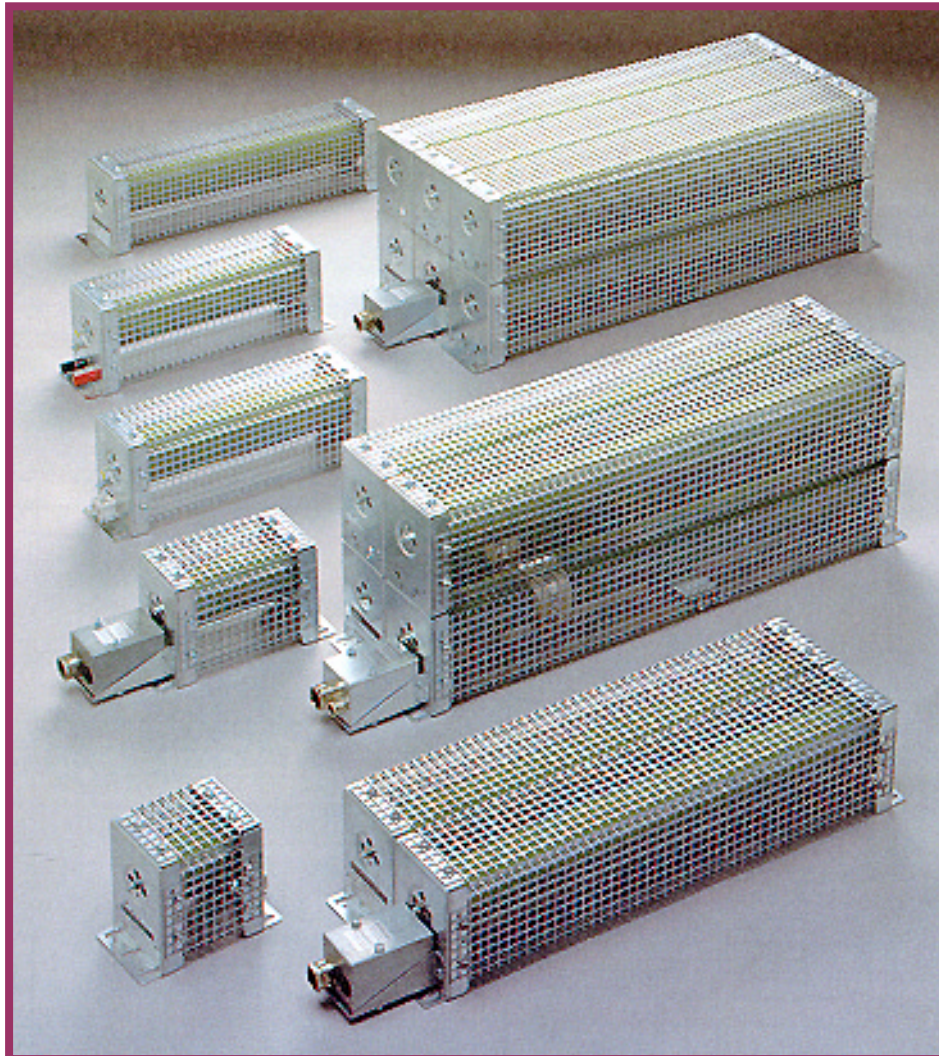


# Σ SIGMA

## Modular Wire Wound Brake Resistors



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# Σ SIGMA - Modular Wire Wound Brake

**SIGMA** is our range of **MODULAR BRAKE RESISTORS**. Thanks to the modular construction it is possible also at small quantities to supply an optimum solution to any problem concerning start- or brake resistors in connection with frequency converters.

The resistor components consist of fully welded wire wound ceramic resistors, which is a well-known and approved technology.

The base material is corderite, which is a type of ceramic with a very high resistance to temperature changes and the wire is coated with aluminium phosphate to protect the wire and conduct the heat developed in the wire on to the ceramic core. Aluminium-phosphate is stable at 700°C.

The modular resistor cages comply with IP20 and give electrical and thermal protection

The resistors have a nominal load from 100W and upward and are particularly suitable for pulse load of 10 – 20 time or more compared to the nominal load because of the ceramic core material and an extra high weight of wire.

We have developed **thermal models** corresponding to all resistor types and resistor values. By using these models we are able to calculate the temperature rises in the resistor wire for all possible load situations. Danotherm offers our assistance to our customers to find the optimum solution for any situation.

Each **SIGMA-MODULE** is supplied with resistor components corresponding to the actual load and according to the mechanical sizes shown in the table. In principle as many components as necessary can be mounted together.

