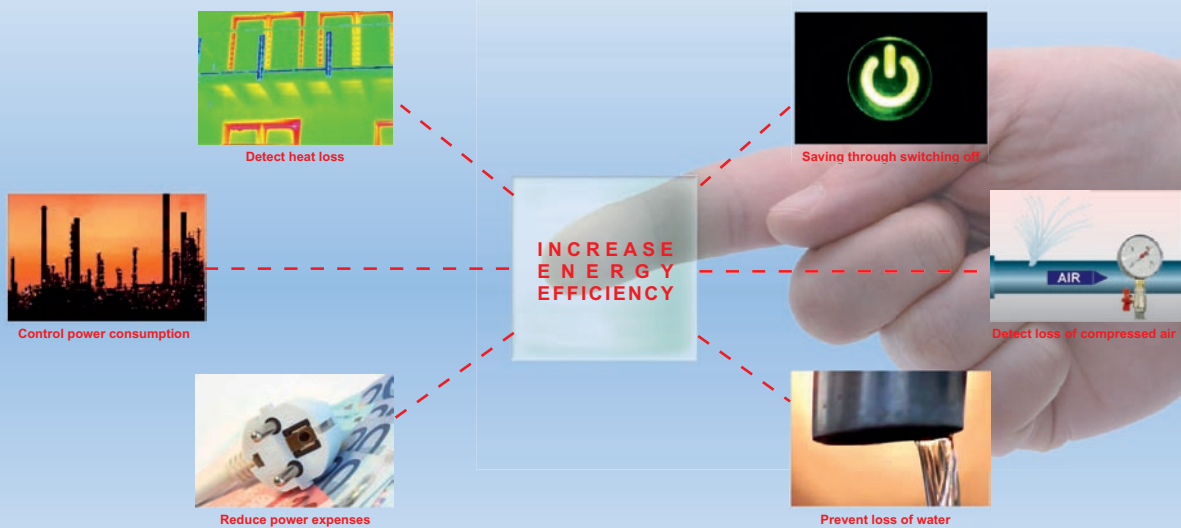




Energy Management and more...

Special Edition



It's all about saving your money!

// Energy Management and more...

The **FRAKO** Energy Management System (EMS) provides information on energy and other processing data for the customer. At the same time certain parts of the system realize energy savings in the background.

The latest generation of system can use existing Ethernet lines and includes a fully developed alarm management system. A typical setup is shown by means of a small system in Fig.1 and 2.

