<AutomationML/>

The Glue for Seamless Automation Engineering

Best Practice Recommendations: Constraints with regular expressions in AutomationML

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Preface

AutomationML provides the basis for an efficient data exchange within the engineering process of production systems. The AutomationML standard series IEC 62714 "Engineering data exchange format for use in industrial automation systems engineering" already contains many use cases and guidelines of how system engineering information is modelled.

In order to specify these definitions with examples, to apply them to specific use cases, and to facilitate the first steps with AutomationML, specific issues for the modelling of data in AutomationML are illustrated in Best Practise Recommendations (BPR).

In addition, the BPR shall provide a consistent realisation for specific use cases and shall thus, complement the AutomationML standard documents.

1 Motivation for the realisation of regular expressions as Constraints

Attributes modelled in AutomationML may fulfil different format or value range specifications. Value ranges or explicit lists of values are already possible in AutomationML. Some attributes also have to comply with more complex rules, e.g. if there are certain name conventions. The description of those rules can be modelled with regular expressions.

2 Realisation

The regular expressions are stored at the attribute as requirement of the constraint with the name "aml-RegExp" of the type "UnknownType". The regular expressions have to be modelled according to the Standard Perl Compatible Regular Expressions (PCRE).

3 Example

In the following example the part number, stored with the attribute “Part number”, have to comply with the following formatting rules:

1. The first letter have to be an “F”
2. followed by 10 digits
3. followed by a “-”
4. The “-” is followed by a capital letter
5. The last sign is a digit

Thereby a possible regular expression is: ^F[0-9]{10}\-[A-Z][0-9]$

This regular expression shall be stored at the attribute as requirement of the constraint with the name "aml-RegExp" of the type "UnknownType".

Figure *1* and Figure *2* show the implementation with the AML Editor and the corresponding XML text.

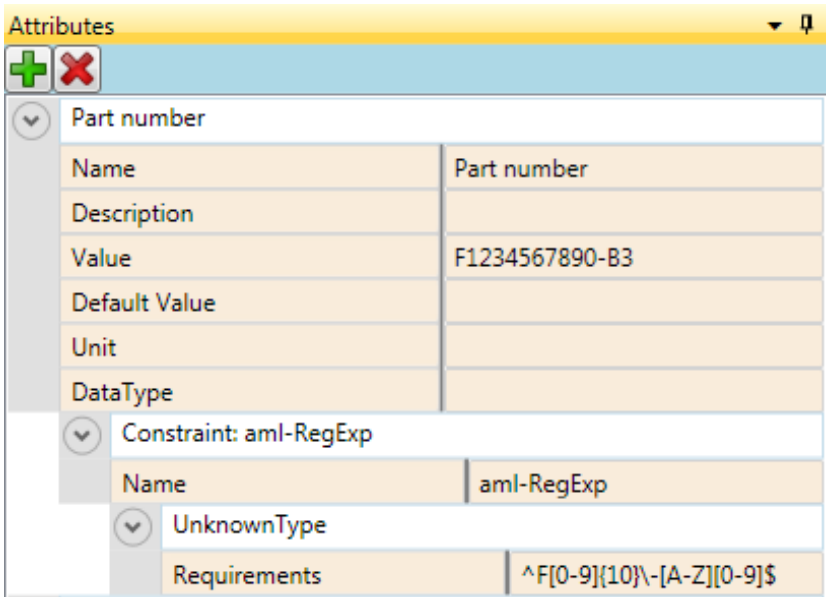

Figure 1 – RegExp-Constraint of an attribute with the AML-Editor

```
<Attribute Name="Part number">
  <Value>F1234567890-B3</Value>
  <Constraint Name="aml-RegExp">
    <UnknownType>
      <Requirements>^F[0-9]{10}\-[A-Z][0-9]$</Requirements>
    </UnknownType>
  </Constraint>
</Attribute>
```

Figure 2 – XML text of a RegExp-Constraint of an attribute

3.1 Additional example for value range constraints

With the constraints mechanisms value ranges can also be defined. The corresponding implementations are represented in Figure *3* and Figure *4* as an implementation within the AML-Editor as well as the XML text.