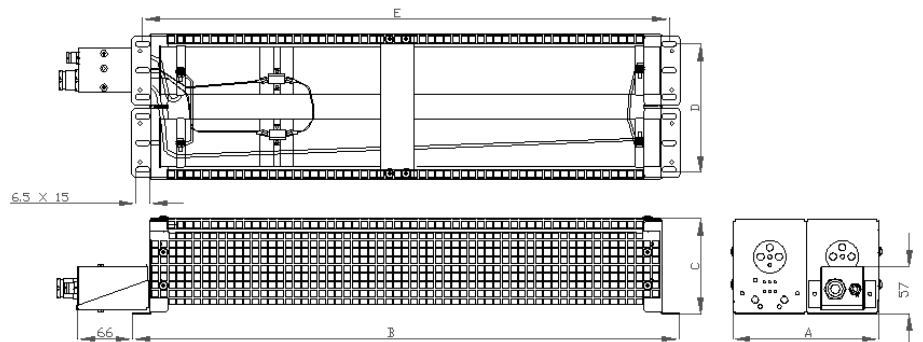
The modules can be supplied as open resistors (only resistor and mounting brackets) or with protection grating according to IP20 and with a ceramic housing connector or with a connector box. Further more it is possible to have a thermostat which works as a temperature watch and high voltage versions >400VDC.

## Thermostats

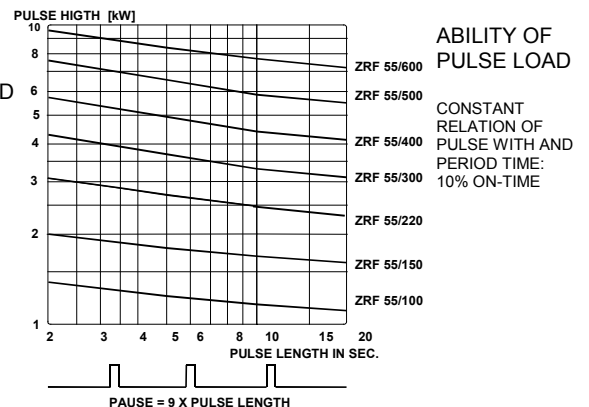
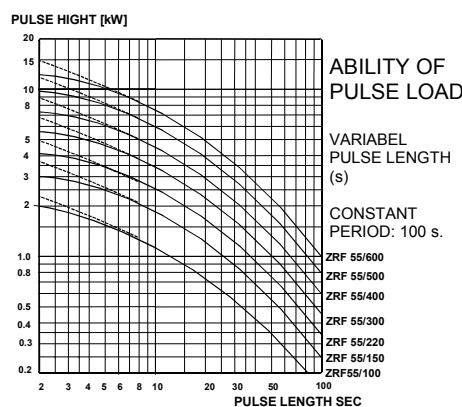
The thermostat, which surveys the temperature on the resistor element, is equipped with a NC switch for warning the frequency converter if the resistor is over loaded.

It is mounted on lower side of one or more resistor elements and has directly thermal contact. The standard switching temperature is 260°C. Other (lower) temperatures are possible. If the thermostat is connected to the coil of a contactor, it can work as a thermal fuse. The switch is specified to 250/380VAC, 10/5A.

The thermostat is isolated from the resistor via the ceramic housing. For voltages >400VDC the thermostat is isolated with a double MICA strip.



