SIEMENS

SIMODRIVE 611 digital/ SINUMERIK 840D/810D

Drive Functions

Function Manual

Valid for

Control
SINUMERIK 840D
SINUMERIK 840DE (export version)
SINUMERIK 840D powerline
SINUMERIK 840DE powerline
SINUMERIK 810D
SINUMERIK 810DE (export version)
SINUMERIK 810D powerline
SINUMERIK 810DE powerline

Drive
SIMODRIVE 611 digital

Drive
SIMODRIVE 611 digital

11/2005 Edition

SINUMERIK® Documentation

Printing history

Brief details of this edition and previous editions are listed below.

The status of each edition is shown by the code in the "Remarks" columns.

Status code in the "Remarks" column:

A . . . . . New documentation.
B . . . . . Unrevised reprint with new Order No.
C . . . . . Revised edition with new status.
           If the technical subject matter shown on the page has changed compared to the
           previous edition status, this is indicated by the changed
           edition status in the header of the respective page.

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09.01	6SN1 197-0AA80-0BP7	**C**
12.01	6SN1 197-0AA80-0BP8	**C**
12.02	6SN1 197-0AA80-1BP0	**C**
03.04	6SN1 197-0AA80-1BP1	**C**
10.04	6SN1 197-0AA80-1BP2	**C**
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Other functions not described in this documentation may be executable in the control. However, no claim can be made regarding the availability of these functions when the equipment is first supplied or in the event of servicing.

Further information is available in the Internet at:
http://www.ad.siemens.com/sinumerik

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We have checked that the contents of this document correspond to the hardware and software described. Nevertheless, differences might exist and we cannot, therefore, guarantee that they are completely identical. However, the information contained in this document is reviewed regularly and any necessary changes included in subsequent editions. We welcome suggestions for improvement.

Subject to change without prior notice.

Preface

SINUMERIK documentation

The SINUMERIK documentation is subdivided into 3 parts:

- General documentation

- User documentation

- Manufacturer/service documentation

For more detailed information on SINUMERIK 840D/810D publications and other publications covering all SINUMERIK controls (e.g., universal interface, measuring cycles, etc.), please contact your local Siemens office.

An overview of publications, which is updated on a monthly basis and also provides information about the language versions available, can be found on the Internet at:
http://www.siemens.com/motioncontrol
Follow menu items – "Support" –> "Technical Documentation" –> "Overview of Publications".

The Internet version of DOConCD (DOConWEB) is available at:
http://www.automation.siemens.com/doconweb

Target audience

This document is designed for machine-tool manufacturers. The brochure contains a detailed description of the scope of functions offered by SINUMERIK 840D/810D controllers and SIMODRIVE 611D drives.

Standard version

This Description of Functions describes only the functionality of the standard version. Extensions or changes made by the machine tool manufacturer are documented by the machine tool manufacturer.

Other functions not described in this documentation might be executable in the control. This does not, however, represent an obligation to supply such functions with a new control or when servicing.

Hotline

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Notes on how to use this manual

This Function Manual is structured as follows:

- General contents

- Descriptions of functions in alphabetical order in accordance with description-of-function codes

- Appendix with lists of abbreviations, terms and references

- Index

- List of machine data with cross references to the corresponding description of functions

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Note

The following information is provided on each page:
Part of Description of Functions / Publication / Chapter – Page

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Important

This document is valid for:

- SINUMERIK 840D control and SIMODRIVE 611D drive, software version 6

- SINUMERIK 810D control, software version 6

Safety information

⚠ Danger

indicates that death or serious injury **will** result if proper precautions are not taken.

⚠ Warning

indicates that death or serious injury **may** result if proper precautions are not taken.

⚠ Caution

indicates that minor personal injury **may** result if proper precautions are not taken.

Caution

without a warning triangle this indicates that property damage may occur 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 several hazards of different degrees are present, the warning notice representing the highest degree of danger will be used. A warning notice accompanied by a safety alert symbol indicating a risk of bodily injury can also indicate a risk of property damage.

Qualified personnel

Startup and operation of the device / equipment/ system in question must only be performed using this documentation. Commissioning and operation of a device/system may only be performed by qualified personnel. Qualified persons are defined as persons who are authorized to commission, ground, and tag equipment, systems, and circuits in accordance with established safety standards.

Intended use

Please note the following:

Warning

The unit may be used only for the applications described in the catalog or the technical description, and only in combination with equipment, components and devices supplied by other -manufacturers where recommended or permitted by Siemens. To ensure trouble-free and safe operation of the product, it must be transported, stored and installed as intended and maintained and operated with care.

Explanation of symbols

Ordering Data Option

In this documentation you will find the symbol shown on the left with a reference to an ordering data option. The described function is only executable on the control if the control has the designated option.

Machine Manufacturer

This pictorial symbol always appears in this document to indicate that the machine manufacturer can affect or modify the function described. See machine manufacturer's specifications.

Technical information

Notations

The following notations and abbreviations are used in this document:

- Machine data –> MD: MD_NAME (German name)

- Setting data –> SD: SD_NAME (German name)

- The symbol "≐" means "corresponds to".

Explanation for abbreviations used in Chapters 4 & 5

The data/signals that are important for each function are described in Chapters 4 and 5 of each Description of Functions. Certain terms and abbreviations, which are used in these tabular descriptions, are explained here.

Default value

The machine data/setting data is preset to this value during startup. If default values for the channels differ, this is indicated by "/".

Value range (minimum and maximum value)

Specifies the input limits. If no value range is specified, the data type determines the input limits and the field is marked "∗∗∗".

Effectiveness of changes

Changes made to machine data, setting data, etc. do not take immediate effect in the control. The conditions for such changes to take effect are always indicated. The possible options are listed in order of priority below:

- POWER ON (po)   "RESET" key on front panel of NCU module, or disconnection/reconnection of power supply

- NEW_CONF (cf)   – Reconfiguration of the PLC interface
                  – "RESET" key on control unit, or

- RESET (re)   "RESET" key on control unit or

- Immediately (im)   after the value has been entered

Protection level

Protection levels 0 to 7 have been used. The lock for protection levels 0 to 3 (4 to 7) can be canceled by entering the correct password (setting the correct keyswitch position). The user only has access to information protected by one particular level and the levels below it. The machine data is assigned different protection levels by default.

Only the write protection level appears in the table. However, there is a fixed assignment between write and read levels:

Write protection level	Read protection level
0	0
1	1
2	4

References: /BA/, Operator's Guide
       /FB/, A2, Various Interface Signals

Value

The unit refers to the default setting for the machine data SCALING_FACTOR_USER_DEF_MASK and SCALING_FACTOR_USER_DEF.
If a physical unit has not been assigned to the MD, "–" appears in the field.

Data type

The following data types are used in the control:

- DOUBLE
  Real values or integers
  Input limits from $+/-4.19*10^{-307}$ to $+/-1.67*10^{308}$

- DWORD
  Integers
  Input limits from $-2.147*10^9$ to $+2.147*10^9$

- BOOLEAN
  Possible input values: true or false/0 or 1

- BYTE
  Integers from –128 to +127

- STRING
  Comprising a max. of 16 ASCII characters (upper case letters, numbers and underscores)

Data management

The explanations of the PLC interface in the individual Descriptions of Functions assume a theoretical maximum number of components:

- 4 mode groups (corresponding signals stored in DB11, ...)

- 8 channels (corresponding signals stored in DB21, ...)

- 18 axes (corresponding signals stored in DB31, ...)

For details of the actual number of components which can be implemented with each software version, please refer to
References: /FB/, K1, Mode Groups, Channels, Program Operation

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SIMODRIVE 611D/SINUMERIK 840D/810D Drive Functions

Operational Messages/Alarm Responses (DB1)

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SIMODRIVE 611 Digital / SINUMERIK 840D/810D Drive Functions (FBA) – 11.05 Edition

DB1–i

Notes

SIMODRIVE 611 Digital / SINUMERIK 840D/810D Drive Functions (FBA) – 11.05 Edition

Brief Description

<div style="text-align: right; font-size: 3em;">**1**</div>

Pulse suppression when the servo enable is canceled

When the drive servo enable is canceled (using terminal 64, initiated from the NC, PLC or under fault conditions), the drive decelerates along the torque limit with speed setpoint = 0, until the speed falls below the creep speed or the timer has expired. The pulses are then suppressed.

Signaling functions/ Operational messages

Torque and speed messages can be output to the PLC as a function of limit settings. Operational messages can also be seen in the service displays.

Signal exchange via system variables

Machine data can be used to configure the "Drive load", "Drive torque setpoint" and "Actual current values of axis/spindle" signals with the PT1 smoothing filter.

System variables can be used to read drives signals via the part program:

- Drive load ($AA_LOAD), described in /FBA/ DD1

- Drive torque setpoint ($AA_TORQUE)

- Active drive power ($AA_POWER)

- Actual current values of axis/spindle ($AA_CURR)

Further information about programming:
References: /PGA/ Programming Guide Advanced, Chapters 1 and 15.

Alarm response, concealing alarms

User-configured monitoring functions are available. Alarms can be concealed and the shutdown response to a fault/error condition can be set (immediate pulse disable or the drive servo enable canceled).

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Notes

Detailed Description   **2**

2.1   Pulse suppression

1403	**PULSE_SUPPRESSION_SPEED**				**Cross reference: –**
	Creep speed, pulse suppression			Relevant: FSD/MSD	Protection level: 2/4
Unit: 1/min	Default: (FSD/MSD) 0.0/2.0	Minimum: 0.0	Maximum: 7,200.0	Data type: FLOAT	Active: Immediately

The default setting depends on the motor type (FSD $\doteq$ 0, MSD $\doteq$ 2) and is parameterized during startup using the drive configuration. The default value 0 means that the machine data is inactive. Pulses are now exclusively suppressed via machine data
MD 1404: PULSE_SUPPRESSION_DELAY.

When the drive servo enable is canceled (this is possible using terminal 64, from the NC or in the event of an error), the drives decelerate along their torque limit. If the speed actual value falls below the specified speed threshold during shutdown, the pulse enable is suppressed and the drives coast down.

The pulses are deleted before this if the timer, set in MD 1404, has expired.

The functionality of machine data MD 1403 is necessary, if the overshoot is to be suppressed when zero speed is reached after the drive servo enable signal has been canceled.

Note

When the PLC cancels the servo-enable interface signal, the NC and drives are sequentially shut down with different, adjustable timers.
Axis-specific MD 36620: SERVO_DISABLE_DELAY_TIME and
MD 36060: STANDSTILL_VELO_TOL.
If the drive develops a fault or terminal 64 is deactivated, then the drive is only shut down with MD 1403 and MD 1404.

References: /FB, A2/ Description of Functions

2.1 Pulse suppression

1404	PULSE_SUPPRESSION_DELAY				Cross reference: –
Timer, pulse suppression				Relevant: FSD/MSD	Protection level: 2/4
Unit: ms	Default: (FSD/MSD) 100.0/5,000.0	Minimum: 0.0	Maximum: 100,000.0	Data type: FLOAT	Active: Immediately

The default setting depends on the motor type (FSD ≐100, MSD ≐ 5000) and is parameterized during startup using the drive configuration.

Enter the timer for pulse suppression (pulse enable = 0). After the drive servo enable signal has been canceled (this is possible using terminal 64, from the NC or in the event of an error), the control pulses of the power section transistors are cancelled on the drive side after an adjustable delay.

The pulses will already have been suppressed if the speed threshold set in MD 1403: PULSE_SUPPRESSION_SPEED has previously been undershot.

Note

When the PLC cancels the servo-enable interface signal, the NC and drives are sequentially shut down with different, adjustable timers.
If MD 1605 > MD 1404 is not selected, alarm "300608 Speed controller output limited" is output when the drive servo enable is canceled.
MD 1404 must also be selected as > MD 36610.
Axis-specific MD 36620: SERVO_DISABLE_DELAY_TIME and
MD 36060: STANDSTILL_VELO_TOL.
If the drive develops a fault or terminal 64 is deactivated, then the drive is only shut down with MD 1403 and MD 1404.

References: /FB, A2/ Description of Functions

2.2   Relay functions/operational messages

1002	MONITOR_CYCLE_TIME					Cross reference: –
	Monitoring cycle				Relevant: FSD/MSD	Protection level: 2/4
Unit: 31.25 µs 810D 840D	Default: 640 3,200	Minimum: 128 128	Maximum: 3,200 3,200		Data type: UNS.WORD	Active: POWER ON

810D: The relay functions, heatsink– and motor-temperature monitoring are calculated in this cycle. The value entered must be an integral multiple of 32 x MD 1000 (in order to avoid a parameterization error). The default monitoring time is 20 ms.

MD 1002 = K x 32 x MD 1000   K = 1, 2, 3,...

840D/611D: The heatsink– and motor-temperature monitoring are calculated in this cycle. The relay functions are calculated in the position controller cycle. The value entered must be a multiple of 4 ms (in order to avoid a parameterization error). The default monitoring time is 100 ms.

MD 1002 = K x 128   K = 1, 2, 3,...25

Note

The computation time in the interrupt level must not be exceeded, as this would cause the drive to shut down (system error).
Machine data must be the same in all axes of a controller plug-in, i.e., the same value must be entered in all axes on the 810D, and in both module axes with a 611D dual-axis module.

2.2 Relay functions/operational messages

1012	FUNC_SWITCH				Cross reference: –
	Function switch			Relevant: FSD/MSD	Protection level: 2/4
Unit: Hex 810D 840D	Default: (FSD/MSD) 4/C 4	Minimum: 0000 0000	Maximum: FFFF b5	Data type: WORD	Active: Immediately

Entering the configuration for the power-up functionality.

Table 2-1   Function switch

Bit no.	Meaning	Note	Default setting	
			FSD	**MSD**
Bit 0 840D only	Ramp-function-generator tracking	0 = Not active 1 = Active	0	0
Bit 1	Reserved		0	0

Bit 2	Drive ready
	Interface:
	"DRIVE READY" DB31, ... DBX 93.5
		0 = The drive is ready if no alarms are
		    present
		1 = The drive is ready if the conditions
		    below are present simultaneously:
		    – No alarm
		    – Terminal 663 = 1 (810D)/(611D
		      module)
			1	1

	IS "611D-Ready" DB10 DBX 108.6	All of the existing drives signal "Drive ready", terminal 63 and terminal 64 of the infeed/regenerative feedback module are energized, independently of S1.2 "Ready/fault".		
Bit 3	Relay functions active (always active for 840D, function available with SW 2.4 and higher for 810D CCU2, not available for 810DE CCU1)	0 = Deactivate relay function 1 = Activate relay function $\lvert m \rvert < m_{dx}$ $\lvert n_{act} \rvert < n_{min}$ $\lvert n_{act} \rvert < n_x$ $n_{act} = n_{set}$, ramp-up function complete	0	1
Bit 4 840D only	Parameterization errors	0 = (default). A parameterization error leads to shutdown (servo disable). 1 = A parameterization error leads to a warning signal on the screen.	0	0
Bit 5	"Hide error I_RLI_ERR"		0	0
Bit 6	Reserved		0	0
Bit 7 840D only	Pre-assigned, pre-control speed (AM) for pulse suppression and re-enable of the drive on a motor, which is still rotating	0 = The drive brings the motor directly to the current setpoint speed. 1 = The drive decelerates the motor to- wards speed 0 and then accelerates to the current setpoint speed.	0	0
Bits 8 – 15	Reserved		0	0

2.2.1   Threshold torque for Md < Mdx

Note

On the SINUMERIK 810D CCU2, the relay functions must be activated by setting bit 3 in MD 1012.

1428	TORQUE_THRESHOLD_X[n] 0...7 index of parameter set			Cross reference: –	
Threshold torque				Relevant: FSD/MSD	Protection level: 2/4
Unit: %	Default: 90.0	Minimum: 0.0	Maximum: 100.0	Data type: FLOAT	Active: Immediately

The machine data specifies the torque limit, which when exceeded deactivates the PLC interface signal "$M_d < M_{dx}$" DB 31, ... DBX 94.3. The value entered refers to the actual torque limit. Analog to this value, above the rated speed in the constant power range (field weakening operation), the maximum permissible torque is dependent on the operating point. Thus, a decreasing threshold torque characteristic is obtained as a function of $1/n$; from the stall torque onwards, this becomes a $1/n^2$ characteristic.
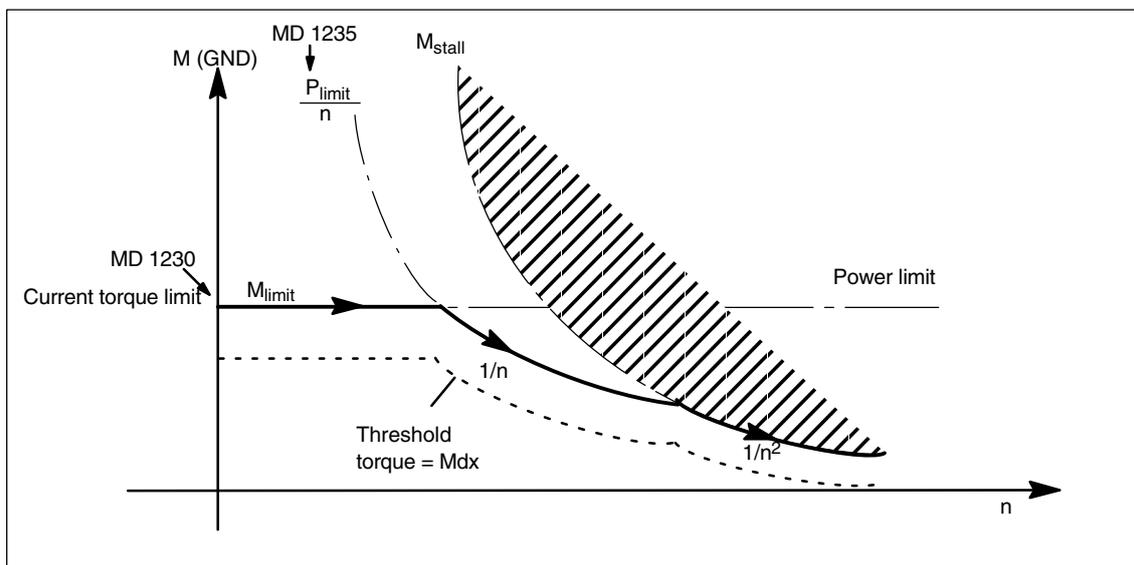

Fig. 2-1   Threshold torque characteristic for $M_d < M_{dx}$ signal

The "$M_d < M_{dx}$" signal is latched in the active status as long as the interface signal "Ramp-up function complete" DB 31, ... DBX 94.2 is not active. If "ramp-up function complete" is active, a delay time (MD 1429) is applied before the $M_d < M_{dx}$" signal can become inactive.

