

**SIEMENS**



# SINAMICS drives

## SINAMICS DCM DC Converter

### Migration Guide

Reference Manual

Edition

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Answers for industry.



# SIEMENS

## SINAMICS

### SINAMICS DC MASTER Migration Guide

Reference Manual

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# Introduction

As a result of its functionality, range of power ratings and flexibility, for many years now SIMOREG DC-MASTER has been an extremely successful product series. It has been used for single and multi-motor applications for production machines, in general machinery construction and in all industrial sectors.

After the discontinuation of SIMOREG DC-MASTER in February 2014, with our SINAMICS DC MASTER as successor we are continuing the Siemens success story as global market leader for DC converters.

Since 2010, with SINAMICS DCM 6RA80 we have a product series completely integrated in the SINAMICS platform with extended modularity and functionality. For example, Drive Control Chart (DCC) for graphically configuring and extending the device functionality using freely available closed-loop control, arithmetic and logic blocks.

## Motivation

Frequently, DC drives are being replaced by AC drives; however, many customers have high regard for the advantages of DC technology

SINAMICS DC MASTER has been developed for this group of customers, and in turn the proven technology of SIMOREG DC-MASTER integrated in the SINAMICS platform.

This modernization sends a clear signal to our customers: "Also in the future, Siemens will place a lot of emphasis on DC technology!"

This document is intended to help customers better understand SINAMICS DC MASTER – and especially its new functions, therefore providing valuable support when transitioning to our new generation of devices.



Figure 1-1 SINAMICS DC MASTER product family



Figure 1-2 SIMOREG DC-MASTER product family

### Additional documentation on SINAMICS DC MASTER

- SINAMICS DC MASTER in the Internet (<https://www.industry.siemens.com/drives/global/de/umrichter/dc-stromrichter/sinamics-dcm>)
- SINAMICS DC MASTER operating instructions (<http://support.industry.siemens.com/WW/view/en/55622945>)

### Accessories

- SICROWBAR AC overvoltage protection
- SICROWBAR DC overvoltage protection
- SIMOREG DC-MASTER CCP
- Commutating reactors
- Radio interference suppression filters
- Advanced Operator Panel AOP30
- and more

You can obtain more information about all of the accessories in Catalog D23.1: ([https://www.industry.siemens.com/mcms/infocenter/content/de/Seiten/order\\_form.aspx?nodeKey=key\\_9181486&InfoType=catalogs](https://www.industry.siemens.com/mcms/infocenter/content/de/Seiten/order_form.aspx?nodeKey=key_9181486&InfoType=catalogs))



### Additional information in the Internet

- FAQ (<http://support.industry.siemens.com/WW/view/de/38157755/133000>)
- Selecting replacement DC converters (<http://support.industry.siemens.com/WW/view/de/26117006>)

### Service and support

Our specialist support and product management are more than willing to provide you with information about reference projects and respond to any questions that you might have - ([DC-migration-support.industry@siemens.com](mailto:DC-migration-support.industry@siemens.com))

You can find information about our services and regional contact persons in the Internet - ([www.siemens.de/industry/csi\\_de/service](http://www.siemens.de/industry/csi_de/service)).



# SINAMICS DC MASTER – an overview of the highlights

# 2

SINAMICS DC MASTER devices address all industrial applications involving low-voltage DC drive technology. The open-design closed-loop control structure offers allows users to optimally adapt the drive control to their particular requirements.

## **SINAMICS DC MASTER offers the following highlights:**

- UL certification (for all devices up to 575 V)
- Marine certification
- 6 devices can be connected in parallel to increase the power rating and achieve redundancy (n + m operation)  
If a power unit fails, then the remaining functional SINAMICS DC MASTER devices continue to operate without any interruption.
- The power rating can be extended with engineered solutions, up to 60 kA and more in a cabinet design (12 pulse)
- Control Modules for retrofit drive projects and for high current rectifiers in electrochemical applications up to 100 kA
- Rated input voltages from 3 AC 50 V up to 950 V
- Single-phase connection (110 V to 575 V AC) for devices up to 125 A
- Extended temperature range for transport and storage (-40 °C up to +70 °C)
- The DC motor insulation resistance can be measured without having to disconnect the motor from the DC converter
- SIMOREG CCP to protect against inverter commutation faults
- Optimized cooling and service concept (optional, single-phase, quieter, integrated operating hours counter)
- The memory card can be used to save the project, update the firmware and for series commissioning
- Offline and online long-term traces
- Field power supply that complies with requirements
  - Without field (for devices from 60 A rated armature current, with price reduction)
  - With 1Q field (up to 85 A rated field current)
  - With 2Q field and active current reduction, including field overvoltage protection (for devices with 60 A rated armature current and above)
- DCC for demanding closed-loop control tasks
- Free function blocks the standard (no option S00)
- Onboard encoder interfaces
- Integrated electronics power supply for 24 V DC (option L05)

