



Bundesamt  
für Sicherheit in der  
Informationstechnik

# LARS ICS version 1.0

Light and Right Security ICS - A tool for lightweight introduction to industrial cyber security

User Guide



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# 1 introduction

Industrial control environments (hereinafter referred to as ICS for Industrial Control System) are becoming increasingly interconnected and complex. The security of such systems is thus increasingly becoming more challenging. The managers initially Security are faced with the task of ICS with respect. To analyze in order to identify weaknesses and to identify an existing security level. At this point the provided tool assists the user. LARS (Light and Right Security) was developed to assist the operators of ICS to plan these safer and operate. It includes functionality to capture ICS and the degree of implementation of security measures and to assess the current security level based on a predetermined metric. It can then be generated by the user various reports such. As a listing of all measures that must be implemented to achieve the next best security level. After measures were implemented, the changes may redrawn in the tool and its impact on the security level through the tool to be redetermined. The tool is not meant to replace a holistic Information Security Management System (ISMS), but it is designed to facilitate entry into the hedge ICS and the way to use an ISMS such. B. IT Baseline Protection or IEC 62443 ready. can traced in the tool and its impact on the security level through the tool to be redetermined the changes. The tool is not meant to replace a holistic Information Security Management System (ISMS), but it is designed to facilitate entry into the hedge ICS and the way to use an ISMS such. B. IT Baseline Protection or IEC 62443 ready. can traced in the tool and its impact on the security level through the tool to be redetermined the changes. The tool is not meant to replace a holistic Information Security Management System (ISMS), but it is designed to facilitate entry into the hedge ICS and the way to use an ISMS such. B. IT Baseline Protection or IEC 62443 ready.

This document describes the tool for the security analysis of ICS. The stored in the tool methodology contains the following essential elements:

- An input interface that supports the user in the analysis.
- A metric that is calculated transparent to the user, the criticality of vulnerabilities and the achieved security level for an industrial control system (ICS).
- A reporting functionality can be generated automatically using the standardized reports.
- The illustration on other standards such as IEC 62443 and basic protection catalogs of BSI. The methodology has been greatly

simplified in comparison to conventional Schutzbedarfs- and risk analyzes in order to facilitate entry into cyber security, especially for medium-sized companies, both regarding. Knowledge of security and analysis techniques as well as respect. Personnel expenses. of course supported by LARS methodology does not replace detailed Schutzbedarfs- and risk analysis by experienced professionals. In addition, the developed tool can be used in the present, the first version only for not too complex environments.

In the published version is a prototype. Comments and suggestions are welcome to be sent to [ics-sec@bsi.bund.de](mailto:ics-sec@bsi.bund.de).

It is the complete source code of LARS. The software is licensed under the Apache 2.0 (see Appendix).

## 2 Installation and Start

### 2.1 installation

LARS does not have to be installed over an installation routine. To execute it, Java 7 or later is needed; a corresponding runtime environment for Microsoft Windows (Java SE 8u25) is included with the program so that LARS is also capable of running, without having to install Java. The program consists of a folder containing all the necessary information. Furthermore, the procedure under Windows is described.

The archive can LARS.zip with standard Windows tools (right click-> Extract All ...) or the preferred compression utility to unzip to any location. There arises a directory LARS containing multiple subdirectories and files, among other things Start.bat, lars.db3 (the database are managed in the measures and inputs) and the license for LARS.

### 2.2 start

the program can be started by double-clicking on the to-find in the unzipped folder Start.bat. Provided on the PC a suitable Java Runtime Environment is installed, the file LARS ICS.jar can be used directly for starting. After starting the program, the license and a security warning will be displayed first, before the user and after the project is requested.

#### 2.2.1 User Management

In the "User Management", in the list in the left half of the screen, a user selects and the button *Choose* at the bottom of the window or be selected by double-clicking on the list item. To create a new user, the two text fields with full name (upper panel) and abbreviation (lower text box) to be filled in the right half of the window. By clicking on the button *New* left below the text fields of the new user is created and appears in the list. To delete a user, the corresponding user in the list has to be selected, and then click the button *Clear* to click right below the text boxes. Note: The user administration is only the logging for the emerging on the final report and does not include any security functionality.