2.2   Relay functions/operational messages

1429	TORQUE_THRESHOLD_X_DELAY				Cross reference: –
	Delay time $M_d < M_{dx}$ signal			Relevant: FSD/MSD	Protection level: 2/4
Unit: ms	Default: 800.0	Minimum: 0.0	Maximum: 1,000.0	Data type: FLOAT	Active: Immediately

The delay time, which must expire before the "$M_d < M_{dx}$" signal can become inactive following the "Ramp-up function complete" signal, is entered. As long as "ramp-up function complete" is not active and the delay time has still not expired, the "$M_d < M_{dx}$" signal is set to "HIGH", regardless of the torque.

2.2.2   Minimum speed for $|n_{act}| < n_{min}$

Note

On the SINUMERIK 810D CCU2, the relay functions must be activated by setting bit 3 in MD 1012.

1418	SPEED_THRESHOLD_MIN [n]				Cross reference: –
	n_{min} for $|n_{act}| < n_{min}$ signal [drive parameter set]: 0 ... 7			Relevant: FSD/MSD	Protection level: 2/4
Unit: 1/min	Default: 5.0	Minimum: 0.0	Maximum: 100,000.0	Data type: FLOAT	Active: Immediately

The threshold speed is entered for monitoring purposes. If the actual speed falls below the set threshold speed (absolute value), IS "$|n_{act}| < n_{min}$" DB 31, ... DBX 94.4 is signaled to the PLC, see Fig. 2-2.
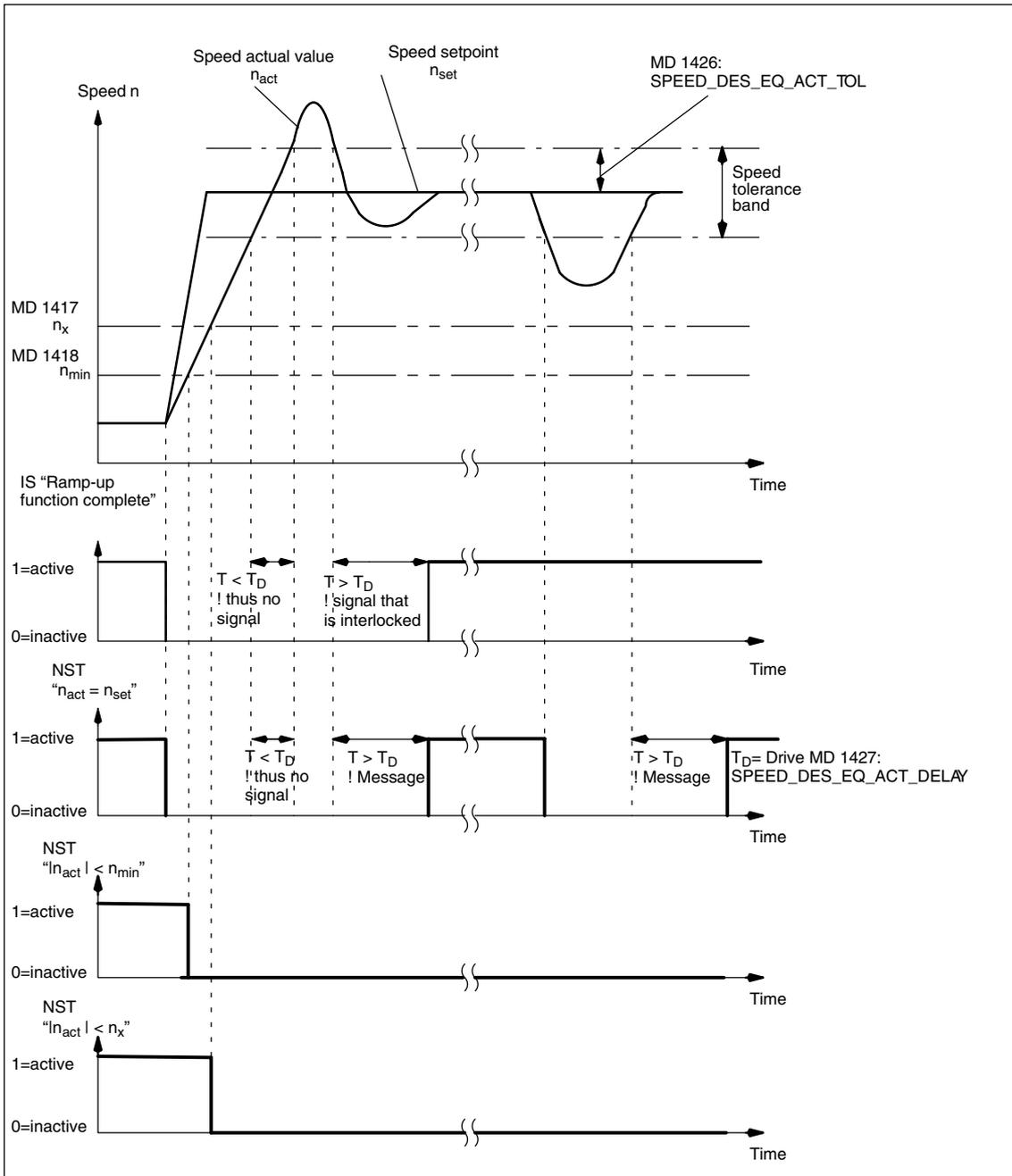
Fig. 2-2   Interface signals (IS)

2.2.3 Threshold speed for $n_{act} < n_x$

Note

On the SINUMERIK 810D CCU2, the relay functions must be activated by setting bit 3 in MD 1012.

1417	SPEED_THRESHOLD_X[n] 0...7 index of parameter set			Cross reference: –	
n_x for $|n_{act}| < n_x$ message				Relevant: FSD/MSD	Protection level: 2/4
Unit: 1/min	Default: 6,000.0	Minimum: 0.0	Maximum: 50,000.0	Data type: FLOAT	Active: Immediately

The threshold speed is entered for monitoring purposes. If the actual speed falls below the selected threshold speed (absolute value), a signal is sent to the PLC (IS "$n_{act} < n_x$" DB 31, .. DBX 94.5), see Fig. 2-2.

2.2.4 Speed in the setpoint range for $n_{act} = n_{set}$

Note

On the SINUMERIK 810D CCU2, the relay functions must be activated by setting bit 3 in MD 1012.

1426	SPEED_DES_EQ_ACT_TOL[n] 0...7 index of parameter set			Cross reference: –	
Tolerance band for $n_{act} = n_{set}$ signal				Relevant: FSD/MSD	Protection level: 2/4
Unit: 1/min	Default: 20.0	Minimum: 0.0	Maximum: 10,000.0	Data type: FLOAT	Active: Immediately

Enter the response value for the tolerance band of the PLC status messages
    IS "$n_{act} = n_{set}$" DB 31, ... DBX 94.6 and
    IS "Ramp-up function complete" DB 31, ... DBX 94.2.

The "$n_{act} = n_{set}$" signal becomes active if the speed actual value enters the selected tolerance band associated with the speed setpoint and remains within this band at least for the delay time (MD 1427). The signal becomes inactive immediately when the tolerance band is exited.

Although the "ramp-up function complete" signal becomes active simultaneously with the "$n_{act} = n_{set}$" signal, it is latched in the active state until the next setpoint change, even if the speed actual value exits the tolerance band. The "ramp-up function complete" signal becomes inactive immediately if the setpoint changes, see Fig. 2-2.

Functionality in SW 3.40/04 and higher

As long as the controller signals adjustment of the speed setpoint, the tolerance band is "frozen" at the last setpoint value. The signal is deleted when the setpoint moves outside of the tolerance band. In this way, no signals are produced if the setpoint value changes within the tolerance band.

See also "Ramp-up timing", MD 1723: ACTUAL_RAMP_TIME.

1427	SPEED_DES_EQ_ACT_DELAY				Cross reference: –
Delay time $n_{act}=n_{set}$ signal				Relevant: FSD/MSD	Protection level: 2/4
Unit: ms	Default: 200.0	Minimum: 0.0	Maximum: 500.0	Data type: FLOAT	Active: Immediately

The delay time, after which the "$n_{act} = n_{set}$" signal should respond after entering the tolerance band (MD 1426), is entered here, see Fig. 2-2.

2.3   Filter for the current and torque display

Filter for the current actual-value display

1250	ACTUAL_CURRENT_FILTER_FREQ				Cross reference: –
Frequency limit, current actual-value smoothing				Relevant: FSD/MSD	Protection level: 2/4
Unit: Hz 810D 840D	Default: 100.0 100.0	Minimum: 0.0 0.0	Maximum: 3,999.0 8,000.0	Data type: FLOAT	Active: Immediately

Enter the 3 dB frequency limit f_o for q-axis current actual-value smoothing (PT1 low pass) for the display. The time constant TI of the PT1 filter is obtained using the formula $T1 = 1/(2\,\pi\,f_o)$. It is displayed in machine data MD 1708: ACTUAL_CURRENT.
The filter is calculated in the current controller cycle.
This machine data has no effect on the closed-loop control.

Note

The filter is disabled when values < 1 Hz are entered.

2.3 Filter for the current and torque display

Filter for the torque-setpoint display

1251	LOAD_SMOOTH_TIME				840D only	Cross reference: –
	Time constant, motor utilization				Relevant: FSD/MSD	Protection level: 2/4
Unit: ms	Default: 0.0	Minimum: 0.0	Maximum: 1,000.0		Data type: FLOAT	Active: Immediately

Smoothing means that the motor load (MD 1722) can be displayed more smoothly on the HMI.
The filter is calculated in the position controller cycle.

Note

Enter "0" to deactivate the filter.

1252	TORQUE_FILTER_FREQUENCY					Cross reference: –
	Frequency limit, torque-setpoint smoothing				Relevant: FSD/MSD	Protection level: 2/4
Unit: Hz 810D 840D	Default: 100.0 100.0	Minimum: 0.0 0.0	Maximum: 3,999.0 8,000.0		Data type: FLOAT	Active: Immediately

Enter the 3 dB frequency limit f_0 for torque setpoint smoothing (PT1 low pass) for the display. The time constant T1 of the PT1 filter is obtained using the formula $T1 = 1/(2 \pi f_0)$.
The filter is calculated in the speed controller cycle.
This machine data has no effect on the closed-loop control.

Note

The filter is disabled when values < 1 Hz are entered.

2.4 Alarm response, concealing alarms

1600	ALARM_MASK_POWER_ON				Cross reference: –
Concealable alarms (POWER ON)				Relevant: FSD/MSD	Protection level: 2/4
Unit: Hex	Default: 0	Minimum: 0	Maximum: FFFF	Data type: UNS.WORD	Active: Immediately

POWER-ON alarms can be concealed using this machine data. If the corresponding bit = 0, the appropriate monitoring function is active. The default setting is active for all monitoring functions.

Table 2-2   Concealable POWER-ON alarms

Bit no.	Meaning	Alarm no.
Bit 0	Internal error – **cannot be concealed**	
Bit 1	Measuring-circuit error, absolute current value [1]	300501
Bit 2, 840D only	Measuring-circuit error, phase current R [1]	300502
Bit 3, 840D only	Measuring-circuit error, phase current S [1]	300503
Bit 4	Measuring-circuit error, motor measuring system	300504
Bit 5	Measuring-circuit error, absolute track, motor measuring system	300505
Bit 6	–	
Bit 7	Synchronization error, rotor position	300507
Bit 8	Zero-mark monitoring, motor measuring system	300508
Bit 9	Drive converter limit frequency exceeded	300509
Bit 10	Error in the center frequency measurement – cannot be suppressed	300510
Bit 11	Measured-value memory active – **cannot be concealed**	300511
Bit 12	–	
Bit 13	–	
Bit 14	–	
Bit 15	Heatsink temperature exceeded	300515

1) The power section could be destroyed if these alarms are concealed.

Note

POWER-ON alarms can only be acknowledged using a hardware reset.

2.4   Alarm response, concealing alarms

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Important

The power section or the machine mechanical system could be destroyed if the POWER-ON alarms are concealed.

1601	ALARM_MASK_RESET				Cross reference: –
Concealable alarms (Reset)				Relevant: FSD/MSD	Protection level: 2/4
Unit: Hex	Default: 0000	Minimum: 0000	Maximum: FFFF	Data type: UNS.WORD	Active: Immediately

Reset alarms can be concealed or disabled using this machine data. The alarm is active if the corresponding bit = 0. All alarms are active by default.

Table 2-3   Concealable reset alarms

Bit no.	Meaning	Alarm no.
Bit 0	**Cannot be concealed** using software interlock (configuration error)	
Bit 1	–	
Bit 2	–	
Bit 3	–	
Bit 4	–	
Bit 5	–	
Bit 6, 840D only	Flux controller output limited	300606
Bit 7, 840D only	Current controller output limited	300607
Bit 8	Speed controller output limited	300608
Bit 9	Encoder limit frequency exceeded	300609
Bit 10	–	
Bit 11	–	
Bit 12	–	
Bit 13	Max. permissible motor temperature exceeded	300613
Bit 14	Motor temperature exceeded	300614
Bit 15	–	

Note

Reset alarms can be acknowledged via the reset key.

!

Important

The power section could be destroyed if the reset alarms are concealed.

1612	ALARM_REACTION_POWER_ON				Cross reference: –
Configurable shutdown responses for PO alarms				Relevant: FSD/MSD	Protection level: 2/4
Unit: Hex 810D 840D	Default: (FSD/MSD) db2/FFFF fbc/FFFF	Minimum: 0000 0000	Maximum: FFFF FFFF	Data type: UNS.WORD	Active: Immediately

Input bit field to change over the respective POWER-ON alarm. The following can be selected: shutdown response "pulse disable", bit = 1 or "servo disable" bit = 0 (shutdown via MD 1403/MD 1404). The default setting is dependent on the motor type (FSD $\doteq$ DB 2, MSD $\doteq$ FFFF) and is parameterized during startup based on the drive configuration.

!

Important

It is possible to disable or conceal alarms via machine data MD 1600 ALARM_MASK_POWER_ON, which means that they are then **no longer active**.

Table 2-4   Configurable POWER-ON alarms

Bit no.	Meaning	Alarm no.	Default setting	
			FSD	MSD
Bit 0	Pulse disable for system error		0	1
Bit 1	**Not configurable** (measuring-circuit error, absolute current)	300501	1	1
Bit 2	–		0	1
Bit 3	–		0	1
Bit 4	**Not configurable** (measuring-circuit error, motor measuring system)	300504	1	1
Bit 5	**Not configurable** (measuring-circuit error, motor measuring system, optical encoder)	300505	1	1
Bit 6	Pulse disable for NC sign of life	300500 (from SW 4.2 300506)	0	1
Bit 7	810D: **Not configurable** (synchronization error, rotor position) For 840D: Pulse disable, synchronization error, rotor position (valid up to SW 2)	300507	1	1
Bit 8	Pulse disable for zero-mark monitoring, motor measuring system	300508	1	1
Bit 9	Pulse disable for converter limit frequency exceeded	300509	0	1
Bit 10	**Not configurable** (speed too high during ramp-up)		1	1
Bit 11	**Not configurable** (trace ran during ramp-up)		1	1
Bit 12	–		0	1
Bit 13	–		0	1
Bit 14	–		0	1
Bit 15	Pulse disable for heatsink temperature exceeded	300515	0	1

2.4 Alarm response, concealing alarms

1613	ALARM_REACTION_RESET				Cross reference: –
Configurable shutdown responses for reset alarms				Relevant: FSD/MSD	Protection level: 2/4
Unit: Hex	Default: (FSD/MSD) 100/FFFF	Minimum: 0000	Maximum: FFFF	Data type: UNS.WORD	Active: Immediately

Input bit field to change over the respective 611D reset alarm. The following shutdown responses can be selected: Pulse disable (bit = 1) or servo disable (bit = 0) (shutdown via MD 1403/MD 1404). The default setting is dependent on the motor type (FSD $\doteq$ 0100, MSD $\doteq$ FFFF) and is initialized during startup based on the drive configuration.

> **!**
>
> **Important**
>
> It is possible to disable or conceal alarms via MD 1601: ALARM_MASK_RESET, which means that they are then **no longer active**.

Table 2-5   Configurable reset alarms

Bit no.	Meaning	Alarm no.	Default setting	
			FSD	MSD
Bit 0	Pulse disable for configuration error	3007xx	0	1
Bit 1	–		0	1
Bit 2	–		0	1
Bit 3	–		0	1
Bit 4	Pulse disable motor encoder not calibrated	300604	0	1
Bit 5	–		0	1
Bit 6	–		0	1
Bit 7	–		0	1
Bit 8	Pulse disable controller output limited	300608	1	1
Bit 9	Pulse disable when an alarm occurs: Encoder frequency exceeded	300609	0	1
Bit 10	–		0	1
Bit 11	–		0	1
Bit 12	–		0	1
Bit 13	Pulse disable when an alarm occurs: Max. permissible motor temperature exceeded	300613	0	1
Bit 14	Pulse disable when an alarm occurs: Motor temperature exceeded	300614	0	1
Bit 15	–		0	1

1731	CL1_PO_IMAGE				Cross reference: –
	Image, PO alarm register			Relevant: FSD/MSD	Protection level: 2/4
Unit: Hex	Default: 0000	Minimum: 0000	Maximum: FFFF	Data type: UNS. WORD	Active: Immediately

This machine data is used to display the **internal** POWER-ON alarm register. MD 1600: ALARM_MASK_POWER_ON is **not** taken into account for this diagnostic data.