Type	Weight	Ohmic Value Rmin – Rmax	Number of Resistors	Nominal Load	Pulse Load 10% E.D. 10 sec	Width A	Length B	High C	Mount. Holes D	Mount. Holes E
	Kg	mΩ- KΩ		W	kW	mm	mm	mm	mm	mm
ZRF 20 / 140 OX1	0.8	180 - 82	1	100	0,55	89	210	115	64	186
ZRF 30 / 152 OX1	1.0	120 - 82	1	150	0,92	89	210	115	64	186
<b>ZRF 55 / 100 OX1</b>	<b>1.1</b>	<b>120 - 47</b>	<b>1</b>	<b>180</b>	<b>1,25</b>	<b>89</b>	<b>160</b>	<b>115</b>	<b>64</b>	<b>135</b>
ZRF 55 / 100 OX2	1.7		2	360	2,50	176	160	115	150	135
ZRF 55 / 100 OX3	2.5		3	540	3,60	265	160	115	240	135
ZRF 55 / 100 OX4	3.2		4	570	4,10	176	160	230	150	135
ZRF 55 / 100 OX6	4.6		6	850	6,10	265	160	230	240	135
<b>ZRF 55 / 150 OX1</b>	<b>1.2</b>	<b>270 - 56</b>	<b>1</b>	<b>250</b>	<b>1,70</b>	<b>89</b>	<b>210</b>	<b>115</b>	<b>64</b>	<b>186</b>
ZRF 55 / 150 OX2	2.0		2	500	3,40	176	210	115	150	186
ZRF 55 / 150 OX3	3.2		3	750	5,00	265	210	115	240	186
ZRF 55 / 150 OX4	3.8		4	800	5,80	176	210	230	150	186
ZRF 55 / 150 OX6	5.7		6	1200	8,70	265	210	230	240	186
<b>ZRF 55 / 220 OX1</b>	<b>2.1</b>	<b>560 - 75</b>	<b>1</b>	<b>330</b>	<b>2,60</b>	<b>89</b>	<b>270</b>	<b>115</b>	<b>64</b>	<b>246</b>
ZRF 55 / 220 OX2	2.9		2	650	5,20	176	270	115	150	246
ZRF 55 / 220 OX3	4.1		3	1000	7,80	265	270	115	240	246
ZRF 55 / 220 OX4	5.0		4	1100	8,60	176	270	230	150	246
ZRF 55 / 220 OX6	7.2		6	1500	12,50	265	270	230	240	246
<b>ZRF 55 / 300 OX1</b>	<b>2.2</b>	<b>680 - 100</b>	<b>1</b>	<b>450</b>	<b>3,60</b>	<b>89</b>	<b>350</b>	<b>115</b>	<b>64</b>	<b>326</b>
ZRF 55 / 300 OX2	3.5		2	900	7,20	176	350	115	150	326
ZRF 55 / 300 OX3	5.1		3	1300	10,80	265	350	115	240	326
ZRF 55 / 300 OX4	6.3		4	1500	12,00	176	350	230	150	326
ZRF 55 / 300 OX6	9.0		6	2200	18,00	265	350	230	240	326
<b>ZRF 55 / 400 OX1</b>	<b>2.4</b>	<b>1000 - 150</b>	<b>1</b>	<b>600</b>	<b>4,80</b>	<b>89</b>	<b>450</b>	<b>115</b>	<b>64</b>	<b>426</b>
ZRF 55 / 400 OX2	4.2		2	1200	9,60	176	450	115	150	426
ZRF 55 / 400 OX3	5.6		3	1800	14,40	265	450	115	240	426
ZRF 55 / 400 OX4	7.6		4	2000	16,00	176	450	230	150	426
ZRF 55 / 400 OX6	11		6	3000	24,00	265	450	230	240	426
<b>ZRF 55 / 500 OX1</b>	<b>3.0</b>	<b>1200 - 180</b>	<b>1</b>	<b>800</b>	<b>5,80</b>	<b>89</b>	<b>550</b>	<b>115</b>	<b>64</b>	<b>526</b>
ZRF 55 / 500 OX2	4.6		2	1600	11,60	176	550	115	150	526
ZRF 55 / 500 OX3	7.2		3	2400	17,40	265	550	115	240	526
ZRF 55 / 500 OX4	8.9		4	2600	19,00	176	550	230	150	526
ZRF 55 / 500 OX6	13.2		6	3800	28,50	265	550	230	240	526
<b>ZRF 55 / 600 OX1</b>	<b>3.5</b>	<b>1500 - 200</b>	<b>1</b>	<b>1000</b>	<b>7,00</b>	<b>89</b>	<b>650</b>	<b>115</b>	<b>64</b>	<b>626</b>
ZRF 55 / 600 OX2	5.8		2	2000	14,00	176	650	115	150	626
ZRF 55 / 600 OX3	7.6		3	3000	21,00	265	650	115	240	626
ZRF 55 / 600 OX4	10.4		4	3200	22,50	176	650	230	150	626
ZRF 55 / 600 OX6	15		6	5000	34,00	265	650	230	240	626

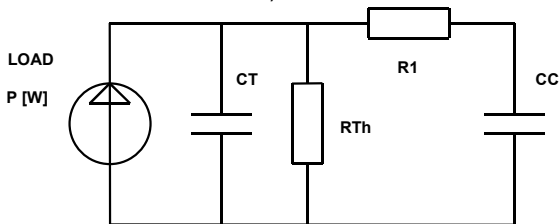


# Σ SIGMA - Modular Wire Wound Brake

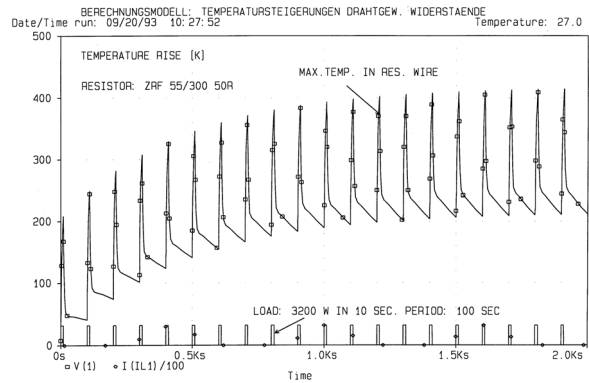
## PULSE LOAD SIMUATIONS

For all our resistor components DANOTHERM can supply a thermal model as an equivalent circuit. With this model it is possible by using standard software (like. PSpice) to calculate temperature rises in the resistor during any pulse load. By using this tool Danotherm will always be able to offer the optimum Σ-brake resistor. **Please contact Danotherm for assistance.**