#### 2.2.2 Project Management

In the "Project Management" is in the list in the top half of the window a project is selected and the button *load* are selected on the left below the list, or by double-clicking the list item. To create a new project, the text field must be filled in the lower half of the window. By clicking on the button *New project* left below the text field, the new project is created and appears in the list. Projects can not be deleted in the current version of the tool.

### 2.3 Safety notice

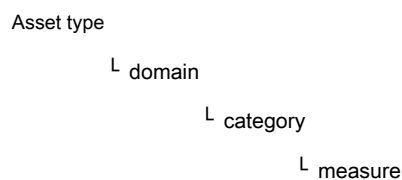
The database of the program and all incidental, partly sensitive data are protected in any way and must be protected accordingly by the user.

### 3 Elements of the tool

The tool supports the user at a Security analysis of an ICS by the following features:

- Structural analysis: All acquired assets are displayed in a tree structure.
- Security measures: After the acquisition of the assets are automatically tightened security measures. The user can specify the degree of implementation of the measures and paste remarks.
- Security Metrics: In the tool, a security metric is permanently stored. Based on the data entered, the tool automatically calculates a security level.
- Reports: Users can create different reports on menu items. The user does not explicitly save their entries or changes. Input

from the user are automatically saved when switching to a new menu item or sub-tree, or exit the program. For example, the entered data is then stored transparently to the user when he switches to a different category domain to another asset types or selects the menu item for generating reports or closes the program. The structure of the asset tree is as follows:



These elements are described in more detail below.

#### 3.1 Asset Types

LARS groups the assets of an ICS according to the following asset types:

- ICS total
- communication links
- Intelligent Electronic Device (IED)
- Remote Terminal Unit (RTU)
- Programmable Logic Controller (PLC), Master Terminal Unit (MTU)
- Human Machine Interface (HMI)
- Data Historian
- Engineering Workstation (EWS)
- router
- Switch
- firewall
- gateway
- Mobile devices

- external devices
- Mobile disk

Currently, only those listed here asset types are available. The asset type ICS in total is used to display asset overarching security measures the user which affect the entire ICS (see section 3.3), so that it can specify the degree of conversion.

## 3.2 domains

The asset types may occur in different domains. The following domains are stored in the tool:

- Field level (Safety)
- Field level (Operation)
- Control level (Safety)
- Control level (Operation)
- control level
- Corporate level
- external network

In the standard IEC 62443, the term "zone" is roughly equivalent to the used herein, the term domain.

## 3.3 Categories

The measures for the various combinations of asset type and domain are grouped into categories. Categories correspond packages of measures.

The asset type ICS are overall as assigned the following overall categories:

- Security management
- Network Design & Management
- Malware Protection
- application security
- remote access
- Log Monitoring & Management
- physical security
- personnel aspects
- Business Continuity Management
- processes
- Audit & Revision
- Selection and procurement of components

These categories apply to the entire ICS. Depending on asset type and domain other categories are defined.



## 3.4 Pre-defined security level

The prescribed measures are divided into four criticality:

- **KO:** Measures of this criticality must be implemented strictly, otherwise the lowest requirements of security are not met.
- **1:** Measures of this criticality level must be implemented in order to realize a basic protection.
- **2:** The amount of these measures is to be implemented (in addition to the measures to step 1) in order to reach a medium security level.
- **3:** These measures are to be implemented (in addition to the measures to level 2) in order to achieve an adequate security level. It is assumed here that one has to protect adequately against a skilled attacker. The following security levels are available:

- **Green:** All measures have been implemented.
- **Yellow:** At least one measure of criticality 3 has not been implemented, or more than 20% of the measures with criticality three were partially implemented.
- **Orange:** At least one measure of criticality 2 has not been implemented, or more than 20% of the measures with criticality 2 were partially implemented.
- **Red:** At least one measure of criticality 1 has not been implemented, or more than 20% of the measures with criticality 1 were partially implemented.
- **Dark Red:** At least one measure of criticality KO has been partially or not implemented.

