



SINAMICS DC-MASTER

© Siemens Ltd. 2020

siemens.com/sinamics-dcm

SINAMICS DC-Master – the Master of DC Webinar



Schedule

- 1. Historical review of DC-power generation
- 2. The DC-Motor principle of operation
- 3. Family of Siemens DC-drives
- 4. SINAMICS DCM 6RA80 Product overview
- 5. Selection and Commissioning
- 6. Software function
- 7. Applications



Werner von Siemens – discoverer of the dynamo-electric principle

SIEMENS Ingenuity for life



SIEMENS

- First international sales agency in London
- 1866 Siemens discovered dynamo-electric principle, a reliable energy supply for electric motors
- 1879 First electric locomotive
- 1885 Tesla invents rotating magnetic field
- 1889 First asynchronous motor by Dobrowolski

Restricted © Siemens AG 2018. All rights reserved. 2020-07-03



First source of DC-power

• DC-or Direct Current – power has been the first available electrical power, coming mainly from electro-chemical batteries



Volta's battery from 1800



Arc-lamp using Volta's battery

Restricted © Siemens AG 2018. All rights reserved. 2020-07-03



The Lorentz-force

Simple spinning DC-generators (magneto-electric machines), working on the principle of induction, were
providing power just enough for street lighting, telegraphic purposes and small DC-motors (not more
than 700W)





The dynamo-electric principle

• Only the discovery of the dynamo-electric principle by Werner von Siemens in 1866, using self-excitation, producing electrical power on a much larger scale, allowing applications like electric trams and elevators



The Siemens Dynamo machine from 1866 - by reconfiguring a magneto with a double-T armature



First electric tram in 1881

Restricted © Siemens AG 2018. All rights reserved. 2020-07-03

The DC-motor



U=constant

ω

Compound excitation



 additional field winding controls speed at low loads

Restricted © Siemens AG 2018. All rights reserved.

2020-07-03

DC-motor with separate excitation-armature circuit

Armature current circuit Carbon Field winding brush Ua = EMF + la * Ra + La * <u>di</u> **EMF** = const. $*\Phi$ * n R_a Ua EMF= ElectroMotive Force [V] La Φ Φ = Magnetic flux [Vs], [Weber] EMF n = Speed [rpm] I_f U_f $U_a \times I_a = E \times I_a + R_a \times I_a^2 \quad E = U_a - U_{EMF} \quad U_{EMF} = \omega \times i \times \Phi$ Armature copper losses Angular speed Mechanical shaft power la = <u>U_a – U_{EMF}</u> Restricted © Siemens AG 2018. All rights reserved. Ra Electrical terminal power 2020-07-03

SIEMENS Ingenuity for life

Speed control range of the separately excited DC machine



Restricted © Siemens AG 2018. All rights reserved.

2020-07-03

SIEMENS

Ingenuity for life

The family of Siemens DC-drives







SIMOREG 6RA23/24 - second generation of digital DC-converters, already providing Profibus communications

SIMOREG 6RA70 third generation of digital DC-converters, using connector/binector (BICO)-technology for flexible programming

SIEMENS



SINAMICS DCM 6RA80 – fourth generation of digital DC-converters, fully integrated into SINAMICS world of drives

SIMOREG 6RA21 analogue DCconverters

SIMOREG 6RA22 – first digital DC-converters, with options for communication (SINEC L1/SINEC L2

Restricted © Siemens AG 2018. All rights reserved. 2020-07-03



AC-generator



Dr. ing. h. c. Friedrich Aug. Safelwauders Drehftrom-Maichine

Restricted © Siemens AG 2018. All rights reserved.

2020-07-03



Single / multi-quadrant operation

Restricted © Siemens AG 2018. All rights reserved. 2020-07-03



Voltage and current range of SINAMICS DCM 6RA80

15-30A60-280A400-600A720-850A950-1200A1500-3000AImage: State of the s

Rated connection voltage 50/60 Hz

- Arma-ture	400V / 480V 3AC	400V / 480V / 575V 3 AC		400V / 480V/ 575V / 690V 3AC	400V / 480V/ 575V / 690V / 830V 3 AC	400V / 480V / 575V / 690V / 830V / 950V 3 AC				
Rated current										
- Arma-ture	15A, 30A	60A - 125A, 210A - 280A	400A - 600A	720A - 850A	950A - 1200A	1600 - 3000A				
- Field	3A (325V/375V=) 5A (325V/375V=)	10A (325V/375V=) 15A (325V/375V=)	25A (325V/375V=)	30A (325V/375V=)	40A (375V=)	40A (375V=)				

2020-07-03

Siemens DI MC

SIEMENS

Ingenuity for life



Control units (CUD)

- Standard CUD: Basic functions for regulation + free function blocks + DCC
- Advanced CUD: Basic functions + DRIVE-CLiQ and option Slot + DCC
- •Or any combination there-off





Standard CUD

Restricted © Siemens AG 2018. All rights reserved. 2020-07-03

Advanced CUD



CUD Advanced



Restricted © Siemens AG 2018. All rights reserved.

