Modular Construction System

MCS-System

These components fit together

- Design your own high quality Power Factor Correction System
- Type-tested components made in Germany
- High operational reliability of Power Factor Correction Systems
- Gain from 80 years experience in Power Factor Correction Technologies

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Description

The FRAKO MCS-System is a modular system, with which a skilled switchgear manufacturer can design a technically high-quality power factor correction system. However, knowing our “manual of power factor correction” is absolutely important to design such a power factor correction system. In this manual one will find all the necessary planning information as well as all the important technical data. You can download the manual free of charge from our website or order it free of charge from your local FRAKO partner.

The FRAKO MCS-System consists of selected and tested components for the design of power factor correction systems. FRAKO uses these components in its own production of power factor correction systems in Teningen. This way the skilled switchgear manufacturer can gain from an experience and application know-how of almost 80 years.

The FRAKO MCS-System contains the following components:

- Power factor control relay
- Control terminal strip for power factor control relay and Power Factor Correction Systems
- Control wires
- Busbar holders
- NH-fuse base and NH-isolating switch
- NH-fuse links
- Contactors
- Discharge reactors
- Harmonic filter reactors
- Power factor correction capacitors

Page 37 Specimen order 1 shows the combination of all FRAKO components for a power factor correction system with no harmonic filter reactors with a total power of 350 kvar at 400 V, 50 Hz and a step rating of 25 kvar at a switching sequence of the capacitor steps of: 1:1:2:2:2:2:2:2.

Page 38 Specimen order 2 shows the combination of all FRAKO components for a choked power factor correction system with a total power of 375 kvar at 400V, 50 Hz, a series resonance frequency of 189 Hz (p=7 %) and a step rating of 25 kvar at a switching sequence of the capacitor steps of: 1:2:2:2:2:2:2:2.

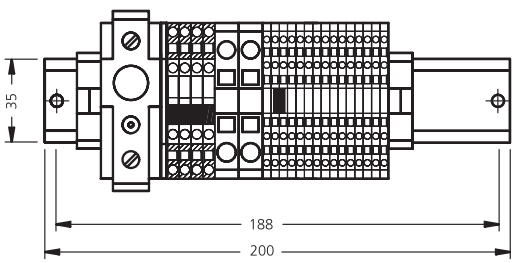
Technical Data

Power Factor Control Relays and accessories
For technical details on our power factor control relays we would like to refer you to our catalogue (page 29 to 32).

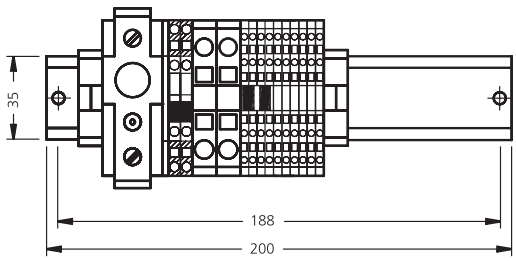
For the relays, FRAKO recommend to use the suitable control terminal strips, the thermal trip contact for the monitoring of the cabinet temperature as well as the prepared control cables. All items can be ordered as single components or as a complete control relay package.

The following chart shows the different types of relays as well as the suitable accessories for the assembly and the connection of the devices.

Article number:	Description:	Order Code:
	Power factor control relay	
38-00250	with 6 control contacts	RM 9806
38-00103	with 6 control contacts	RM 9606
38-00301	with 12 control contacts	EMR 1100 S
20-50008	with 12 control contacts and bus interface to FRAKO Energy-Management-System	EMR 1100
20-50013	Software-Upgrade EMR 1100 S to full version EMR 1100	
	Control terminal strip with thermal trip contact, pre-mounted	
34-80002	suitable for RM 9606	RKL–RM 9606
34-80003	suitable for EMR 1100 / EMR 1100 S	RKL–EMR 1100
34-80027	for extension units (only 12 control contacts)	RKL–Z–cabinet
	Control cable, prepared	
89-20557	for connection of RM 9606 with control terminal strip (1000 mm long, 6 control contacts)	RK RM 9606–1150
89-20558	for connection of RM 9606 with control terminal strip (1500 mm long, 6 control contacts)	RK RM 9606–1500
89-20555	for connection of EMR 1100 / EMR 1100 S with control terminal strip (1150 mm long 12 control contacts)	RK EMR 1100–1150
89-20556	for connection of EMR 1100 / EMR 1100 S with control terminal strip (1500 mm long, 12 control contacts)	RK EMR 1100–1500
89-20559	for connection of the “basic unit” with the “extension unit” (6 m long, 12 control contacts)	SS 12–6000
	Reactive power factor control relay package Completely assembled and tested units comprising: Power factor control relay with control terminal strip, thermal trip contact and relay cable, 1150 mm long	
34-72016	RM 9606, control terminal strip with thermal trip contact, cable 1150 mm long	STR–RM 9606
34-72024	EMR 1100 S, control terminal strip with thermal trip contact, cable 1150 mm long	STR–EMR 1100 S
34-72002	EMR 1100, control terminal strip with thermal trip contact, cable 1150 mm long	STR–EMR 1100



RKL-EMR 1100



RKL-RM 1100

// Technical Data

Copper busbar holders, NH-fuses

For the design of power factor correction systems FRAKO recommend to use the below-mentioned devices and fuses.

