

# Customer Requirements Specification

## *(Lastenheft)*

(TINF18C, SWE I Praxisprojekt 2019/2020)

*Project:* **DD2AML Converter**

*Customer:* Rentschler & Ewertz  
Rotebühlplatz 41  
70178 Stuttgart

*Supplier:* by Lara Mack und Nora Baitinger - Team 3  
(Nora Baitinger, Antonia Wermerskirch, Carl Beese, Lara Mack, Bastiane Storz)  
Rotebühlplatz 41  
70178 Stuttgart

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## 1. Goal

For the conversion of device description files for Profinet devices (called PN-GSD) to AML/CAEX V2.15, a tool called GSD2AML exists. GSDML is short for “General Station Description Markup Language” and AML is short for “Automation Markup Language”. Both formats are based on XML.

The goal of this project is to develop a software which can convert other field-bus-specific formats to AML/CAEX V2.15 and AML/CAEX V23.0. Those formats will be IODD and CSP+ and the software should be able to recognize the given format on its own.

The generated AML-DD (“AML-Device-Description”) must contain an AML root file with all the necessary information. The AML-DD with its companion files shall be contained in an AMLX package which can be loaded into the AML editor.

The software shall be implemented as a library and supplied with a command line interface-based reference implementation and should also be usable through a graphical user interface.

The documentation of the software as well as the documentation of the development and project is also part of the goal.

## 2. Product Environment

AutomationML (AML) is short for Automation Markup Language and is used to describe parts of automation plants as objects. These objects can consist of multiple other objects and be part of a larger assembly of objects. That way AML can be used to describe a single screw or an entire robot with the necessary level of detail.

AML makes use of various standards to describe plant components:

1. CAEX (Computer Aided Engineering Exchange) to describe attributes of objects and their relations in a hierarchical structure. This is called a system topology. In this respect, CAEX forms the overarching integration framework of AutomationML. [1]
2. COLLADA to describe the geometry and 3D models of a objects
3. COLLADA also integrates motion planning. It describes the connections and relations of moveable objects, which is called Kinematics.
4. PLCopen XML describes the logic. Internal behaviour and states if objects, action-sequences and I/O connections are implemented via this format.

An IODD (IO Device Description) file describes the sensors and actuator of a plant or component. It also contains information on identity, parameters, process data, communication and more. It is written in XML-format, same as AML, which ensures a conversion. [2]

CSP+ is used to describe components of the CC-Link Family or those which are compatible with them.

The converter will be implemented as a library. It will give the option of a standalone tool, a command line interface and a graphical user interface. The library will work with other software and thus supporting the export of an AML as a string.

