



AutomationML ECLASS Integration 2.0

2021-09-22



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Digital Innovations

- **What is ECLASS?**
- **Why should I combine AutomationML and ECLASS?**
- **A short example for the motivation.**
- **An ECLASS Role Class Library (for the example).**
- **An ECLASS based System Unit Class.**
- **Attributes as Internal Elements.**
- **A closer look at an ECLASS Role Class Library**

- If I say „property“, I talk about ECLASS
- If I say „attribute“, I talk about AutomationML
- ...same in the whitepaper

- **ECLASS is a worldwide ISO/IEC-compliant data standard for goods and services**
- **Purpose: Distribution of article information between companies**
 - BMEcat
 - Json (new)
- **~41.000 Classes**
- **~17.000 Properties**
- **See also: <https://www.eclass.eu/en/>**

- **ECLASS (Advanced) has 4 levels of classification**
- **The properties of an ECLASS class are defined in the 4th level**

ECLASS ADVANCED 11.1 (en)**27 Electric engineering, automation, process control engineering**

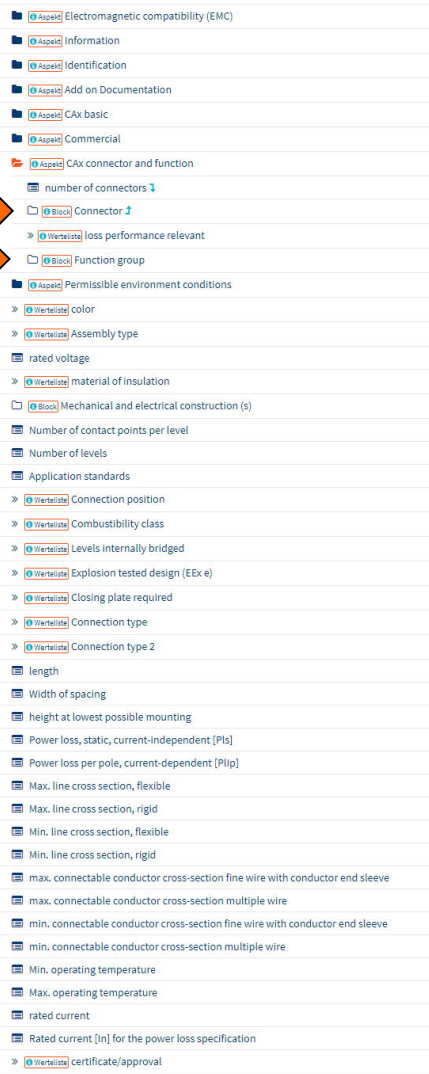
- ⊕ 13 Development (Service)
- ⊕ 14 Logistics (Service)
- ⊕ 15 Maintenance (Service)
- ⊕ 16 Food, beverage, tobacco
- ⊕ 17 Machine, device (for s)
- ⊕ 18 Equipment f. mining,
- ⊕ 19 Information, commun
- ⊕ 20 Packing material
- ⊕ 21 Plant equipment, too
- ⊕ 22 Construction technol
- ⊕ 23 Machine element, fixi
- ⊕ 24 Office product, facilit
- ⊕ 25 General service
- ⊕ 26 Energy, extraction pr
- ⊕ 27 Electric engineering, i
- ⊕ 28 Vehicle (complete vel
- ⊕ 29 Home economics, Ho
- ⊕ 30 Auxiliary supply, addi
- ⊕ 31 Polymer
- ⊕ 32 Laboratory material.
- ⊕ 27-01 Generator
- ⊕ 27-02 Electrical drive
- ⊕ 27-03 Transformer, converter, coil
- ⊕ 27-04 Power supply devices
- ⊕ 27-05 Accumulator, battery
- ⊕ 27-06 Cable, wire
- ⊕ 27-07 Medium voltage switchgear, system
- ⊕ 27-08 High voltage switchgear, system
- ⊕ 27-09 Power quality management
- ⊕ 27-10 Network control technology
- ⊕ 27-11 Lighting installation, device
- ⊕ 27-12 Substation automation
- ⊕ 27-13 Protection installation, device (electric)
- ⊕ 27-14 Electrical installation, device
- ⊕ 27-15 Analysis technology, device
- ⊕ 27-16 Overhead line technology
- ⊕ 27-18 Electrical cabinet, housing, rack
- ⊕ 27-20 Measurement technology, process measurement technology
- ⊕ 27-21 Signal processing
- ⊕ 27-22 Actuator (fitting)

ECLASS ADVANCED 11.1 (en)

