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TECHNICAL REPORT

ISA-TR18.2.1-2018

Alarm Philosophy

Approved 26 February 2018

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Preface

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This technical report has been prepared as part of the service of ISA, the International Society of Automation, toward a goal of helping in the understanding and use of the ANSI/ISA-18.2-2016, *Management of Alarm Systems for the Process Industries*. To be of real value, this document should not be static but should be subject to periodic review. Toward this end, the Society welcomes all comments and criticisms and asks that they be addressed to the Secretary, Standards and Practices Board; ISA, 67 T.W. Alexander Drive; P.O. Box 12277; Research Triangle Park, NC 277099; Telephone (919) 549-8411; Fax (919) 549-8288; E-mail: standards@isa.org.

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Foreword

In June of 2009, ANSI/ISA-18.2-2009, *Management of Alarm Systems for the Process Industries*, commonly referred to as ISA-18.2, was issued. In that same year the ISA18 committee established six working groups to develop a series of technical reports with guidance on how to implement the practices outlined in ISA-18.2. In 2012, a seventh working group was also added. In 2016, a revision of ISA-18.2 was published as ANSI/ISA-18.2-2016.

- TR1 – Alarm Philosophy – provides guidance on the alarm philosophy. TR1 is limited to the scope of ISA-18.2 Clause 6. The alarm philosophy provides guidance for successful management of the alarm system. It covers the definitions, principles, and activities by providing overall guidance on methods for alarm identification, rationalization, classification, prioritization, monitoring, management of change, and audit.
- TR2 – Alarm Identification and Rationalization – provides guidance on alarm identification and rationalization. TR2 is limited to the scope of ISA-18.2 Clauses 8 and 9. Identification and rationalization covers the processes to determine the possible need for an alarm or a change to an alarm, systematically compare alarms to the alarm philosophy, and determine the alarm setpoint, consequence, operator action, priority, and class. Activities include, but are not limited to, identification, justification, prioritization, classification, and documentation.
- TR3 – Basic Alarm Design – provides guidance on basic alarm design. TR3 focuses on the scope of ISA-18.2 Clause 10 and may include other clauses as needed (e.g., operations and maintenance). Basic alarm design covers the selection of alarm attributes (e.g., types, deadbands, and delay times) and may be specific to each control system.
- TR4 – Enhanced and Advanced Alarm Methods – provides guidance on advanced and enhanced alarm methods. TR4 focuses on the scope of ISA-18.2 Clause 12. Enhanced alarm design covers guidance on additional logic, programming, or modeling used to modify alarm behavior. These methods may include dynamic alarming, state-based alarming, adaptive alarms, logic-based alarming, predictive alarming, as well as most of the designed suppression methods.
- TR5 – Alarm Monitoring, Assessment, and Audit – provides guidance on monitoring, assessment, and audit of alarms. TR5 focuses on the scope of ISA-18.2 Clauses 16 and 18. Monitoring, assessment, and audit cover the continuous monitoring, periodic performance assessment, and recurring audit of the alarm system.
- TR6 – Alarm Systems for Batch and Discrete Processes – provides guidance on the application of ISA-18.2 alarm life cycle activities to batch and discrete processes, expanding on multiple clauses of ISA-18.2.
- TR7 – Alarm Management when Utilizing Packaged Systems – provides guidance on the application of ISA-18.2 to plants utilizing packaged systems, expanding on multiple clauses of ISA-18.2.

Each technical report is written to be a standalone document. In an effort to minimize repetition, the technical reports have cross references.

The guidance as presented in this document is general in nature and should be applied to each system as appropriate by personnel knowledgeable in the manufacturing process and control systems to which it is being applied.

