

MEROPS RMS

Risk Management System

European FMEA Congress 2023



merops it

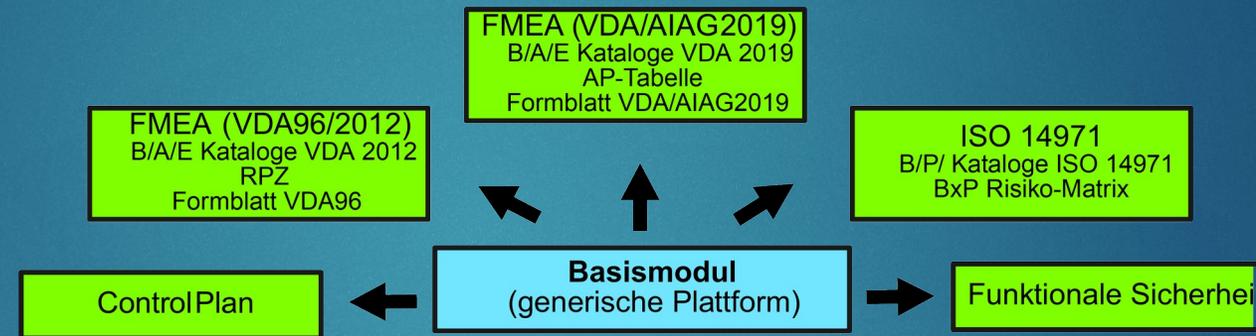
www.merops-it.com

MEROPS RMS - Overview



► Software:

Modular, generic software platform for risk analysis and assessment with industry- and method-specific extensions (FMEA, PLP, ISO 14971, MIL-STD 882 ...)



► Modular concept:

- The base module can be used to perform all preparatory steps such as structural, functional or failure analysis.
- For risk assessment and analysis, additional industry / standard specific modules are available.
- In addition to the building blocks of the assessment/analysis method, these modules also contain editors for the relevant QM documents (e.g. FMEA form in the respective layout) to document the application of the method in accordance with the standards.

Support of established concepts

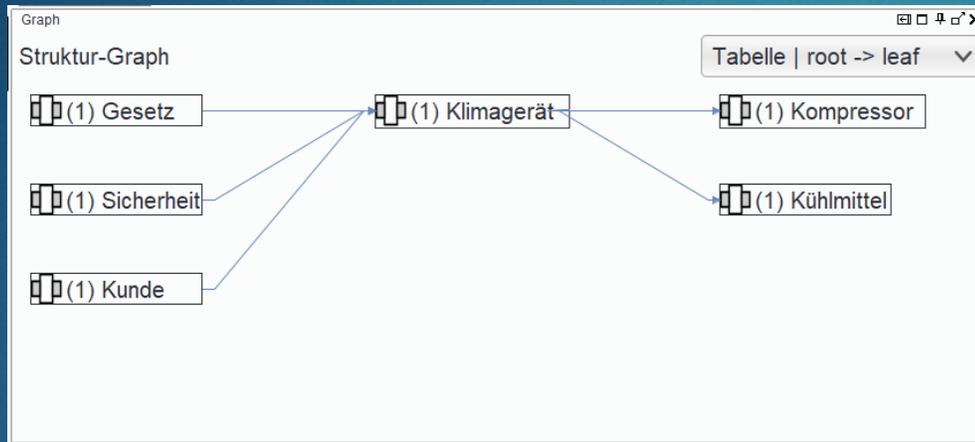


- ▶ **Multilingual content**
- ▶ **Reuse: templates for all object types**
- ▶ **Globale attributes for all instances of a template**
- ▶ **Networks / graphs of arbitrary complexity (complete and/or focused)**
- ▶ **Variants (attributes, object exclusion, edge exclusion)**
- ▶ **XML-MSR import**

New features / concepts



► Structure net support:



► Cost control:

- At all structural levels, costs can be entered directly or calculated from the elements of the subordinate structural levels.