- Integrated in the SINAMICS drive family therefore, the same commissioning tools, same look & feel, parameterization supported by graphic screen forms, same components used for expansion
- Optional coated modules
- Optional nickel-plated busbars
- PROFIBUS on board/ PROFINET optional
- The Control Units can be variably configured – and therefore optimally adapted to address a wide range of requirements, from a technical and cost perspective
- Optional armature circuit supply with low voltage  
SINAMICS DC MASTER can be re-equipped for operation with line input voltages from 10 up to 50 V.
- Optional Ethernet-IP communication with CBE20
- SIMOLINK  
replaced by other communication standards:
  - SINAMICS Link
  - Parallel interface
  - CU-Link (controller-controller direct data exchange)
  - OA link
- Position actual value sensing
- rms phase current sensing
- Password protection and know-how protection
- Commissioning engineers are supported by graphic screens

## Comparison of the functions

The following comparison of the functions provides a factual comparison between SINAMICS DC MASTER with its predecessor, the SIMOREG DC-MASTER.

The comparison includes all of the usual evaluation criteria.

### Reading notes

The symbols in the table columns of the following chapter have the following significance:

- + Advantage
- = Neutral
- Disadvantage

### Ambient conditions

	SINAMICS DC MASTER	SIMOREG DC-MASTER
Degree of protection	+ IP00, IP20 possible up to 850 A	- IP00
Ambient temperature Storage	+ -40 °C ... +70 °C	- -25 °C ... +70 °C
Ambient temperature Operation	= 0 °C ... +55 °C  above 40 °C derating	= 0 °C ... +50 °C or +60 °C (devices < 125 A)  above 40 °C derating
Max. installation altitude	= up to 5000 m above sea level	= up to 5000 m above sea level
Current derating	+ from 1000 m above sea level, temperature- dependent current derating max. 70 %	- from 1000 m above sea level, temperature- dependent current derating max. 67 %
Voltage derating	= were relevant, from 4000 m above sea level	= from 4000 m above sea level
Rated frequency	= 45 - 65 Hz (extended range on request)	= 45 - 65 Hz (extended range on request)
Field power supply	+ integrated (up to 85 A field current) for all types ≥ 1500 A	- integrated (up to 85 A field current) for 8 specific types ≥ 1500 A
Power semiconductors	= thyristor bridges	= thyristor bridges

	SINAMICS DC MASTER	SIMOREG DC-MASTER
Closed-loop control stability (operation with a pulse encoder and digital setpoint and/or rated speed)	= $\Delta n = 0.006 \%$	= $\Delta n = 0.006 \%$
Closed-loop control accuracy without encoder (EMF control, dependent on the motor temperature)	= approx. 5 %, field weakening not possible	= approx. 5 %, field weakening not possible

**Power units**

	SINAMICS DC MASTER	SIMOREG DC-MASTER
Permissible line fluctuations	= Electronics power supply AC 380 (-25 %) to 480 (+10 %)	= Electronics power supply AC 380 (-25 %) to 480 (+10 %)
Power range	= 15-3000 A	= 15-3000 A
Number of devices that can be connected in parallel	= 6	= 6
Compact size	= for devices with high and average currents; 1200 A devices 268 mm wide	= for devices with high and average currents; 1200 A devices 410 wide
Noise when installed in a cabinet	= no fan noise up to and including 125 A devices	= no fan noise up to and including 125 A devices
Overload capability	= 180%	= 180%
Discharge resistance from the power unit (armature and field with respect to ground)	very high (> 100 M $\Omega$ ) isolated voltage sensing	Armature 575 V = 0.91 M $\Omega$ Armature 830 V = 1.3 M $\Omega$ Armature 1000 V = 1.6 M $\Omega$ Field 460 V = 1.8 M $\Omega$

