Monitoring Technique

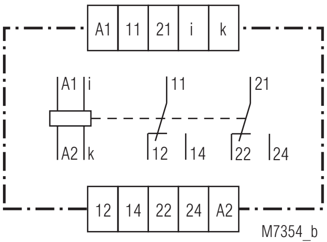
VARIMETER
Current Relay
BA 9053, MK 9053N

DOLD

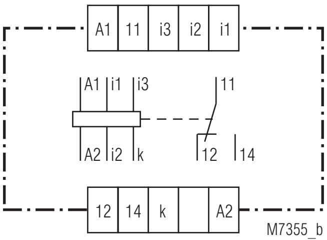
0221540

BA 9053 MK 9053N

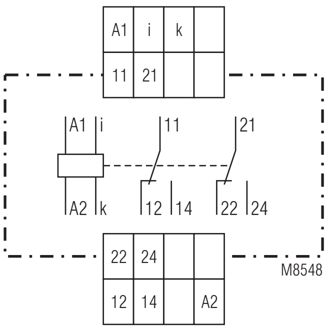
Circuit Diagrams



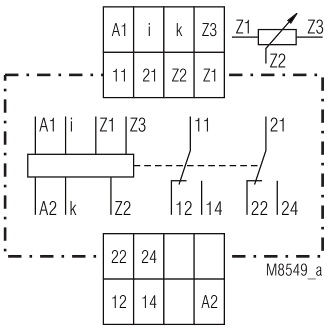
BA 9053



BA 9053/4_ _ z. B.:
Terminals i1/k: 0.1 ... 1 A
Terminals i2/k: 0.5 ... 5 A
Terminals i3/k: 1 ... 10 A



MK 9053N



MK 9053N/1_ _

Connection Terminals

Terminal designation	Signal designation
A1, A2	Auxiliary voltage
i, k	Current measuring input
11, 12, 14	1st changeover contact
21, 22, 24	2nd changeover contact

Your Advantages
- Preventive maintenance
- For better productivity
- Quicker fault locating
- Precise and reliable

Features
- According to IEC/EN 60 255, DIN VDE 0435-303, IEC/EN 60 947-1
- to: monitor DC and AC
- BA 9053 with measuring ranges from 2 mA to 25 A
- BA 9053 optionally with 3 measuring ranges 0.1 up to 25 A
- MK 9053N with measuring ranges from 2 mA up to 10 A
- High overload possible
- Input frequency up to 5 kHz
- Galvanic separation between auxiliary circuit - measuring ciruit
- Auxiliary supply AC/DC; BA 9053 with AC
- BA 9053 optionally with start-up delay (MK = standard)
- with time delay, up to max. 100 sec
- BA 9053 optionally with safe separation to IEC/EN 61140
- **As option with manual reset**
- MK 9053N optionally with remote potentiometer
- LED indicators for operation and contact position
- MK 9053N as option with pluggable terminal blocks for easy exchange of devices
  - with screw terminals
  - or with cage clamp terminals
- Width BA 9053: 45 mm
  Width MK 9053N: 22.5 mm

Approvals and Markings

CE
c UL us *
Canada / USA
CCC
A025518

* see variants

Applications

Monitoring current in AC or DC systems

Function

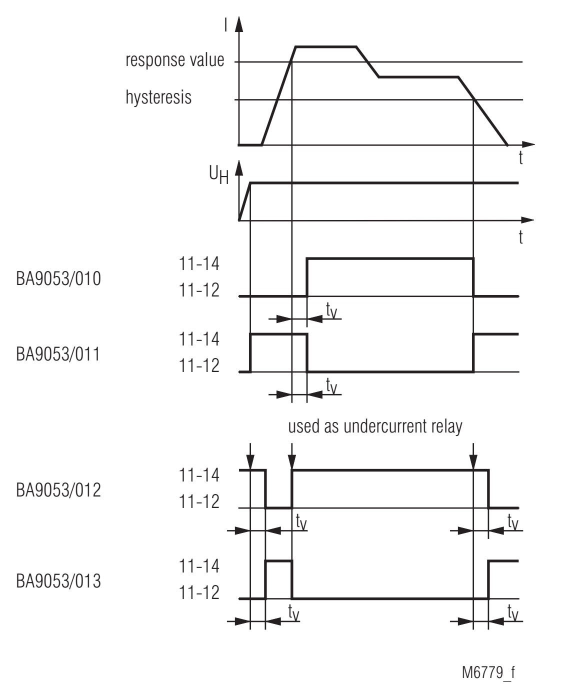
The relays measure the arithmetic mean value of the rectified measuring current. The AC units are adjusted to the r.m.s value. They have settings for response value and hysteresis. The units work as overcurrent relays but can also be used for undercurrent detection. The hysteresis is dependent on the response value.