Concealed POWER-ON alarms (MD 1600) are also displayed.

If bit n is set to 1, alarm 300500 + n is displayed.

1732	CL1_RES_IMAGE				Cross reference: –
	Image, RES alarm register			Relevant: FSD/MSD	Protection level: 2/4
Unit: Hex	Default: 0000	Minimum: 0000	Maximum: FFFF	Data type: UNS. WORD	Active: Immediately

This machine data is used to display the **internal** alarm reset register. MD 1601: ALARM_MASK_RESET is **not** taken into account for this diagnostic data.

Concealed RESET alarms (MD 1601) are also displayed.

If bit n is set to 1, alarm 300600 + n is displayed.

Note

This display value is only reset by an NC-side reset (software reset).

■

Notes

Supplementary Conditions

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Data Descriptions (MD, SD)

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see Chapter 2

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Signal Descriptions

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DB 31, ... **DBX94.2**	**Ramp-up function completed**	
Data Block	Signal(s) from axis/spindle (drive → PLC)	
Edge evaluation: No	Signal(s) updated: Cyclic	Signal(s) valid as of software version: 1.1
Signal state 1 or signal transition 0 ——> 1	After a new speed setpoint is input, the PLC receives confirmation that the actual speed value has reached the tolerance band MD 1426: SPEED_DES_EQ_ACT_TOL (tolerance band for $n_{set} = n_{act}$ – signal) and has remained within this tolerance band for at least the duration set with MD 1427: SPEED_DES_EQ_ACT_DELAY (delay time $n_{set} = n_{act}$ – signal) (see Fig. 5–6). Even if the actual speed value leaves the tolerance band (because of speed fluctuations resulting from changes in load), the "Rampup function complete" signal remains (1 signal).	
Signal state 0 or signal transition 1 ——> 0	The conditions described above have not yet been fulfilled. The rampup function has therefore not yet been completed.	
Signal irrelevant for	SINUMERIK FM-NC	

DB 31, ...	**Ramp-up function completed**
DBX94.2	
Data Block	Signal(s) from axis/spindle (drive $\rightarrow$ PLC)
Fig. 5–5	
Related to	IS "$n_{act} = n_{set}$" (DB 31, ... DBX 94.6) IS "$|M_D| = M_{dx}$" (DB 31, ... DBX 94.3) MD 1426: SPEED_DES_EQ_ACT_TOL MD 1427: SPEED_DES_EQ_ACT_DELAY
Additional references	/IAD/, SINUMERIK 840D Installation and Startup Guide, Section SIMODRIVE 611D /IAG/, SINUMERIK 810D Installation and Startup Guide

DB 31, ... **DBX 94.3**	$|M_d| < M_{dx}$		
Data Block	Signal(s) from axis/spindle (drive $\rightarrow$ PLC)		
Edge evaluation: No		Signal(s) updated: Cyclic	Signal(s) valid as of software version: 1.1
Signal state 1 or signal transition 0 ——> 1	611D reports to the PLC that the torque setpoint $|M_d|$ does not exceed the threshold torque M_{dx} in the stationary condition (i.e., rampup function complete) (see Fig. 5–7). The threshold torque is set with MD 1428: TORQUE_THRESHOLD_X (threshold torque) as a percentage of the current torque limit value. The torque threshold is speeddependent. During rampup, IS $|M_d| < M_{dx}$ remains at 1. The signal $|M_d| < M_{dx}$ becomes active as soon as the rampup function is complete ("rampup function complete" IS = 1) and the signal disable time for the torque threshold. (MD 1429: TORQUE_THRESHOLD_X_DELAY (delay time $n_d < n_{dx}$ signal) has expired.			
Signal state 0 or signal transition 1 ——> 0	The torque setpoint $|M_d|$ is larger than the threshold torque M_{dx}. If necessary, the PLC user program can initiate a response.		
Signal irrelevant for	SINUMERIK FM-NC		

DB 31, ... **DBX 94.3**	$|M_d| < M_{dx}$
Data Block	Signal(s) from axis/spindle (drive $\rightarrow$ PLC)
Fig. 5–6	
Related to	IS "Rampup function complete" (DB 31, ... DBX 94.2) MD 1428: TORQUE_THRESHOLD_X MD 1429: TORQUE_THRESHOLD_X_DELAY MD 1427: SPEED_DES_EQ_ACT_DELAY
Additional references	/IAD/, SINUMERIK 840D Installation and Startup Guide, Section SIMODRIVE 611D /IAG/, SINUMERIK 810D Installation and Startup Guide

DB 31, ... **DBX 94.4**	$|n_{act}| < n_{min}$	
Data Block	Signal(s) from axis/spindle (drive → PLC)	
Edge evaluation: No	Signal(s) updated: Cyclic	Signal(s) valid as of software version: 1.1
Signal state 1 or signal transition 0 ——> 1	The SIMODRIVE 611D signals to the PLC that the actual speed value n_{act} is less than the minimum speed (n_{min}). The minimum speed is defined in MD 1418: SPEED_THRESHOLD_MIN.	
Signal state 0 or signal transition 1 ——> 0	The speed actual value is higher than the minimum speed.	
Signal irrelevant for	SINUMERIK FM-NC	
Related to	MD 1418: SPEED_THRESHOLD_MIN (minimum speed value (n_{min} for $n_{act} < n_{min}$))	
Additional references	/IAD/, SINUMERIK 840D Installation and Startup Guide, Section SIMODRIVE 611D /IAG/, SINUMERIK 810D Installation and Startup Guide	

DB 31, ... **DBX 94.5**	$|n_{act}| < n_x$	
Data Block	Signal(s) from axis/spindle (drive → PLC)	
Edge evaluation: No	Signal(s) updated: Cyclic	Signal(s) valid as of software version: 1.1
Signal state 1 or signal transition 0 ——> 1	The 611D signals to the PLC that the actual speed value n_{act} is less than the threshold speed (n_x). The threshold speed is defined in MD 1417: SPEED_THRESHOLD_X.	
Signal state 0 or signal transition 1 ——> 0	The speed actual value is higher than the threshold speed.	
Signal irrelevant for	SINUMERIK FM-NC	
Related to	MD 1417: SPEED_THRESHOLD_MIN (minimum speed value (n_x for $n_{act} < n_x$))	
Additional references	/IAD/, SINUMERIK 840D Installation and Startup Guide, Section SIMODRIVE 611D /IAG/, SINUMERIK 810D Installation and Startup Guide	

DB 31, ... **DBX 94.6**	$n_{act} = n_{set}$	
Data Block	Signal(s) from axis/spindle (drive → PLC)	
Edge evaluation: No	Signal(s) updated: Cyclic	Signal(s) valid as of software version: 1.1
Signal state 1 or signal transition 0 ——> 1	After a new speed setpoint is input, the SIMODRIVE 611D signals to the PLC that the actual speed value n_{act} has reached the speed tolerance band MD 1426: SPEED_DES_EQ_ACT_TOL (tolerance band for $n_{set} = n_{act}$ signal)) and has remained within this tolerance band for a time period corresponding to the setting in MD 1427: SPEED_DES_EQ_ACT_DELAY (delay time $n_{set} = n_{act}$ signal) (see Fig. 5-6). If the actual speed value then leaves the tolerance band, IS "$n_{act} = n_{set}$" is reset to "0" instead of "Rampup function complete".	
Signal state 0 or signal transition 1 ——> 0	The conditions described above have not yet been fulfilled. The speed actual value is outside the speed tolerance band.	
Signal irrelevant for	SINUMERIK FM-NC	
see Fig. 5–6		
Related to	IS "Rampup function complete" (DB 31, ... DBX94.2) MD 1426: SPEED_DES_EQ_ACT_TOL MD 1427: SPEED_DES_EQ_ACT_DELAY	
Additional references	/IAD/, SINUMERIK 840D Installation and Startup Guide, Section SIMODRIVE 611D /IAG/, SINUMERIK 810D Installation and Startup Guide	

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Example

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Data Fields, Lists

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7.1 Pulse cancellation

Table 7-1   Machine data

No.	Identifier	Name	Drive
1403	PULSE_SUPPRESSION_SPEED[DRx]	Shutoff speed for pulse suppression	FDD/MSD
1404	PULSE_SUPPRESSION_DELAY[DRx]	Timer for pulse suppression	FDD/MSD

7.2 Relay functions

Table 7-2   Machine data

No.	Identifier	Name	Drive
1002	MONITOR_CYCLE_TIME[DRx]	Monitoring cycle	FDD/MSD
1012	FUNC_SWITCH[DRx]	Function switch	FDD/MSD

7.2.1 Threshold torque for Md < Mdx

Table 7-3   Machine data

No.	Identifier	Name	Drive
1428	TORQUE_THRESHOLD_X[0...7,DRx]	Threshold torque Mdx	FDD/MSD
1429	TORQUE_THRESHOLD_X_DELAY[DRx]	Delay time, 'Md < Mdx' signal	FDD/MSD

7.2.2   Minimum speed for |nact| < nmin

Table 7-4   Machine data

No.	Identifier	Name	Drive
1418	SPEED_THRESHOLD_MIN[0...7,DRx]	nmin for 'nact < nmin' message	FDD/MSD

7.2.3   Threshold speed $n_{act} < nx$

Table 7-5   Machine data

No.	Identifier	Name	Drive
1417	SPEED_THRESHOLD_X[0...7,DRx]	nx for 'nact < nx' message	FDD/MSD

7.2.4   Speed in the setpoint range, $n_{act} = n_{set}$

Table 7-6   Machine data

No.	Identifier	Name	Drive
1426	SPEED_DES_EQ_ACT_TOL[0...7,DRx]	Tolerance band for 'nset = nact' signal	FDD/MSD
1427	SPEED_DES_EQ_ACT_DELAY[DRx]	Delay time 'nset = nact' signal	FDD/MSD

7.3   Filter for the current and torque display

Table 7-7   Machine data

No.	Identifier	Name	Drive
1250	ACTUAL_CURRENT_FILTER_FREQ[DRx]	Frequency limit, current actual–value smoothing	FDD/MSD
1252	TORQUE_FILTER_FREQUENCY[DRx]	Frequency limit, torque–setpoint smoothing	FDD/MSD

7.4   Alarm response, concealing alarms

Table 7-8   Machine data

No.	Identifier	Name	Drive
1600	ALARM_MASK_POWER_ON[DRx]	Concealable alarms (power ON)	FDD/MSD
1601	ALARM_MASK_RESET[DRx]	Concealable alarms (Reset)	FDD/MSD
1612	ALARM_REACTION_POWER_ON[DRx]	Configurable shutdown responses, POWER-ON alarms	FDD/MSD
1613	ALARM_REACTION_RESET[DRx]	Configurable shutdown responses, reset alarms	FDD/MSD
1731	CL1_PO_IMAGE	Image, PO alarm register	FDD/MSD
1732	CL1_RES_IMAGE	Image, RES alarm register	FDD/MSD

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SIMODRIVE 611D/SINUMERIK 840D/810D Drive Functions

Diagnostic Functions (DD1)

■

Notes

Brief Description

<div style="text-align: right; font-size: 3em; font-weight: bold;">1</div>

Digital-to-analog converters, DAC	The startup tool or HMI Advanced can be used to assign internal signals to the SINUMERIK-810D test sockets or the 611D-drive test sockets (in conjunction with SINUMERIK 840D), which are then available as analog values.

X 351   **DAC 1**
X 352   **DAC 2**
X 341   **DAC 3**
X 342   **Common reference ground**

Software version	The drive software version is stored in a display machine data.
Other diagnostic parameters	Various machine data, intended exclusively for display, are available for diagnostics. The contents of these machine data are displayed in the diagnostics / service display area.
Diagnostics monitor	The diagnostics monitor is relevant for internal Siemens purposes only.
Normalization of internal variables	This is relevant for internal Siemens purposes only.

■

Notes

Detailed Description

<div style="text-align: right; font-size: large;">**2**</div>

2.1   Digital-to-analog converters (DAC)
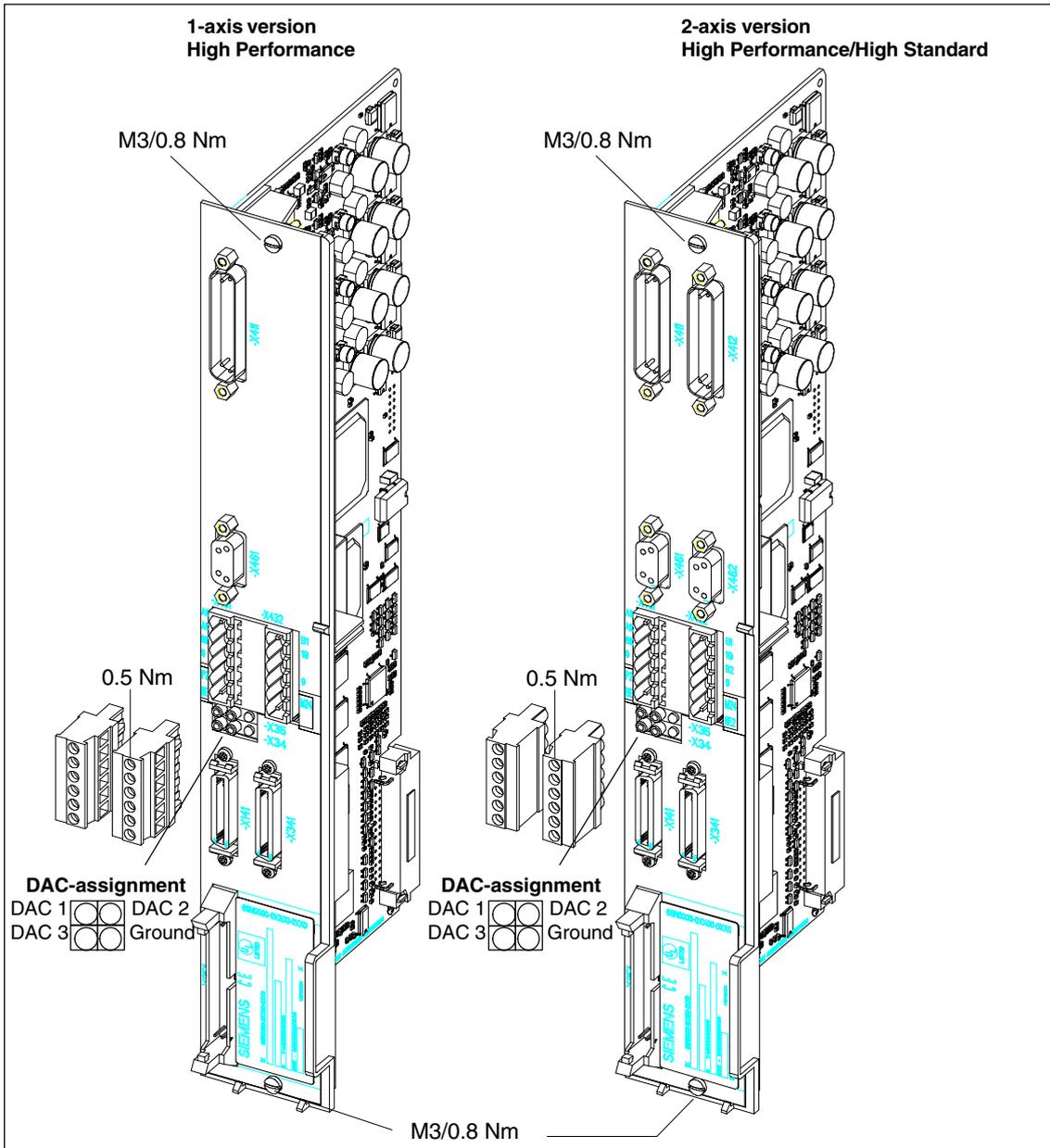

Fig. 2-1   Digital control High Performance and High Standard without direct measuring system

2.1 Digital-to-analog converters (DAC)

Functionality

Three 8-bit DAC (Digital-to-Analog Converter) channels are available on the SINUMERIK 810D and on each 611D closed-loop control module. An analog image of various drive signals can be connected through to a test socket via these converters. Only a window of the 24-bit-wide drive signals can be displayed with the 8 bits (=1 byte) of the DAC, see Fig. 2-4. For this reason, the shift factor must be set to determine how fine the quantization of the selected signal must be. The normalization factor is calculated as the parameters are set and displayed as user info, e.g., 1 V = 22.5 A.

DAC assignment

The 3 DAC channels are assigned the following drive signals by default:

DAC 1 : Setpoint current   Default shift factor: 4
DAC 2 : Setpoint speed   Default shift factor: 6
DAC 3 : Actual speed   Default shift factor: 6
GND   : Reference socket (ground)
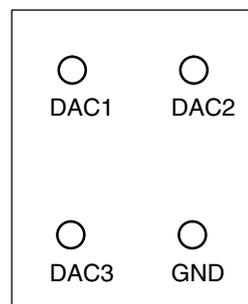
Arrangement of the DAC output channels on the 611D closed-loop control module.

MD 13100: DRIVE_DIAGNOSIS[6] (drive link diagnosis [0...7]) can be used to define the following:

DRIVE_DIAGNOSIS[6] = 0   No analog output to the DACs
DRIVE_DIAGNOSIS[6] = 1   With dual-axis modules, the output takes place on axis 1 (default setting).
DRIVE_DIAGNOSIS[6] = 2   With dual-axis modules, the output takes place on axis 2 (default setting).