## Control Unit (CU/CUD)

	SINAMICS DC MASTER	SIMOREG DC-MASTER
Memory card	+ for a firmware update (the drive automatically powers up with the new firmware), offline trace or series commissioning	- no memory card, internal flash memory
Power-up time (up to o7.0)	-- 40 s	+ 3 s
<b>Data interfaces</b>		
PROFIBUS	++ onboard 2 x 32 PZDs (IF1 and IF2) Isochronous PROFIBUS Slave-to-slave communication	- Option 10 PZDs No isochronous PROFIBUS Slave-to-slave communication
RS232 or RS485 / USS	= onboard	= onboard
Peer-to-peer	= onboard	= onboard
Ethernet / PROFINET	++ via CBE20 + Advanced CUD	- no
SIMOLINK	= functionally replaced by SINAMICS Link to CU320-2 and using OA-Link	= yes
EtherNet/IP	++ yes	- no
CAN	- yes, via external bus coupler	+ CANopen on request (option CBC)
Device Net	- yes, via external bus coupler	+ yes
<b>Inputs and outputs</b>		
Digital inputs on board	++ 4 inputs + 4 inputs or outputs per CUD	- 4
Digital outputs on board	++ 4 per CUD	- 2
Analog inputs on board	++ 7 (+/-10 V) per CUD	- 2
Resolution, analog outputs with sign	= 3x with 14 bit 4x with 11 bit	= 4x with 14 bit

	SINAMICS DC MASTER	SIMOREG DC-MASTER
Analog outputs on board	= 2 per CUD	= 2 + fixed current actual value output
Resolution, analog outputs with sign	+ 15 bit	- 11 bit
Onboard encoder interfaces	= 1 x pulse encoder (15 V) (analog tachometer connected to the basic device)	= 1x pulse encoder (analog tachometer connected to the basic device)
Temperature evaluation onboard	+ 1 (PTC / KTY84, PT100 and PT1000)	- 1 (PTC or KTY84-130)
<b>Others</b>		
Electronics power supply 24 V	+ yes	- no

### Accessories and supplementary components

	SINAMICS DC MASTER	SIMOREG DC-MASTER
Commutating reactor single and three-phase	= as accessory	= as accessory
Line-side overvoltage protection to protect the power semiconductors	= Overvoltage protection SICROWBAR AC	= Overvoltage protection SICROWBAR AC
Recommendation for overvoltage protection at the output when supplying high inductances	= SICROWBAR DC overvoltage protection and special thyristor control "reliable triggering"	= SICROWBAR DC overvoltage protection and special thyristor control "reliable triggering"
Protection against the effects of inverter commutation faults	= CCP optional up to 2000 A rated current up to 690 V	= CCP optional up to 2000 A rated current up to 690 V
Radio interference suppression filter for field and armature circuit	= Optional	= Optional
Integrated semiconductor protection fuses (arm fuse)	= existing devices for $\geq 900$ A	= existing devices for $\geq 900$ A
Optional encoder interfaces	SMC 30	SBP
HTL / TTL encoder	= yes	= yes
SSI encoder	+ yes	- no
<b>Expanded interfaces</b>		



	SINAMICS DC MASTER	SIMOREG DC-MASTER
	<p>+</p> <p><b>Terminal Module TM15</b> 24 digital inputs/digital outputs</p> <p><b>Terminal Module TM31</b> 2 analog inputs 2 analog outputs 4 digital inputs 4 digital outputs 4 digital inputs/digital outputs 2 relay contacts</p> <p><b>Terminal Module TM150</b> Up to 9 temperature sensors can be connected (2, 3 or 4-wire connection) including short-circuit and wire breakage monitoring</p> <ul style="list-style-type: none"> <li>• PT100</li> <li>• PT1000</li> <li>• KTY84</li> <li>• PTC</li> <li>• Bimetallic NC contact (without monitoring)</li> </ul> <p>Max. 3 TM per CUD possible</p> <p><b>Second CUD for performance and terminal expansion</b></p>	<p>-</p> <p><b>Terminal expansion board EB1</b> 3 digital inputs 4 digital inputs/digital outputs 3 analog inputs</p> <p><b>Terminal expansion board EB2</b> 2 digital inputs 4 relay contacts 2 analog outputs or fiber optic cable modules SCI1, SCI2</p> <p><b>T100, T300, T400</b> max. 2 EB modules possible per CUD</p> <p><b>CUD2 to expand terminals</b></p>
<b>Optional panel</b>	Advanced Operator Panel AOP30	Operator Panel OP1S
Control panel	= yes	= yes
Fault diagnostics in plain text	+ yes	- no
Fully graphic capable	+ yes	- no