New features / concepts



- ▶ **Specification**
 - ▶ **Qualitative and quantitative**
 - ▶ **Support of all SI units (recognition and conversion)**

Your Input →

Recognition and Conversion →

Eigenschaften

Spezifikation

Variantenspezifischen Wert löschen

Text

gemäß DIN 0815

Quantitativ

Operator <=

2 kWh

Energy

Physikalische Größe SI-Unit: 1 W·s = 1 J (Joule)

Dimension: Length²·Mass/Time²

Erkannter Wert 2 kW·h

Umwandeln in kW·h

Umwandeln in J

Positive Abweichung 0.1

Oberer Grenzwert 2.1

Negative Abweichung 0.1

Unterer Grenzwert 1.9

New features / concepts



► Grouping options at all structural levels

Risk-Management-Software (LIVE)

Menü Einstellungen Daten Hierarchie Graph

Projekt (Unbenannt) Varianten editieren zu Graph zu Übersetzung

Zeige ausgewähltes Projekt zu Formblatt Ebenen

Zeige alle Projekte zu Eigenschaften Synchronisiere

Selektion Optionen Synchronisiere

Übersetzung

Graph Filtern

Suchen

- Projekt (Unbenannt)
 - Produkt Signalkabel
 - (1) Signalkabel
 - (1) Biegeradius
 - (1) Beständigkeit bei Abrieb
 - (1) Abstrahleigenschaften
 - (1) Widerstandsfähigkeit Wasser
 - (1) elektrischer Widerstand
 - (1) elektrische Kapazität
 - (1) Widerstandsfähigkeit Schwefelsäure

Verwaltung Formblatt

C:\demo - prototyp\groupexample.rms

Show development settings

Risk-Management-Software (LIVE)

Menü Einstellungen Daten Hierarchie Graph

Projekt (Unbenannt) Varianten editieren zu Graph zu Übersetzung

Zeige ausgewähltes Projekt zu Formblatt Ebenen

Zeige alle Projekte zu Eigenschaften Synchronisiere

Selektion Optionen Synchronisiere

Übersetzung

Graph Filtern

Suchen

- Projekt (Unbenannt)
 - Produkt Signalkabel
 - (1) Signalkabel
 - (1) Materialeigenschaften
 - (1) Biegeradius
 - (1) Beständigkeit bei Abrieb
 - (1) Widerstandsfähigkeit Wasser
 - (1) Widerstandsfähigkeit Schwefelsäure
 - (1) elektrische Eigenschaften
 - (1) Abstrahlung
 - (1) elektrischer Widerstand
 - (1) elektrische Kapazität

Verwaltung Formblatt

C:\demo - prototyp\groupexample.rms

Show development settings

New features / concepts



- ▶ **Global attributes (Vs. “Global objects”)**
 - ▶ **Basic concept: template -> instance**
 - ▶ **Template attributes (value can be stored at template -> template value)**
 - ▶ **Global attribute: template value is mandatory for all instances**
 - ▶ **Additional option: stored template value as a recommendation, which *can* be used for instances**
 - ▶ **Each attribute is handled separately (no „Global objects”)**

New features / concepts



Variant concept (base and family FMEAs)

