistency of information exchange between different engineering disciplines in projects or maintenance activities.

Minimum requirements, which come from existing design documents, such as P this document does not cover how to translate the relationships defined in the cause-effect matrix into the functions or source code of a PLC/DCS application, nor does it cover Implementing complex and/or sequential logic on dedicated automation platforms that require execution/compliance with additional regulations.

The cause-effect matrix can be used to record the failure reactions of plant equipment and can therefore be used as a reference point for necessary safety verification.

The cause-and-effect matrix defined in this document has a different scope from the fishbone diagram or Ishikawa diagram, which are generally referred to as cause-and-effect diagrams.

2 Normative references

The contents of the following documents constitute the essential clauses of this document through normative references in this text. Among them, the referenced documents with dates are.

Only the version corresponding to that date applies to this document; for un-dated referenced documents, the latest version (including all amendments) applies to this document.

ISO 7200 Technical product documentation Title block and data fields in document headers

IEC 62708 Document types for electrical and instrumentation engineering in process industries Note. GB/T 5094.1-2018 Structural principles and reference codes for industrial systems, devices and equipment and industrial products Part 1: Basic rules (IEC 81346-1:2009, IDT) IEC 81346-1 Structural principles and reference codes for industrial systems, devices and equipment and industrial products Part 1: Basic rules Note. GB/T 40214-2021 Document types for electrical and instrumentation engineering in process industries (IEC 62708:2015, IDT)

3.1 Terms and Definitions

The following terms and definitions apply to this document.

The URLs for terminology databases used for standardization maintained by ISO and IEC are as follows.

3.1.1

A matrix that relates causes (3.1.2) and their effects (3.1.3) using corresponding relations (3.1.4).

NOTE: ISO 10418:2003 Chapter 5 and C.1 give a similar definition for offshore production platforms in the oil and gas industry.