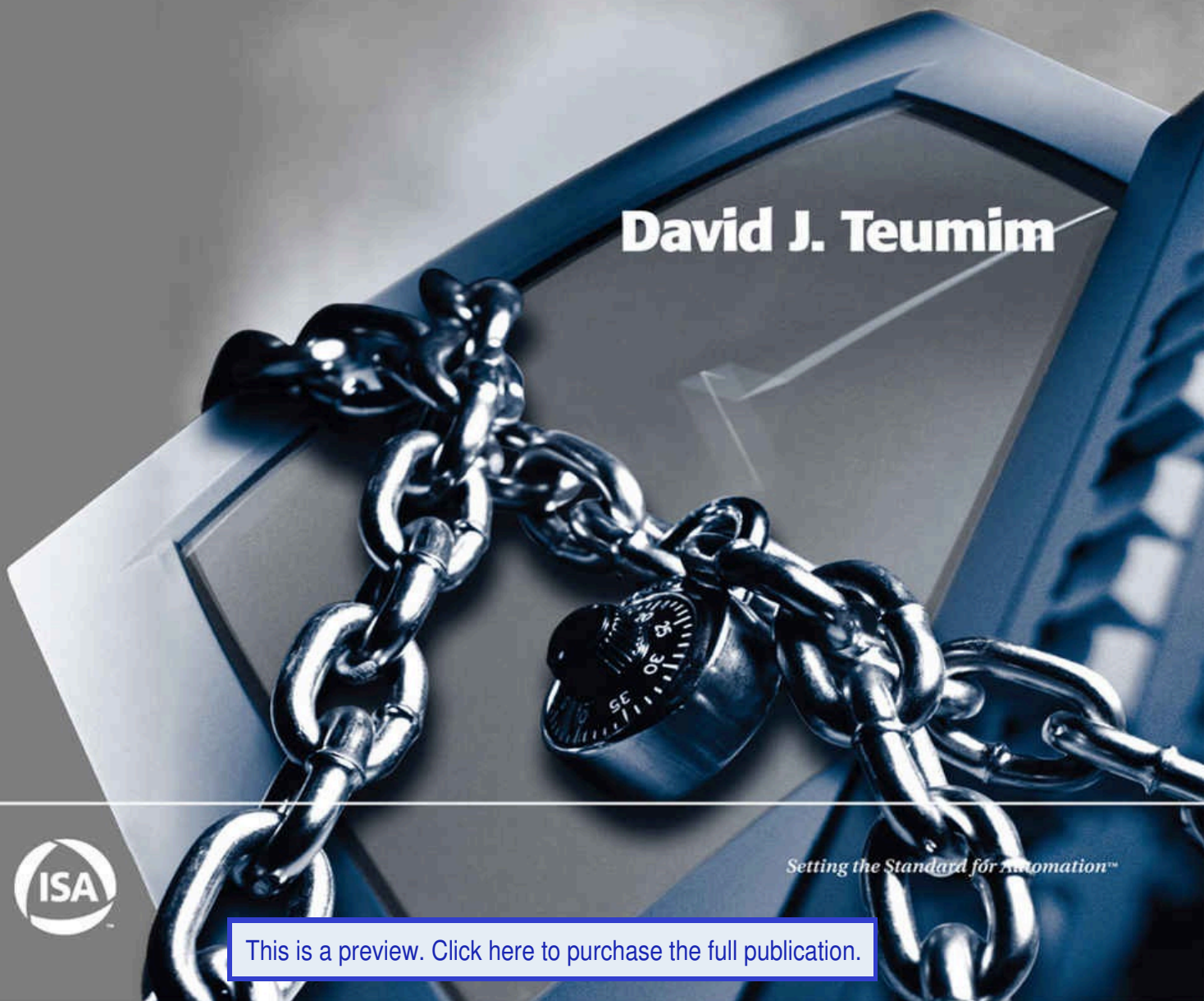
Industrial Network Security

2nd Edition



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ISA

Setting the Standard for Automation™

Industrial Network Security

Second Edition

By David J. Teumim

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John Clem, from Sandia National Laboratories, contributed content on Red Teaming for the new Chapter 9, New Topics in Industrial Network Security.

My good friend from college, Andy Hagel, provided content and review for Chapter 3, COTS and Connectivity.

As with the first edition, Tom Good from DuPont and Dave Mills of Procter & Gamble provided content for Chapter 10.

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About the Author

Preface

So much has happened since the first edition of *Industrial Network Security* was published in 1995. This area has gone "mainstream" in terms of public awareness of the importance of Industrial Networks to our critical infrastructure and the threat to them from hackers, cyberspies, and cyberterrorists.

For instance, the story "America's Growing Risk: Cyber Attack" is featured on the cover of the April 2009 *Popular Mechanics*. And one of the lead stories on the front page of the 8 April 2009 edition of *The Wall Street Journal* was "Electricity Grid in U.S. Penetrated By Spies." The story talked about how foreign powers had mapped the U.S. electrical grid and left behind some rogue programs that could be activated remotely to disrupt the grid.

The "Big R," Regulation, has reared its head in the electric power industry. The NERC-CIP control system cybersecurity standards for electric power generation and transmission entities are now mandated by the U.S. government.

Commercial-off-the-shelf (COTS) hardware and software, as described in Chapter 3, continues its move into Industrial Networks as legacy equipment is phased out. And other sectors, such as passenger rail, described through the writer's eyes in the new Chapter 9, are coming up to speed on Industrial Network Security as COTS become commonplace in that sector control systems.

Consistent with the first edition, an effort has been made to keep this book introductory and easy-to-read. As with the first edition, this edition is intended for the technical layman, manager, or automation engineer without a cybersecurity background. New cyber incidents and updated information have been added to the chapters without changing the original format.

1.0

Industrial Network Security

1.1 What Are Industrial Networks?

To define industrial network security, one first has to define industrial networks. For the purposes of this book, industrial networks are the instrumentation, control, and automation networks that exist within three industrial domains:

- *Chemical Processing* – The industrial networks in this domain are control systems that operate equipment in chemical plants, refineries, and other industries that involve continuous and batch processing, such as food and beverage, pharmaceutical, pulp and paper, and so on. Using terms from ANSI/ISA-84.00.01-2004 Part 1[6], industrial networks include the Basic Process Control System (BPCS) and the Safety Instrumented Systems (SIS) that provide safety backup.

- *Utilities* – These industrial networks serve distribution systems spread out over large geographic areas to provide essential services, such as water, wastewater, electric power, and natural gas, to the public and industry. Utility grids are usually monitored and controlled by Supervisory Control And Data Acquisition (SCADA) systems.

- *Discrete Manufacturing* – Industrial networks that serve plants that fabricate discrete objects ranging from autos to zippers.

The term Industrial Automation and Control Systems (IACS) is used by ISA in its committee name and in the recently issued standards and technical report series from the ISA99 Industrial Automation and Control Systems Security standards and technical committee (also, simply ISA99). This term is closely allied with the term *Industrial Networks*.

The standard, ANSI/ISA-99.00.01-2007-Security for *Industrial Automation and Control Systems, Part 1*[1], defines the term Industrial Automation and Control Systems to include "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." This standard will be referred to as "ISA-99 Part 1" in the book.

The technical report ANSI/ISA-TR99.00.01-2007 *Security Technologies for Industrial Automation and Control Systems* [4] succeeds the 2004 version of the document referenced in the first edition of this book. This report will be referred to as "ISA-99 TR1." Note: At the time of this writing, Part 2 of the ISA-99 standard has just been approved. Part 2 is