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1 Scope

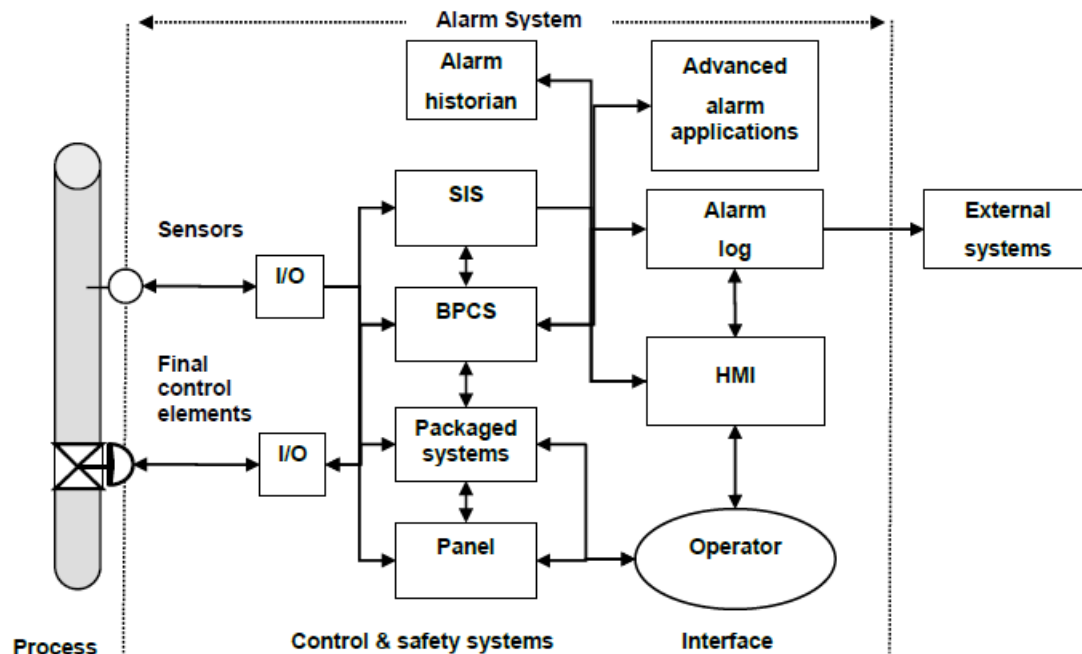
1.1 General applicability

This technical report was written in support of the standard ANSI/ISA-18.2-2016, *Management of Alarm Systems for the Process Industries* (March 2016), hereinafter referred to as ISA-18.2. The goal of this technical report is to provide guidance on how to implement the recommendations and the requirements described in the Alarm Philosophy clause (Clause 6) of the standard. It outlines potential approaches and provides specific examples that can be included in an alarm philosophy in order to properly manage the identification, rationalization, detailed design, implementation, operations, maintenance, monitoring and assessment, management of change, and audit life cycle work processes.

Similar to ISA-18.2, this document is intended for those individuals and organizations that:

- a) manufacture or implement embedded alarm systems;
- b) manufacture or implement third-party alarm system software;
- c) design or install alarm systems;
- d) operate and/or maintain alarm systems;
- e) audit or assess alarm system performance.

This technical report includes alarm system dataflow from ISA-18.2 for completeness in Figure 1.



NOTE Other packaged systems (i.e., fire and gas systems) can be included in the control system.

Figure 1 – Alarm system dataflow

This technical report includes guidance for the topics listed in the table in the Alarm Philosophy clause of ISA-18.2. This table, repeated here for completeness in Figure 2 – Required and recommended alarm philosophy content, defines the topics that should be addressed in an alarm philosophy document.

ALARM PHILOSOPHY CONTENTS	REQUIRED	RECOMMENDED	TR SUBCLAUSE
Purpose of alarm system	Yes		4.1
Definitions	Yes		3
References		Yes	2
Roles and responsibilities for alarm management	Yes		4.6
Alarm design principles	Yes		7
Alarm setpoint determination		Yes	6.4
Prioritization method	Yes		6.2
Alarm class definition	Yes		4.5.6.3
Highly managed alarms (or site equivalent)		Yes	6.3.2
Rationalization	Yes		6
Alarm documentation	Yes		4.8
Alarm design guidance	Yes		7.1
Specific alarm design considerations		Yes	7
HMI design principles	Yes		7.2
Approved enhanced and advanced alarming techniques		Yes	7.3
Implementation guidance	Yes		8.0
Alarm response procedure	Yes		7.1.16
Training	Yes		8.3
Alarm shelving		Yes	8.5
Alarm system maintenance	Yes		8.6
Testing of alarms	Yes		8.4
Alarm system performance monitoring	Yes		10
Management of change	Yes		9.0
Alarm management audit	Yes		11
Related site procedures		Yes	4.7

Figure 2 – Required and recommended alarm philosophy content

This technical report (TR) is not intended to be used as an organization's alarm philosophy. Instead it provides details on the requirements. The objective of this TR is to be the starting point for the development of an alarm philosophy document.