27 Electric engineering, automation, process control engineering		27 Electric engineering, automation, process control engineering	
27-01 Generator	27-02 Electrical d	27-14 Electrical installation, device	27-14-11 Terminal (not overhead line)
27-03 Transform	27-04 Power sup	27-14-01 Electrical installation	27-14-11-03 Terminal for luminaire
27-05 Accumulat	27-06 Cable, wire	27-14-02 Lightning protector (inner	27-14-11-04 Screw less terminal
27-07 Medium vo	27-08 High voltag	27-14-03 Grounding installation	27-14-11-05 Terminal (main, branch)
27-09 Power qua	27-10 Network c	27-14-04 Device protection unit	27-14-11-06 Single- and multi-pole terminal strip
27-11 Lighting in	27-12 Substation	27-14-05 Auxiliary heating (electr.)	27-14-11-10 Distribution terminal for transformer
27-13 Protection	27-14 Electrical i	27-14-07 Cable laying (not earth ca	27-14-11-16 Fuse terminal block
27-15 Analysis te	27-16 Overhead l	27-14-09 Installation pipe/cable pr	27-14-11-20 Feed-through terminal block
27-18 Electrical c	27-20 Measurem	27-14-11 Terminal (not overhead li	27-14-11-24 Distribution connector
27-21 Signal pro	27-22 Actuator (f	27-14-19 Miniature circuit breaker:	27-14-11-25 Multi level installation terminal block
		27-14-20 Safety fuse inserts	27-14-11-26 Disconnect terminal block
		27-14-21 Safety fuse systems	27-14-11-27 Component terminal block
		27-14-22 Residual current protecti	27-14-11-28 Sensor/actor terminal block
		27-14-23 Modular serial built-in de	27-14-11-33 End and partition plate for terminal block
		27-14-24 Electrical distribution sys	27-14-11-34 Panel feed-through terminal block
		27-14-25 Low-voltage distribution:	27-14-11-35 End bracket for terminal block
		27-14-26 Low-voltage distribution:	27-14-11-36 Light indicator terminal block
		27-14-27 Busbar trunking system	27-14-11-38 Neutral disconnect terminal block
		27-14-28 Quick-installation system	27-14-11-39 Neutral busbar
		27-14-30 Control system for electri	
		27-14-31 Bus system	
		27-14-32 Signaling technique	

 **Klassifikation: 27141120 [AFZ769021]**

Bevorzugte Benennung	27-14-11-20 Feed-through terminal block
Definition	Component which is arbitrarily aligned to be mounted securely on a carrier rail, and can be clamped with two conductors
Schlagwörter	Terminal block Multistorey terminal Doubledeck terminal (terminal block) Tripledeck terminal Stud terminal Screwless terminal Pluggable terminal
IRDI	0173-1#01-AFZ769#021



The screenshot shows a detailed ECLASS classification tree. On the left, three orange arrows point to the 'Connector' entry, its 'loss performance relevant' sub-property, and the 'Function group' sub-property. The main list of properties includes:

- Aspect: Electromagnetic compatibility (EMC)
- Information
- Identification
- Aspect: Add on Documentation
- Aspect: Cx basic
- Aspect: Commercial
- Aspect: Cx connector and function
 - number of connectors
 - Block: Connector
 - Vertelista: loss performance relevant
 - Block: Function group
- Aspect: Permissible environment conditions
 - Vertelista: color
 - Vertelista: Assembly type
- rated voltage
- Vertelista: material of insulation
- Block: Mechanical and electrical construction (s)
 - Number of contact points per level
 - Number of levels
 - Application standards
- Vertelista: Connection position
- Vertelista: Combustibility class
- Vertelista: Levels internally bridged
- Vertelista: Explosion tested design (EEx e)
- Vertelista: Closing plate required
- Vertelista: Connection type
 - Vertelista: Connection type 2
- length
- Width of spacing
- height at lowest possible mounting
- Power loss, static, current-independent [Pls]
- Power loss per pole, current-dependent [Plip]
- Max. line cross section, flexible
- Max. line cross section, rigid
- Min. line cross section, flexible
- Min. line cross section, rigid
- max. connectable conductor cross-section fine wire with conductor end sleeve
- max. connectable conductor cross-section multiple wire
- min. connectable conductor cross-section fine wire with conductor end sleeve
- min. connectable conductor cross-section multiple wire
- Min. operating temperature
- Max. operating temperature
- rated current
- Rated current [In] for the power loss specification
- Vertelista: certificate/approval

22.09.2021

ECLASS

<AutomationML/>
The Glue for Seamless
Automation Engineering

- A long list of properties
- Properties with folder symbol have sub-properties
- Short: a lot of properties!