## 4 operation

### 4.1 Description of the User Interface

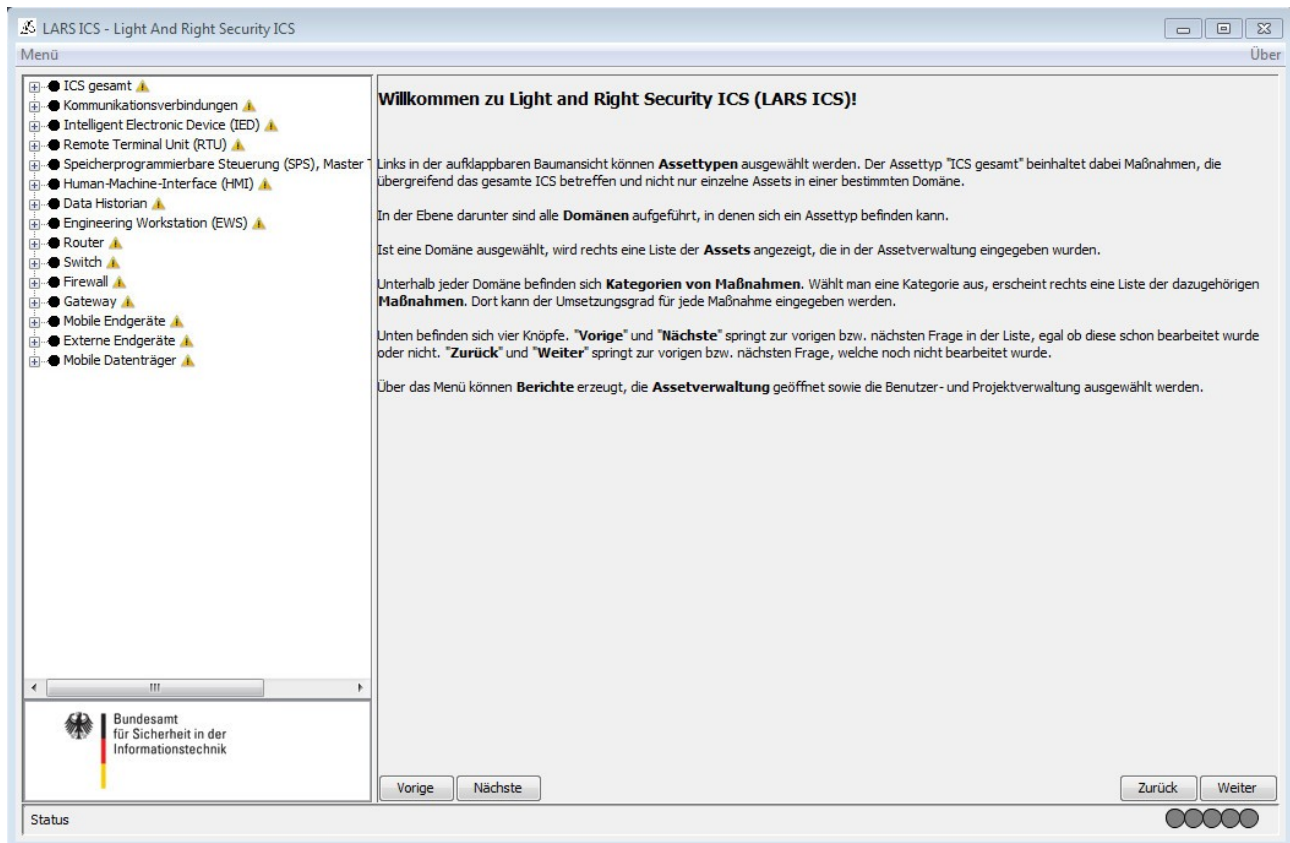


Figure 1: user interface after the program start

Figure 1 shows the main interface of LARS. In the menu bar at the top of the window appears to the left of the button *menu* for the main menu. From the main menu the project, user and asset management can be opened, and generates reports and the program be terminated. In the menu bar on the far right is the button *over* for general information about the program and the licenses used.

In the column at the left edge of the window, the tree view of asset types is. In the right part of the window, different controls are displayed depending on the selection in the tree view. At the bottom of the right pane control buttons for navigation are displayed in the **tree of the left column**. The pair of buttons *Previous / Next* on the left side on by the categories, the pair *Previous Next* on the right side through the categories in which there are still unanswered questions.