NOTE The contents of this technical report are informative. ANSI/ISA-18.2-2016 contains the mandatory (normative) requirements.

2 Normative references

2.1 References

The reference section of alarm philosophies should include those references that are relevant to it, such as ISA-18.2.

The following referenced documents are useful for the application of this TR. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ANSI/ISA-18.2-2016, *Management of Alarm Systems for the Process Industries* (March 2016), also known as ISA-18.2

ISA-84.00.01-2004 Part 1 (IEC 61511 Mod), *Functional Safety: Safety Instrumented Systems for the Process Industry Sector – Part 1: Framework, Definitions, System, Hardware and Software Requirements*

3 Terms and definitions

3.1 Terms and definitions reference

For the purposes of this technical report, all terms defined in ISA-18.2 Subclause 3.1 are used with their identical meaning. For ease of reference, they are repeated in this clause.

3.2 Terms and definitions

3.2.1

absolute alarm

alarm generated when the setpoint is exceeded (e.g., high-high, low, low-low)

3.2.2

acknowledge

operator action that confirms recognition of an alarm

3.2.3

advanced alarming

collection of techniques that can help manage annunciations during specific situations

EXAMPLE: state-based alarming

3.2.4

alarm

audible and/or visible means of indicating to the operator an equipment malfunction, process deviation, or abnormal condition requiring a response

3.2.5

alarm attribute

setting for an alarm within the process control system

EXAMPLE: alarm priority

3.2.6**alarm class**

group of alarms with a common set of alarm management requirements (e.g., testing, training, monitoring, and auditing requirements)

3.2.7**alarm deadband**

change in signal from the alarm setpoint necessary for the alarm to return to normal

3.2.8**alarm flood**

condition during which the alarm rate is greater than the operator can effectively manage (e.g., more than 10 alarms per 10 minutes)

3.2.9**alarm log**

short-term repository for alarm records

3.2.10**alarm management****alarm system management**

collection of processes and practices for determining, documenting, designing, operating, monitoring, and maintaining alarm systems

3.2.11**alarm message**

text string displayed with the alarm indication that provides additional information to the operator (e.g., operator action)

3.2.12**alarm off-delay****debounce**

time an alarm remains active after the process measurement has returned within the alarm setpoint

3.2.13**alarm on-delay**

time before an alarm becomes active after the process measurement has exceeded the alarm setpoint

3.2.14**alarm philosophy**

document that establishes the basic definitions, principles, and processes to design, implement, and maintain an alarm system

3.2.15**alarm priority**

relative importance assigned to an alarm within the alarm system to indicate the urgency of response (e.g., seriousness of consequences and allowable response time)

3.2.16

alarm setpoint

alarm limit

alarm trip point

threshold value of a process variable or discrete state that is used to determine if the alarm is active

3.2.17

alarm summary

alarm list

display that lists annunciated alarms with selected information (e.g., date, time, priority, and alarm type)

Note 1 to entry: Return to normal indications can also appear on the alarm summary.

3.2.18

alarm system

collection of hardware and software that detects an alarm state, communicates the indication of that state to the operator, and records changes in the alarm state

Note 1 to entry: The operator is included in the alarm system. See Figure 1.

