SINAMICS DCM

DC converters from 6 kW to 2500 kW for variable-speed direct-current drives

Application:
Continuous operation in the case of a pulse encoder error

Edition 01 - 12/2010

SINAMICS drives

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Compact User Manual

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠ DANGER
indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING
indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ CAUTION
with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.

CAUTION
without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.

NOTICE
indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation for the specific task, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

⚠ WARNING
Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be adhered to. The information in the relevant documentation must be observed.

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1   Instructions

Note

This application document does not claim to contain all details and versions of units, or to take into account all conceivable operational cases and applications.

The standard applications do not represent specific customer solutions, but are only intended to provide support in the implementation of typical applications. The operator is responsible for the correct operation of the products described.

Should you require further information or encounter specific problems which have not been handled in enough detail, please contact your local Siemens office.

The contents of this application document are not part of an earlier or existing contract, agreement or legal relationship, nor do they change such contracts, agreements or legal relationships. The contract of sale in each case outlines all the obligations of the I DT Drive Technologies Division of Siemens AG. The warranty conditions specified in the contract between the parties are the only warranty conditions accepted by the I DT Drive Technologies Division. Any statements contained herein neither create new warranties nor modify the existing warranty.

⚠ WARNING
The units listed here contain dangerous electric voltages, dangerous rotating machine parts (fans) and control rotating mechanical parts (drives). Failure to follow the relevant Operating Instructions may result in death, serious injury or extensive material damage.

Technical Support

You can also find help for technical issues through our Technical Support:
www.siemens.de/automation/support-request (German)
www.siemens.com/automation/support-request (English)

2   Field of application

In some critical processes, the converter equipment cannot be permitted to switch off in the event of a pulse encoder or tacho error. If an error occurs on the actual speed value encoder, the device must remain in operation and automatically switch to the calculation of the actual speed value as a replacement for the actual speed value signal. The calculated actual speed value is based on the measured armature voltage and the motor flow.

This application document describes the parameter settings required in order to implement the above application in SINAMICS DCM with the use of free function blocks in the software.

If a switch is made from the measured speed to the calculated speed, this is signaled by a HIGH signal on terminal X177.19.

Requirement

A pulse encoder or analog tacho is required if the system is also to be operated in the field weakening range. This encoder is required in order to record the field characteristic during commissioning and to determine the flow across the field current. (p50051 = 27). Once the field characteristic has been recorded, the speed for both the armature voltage range and the field weakening range can be calculated.

3   Parameter settings

The following parameter settings configure the SINAMICS DCM in such a way that in the event of an encoder error, the encoder automatically switches to a calculated actual speed value for closed-loop control.

Selection of free function blocks

These parameters are also possible in DO1, setting with BOP20.

p003	=	3	Expert
p009	=	2	Defining the drive type/function module
p108[1]	=	Bit 16	Technology controller
		Bit 18	Free function blocks
		Bit 31	PROFINET
		00040000 Hex: Bit 18, 80040000 Hex: Bit 18 + Bit 31	
p009	=	0	The device is now reinitialized

The following parameters are in DO2

p20000[0]	=	4	Runtime group 0 is calculated with 4 ms
p50083	=	4	Selects the actual speed value source from the free source via p50609
p50609	=	20220	Selects the output of the free changeover switch NSW 0 as the actual value source
p20118[0]	=	52287	Connects the motor EMF to the X0 divider input DIV 0
p20118[1]	=	52290	Connects the motor flow to the X1 divider input DIV 0
p20121	=	0	Runtime group 0 for DIV 0
p20122	=	1000	Run sequence for DIV 0
p20110[0]	=	20119[0]	Connects the output of the DIV 0 to the input X0 of the multiplier MUL 0
p20110[1]	=	52401	Connects a fixed signal (p50401) to the multiplier input X1 of MUL 0
p20110[2]	=	52001	X2 is 100% for MUL 0
p20110[3]	=	52001	X3 is 100% for MUL 0
p20112	=	0	Runtime group 0 for MUL 0
p20113	=	1010	Run sequence for MUL 0
p50401	=	xx %	Scales the calculated speed in accordance with the maximum speed and the field weakening range (see chapter 5, Alignments), same value for index 0 and index 1

p20128	=	61[0]	Connects the measured actual speed value of the pulse encoder to AVA 0
p20131	=	0	Runtime group 0 for absolute value generator AVA 0
p20132	=	1020	Run sequence for AVA 0
p20133	=	20111	Connects the calculated actual speed value to AVA 1
p20136	=	0	Runtime group 0 for absolute value generator AVA 1
p20137	=	1030	Run sequence for AVA 1
p20102[0]	=	20129	Output of AVA 0 to X1 of subtracter SUB 0
p20102[1]	=	20134	Output of AVA 1 to X2 of subtracter SUB 0
p20104	=	0	Runtime group 0 for SUB 0
p20105	=	1040	Run sequence for SUB 0
p20266	=	20103	Output of SUB 0 to input of limit monitor LVM 0
p20267	=	0.00	LVM 0 interval mean value M
p20268	=	0.1	LVM 0 interval limit L
p20269	=	0.03	LVM 0 hysteresis HY
p20273	=	0	Runtime group 0 for LVM 0
p20274	=	1050	Run sequence for LVM 0
p20158	=	20272	Output of LVM 0 to switch-on delay device PDE 0
p20159	=	10.0	10 ms switch-on delay for PDE 0, set to 10 to 40 ms
p20181	=	0	Runtime group 0 for PDE 0
p20162	=	1060	Run sequence for PDE 0
p20218[0]	=	61[0]	Connects the actual speed value of the pulse encoder to X0 of NSW 0
p20218[1]	=	20111	Connects the calculated speed to X1 of NSW 0
p20219	=	20160	Configures r20160 as "Activate changeover switch"
p20221	=	0	Runtime group 0 for NSW 0
p20222	=	1070	Run sequence for NSW 0
p2118.0	=	60042	Select tacho fault error message to be hidden
p2119.0	=	3	Hide tacho fault error message
p50263	=	0	Use flow calculation from field current actual value
p50771	=	20160	Message: switch to calculated speed via terminal X177.19, HIGH signal when switch is made to calculated speed