Activating the analog output

The display for activating and setting the parameters of the DAC outputs is called up from the basic machine display by pressing the **Startup**/**Drive**/**Servo**/**Configur. DAC** softkeys.

To activate the configuration, press **Start**. Active DACs are identified (active/inactive) on the left of the display. stop the output by pressing **Stop** (active/inactive).

Note

Prior to selecting a new DAC output with the **Start** softkey, you should always press the **Stop** softkey to terminate any active DAC outputs (for all axes).

As of SW 4

In SW 4 and higher, the selected signals are also active after POWER ON.
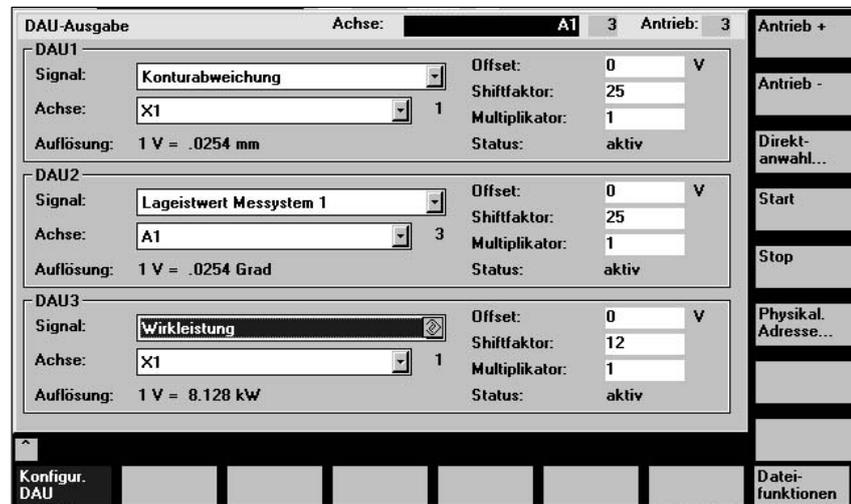

Fig. 2-2   Menu for DAC settings

DAC configuration

Assigning measuring channels and selecting the signals to be output:

- Select the **Drive no.** of the drive module, on which signals are to be output via DAC channels.

- Select the **Axis name** of the axis/spindle, which supplies the signal to be output.

- Specify a shift factor to adapt the resolution. The shift factor places an 8-bit-wide output window over the memory cell to be output (range: –7 ... 31 or 24 with drive signals). When a shift factor of 0 is entered, the output window is always situated on the highest-order byte.

- Select signal assignment for every channel used. The signal selection field is called for this purpose and a selection made (marked by cursor or mouse) from the list of available signals (FSD, MSD, servo).

!

Important

The additional fields of MD 13100: DRIVE_DIAGNOSIS are **only** relevant for Siemens internal purposes and they **must not be changed**.

2.1 Digital-to-analog converters (DAC)

Bit 23 ... 16 15 ... 8 7 ... 0 (LSB)

DAC with SF0

DAC with SF1

DAC with SF8

DAC with SF16

LSB = Least Significant Bit
SF = Shift Factor

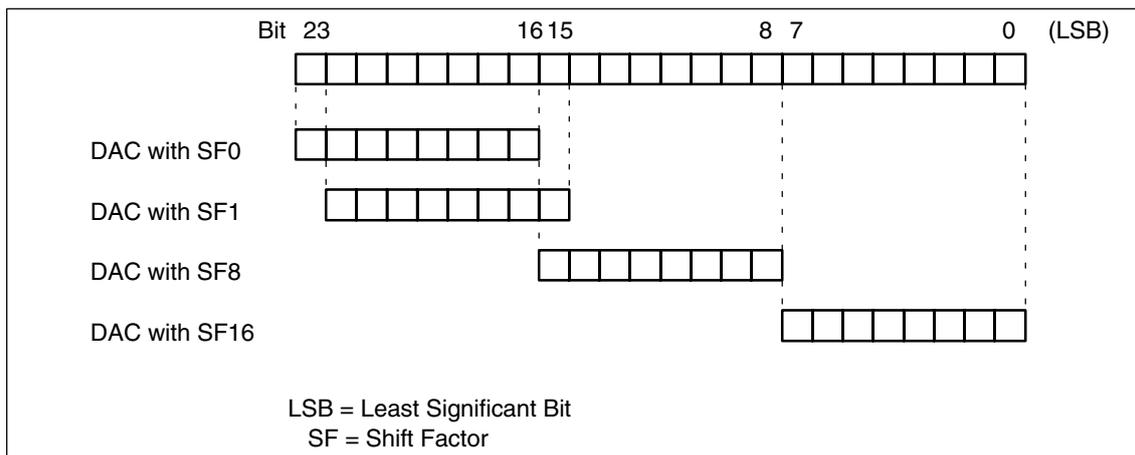Fig. 2-3   Representation of the shift factor

The DAC operates on a voltage of between 0 V and +5 V. The 2.5 V output voltage corresponds to the zero point of the displayed signal. A two's complement is used in the digital/analog conversion, see Fig. 2-4.
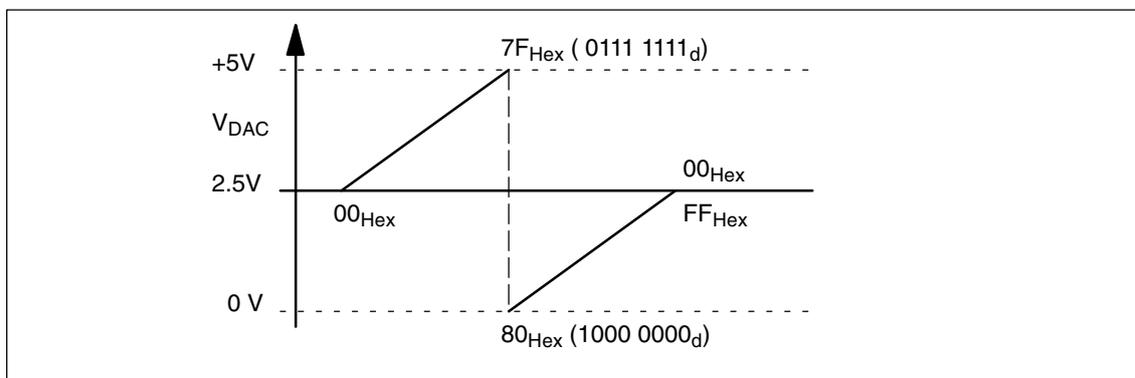
$7F_{Hex}$ ($0111\ 1111_d$)

+5V

V_{DAC}

2.5V

00_{Hex}

00_{Hex}

FF_{Hex}

0 V

80_{Hex} ($1000\ 0000_d$)

Fig. 2-4   Analog output voltage range

DAC selection list

Table 2-1　　DAC selection list

| No.	Designation	Value	Comments
1	Current i(R)	A	
2	Current i(S)	A	
3	Current i(d)	A	
4	Current i(q), peak value	A	Torque-producing current proportional to torque
5	Setpoint current I(q) (limited acc. to filter)	A	
6	Setpoint current I(q) (before filter)	A	
7	Speed actual value motor	rpm	
8	Speed setpoint	rpm	
9	Speed setpoint reference model	rpm	not CCU1, 2
10	Setpoint torque (limited)	Nm	
11	Load (m_set/m_set, limit)	%	
12	Active power	kW	
13	Rotor flux setpoint	μVs	
14	Rotor flux actual value	μVs	
15	Cross voltage V(q)		
16	Direct-axis voltage V(d)		
17	Setpoint current I(d)	A	
18	Motor temperature	°C	
19	DC link voltage	V	
20	Zero-mark signal, motor measuring system		not CCU1, 2
21	BERO signal		not CCU1, 2
22	Speed actual value	rpm	
23	Slip frequency setpoint		
24	Rotor position (electrical)		
25	Torque setpoint (speed controller output)	Nm	not CCU1, 2
26	Feedforward control torque	Nm	not CCU1, 2
27	Physical address (drive)		
28	Slip frequency setpoint		
29	Control voltage Q feedforward control	V	
30	Control voltage D feedforward control	V	
31	Rotor position in $10 000 format with extrapolation	degrees	$10 000 = 360°
32	Voltage setpoint value	V	As of SW 4.2
33	Current actual value	A	As of SW 4.2
34	Actual speed value, direct measuring system	rpm	SW 6.08 and higher

2.1 Digital-to-analog converters (DAC)
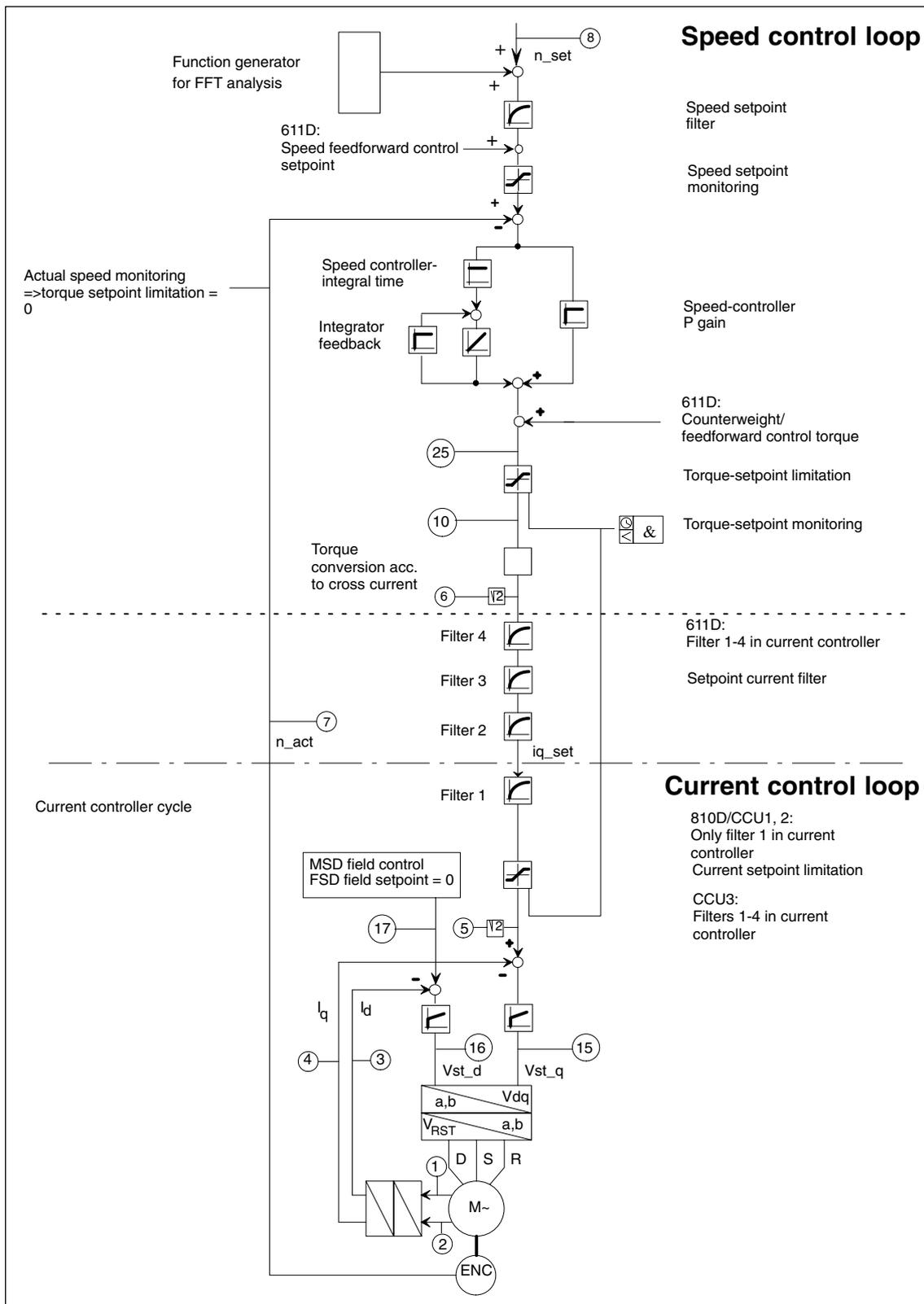
Fig. 2-5   Current and speed control loop, measured variables, which can be represented by the DACs

2.2   Software version

1797	PBL_VERSION				Cross reference: –
	Data version			Related to: FSD/MS	Protection level: 2/4
Unit: – 810D 840D	Default: 0 0	Minimum: 0 0	Maximum: 32,767 65,535	Data type: UNS.WORD	Active: Immediately

Output of current data version (machine-data list)

1798	FIRMWARE_DATE				Cross reference: –
	Firmware date			Related to: FDD/MSD	Protection level: 2/4
Unit: – 810D 840D	Default: 0 0	Minimum: 0 0	Maximum: 32,767 65,535	Data type: UNS.WORD	Active: Immediately

Output of coded software release. The display is decimal. The character string has the following format: DDMMY, in which DD stands for day, MM for month and Y = last digit of year.

For example: 22.07.2005 corresponds to 22075_{dec}

1799	FIRMWARE_VERSION				Cross reference: –
	Firmware version			Relevant: FSD/MSD	Protection level: 2/4
Unit: – 810D 840D	Default: 0 0	Minimum: 0 0	Maximum: 32,767 2,147,483,647	Data type: UNS.WORD	Active: Immediately

Output of current software version. The display is decimal, e.g., 21,000. This is the code for SW version 2.10/00.

2.3 Diagnostics monitor

!

Important

This machine data is **only** relevant for Siemens internal purposes and must **not be changed**.

1610	DIAGNOSIS_ACTIVATION_FLAGS			840D only	Cross reference: –
	Diagnostic functions			Relevant: FSD/MSD	Protection level: 2/4
Unit: –	Default: 0/1	Minimum: 0	Maximum: 3	Data type: UNS.WORD	Active: POWER ON

Diagnostic functions can be activated using this machine data.

If the appropriate bit = 1, then the function is active.

Table 2-2   Diagnostic functions

Bit 0	Load test monitoring = dn/dt monitoring (setting in MD 1611)
Bit 1	Monitor rotational accuracy
Bits 2 –15	Not assigned

1611	DNDT_THRESHOLD			840D only	Cross reference: –
	Response threshold dn/dt			Related to: FDD/MSD	Protection level: 2/4
Unit: %	Default: 800	Minimum: 0	Maximum: 1,600	Data type: UNS.WORD	Active: Immediately

Enter the response threshold for dn/dt monitoring, which can be activated using MD 1610: DIAGNOSIS_ACTIVATION_FLAGS, bit 0 = 1.

1650	DIAGNOSIS_CONTROL_FLAGS			840D only	Cross reference: –
	Diagnostic control			Relevant: FSD/MSD	Protection level: 2/4
Unit: Hex	Default: 0	Minimum: 0	Maximum FFFF	Data type: UNS.WORD	Active: Immediately

Select the diagnostic functions

- Min/max memory

- Voltage-controlled V_q operation in the diagnostic word

Table 2-3   Diagnostic control

Bit 0	Min/max memory	0 = Not active 1 = Active
Bit 1	Min/max memory segment	0 = DSP address space X 1 = DSP address space Y
Bit 2	Signed comparison	0 = Without sign 1 = With sign
Bits 3 –7	Not assigned	
Bit 8 (up to SW 3.1)	Voltage-controlled V_q operation	0 = Normal operation 1 = V_q operation active
Bit 9	Reserved	
Bits 10 –15	Not assigned	

!

Important

These diagnostic functions are **only** relevant for Siemens internal purposes and **must not be changed**.

1721	ACCEL_DIAGNOSIS				840D only	Cross reference: –
	Diagnosis, speed actual value				Related to: FSD/MS	Protection level: 2/4
Unit: – 810D 840D	Default: 0 0	Minimum: 0 0	Maximum: 32,767 65,535		Data type: UNS.WORD	Active: Immediately

Displays the machine data. If an excessive speed difference occurs within the operating time, the machine data value is incremented. Sporadic response involving just a few increments is of no significance, as this does not affect the speed controller. If the contents of MD 1721 are continually increased by several increments, then an increased fault level exists.

The cause could be:

- Encoder shield not grounded

- Encoder defective

- Defective earthing of the electronic ground of the main-spindle-drive module

- Motor ground not connected to the main-spindle-drive module

- The motor moment of inertia entered is too high

- Evaluation electronics

Diagnostic function: Min/max memory

This function can be used to determine the min./max. value range. It runs in the current controller cycle (quickest cycle), in order to reliably detect all system variables.

The variable to be monitored can be selected by entering a signal number or by entering a physical address (see MD 1651).

The value can be compared with the minimum and maximum value either unsigned or signed (bit 2).

The corresponding machine data are:

- MD 1650: DIAGNOSIS_CONTROL_FLAGS, bits 0, 1, 2
- MD 1651: MINMAX_SIGNAL_NR
- MD 1652: MINMAX_ADDRESS
- MD 1653: MINMAX_MIN_VALUE
- MD 1654: MINMAX_MAX_VALUE

Note

MD 1650, bit 1 is **only** effective, if in MD 1651: MINMAX_SIGNAL_NR, signal number 0 is selected.

Diagnostic function: Voltage-controlled V/f operation

In SW 3.1 and higher, V/f operation for test purposes is a separate operating mode (see Chapter DE1).

1651	MINMAX_SIGNAL_NR			840D only	Cross reference: –
	Signal number: Min/max memory			Relevant: FSD/MSD	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 100	Data type: UNS.WORD	Active: Immediately

The signal number of the memory location, which is to be monitored via the min. / max. memory function, is entered.

! **Important**

This machine data is **only** relevant for Siemens internal purposes and **must not be changed**.