Why should I combine AutomationML and ECLASS?

- **AutomationML allows the modelling, storage and exchange of engineering models covering a multitude of relevant aspects of engineering**
 - AutomationML can describe complex systems
- **ECLASS classifies and describes single articles in detail**
 - ECLASS cannot describe complex systems
- **But: AutomationML defines the semantics of things by Role Classes**
 - ELCASS is a semantics definition of things (41k classes, 17k properties)

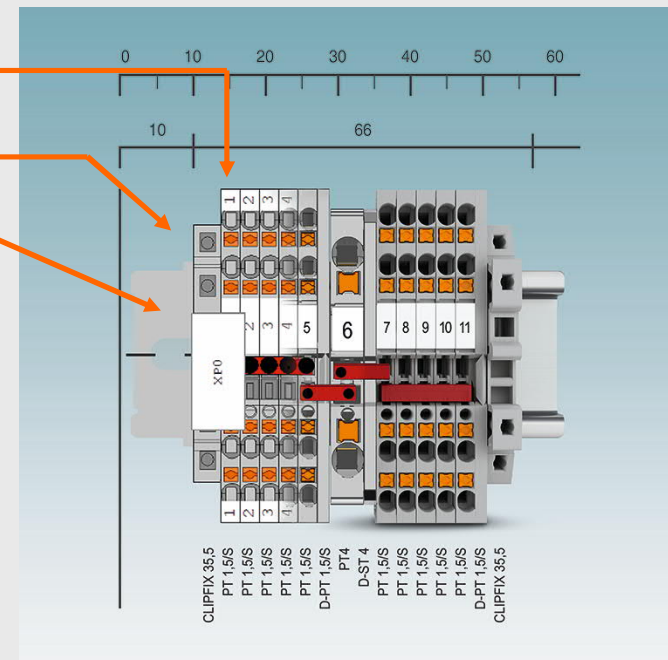
Why should I combine AutomationML and ECLASS?

- **Idea**

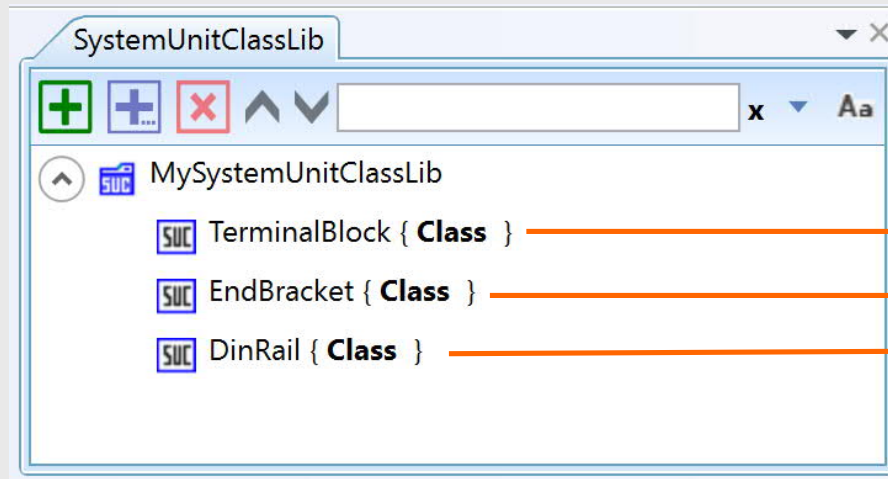
- Use AutomationML to describe complex systems
- Use ECLASS as (additional) Role Class Library

- **Let's create something**

- With terminal block
- With end brackets
- With din rail



- Let's find some suitable Role Classes



Clamp? Product?

Fixture? Product?

Fixture? Static Object?



Get ECLASS classification

<AutomationML/>
The Glue for Seamless
Automation Engineering

- **ECLASS classification**

- Website
- BMEcat

- → **27141120**



Classifications

ECLASS

ECLASS 10.0.1	27141120
ECLASS 11.0	27141120
ECLASS 4.0	27141100
ECLASS 4.1	27141100
ECLASS 5.0	27141100
ECLASS 5.1	27141100
ECLASS 6.0	27141100
ECLASS 7.0	27141120
ECLASS 9.0	27141120