	SINAMICS DC MASTER	SIMOREG DC-MASTER
Multilingual	+ German English French Spanish Italian Chinese Russian Polish	= no Russian, Chinese with special software
Numerical keypad	= yes	= yes

### Engineering tools

	SINAMICS DC MASTER	SIMOREG DC-MASTER
Engineering support	+ SIZER LD web DT Configurator SINAMICS DCM Pro SIZER WEB engineering	= SIZER (free load cycles) SIMOREG Pro
Engineering software	STARTER commissioning tool	DriveMonitor
Connection	= via PROFIBUS, PROFINET also routing from a higher-level control system	= via RS232 / RS485
Graphic function diagram screen forms	+ available	- not available
Trace	+ 2 x 8 channels Longer-term trace with memory card Arithmetic functions (several y scales)	- 10 channels Trace ½
Function generator	+ available	- not available
Scripting	= yes	= yes
Prompted commissioning Wizard	+ yes	- only user-defined list

## Functions

	SINAMICS DC MASTER	SIMOREG DC-MASTER
12-pulse series	= possible	= possible
12-pulse parallel	= possible	= possible
Topology switchover series/parallel	+ yes (option S50)	- no
Single-phase connection (armature circuit)	+ possible	- not possible
Redundant operation armature circuit	= optimized for SINAMICS DC MASTER possible without interruption	= possible without interruption
Redundant operation field circuit	= possible	= possible
<b>Data sets</b>		
BICO data sets	= 2 (CDS - command the data set)	= 2
	= 4 drive data sets (DDS) with 4 encoder data sets each	= 4 function data sets
<b>Automatic optimization runs</b>		
Current controller	= yes	= yes
Speed controller including precontrol (frictional torque and moment of inertia)	= yes	= yes
Plotting the field characteristic	= yes	= yes
EMF controller optimization	= yes	= yes
Optimization run for mechanical systems that are prone to oscillation	+ yes	- no
<b>Free function blocks</b>		
	= 52 function blocks for basic logic interconnections with standard performance available at no additional price	-
	+ DCC (license cost for each PC) for high requirements, graphic editor, simulation mode, as many block instances as required (only restricted by the arithmetic and storage capacity)	- Option S00 (license cost for each device) no graphic editor, no simulation mode, a maximum of 300 blocks available

	SINAMICS DC MASTER	SIMOREG DC-MASTER
	= Expanded by CUD inserted in the right-hand slot	= CFC in technology modules T300 and T400
<b>Additional functions</b>		
Communication between 2 devices	+ SINAMICS Link Peer-to-peer CU-Link	- SIMOLINK Peer-to-peer
Control Module	= available	= available
Know-how protection	= yes	= yes
Same speed controller reference model as for the SINAMICS S120	+	-

**Services**

	SINAMICS DC MASTER	SIMOREG DC-MASTER
Maintenance See also maintenance concept	Fan replacement (if a fan is available)	Fan replacement (if a fan is available)
Remote access	- only with higher-level control	- only with higher-level control
Fault diagnostics	+ Faults and recommendations for resolving faults are output in plain text (on the AOP30 or the STARTER commissioning tool)	+ Faults and recommendations for resolving faults are output in plain text (in DriveMonitor)
Detailed documentation in several languages	+ 7-languages including Russian. Operating instructions and List Manual including function diagrams	- 5 languages
Range of training courses	+ Service & commissioning- DR-DCM-SI Diagnostics & maintenance- DR-DCM-DG Repair (only for Siemens personnel) - DR-DCM-REP	- 5-day training course

**Certificates/tests/standards**

	SINAMICS DC MASTER	SIMOREG DC-MASTER
UL approval	= yes	= yes
Marine	+ yes, in the standard version	- yes, with EMC envelope/covering
EAC (GOST)	+ yes	+ yes
PROFIBUS	+ PROFIdrive certified according to PNO	- no
PROFINET	+ PROFIdrive certified according to PNO	- no