3.2.19

alarm type

alarm attribute that gives a distinction of the alarm condition

EXAMPLE: low process variable alarm, high process variable alarm, or discrepancy alarm

3.2.20

alert

audible and/or visible means of indicating to the operator an equipment or process condition that requires awareness and that does not meet the criteria for an alarm

3.2.21

allowable response time

maximum time between the annunciation of the alarm and the time when the operator must take corrective action to avoid the consequence

3.2.22

annunciator

device or group of devices that call attention to changes in process conditions

3.2.23

bad-measurement alarm

alarm generated when the signal for a process measurement is outside the expected range (e.g., 3.8 mA for a 4–20 mA signal)

3.2.24

chattering alarm

alarm that repeatedly transitions between active state and not active state in a short period of time

3.2.25**classification**

process of separating alarms into classes based on common requirements (e.g., testing, training, monitoring, and auditing requirements)

3.2.26**clear**

alternate description of the state of an alarm that has transitioned to the normal state

3.2.27**console**

interface for an operator to monitor and/or control the process, which may include multiple displays or annunciators and defines the boundaries of the operator's span of control

3.2.28**control system**

system that responds to input signals from the equipment under control and/or from an operator and generates output signals that cause the equipment under control to operate in the desired manner

NOTE 1 to entry: Control system may include both basic process control systems (BPCS) and safety instrumented systems (SIS).

3.2.29**first-out alarm****first-up alarm**

alarm determined (i.e., by first-out logic) to be the first, in a multiple-alarm scenario

3.2.30**highly managed alarm (HMA)**

alarm belonging to a class with additional requirements (e.g., regulatory requirements) above general alarms

EXAMPLE: safety alarm

3.2.31**implementation**

transition stage between design and operation during which the alarm is put into service

Note 1 to entry: Implementation includes activities such as commissioning and training.

3.2.32**instrument diagnostic alarm**

alarm to indicate a field device or signal fault

EXAMPLE: out-of-range alarm

3.2.33**latching alarm**

alarm that remains in the alarm state after the process condition has returned to normal and requires an operator reset before the alarm returns to normal

3.2.34

master alarm database

authorized list of rationalized alarms and associated attributes

Note 1 to entry: The list can be in many forms and not only in the form of a database.

3.2.35

nuisance alarm

alarm that annunciates excessively, unnecessarily, or does not return to normal after the operator action

EXAMPLE: chattering alarm, fleeting alarm, or stale alarm

3.2.36

operator controller

person who monitors and makes changes to the process

3.2.37

out-of-service

state of an alarm during which the alarm indication is indefinitely suppressed, typically manually, for reasons such as maintenance

3.2.38

pre-trip alarm

alarm that indicates approach to demand on a safety function

3.2.39

prioritization

process of assigning a level of operational importance to an alarm

3.2.40

rationalization

process to review potential alarms using the principles of the alarm philosophy, to select alarms for design, and to document the rationale for each alarm

3.2.41

recipe-driven alarm

alarm with setpoints that depend on the recipe that is currently being executed

3.2.42

remote alarm

alarm from a remotely operated facility or directed to a remote interface

3.2.43

safety alarm

safety-related alarm

alarm that is classified as critical to process safety for the protection of human life or the environment

3.2.44**shelve**

temporarily suppress an alarm, initiated by the operator, with engineering controls (e.g., time-limited) that unsuppress the alarm

3.2.45**stale alarm**

alarm that remains annunciated for an extended period of time (e.g., 24 hours)

3.2.46**state-based alarm****mode-based alarms**

alarm that has attributes modified or is suppressed based on operating states or process conditions

3.2.47**suppress**

to prevent the annunciation of the alarm to the operator when the alarm is active

EXAMPLE: shelving, suppressed by design, removed from service

3.2.48**system diagnostic alarm**

alarm generated by the control system to indicate a fault within the system hardware, software or components

EXAMPLE: communication error

3.2.49**tag****point**

unique identifier assigned to a process measurement, calculation, or device within the control system

3.2.50**unacknowledged**

alarm state in which the operator has not yet confirmed recognition of an alarm indication

4 Introduction

4.1 General

As ISA-18.2 indicates, an alarm philosophy documents the objectives of the alarm system and the processes to meet those objectives. The philosophy starts with the basic definitions and extends them to operational definitions. Alarm priorities, classes, performance metrics, performance limits, and reporting requirements are determined based on the objectives, definitions, and principles of the alarm system. The presentation of alarm indications in the human-machine interface (HMI), including the use of priorities, is also set in the alarm philosophy, which should be consistent with the overall HMI design. The philosophy specifies the processes used for each of the life-cycle stages, such as the triggers for the management of change process and the specific requirements to document the change. All of these topics are covered in this technical report.