See: www.phoenixcontact.com

<AutomationML/>

The Glue for Seamless
Automation Engineering

22.09.2021

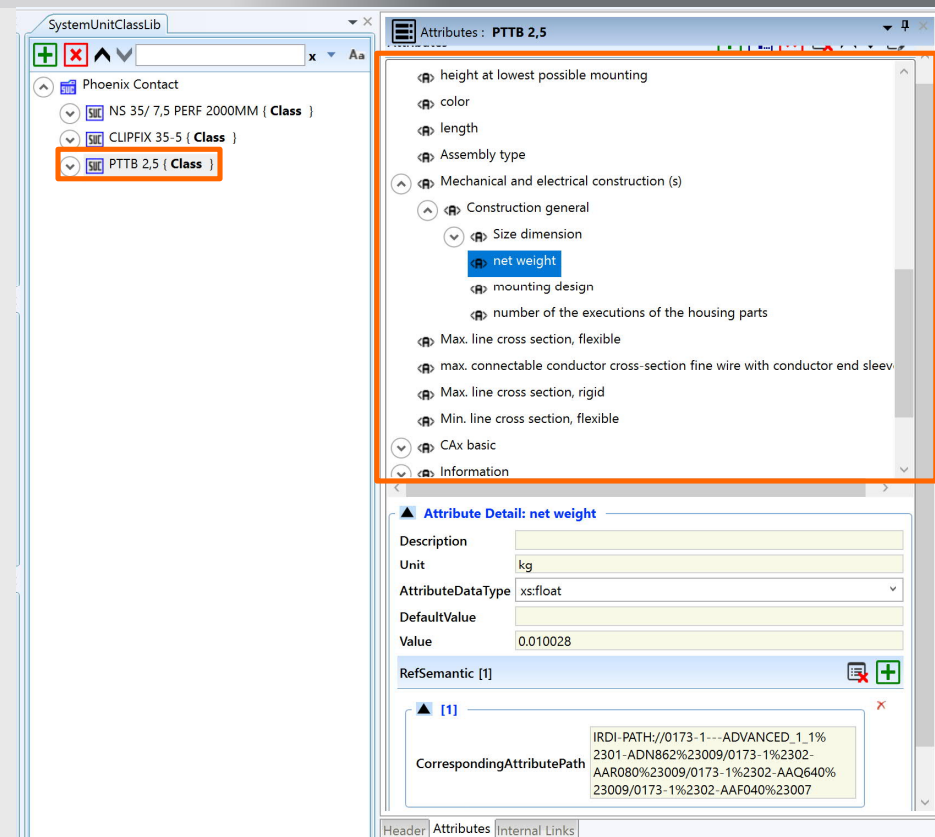
<AutomationML/>

The Glue for Seamless
Automation Engineering

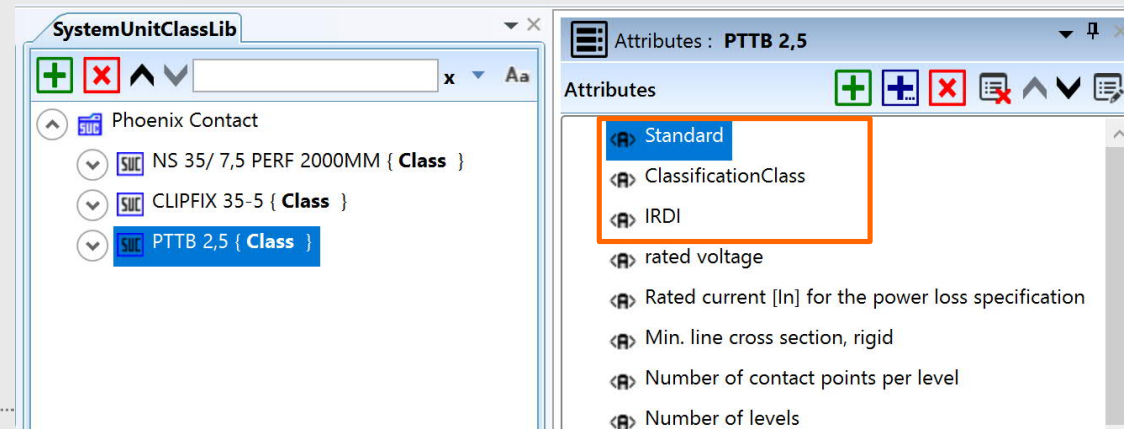
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ECLASS Properties (System Unit Classes)

- An ECLASS based System Unit Class can have all ECLASS (Advanced) properties



- **Every ECLASS based SUC has 3 default attributes**
 - Standard (here “ECLASS-11.0”)
 - ClassificationClass (here “27 14 11 20”)
 - IRDI (here: “IRDI://0173-1---ADVANCED_1_1#01-ADN862#009”)
 - This is the ECLASS Application Class



Semantics in System Unit Classes

- Every ECLASS based attribute has an IRDI-PATH as RefSemantic
 - IRDI-PATH://
 - + IRDI of ApplicationClass (here Feed-through terminal block)
 - + IRDIs of parent attributes (no parent here)
 - + IRDI of the ECLASS property (here: 0173-1#02-BAA351#3014)