Table 2-4   Signal number of min/max memory

Signal number	Signal designation	Normalization (unit)
0	Physical address	–
1	–	–
2	Current I_R	MD 1710
3	Current I_S	MD 1710
4	Current I_d	MD 1710
5	Current I_q	MD 1710

Table 2-4   Signal number of min/max memory

Signal number	Signal designation	Normalization (unit)
6	Current setpoint I_q (limited acc. to filter)	MD 1710
7	Current setpoint I_q (before filter)	MD 1710
8	Speed actual value motor	MD 1711
9	Speed setpoint	MD 1711
10	Speed setpoint reference model	MD 1711
11	Torque setpoint (speed controller output)	MD 1713
12	Torque setpoint limit	MD 1713
13	Utilization ($m_{set}/m_{set,\ limit}$)	$8,000H \doteq 100\%$
14	Active power	0.01 kW
15	Rotor flux setpoint	MD 1712
16	Rotor flux actual value	MD 1712
17	Quadrature voltage V_q	MD 1709 $\times$ VDC/2
18	Direct voltage V_d	MD 1709 $\times$ VDC/2
19	Current setpoint I_d	MD 1710
20	Motor temperature	0.1 °C
21	DC link voltage	1 V
22	Zero-mark signal, motor measuring system	–
23	BERO signal	–
24	Absolute speed actual value	MD 1711
25	Slip frequency setpoint	$\dfrac{2,000 \times 2\Pi}{800,000H \times 1s^{-1}}$
26	Rotor position (electrical)	MD 1714
27	Torque setpoint, speed controller	MD 1713
28	Feedforward control torque	MD 1713
29	Control voltage Q feedforward control	MD 1709 $\times$ VDC/2
30	Control voltage D feedforward control	MD 1709 $\times$ VDC/2

1652	MINMAX_ADDRESS				840D only	Cross reference: –
Memory location: Min/max memory					Relevant: FSD/MSD	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 65,535	Data type: UNS.WORD	Active: Immediately	

The address of the memory location, which is to be monitored via the min./max. memory function, is entered.

Note

This machine data is effective **only** if the signal number is set to 0 (see MD 1651).

1653	MINMAX_MIN_VALUE			840D only	Cross reference: –
	Minimum value: Min/max memory			Relevant: FSD/MSD	Protection level: 2/4
Unit: Hex	Default: 0	Minimum: 0	Maximum: 16,777,215	Data type: UNS.DWORD	Active: Immediately

Outputs the display value of the minimum value, min./max. memory.

1654	MINMAX_MAX_VALUE			840D only	Cross reference: –
	Maximum value: Min/max memory			Relevant: FSD/MSD	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 16,777,215	Data type: UNS.DWORD	Active: Immediately

Outputs the display value of the maximum value, min./max. memory.

1655	MONITOR_SEGMENT				Cross reference: –
	Monitor memory location segment			Relevant: FSD/MSD	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 1	Data type: UNS.WORD	Active: Immediately

The segment of the memory location for the monitor function is addressed using this machine data.

Table 2-5   Monitor memory location segment

0	DSP address space X
1	DSP address space Y

The DSP address is obtained together with the offset address (MD 1656). The contents of the DSP address can be displayed via machine data MD 1657: MONITOR_DISPLAY.

1656	MONITOR_ADDRESS				Cross reference: –
	Monitor memory location address			Relevant: FSD/MSD	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 65,535	Data type: UNS.WORD	Active: Immediately

The offset address of the memory location for the monitor function is addressed using this machine data. The DSP address is obtained together with the memory-location segment (MD 1655). The contents of the DSP address can be displayed via machine data MD 1657: MONITOR_DISPLAY.

1657	MONITOR_DISPLAY				Cross reference: –
	Monitor value display			Relevant: FSD/MSD	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 16,777,215	Data type: UNS.DWORD	Active: Immediately

Displays the monitor function value. This machine data displays the contents of the address, obtained from the segment (MD 1655) and the offset (MD 1656).

1658	MONITOR_INPUT_VALUE				Cross reference: –
	Monitor value input			Relevant: FSD/MSD	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 16,777,215	Data type: UNS.DWORD	Active: Immediately

A 24-bit value can be entered in this machine data. The value is written to the monitor function at the address, specified by the segment (MD 1655) and the offset (MD 1656). The value is only written if the value of MD 1659: MONITOR_INPUT_STROBE is set to 1.

1659	MONITOR_INPUT_STROBE				Cross reference: –
	Monitor value transfer			Relevant: FSD/MSD	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 1	Data type: UNS.WORD	Active: Immediately

The value (MD 1658) is written to the addressed memory location (MD 1655, MD 1656) using this machine data if the write operation was initiated with value 1. After the value has been accepted, the machine data is automatically reset to 0.

2.3   Diagnostics monitor

Display hardware type (SW 6.4 and higher)   During startup, the following codes for hardware (module) types recognized by the system are entered in display MD 1796:

1796	HW_VERSION			840D only	Cross reference: –
	Hardware type display			Relevant: FSD/MSD	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 65,535	Data type: UNS.WORD	Active: Immediately

Table 2-6   Codes for hardware types

Number	Meaning	Features
01	Incompatible module	Not supported by drive software
03	Compatible module	Supported by drive software
11	SIMODRIVE 611digital with submodules	
21	SIMODRIVE 611digital Standard 1	30 MHz, Sida, no Safety Integrated, no encoder amplitude control
23	SIMODRIVE 611digital Standard 2	30 MHz, Sida with Safety Integrated
25	SIMODRIVE 611digital High Standard	80 MHz, Sida C
31	SIMODRIVE 611digital Performance 1	32 MHz, Sida
33	SIMODRIVE 611digital Performance 1	60 MHz, Sida C
35	SIMODRIVE 611digital High Performance	80 MHz, Sida C
75	SINUMERIK 810D CCU3	With 6 measuring circuits

2.4   Other diagnostic parameters

1148	ACTUAL_STALL_POWER_SPEED			840D only	Cross reference: –
	Threshold speed, pull-out power			Relevant: FSD/MSD	Protection level: Read-only
Unit: rev/min	Default: 0.0	Minimum: –100,000.0	Maximum: 100,000.0	Data type: FLOAT	Active: Immediately

Displays the speed, at which the torque characteristic will start to fall, according to the function $1/n^2$.

1700	TERMINAL_STATE				Cross reference: –
	Status of binary inputs			Relevant: FSD/MSD	Protection level: 2/4
Unit: Hex	Default: 0	Minimum: 0	Maximum FFFF	Data type: UNS.WORD	Active: Immediately

This machine data is used to display the status of the binary inputs.

Table 2-7   Status of binary inputs

Bit 0	Gating unit enable (module internal), including the marking according to MD 1003 bit 5	0 = OFF 1 = ON
Bit 1	Image, terminal 663 (module-specific pulse suppression)	
Bit 2	Image, terminal 63/48 of the I/RF unit (central-drive pulse suppression)	
Bit 3	Pulse-enable composite signal: – Stored hardware composite signal – Axial pulse enable via PLC	
Bit 4	Signal, power section heatsink too hot	
Bit 5	Image, terminal 112 of the I/RF unit (setup-mode signal)	
Bit 6	Image, terminal 64/63 of the I/RF unit (central drive enable, setpoint = 0)	
Bit 7	not assigned	
Bit 8	Image, terminal 5 of the I/RF unit, temperature prewarning, motor and power section	0 = OFF 1 = ON
Bit 9	not assigned	
Bit 10	not assigned	
Bit 11	not assigned	
CCU3 Bit 12	Temperature monitoring responded, external heatsink 3	
CCU3 Bit 13	Temperature monitoring responded, heatsink 4	
CCU3 Bit 14	Temperature monitoring responded, heatsink 5	
CCU3 Bit 15	Temperature monitoring responded, heatsink 6	

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2.4 Other diagnostic parameters

1701	LINK_VOLTAGE					Cross reference: –
	DC link voltage				Relevant: FSD/MSD	Protection level: 2/4
Unit: V 810D 840D	Default: 0 0	Minimum: 0 0	Maximum: 32,767 65,535		Data type: UNS.WORD	Active: Immediately

This machine data displays the voltage level on the DC link in normal operation or setup mode. DC-link voltage VDC is measured continuously.
The display is invalid if a fixed value was entered for the DC link voltage in machine data MD 1161.

1702	MOTOR_TEMPERATURE					Cross reference: –
	Motor temperature				Relevant: FSD/MSD	Protection level: 2/4
Unit: °C	Default: 0	Minimum: 0	Maximum: 32,767		Data type: WORD	Active: Immediately

This machine data is used to display the motor temperature. The motor temperature is measured using temperature sensors and evaluated in the drive. The display is invalid if a fixed value was entered for the motor temperature in machine data MD 1608.

1705	DESIRED_VOLTAGE			840D only		Cross reference: –
	Absolute voltage setpoint (rms)				Relevant: FSD/MSD	Protection level: Read-only
Unit: V	Default: 0.0	Minimum: −100,000.0	Maximum: 100,000.0		Data type: FLOAT	Active: Immediately

The absolute voltage setpoint value is sampled in 4 ms cycles. This "large" sampling time can result in aliasing or in incomplete representation or exaggeration of dynamic effects that are present for less than 4 ms.

$$\text{MD } 1705 = \sqrt{u^2_{qset} + u^2_{dset}}$$

1706	DESIRED_SPEED				Cross reference: –
	Speed setpoint			Relevant: FSD/MSD	Protection level: 2/4
Unit: 1/min	Default: 0.0	Minimum: −100,000	Maximum: 100,000	Data type: FLOAT	Active: Immediately

This machine data is used to display the speed setpoint. The speed setpoint represents the unfiltered aggregate setpoint. It is made up of the position controller output component and the speed feedforward branch. Machine data MD 1706, MD 1707 and MD 1708 are not picked up in synchronism.
The data is picked up by the read request of the non-cyclic communications protocol.

1707	ACTUAL_SPEED				Cross reference: –
	Speed actual value			Relevant: FSD/MSD	Protection level: 2/4
Unit: 1/min 810D 840D	Default: 0.0 0.0	Minimum: 0.0 −100,000.0	Maximum: 32,767.0 100,000.0	Data type: FLOAT	Active: Immediately

This machine data is used to display the speed actual value. It represents the non-filtered speed actual value. Machine data MD 1706, MD 1707 and MD 1708 are not picked up in synchronism. The specific machine data is picked up by the "Read variables" HMI request via the STF-ES communications interface.

1708	ACTUAL_CURRENT				Cross reference: –
	Smoothed current actual value			Relevant: FSD/MSD	Protection level: 2/4
Unit: % 810D 840D	Default: 0.0 0.0	Minimum: 0.0 −100,000.0	Maximum: 32,767.0 100,000.0	Data type: FLOAT	Active: Immediately

This machine data is used to display the smoothed quadrature current actual value. The torque-generating current actual value is smoothed by a PT1 element with the coefficient (MD 1250).

The smoothed absolute current actual value is displayed as a percentage. 100 % corresponds to the max. power-section current
(e.g., for the 18/36 A power section $\rightarrow$ 100 % = 36 A rms).

2.4 Other diagnostic parameters

1719	ABS_ACTUAL_CURRENT			840D only	Cross reference: –
	Absolute current actual value (rms)			Related to: FDD/MSD	Protection level: Read-only
Unit: A	Default: 0.0	Minimum: −100,000.0	Maximum: 100,000.0	Data type: FLOAT	Active: Immediately

The absolute current actual value is sampled in 4 ms cycles. This "large" sampling time can result in aliasing or in incomplete representation or exaggeration of dynamic effects that are present for less than 4 ms.

$$MD\ 1719 = \sqrt{i^2_{qact} + i^2_{dact}}$$

1720	CRC_DIAGNOSIS				Cross reference: –
	CRC diagnostic parameter			Relevant: FSD/MSD	Protection level: 2/4
Unit: – 810D 840D	Default: 0 0	Minimum: 0 0	Maximum: 32,767 65,535	Data type: UNS.WORD	Active: Immediately

This machine data is used to display the identified CRC (Cyclic Redundancy Check) errors. The counter information is displayed on every read request and is 5 bits wide (bit 4...bit 0 or count 0...31).

Note

The assignment of CRC errors to the respective drives is not assured in all cases. The "wrong" module (if installed) displays the error when the address is incorrect.

1722	LOAD				Cross reference: –
	Load			Relevant: FSD/MSD	Protection level: 2/4
Unit: % 810D 840D	Default: 0 0	Minimum: 0 −100,000	Maximum: 32,767 100,000	Data type: FLOAT	Active: Immediately

This is a display machine data to indicate drive load. The ratio of the torque setpoint M_d to the actual torque limit M_{dmax} is displayed. Values less than 100% indicate that the system is not running at its full capacity.

1733	LPFC_DIAGNOSIS				Cross reference: –
	LPFC diagnostic counter			Relevant: FSD/MSD	Protection level: 2/4
Unit: – 810D 840D	Default: 0 0	Minimum: 0 0	Maximum: 32,767 65,535	Data type: UNS.WORD	Active: Immediately

This diagnostic machine data provides information about how often the motor-temperature/DC-link measurements taken via the lower-priority frequency channel were erroneous. Thus, the machine data is indirectly a hardware indicator (hardware-diagnosis-status indication) for the lower-priority frequency channel.

Note

This machine data is always reset when the drive is powered up.

1735	PROCESSOR_LOAD			840D only	Cross reference: –
	Processor capacity utilization			Relevant: FSD/MSD	Protection level: 2/4
Unit: %	Default: 0	Minimum: 0	Maximum: 100	Data type: UNS.WORD	Active: Immediately

The processor capacity utilization display provides online information about available computing capacity.

2.5 Variable signaling function

1620	PROG_SIGNAL_FLAGS			840D only	Cross reference: –
	Bits variable signal function			Relevant: FSD/MSD	Protection level: 2/4
Unit: Hex	Default: 0	Minimum: 0	Maximum: 7	Data type: UNS.WORD	Active: Immediately

Input bit field for controlling the variable signaling function.

Table 2-8   Bits variable signal function

Bit 0	Variable signaling function	0 = Not active 1 = Active
Bit 1	Segment, variable signaling function	0 = Address space X 1 = Address space Y
Bit 2	Comparison, variable signaling function	0 = Comparison without sign 1 = Comparison with sign

---

Note

Bit 1 is **only** effective, if in MD 1621: PROG_SIGNAL_NR, signal number 0 is selected.

Any memory location from address space X or Y in the data RAM can be monitored for violation of a set threshold for the variable signaling function. A tolerance band can be set around this threshold; this is taken into account when the threshold is scanned for violation in either direction. Any violation of the tolerance band is signaled to the PLC. This violation message can be linked to a pickup and/or dropout delay. The signaling function operates in a 4-ms cycle.
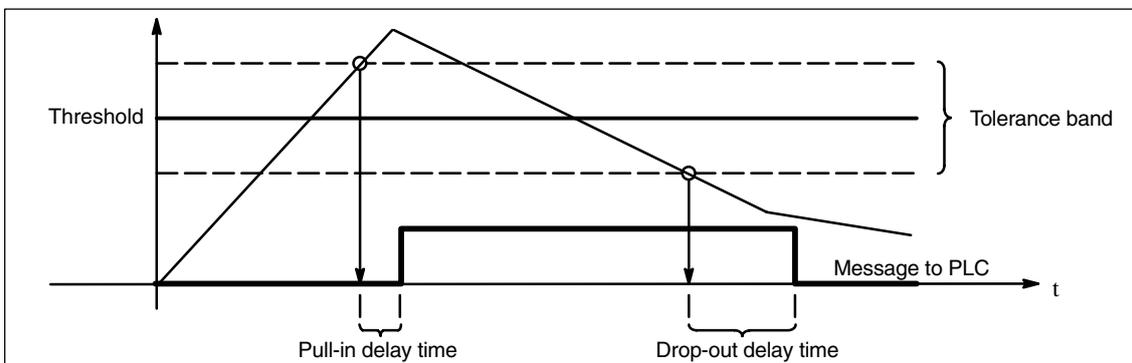

Fig. 2-6   Variable signaling function

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Note

The quantity to be monitored can be selected by entering either a signal number or a physical address, the physical address having relevance **only** for Siemens servicing activities.

Corresponding machine data to this machine data:

- MD 1621: PROG_SIGNAL_NR

- MD 1622: PROG_SIGNAL_ADDRESS

- MD 1623: PROG_SIGNAL_THRESHOLD

- MD 1624: PROG_SIGNAL_HYSTERESIS

- MD 1625: PROG_SIGNAL_ON_DELAY

- MD 1626: PROG_SIGNAL_OFF_DELAY

Note

Changes entered in machine data MD 1621 to MD 1624 while the monitoring function is active ($\doteq$ MD 1620, bit 0 = 1) do not automatically result in the PLC signal being re-initialized, i.e., reset to 0. If the signal must be re-initialized, the monitoring function must be switched off and on again via MD 1620, bit 0, once the MD setting has been changed.

1621	**PROG_SIGNAL_NR**			**840D only**	**Cross reference:** –
	Signal number of variable signaling function			Relevant: FSD/MSD	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 100	Data type: UNS.WORD	Active: Immediately

Input of signal number of memory location, which must be monitored by the variable signaling function.

