

# De evolutie naar een modulair systeemontwerp: de opkomst van decentrale voedingen

ir. Dorien Van Deun  
Sales Director – Elipse NV

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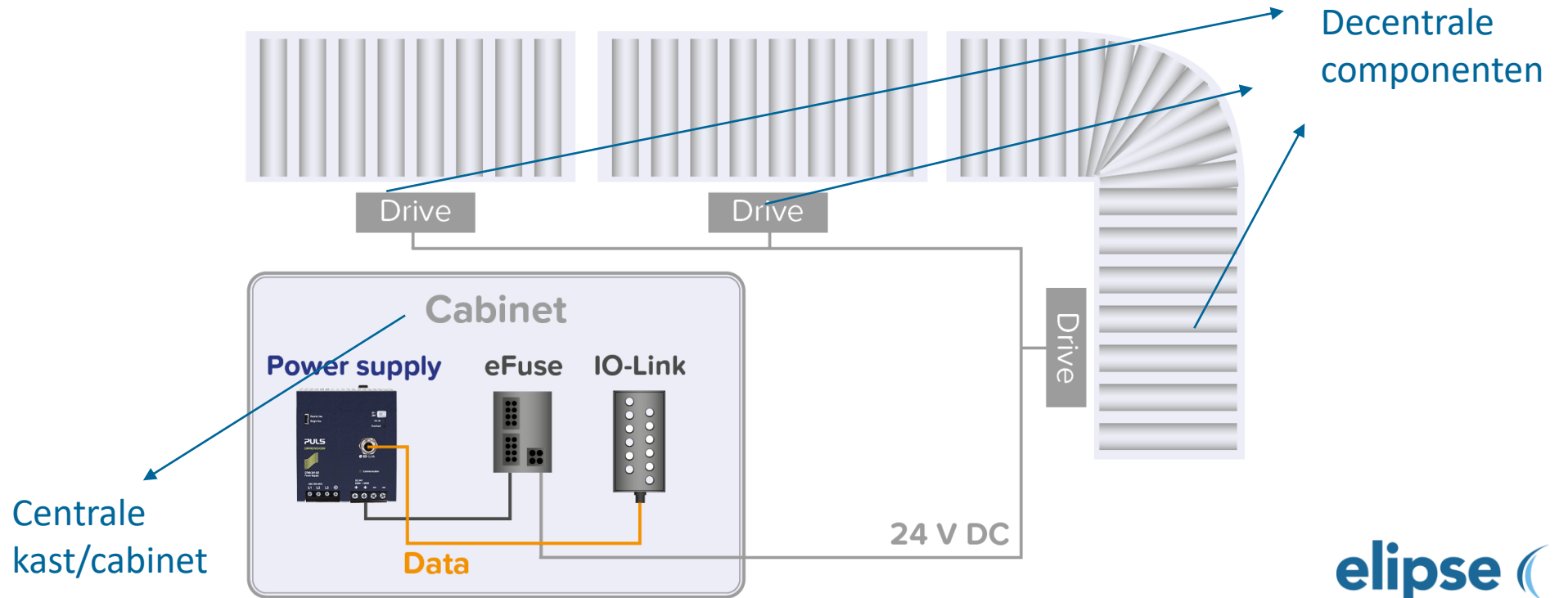


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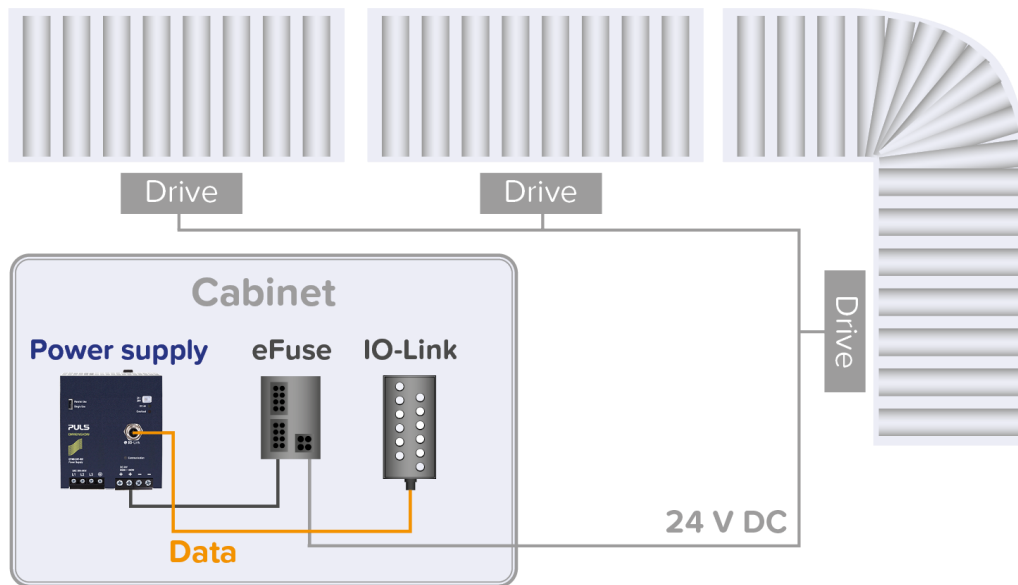