2 time delays are possible in different variants:
The start up delay t_a operates only when connecting the auxiliary supply. It disables tripping e.g. caused by an increased starting current of a motor. The response delay t_v is active after exceeding a response value. On overcurrent relays the delay is active when the current goes over the tripping value, on undercurrent relays when the current drops below the hysteresis value.

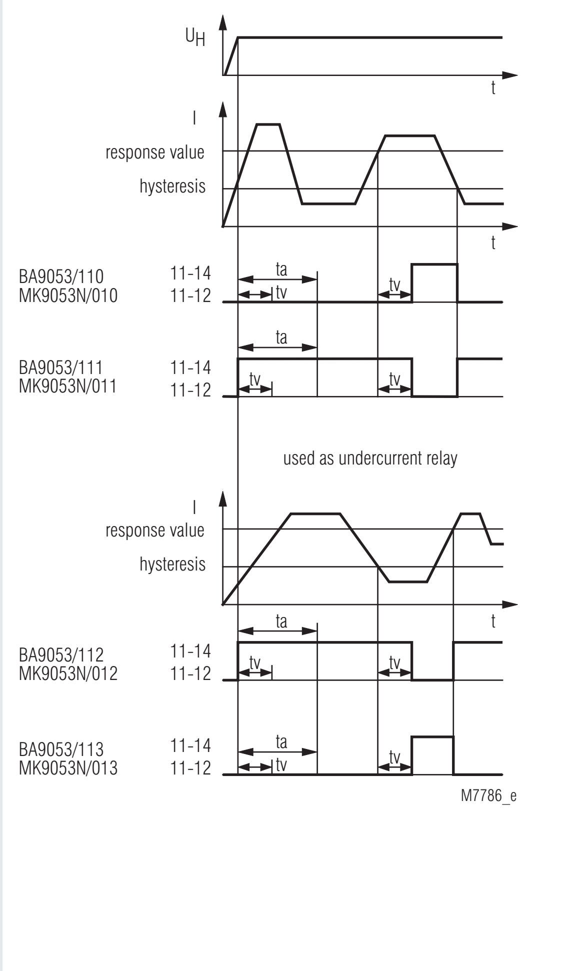
Indicators

green LED: on, when auxiliary supply connected
yellow LED: on, when output relay acitvated

Function Diagram without Start-up Delay



Function Diagram with Start-up Delay



On model BA 9053/6_ _ with manual reset the contacts remain in the fault state after detecting a fault or after to has elapsed. The contacts are reset by disconnecting the supply voltage.

Technical Data

Input (i, k)

BA 9053 for AC **a n d** DC				
Measuring range*)		internal resis-tance	max. perm. cont. current	max. permiss. current 3 s On, 100 s Off
AC	DC		Device mounted without distance	
2 - 20 mA	1.8 - 18 mA	1.5 Ω	0.7 A	1 A
20 - 200 mA	18 - 180 mA	0.15 Ω	2 A	4 A
30 - 300 mA	27 - 270 mA	0.1 Ω	2.5 A	8 A
50 - 500 mA	45 - 450 mA	0.1 Ω	2.5 A	8 A
80 - 800 mA	72 - 720 mA	40 mΩ	4 A	12 A
0.1 - 1 A	0.09 - 0.9 A	30 mΩ	4 A	12 A
0.5 - 5 A	0.45 - 4.5 A	6 mΩ	10 A	30 A
1 - 10 A	0.9 - 9 A	3 mΩ	20 A	40 A
1.5 - 15 A	1.35 - 13.5 A	3 mΩ	25 A	40 A
2 - 20 A	1.8 - 18 A	3 mΩ	25 A	40 A
2.5 - 25 A	2.25 - 22.5 A	3 mΩ	25 A	40 A