// In the RefSemantic ,#' is replaced by „%23“

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Attributes

Attributes

- Width of spacing
- height at lowest possible mounting
- color
- length
- Assembly type
- Mechanical and electrical construction (s)
- Construction general
 - Size dimension
 - net weight
 - mounting design
 - number of the executions of the housing parts
- Max. line cross section, flexible
- max. connectable conductor cross-section fine wire with condu
- Max. line cross section, rigid

Attribute Detail: color

Description

Unit

AttributeDataType xs:string

DefaultValue

Value gray

RefSemantic [1]

CorrespondingAttributePath

IRDI-PATH://0173-1---ADVANCED_1_1%2301-ADN862%23009/0173-1%2302-BAA351%23014

Header Attributes Internal Links

Why the whole IRDI-Path?

- **Because it is allowed to use attributes as Internal Elements**

Put a wire into the terminal block

The screenshot displays two windows from the AutomationML software:

- InstanceHierarchy**: Shows a hierarchical tree of instances. The selected item is `PTTB 2,5_instance_1 { Class PTTB 2,5 Role }`. Below it, the role specification is detailed: `EclassRoleClassLib/EclassClassSpecification/27-00-00-00 Electric engineering, automation, process control engineering/27-14-00-00 Electrical installation, device/27-14-11-00 Terminal (not overhead line)/27-14-11-20 Feed-through terminal block`.
- SystemUnitClassLib**: Shows a list of classes. The selected item is `Blue Wire { Class }`.

An orange arrow points from the `Blue Wire { Class }` in the **SystemUnitClassLib** window to the `PTTB 2,5_instance_1 { Class PTTB 2,5 Role }` in the **InstanceHierarchy** window, indicating the assignment of the wire to the terminal block role.

Put a wire into the terminal block

The screenshot displays two side-by-side panes in the AutomationML software interface:

- InstanceHierarchy**: Shows a tree structure of instances. The selected item is `Blue Wire_instance_1 { Class Blue Wire Role }`. Below it, the source path is listed: `EclassRoleClassLib/EclassClassSpecification/27-00-00-00 Electric engineering, automation, process control engineering/27-14-00-00 Electrical installation, device/27-14-11-00 Terminal (not overhead line)/27-14-11-20 Feed-through terminal block`.
- SystemUnitClassLib**: Shows a tree structure of classes. The selected item is `Blue Wire { Class }`.

An orange arrow points from the `Blue Wire { Class }` in the SystemUnitClassLib to the `Blue Wire_instance_1 { Class Blue Wire Role }` in the InstanceHierarchy, indicating the assignment of the class to the role.

Put a wire into the terminal block

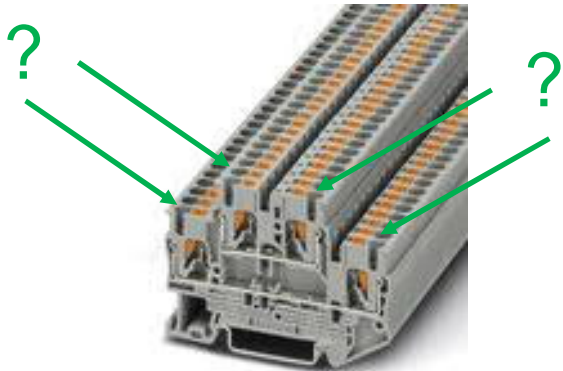
InstanceHierarchy

- InstanceHierarchy1
 - IE NS 35/ 7,5 PERF 2000MM_instance_1 { **Class** 7,5 PERF 2000M
 - CLIPFIX 35-5_instance_1 { **Class** CLIPFIX 35-5 **Role** }
 - PTTB 2,5_instance_1 { **Class** PTTB 2,5 **Role** }
 - Blue Wire_instance_1 { **Class** Blue Wire **Role** } ←
 - EclassRoleClassLib/EclassClassSpecification/27-00-00 control engineering/27-14-00-00 Electrical installation line)/27-14-11-20 Feed-through terminal block
 - PTTB 2,5_instance_2 { **Class** PTTB 2,5 **Role** }
 - CLIPFIX 35-5_instance_2 { **Class** CLIPFIX 35-5 **Role** }
 - EclassRoleClassLib/EclassClassSpecification/27-00-00-00 control engineering/27-40-00-00 Electrical insulation and distribution system/27-40-06-02 DIN rail

SystemUnitClassLib

{ **Class** }

Where is the wire?