The busbar holders have a centre to centre distance of 60 mm to the single copper busbars. The copper busbars have either dimensions of 30x5 mm or 30x10 mm, depending on the total power of the power factor correction system.

Article-No.	Description
90-00046	Busbar holder with a bar centre to centre distance of 60 mm, Cu 30x10mm

90-00046

NH-isolating switch size 00. Applicable up to a mains rated voltage of 690 VAC. Available as NH-bus-mounting isolating switches for direct mounting on a busbar system with 60 mm bar centre to centre distance, or for mounting on mounting plates.

Article-No.	Description
90-00167	NH-isolating switch for plate mounting size 00, 160 A, 690 VAC
90-00166	NH-bus-mounting isolating switch size 00, 160 A, 690 VAC

90-00167

90-00166

To assemble reasonably priced power factor correction systems, NH-fuse holders size 00 up to a mains rated voltage of 690 VAC, can be used. These NH-fuse holders are also available as bus-mounting fuse holders for direct mounting on a busbar system with a bar centre to centre distance of 60 mm, or for mounting on mounting plates.

Article-No.	Description
90-00043	NH-bus-mounting fuse base size 00, 160 A, 690 VAC
90-00162	NH-fuse base for plate mounting size 00, 160 A, 690 VAC
90-00142	Cover for NH-fuses with nonisolated grip lugs

90-00043

90-00162

When operating the above mentioned devices, please note that special attention has to be paid to the corresponding safety regulations, especially the regulations concerning accident prevention!

Article-No.	Description
90-00061	D0-fuse NEOZED 2A, E14
90-00041	D0-fuse NEOZED 4A, E14
90-00092	D0-fuse NEOZED 6A, E14
90-00229	Fuse link with nonisolated metal grip lugs 25 A, 500 VAC
90-00062	Fuse link with isolated metal grip lugs 25 A, 500 VAC
90-00131	Fuse link with nonisolated metal grip lugs 35 A, 500 VAC
90-00056	Fuse link with isolated metal grip lugs 35 A, 500 VAC
90-00130	Fuse link with nonisolated metal grip lugs 50 A, 500 VAC
90-00055	Fuse link with isolated metal grip lugs 50 A, 500 VAC
90-00125	Fuse link with nonisolated metal grip lugs 63 A, 500 VAC
90-00054	Fuse link with isolated metal grip lugs 63 A, 500 VAC
90-00124	Fuse link with nonisolated metal grip lugs 80 A, 500 VAC
90-00053	Fuse link with isolated metal grip lugs 80 A, 500 VAC
90-00126	Fuse link with nonisolated metal grip lugs 100 A, 500 VAC
90-00052	Fuse link with isolated metal grip lugs 100 A, 500 VAC
90-00051	Fuse link with isolated metal grip lugs 125 A, 500 VAC
90-00050	Fuse link with isolated metal grip lugs 160 A, 500 VAC
90-00230	Fuse link with isolated metal grip lugs 35 A, 690 VAC
90-00132	Fuse link with isolated metal grip lugs 40 A, 690 VAC
90-00111	Fuse link with isolated metal grip lugs 50 A, 690 VAC
90-00133	Fuse link with isolated metal grip lugs 63 A, 690 VAC

Modular Construction System

These components fit together

Description

FRAKO MCS-System, Specimen order 1

Example: assembly of an unchoked power factor correction system with the following specification:

Total power: 350 kvar, 400V, 50 Hz
Step rating: 2x25 kvar and 6x50 kvar

12-step power factor control relay with switching times larger than 5 seconds.

1. Step:

The system has 7 switching stages and requires a 12-step power factor control relay. Please select a reactive power control relay package with relay EMR 1100S, consisting of the relay, temperature switch for the monitoring of the cabinet temperature, terminal strip with control system fuse and connecting cables.

2. Step:

The system requires 2 contactors for 25 kvar, 400 V, 50 Hz and 6 contactors for 50 kvar, 400 V, 50 Hz. Please select contactors with series resistors:

25 kvar steps: contactors type K3-32K00 Article-No.: 89-00278
50 kvar steps: contactors type K3-62K00 Article-No.: 89-00276

3. Step:

Choose the power factor correction capacitors: Please select standard power factor correction capacitors with a rated voltage of 400 V for a mains rated voltage of 400 V. For the 25 kvar step rating, depending on the construction and the available space, one can choose between 2 pcs. of LKT 12.5-400-DP, **or** 1 pc. of LKT 25.0-400-DP. For the 50 kvar step one can choose between 4 pcs. of LKT 12.5-400-DP **or** 2 pcs. of LKT 25-400-DP.
For the complete system one requires either 28 pcs. of capacitor LKT 12.5-400-DP **or** 14 pcs. LKT 25.0-400-DP.