In the bottom line of the window, the path of the currently selected in the tree view on the right side element and a traffic signal is displayed on the left side. The traffic light indicates the current security level of the entire control environment. If not a response has been given to all the action, the traffic light is gray. Otherwise, one of the colors that are defined in section 3.4, is displayed.

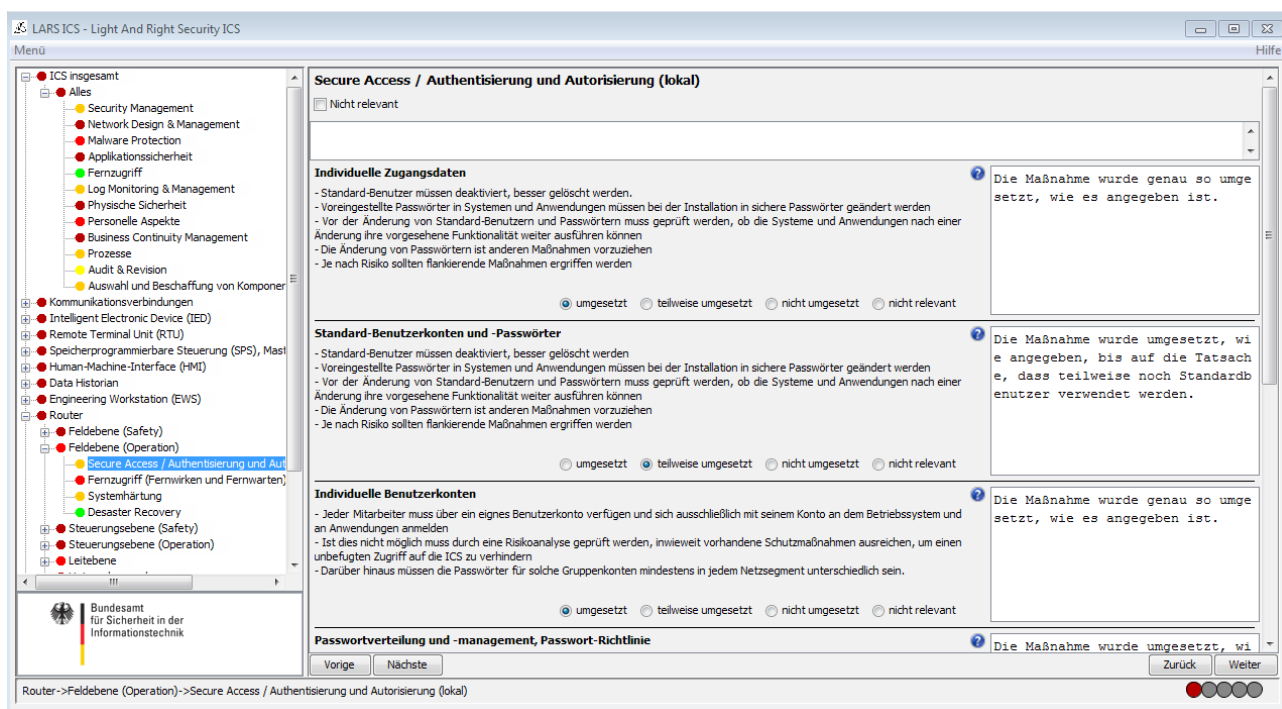


Figure 2: User interface with fully completed measures

By clicking on the plus or minus sign in front of the elements in the tree, or by double-clicking on an element (see Figure 1), the parts of the tree can be opened and closed. After that, the tree is expanded as in Figure 2.

The circle at the left side of each tree element in Figure 2 indicates the current security status of the element. When the circle is black or on the right side of the tree element, a yellow warning triangle appears, has not yet been given to all measures which are in the tree hierarchy below the element responses.

When a domain is selected in the tree view that displays the assigned in the asset management assets in the right pane of the window.

When a category is selected in the tree view, the corresponding measures for replying are in the right area of the window (as shown in Figure 2). the title of the measure, a brief description, input options for the possible answers to the implementation status of the measures, a question mark button to display a long description of the action and a text box for entering a comment is indicated for each measure. After selecting the question mark button of the measure an allocation to the relevant parts of existing standards and recommendations (IEC 62443, IT Baseline Protection [stimulator], ISO 27001 and BSI ICS Security Compendium [COMP]) appears next to a more detailed description additionally.