- **ECLASS has for every „connection point“ a property, describing**
 - Technical details
 - And its position
- **It is allowed, to take the attribute out of the attribute tree and use it as Internal Element as child of the System Unit Class**

SystemUnitClassLib

- Phoenix Contact
 - NS 35/ 7,5 PERF 2000MM { **Class** }
 - CLIPFIX 35-5 { **Class** }
 - PTTB 2,5 { **Class** }
 - Component receptacle*1 { **Class Role** }
 - Component receptacle*2 { **Class Role** }
 - Component receptacle*3 { **Class Role** }
 - Component receptacle*4 { **Class Role** }
 - Connector*1 { **Class Role** }**
 - Connector*2 { **Class Role** }
 - Connector*3 { **Class Role** }
 - Connector*4 { **Class Role** }
 - Connector*5 { **Class Role** }
 - Connector*6 { **Class Role** }
 - Fixing variant { **Class Role** }
- EclassRoleClassLib/EclassClassSpecification/27-00 control engineering/27-14-00-00 Electrical install line/27-14-11-20 Feed-through terminal block
- Blue Wire { **Class** }

Attributes : Connector*1

Attributes

- Frame
- Connector*1
 - Type of connection
 - Number of parts relations
 - Part relation
 - Position (in mm)**
 - 2.58
 - 51.77
 - 17.1
 - 0

Attribute Detail: Position (in mm)

Description

Unit

AttributeDataType xs:string

DefaultValue

Value

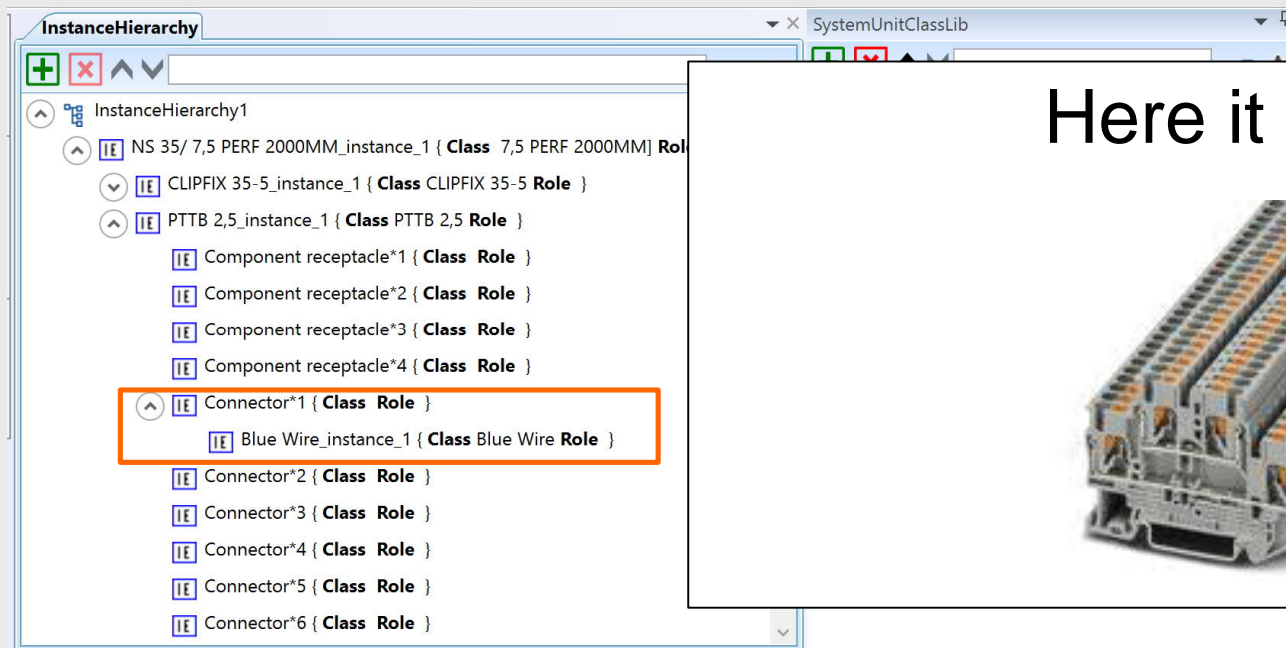
RefSemantic [1]

[1]

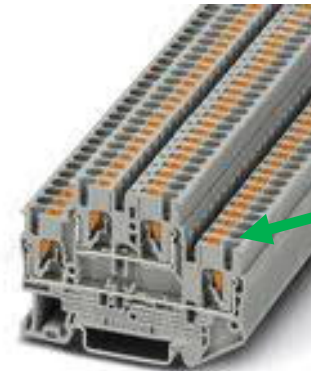
CorrespondingAttributePath

IRDI-PATH://0173-1---ADVANCED_1_1%2301-ADN862%23009/0173-1%2301-ADN293%23009/0173-1%2302-AAQ672%23009*1/0173-1%2302-AAM650%23002

Attribute as Internal Element



Here it is!