**THERMAL EQUIVALENT CIRCUIT OF A Σ BRAKE RESISTOR (SHOWN WITH TWO TIME CONSTANTS)**



CT: THERMAL CAPACITY OF WIRE [Ws/K]  
 CC: THERMAL CAPACITY OF CERAMIC CORE [Ws/K]  
 RTh: THERMAL RESISTANCE, COMPONENT / AIR [K/W]  
 R1: INTERNAL THERMAL RESISTANCE [K/W]



R	ZRF 55/100 CC=160Ws/K RTh=2.08K/W		ZRF 55/150 CC=240Ws/K RTh=1.39K/W		ZRF 55/220 CC=350Ws/K RTh=0.96K/W		ZRF 55/300 CC=480Ws/K RTh=0.70K/W		ZRF 55/400 CC=640Ws/K RTh=0.52K/W		ZRF 55/500 CC=800Ws/K RTh=0.42K/W		ZRF 55/600 CC=960Ws/K RTh=0.36K/W	
	W	CT Ws/ K	R1 K/W	CT Ws/K	R1 K/W	CT Ws/K	R1 K/W	CT Ws/K	R1 K/W	CT Ws/K	R1 K/W	CT Ws/K	R1 K/W	CT Ws/K
10	4.2	.2	8.2	0.14	18	0.092	30	0.069	45	0.051	58	0.022	60	0.016
20	4.0	.21	8.4	0.13	12	0.093	22	0.067	37	0.05	54	0.023	55	0.02
50	2.7	.23	5.8	0.13	12	0.088	23	0.066	29	0.047	49	0.04	75	0.035
100	2.2	.19	5.5	0.13	9.6	0.085	19	0.065	26	0.047	47	0.038	47	0.033
200	1.8	.18	4.5	0.13	7.6	0.085	18	0.061	23	0.046	39	0.037	47	0.033
300	1.7	.18	3.6	0.12	6.7	0.084	11	0.061	18	0.046	28	0.037	39	0.032
500	1.2	.18	2.9	0.12	6	0.082	11	6.06	16	0.045	19	0.037	30	0.03
1000	.75	.18	2.4	0.12	5.2	0.082	9.2	0.058	12	0.044	15	0.036	22	0.03

By ordering please give us the following information:

- Resistor value
- P<sub>MAX</sub> (Max. Pulse load in kW)
- Pulse with in sec. (square load)
- Pulse shape (other than square)
- Period time or frequency
- Working voltage and
- Version according to the TYPE IDENTIFICATION

### MATERIALS :

Only the best materials have been used when producing the resistors and they need no particular service in use.

### Resistor:

Ceramic Core: 20-30 mm Ø Steatite C221  
 55 mm Ø Corderite

Resistor Wire: CrAlFe / CrNi / CuNi

Terminals: FeNi42

Coating: Aluminiumphosphate

### Resistor Cage:

Mounting Bracket: Steel, hot galvanised 1,5mm

Protection grating: Steel, hot galvanised 1,5mm, perforated

Connectors: Porcelain

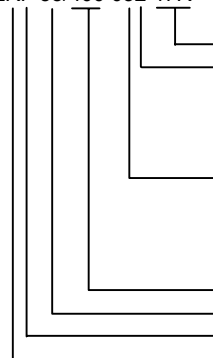
Cables: Silicone (Silicone less possible)

### Resistor tolerance:

Standard: ± 10%

### TYPE IDENTIFICATION:

ZRF 55/400 032 47R



Resistor value (F.eks. 47Ω)  
 Number of resistor elements

1: MB

2: MB + PC

3: MB + PC + PG

4: MB + PC + PG + TW

5: MB + PC + PG + CB

6: MB + PC + PG + CB + TW

7: like 5, but with Connector for >400VDC

8: like 6, but with connector for >400VDC

Length of resistor element

Diameter of resistor element

F: Normally Wire wound; I: Non-inductive

R: Standard; B: Edgewound

MB: Mounting Bracket PC: Porcelain connector PG: Protecting Grating TW: Temperature Watch CB: Connector Box

### Examples of type names of Σ modules:

- ZRF 55/X00 02X is a resistor module with mounting brackets and porcelain connector and X resistors.
- ZRF 55/X00 06X is a resistor module with protection grating, connector box and thermostat.



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