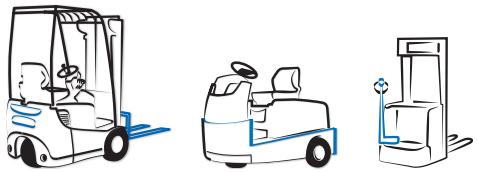
mobile easykey®

WHITE PAPER

FFZ-KPI - From gut feeling to facts
Industrial trucks
Key Performance Indicator

The key figure that provides simple, fast and reliable information about the condition of the industrial truck fleet



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1.1
Industrial trucks in intralogistics

Industrial trucks (FMCs) are becoming an increasingly important part of the information network in intralogistics . In order to save costs, optimally utilise vehicle fleets and at the same time increase safety in the warehouse, companies are increasingly opting for the use of digital solutions. Part of this digital solution is the Mobile Easykey's FFZ KPI.

From gut feeling to facts

Many operators of industrial truck fleets ask themselves the following questions:

- Do I have enough FFZ?
- Am I using the fleet effectively?
- How busy are the FFZ and when?
- How often are the FFZ for repair or maintenance?
- How are the FFZ claimed (e.g. Crash)?
- Are the legally required requirements met?

1.2
Our goal

Our goal was to develop a reliable indicator for assessing the effectiveness of industrial trucks in intralogistics. The aim is to integrate this key figure as a fixed inventory in shop floor management, understandable for everyone. The key figure is intended to provide simple, fast and reliable information about the condition of the industrial truck fleet.
In the long term, Mobile Easykey strives for these FFZ-KPIs as "State of the art" e.g. also to be established in the VDI-guidelines.

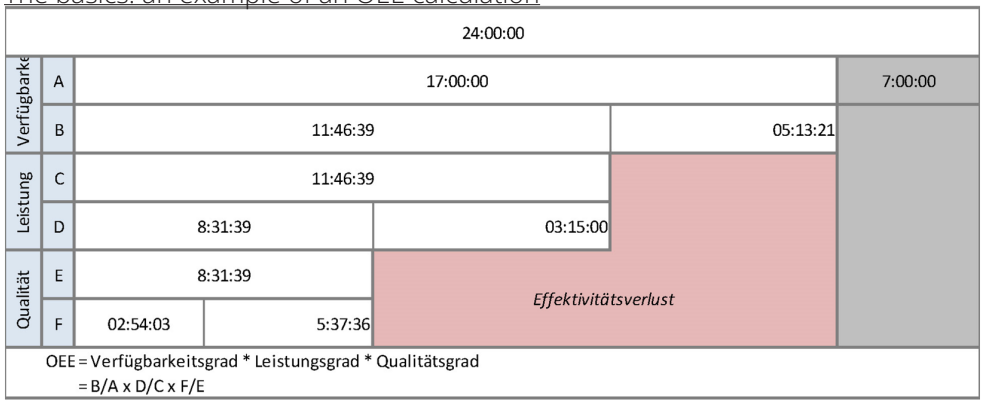
1.3
How to get there

Since 2017, we have been dealing with the topic of key figures for industrial trucks. At the beginning, we started together with a large contract logistics company and in cooperation with a technical university. After extensive research, we found the **OEE Overall Equipment Effectiveness** – a metric developed by the Japan Institute of Plant Maintenance that reflects the level of value added of a plant.

OEE is based on three factors:
1. Availability Factor
2. Performance Factor
3. Quality Factor

OEE = Availability x Performance x Quality

The basics: an example of an OEE calculation

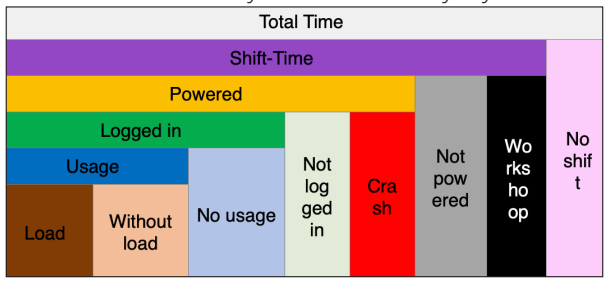


69,3% Verfügbarkeitsgrad
72,4% Leistungsgrad
34,0% Qualitätsgrad
17,1% OEE - FFZ

1 Introduction

Here, however, it turned out that this was perfect for static machines, but for mobile applications such as Industrial trucks are not meaningful enough.