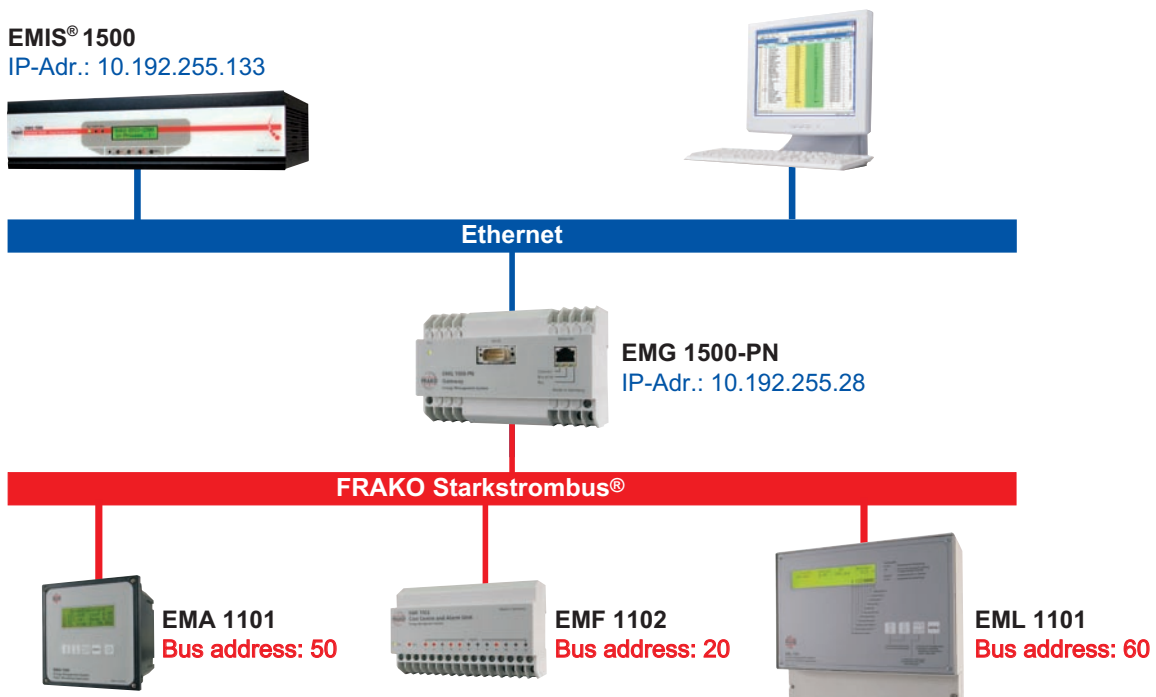


Figure 1: Typical setup of a small system

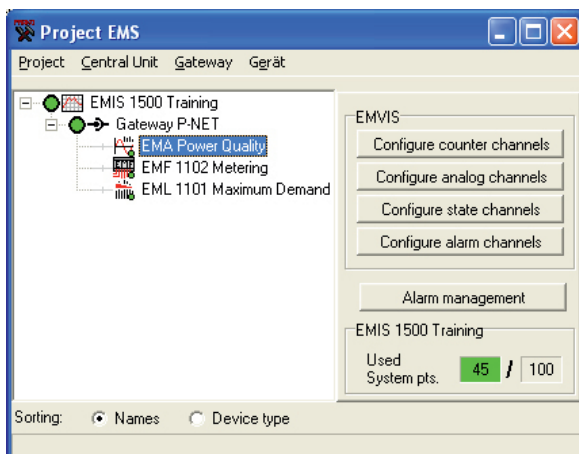


Figure 2: System tree in EM software for the example depicted in Fig.1

// Three domains to start with...

The **FRAKO** Energy Management System started out some 15 years ago with the coverage of 3 domains, all of them strongly related to electrical energy:

- Power Quality Monitoring
- Maximum Demand Control
- Power Factor Correction

In context of the 2nd and 3rd domain there are EM instruments available that realize direct savings by minimizing the following two items of charge on your electricity bill:

1. Expenses for maximum demand (often charged as kW per month) are reduced considerably: Payback periods usually range from ½ to 1½ years.
2. Expenses for reactive work (often charged as kVAh above a certain %-age of consumed active work) are reduced to zero: Typical payback periods are about 2-3 years.

Within the first domain – Power Quality – no direct savings (on bills) are realized, because bad power quality is not penalized by the utilities (yet). However monitoring of power quality becomes an increasingly prominent issue: Early warnings prevent the customers from costly malfunctions such as production downtimes.

// Domain No. 4: Monitoring consumption of electrical energy and other resources

The third item of charge on your electricity bill, the consumed electrical energy (kWh), is covered by the fourth domain of the **FRAKO** Energy Management System: Cost Allocation.

Here **FRAKO** chose for a very flexible setup:

Coupling to arbitrary devices with a pulse output. These pulse outputs can be connected to the EM system. Among others, electrical energy meters with pulse output can easily be connected.

With this same solution all other sorts of meters and counters (gas, water, compressed air, counters of pieces, etc.) can be linked to the system via pulse outputs. There the consumption and the rate of consumption can be monitored both as actual and historical values.

In addition the customer can carry out submetering of electrical energy and other resources. Fig. 4 shows a monthly report for electrical energy, maximum demand expenses and natural gas expenses set up as a spread sheet. These figures are calculated from ¼-hourly readings of hundreds of submeters installed at the site and connected to the system. The data are accessed from the SQL database that is delivered along with the Central Data Collector EMIS 1500.

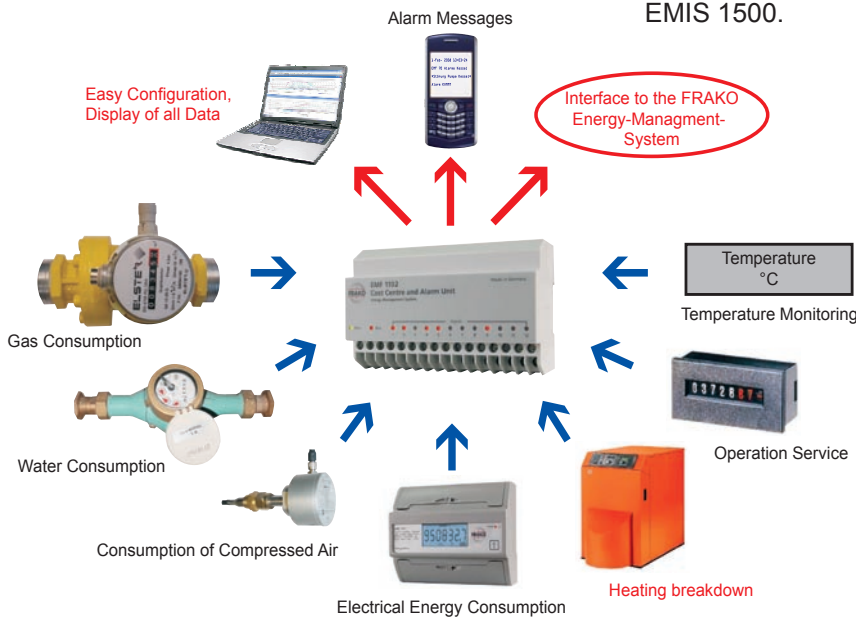


Figure 3:
Cost Center and Alarm Unit EMF 1102 can be connected to pulse meters and other pulse emitting devices.