**Quality**

	SINAMICS DC MASTER	SIMOREG DC-MASTER
Ruggedness of the devices	+ The ruggedness of the devices has been decisively improved as a result of continuous improvement, internal quality standards and the more stringent situation regarding standards.	-



# Terminal assignment SIMOREG DC-MASTER - SINAMICS DC MASTER

# 4

## 4.1 Digital inputs

Table 4- 1 Digital inputs

Terminal number SIMOREG DC-MASTER	Terminal number SINAMICS DC MASTER	Comment
X171.34	X177.9, X177.10	24 V DC short-circuit proof
X171.35	X177.23, X177.24	Digital ground
X171.36	X177.11	Binary select input 1
X171.37	X177.12	Binary select input 2
X171.38	X177.13	Binary select input 3
X171.39	X177.14	Binary select input 4
<b>If CUD2 is inserted</b>		
X163.40	X177.15	Binary select input/output 1
X163.41	X177.16	Binary select input/output 2
X163.42	X177.17	Binary select input/output 3
X163.43	X177.18	Binary select input/output 4
X163.44	X177.9	24 V DC short-circuit proof
<b>Replaced by Terminal Module TM31</b>		
X161.210	X540.1	24 V DC short-circuit proof
X161.211	X520.1	Binary select input
X161.212	X520.2	Binary select input
X161.213	X520.3	Binary select input
X161.214	X520.4	Binary select input
X161.215		Ground for binary inputs
X161.216	X520.5	Ground for binary inputs
X161.217	X520.6	Ground

## 4.2 Digital outputs

Table 4- 2 Digital outputs

Terminal number SIMOREG DC-MASTER	Terminal number SINAMICS DC MASTER	Comment
X171.46	X177.19	Binary select output 1
X171.47	X177.23	Ground, digital
X171.48	X177.20	Binary select output 2
X171.54	X177.23	Ground, digital
<b>If CUD2 is inserted</b>		
X163.50	X177.21	Binary select output 3
X163.51	X177.24	Ground, digital
X163.52	X177.22	Binary select output 4
X163.53	X177.24	Ground, digital



## 4.3 Analog inputs

Table 4- 3 Analog inputs

Terminal number SIMOREG DC-MASTER	Terminal number SINAMICS DC MASTER	Comment
X174.1	X177.33, X177.34	Ground, analog
X174.2	X177.31	P10
X174.3	X177.32	N10
X174.4	X177.25	Main setpoint +
X174.5	X177.26	Main setpoint -
X174.6	X177.27	Analog select input 1 +
X174.7	X177.28	Analog select input 1 -
X174.22	X177.53	Motor temperature +
X174.23	X177.55	Motor temperature-
X174.24	X177.33	Ground, analog
<b>If CUD2 is inserted</b>		
X164.8	X177.29	Analog select input 2
X164.9	X177.30	Ground, analog
X164.10	X177.1	Analog select input 3
X164.11	X177.2	Ground, analog
X164.204	X522.7	Motor temperature 2 + (on TM31)
X164.205	X522.8	Motor temperature 2 - (on TM31)

## 4.4 Analog outputs

Table 4- 4 Analog outputs

Terminal number SIMOREG DC-MASTER	Terminal number SINAMICS DC MASTER	Comment
X175.12		Current actual value
X175.13		Ground, analog
X175.14	X177.49	Analog output 1
X175.15	X177.50	Ground, analog
X175.16	X177.51	Analog output 2
X175.17	X177.52	Ground, analog
<b>If CUD2 is inserted</b>		
X164.18	X522.1	Analog output 3 (on TM31)
X164.19	X522.2	Ground, analog
X164.20	X522.4	Analog output 4 (on TM31)
X164.21	X522.5	Ground, analog

4.5 Pulse encoder

## 4.5 Pulse encoder

Table 4- 5 Pulse encoder

<b>Terminal number SIMOREG DC-MASTER</b>	<b>Terminal number SINAMICS DC MASTER</b>	<b>Comment</b>
X173.26	X177.41	P15 for supply in the pulse encoder
X173.27	X177.42	Ground
X173.28	X177.43	Track 1 +
X173.29	X177.44	Track 1 -
X173.30	X177.45	Track 2 +
X173.31	X177.46	Track 2 -
X173.32	X177.47	Zero mark +
X173.33	X177.48	Zero mark -