We then continued our research without external partners and analysed a great deal of data. – with the result of extending the OEE to include the **Factor Empty runs / Full rides** as well as the **Factor Z Types of equipment.** Furthermore, the crash shutdown and the workshop transponder were involved.
The data collected by the Mobile Easykey Mana-



1 Introduction

1.4 The FFZ-KPI

After some tests and evaluations, the FFZ KPI was created:

Factor 1 **Powered**	8:00:00 / 7:14:28	**= Powered/ Shift Time**
Factor 2 Logged in	7:14:28 / 5:41:22	**= Logged in / Powered**
Factor 3 Usage	5:41:22 / 4:33:18	**= Usage / Logged in**
Factor 4 Last	4:33:18 / 2:07:12	**= Load / Usage**
Factor Z	Depending on the typical load type (ratio with load / without load)	**Individual factor Z**

The total factor, i.e. the FFZ-KPI is calculated as follows:

FZI-KPI = Factor 1
x Factor 2 (if applicable x Factor y)
x Factor 3
x Factor 4
x Factor Z

The FFZ KPI can be determined as the smallest unit over a single layer. If the FFZ KPI is calculated over longer periods of time (one day to one year), the values for shift-time, powered -time, logged-in-time, usage-time and last-time (within the respective shift times) is used for the calculation.

1.5 Interpretation of FFZ-KPIs

The FFZ-KPI must be considered and evaluated in conjunction with the industry and the device classes. The future viability and market relevance of Mobile Easykey's FFZ-KPIs is based on continuous customer feedback and agile product development that is always close to the market. For this purpose, the overarching needs of the customers were identified and analysed. The main focus was on the sustainably relevant evaluation and reporting possibilities for the permanent and immediate optimisation of processes. In conclusion, and after consultation with the initial users of the product, the FFZ-KPI is a plausible metric.

2 Calculation

2.1
Factors
The FFZ KPI consists of four individual factors. In addition, there are two factors for adapting to operational conditions. In general, only data within the shift times, i.e., the actual usage-times, are taken into account.

2.1.1
Factor 1: Powered
The factor 1 is calculated according to the formula:
Factor 1 = Powered-time / Shift time
Powered or non-powered times outside shift times are irrelevant.
Workshop times are counted as 'non-powered'.
The factor thus determines how long the module was powered within the shift time.

2.1.2
Factor 2: Logged in
The factor 2 is calculated according to the formula:
Faktor 2 = Logged in-time / Powered-time
x if applicable Factor Y
If the module was logged in outside shift hours, this is not taken into account here.
Crash times (crash relays) are counted as 'not logged in'.

Factor Y
The factor Y is only used for modules that are rarely used. The factor Y is therefore always > 1.
Factor Y can be calculated as follows:
Factor Y = Actual working hours/ Expected working time
For example:
If an FFZ is only needed twice per month, factor Y can be defined as follows:
- Actual working time per month approx. 20 days (in case of shift operation without weekend)
- Expected working time for the specific FFZ (approx. 2 days per month)
- Factor Y = 20 / 2 = 10
- Factor 2 is then multiplied accordingly by the factor Y (in this example by the number 10)

2.1.3
Factor 3: Usage
The factor 3 is calculated according to the formula: **Factor 3 = Usage-Time / Logged in time**
Useful times outside shift times are not taken into account

2.1.4
Factor 4: Last
The factor 4 is calculated according to the formula:
Factor 4 = usage time with load / total usage time
Again, data outside shift times are not taken into account.