## 4.2 analysis

The tool is used to support a security analysis of an ICS. The following phases are passed through in the analysis:

- preparation
- acquisition assets
- Detection degree of implementation of security measures
- creating reports

The phases "Acquisition Assets", "detection degree of implementation of security measures" and "Creating reports" are supported by the tool.

#### 4.2.1 the prepare

The methodology requires a preparatory phase, which must go through the user to perform the analysis. The preparation phase includes the following points:

- Team building for security analysis, including role definition.:
  - Decision-makers, business, safety and security experts with their responsibilities
- Scope Definition
  - Description of the ICS to be examined
  - Interfaces of the ICS (for example, remote maintenance)
  - Confines of the ICS to be examined
- Creating a logical network plan of the ICS
  - Detection of the components (assets)
  - Communication links and interfaces
  - Identification of safety-relevant components and IT systems
- Collecting and sifting relevant documentation with respect. Security for
  - the to be examined ICS (information about software and hardware)
  - the associated processes and organization

#### 4.2.2 acquisition Assets

First, the assets should found (in the asset-management menu item *Asset Management*) the corresponding asset types and domains are assigned. In asset management window asset type and domain are selected from left to right first. Following Assets can be entered in the rightmost column and added to the list in the third column from the left. With the

*Clear*- Button under the column associated assets can be deleted. The assets to be acquired should have unique identifier, with which they can be identified in the logical network plan and in the tool.

The assigned assets can be viewed by selecting the domain. in the tree when a domain is selected, this combination of asset type and domain assigned assets are displayed.

#### 4.2.3 detection measures

Following the questions about the offered measures that are bundled in different categories can be answered.

If you select a category, whether it is needed can be specified. A comment field is used to indicate comments and justifications. If a category is not required, which means that all the security measures that have been bundled under this category, as not relevant for the currently

examined ICS are considered. This must be well justified in the comments section. When a category is marked as required, the associated measures need not be answered. If the category is marked as required, are located below the entry field for the comment, the input options for the measures. For each measure can be detected, whether they are "implemented", "partially implemented", "not implemented" or "not relevant". On the right side is a box in which the selection should be commented.

If all measures a category have been processed, is shown in the tree view security level is achieved with the specified action status. When all categories of a domain have been edited, the security level will be displayed for the domain, and if all the domains of an asset types have been processed, the security level will be displayed for the asset types. When all questions have been answered, is displayed through the traffic lights at the bottom right window the overall security level of the ICS.

## 5 Preparation of reports

Reports on the sub-item *Generate reports* are created in the main menu when the necessary information has been entered. For some types of reports do not have to be answered all the questions. For the report types "*Asset type domain Overview*" and "*domain Overview*" Must be answered only the questions for the selected combination of asset type and domain or the selected domain. In case of "*domain Overview*" The issues are probably distributed across multiple asset types. For the report type "*ICS Overview*" Need only the questions below the point" be answered in total "ICS. The report types "*Asset type domain Overview*" and "*domain Overview*" The desired combination of asset type and domain or the desired domain is first requested. In the following dialog location, file name and output format for the report can be specified. The report types "*ICS total*", "*Asset type domain Overview*" and "*domain Overview*" Give out the measures, the security level can be increased by one step with their implementation. For example, if measures of criticality 2 and measures the criticality KO been marked as not implemented, only the actions of the criticality KO output. Report Type "*ICS total*" Outputs an overview of the measures and their implementation status, in the tree hierarchically below the asset type" are ICS total ". The report type "*Prioritized action plan*" Outputs all partially implemented measures and their implementation level. The measures are sorted by criticality.

If a measure in the reports negatively affected the result, even though the user is of the opinion that this measure has no criticality to the extent that claims the program, the user should the answer to this measure "partially implemented" on or " put not relevant "to remove this measure from the calculation of earnings and comment on it accordingly.

## attachment

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Libraries used: sqlite JDBC 3.7.2 of Xerial, Apache (TM) FOP 1.1

To run LARS is a Java SE Runtime Environment Version 7 or later. is included in the program Java SE 8u25 for Windows.

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