* DC or AC current 50 ... 5000 Hz
(other frequency ranges of 10 ... 5000 Hz, e.g. 16 $^2/_3$ Hz on request)

BA 9053/4_ _ with 3 measuring ranges:				
Range:		**Terminals i1/k**	**Terminals i2/k**	**Terminals i3/k**
AC 20 mA / 200 mA / 1A:	AC	AC 2.0 ... 20 mA	AC 20 ... 200 mA	AC 0.1 ... 1 A
	DC	DC 1.8 ... 18 mA	DC 18 ... 180 mA	DC 0.09 ... 0.9 A
AC 1 / 5 / 10A:	AC	AC 0.1 ... 1 A	AC 0.5 … 5 A	AC 1.0 ... 10 A
	DC	DC 0.09 ... 0.9 A	DC 0.45 ... 4.5 A	DC 0.9 ... 9 A
AC 5 / 10 / 25A:	AC	AC 0.5 ... 5 A	AC 1.0 ... 10 A	AC 2.5 ... 25 A
	DC	DC 0.45 ... 4.5 A	DC 0.9 ... 9 A	DC 2.25 ... 22.5 A

MK 9053N with 1 Measuring range for AC **a n d** DC					
Measuring rang*)		internal resis-tance	max. perm. cont. current		max. permiss. current 3 s On, 100 s Off
AC	DC		Device mount. without distance	with 5 mm dis-tance	
2 - 20 mA	1.8 - 18 mA	1.5 Ω	0.5 A	0.7 A	1 A
20 - 200 mA	18 - 180 mA	0.15 Ω	1.5 A	2 A	4 A
30 - 300 mA	27 - 270 mA	0.1 Ω	2 A	2.5 A	8 A
50 - 500 mA	45 - 450 mA	0.1 Ω	2 A	2.5 A	8 A
0.1 - 1 A	0.09 - 0.9 A	30 mΩ	3 A	4 A	8 A
0.5 - 5 A	0.45 - 4.5 A	6 mΩ	8 A	11 A	20 A
1 - 10 A	0.9 - 9 A	3 mΩ	12 A	15 A	20 A

* DC or AC current 50 ... 5000 Hz
(Other frequency ranges of 10 ... 5000 Hz, e.g. 16 $^2/_3$ Hz on request)

Extending of measuring range: For DC-current higher then the highest measuring range the voltage relay BA 9054 or MK 9054N measuring range 15 ... 150 mV or 6 ... 60 mV can be used with external Shunt.
For AC current higher then the highest measuring range can be used a current transformer e. g. with secondary winding of 1 A or 5 A togehter with BA 9053 or MK 9053N. The nominal load of the CT should be ≥ 0.5 VA.

Measuring principle: arithmetic mean value

Adjustment: The AC - devices can also monitor DC current. The scale offset in this case is: ($I = 0.90\ I_{eff}$)

Temperature influence:: < 0.05 % / K

Technical Data

Setting Ranges

Setting

Response value: infinite variable 0.1 I_N ... 1 I_N relative scale

Hysteresis
at AC: infinite variable 0.5 ... 0.98 of setting value
at DC: infinite variable 0.5 ... 0.96 of setting value

Accuracy:
Response value at
Potentiometer right stop (max): 0 .... + 8 %
Potentiometer left stop (min): - 10 .... + 8%

Repeat accuracy: ≤ ± 0.5 %

Recovery time
at devices with manual reset (Reset by braking of the auxiliary voltage)
BA 9053/6_ _; MK 9053N/6_ _: ≤ 1 s (dependent to function and auxiliary voltage)

Time delay t_v: infinite variable at logarythmic scale from 0 ... 20 s, 0 ... 30 s, 0 ... 60 s, 0 ... 100 s
setting 0 s = without time delay