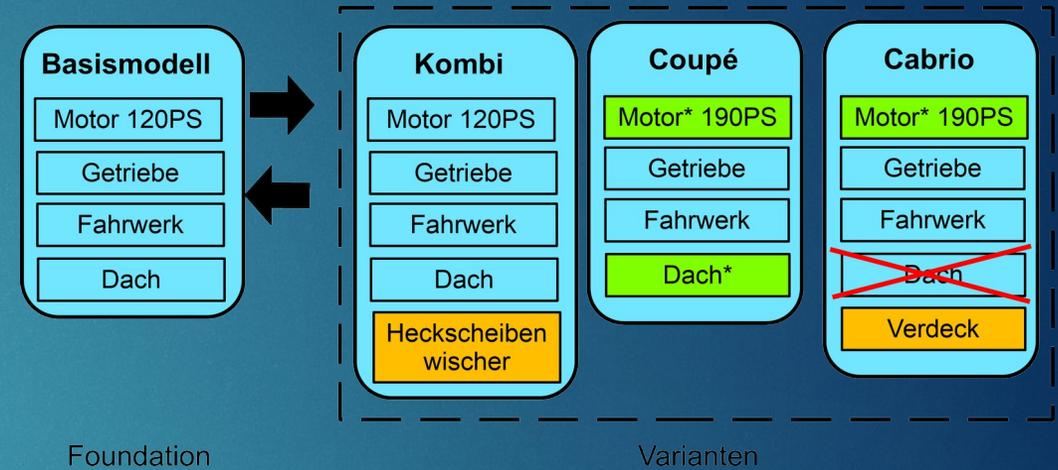
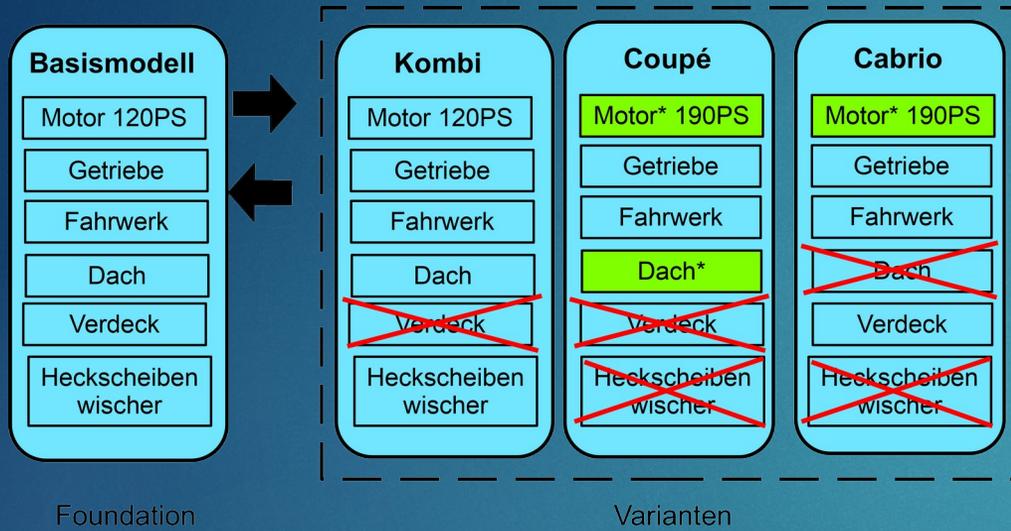
▶ Summary

- ▶ Variant specific attributes
- ▶ Variant specific objects (system-managed)
- ▶ Inheritance and specialization
- ▶ Exclusion and exclusivity of objects and edges

Our modeling method combines the traditional object exclusion in variants with the additional possibility to define certain objects exclusively for certain variants. These exclusive objects are then not included in the foundation.

=> Allows simpler models for the same problems / facts at hand

Comparison of variant concepts



Traditional model (exclusion only):

- Foundation is mandatory union of all possible components
- Higher complexity

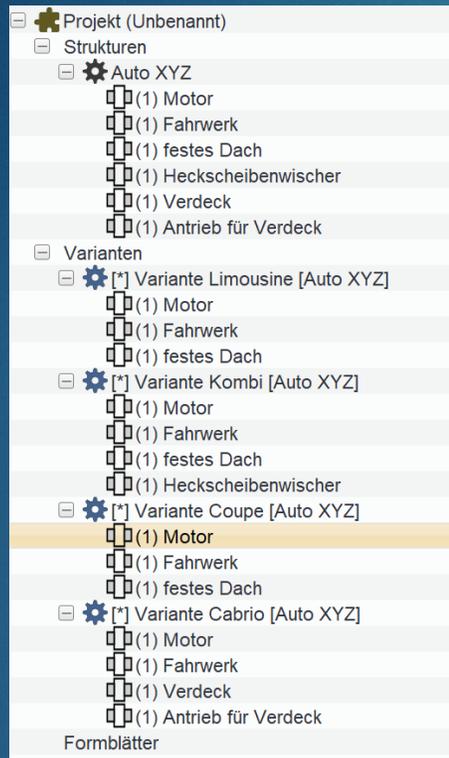
MEROPS model (combines exclusion with exclusive objects):