# Standaard centrale 24VDC setup

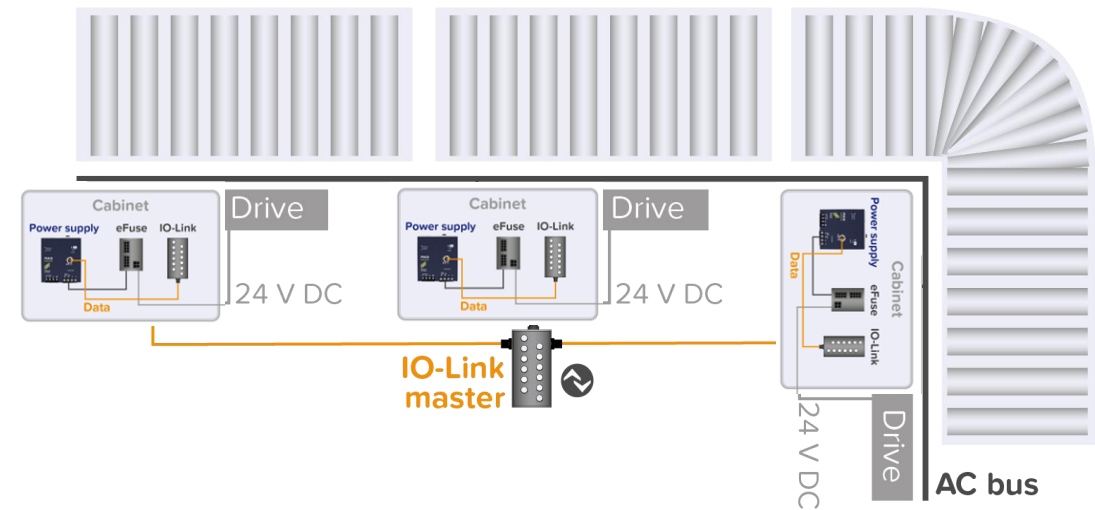


# Centraal vs decentraal 24VDC ontwerp

Centraal ontwerp

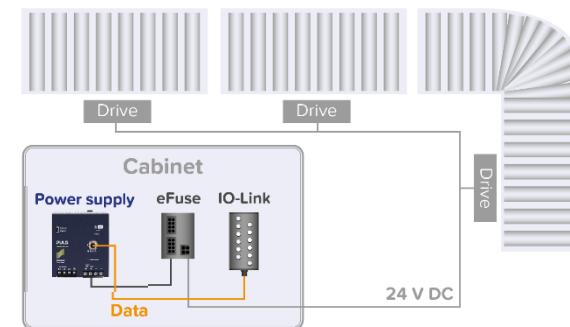


Decentraal ontwerp



# Decentraal systeemontwerp: waarom?

- Intra-logistiek
- Lange afstanden = grote kabelverliezen ( $P = R \times I^2$ ) = spanningsval
- ➔ Optie 1) Centrale PSU over-sizen om verliezen te compenseren



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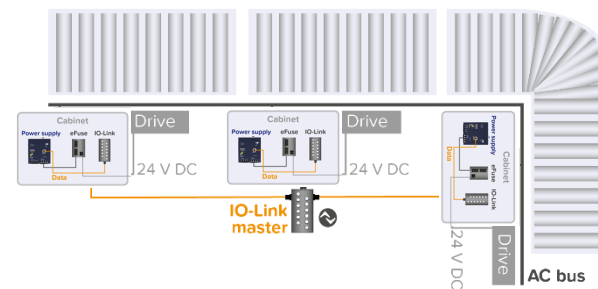
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# Decentraal systeemontwerp: waarom?

- Intra-logistiek
  - Lange afstanden = grote kabelverliezen ( $P = R \times I^2$ ) = spanningsval
- ➔ Optie 2): 1F/3F in het veld en lokale AC/DC conversie per systeemmodule



## Decentraal ontwerp



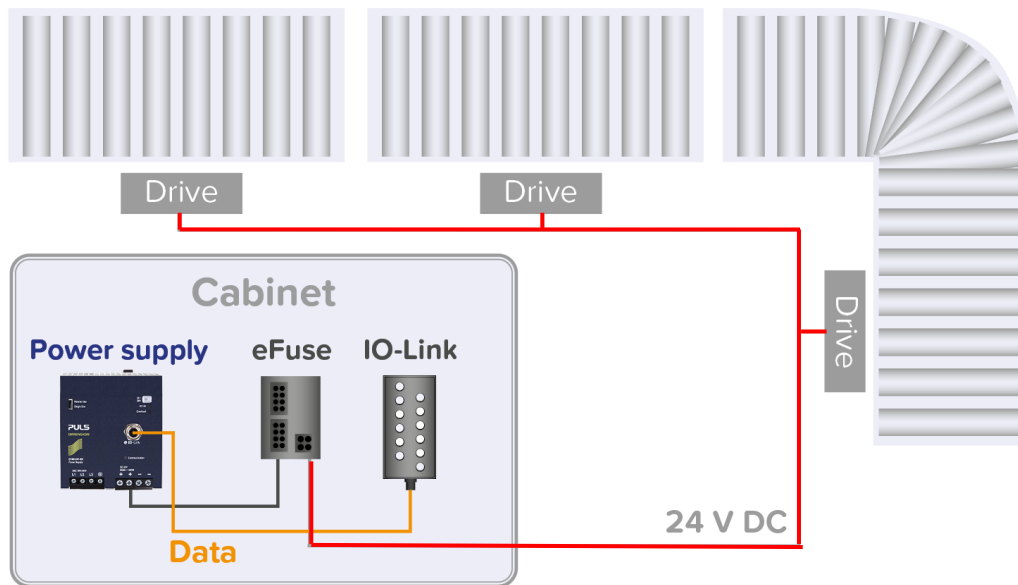
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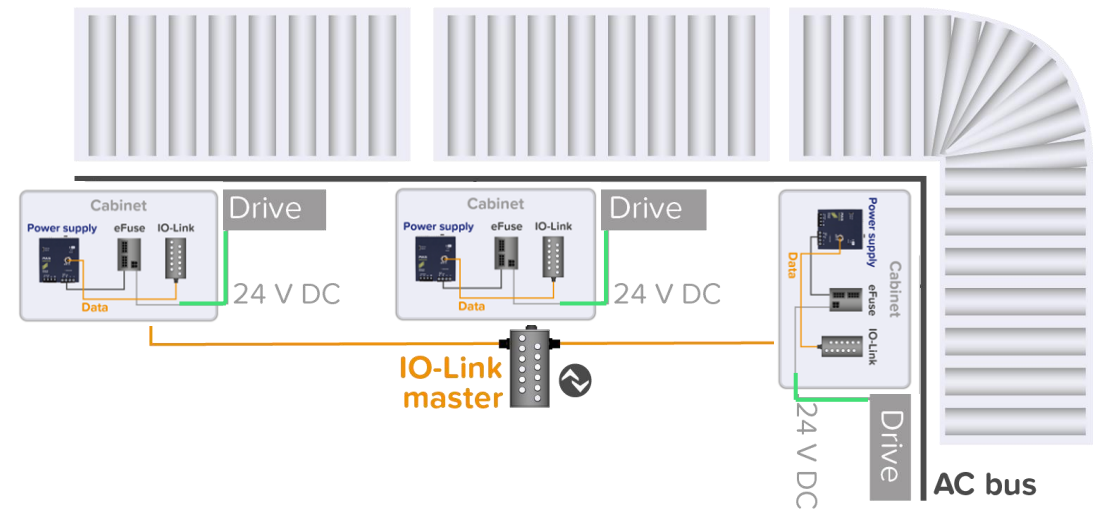
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# Centraal vs decentraal 24VDC ontwerp