4. Step:

The short switching times given, require a discharge of the capacitors by means of discharge reactors. For 25 and 50 kvar the same discharge reactor can be selected. The 7 capacitor steps require 7 discharge reactors.

5. Step:

One 25 kvar step has a rated current of 36.1 A at 400 V, 50 Hz. This requires a protection with a 50 A, gl fuse. One 50 kvar step has a rated current of 72.2 A at 400 V, 50 Hz. This requires a protection with a 100 A, gl fuse. For this system we would need altogether 6 pcs NH-fuses 50 A, 500 V, gl (Article-No. 90-00055) and 18 pcs NH-fuses 100 A, 500 V, gl (Article-No. 90-00052). FRAKO recommend to use NH-fuses with isolated grip lugs.

6. Step:

For the fuse links, NH-bus-mounting isolating switches size 00 (article-no. 90-00166) should be selected. For the 7 steps, 7 pcs. of bus-mounting isolating switches will be needed.

7. Step:

For the assembly of the busbar system FRAKO recommend a maximum space of 250 mm for the busbar holders. So 8 pieces of busbar holders are needed (article-no. 90-00046) for the busbar system.
Due to the total rated current of the system of 505 A, copper busbars with 30x10 mm are required.

8. Step:

ordering chart:

Qty	Article-No.	Description:
1	34-72024	complete power factor control relay package EMR 1100S
2	89-00278	contactor K3-32K00
6	89-00276	contactor K3-62K00
28	31-10502	capacitor LKT 12.5-400-DP
7	88-02013	discharge reactor
6	90-00055	NH-fuse size 00, 50 A, 500 V, gl
18	90-00052	NH-fuse size 00, 100 A, 500 V, gl
7	90-00166	NH-bus-mounting isolating switch size: 00, 160 A
8	90-00046	busbar holder, 60 mm, 30x10 mm

Modular Construction System

These components fit together

Description

FRAKO MCS-System, Specimen order 2

Example: assembly of a power factor correction system with the following specification:

Total power: 375 kvar, 400 V, 50 Hz, series resonance frequency of 189 Hz (7 %)
Step rating: 1x25 kvar and 7x50 kvar
Power factor control relay with 12 control contacts.

1. Step:

The system has 8 switching stages and requires a 12-step power factor control relay. We select a complete power factor control relay package with a relay EMR 1100S, consisting of the relay, temperature switch for the monitoring of the cabinet temperature, clamp with control fuse and connecting cables.

2. Step:

The system requires one contactor for 25 kvar, 400 V, 50 Hz and 7 contactors for 50 kvar, 400 V, 50 Hz. Please select contactors without series resistors.
25 kvar step: contactor type K3-32A00, Article-No.: 89-00290
50 kvar steps: contactors type K3-62A00, Article-No.: 89-00292

3. Step:

Choose the power factor correction capacitors: Please select standard power factor correction capacitors with a rated voltage of 440 V or superior capacitors with a rated voltage of 400 V for a mains rated voltage of 400 V. For the 25 kvar step rating we need 2 pcs. of LKT 11.7-400-DL. For the 50 kvar step we need 4 pcs. of LKT 11.7-400-DL.

4. Step:

The short switching times given, require a discharge of the capacitors by means of discharge reactors. For 25 and 50 kvar the same discharge reactor can be selected. The 8 capacitor steps require 8 discharge reactors.

5. Step:

One 25 kvar step has a rated current of 36.1 A at 400 V, 50 Hz. This requires a protection with a 50 A, gl fuse. One 50 kvar step has a rated current of 72.2 A at 400 V, 50 Hz. This requires a protection with a 100 A, gl fuse. For this system we would need altogether 3 pcs NH-fuses 50 A, 500 V, gl Article-No. 90-00055 and 21 pcs NH-fuses 100 A, 500 V, gl Article-No. 90-00052. FRAKO recommends to use NH-fuses with isolated grip lugs.

6. Step:

For the fuse links, NH-bus-mounting isolating switches size 00 Article-No. 90-00166 should be selected. For the 8 steps, 8 pcs. NH-bus-mounting isolating switches would be needed.

7. Step:

For the assembly of a busbar system FRAKO recommend a maximum space of 250 mm for the busbar holders. So 8 pieces of busbar holders are needed (Article-No. 90-00046) for the busbar system.

8. Step:

ordering chart:

Qty	Article-No.	description:
1	34-72024	power factor control relay package EMR 1100S
1	89-00290	contactor K3-32A00
7	89-00292	contactor K3-62A00
30	31-10604	capacitor LKT 11.7-400-DL
8	88-02013	discharge reactor
3	90-00055	NH-fuse size 00, 50 A, 500 V, gl
21	90-00052	NH-fuse size 00, 100 A, 500 V, gl
8	90-00166	NH-bus-mounting-isolating switch size 00, 160 A
8	90-00046	busbar holder, 60 mm, 30x10 mm