## 4.6 Interfaces

Table 4- 6 Interfaces

Terminal number SIMOREG DC-MASTER	Terminal number SINAMICS DC MASTER	Comment
X165	X165	Parallel interface
X166	X166	Parallel interface
<b>RS232/G-SST1</b>		
X300.1		Housing ground
X300.2	X179.4	Receive line RXD1
X300.7	X179.3	Transmit line TXD1
X300.5	X179.2	Ground
<b>RS485/G-SST1</b>		
X300.3	X178.3	Transmit and receive line RxD/TxD-P
X300.8	X178.4	Transmit and receive line RxD/TxD-N
X300.9	X178.5	Ground
<b>RS485/G-SST2 -if parameter 790 = 2</b>		
X172.58	Not replicated	Transmit and receive line RxD/TxD-P
X172.59	Not replicated	Transmit and receive line RxD/TxD-N
X172.60	Not replicated	Ground
<b>RS485/G-SST2 -if parameter 790 = 5</b>		
X172.56	X177.37	Transmit line TX+
X172.57	X177.38	Transmit line TX-
X172.58	X177.39	Receive line RX+
X172.59	X177.40	Receive line RX-
X172.60	X177.35, X177.36	Ground
<b>RS485/G-SST3</b>		
X162.61	Not replicated	Transmit line TX+
X162.62	Not replicated	Transmit line TX-
X162.63	Not replicated	Receive line RX+
X162.64	Not replicated	Receive line RX-
X162.65	Not replicated	Ground
X162.63	Not replicated	RS485/GSST3



# Commissioning SINAMICS DC MASTER using the BOP20 operator panel

# 5

## 5.1 Preconditions

### Fundamentals of SINAMICS

If you do not already know the fundamentals of SINAMICS (parameters, drive objects, BICO technology etc.), then before starting commissioning, in the SINAMICS DCM operating instructions in Chapter "Operation" read the "Fundamentals" section.

### BOP20 basic operator panel

If you still do not know the BOP20 operator panel, before commissioning, in the SINAMICS DCM operating instructions, in Chapter "Operation", read the section "Parameterizing using the BOP20".

### Parameter notation

A complete parameter comprises  
drive object + parameter number + index the following notation

(oo)pxxxx[ii]      for indexed parameters  
(oo)pxxxx          for non-indexed parameters

To improve readability, in this chapter, the drive object is omitted for all parameters belonging to the drive object "Closed-loop drive control" (= drive object 2).  
For example, p50076[1] means parameter (2)p50076[1] (= drive object 2, parameter 50076, index 1).

## 5.2 Commissioning steps

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### Note

Parameter with [D] depend on a data set. Commissioning must be carried out for each data set.

---

### <1> Access authorization

In order to be able to set access authorization, at the BOP20 basic operator panel, drive object 1 (DO1) must be activated; see the operating instructions of SINAMICS DCM, Chapter 9, Section Display and operation using the BOP20 basic operator panel.

Access level

- (1)p0003 = 1 Standard
- (1)p0003 = 2 Advanced
- (1)p0003 = 3 Expert

### <2> Adapting the rated device currents

---

### Note

For the base drives produced in North America (Type 6RA80xx-2xxxx), the US rating must be adjusted at p50067.

---

The **rated armature DC current for the unit** must be adjusted by setting p50076[0] (in %) or p50067 if:

Maximum armature current  $< 0.5 \times$  rated armature DC current for the unit

The **rated field DC current for the unit** must be adapted by setting p50076[1] (in %) if:

Maximum field current  $< 0.5 \times$  rated field DC current for the unit

### <3> Adapting the actual device supply voltage

- p50078[0] Rated DC converter input voltage, armature (in Volt)
- p50078[1] Rated DC converter input voltage, field (in Volt)

**〈4〉 Entering the motor data**

The motor data according to the motor rating plate must be entered into the following parameters (see also the operating instructions of SINAMICS DCM, Chapter "Thermal overload protection of the DC motor" and "Speed-dependent current limiting"):