Centraal ontwerp

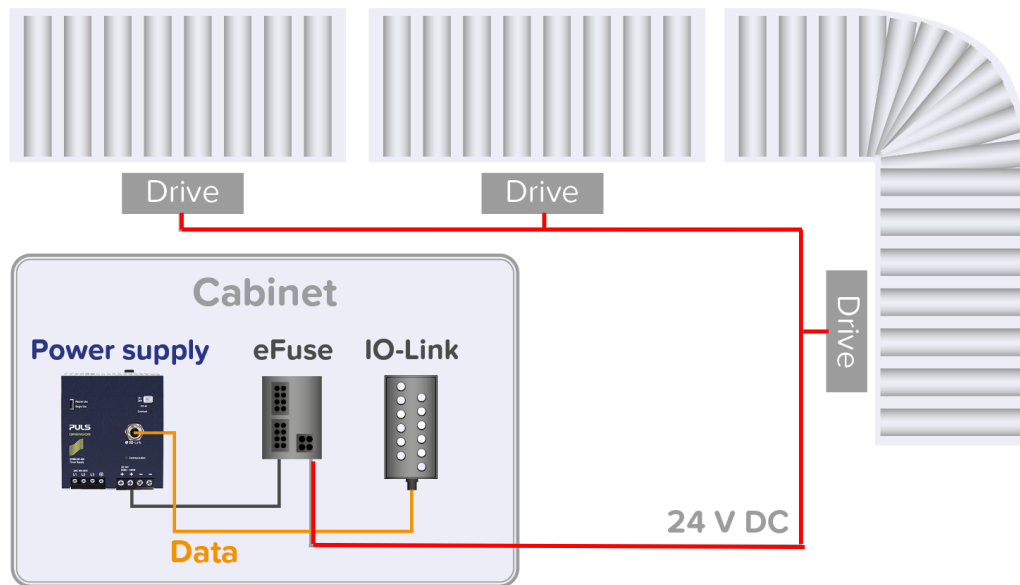


Decentraal ontwerp

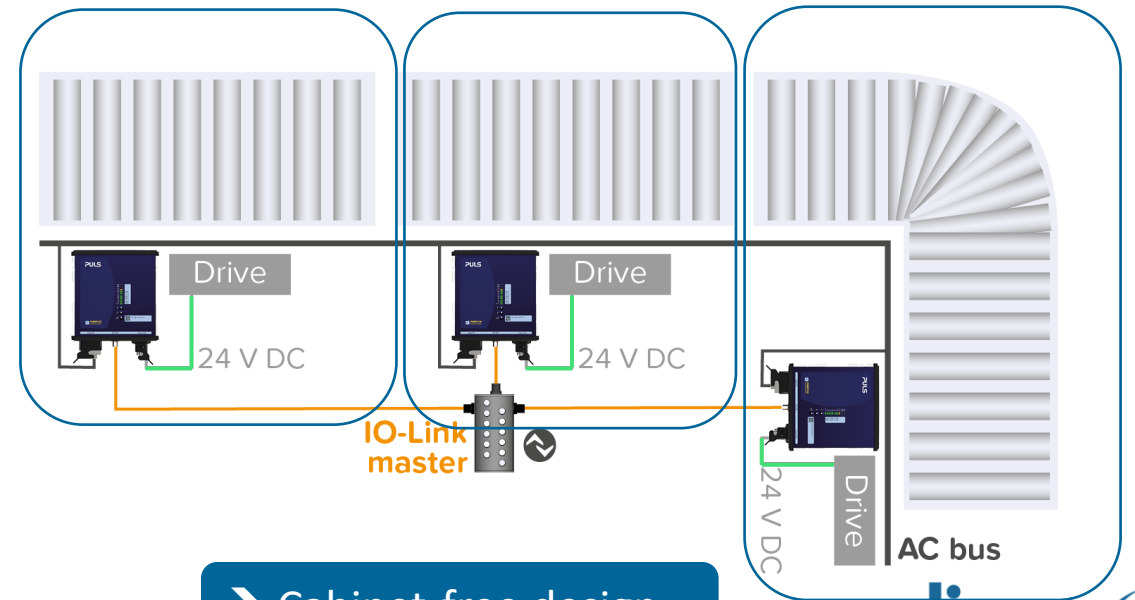


# Centraal vs decentraal 24VDC ontwerp

Centraal ontwerp



Decentraal ontwerp



→ Cabinet-free design

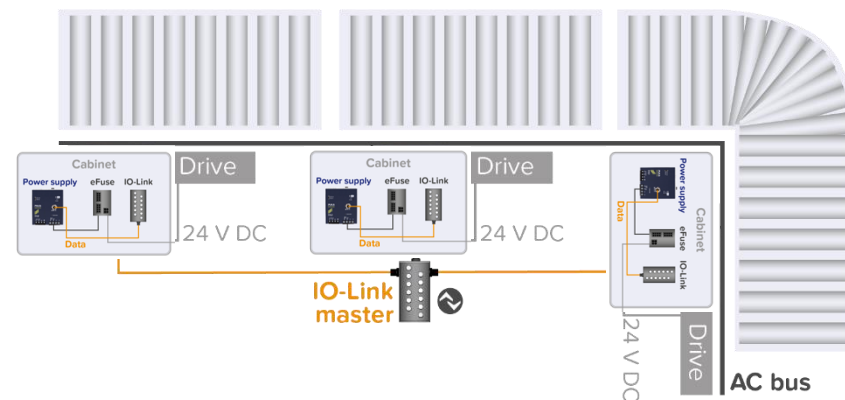
→ Modulair



# Decentraal ontwerp: voordelen

- Minder zware bekabeling (AC bus) en minder spanningsval = *efficiënter!*
- Geen oversized PSU
- Eenvoudigere set-up & toegang voor service/onderhoud
- Zeer flexibel en modulair te ontwerpen
- Makkelijk uit te breiden/ aan te passen
- Plaatsbesparing

➔ *KOSTENBESPARING!*



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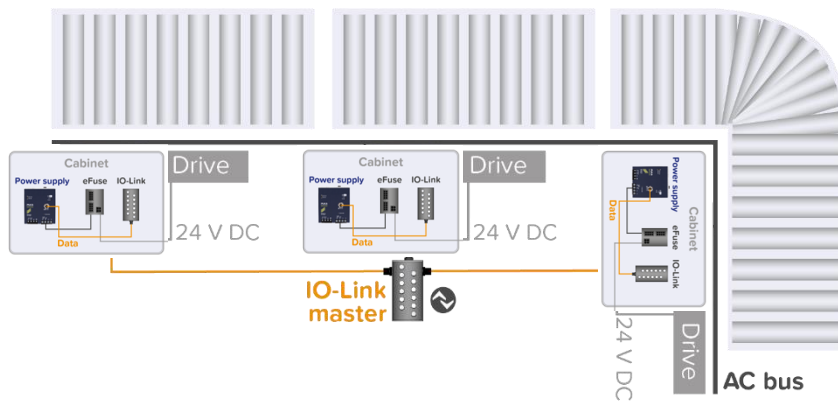
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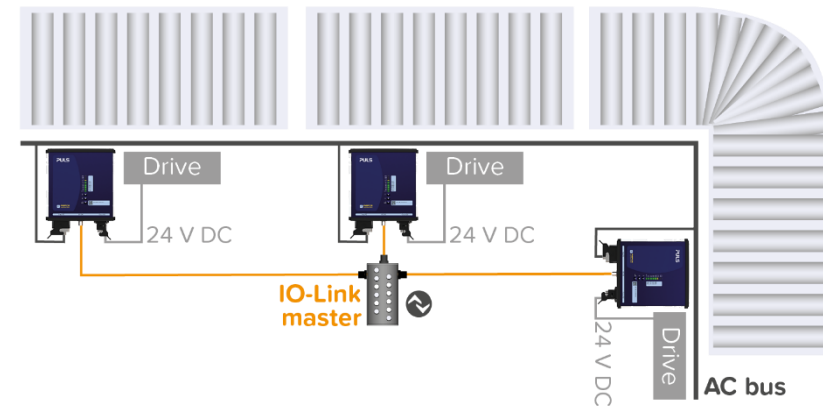
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# Decentraal cabinet-free ontwerp: uitdagingen field power supply