Start-up delay t_a:
BA 9053/1 _ _: 1 ... 20 s; 1 ... 60 s; 1 ... 100 s, adjustable on logarithmic scale.
t_a is started when the supply voltage is connected. During elapse of time the output contact is in good state
MK 9053N: 0.1 ... 20 s; 0.1 ... 60 s; 0.1 ... 100 s

Auxiliary Circuit BA 9053 and MK 9053N

Auxiliary voltage U_H (A1, A2)
BA 9053, Nominal voltages: AC 24, 42, 110, 127, 230, 400 V
Voltage range: 0.8 ... 1.1 U_H
Nominal frequency: 50 / 60 Hz
Frequency range: ± 5 %
Nominal consumption: 2.5 VA

BA 9053:		
Nominal voltage	**Voltage range**	**Frequency range**
AC/DC 24 ... 80 V	AC 18 ... 100 V	45 … 400 Hz; DC 48 % W
	DC 18 ... 130 V	W ≤ 5 %
AC/DC 80 ... 230 V	AC 40 ... 265 V	45 … 400 Hz; DC 48 % W
	DC 40 ... 300 V	W ≤ 5 %
DC 12 V	DC 10 ... 18 V	battery voltage

MK 9053N:		
Nominal voltage	**Voltage range**	**Frequency range**
AC/DC 24 ... 80 V	AC 18 ... 100 V	45 … 400 Hz; DC 48 % W
	DC 18 ... 130 V	W ≤ 5 %
AC/DC 80 ... 230 V	AC 60 ... 265 V	45 … 400 Hz; DC 48 % W
	DC 60 ... 300 V	W ≤ 5 %

Nominal consumption: 4 VA; 1.5 W at AC 230 V Rel. energized
1 W at DC 80 V Rel. energized

Technical Data

Output

Contacts

BA 9053:	2 changeover contacts	
MK 9053N:	2 changeover contacts	
Thermal current I_{th}:		
BA 9053:	2 x 5 A	
MK 9053N:	2 x 4 A	
Switching capacity		
BA 9053		
to AC 15:		
NO contact:	2 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
MK 9053N		
to AC 15:	1.5 A / AC 230 V	IEC/EN 60 947-5-1
BA 9053, MK 9053N		
to DC 13:	1 A / DC 24 V	IEC/EN 60 947-5-1
Electrical life		
BA 9053		
to AC 15 at 3 A, AC 230 V:	5 x 10^5 switch. cycl.	IEC/EN 60 947-5-1
MK 9053N		
to AC 15 at 3 A, AC 230 V:	10^5 switching cycles	IEC/EN 60 947-5-1
Short-circuit strength		
max. fuse rating:	6 AgL	IEC/EN 60 947-5-1
Mechanical life		
BA 9053:	50 x 10^6 switching cycles	
MK 9053N:	30 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range:		
BA 9053:		
≤ 10 A:	- 40 ... + 60°C	
≥ 15 A:	- 40 ... + 50°C	
MK 9053N:	- 20 ... + 50°C	
Clearance and creepage distances		
rated impulse voltage / pollution degree		
BA 9053 meas. range ≤ 10 A:	6 kV / 2	IEC 60 664-1
BA 9053 meas. range ≥ 15 A:	4 kV / 2	IEC 60 664-1
MK 9053N:	4 kV / 2	IEC 60 664-1
EMC tested according to railway standard EN 50155		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation		
80 MHz ... 1 GHz:	20 V/m	IEC/EN 61 000-4-3
1 GHz ... 2.7 GHz:	10 V/m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages		
between		
wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance		
BA 9053		
≤ 10 A:	40 / 060 / 04	IEC/EN 60 068-1
≥ 15 A:	40 / 050 / 04	IEC/EN 60 068-1
MK 9053N:	20 / 060 / 04	IEC/EN 60 068-1