The ECLASS Role Class Library

<AutomationML/>
The Glue for Seamless
Automation Engineering

27 Electric engineering, automation, process control engineering

27-14 Electrical installation, device

27-14-11 Terminal (not overhead line)

27-14-11-03 Terminal for luminaire

27-14-11-04 Screw less terminal

27-14-11-05 Terminal (main, branch)

27-14-11-06 Single- and multi-pole terminal strip

27-14-11-10 Distribution terminal for transformer

27-14-11-16 Fuse terminal block

27-14-11-20 Feed-through terminal block

27-14-11-24 Distribution connector

27-14-11-25 Multi level installation terminal block

27-14-11-26 Disconnect terminal block

27-14-11-27 Component terminal block

27-14-11-28 Sensor/actor terminal block

27-14-11-33 End and partition plate for terminal block

27-14-11-34 Panel feed-through terminal block

27-14-11-35 End bracket for terminal block

27-14-11-36 Light indicator terminal block

27-14-11-38 Neutral disconnect terminal block

27-14-11-39 Neutral busbar

27-14-11-40 Cross-connector for terminal block

27-14-11-41 Ground terminal block

RoleClassLib

AutomationMLBaseRoleClassLib

EclassRoleClassLib

EclassClassSpecification { Class AutomationMLBaseRole }

27-00-00-00 Electric engineering, automation, process control engineering { Class EclassClassSpecification }

27-14-00-00 Electrical installation, device { Class 27-00-00-00 Electric engineering, automation, process control engineering }

27-14-11-00 Terminal (not overhead line) { Class 27-14-00-00 Electrical installation, device }

27-14-11-20 Feed-through terminal block { Class 27-14-11-00 Terminal (not overhead line) }

27-14-11-35 End bracket for terminal block { Class 27-14-11-00 Terminal (not overhead line) }

27-40-00-00 Electrical insulation and connecting material { Class 27-00-00-00 Electric engineering, automation, process control engineering }

27-40-06-00 Energy distribution system { Class 27-40-00-00 Electrical insulation and connecting material }

27-40-06-02 DIN rail { Class 27-40-06-00 Energy distribution system }

The ECLASS Role Class Library

<AutomationML/>
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- 27-14-11-41 Ground terminal block

RoleClassLib

AutomationMLBaseRoleClassLib

EclassRoleClassLib

EclassClassSpecification { Class AutomationMLBaseRole }

27-00-00-00 Electric engineering, automation, process control engineering { Class EclassClassSpecification }

27-14-00-00 Electrical installation, device { Class 27-00-00-00 Electric engineering, automation, process control engineering }

27-14-11-00 Terminal (not overhead line) { Class 27-14-00-00 Electrical installation, device }

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AutomationMLBaseRoleClassLib

EclassRoleClassLib

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RoleClassLib

AutomationMLBaseRoleClassLib

EclassRoleClassLib

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27-40-06-00 Energy distribution system { Class 27-40-00-00 Electrical insulation and connecting material }

27-40-06-02 DIN rail { Class 27-40-06-00 Energy distribution system }

ECLASS Role Class Attributes

- ECLASS Role Classes only have 3 attributes

The screenshot displays the AutomationML software interface. On the left, the 'RoleClassLib' tree shows the hierarchy of ECLASS role classes. The class '27-14-11-20 Feed-through terminal block' is selected. On the right, the 'Attributes' panel shows the attributes for this class: 'Standard', 'ClassificationClass', and 'IRDI'. The 'Attribute Detail: IRDI' section is expanded, showing fields for Description, Unit, AttributeDataType (xs:string), DefaultValue, and Value (0173-1#01-AFZ769#020). There are also buttons for 'RefSemantic [0]' and 'Constraint [0]'.