*DIN-rail PSU's*

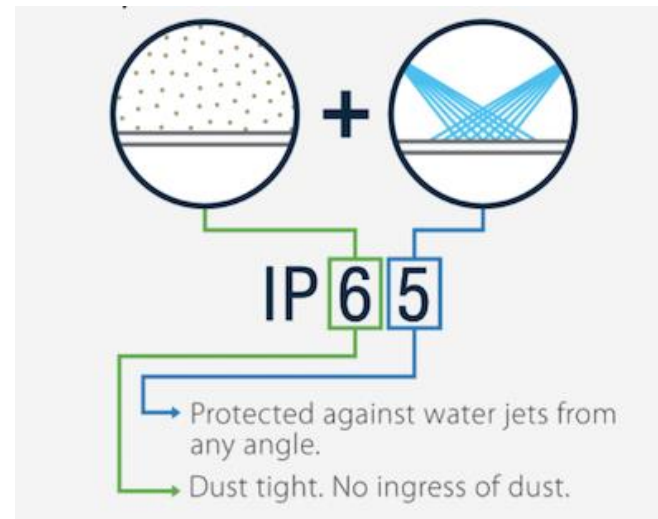


*Field PSU's*

→ Cabinet-free

# Decentraal cabinet-free ontwerp: uitdagingen field power supply

- Hogere IP graad van de PSU (IP54/67 vs IP20)



# Decentraal cabinet-free ontwerp: uitdagingen field power supply

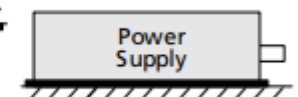
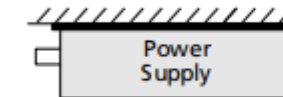
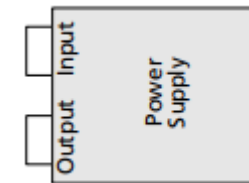
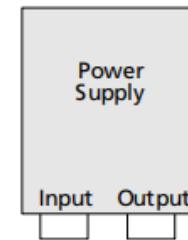
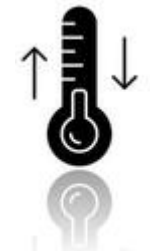
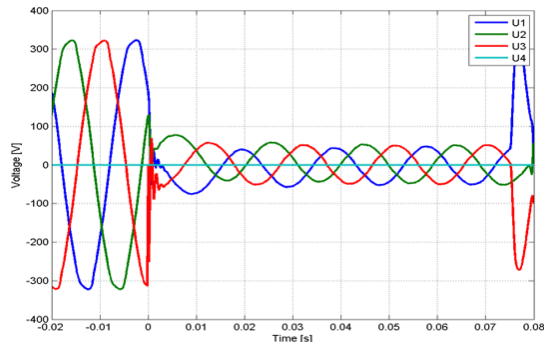
- Hogere IP graad van de PSU (IP54/67 vs IP20)
- Snelle en eenvoudige installatie (plug & play)



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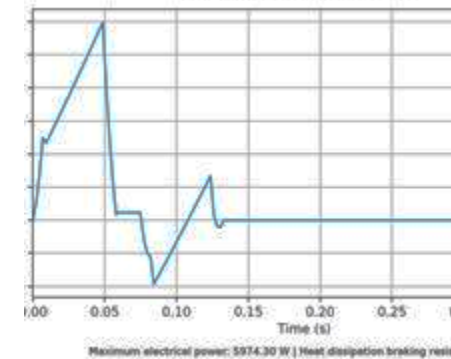
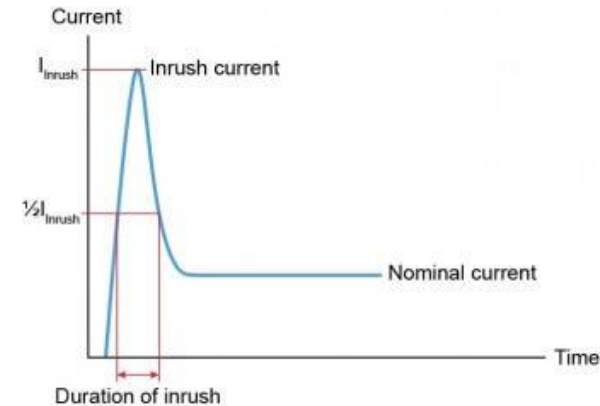
# Decentraal cabinet-free ontwerp: uitdagingen field power supply

- Hogere IP graad van de PSU (IP54/67 vs IP20)
- Snelle en eenvoudige installatie (plug & play)
- Wisselende omgevingsomstandigheden:
  - Temperatuurschommelingen
  - Trillingen
  - Verschillende montageposities
  - AC-input dips

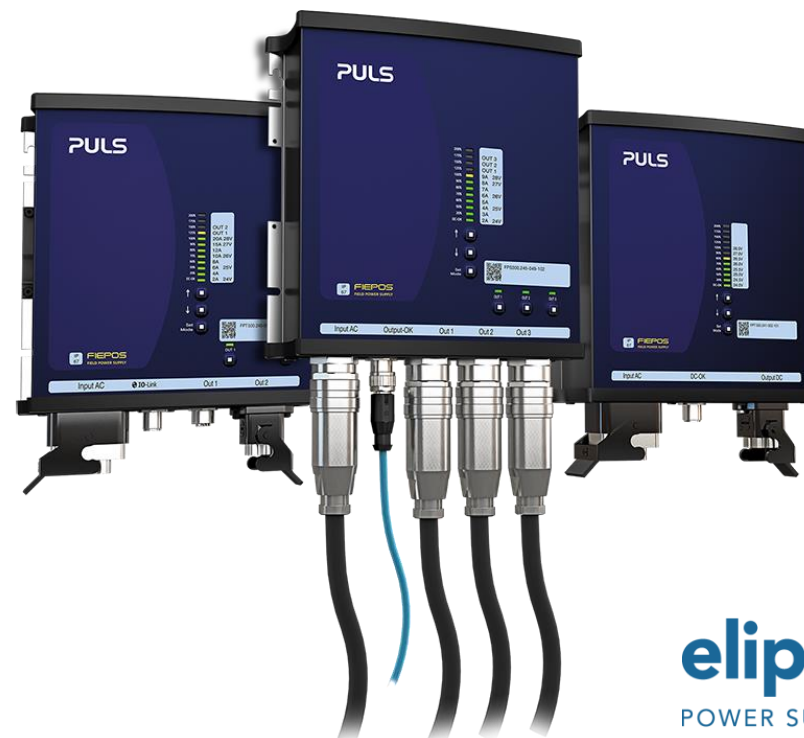
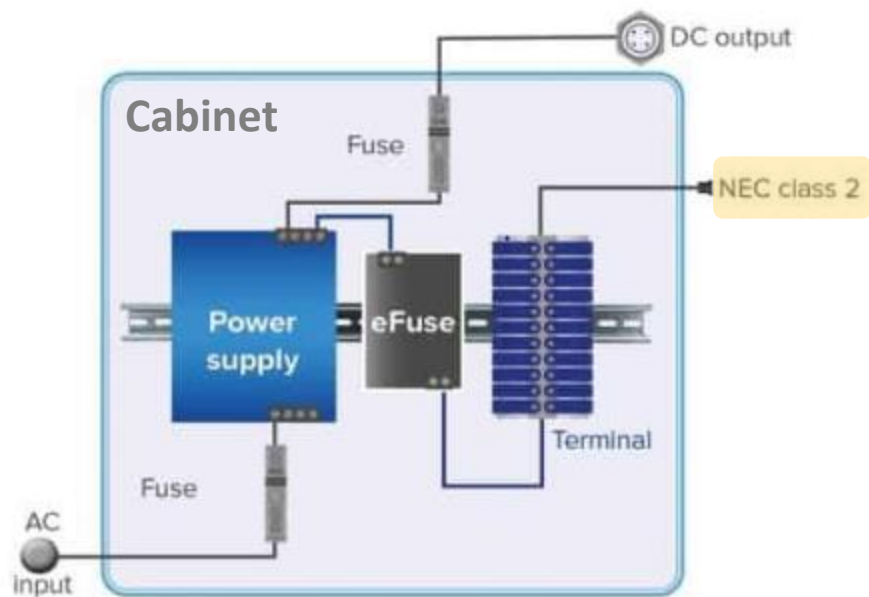