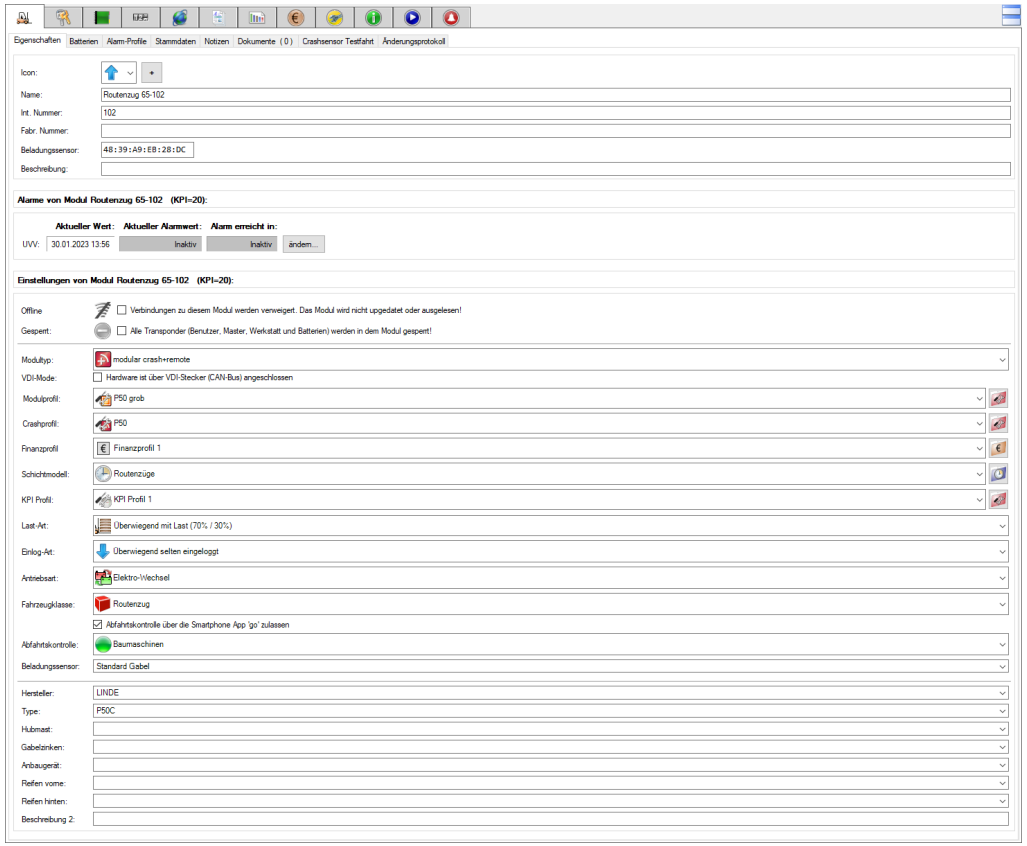
2.1.5
Factor Z
The factor Z is defined in such a way that in a typical distribution of journeys with and without load, the product results in factor **4 x factor Z = 1**.
For the factor Z, the formula is:
Factor Z = 1 / typical Load-Factor

Type values for factor Z

Last-Type	Faktor Z
Uniform load distribution (e.g.: 50 % / 50 %) In normal operation, vehicles drive with load as often as without load E.g.: loading and unloading process	2 (= 1 / 0,5)
Predominantly with load (e.g.: 70 % / 30 %) Vehicles typically run 70% with load and 30% without load. E.g.: Pickingoperations	1,43 (= 1 / 0,7)
Predominantly without load (e.g.: 30 % / 70 %)Vehicles typically drive 30 % with load and 70 % without load. E.g.: Container loading	3,33 (= 1 / 0,3)