RoleClassLib

- AutomationMLBaseRoleClassLib
- EclassRoleClassLib
 - EclassClassSpecification { **Class** AutomationMLBaseRole }
 - 27-00-00-00 Electric engineering, automation, process control engineering { **Class** EclassClassSpecification }
 - 27-14-00-00 Electrical installation, device { **Class** 27-00-00-00 Electric engineering, automation, process control engineering }
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 - 27-40-00-00 Electrical insulation and connecting material { **Class** 27-00-00-00 Electric engineering, automation, process control engineering }

Attributes : 27-14-11-20 Feed-through terminal block

Attributes

- Standard
- ClassificationClass
- IRDI**

Attribute Detail: IRDI

Description

Unit

AttributeDataType xs:string

DefaultValue

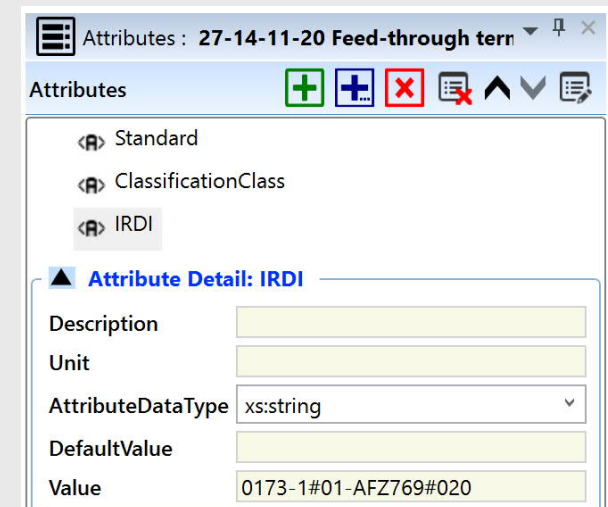
Value 0173-1#01-AFZ769#020

RefSemantic [0]

Constraint [0]

ECLASS Role Class Attributes

- **ECLASS Role Classes only have 3 attributes**
- **Standard: Used classification standard (here: ECLASS-11.0)**
 - Could also be CDD (IEC Common Data Dictionary)
- **Classification Class: Numeric value for the class (here 27141120)**
- **IRDI: ID for the classification class (not the application class!)**



Attributes : 27-14-11-20 Feed-through term

Attributes

- Standard
- ClassificationClass
- IRDI

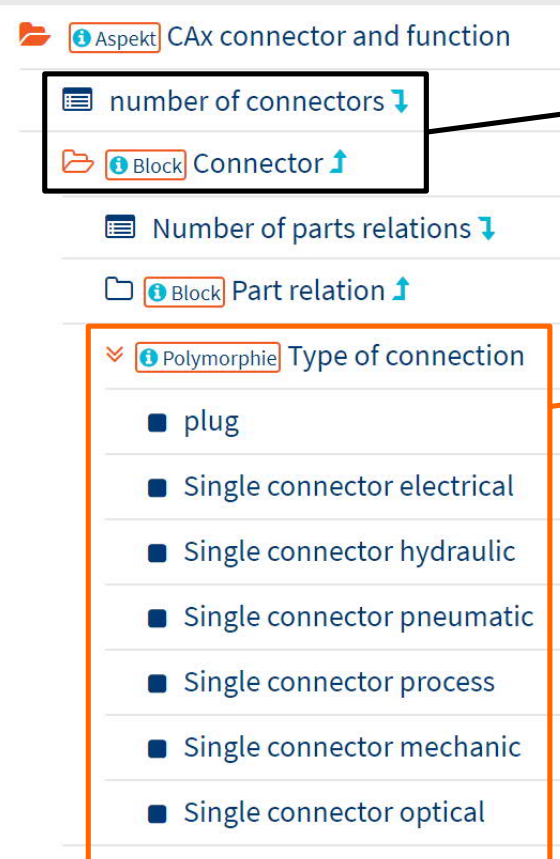
▲ Attribute Detail: IRDI

Description	
Unit	
AttributeDataType	xs:string
DefaultValue	
Value	0173-1#01-AFZ769#020

Why no ECLASS properties (in the RCs)?

- **RCs can be seen as templates for SUCs**
- **ECLASS uses “cardinalities” and “polymorphism”**
 - Some properties can appear multiple times in an application class (e.g., connection)
 - Some properties can be used in application classes with different characteristics
 - A connection can be
 - Plug
 - Single connector electrical
 - Single connector pneumatic
 - Single connector process
 - Single connector mechanic
 - Single connector optical

Why no ECLASS properties (in the RCs)?



Cardinality

Polymorphism

No agreement (so far) on how
such properties should be mapped

- **ECLASS can be used as Role Class Library**
 - Supporting AutomationML by a huge variety of roles or „things“
 - All roles are defined and described:
<https://www.eclass.eu/standard/suchen-im-eclass-standard.html>
 - Each class has a huge set of properties describing the role class
 - ECLASS information can be accessed by a webservice:
https://wiki.eclass.eu/wiki/ECLASS_Webservice

Eclass can enrich AutomationML
with defined semantics for roles
and things