Table 2-9   Signal number variable signal function

Signal number	Signal designation	Normalization (LSB corresponds to:)
0	Physical address	–
1	–	–
2	Current I_R	MD 1710
3	Current I_S	MD 1710
4	Current I_d	MD 1710
5	Current I_q	MD 1710
6	Current setpoint I_q (limited acc. to filter)	MD 1710
7	Current setpoint I_q (before filter)	MD 1710
8	Speed actual value motor	MD 1711

2.5 Variable signaling function

Table 2-9   Signal number variable signal function

Signal number	Signal designation		Normalization (LSB corresponds to:)
9	Speed setpoint		MD 1711
10	Speed setpoint, reference model	840D only	MD 1711
11	Torque setpoint (speed controller output)		MD 1713
12	Torque setpoint limit		MD 1713
13	Utilization ($m_{set}/m_{set, limit}$)		8,000H $\doteq$ 100%
14	Active power		0.01 kW
15	Rotor flux setpoint		MD 1712
16	Rotor flux actual value		MD 1712
17	Quadrature voltage V_q		MD 1709 $\times$ VDC/2
18	Direct voltage V_d		MD 1709 $\times$ VDC/2
19	Current setpoint I_d		MD 1710
20	Motor temperature		0.1 °C
21	DC link voltage		1 V
22	Zero-mark signal, motor measuring system	840D only	–
23	Bero signal	840D only	–
24	Absolute speed actual value		MD 1711
25	Slip frequency setpoint		$\dfrac{2,000 \times 2\Pi}{800,000H \times 1s^{-1}}$
26	Rotor position (electrical)	840D only	MD 1714
27	Torque setpoint, speed controller	840D only	MD 1713
28	Feedforward control torque		MD 1713
29	Control voltage Q feedforward control		MD 1709 $\times$ VDC/2
30	Control voltage D feedforward control		MD 1709 $\times$ VDC/2

<table>
<tr><td>1622</td><td colspan="3">PROG_SIGNAL_ADDRESS</td><td>840D only</td><td>Cross reference:
–</td></tr>
<tr><td colspan="4" align="center">Address of variable signaling function</td><td>Relevant:
FSD/MSD</td><td>Protection level:
2/4</td></tr>
<tr><td>Unit:
–</td><td>Default:
0</td><td>Minimum:
0</td><td>Maximum:
65,535</td><td>Data type:
UNS.WORD</td><td>Active:
Immediately</td></tr>
</table>

Input of address of memory location, which must be monitored by the variable signaling function.

Note

This machine data is effective **only** if the signal number is set to 0 (see MD 1621).

1623	PROG_SIGNAL_THRESHOLD			840D only	Cross reference: –
	Threshold of variable signaling function			Relevant: FSD/MSD	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 16,777,215	Data type: UNS.DWORD	Active: Immediately

Input of threshold for the memory location address entered in MD 1622: PROG_SIGNAL_ADDRESS, which is to be monitored by the variable signaling function. Together with
MD 1624: PROG_SIGNAL_HYSTERESIS, the actual value to be checked is obtained for monitoring (see the graphic for MD 1620).

Note

The numerical value entered in MD 1623 is interpreted as a function of machine data MD 1620: PROG_SIGNAL_FLAGS, bit 2 unsigned (bit 2 = 0) or signed (bit 2 = 1).

1624	PROG_SIGNAL_HYSTERESIS			840D only	Cross reference: –
	Hysteresis of variable signaling function			Relevant: FSD/MSD	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 16,777,215	Data type: UNS.DWORD	Active: Immediately

Enter the hysteresis (tolerance band) for the memory location address entered in
MD 1622: PROG_SIGNAL_ADDRESS, which is to be monitored by the variable signaling function. Together with MD 1623: PROG_SIGNAL_THRESHOLD, the actual value to be checked is obtained for monitoring (see the graphic for MD 1620).

Note

The numerical value entered in MD 1624 is interpreted as a function of
MD 1620: PROG_SIGNAL_FLAGS, bit 2 unsigned (bit 2 = 0) or signed (bit 2 = 1).

1625	PROG_SIGNAL_ON_DELAY			840D only	Cross reference: –
	Pickup delay of variable signaling function			Relevant: FSD/MSD	Protection level: 2/4
Unit: ms	Default: 0	Minimum: 0	Maximum: 10,000	Data type: UNS.DWORD	Active: Immediately

Enter the pickup delay to set the signal, if the threshold (with hysteresis) is exceeded (see the graphic for MD 1620).

2.5   Variable signaling function

Note

Changing the settings in MD 1625: PROG_SIGNAL_ON_DELAY and
MD 1626: PROG_SIGNAL_OFF_DELAY affects a time watchdog that is
already running. The monitor is initialized with the new time settings.

1626	PROG_SIGNAL_OFF_DELAY				840D only	Cross reference: –
	Dropout delay of variable signaling function				Relevant: FSD/MSD	Protection level: 2/4
Unit: ms	Default: 0	Minimum: 0	Maximum: 10,000		Data type: UNS.WORD	Active: Immediately

Enter the dropout delay time for resetting the signal when the threshold (with
hysteresis) is fallen short of (see the graphic for MD 1620).

Note

Changing the settings in MD 1625: PROG_SIGNAL_ON_DELAY and
MD 1626: PROG_SIGNAL_OFF_DELAY affects a time watchdog that is
already running. The monitor is initialized with the new time settings.

2.6 Normalization of internal variables

!

Important

This machine data is **only** relevant for Siemens internal purposes and must **not be changed**.

1401	MOTOR_MAX_SPEED[n] 0...7 index of parameter set					Cross reference: –
	Speed for maximum useful motor speed				Relevant: FSD/MSD	Protection level: 2/4
Unit: 1/min 810D 840D	Default: 0.0 0.0	Minimum: 0.0 0.0	Maximum: 50,000.0 100,000	Data type: FLOAT	Active: POWER ON	

This machine data defines the maximum motor operating speed. It serves as setpoint for the speed reference value interface as well as for machine data MD 1405: MOTOR_SPEED_LIMIT. When the operator selects **Calculate controller data**, the default setting is calculated for FSDs with the rated motor speed according to the motor data sheet, and for MSDs with the maximum speed.

The MD 1401 index has a particular significance in the NC. Only the value of this index is included in the normalization of the speed setpoint interface.
To retain the normalization value after the machine data set is changed, all of the array's indices must be assigned the value from MD 1401[0].
If the changeover is to be between motors with the lowest possible maximum speeds, MD 1401, MD 2401, MD 3401, MD 4401 must be used.

1709	VOLTAGE_LSB					Cross reference: –
	Significance of voltage representation				Relevant: FSD/MSD	Protection level: 2/4
Unit: – 810D 840D	Default: 0.0 0.0	Minimum: 0.0 −100 000.0	Maximum: 32,767.0 100,000.0	Data type: FLOAT	Active: Immediately	

This machine data is used to display the significance of the voltage representation. To assign the internal notation of the voltage states to the control of the pulse-controlled inverter, the percentage significance of bit 0 is displayed.

$$U_{LSB} \ = \ MD\ 1709 \ x \ \frac{U_{Zwk}}{2}$$

2.6   Normalization of internal variables

1710	CURRENT_LSB				Cross reference: –
	Significance, current representation			Relevant: FSD/MSD	Protection level: 2/4
Unit: μA 810D 840D	Default: 0.0 0.0	Minimum: 0.0 −100,000.0	Maximum: 32,767.0 100,000.0	Data type: FLOAT	Active: Immediately

This machine data is used to display the significance of the current representation. The significance of bit 0 is displayed to assign the internal representation of the current states to the physical amp values.

1711	SPEED_LSB				Cross reference: –
	Significance, speed representation			Relevant: FSD/MSD	Protection level: 2/4
Unit: 1/min 810D 840D	Default: 0.0 0.0	Minimum: 0.0 −100,000.0	Maximum: 32,767.0 100,000	Data type: FLOAT	Active: Immediately

This machine data is used to display the significance of the speed representation. The significance of bit 0 is displayed to assign the internal significance of the speed states to the physical rotation values.

1712	ROTOR_FLUX_LSB				Cross reference: –
	Significance, rotor-flux representation			Relevant: FSD/MSD	Protection level: 2/4
Unit: μVs 810D 840D	Default: 0.0 0.0	Minimum: 0.0 −100,000.0	Maximum: 32,767.0 100,000.0	Data type: FLOAT	Active: Immediately

This machine data is used to display the significance of the rotor-flux representation. The significance of bit 0 is displayed to assign the internal representation of the rotor-flux states to the physical values in Vs.

1713	TORQUE_LSB				Cross reference: –
	Significance, torque representation			Relevant: FSD/MSD	Protection level: 2/4
Unit: μNm 810D 840D	Default: 0.0 0.0	Minimum: 0.0 100,000.0	Maximum: 32,767.0 100,000	Data type: FLOAT	Active: Read-only

This machine data is used to display the significance of the torque representation.

1714	ROTOR_POS_LSB					Cross reference: –
	Significance, rotor position representation				Relevant: FSD/MSD	Protection level: 2/4
Unit: deg 810D 840D	Default: 0.0 0.0	Minimum: 0.0 −100,000	Maximum: 32,767.0 100,000		Data type: FLOAT	Active: Immediately

> This machine data is used to assign the internal representation of the rotor position to the physical units system, degrees electrical.

1725	MAX_TORQUE_FROM_NC					Cross reference: –
	Normalization of torque setpoint interface				Relevant: FSD/MSD	Protection level: 2/4
Unit: Nm 810D 840D	Default: 0.0 0.0	Minimum: 0.0 −100,000	Maximum: 32,767.0 100,000		Data type: FLOAT	Active: Immediately

> This machine data includes the reference value of the torque-setpoint limit values and torque limit values to be transferred from the NC to the drive.

1730	OPERATING_MODE (810D: SW 1 and higher, 840D: SW 3.1 and higher)					Cross reference: –
	Operating mode (display)				Relevant: FSD/MSD	Protection level: 2/4
Unit: – 810D 840D	Default: 0 1	Minimum: 0 1	Maximum: 32,767 65,535		Data type: UNS.WORD	Active: –

> This machine data displays the actual operating mode.

Table 2-10   Operating mode (display)

Bit 0	FSD	0 = OFF 1 = ON
Bit 1	not assigned	
Bit 2	not assigned	
Bit 3	not assigned	
Bit 4	MSD	0 = OFF 1 = ON
Bit 5	not assigned	
Bit 6	not assigned	
Bit 7	not assigned	
Bit 8, 840D only	AM open-loop	0 = OFF 1 = ON
Bit 9, 840D only	AM closed-loop	0 = OFF 1 = ON
Bit 10	not assigned	
Bit 11	not assigned	
Bit 12, 840D only	V/f operation AM mode also possible on the CCU3	0 = OFF 1 = ON

2.7 Load test parameters

1615	SMOOTH_RUN_TOL				Cross reference: –
	Tolerance, rotational accuracy monitoring			Relevant: FSD/MSD	Protection level: 2/4
Unit: 1/min	Default: 2.0	Minimum: 0.0	Maximum: 100.0	Data type: FLOAT	Active: Immediately

Load test: Sets the tolerance band for the rotational accuracy monitoring. When the tolerance band is violated (exceeded or fallen short of), the "Diagnosis, rotational-accuracy monitoring" MD 1724 counter is incremented by the actual speed.

1723	ACTUAL_RAMP_TIME				Cross reference: –
	Diagnosis, ramp-up time			Relevant: FSD/MSD	Protection level: 2/4
Unit: ms 810D 840D	Default: 0 0	Minimum: 0 0	Maximum: 32,767 65,535	Data type: UNS.WORD	Active: Immediately

Load test: The ramp-up time from the drive is displayed in this machine data. The ramp-up time is the time between a 0-1 edge of the control-word signal "Ramp-function generator active" and the point at which the actual speed enters the tolerance range around the speed setpoint, defined in MD 1426: SPEED_DES_EQ_ACT_TOL [n].

Functionality in SW 3.40/04 and higher

If the speed actual value exits the tolerance band around the speed setpoint, the ramp-up-time measurement is not evaluated, i.e., MD 1723 = 0.
The ramp-up time is then appropriately evaluated if the drive is operated at the torque limit, i.e., the difference between setpoint and actual values remains larger.
Acceleration, MD 35200: GEAR_STEP_SPEEDCTRL_ACCEL, must be set to a sufficiently high value.

Note

If the acceleration is sufficient to follow the setpoint value ramp in the lower but not in the higher range, only the time, during which the value was not within the tolerance band, is displayed in the MD 1723 and not the ramp-up time.

1724	SMOOTH_RUN_DIAGNOSIS				Cross reference: –
	Diagnosis, rotational accuracy monitoring			Relevant: FSD/MSD	Protection level: 2/4
Unit: – 810D 840D	Default: 0 0	Minimum: 0 0	Maximum: 32,767 65,535	Data type: UNS.WORD	Active: Immediately

Load test: If rotational accuracy monitoring is active, this machine data is used to count how often the actual speed leaves the tolerance band around the speed setpoint, defined in MD 1615: SMOOTH_RUN_TOL.

■

Notes

SIMODRIVE 611 Digital / SINUMERIK 840D/810D Drive Functions (FBA) – 11.05 Edition

Supplementary Conditions   **3**

None

Data Descriptions (MD, SD)   **4**

See Chapter 2

Signal Descriptions   **5**

None

Example   **6**

None

■

SIMODRIVE 611 Digital / SINUMERIK 840D/810D Drive Functions (FBA) – 11.05 Edition   DD1/6-33

Notes

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Data Fields, Lists

7

7.1   Digital-to-analog converters (DAC)

Table 7-1   Machine data

No.	Identifier	Name	Drive
13100	DRIVE_DIAGNOSIS[n]	Diagnosis, drive link [diagnostic parameter drive]: 0...7	FDD/MSD

7.2   Software version

Table 7-2   Machine data

No.	Identifier	Name	Drive
1797	PBL_VERSION	Data version	FDD/MSD
1798	FIRMEWARE_DATE	Firmware date	FDD/MSD
1799	FIRMWARE_VERSION	Firmware release	FDD/MSD

7.3   Diagnostics monitor

Table 7-3   Machine data

No.	Identifier	Name	Drive
1650	DIAGNOSIS_CONTROL_FLAGS	Diagnostic control	FDD/MSD
1651	MINMAX_SIGNAL_NR	Signal number of min/max memory	FDD/MSD
1652	MINMAX_ADDRESS	Memory location of min/max memory	FDD/MSD
1653	MINMAX_MIN_VALUE	Minimum value of min/max memory	FDD/MSD
1654	MINMAX_MAX_VALUE	Maximum value of min/max memory	FDD/MSD
1655	MONITOR_SEGMENT	Monitor memory location segment	FDD/MSD
1656	MONITOR_ADDRESS	Monitor memory location address	FDD/MSD
1657	MONITOR_DISPLAY	Monitor value display	FDD/MSD
1658	MONITOR_INPUT_MONITOR	Monitor value input	FDD/MSD
1659	MONITOR_INPUT_STROBE	Value acceptance monitor	FDD/MSD

7.4 Other diagnostic parameters

Table 7-4 Machine data

No.	Identifier	Name	Drive
1700	TERMINAL_STATE	Status of the binary inputs	FDD/MSD
1701	LINK_VOLTAGE	DC link voltage	FDD/MSD
1702	MOTOR_TEMPERATURE	Motor temperature	FDD/MSD
1706	DESIRED_SPEED	Speed setpoint	FDD/MSD
1707	ACTUAL_SPEED	Speed actual value	FDD/MSD
1708	ACTUAL_CURRENT	Smoothed actual current value	FDD/MSD
1720	CRC_DIAGNOSIS	CRC diagnostic parameter	FDD/MSD
1721	ACCEL_DIAGNOSIS	Diagnosis, speed actual value	FDD/MSD
1722	LOAD	Load	FDD/MSD
1251	LOAD_SMOOTH_TIME	Time constant, motor utilization	FDD/MSD
1723	ACTUAL_RAMP_TIME	Diagnosis, ramp-up time	FDD/MSD
1724	SMOOTH_RUN_DIAGNOSIS	Diagnosis, rotational accuracy monitoring	FDD/MSD
1733	LPFC_DIAGNOSIS	LPFC diagnostic counter	FDD/MSD
1735	PROCESSOR_LOAD	Processor capacity utilization	FDD/MSD

7.5 Variable signaling function

Table 7-5 Machine data

No.	Identifier	Name	Drive
1620	PROG_SIGNAL_FLAGS	Bits variable signal function	FDD/MSD
1621	PROG_SIGNAL_NR	Signal number variable signal function	FDD/MSD
1622	PROG_SIGNAL_ADDRESS	Address variable signal function	FDD/MSD
1623	PROG_SIGNAL_THRESHOLD	Threshold variable signal function	FDD/MSD
1624	PROG_SIGNAL_HYSTERESIS	Hysteresis variable signal function	FDD/MSD
1625	PROG_SIGNAL_ON_DELAY	Pickup delay, variable signaling function	FDD/MSD
1626	PROG_SIGNAL_OFF_DELAY	OFF Delay variable signal function	FDD/MSD

7.6   Normalization of internal variables

Table 7-6   Machine data

No.	Identifier	Name	Drive
1401	MOTOR_MAX_SPEED[0...7,DRx]	Speed for max. useful motor speed	FDD/MSD
1709	VOLTAGE_LSB	Significance of voltage representation	FDD/MSD
1710	CURRENT_LSB	Significance, current representation	FDD/MSD
1711	SPEED_LSB	Significance, speed representation	FDD/MSD
1712	ROTOR_FLUX_LSB	Significance, rotor-flux representation	FDD/MSD
1713	TORQUE_LSB	Significance, torque representation	FDD/MSD
1714	ROTOR_POS_LSB	Significance, rotor position representation	FDD/MSD
1725	MAX_TORQUE_FROM_NC	Normalization, torque setpoint interface	FDD/MSD
1730	OPERATING_MODE (from SW 3.1)	Operating mode (display)	FDD/MSD

7.7   Load test parameters

Table 7-7   Machine data

No.	Identifier	Name	Drive
1610	DIAGNOSIS_ACTIVATION_FLAGS	Diagnostic functions	FDD/MSD
1611	DNDT_THRESHOLD	Response threshold dn/dt	FDD/MSD
1615	SMOOTH_RUN_TOL	Tolerance, rotational accuracy monitoring	FDD/MSD

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Notes

SIMODRIVE 611D/SINUMERIK 840D/810D Drive Functions

Speed Control Loop (DD2)

■

Notes

Brief Description

<div style="text-align: right; font-size: 2em; font-weight: bold;">1</div>

Startup tool   You need the startup tool or HMI Advanced to configure the drives and set the parameters.