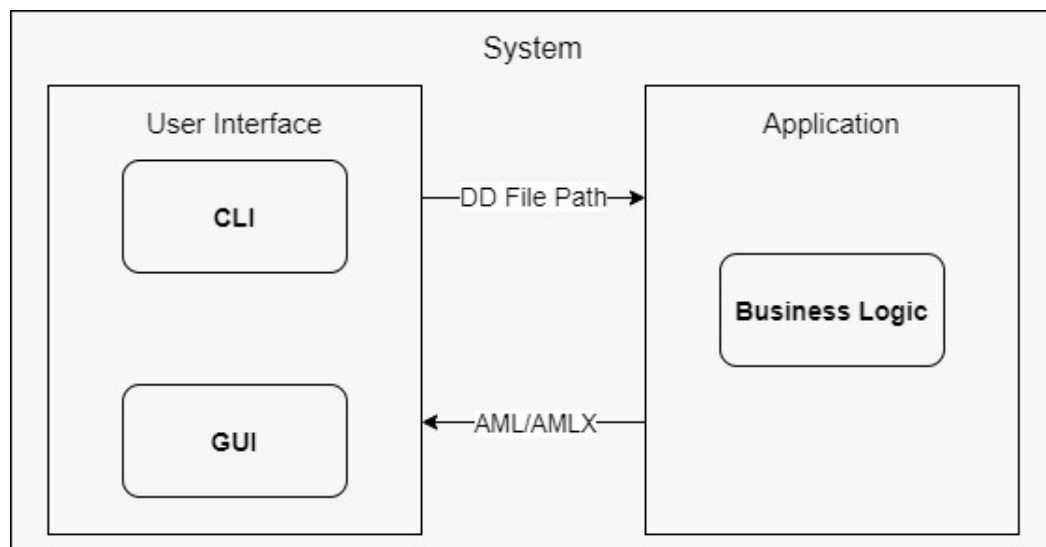


Figure 1 Product Environment

### 3. Product Usage

The main purpose of the software will be to convert the original format into an AMLX file. Thus, from the user's point of view, the main case of application is the conversion into an AMLX file. This can be done using the options mentioned in the business process. To make things easier, the converted file should be stored in the same folder.

The following features must essentially be executable by the software:

1. The DD2AML converter automatically recognizes the input format.
2. Design and implementation of the DD2AML converter as command line tool and library. The tool should be implemented as a portable application without registry entries.
3. Transformation rules for IODD (IO-Link) and CSP + (CC-Link) shall be developed analogous to the previous transformation rules for PN-GSDs (in gsd2aml.xml).

#### 3.1. Business Processes

This section will make a difference between the conversion of the file and the implementation of the library in a different project.

##### 3.1.1. <BP.001>: File conversion

Triggering Event:	User has a DD file and wants to convert it to an AMLX.
Result:	The system converts the DD file and stores the output AMLX file in the same directory.
Involved Roles:	User and DD2AML converter

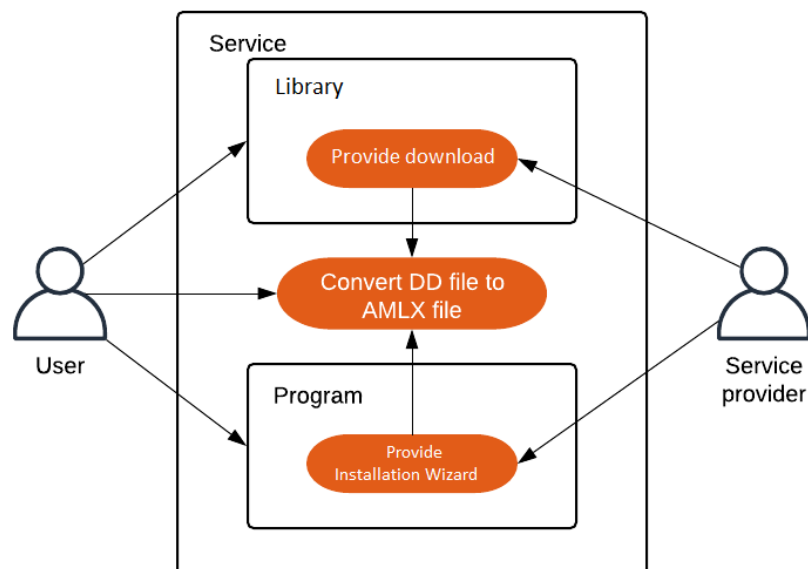


Figure 2 <BP.001> File conversion service

### 3.1.2. <BP.002>: Library

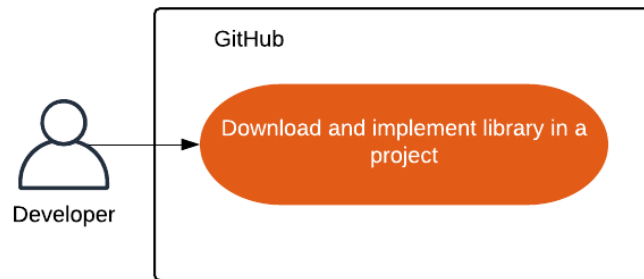


Figure 3 <BP.002> Library usage

Triggering Event:	Developer wants to implement the functionality of the DD2AML converter to his project.
Result:	The developer implements the library to his project.
Involved Roles:	Developer and DD2AML converter

### 3.2. Use Cases

This project will implement the library with a command line interface and optionally with a graphical user interface. Those will be two different, independent programs.