- Which components to include in the foundation is up to you!
- Lower complexity

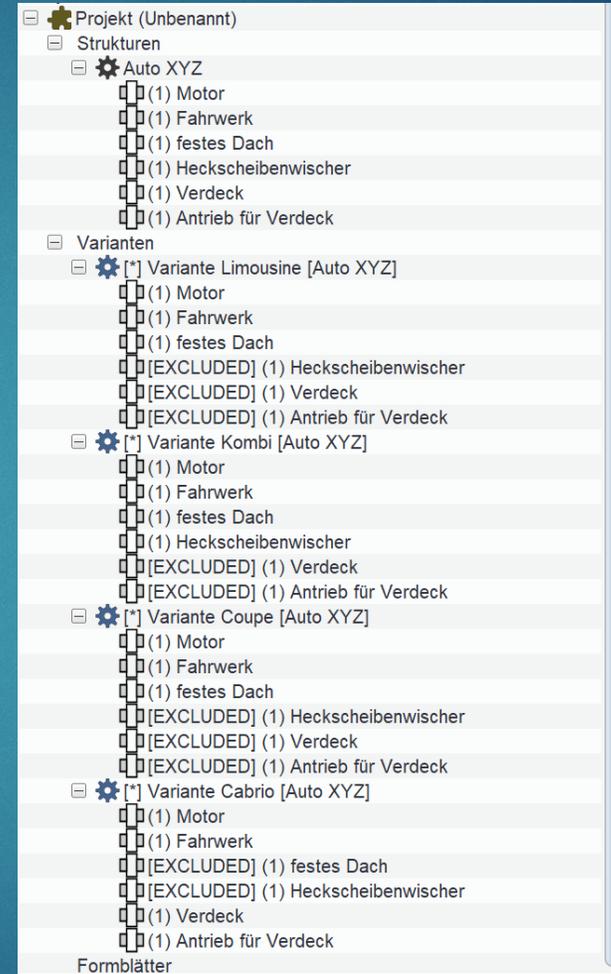
New features / concepts



Variants - example



Normal view

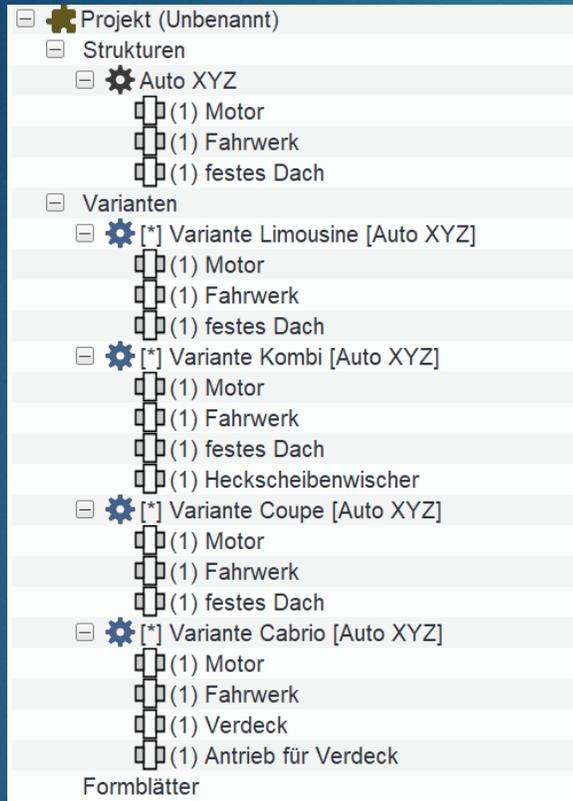


Variant mode view:
Modeling without exclusive objects

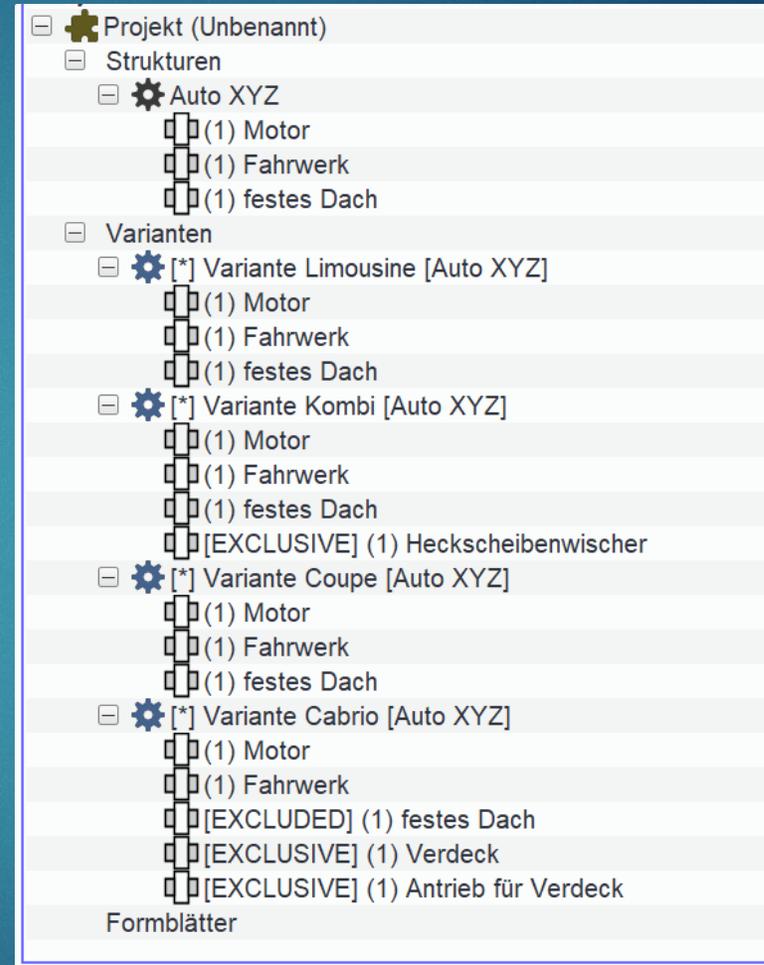
New features / concepts



Variants - example



Normal view



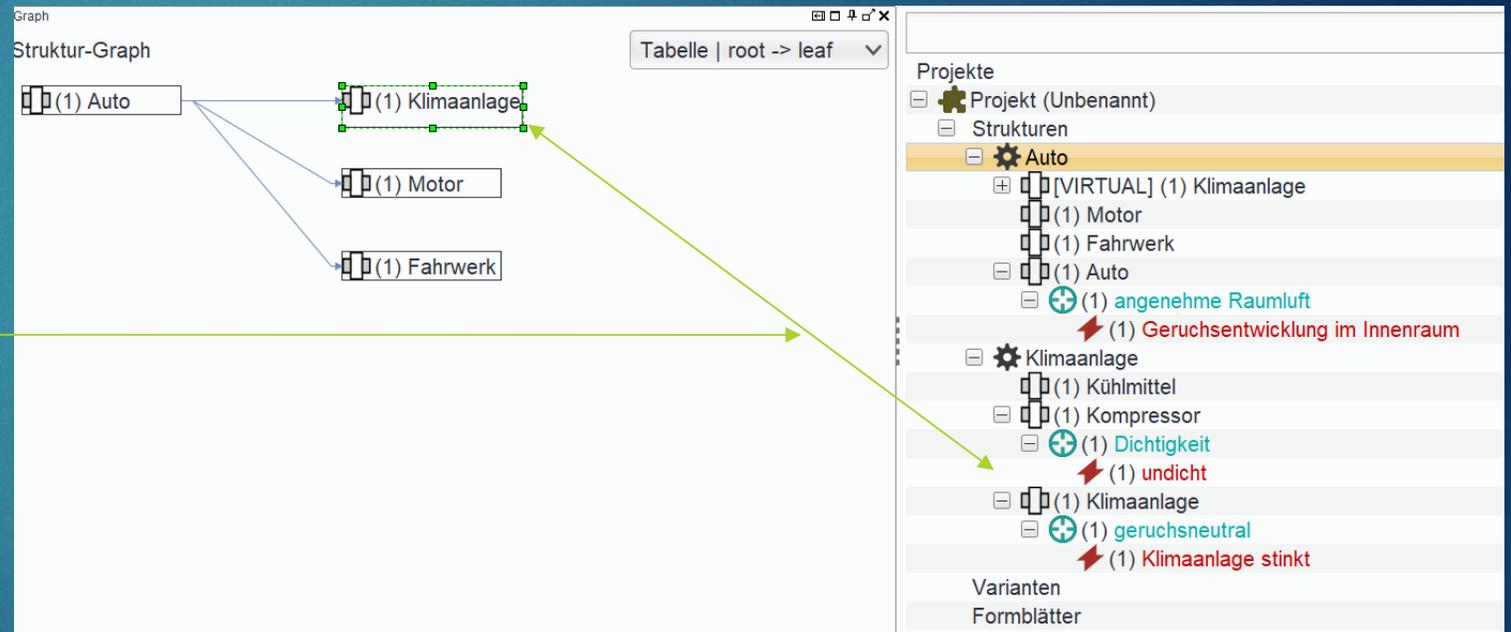
Variant mode view:
Modeling with exclusive objects

New features / concepts



Further possibility of reuse (general fade-in concept / virtual anchoring), among other things for modeling the relationships between system-/product-/process-FMEAs

In the example, the root element "A/C system" defined in the product structure is directly reused as a component in the "Car" system structure