2.2
actor Y and Factor Z in the Mobile Easykey Manager

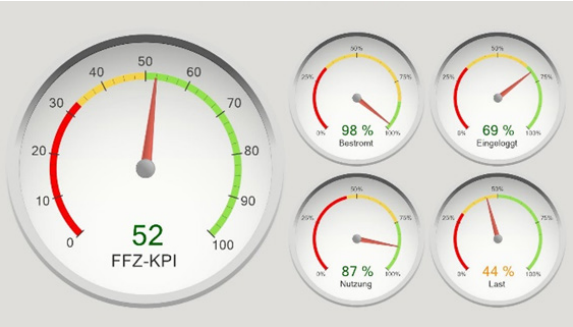
The load type (factor Z) as well as the planned frequency of use or Log-in type (factor Y) can now be defined individually for selected FFZs in the module configuration of the Mobile Easykey Manager (MEKM) software



2 Calculation

3.1
Statistics Overview

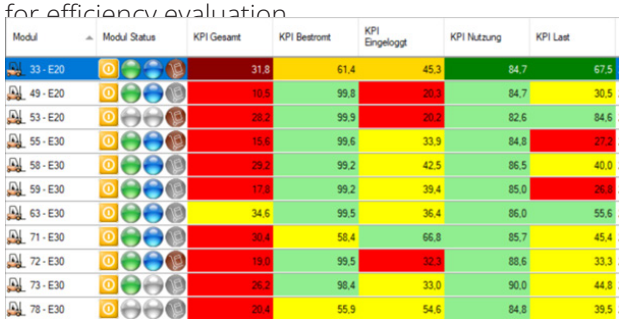
All four factors are displayed together with the total factor, i.e., the FFZ-KPI (= usage / shift time) as five speedometer elements within or below the overview graphic (pie chart).
The displayed FFZ-KPI is displayed from the selected time (for example, one month) and the selected shift(s).
There is a button for each shift. Several buttons can be selected at the same time, e.g., to select shift 1 and shift 2.



There are various statistics in the MEKM software, in which the FFZ-KPI can be additionally evaluated beyond its own significance.

3.2
Information Centre

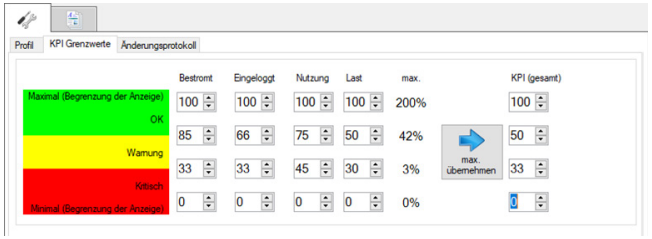
he FFZ-KPI can also be displayed in the information center of the software (up to six additional columns):
KPI-total, KPI-powered, KPI-logged in, KPI- utilisation, KPI-load. Each with the set limit values in green, yellow and red.
In addition, the respective individual factor Z can be displayed as a separate column.
The FFZ-KPI is basically a "live key-figure". However, the information center displays the FFZ-KPI for the last month with complete data. Thus, the figures in the information center for a comparison e.g., of individual devices provides a reliable basis for efficiency evaluation.



3.3
Classification of the determined FFZ KPIs

For each of the four factors (as well as for total) limit values can / must be defined for the traffic light display green/yellow/red.

For each of the four factors and for the overall value, limit values for the traffic light system are defined. For green, the maximum value is 100, for red the minimum value is 0.Important are the settings when the traffic light turns yellow or yellow should jump to red. These limit values are defined individually depending on the industry, device and process. This is where Mobile Easykey's 25 years of intralogistics know-how comes into play. Corresponding values are made available to companies.



These limits are entered in one or more different KPI-profiles.
If no FFZ-KPI-profile is assigned to a vehicle, the default in the database configuration is: uniform load distribution (50 % / 50 %).

3 Display and quality determination

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