Secondly other developers might want to implement this library to their software. Since a developer might not want to save the file to the file system immediately, he can choose to get a string back from the library which contains the AML.

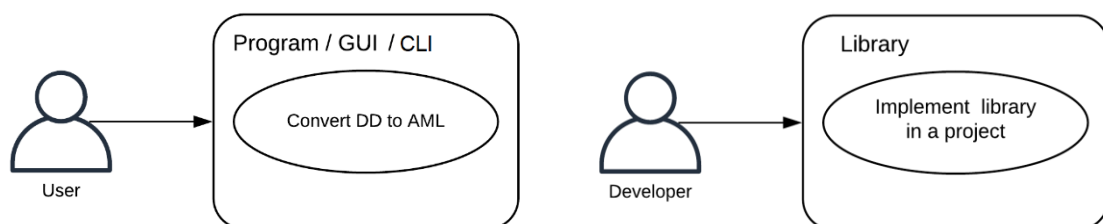


Figure 4 Use Case Overview Diagram

### 3.2.1. <UC.001> File conversion CLI

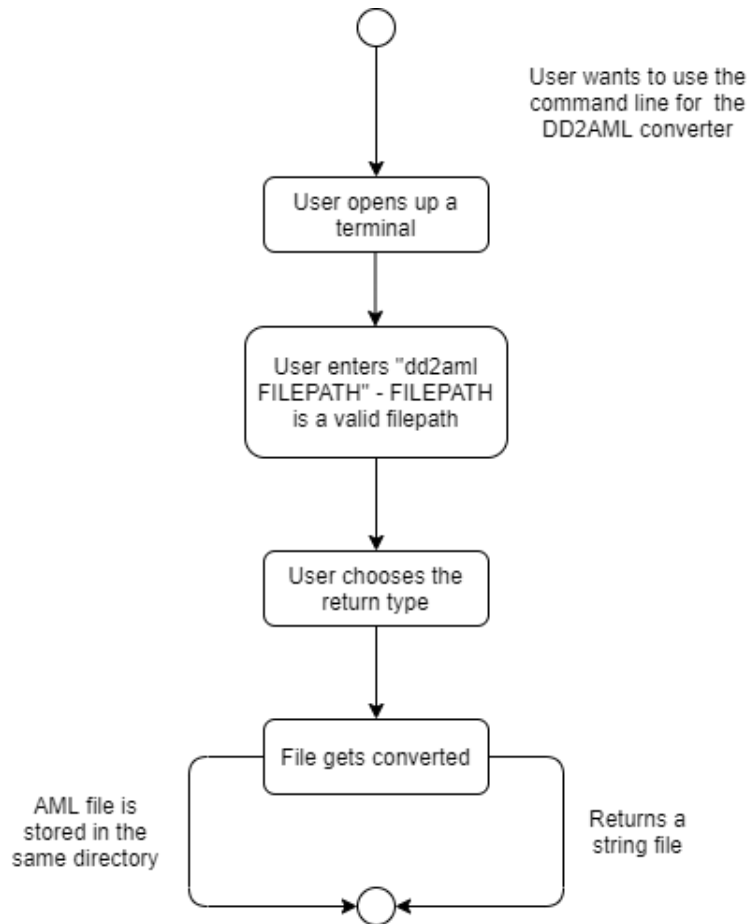


Figure 5 <UC.001> File conversion command line

<b>Related Business Process:</b>	<BP.001>: File conversion
<b>Use Cases Objective:</b>	User wants to convert his DD file to an AMLX file using the command line.
<b>System Boundary:</b>	Program itself is the system boundary.
<b>Precondition:</b>	<ul style="list-style-type: none"> <li>- The program must be installed on the device.</li> <li>- "dd2aml" needs to be registered as a environment variable</li> <li>- The DD file must be without errors.</li> </ul>
<b>Postcondition on success:</b>	The command line should not be closed before the conversion is finished.
<b>Involved roles:</b>	User and Converter
<b>Triggering Event:</b>	Typing dd2aml file with a valid FILEPATH in the command line