New features / concepts



Extensive support for editing evaluation catalogs and AP tables

Motivation:

In contrast to the "old" RPN, the new Action Priority contains an element in the form of the AP table which may make it more difficult to compare different results:

While the RPN always guarantees the same result for the same evaluation of the input variables B, A and E, this only applies to the Action Priority if the identical (or a compatible) AP table is used for different evaluations!

- ▶ AP tables: internal consistency
- ▶ AP tables: automatic compression and alternative matrix display
- ▶ AP tables: VDA2019 compatibility check
- ▶ AP tables and custom evaluation catalogs: consistent use of value ranges („very high“, „high“, „moderate“ etc.)

AP Table Consistency



► Definition AP table = $\{ \langle B_1, A_1, E_1, AP_1 \rangle, \dots, \langle B_n, A_n, E_n, AP_n \rangle \}$, where:

$B_1, \dots, B_n \in \{1, \dots, 10\}$

$A_1, \dots, A_n \in \{1, \dots, 10\}$

$E_1, \dots, E_n \in \{1, \dots, 10\}$

$AP_1, \dots, AP_n \in \{LOW, MEDIUM, HIGH\}$

Assuming that a comparative order „is better than“ (symbolically „ $<$ “) is defined for B, A, E, AP, the following must hold for any two entries $\langle B_n, A_n, E_n, AP_n \rangle$ and $\langle B_m, A_m, E_m, AP_m \rangle$ of the AP table:

$$B_n \leq B_m, A_n \leq A_m, E_n \leq E_m \Rightarrow AP_n \leq AP_m$$

The assumption is fulfilled for B, A, E by mapping to the numbers $\{1, \dots, 10\}$,
for the AP values applies: LOW < MEDIUM < HIGH

Violations of this criterion should be justified - our consistency check alerts you to this fact when creating such entries.