Technical Data

Terminal designation:	EN 50 005	
Wire connection		
BA 9053:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded wire with sleeve	
MK 9053N:		
Screw terminals (integrated):	1 x 4 mm² solid or 1 x 2.5 mm² stranded ferruled (isolated) or 2 x 1.5 mm² stranded ferruled (isolated) or 2 x 2.5 mm² solid	
Insulation of wires or sleeve length:	8 mm	
Plug in with screw terminals		
max. cross section for connection:	1 x 2.5 mm² solid or 1 x 2.5 mm² stranded ferruled (isolated)	
Insulation of wires or sleeve length:	8 mm	
Plug in with cage clamp terminals		
max. cross section for connection:	1 x 4 mm² solid or 1 x 2.5 mm² stranded ferruled (isolated)	
min. cross section for connection:	0.5 mm²	
Insulation of wires or sleeve length:	12 $^{\pm 0.5}$ mm	
Wire fixing:		
BA 9053:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
MK 9053N:	Plus-minus terminal screws M3.5 box terminals with wire protection or cage clamp terminals	
Mounting:	DIN-rail	IEC/EN 60 715
Weight		
BA 9053:	AC-device: 280 g AC/DC-device: 200 g	
MK 9053N:	150 g	

Dimensions

Width x height x depth	
BA 9053:	45 x 75 x 120 mm
MK 9053N:	22.5 x 90 x 97 mm

UL-Data

Auxiliary voltage U_H(A1, A2)		
BA 9053:	AC 24, 42, 48, 110, 115, 120 V	
Thermal current I_{th}:		
BA 9053:	2 x 5 A	
MK 9053N:	2 x 4 A	
Clearance and creepage distances		
BA 9053, MK 9053N:	4 kV / 2	IEC 60 664-1
HF irradiation		
BA 9053 (80 MHz ... 2.7 GHz)	10 V/m	IEC/EN 61 000-4-3
Switching capacity:	Pilot duty B150	
Ambient temperature:	- 40 ... + 60°C	

Technical data that is not stated in the UL-Data, can be found in the technical data section.

CCC-Data

Switching capacity		
to AC 15:	1.5 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:	1 A / DC 24 V	IEC/EN 60 947-5-1

Technical data that is not stated in the CCC-Data, can be found in the technical data section.

Standard Types

BA 9053/010 AC 0.5 ... 5 A AC 230 V
Article number: 0053128
- for Overcurrent monitoring
- Measuring range: AC 0.5 ... 5 A
- Auxiliary voltage U_H: AC 230 V
- Time delay by I_{an}: 0 ... 20 s
- Width: 45 mm

BA 9053/012 AC 0.5 ... 5 A AC 230 V
Article number: 0053192
- for Undercurrent monitoring
- Measuring range: AC 0.5 ... 5 A
- Auxiliary voltage U_H: AC 230 V
- Time delay by I_{ab}: 0 ... 20 s
- Width: 45 mm

MK 9053N.12/010 AC 0.5 ... 5 A AC/DC 80 ... 230 V t_v 0 ... 20 s t_a 0.1 ... 20 s
Article number: 0063176
- for Overcurrent monitoring
- Measuring range:: AC 0.5 ... 5 A
- Auxiliary voltage U_H: AC/DC 80 ... 230 V
- Time delay by t_v: 0 ... 20 s
- Start up delay t_a: 0.1 ... 20 s
- Width: 22.5 mm

Ordering example for variants

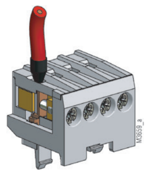
BA 9053 /_ _ _ /61 AC 1 ... 10 A AC 24 V 0 ... 20 s 1 ... 100 s

- Start up delay t_a
- Time delay t_v
- Auxiliary voltage
- Measuring range
- With UL-approval
- 10 Overcurrent relay energized on trip time delay at setting value
  11 Overcurrent relay de-energized on trip time delay at setting value
  12 Undercurrent relay energized on trip time delay at hysteresis value
  13 Undercurrent relay de-energized on trip time delay at hysteresis value
- 0 Standard version
  1 With start up delay t_a
  2 With safe electrical separation of input- and output circuit accroding to DIN 61140
  Meas. range up to ≤ 10 A: DIN EN 60947-1; 4 kV/2 in relation of over-voltage category III with basic insulation to DIN EN 60664-1 of 4 kV;
  Meas. range up to ≥ 15 A: overvoltage category II with basic insulation of 2.5 kV
  3 With 5 µm gold plated contacts
  4 With 3 current ranges 1 C/O contact
  431 With 3 current ranges 1 C/O contact, with safe separation up to 10 A
  5 With forcibly guided contacts
  6 With manual reset, resetting by disconnecting the power supply
- Type