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Also analogue values can be registered via 4 - 20 mA, 0-10V signals or pulse frequencies.

In this way many readings can be included in the system. Examples are: temperature, humidity, pressure, pollution of exhaust gas and waste water, states of machines, etc. (See Fig. 3)

Another words the Cost Center and Alarm Unit EMF 1102 can also be used to link to all sorts of process data. Often a glance at these data is very helpful at solving riddles.

This is illustrated by the example on page 5.

Energy Cost
June 1st, 00:00 till July 1st, 00:00 2006

Energy type	Cost unit	Tariff	Consumption	Unit	Consumption cost	Consumption HT + LT	Unit	Consumption cost HT + LT	15 minutes peak	Unit	Time of peak	Cost	Total cost
Electrical	Total EML 1101	HT	58.053,38	kWh	3.622,53 €	79.052,32	kWh	4.932,86 €	264,80	kW	01.06.2006 08:30	1.853,60 €	6.786,46 €
		LT	20.998,94	kWh	1.310,33 €								
	HT from 6.00 am till 09.00 pm	Sum submeters	55.087,74	kWh	3.437,47 €	75.066,19	kWh	4.684,13 €	252,08	kW		1.764,56 €	6.448,69 €
	Cost / kWh		19.978,45	kWh	1.246,66 €								
	0,0624 €	Compressed air	5.027,88	kWh	313,74 €	5.122,56	kWh	319,65 €	45,60	kW		319,20 €	638,85 €
			94,69	kWh	5,91 €								
		Administration	5.809,59	kWh	362,52 €	7.997,61	kWh	499,05 €	20,80	kW		145,60 €	644,65 €
			2.188,02	kWh	136,83 €								
	LT from 09.00 pm till 06.00 am	Test rooms	18.938,97	kWh	1.181,79 €	30.563,04	kWh	1.907,13 €	38,48	kW		269,36 €	2.176,49 €
			11.624,07	kWh	725,34 €								
	0,0624 €	Heat treatment	6.182,09	kWh	385,76 €	7.812,01	kWh	487,47 €	28,80	kW		201,60 €	689,07 €
			1.629,92	kWh	101,71 €								
	Cost maximum demand / kW	Production capacitors	13.056,34	kWh	814,72 €	16.843,76	kWh	1.061,05 €	75,20	kW		526,40 €	1.577,45 €
			3.787,42	kWh	236,34 €								
	7,00 €	Prod. PFC + dispatch	6.072,87	kWh	378,95 €	6.727,21	kWh	419,78 €	43,20	kW		302,40 €	722,18 €
			654,34	kWh	40,83 €								
		Not submetered rest	2985,64	kWh	185,06 €	3.986,13	kWh	248,73 €	12,72	kW		89,04 €	337,77 €
			1020,49	kWh	63,68 €								
	Additional fee per kWh												
		Consumption <= 8333 kWh / month				8.333,00 kWh		28,00 €					
		0,0034 €											
		Consumption > 8333 kWh / month				70.719,32 kWh		35,36 €					
		0,0005 €											
Water	Total	-	30.380,00	l	107,78 €								107,78 €
	Cost / liter	Administration	23.130,00	l	82,11 €								
		Hall 6	7.230,00	l	25,67 €								
	0,00355 €												
													0,00 €
Heat via natural gas	Total	-	1.540,40	kWh	77,17 €								77,17 €
	Cost / m³	Process heat	1.540,40	kWh	77,17 €								
	0,050 €												
	Service fee per year	No. of 15 min intervals in report time				2680						98,63 €	98,63 €
	1,200 €												
Energy for heating	Total				89,06 €								89,06 €
	Cost / kWh	Administration VVE	730,00	kWh	23,99 €								
		Hall 1 KP	1.440,00	kWh	47,32 €								
	0,033 €	Hall 2 AP + lab	100,00	kWh	3,29 €								
		Hall 4b LV		kWh	0,00 €								
		Hall 9 regen. room	440,00	kWh	14,46 €								
	Service fee per year	No. of 15 min intervals in report time				2680						164,38 €	164,38 €
	2,000 €												
												Total energy cost	7.323,49 €

Figure 4: Spreadsheet with monthly report of cost for energy consumption and maximum demand

Controlling process data directly, an example

For aging tests of power capacitors these are operated at over voltage and over temperature for thousands of hours. These tests are interrupted every once in a while for measurements of capacity and loss factor.