Prominent examples for violations:

AP table for MSR-FMEA, modified AP table for design/process in Pfeufer2021

MEROPS AP-Table (Design/Process)



| Aufgabenpriorität (AP) für DFMEA und PFMEA (VDA/AIAG 2019 - MEROPS) | | | | | | | |
|--|--------|---|--------|--------------------------|--------|------------------------|--------------------------|
| Die Aufgabenpriorität basiert auf Kombinationen der Bedeutung, Auftreten und Entdeckung und dient der Priorisierung von Maßnahmen zur Risikoreduzierung. | | | | | | | Vom Benutzer auszufüllen |
| Auswirkung auf Produkt oder Werk | B | Prognose des Auftretens der Fehlerursache | A | Entdeckungsfähigkeit | E | Ausgabenpriorität (AP) | Anmerkungen |
| Sehr hoch | 9 - 10 | Sehr hoch - Extrem hoch | 8 - 10 | Sehr hoch - Sehr niedrig | 1 - 10 | H | |
| | | Hoch | 6 - 7 | Sehr hoch - Sehr niedrig | 1 - 10 | H | |
| | | Mittel | 4 - 5 | Niedrig - Sehr niedrig | 7 - 10 | H | |
| | | | | Mittel | 5 - 6 | H | |
| | | | | Hoch | 2 - 4 | H | |
| | | Sehr hoch | 1 | M | | | |
| | | Sehr Niedrig - Niedrig | 2 - 3 | Niedrig - Sehr niedrig | 7 - 10 | H | |
| | | Mittel | 5 - 6 | M | | | |
| | | Hoch | 2 - 4 | L | | | |
| | | Sehr hoch | 1 | L | | | |
| Extrem niedrig | 1 | Sehr hoch - Sehr niedrig | 1 - 10 | L | | | |
| Hoch | 7 - 8 | Sehr hoch - Extrem hoch | 8 - 10 | Sehr hoch - Sehr niedrig | 1 - 10 | H | |
| | | Hoch | 6 - 7 | Niedrig - Sehr niedrig | 7 - 10 | H | |
| | | | | Mittel | 5 - 6 | H | |
| | | | | Hoch | 2 - 4 | H | |
| | | Sehr hoch | 1 | M | | | |
| | | Mittel | 4 - 5 | Niedrig - Sehr niedrig | 7 - 10 | H | |
| | | Mittel | 5 - 6 | M | | | |
| | | Hoch | 2 - 4 | M | | | |
| | | Sehr hoch | 1 | M | | | |
| | | Sehr Niedrig - Niedrig | 2 - 3 | Niedrig - Sehr niedrig | 7 - 10 | M | |
| Mittel | 5 - 6 | M | | | | | |
| Hoch | 2 - 4 | L | | | | | |
| Sehr hoch | 1 | L | | | | | |
| Extrem niedrig | 1 | Sehr hoch - Sehr niedrig | 1 - 10 | L | | | |
| Mittel | 4 - 6 | Sehr hoch - Extrem hoch | 8 - 10 | Niedrig - Sehr niedrig | 7 - 10 | H | |
| | | Mittel | 5 - 6 | H | | | |
| | | | | Hoch | 2 - 4 | M | |
| | | | | Sehr hoch | 1 | M | |
| | | Hoch | 6 - 7 | Niedrig - Sehr niedrig | 7 - 10 | M | |
| | | Mittel | 5 - 6 | M | | | |
| | | Hoch | 2 - 4 | M | | | |

- Compatible with VDA/AIAG 2019
- Range Identifiers consistent with evaluation catalogues for B/A/E
- Compact

License model



- ▶ Combines subscription for updates with temporal unlimited right to use:

While your subscription is active, you can install and use the latest version free of charge.

After your subscription expires, you can continue to use the last major version released during your active subscription.

- ▶ Online license management:

Here you can extend or cancel your subscription - or extend your license with additional modules.

- ▶ Free of charge viewer:

For read-only access to our data format, a free viewer (without further functional restrictions) is available.

Roadmap



- ▶ Nov 2021: Establishment of MEROPS IT GmbH
- ▶ Prototype / Beta test phase (Base module + FMEA):
06/2023 -09/2023
- ▶ Base module + FMEA available as of 09/2023

Information & Contact: info@merops-it.com

