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Security for Industrial Automation and Control Systems Part 1: Terminology, Concepts, and Models

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Foreword

This is the first in a series of ISA standards that addresses the subject of security for industrial automation and control systems. The focus is on the electronic security of these systems, commonly referred to as cyber security. This Part 1 standard describes the basic concepts and models related to cyber security.

This standard is structured to follow ISO/IEC directives part 2 for standards development as closely as possible. An introduction before the first numbered clause describes the range of coverage of the entire series of standards. It defines industrial automation and control systems and provides various criteria to determine whether a particular item is included within the scope of the standards.

Clause 1 defines the scope of this standard.

Clause 2 lists normative references that are indispensable for the application of this document.

Clause 3 is a list of terms and definitions used in this standard. Most are drawn from established references, but some are derived for the purpose of this standard.

Clause 4 provides an overview of the current situation with respect to the security of industrial automation and control systems, including trends and their potential impact.

Clause 5 contains a broad description of the subject and the basic concepts that establish the scope of industrial automation and control systems security. Many of these concepts are well established within the security discipline, but their applicability to industrial control systems may not have been clearly described. In some cases the nature of industrial control systems leads to an interpretation that may be different from that used for more general information technology applications.

Clause 6 describes a series of models that are used to apply the basic concepts of security for industrial automation and control systems. As with the concepts, several models are based on more generic views, with some aspects adjusted to address specific aspects of industrial control system applications.

The ISA99 Series

Standards in the ISA99 series address the application of these concepts and models in areas such as security program definition and minimum security requirements. The series includes the following standards.

1. **ISA99.00.01 – Part 1: Terminology, Concepts and Models**

   Part 1 (this standard) establishes the context for all of the remaining standards in the series by defining a common set of terminology, concepts and models for electronic security in the industrial automation and control systems environment.

2. **ISA99.00.02 – Part 2: Establishing an Industrial Automation and Control System Security Program**

   Part 2 will describe the elements of a cyber security management system and provide guidance for their application to industrial automation and control systems.

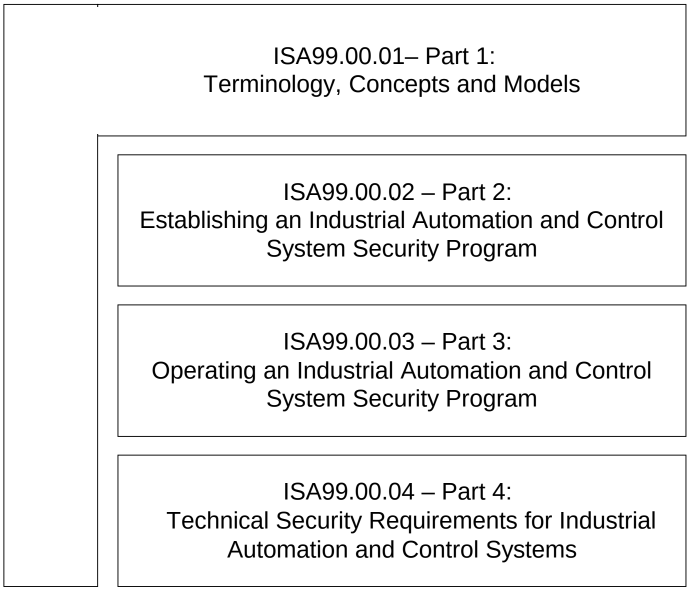
3. **ISA99.00.03 – Part 3: Operating an Industrial Automation and Control System Security Program**

   Part 3 will address how to operate a security program after it is designed and implemented. This includes definition and application of metrics to measure program effectiveness.

4. **ISA99.00.04 – Part 4: Technical Security Requirements for Industrial Automation and Control Systems**

   Part 4 will define the characteristics of industrial automation and control systems that differentiate them from other information technology systems from a security point of view. Based on these characteristics, the standard will establish the security requirements that are unique to this class of systems.