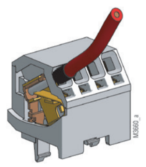
MK 9053N _ _/_ _ _ AC 0,1 ... 1 A AC 230 V 0 ... 20 s 0,1 ... 20 s

- Start up delay t_a
- Time delay t_v
- Auxiliary voltage
- Measuring range
- 10 Overcurrent relay energized on trip
  11 Overcurrent relay de-energized on trip
  12 Undercurrent relay energized on trip
  13 Undercurrent relay de-energized on trip
- 0 Standard version without remote potentiometer
  1 Standard version with remote poten-tiometer (response-value) Z1, Z2, Z3 for 470 kΩ **at this version there is no potentiometer for the response value**
  6 With manual reset, resetting by disconnecting the power supply
- Type of terminals
  Without indication: terminal blocks fixed, with screw terminals
  PC (plug in cage clamp): pluggable terminal blocks with cage clamp terminals
  PS (plug in screw): pluggable terminal blocks with screw terminals
- Type

Options with Pluggable Terminal Blocks



Screw terminal
(PS/plugin screw)

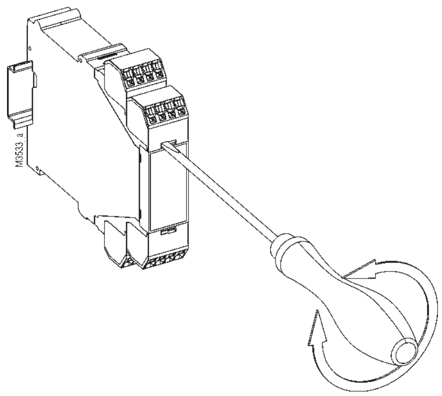


Cage clamp
(PC/plugin cage clamp)

Notes

Removing the terminal blocks with cage clamp terminals

1. The unit has to be disconnected.
2. Insert a screwdriver in the side recess of the front plate.
3. Turn the screwdriver to the right and left.
4. Please note that the terminal blocks have to be mounted on the belonging plug in terminations.



Accessories

AD 3:	Remote potnetiometer 470 KΩ (article number 0050174)

Setting

Example:
Current relay BA 9053 / MK 9053N AC 0.5 ... 5 A

AC according to type plate:
i.e. the unit is calibrated for AC
0.5 ... 5 A = measuring range

Response value AC 3 A
Hysteresis AC 1.5 A

Settings:

upper potentiometer:	0.6	(0.6 x 5 A = 3 A)
lower potentiometer:	0.5	(0.5 x 3 A = 1.5 A)

The AC - devices can also monitor DC current. The scale offset in this case is: $\overline{I} = 0.90 \times I_{eff}$

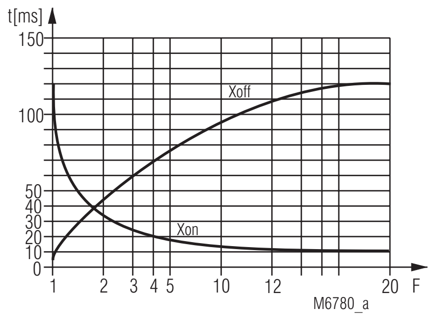
AC 0.5 ... 5 A is equivalent to DC 0.45 ... 4.5 A

Response value DC 3 A
Hysteresis DC 1.5 A

Settings:

upper potentiometer:	0.66	(0.66 x 4.5 A = 3 A)
lower potentiometer:	0.5	(0.5 x 3 A = 1.5 A)

Characteristics



Switching delay

The characteristic shows the switching delay depending on the values of X_{on} - X_{off} when switching the current on or off. A slow current change reduces the delay

$$F = \frac{\text{I applied}}{\text{I setting}}$$