# Decentraal cabinet-free ontwerp: uitdagingen field power supply

- **Zeer wisselende** load requirements:
  - Boost vermogen  
bv. opstart motor(rollen)
  - Versnellen/ vertragen, ...
- Automatische (self)protectie
  - Bij overbelasting, kortsluiting, temperatuur, ...
- Automatische restart

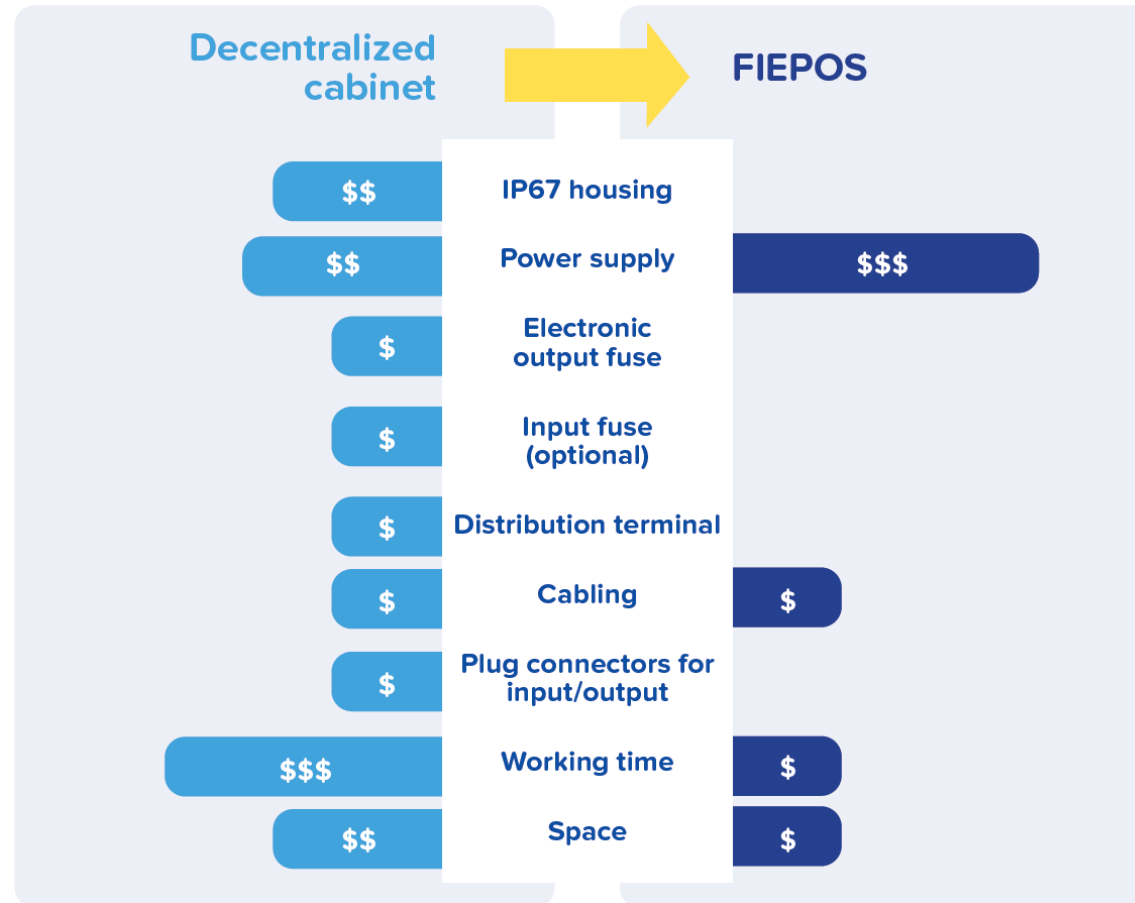
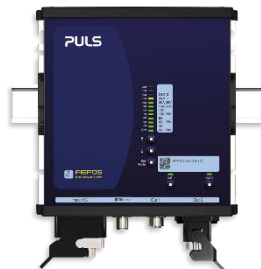
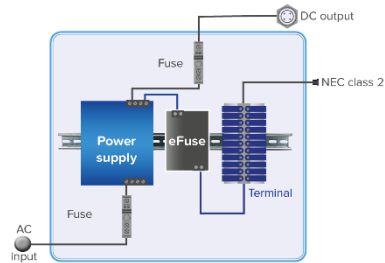


# Protectie: elektronische zekeringen



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# Decentrale cabinet vs FIEPOS: kostenplaatje



## Decentralized cabinet



## FIEPOS

\$\$	IP67 housing	
\$\$	Power supply	\$\$\$
\$	Electronic output fuse	
\$	Input fuse (optional)	
\$	Distribution terminal	
\$	Cabling	\$
\$	Plug connectors for input/output	
\$\$\$	Working time	\$
\$\$	Space	\$



# Field Power Supply (FIEPOS): eigenschappen

- Hoge efficiëntie >95%
- Hoge IP-protectie: IP67
- Brede temp-range: -25°C ... 70°C
- Flexibele connector configuraties (M12 – 7/8” – HAN-Q – As-i)
- 1F of 3F input
- 24VDC of 48VDC
- Variërend vermogen | mét BOOST