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r0061[0]	CO Measured actual speed value of pulse encoder
r20111	CO Actual speed value calculated
r20220	CO Actual speed value measured/calculated by the changeover switch for speed control
r52287	CO Actual EMF value
r52290	Motor flow PHI
r20160	BO HIGH for switch to calculated actual speed value

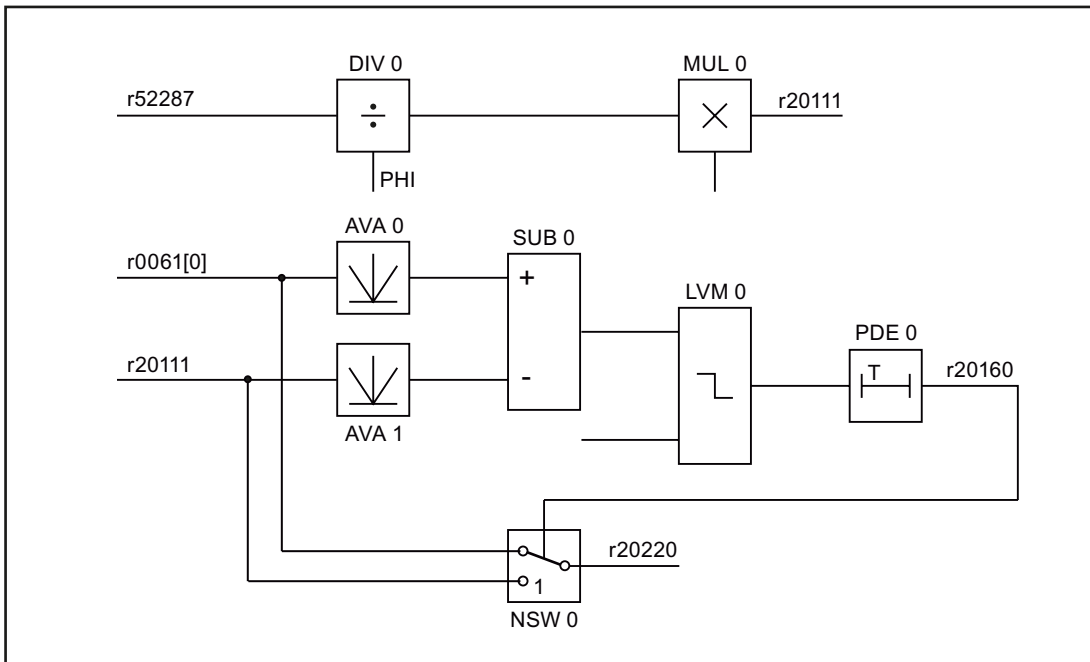# 4 Simplified schematic circuit diagram

Figure 1   Schematic circuit diagram

5 Alignments

- Bring the drive into normal operation using the pulse encoder evaluation and p50083 = 2. Perform a current controller optimization sequence with p50051 = 25 and, if necessary, a speed controller optimization sequence with p50051 = 26. For operation with field weakening, also record the field characteristic with p50051 = 27.
- As soon as the drive is working correctly with the pulse encoder evaluation, make the parameter settings as described in chapter 3. For safety reasons, leave p50083 = 2.

Speed calculation

- Check the output of SUB 0, r20103 and adjust this value to 0.0 using p50401 (measured speed is equal to the calculated speed)
- In so doing, operate the drive at approx. 50% speed and check r20103
- Travel to various speeds and verify that r20103 = 0.0 constantly.
- Then set p50083 = 4.

Tacho break detector

If the calculated speed deviates from the calculated speed by more than 10%, the limit monitor LVM 0 responds and its output is HIGH for switching to the calculated speed

- Interrupt the pulse encoder line to simulate a pulse encoder error and verify that the drive switches to the calculated speed. A minor speed difference occurs during the switchover, but the speed returns to its normal level, with the calculated speed as the actual value.

Parameter set 2 (DDS1)

We recommend that you switch to parameter set 2 when using the calculated speed and to adjust the speed controller parameters accordingly.

p00820[0] = 20160 in the case of calculated speed, switch from DDS0 to DDS1.

Copy data set following commissioning:

p00819[0] = 0
p00819[1] = 1
p00819[2] = 1

Then set speed controller parameters for DDS1:

p50200[1] = 30
p50225[1] = 3
p50226[1] = 0.3

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Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.