The relationship between the standards in this series is shown in the following diagram:


ISA99.00.01– Part 1:
Terminology, Concepts and Models
ISA99.00.02 – Part 2:
Establishing an Industrial Automation and Control System Security Program
ISA99.00.03 – Part 3:
Operating an Industrial Automation and Control System Security Program
ISA99.00.04 – Part 4:
Technical Security Requirements for Industrial Automation and Control Systems

Relationships of the ISA99 Standards

In addition, the ISA99 committee has produced two technical reports on the subject of electronic security within the industrial automation and control systems environment.

1. **ANSI/ISA-TR99.00.01-2007 – Technologies for Protecting Manufacturing and Control Systems**

   Technical Report 1, updated from the original 2004 version, describes various security technologies in terms of their applicability for use with industrial automation and control systems. This technical report will be updated periodically to reflect changes in technology.

2. **ANSI/ISA-TR99.00.02-2004 – Integrating Electronic Security into the Manufacturing and Control Systems Environment**

   Technical Report 2 describes how electronic security can be integrated into industrial automation and control systems. The contents of this technical report will be superseded with the completion of the Part 2 standard.

Introduction

The subject of this standard is *security for industrial automation and control systems*. In order to address a range of applications (i.e., industry types), each of the terms in this description have been interpreted very broadly.

The term *industrial automation and control systems (IACS)* includes control systems used in manufacturing and processing plants and facilities, building environmental control systems, geographically dispersed operations such as utilities (i.e., electricity, gas, and water), pipelines and petroleum production and distribution facilities, and other industries and applications such as transportation networks, that use automated or remotely controlled or monitored assets.

The term s*ecurity* is considered here to mean the prevention of illegal or unwanted penetration, intentional or unintentional interference with the proper and intended operation, or inappropriate access to confidential information in industrial automation and control systems. *Electronic security,* the particular focus of this standard, includes computers, networks, operating systems, applications and other programmable configurable components of the system.

The audience for this standard includes all users of industrial automation and control systems (including facility operations, maintenance, engineering, and corporate components of user organizations), manufacturers, suppliers, government organizations involved with, or affected by, control system cyber security, control system practitioners, and security practitioners. Because mutual understanding and cooperation between information technology (IT) and operations, engineering, and manufacturing organizations is important for the overall success of any security initiative, this standard is also a reference for those responsible for the integration of industrial automation and control systems and enterprise networks.

Typical questions addressed by this Part 1 standard include:

a) What is the general scope of application for “industrial automation and control systems security”?

b) How can the needs and requirements of a security system be defined using consistent terminology?

c) What are the basic concepts that form the foundation for further analysis of the activities, system attributes, and actions that are important to provide electronically secure control systems?

d) How can the components of an industrial automation and control system be grouped or classified for the purpose of defining and managing security?

e) What are the different electronic security objectives for control system applications?

f) How can these objectives be established and codified?

Each of these questions is addressed in detail in subsequent clauses of this standard.

1 Scope

This standard defines the terminology, concepts and models for industrial automation and control systems (IACS) security. It establishes the basis for the remaining standards in the ISA99 series.

To fully articulate the systems and components the ISA99 standards address, the range of coverage may be defined and understood from several perspectives, including:

a) range of functionality included

b) specific systems and interfaces

c) criteria for selecting included activities

d) criteria for selecting included assets

Each of these is described in the following paragraphs.

Functionality Included

The scope of this standard can be described in terms of the range of functionality within an organization's information and automation systems. This functionality is typically described in terms of one or more models.

This standard is focused primarily on industrial automation and control, as described in a reference model (see clause 6). Business planning and logistics systems are not explicitly addressed within the scope of this standard, although the integrity of data exchanged between business and industrial systems is considered.

Industrial automation and control includes the supervisory control components typically found in process industries. It also includes SCADA (supervisory control and data acquisition) systems that are commonly used by organizations that operate in critical infrastructure industries. These include:

a) electricity transmission and distribution

b) gas and water distribution networks

c) oil and gas production operations

d) gas and liquid transmission pipelines

This is not an exclusive list. SCADA systems may also be found in other critical and non-critical infrastructure industries.