PULS

OUT 2  
OUT 1  
20A 28V  
15A 27V  
12A  
10A 26V  
8A  
6A 25V  
4A  
2A 24V

FPT900-245-006-107

FIEPOS  
FIELD POWER SUPPLY

Input AC    10-Link    Out 1    Out 2





# FIEPOS family



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# Toepassingsvoorbeeld: rollenbaan



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# Toepassingsvoorbeeld: rollenbaan

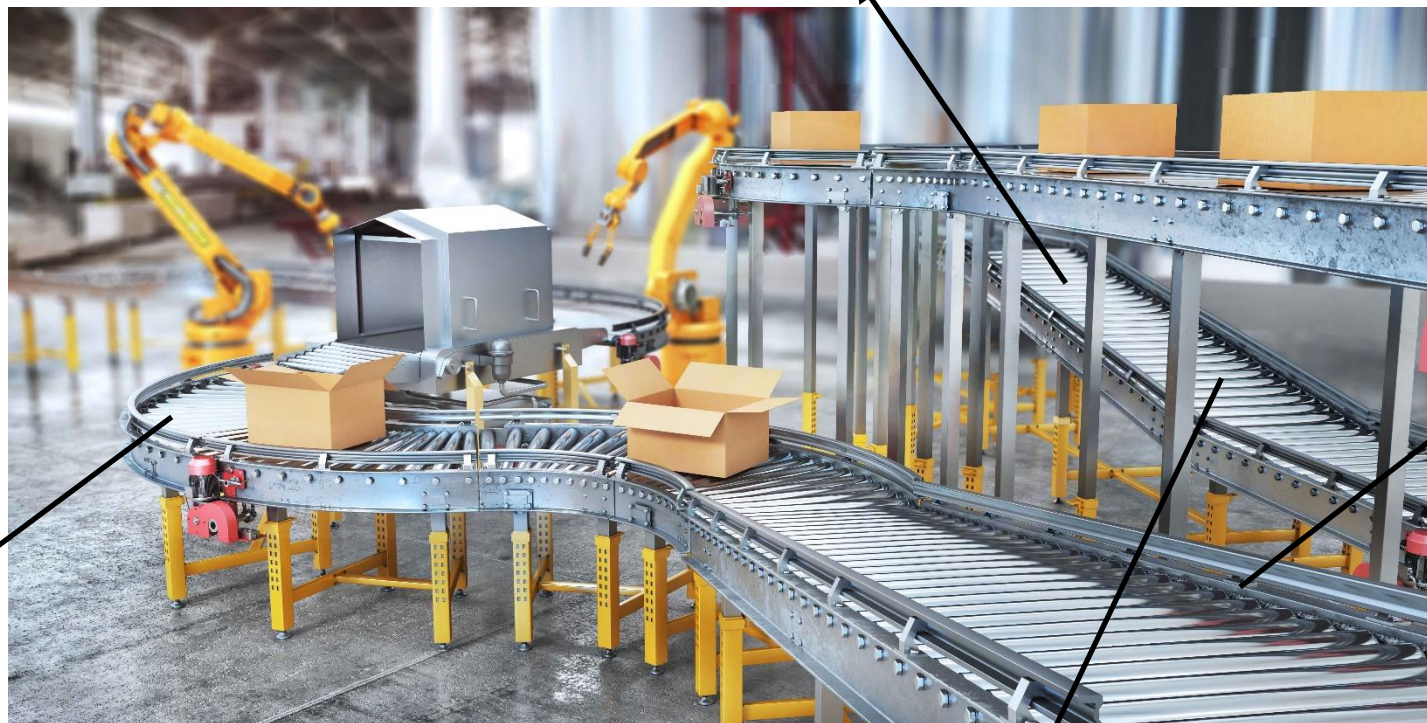
Versnellen/ opstarten  
Meer vermogen

Vertragen/ remmen  
Minder vermogen

Lichte of zware pakketten  
Minder Meer vermogen

Stijging  
Meer vermogen

Backfeeding



Bochten

Rechte modules

Daling  
Minder vermogen

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# Toepassingsvoorbeeld: PSU dimensioneren

- Nominaal vermogen per motorrol: +/- 2A
- Inloopstroom per motorrol: +/- 2x In (= 4A)
- Aantal motorrollen per module: 8x
- ➔ 8x 2A = 16A nominaal gemiddeld vermogen
- ➔ 8x 4A = 32A opstart boost
- ➔ Versnellen/ vertragen = pieken/ dalen in belastingsprofiel
- ➔ RMS vermogen telt!