### 3.2.2. <UC.002> File conversion GUI

<b>Related Business Process:</b>	<BP.001>: File conversion
<b>Use Cases Objective:</b>	User wants to convert his file to an AMLX file using the GUI.
<b>System Boundary:</b>	Program itself is the system boundary.
<b>Precondition:</b>	<ul style="list-style-type: none"><li>- The program must be installed on the device.</li><li>- The DD file must be without errors.</li></ul>
<b>Postcondition on success:</b>	The program should not be closed before the conversion is finished.
<b>Involved roles:</b>	User and Converter
<b>Triggering Event:</b>	Program is started

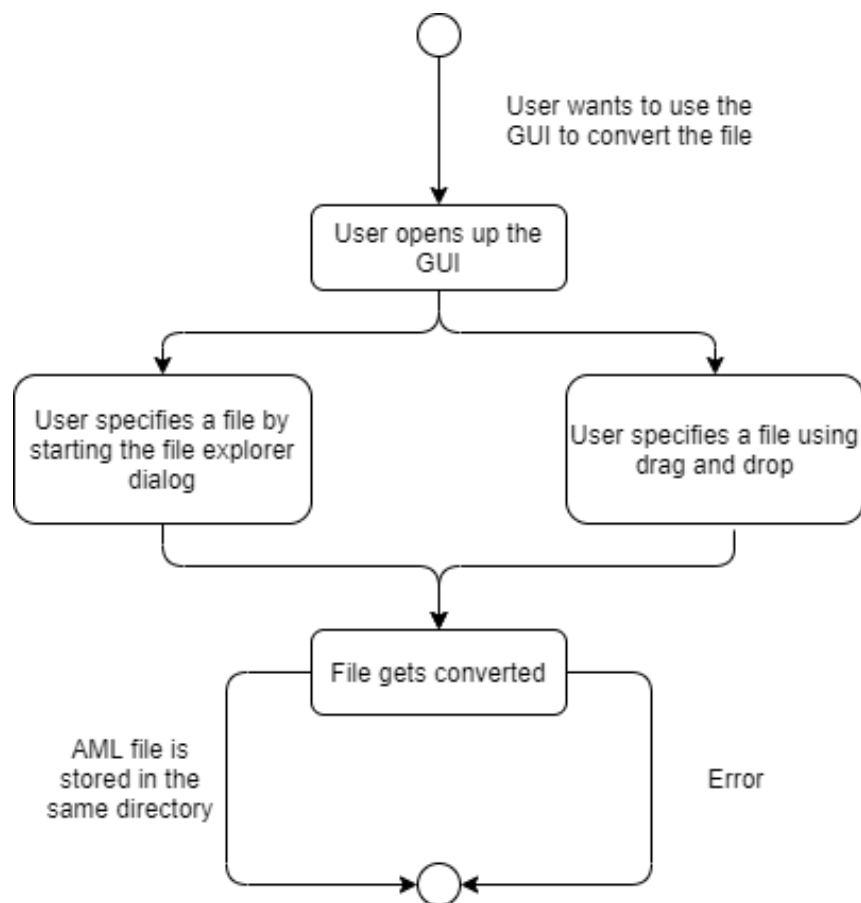


Figure 6 <UC.002> File conversion GUI



### 3.2.3. <UC.003> Library usage

<b>Related Business Process:</b>	<BP.002>: Library implementation
<b>Use Cases Objective:</b>	Possibility for a developer to implement this project in their own software.
<b>System Boundary:</b>	Program itself is the system boundary.
<b>Precondition:</b>	The library needs to have a clearly documented inter-face and must be downloadable from GitHub. It needs to be published under the AGPL-license.
<b>Postcondition on success:</b>	The DD file was successfully converted into an AMLX package.
<b>Involved roles:</b>	Developer and library
<b>Triggering Event:</b>	Developer wants to implement a conversion function to his project.