Whenever these tests reveal an unsatisfactory quality, action is taken. Of course such results could also be due to artefacts... and thanks to EM we became aware of such an artefact early enough to prevent us from all sorts of costly searches in the wrong directions. The temperature of the testing oven was set to 83°C and it was regulated by a thermostat that via contactor turned the heating device on and off. Now this particular contactor just began to malfunction, not opening at times as it was supposed to.

Such temperature peaks damage the capacitors considerably, even when those peaks last only a short time. Without EM this malfunction would have been registered much later and production processes or even development errors would have been taken as causes for the "bad quality" of the tested capacitors.

There are many other examples of early recognitions of hazardous faults such as

- Water pipe bursts
- Performance drops of generators, that were used for maximum demand control (just think, how expensive a break down of that generator during peak times would have been)
- Reduced efficiency of compressors
- Critical environmental data (historical values are extremely helpful for passing eco audits)
- etc.

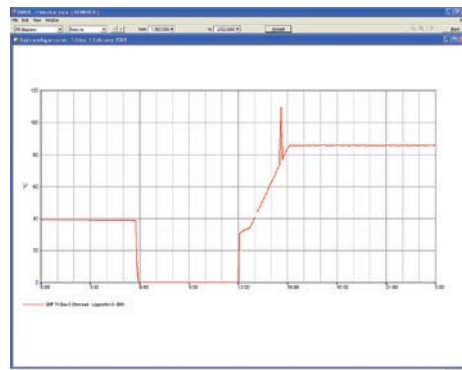


Figure 5: Test oven temperature logged by FRAKO EMS. Hazardous peak due to a defective contactor was recognized early enough – thanks to EMS.

Modularity and Interfacing...

The design of the Energy Management System is modular in two respects: Firstly there are different modules that can be used (choice which domains should be covered). Secondly in the sense that it can easily be embedded into an even bigger, superimposed system. In this latter respect the **FRAKO** Energy Management System can be viewed as a module. In this context the issue of interfaces is most important:

A very frequent example of exchange of data with other systems is the connection of the Maximum Demand Controller EML 1101 to Building Management Systems (BMS) via RS 232 using the protocol 3964R / RK512. The BMS sheds loads according to the input of EML 1101. Advantages are: Reduced cost for installation and making use of knowledge of processes these shedded loads are involved in.

More recent examples are SQL accesses being used by standard visualizations such as spread sheets and web based applications.

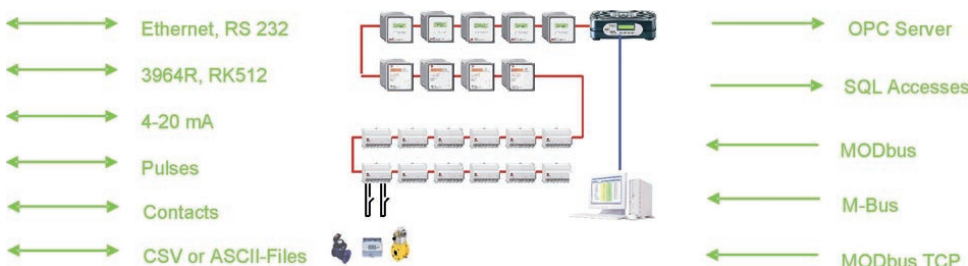


Figure 6: Interfaces available at FRAKO Energy Management System. Interfaces listed to the left side can be used for im- and export, those listed on the right either for im- or export.

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// Summary and final remarks...

The **FRAKO** Energy Management System provides information on energy and other processing data. In addition certain parts realize savings in the background.

The system covers the domains PFC, Maximum Demand, Power Quality and Cost Allocation.

Data is transferred in most cases via Ethernet and **FRAKO** Bus. Also information available in other protocols (such as MOD Bus, etc.) can be readily visualized and processed by **FRAKO** EMS.

Cost Allocation data metered and submetered typically are written in an SQL Data base, which is delivered as part of the Central Data Collecting Unit EMIS 1500. Those data then can be summarized for instance in form of monthly reports.

All data are visualized by the standard visualization software "EMVIS-NET" online as well as in form of historical data as function of time. These plots are very helpful at analyzing process faults.

A rich choice of hardware and software interfaces allows easy embedding of **FRAKO** EMS in a setup of other systems...

Currently several hundred systems are used in many different European and other countries.

The costs of the systems range from below 1000 to several hundred thousand Euro, depending on their size.

One of the biggest applications is a network of some 25 companies located throughout Central Europe. These are interconnected by Ethernet to one system. Here the system tree in the software contains all 25 Central Data Collecting Units along with all devices connected to them.

Changes in the configuration of a system, such as installing and adding a new meter in most cases are carried out by the user himself: The modular software does not have to be changed for newly introduced data points.

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