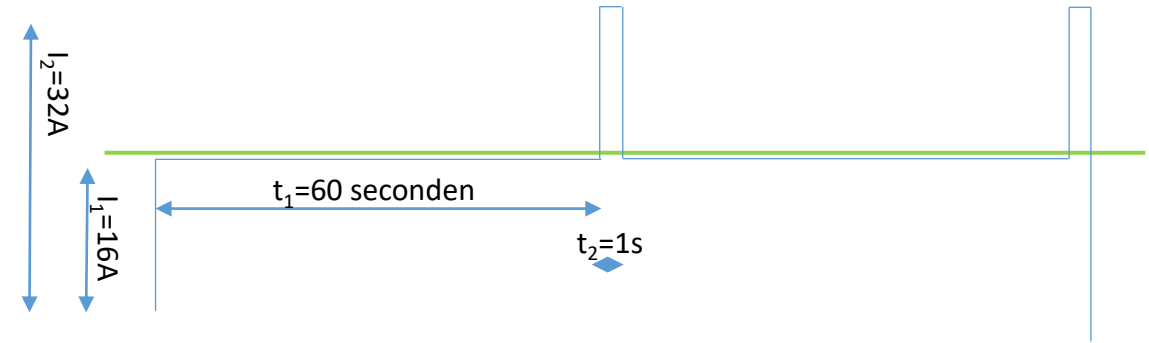
# RMS vermogen berekenen

$$P_{rms} = \sqrt{\frac{(P_1^2 \times t_1) + (P_2^2 \times t_2)}{t_1 + t_2}}$$



# RMS vermogen berekenen: voorbeeld

- Belastingsprofiel:
  - 16A – 60 seconden
  - 32A – 1 seconde



RMS = 16,39A

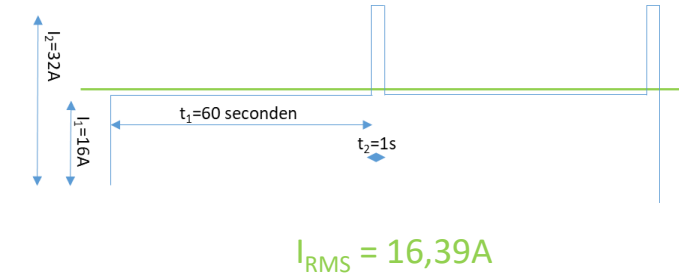
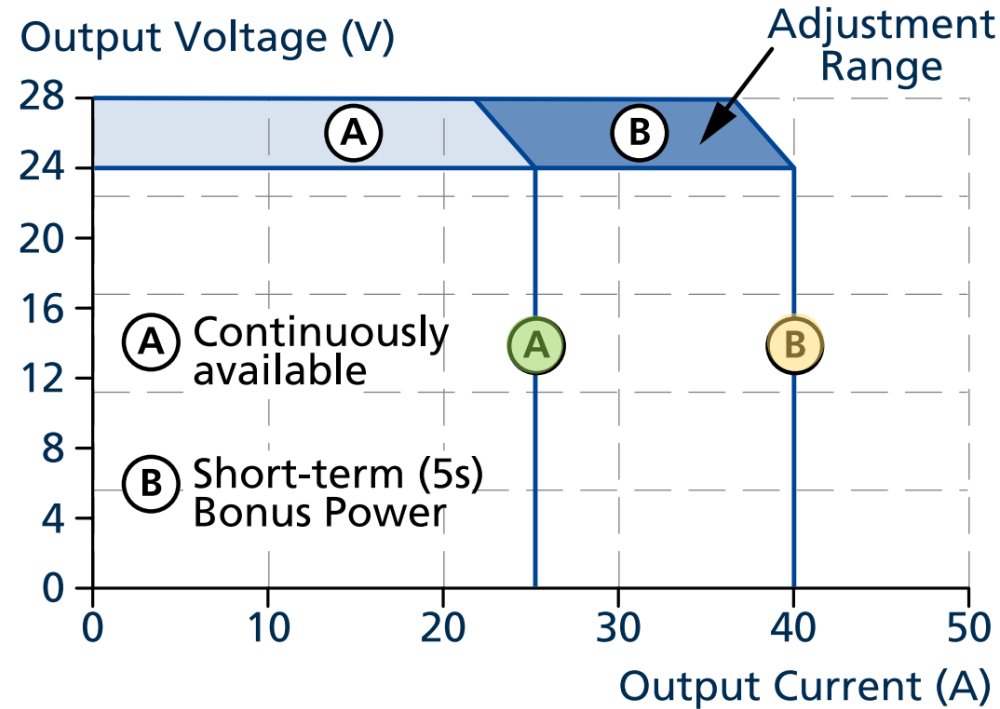
➔ Vermogen dat de PSU 'continu' zou moeten kunnen leveren

$$P_{rms} = \sqrt{\frac{(P_1^2 \times t_1) + (P_2^2 \times t_2)}{t_1 + t_2}}$$

# Fiepos vermogen FPT500.241-002-101



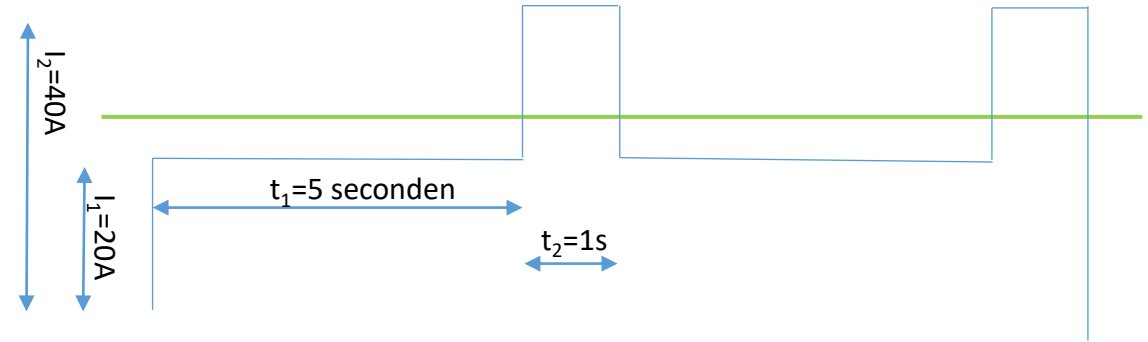
Field PSU  
500W - 24V



Total output power	nom.	600W (25A)	Up to +45°C at ambient temperatures
	nom.	500W (20,8A)	Up to +55°C at ambient temperatures
	nom.	350W (14,5A)	Up to +70°C at ambient temperatures
Short term up to 5s	nom.	1000W (41,2A)	Up to +55°C at ambient temperatures
	nom.	700W (29,2A)	Up to +70°C at ambient temperatures

# Fiepos vermogen FPT500.241-002-101

$$I_{RMS} = 24,5A$$



Total output power	nom.	600W (25A)	Up to +45°C at ambient temperatures
	nom.	500W (20,8A)	Up to +55°C at ambient temperatures
	nom.	350W (14,5A)	Up to +70°C at ambient temperatures
Short term up to 5s	nom.	1000W (41,2A)	Up to +55°C at ambient temperatures
	nom.	700W (29,2A)	Up to +70°C at ambient temperatures

# Toepassingsvoorbeeld: rollenbaan

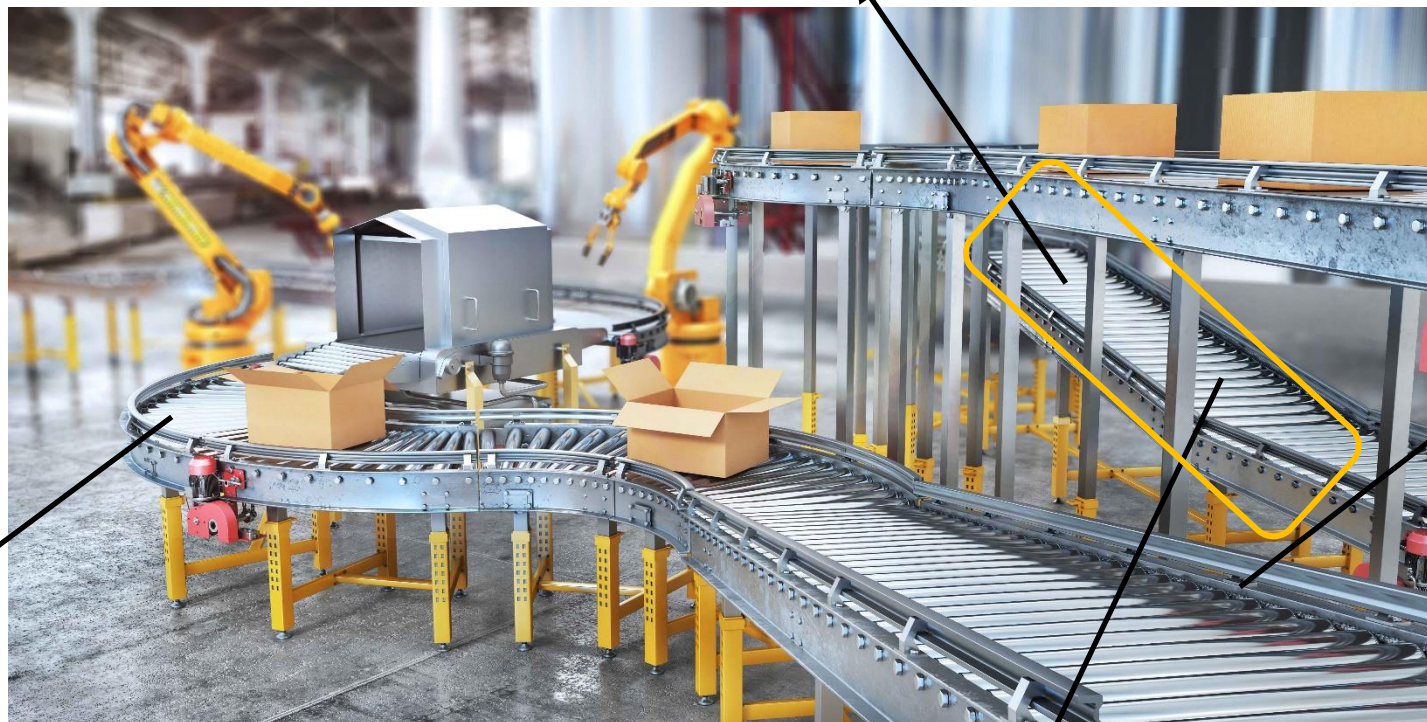
Versnellen/opstarten  
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Backfeeding