**Fig.**

p50100[D]	Rated armature current (in amperes)
p50101[D]	Rated armature voltage (in volts)
p50102[D]	Rated excitation current (in amperes)
p50104[D]	Speed n1 (in rpm)
p50105[D]	Armature current I1 (in amperes)
p50106[D]	Speed n2 (in rpm)
p50107[D]	Armature current I2 (in amperes)
p50108[D]	Maximum operating speed n3 (in rpm)
p50109[D]	1 = Speed-dependent current limitation active
p50114[D]	Motor thermal time constant (in seconds)

**〈5〉 Speed actual value sensing data****〈5.1〉 Operation with analog tachometer**

p50083[D] = 1 The actual speed value comes from the "Main actual value" (r52013) channel (terminals XT.103, XT.104).

p50741[D] Tachometer voltage at maximum speed (– 270.00 to +270.00 V)

Remark:

The value set here defines 100% speed for the closed-loop speed control.

p2000 Speed in rpm for tachometer voltage set on p50741[0]

Comment 1:

Parameter p2000 is used to convert from a "physical speed" (rpm) into a "relative speed" (%) and vice versa.

This conversion is required for:

- Speed setpoint input via the operator panel in the STARTER commissioning tool
- Speed setpoint input via the operating screen form of the AOP30 advanced operator panel
- Calculating the display values r020, r021, r060 and r063

Remark 2:

Parameter p2000 and parameters r020, r021, r060 and r063 are not data-set dependent. This is the reason that the physical speed can only be displayed correctly for one data set (DDS).

5.2 Commissioning steps

**〈5.2〉 Operation with pulse encoder**

p50083[D] = 2 The speed actual value is received from a pulse encoder (r0061) connected at terminal block X177

p0400[0] Encoder type selection

p2000 Speed in rpm at 100% speed

Remark:

The value set here defines 100% speed for the closed-loop speed control.

**〈5.3〉 Operation without tachometer (EMF control)**

p50083[D] = 3 The actual speed value comes from the "Actual EMF value" channel (r52287), but is evaluated with p50115.

p50115[D] EMF at 100% speed (1.00 to 140.00 % of the rated device supply voltage (p50078[0]))

Remark:

The value set here defines 100% speed for the closed-loop speed control.

p2000 Speed in rpm for EMF set on p50115[0]

Comment 1:

Parameter p2000 is used to convert from a "physical speed" (rpm) into a "relative speed" (%) and vice versa.

This conversion is required for:

- Speed setpoint input via the operator panel in the STARTER commissioning tool
- Speed setpoint input via the operating screen form of the AOP30 advanced operator panel
- Calculating the display values r020, r021, r060 and r063

Remark 2:

Parameter p2000 and parameters r020, r021, r060 and r063 are not data-set dependent. This is the reason that the physical speed can only be displayed correctly for one data set (DDS).

**〈5.4〉 Freely wired actual value**

p50083[D] = 4 The actual-value input is defined with p50609[C]

p50609[C] Number of the parameter that is switched to the actual speed controller value



p2000	<p>Speed in rpm at which the parameter selected on p50609[0] accepts the value 100%</p> <p>Comment 1: Parameter p2000 is used to convert from a "physical speed" (rpm) into a "relative speed" (%) and vice versa.</p> <p>This conversion is required for:</p> <ul style="list-style-type: none"> <li>• Speed setpoint input via the operator panel in the STARTER commissioning tool</li> <li>• Speed setpoint input via the operating screen form of the AOP30 advanced operator panel</li> <li>• Calculating the display values r020, r021, r060 and r063</li> </ul> <p>Remark 2: Parameter p2000 and parameters r020, r021, r060 and r063 are not data-set dependent. For that reason, the physical speed can only be displayed correctly for one data set (CDS).</p>
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#### 〈5.5〉 Operation with pulse encoder and SMC30

p50083[D] = 5	The actual speed value comes from an incremental encoder connected to an SMC30 (r3770).
p0400[1]	Encoder type selection
p2000	Speed in rpm at 100% speed
	Remark: The value set here defines 100% speed for the closed-loop speed control.

## 〈6〉 Field data

### 〈6.1〉 Controlling the field

p50082 = 0	Internal field is not used (e.g. for permanent-magnet motors)
p50082 = 1	The field is also switched with the line contactor (the field pulses are energized de-energized simultaneously with the line contactor)
p50082 = 2	The selected standstill field set using p50257 is automatically activated after a time that can be parameterize using p50258 after operating state o7 or higher is reached
p50082 = 3	Field current permanently switched on

### 〈6.2〉 Field weakening

p50081 = 0	No speed or EMF-dependent field weakening
p50081 = 1	Field weakening operation using the internal EMF control, so that in the field-weakening range, this means speeds above the rated motor speed (= "Transition speed"), the motor EMF is kept constant at the setpoint "EMFset" (r52289) = $p50101 - p50100 * p50110$ .