Speed control loop   Select **Select motor** or **Calculate controller data** to calculate the speed control parameters for a no-load motor and store them in the appropriate machine data. This setting corresponds to a "safe" setting, and must be re-optimized by the user in order to be able to fully utilize the drive's dynamic performance, including the mechanical system.

Setpoint current filter   Four independent current-setpoint filters can be configured independently in order to damp any resonance effects in the speed control loop. They can be parameterized as low pass (PT2) or bandstop.

Speed setpoint filter   The speed-setpoint filter (first-order, low pass) is used to smooth the speed-setpoint input. The filter must be disabled during speed-controller optimization.

<div style="text-align: right;">■</div>

Notes

Detailed Description   **2**

2.1 General information

2.1.1 Speed control loop in block diagram
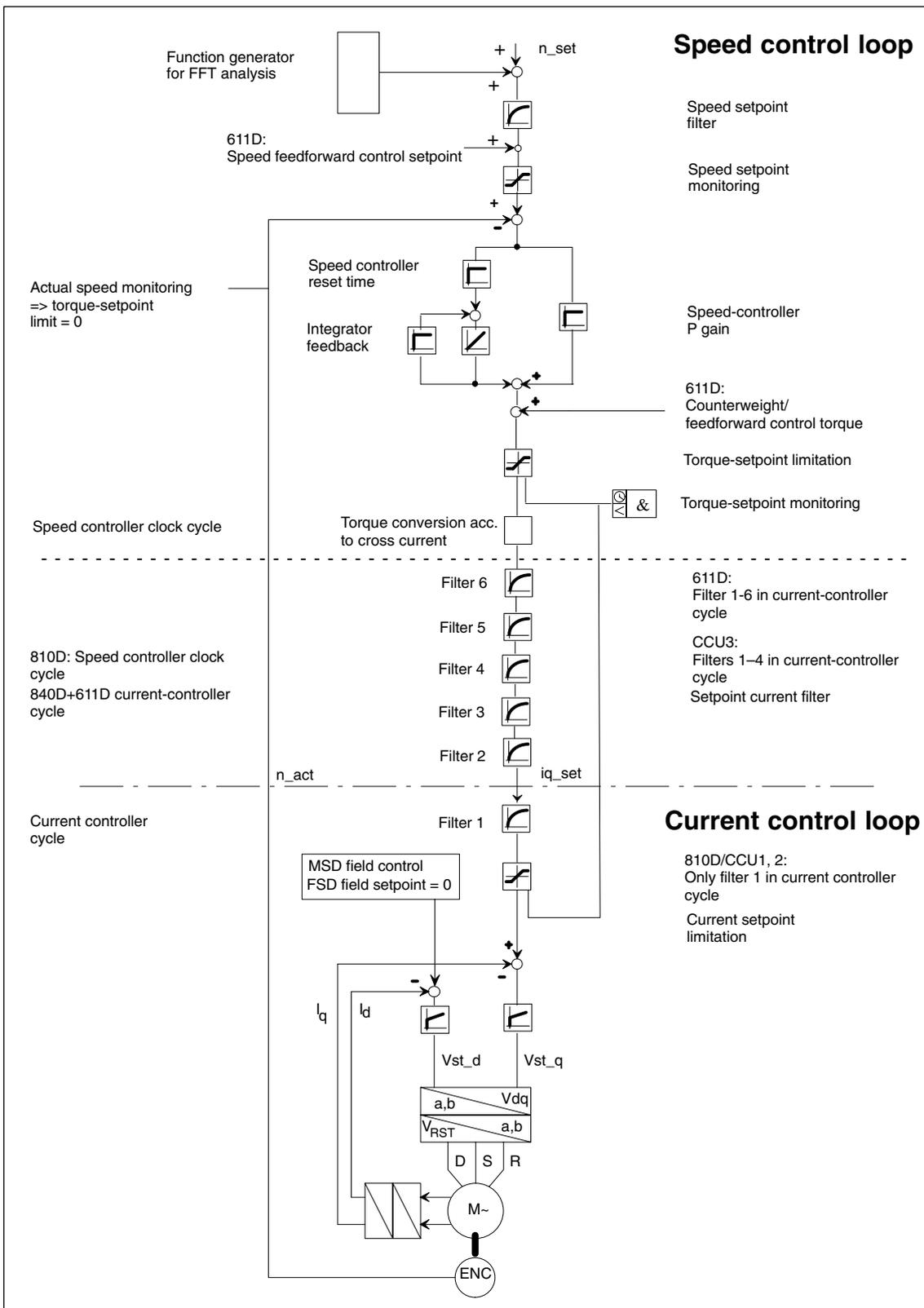
2.1   General information

Fig. 2-1   Speed and current control loop
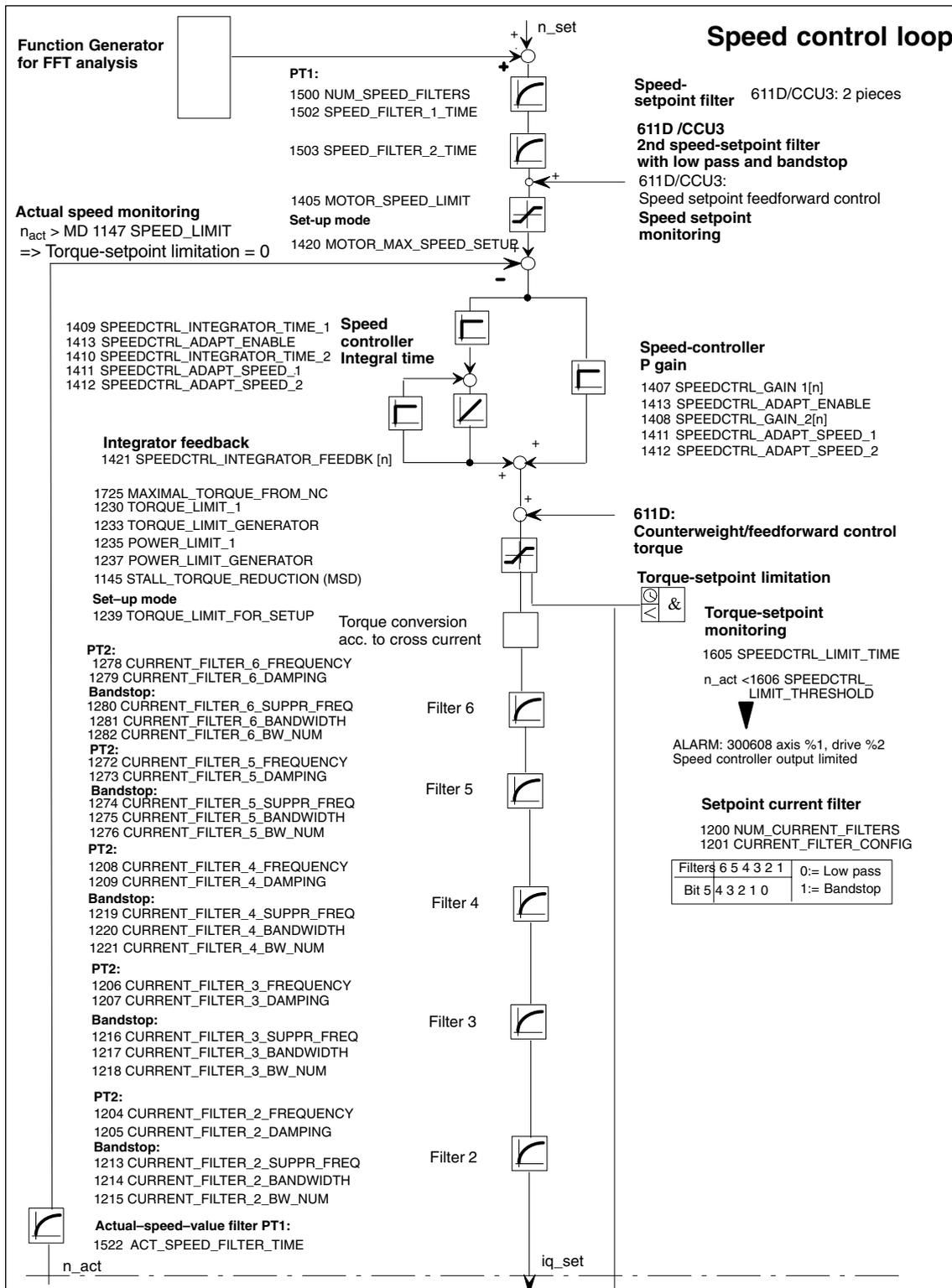
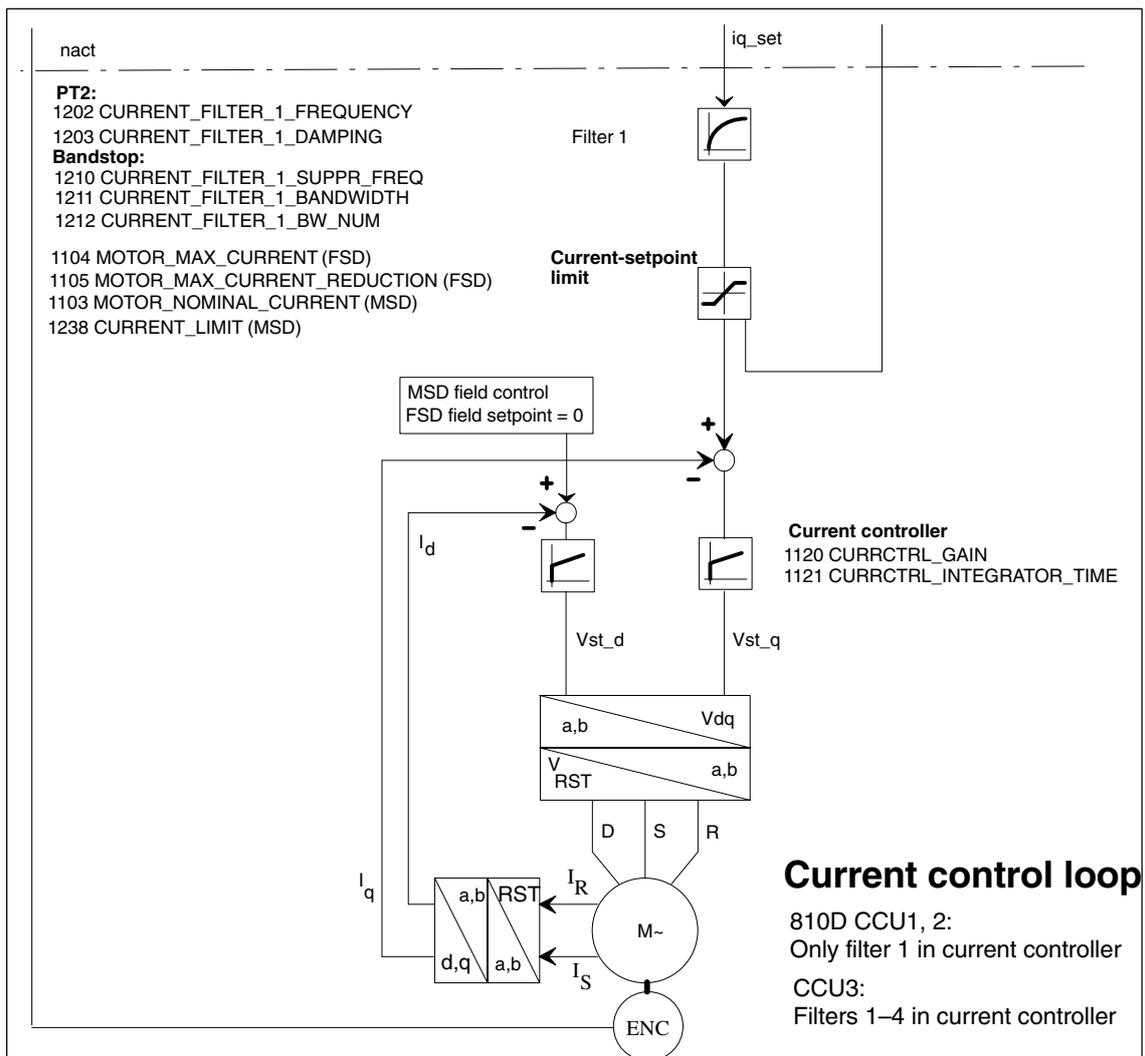Fig. 2-2   Speed control loop

2.1   General information

Fig. 2-3   Current control loop

Fourier analysis

For speed-controller optimization, you are provided with a particularly powerful tool in the form of the integrated Fourier analysis functions for evaluation of the control-loop setting and the mechanical characteristics.

The Fourier analysis (frequency response method) is located in
       → Installation and Startup → Drive, Servo → Speed Control Loop.
The Fourier analysis technique provides precise and reproducible results even at the lowest test signal amplitudes. You can adapt the measurement parameters to the particular application.

All measurements are made with an offset motion of just a few (approx. 1–10) revolutions per minute, which is superimposed on a test-signal amplitude (noise) of one to three revolutions. The accuracy increases with the selectable number of averagings, generally 20 is sufficient.

Settable bandwidth	The bandwidth can be set on the SINUMERIK 840D and 810D–CCU3, whereas, on the SINUMERIK 810D–CCU1/2, the maximum bandwidth is used irrespective of the input.

$$\text{max. bandwidth} = \frac{1}{2 \text{ x } \text{speed controller cycle}}$$

For a speed-controller cycle of 312.5 µs, this is 1,600 Hz.

Due to the short measurement times, traversing distances of just a few revolutions are sufficient to measure the frequency response. The measuring period is obtained from:

$$\text{measuring period[s]} = \frac{512 \text{ x number of averagings}}{\text{bandwidth[Hz]}} + \text{Einschwingzeit}$$

With 20 averagings, this is 6.5 s. With an offset of 5 rpm, a traversing range of less than 0.55 revolutions is needed.

Taking the measurement	Always start the measurements with lowest possible values for offset and amplitude. Only increase the number of averagings or the amplitude if you obtain results with a high level of noise. If the amplitude is too high, this can result in incorrect measurement results or damage the mechanical system.

The offset should always be greater than the amplitude (by a factor of 2–3). If the values are extremely low, different measurement results may be obtained than for a high traversing velocity, as a result of backlash or friction.

When optimizing a cascaded control structure (current, speed, position control loop), which is the case for SINUMERIK 810D/840D, always start with the innermost control loop, the current control loop. The structure is optimized when the operator selects **Calculate controller data** and need not be subsequently optimized by the user.

The speed controller is also preset by selecting **Calculate controller data**. This is a robust setting for the no-load motor (with high stressing) and does not take the built-on mechanical system into account.

2.1.2 Optimizing the proportional gain of the speed controller

The proportional gain is optimized as a first step in the speed controller. The speed controller reset time MD 1409: SPEEDCTRL_INTEGRATOR_TIME_1 is set to 500 ms. This means that the integral component is practically ineffective. The proportional component is now increased in steps until the system resonance points are reached (the motor starts to whistle). The resulting P gain is multiplied by a factor of 0.5. This value is used as an initial value for the first measurement.

The Fourier analysis results are plotted in a Bode diagram. A Bode diagram is subdivided into two graphs, the amplitude response and the phase response. When optimizing the system, an attempt should be made to keep the amplitude at 0 dB over the widest possible range.

The phase is 0° in the lower frequency range and turns, with increasing frequency, towards negative phase angles. If the phase angle exceeds |180°|, the representation in the graph is inverted, i.e., it jumps from −180° to 180 degrees or from 180° to −180°.

Fig. 2-4 shows the frequency response of an optimized speed control loop with an idling motor without a built-on mechanical system.
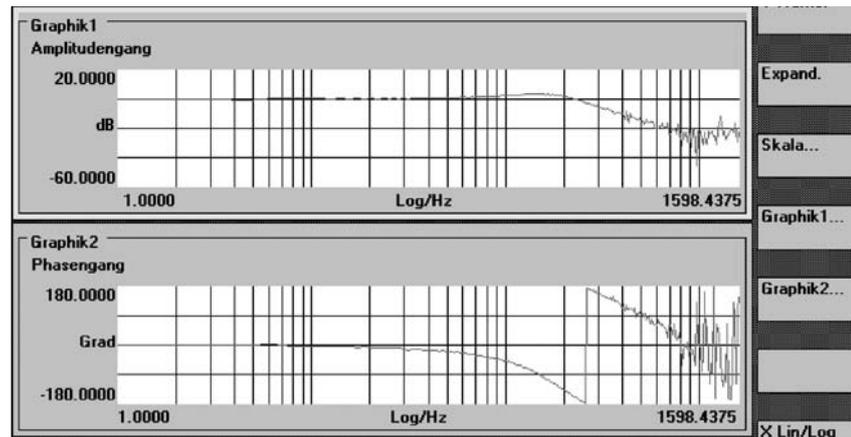

Fig. 2-4   Speed-controller reference frequency response with no mechanical system connected

The following is valid for the optimization:

1. The amplitude should be 0 dB over the widest possible range.

2. Increase the P gain if the amplitude does not rise above the 0 dB line.

3. Decrease the P gain if the amplitude rises above the 0 dB line.

4. Increases of less than a few dB (max. 1 – 3 dB) are permissible.

When the mechanical system is coupled, the frequency response has a somewhat different shape, but nothing changes as far as the optimization procedure is concerned.