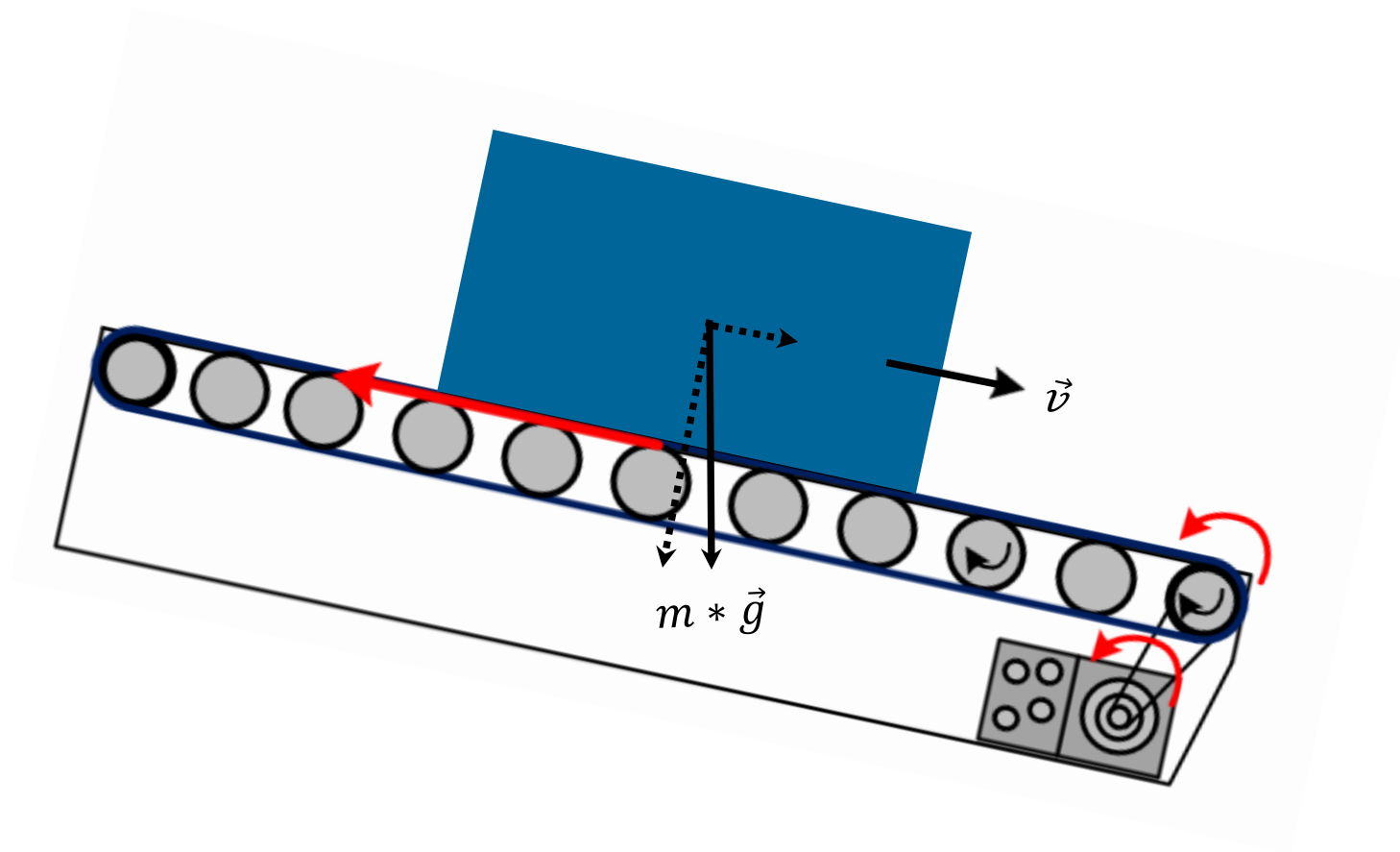
Bochten

Rechte modules

Daling  
Minder vermogen

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# Backfeeding



# Backfeeding: standard units

Output capacitance	typ.	12 500 $\mu$ F	Included inside the power supply,
Back-feeding loads	max.	35V / 4J	The unit is resistant and does not show malfunctioning when a load feeds back voltage to the power supply. It does not matter whether the power supply is on or off. The absorbing energy can be calculated according to the built-in large sized output capacitor.



# Backfeeding: interne brake chopper

- Interne weerstand:  $3,3\Omega$
- @spanning 26Vdc → 7,87A/ 205W  
→ kortstondig!



[referentie:]

		<b>3AC 400 V</b>	<b>3AC 480 V</b>	
Efficiency	typ.	95.8 %	95.6%	At 24 V, 500 W
Average efficiency	typ.	94.2 %	94 %	25 % at 120 W, 25 % at 250 W, 25 % at 370 W 25 % at 500 W
Power losses	typ.	2.5 W	2.5 W	At 24 V, 0 W (no load)
	typ.	12 W	13 W	At 24 V, 250 W (half load)
	typ.	22 W	23 W	At 24 V, 500 W (full load)

# Toepassingsvoorbeeld: power vs safety circuit

- ~~3-fase → 24V conveyors~~
- 1-fase of 3-fase → 24V safety & connectiviteit





# Future trends

- Andere toepassingen:
  - Pick-&-Place robot cellen
  - Modulaire machines | bouwblokken
- 24VDC / 100W & 200W (1-fase input)
- 48VDC / 500W
- 48VDC / 1000W
- Combinatie 24VDC / 48VDC output met safe-off functie (FPT1200.xxx)



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# Dorien Van Deun

Elipse nv

Wijtschotbaan 5 | 2900 Schoten | België

[www.elipse.eu](http://www.elipse.eu) | [d.vandeun@elipse.eu](mailto:d.vandeun@elipse.eu) | +32 (0)3 354 51 80



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