## <7> Setting the basic technological functions

### <7.1> Current limits

- p50171[D] System current limit in torque direction I (as % of p50100)
- p50172[D] System current limit in torque direction II (as % of p50100)

### <7.2> Torque limits

- p50180[D] Torque limit 1 in torque direction I  
(as % of rated motor torque)
- p50181[D] Torque limit 1 in torque direction II  
(as % of rated motor torque)

### <7.3> Ramp-function generator

- p50303[D] Ramp-up time 1 (in seconds)
- p50304[D] Ramp-down time 1 (in seconds)
- p50305[D] Initial rounding 1 (in seconds)
- p50306[D] Final rounding 1 (in seconds)

## <8> Completing fast commissioning

Set p3900 = 3.

This triggers the calculation of the motor data (Ra, La, Lf) as well as the calculation of the controller parameters resulting from the data that was entered in the previous steps.

p3900 is then set back to 0 and fast commissioning completed; this means that p0010 is reset to 0.

## <9> Executing the optimization runs

Perform the optimization runs one after the other:

- p50051 = 24 Optimization of closed-loop field-current control
- p50051 = 25 Optimization of closed-loop armature current control
- p50051 = 26 Optimization of speed control
- p50051 = 27 Optimizing the EMF control (including plotting the field characteristic)
- p50051 = 28 Plotting the friction characteristic
- p50051 = 29 Optimization of closed-loop speed control for drives with a mechanical system capable of oscillation

For more detailed information, refer to the SINAMICS DCM operating instructions, Chapter "Drive optimization".

If an optimization run is not carried out, the motor control uses the motor characteristic values calculated from the rating plate data rather than the measured values.

**! DANGER**

During optimization runs, the drive initiates motor movements that can reach the maximum motor speed. The EMERGENCY OFF functions must be fully operational during commissioning. To protect man and machines, the relevant safety regulations must be observed.

**<10> Checking and possibly finely calibrating the maximum speed**

Once the optimization runs have been executed, the maximum speed needs to be checked and, if necessary, the setting for it corrected.

If the maximum speed has now shifted by more than around 10%, the control response of the closed-loop speed control circuit will need to be checked; it may be necessary to repeat the optimization run for the speed controller or carry out re-optimization manually.

The optimization runs for field weakening and for friction and moment of inertia compensation must be repeated if there is any change to the maximum speed.

**<11> Checking the drive settings**

The optimization runs do not produce the best results for every application, so in all cases it is necessary to check the controller settings using the appropriate tools (oscilloscope, STARTER trace, and so on). Some cases may require manual re-optimization.

**<12> Manually (post) optimizing (if required)**

If the result of the optimization runs is not satisfactory, then manual post or new optimization can be performed.

The procedure is described in the operating instructions, in Chapter "Manual optimization".

**<13> Saving the setting values in a non-volatile fashion**

Previously, all changes in the set values were made in the RAM (Random Access Memory). If the device is switched off in this state, all settings made previously are lost. To permanently store the settings in the ROM (non-volatile memory), a RAM to ROM must be triggered by setting p0977 to 1 (p0977 is allocated to the DO 1). While data is being saved, the BOP20 flashes (and the RDY-LED on the CUD also flashes); this takes approx. 45 s. After the save operation the settings are backed up in the ROM.

The drive can now be switched off (POWER OFF) without losing the settings that have been made. Also refer to the "Operation" chapter, "CompactFlash Card functions" section.

#### **<14> Documenting the setting values**

The following facilities are available so that the settings made can be recorded outside the unit:

- External CompactFlash Card was inserted during the RAM to ROM (p0977=1). The parameters were therefore also transferred to the external CompactFlash Card.
- Write the parameters to a CompactFlash Card (p0804).
- Document the parameters in a STARTER project (load to PG). Also refer to the "Operation" chapter, "CompactFlash Card functions" section and "Commissioning with the STARTER commissioning tool" chapter.



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