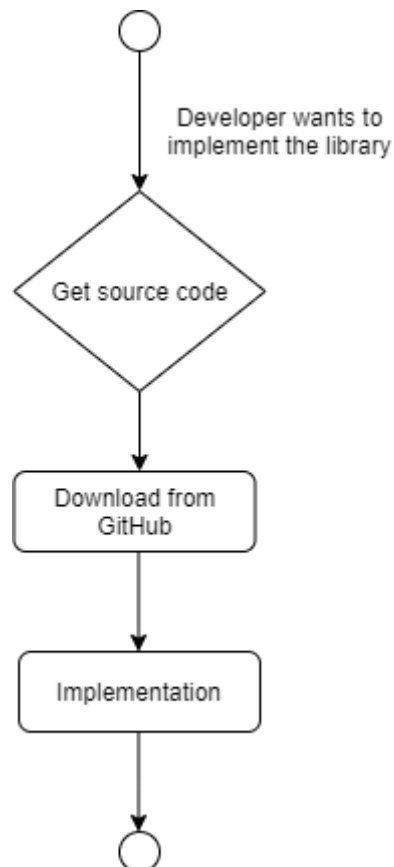


Figure 7 <UC.003> Library usage

### **3.3. Features**

#### **3.3.1. /F01/Import**

The application should be able to import a file by the absolute path to the file.

#### **3.3.2. /F02/File format analysis**

The program shall be able to recognize the file format as one of the listed formats: GSD, IODD or CSP+.

#### **3.3.3. /F03/File validation**

The system shall be able to detect wrongly formatted GSD files and throw an error to the user.

#### **3.3.4. /F04/Conversion**

The system should be able to convert a valid DD file into an AML file.

#### **3.3.5. /F05/ CAEX Version**

The application shall give the option to decide if the CAEX Version 2.12 or the CAEX Version 3.0 should be used for the generated AML.

#### **3.3.6. /F06/AML Package**

The system shall collect all resources and create an AMLX package from the AML file and the resource files.

#### **3.3.7. /F07/Error handling**

The system shall be able to handle errors (unexpected shut down, wrongly formatted files, ...) and throw an error to the user.

#### **3.3.8. /F08/Output selection**

The system shall provide the user with the ability to choose between storing the result as a file or returning the AML as a string.

## **4. Product Data**

### **4.1. /LD10/ AML-DD**

The system shall create a valid AML-DD with all the necessary information the original file contained. Including an AML root file complete with versioning header, a “SystemUnitClass” with logical description, identification and configuration parameters as well as a reference to the original file and pictures if there are any.

### **4.2. /LD20/ File conversion**

The system shall be able to convert a syntactically correct file of the formats GSD, IODD or CSP+.

### **4.3. /LD30/ AMLX package**

The system shall create an AMLX file containing the AML-DD the original file and the device picture(s), which can be loaded into the AML editor.

### **4.4. /LD40/Command line interface**

The software shall support a command line interface.

### **4.5. /LD50/Library**

The software shall be implemented as a library so that other developers can use it in their projects.

## **5. Other Product Characteristics**

This section describes the already known requirements for the product.

### **5.1. /NF10/Graphical User Interface**

The software should support a graphical user interface.

### **5.2. /NF20/System Environment**

The software shall run under Windows 10 or lower version, because the only limitation is the .NET Framework.

### **5.3. /NF30/Installation wizard**

The software shall be installable via an installer.

The installer shall allow to update to a newer version of the program.

### **5.4. /NF40/Portable Program**

Also, the software shall exist as a portable program. This means that no installation is required.

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## 7. References

- [1] <https://www.elektroniknet.de/automation/automationml-die-grundarchitektur-829-Seite-5.html>
- [2] <https://www.kunbus.de/io-device-description.html>