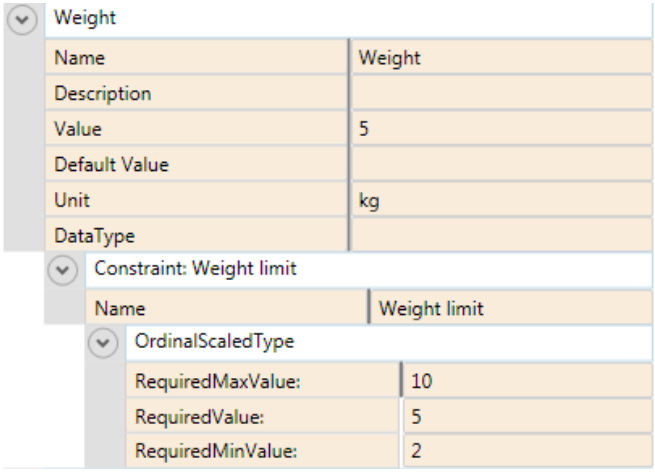

Figure 3 – Value range constraint of an attribute with the AML Editor

```
<Attribute Name="Weight" Unit="kg">
  <Value>5</Value>
  <Constraint Name="Weight limit">
    <OrdinalScaledType>
      <RequiredMaxValue>10</RequiredMaxValue>
      <RequiredValue>5</RequiredValue>
      <RequiredMinValue>2</RequiredMinValue>
    </OrdinalScaledType>
  </Constraint>
</Attribute>
```

Figure 4 – XML text of a value range constraint of an attribute

3.2 Additional example for Enum constraints

With the constraints mechanisms specific fixed values can also be defined. The corresponding realisations are represented in Figure *5* and Figure *6* as an implementing with the AML-Editor and as the XML text.

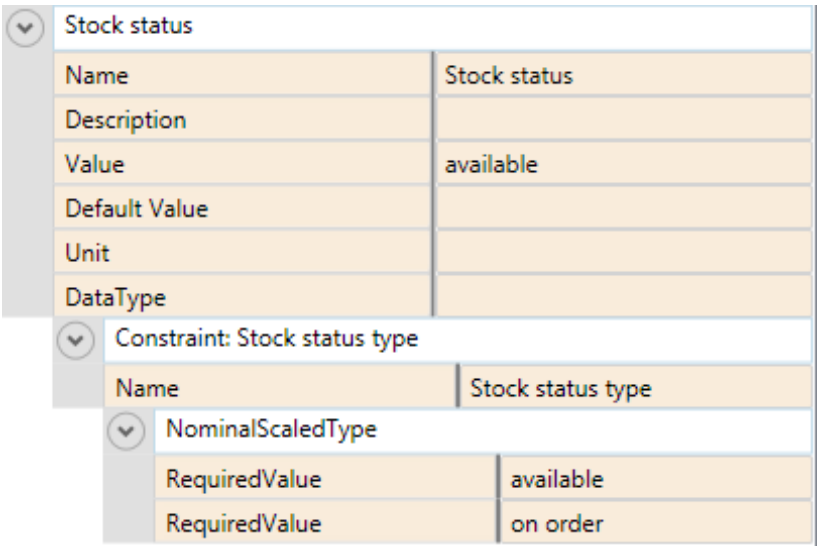

Figure 5 – Enum constraint of an attribute with the AML-Editor

```
<Attribute Name="Stock status">
  <Value>available</Value>
  <Constraint Name="Stock status type">
    <NominalScaledType>
      <RequiredValue>available</RequiredValue>
      <RequiredValue>on order</RequiredValue>
    </NominalScaledType>
  </Constraint>
</Attribute>
```

Figure 6 – XML text of an Enum constraint of an attribute

4 References

http://www.pcre.org/