2020-07-03

CUD Advanced with extensions





Modular extensions



Connecting cables

DRIVE-CLiQ cables

- Standard within the cabinet
- MOTION-CONNECT 500
- MOTION-CONNECT 800



Encoder cable

SMC30 - encoder: HTL, TTL 100 m
 HTL with A+/A- ... 300 m

70 m

100 m

50 m

Restricted © Siemens AG 2018. All rights reserved. 2020-07-03

Field power module

Standard

1Q field with integral free-wheeling circuit (3 – 40A)

Optional:

- without field option code L10 (available from 60A (I_A))
- 1Q field: integral 85A field available (only for 1500A-3000A devices)
- 2Q field (field polarity reversal)

1Q field



Restricted © Siemens AG 2018. All rights reserved. 2020-07-03

2Q field





Memory card

The memory card allows the user to:

- Load additional languages (French, Spanish, Italian) to the Advanced Operator Panel AOP30.
- Record a long-term trace .
- Perform a firmware update.
- Perform an update of the DCC (Drive Control Chart) database.



Overview of main options

Standard CUD left / right	Standard / G10
Advanced CUD left / right	G00 / G11
CBE20 PROFINET left / right	G20 / G21
Memory card left / right	S01 / S02
Field power module 2Q	L11
Without field power module	L10
85-A field power module	L85
Fan for 1-phase connection	L21
24V electronic power supply (for DC converter)	L05
Armature circuit feed at extra-low voltage (10V to 50V)	L04
Coated PCBs	M08
Copper busbars nickel-plated	M10
External sensor for average ambient / intake air temperature	L15

Selection and commissioning

Drives Technology Configurator

SIEMENS Ingenuity for life							Additional actions 📜 List of products	s 🥠 Support	🚱 Language	×
♠ / SINAMICS DCM										
6RA802-0A.0 🤳	on request List price	on request Your price		on request Standard delivery time	on request ^{Weight}	on request Product lifecycle				
The configuration is not complete, please :	set all orange values.						Filter (e.g. "power",			
Input Tech.Data Options							U."		KB version: 53.7	1
Net data										
Load class			ſ						v d i	
Nominal Voltage (armature)			10 ≤	≤ 950 V					d i	
Net frequency			(● 50 Hz ─ 60 Hz					ت ې	
motor data										
Rated DC voltage armature			Ť						v d i	
Rated DC current armature (Basic load)			0 ≤	≤ 3000 A					ц.	
Rated DC voltage field			0 ≤	≤ 390 V					Ę	
Rated DC current field			0 ≤	≤ 85 A					Ę	
inverter data										
Design			(Chassis unit					✓ 4 ¹	
Installation altitude above sea level			1	1000 m					~ (]	
Operational ambient temperature			4	10 °C					✓ 4 ²	
Mode of operation			E						∽ ←	

Restricted © Siemens AG 2018. All rights reserved.

2020-07-03

Siemens DI MC

SIEMENS

Ingenuity for life

Data sheets/dimension drawings



2020-07-03



SINAMICS STARTER



Free functions and DCC (Drive Control Chart)

Free functions blocks

- About 50 free function blocks (e.g. AND, OR, ADD, MUL, Limit-monitors and others)
- no license required (unlike 6RA70 with option S00)
- each block can be used only once

AND 0

DCC (Drive Control Chart)

- DCC is a graphical programming tool with block libraries for configuring your own technology functions
- SINAMICS DCC comprises the graphical configuring tool (DCC Editor) and the standard library.(floating license required)
- Standard library can be expanded with specialised libraries
- Multi-instance blocks/customized parameters





ADD 0

ADD 0 RTG 5 ... 9999 p20096 (9999



2020-07-03



Functional safety with SINAMICS DCM



Restricted © Siemens AG 2018. All rights reserved. 2020-07-03

Shutdown via 2 separate channels

- Shutdown channel 1: through the armature line
- Shutdown channel 2: STO shutdown channel of the SINAMICS DCM Siemens DI MC



12-pulse and parallel connections



- Low harmonics loading
- Low level of DC-ripple



- Up to 6 devices for rated currents up to 18000A
- Achieving redundant configurations

Restricted © Siemens AG 2018. All rights reserved. 2020-07-03

Alternative Applications

Charging & Discharging Batteries

Resistive heating (e.g.paint drying)

Electrolytic application (e.g. electro-coating)

SIEMENS

Ingenuity for life





Restricted © Siemens AG 2018. All rights reserved. 2020-07-03











Other applications

- Operation of electromagnets in crane applications
- Excitation of large DC-motors or synchronous generators
- Supply to controlled direct voltage busbars
- DC-link supply of large pulse-controlled converter systems



Restricted © Siemens AG 2018. All rights reserved. 2020-07-03

Thank you for your attention



Falko Horsch Falko.Horsch@siemens.com +61 427 152 758

SIEMENS

Ingenuity for life

Restricted © Siemens AG 2018. All rights reserved. 2020-07-03