The speed-controller reference frequency response with optimized proportional gain of the same motor as in Fig. 2-4 is illustrated in Fig. 2-5, but with a coupled mechanical system (machine-tool axis).
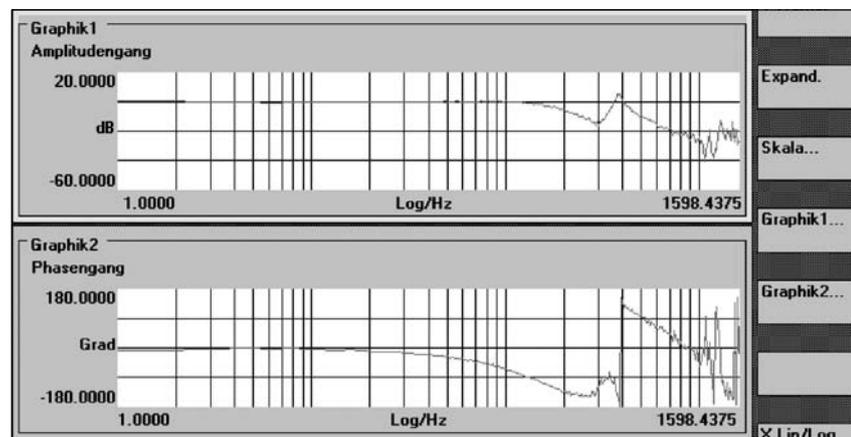

Fig. 2-5   Speed-controller reference frequency response with optimized proportional gain

If the proportional gain were to be further increased, the amplitude would start to increase excessively (see Fig. 2-6 below).
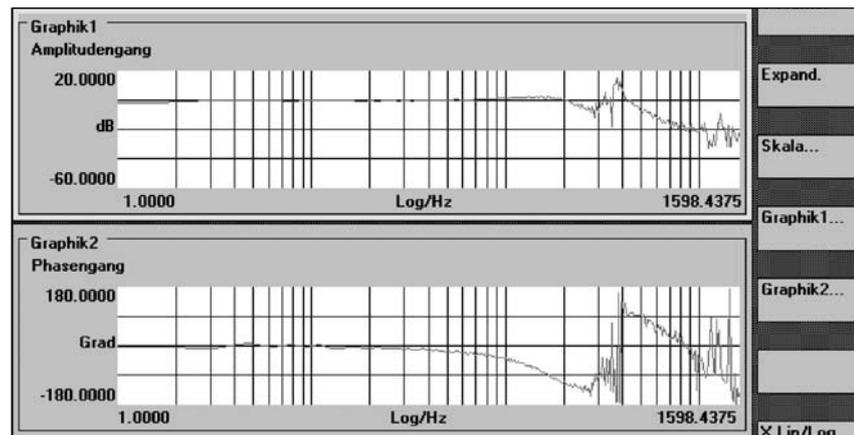
Fig. 2-6   Speed-controller reference frequency response with excessive P gain

2.1.3   Optimizing the integral component of the speed controller

After the proportional gain has been determined, the speed-controller reset time is shortened until the amplitude response starts to rise above the 0 dB line. An increase of 3 dB is generally permissible. If possible, the reset time should be kept < 20 ms (see Fig. 2-7 below).
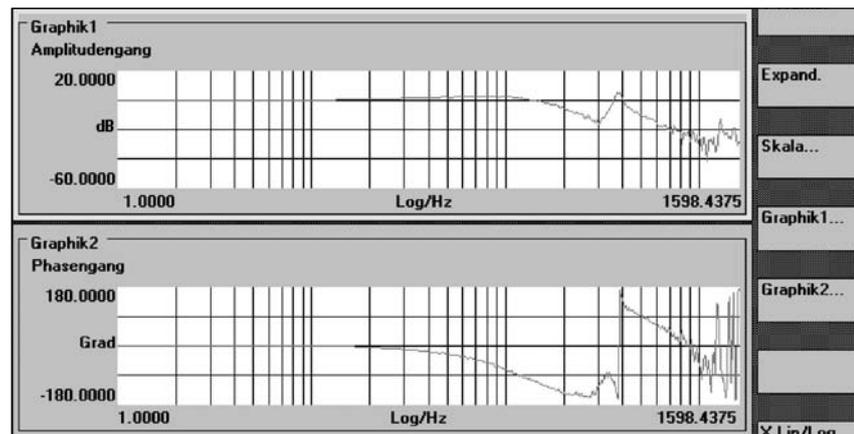

Fig. 2-7   Speed-controller reference frequency response of a speed controller with optimum setting

2.1.4   Using the current-setpoint filters

Current-setpoint filters (low pass or bandstop) are used to dampen resonant frequencies in the speed-controller frequency response. These filters are only used to dampen the resonance points above the operating range. The operating range is the frequency range below the frequency, where the phase turns through –180 degrees; this frequency range should be 200 – 300 Hz.

A **bandstop** is used if a narrow needle-shaped peak rises above the 0 dB line at a fixed frequency (above the operating range of the speed controller). This causes a clearly audible whistling noise in the drive train.

If the peak is not associated with a fixed frequency, but wanders under various conditions, then a **low pass** is a better solution.

However, we cannot provide any "recipes", as the relationships are highly complex. To reap full benefits from mechanically critical machines, we recommend participating in one of our drive courses.

2.2   Speed controller settings

1001	SPEEDCTRL_CYCLE_TIME				Cross reference: –
	Speed controller cycle			Relevant: FSD/MSD	Protection level: 2/4
Unit: 31.25 µs 810D 840D	Default: 10 4	Minimum: 2 2	Maximum: 32 16	Data type: UNS.WORD	Active: POWER ON

This machine data is used in the controller data calculation.

For normal applications, use the default setting. The dynamic performance can be further increased by reducing the cycle times. The speed controller cycle is derived from the current controller cycle of the axis: current controller cycle ≤ speed controller cycle.

810D:
Possible input values for FSDs and for MSDs are:
2^m x MD 1000   m = 1, 2, 3

Table 2-1   Possible combinations of speed- and current-controller cycles

Control type and drive control	Current controller cycle MD 1000 CURRCTRL_ CYCLE_TIME	Speed controller cycle MD 1001 SPEEDCTRL_ CYCLE_TIME	Comments
810D	5 (156.25 µs)	10 (312.5 µs)	Default value
810D	4 (125 µs)	8 (250 µs)	Minimum value Only possible with fewer than 4 axes (CCU1/2)
840D with 611D 1-axis performance control	4 (125 µs)	4 (125 µs)	Default value
840D with 611D 1-axis performance control	2 (62.5 µs)	2 (62.5 µs)	Minimum
840D with 611D 1-axis performance control	2 (62.5 µs)	8 (250 µs)	As of SW 4.2
840D with 611D 2-axis performance control	4 (125 µs)	4 (125 µs)	Default value + minimum
840D with 611D 2-axis performance control	2 (62.5 µs)	2 (62.5 µs)	Minimum
840D with 611D standard control (2 axes)	4 (125 µs)	16 (500 µs)	Default value
840D with 611D standard control, only one axis operated	4 (125 µs)	4 (125 µs)	Default value + minimum

2.2   Speed controller settings

Note

It is not permissible to exceed the computation time in the
speed-controller-cycle level. If this time is exceeded, the drive will shut down
(system error). Alarm 300500 "Speed controller computation time overflow" is
output.
Machine data MD 1000 and MD 1001 must be the same in all axes of a
controller plug-in.

For the 810D with external controllers, the same setting must be selected for
MD 1000 and MD 1001 as in the 810D module.

1004	CTRL_CONFIG		840D only	Cross reference: –
	Configuration structure		Relevant: FSD/MSD	Protection level: 2/4
Unit: Hex	Default: 0	Minimum: 0	Maximum: 2,115	Data type: UNS.WORD	Active: POWER ON

Enter the configuration for control structures, speed measuring systems and
functionality related to the SIMODRIVE 611D system.

Table 2-2   Configuration structure

Bit 0	Speed/torque feedforward control	0 = Not active 1 = Active
Bit 1	not assigned	
Bit 2	Higher dynamic performance (single-axis module)	0 = Current control before speed control 1 = Speed control before current control
Bit 3	Reserved	
Bit 4	Integrator control **Note:** When traveling to a fixed stop, integrator control is always active.	0 = Integrator control active in n controller The integrator is stopped on one side if torque, current or voltage controllers are within the limit. 1 = Integrator control not active in n controller The integrator is not stopped, but is limited to double the torque limit as an absolute value.
Bit 8	ESR (Extended Stop and Retract): Follow NC set-points	0 = In the ESR state, the drive freezes the last valid speed setpoint and follows it for the duration set in MD 1637. 1 = In the ESR state, the drive follows the NC setpoint for the duration set in MD 1637.
Bit 12	Linear interpolation n_set	0 = Not active 1 = After setting bit 12, the speed setpoint (n_set_lr), which supplies the NC in the position controller cycle, is interpolated linearly from the drive.
Bit 13	Encoder evaluation without power section	0 = Not active 1 = Conceal mid-frequency error ("current detection of power section missing"). Module starts up without power section.
Bits 5–11, 14, 15	not assigned	

> **!**
>
> _____
>
> **Important**
>
> Speed control before current control is **only possible for one active axis** on the module!
> The default is: Current control before speed control (bit 2 = 0).
> _____

1406	SPEEDCTRL_TYPE			840D only	Cross reference: –
	Speed controller type			Relevant: FSD/MSD	Protection level: 2/4
Unit: –	Default: 1	Minimum: 1	Maximum: 1	Data type: UNS.WORD	Active: POWER ON

Enter the speed controller type:
MD 1406 = 1

– PI speed controller (PI)

– PI speed controller (PI) with reference model (PIR)

Set the above controller data using MD 1407 ... MD 1416

> **!**
>
> _____
>
> **Important**
>
> This machine data is **only** relevant for Siemens internal purposes.
> _____

1407	SPEEDCTRL_GAIN_1[n] 0...7 index of parameter set				Cross reference: –
	Speed-controller P gain			Relevant: FSD/MSD	Protection level: 2/4
Unit: Nm/rad 810D 840D	Default: 0.3 0.3	Minimum: 0.0 0.0	Maximum: 100,000.0 100,000.0	Data type: FLOAT	Active: Immediately

Enter the speed-control-loop P gain for the complete speed range (exception: with adaptation enabled, see MD 1413) or parameterize (initialize) it automatically using **Calculate controller data**.

> **Note**
>
> _____
>
> Entering a P gain of 0 automatically deactivates the associated integral component (MD 1409).
> _____

2.2   Speed controller settings

1409	SPEEDCTRL_INTEGRATOR_TIME_1[n] 0...7 index of parameter set				Cross reference: –
	Integrator time, speed controller			Relevant: FSD/MSD	Protection level: 2/4
Unit: ms	Default: 10	Minimum: 0.0	Maximum: 500	Data type: FLOAT	Active: Immediately

Enter the speed control loop reset time for the complete speed range (exception: with adaptation enabled, see MD 1413) or parameterize (initialize) it automatically using **Calculate controller data**.

Note

If a reset time of 0 is entered, the I component is disabled for the appropriate speed range (if the integral gain and the integrator contents are deleted = > torque jumps cannot be completely excluded).

!

Important

If the adaptation is active, the integral component should not be deactivated for just one speed range (MD 1409 = 0 and MD 1410 ≠ 0 or vice versa) to avoid problems arising from torque jumps when resetting the integral value at the transition from the adaptation range to the constant range.

1413	SPEEDCTRL_ADAPT_ENABLE			Cross reference: –	
Selection, speed controller adaptation				Relevant: FSD/MSD	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 1	Data type: UNS.WORD	Active: Immediately

This machine data can be used to control adaptation of the speed-controller machine data as a function of the speed.
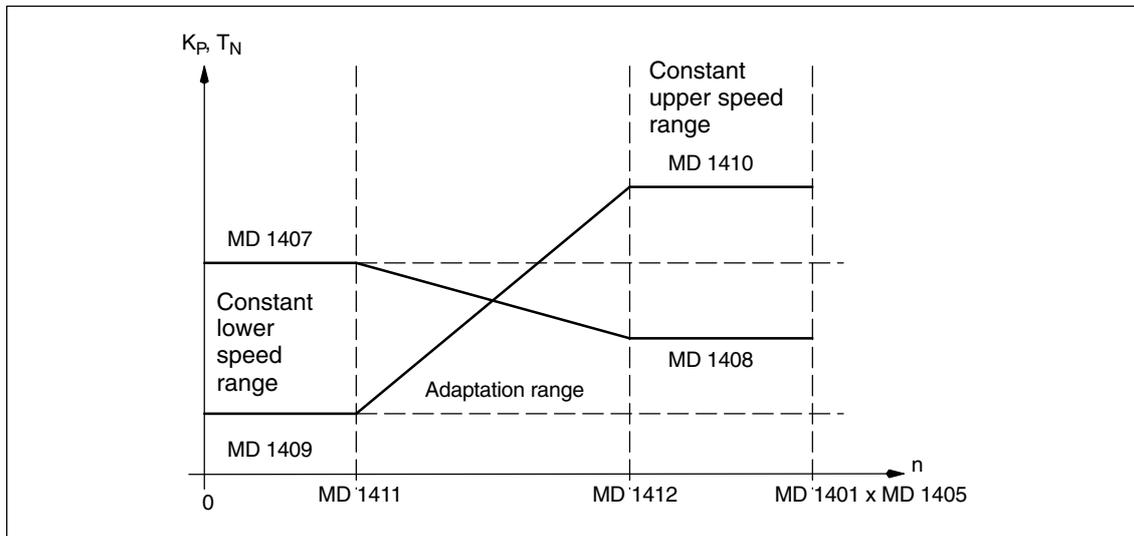

Fig. 2-8   Adaptation of the speed controller machine data based on characteristic

Input 0   The adaptation is not active. The speed controller settings (MD 1407 and MD 1409) are valid for the complete speed range. Machine data MD 1408 and MD 1410 are not taken into account.

Input 1   The adaptation is active. For a description, see machine data MD 1408, MD 1410, MD 1411 and MD 1412.

Note

For main spindle drives, the adaptation is automatically activated using **Calculate controller data**.

2.2 Speed controller settings

1408	SPEEDCTRL_GAIN_2[n] 0...7 index of parameter set				Cross reference: –
	P gain, upper adaptation speed			Relevant: FSD/MSD	Protection level: 2/4
Unit: Nm/s^{-1}	Default: 0.3	Minimum: 0.0	Maximum: 100,000.0	Data type: FLOAT	Active: Immediately

The speed-control-loop P gain is entered in the upper speed range (n > MD 1412: SPEEDCTRL_ADAPT_SPEED_2) or automatically parameterized (initialized) using **Calculate controller data**. The gains in the lower speed range (MD 1407) and in the upper speed range (MD 1408) are not subject to mutual restriction. For a graphical representation, see Fig. 2-8.

Note

Entering a P gain of 0 automatically deactivates the associated integral component (MD 1409).

MD 1408 is not active when speed adaptation is deactivated (MD 413 = 0).

1410	SPEEDCTRL_INTEGRATOR_TIME_2[n] 0...7 index of parameter set				Cross reference: –
	Integrator time, upper adaptation speed [drive parameter set]: 0 ... 7			Relevant: FSD/MSD	Protection level: 2/4
Unit: ms	Default: 10.0	Minimum: 0.0	Maximum: 500.0	Data type: FLOAT	Active: Immediately

Enter the speed control loop reset time in the upper speed range (n > MD 1412: SPEEDCTRL_ADAPT_SPEED_2) or automatically parameterized (initialized) using **Calculate controller data**. The reset times in the lower speed range (MD 1409) and in the upper speed range (MD 1410) are not subject to any mutual restriction. For a graphical representation, see Fig. 2-8.

!

Important

If the adaptation is active, the integral component should not be deactivated for just one speed range (MD 1409 = 0 and MD 1410 ≠ 0 or vice versa) to avoid problems arising from torque jumps when resetting the integral value at the transition from the adaptation range to the constant range.

Note

Enter a reset time of 0 to deactivate the integral component for the range, which is greater than the machine data MD 1412: SPEEDCTRL_ADAPT_SPEED_2 (see also the information in MD 1409). MD 1410 is not active when speed adaptation is deactivated (MD 1413 = 0).

1411	SPEEDCTRL_ADAPT_SPEED_1				Cross reference: –
Lower adaptation speed				Relevant: FSD/MSD	Protection level: 2/4
Unit: 1/min	Default:	Minimum:	Maximum:	Data type: FLOAT	Active: Immediately
810D	0.0	0.0	50,000.0		
840D	0.0	0.0	100,000		

Enter the lower speed threshold to adapt the speed-controller machine data or parameterize (initialize) it automatically using **Calculate controller data**. If adaptation is active, the controller machine data MD 1407 and MD 1409 are active for speeds n < MD 1411. The characteristic between the two control machine data sets is linearly interpolated in the adaptation range MD 1411 < n < MD 1412.

1412	SPEEDCTRL_ADAPT_SPEED_2				Cross reference: –
Upper adaptation speed				Related to: FDD/MSD	Protection level: 2/4
Unit: 1/min	Default:	Minimum:	Maximum:	Data type: FLOAT	Active: Immediately
810D	0.0	0.0	50,000.0		
840D	0.0	0.0	100,000.0		

Enter the upper speed threshold to adapt the speed controller machine data or parameterize (initialize) it automatically using **Calculate controller data**. If adaptation is active, the controller machine data MD 1412 and MD 1408 are active for speeds n > MD 1410. The characteristic between the two control machine data sets is linearly interpolated in the center range MD 1411 < n < MD 1412. For a graphical representation, see Fig. 2-8.

1421	SPEEDCTRL_INTEGRATOR_FEEDBK[n] 0...7 index of parameter set				Cross reference: –
Time constant of integrator feedback				Relevant: FSD/MSD	Protection level: 2/4
Unit: ms	Default: 0.0	Minimum: 0.0	Maximum: 1,000.0	Data type: FLOAT	Active: Immediately

The speed-controller-loop integrator is reduced using a weighted feedback element to a 1st order low-pass characteristic with the configured time constant.

Effect:
The output of the speed-controller integrator is limited to a value proportional to the difference between setpoint and actual values (steady-state proportional action).

Applications:
Machining motions for position setpoint zero and dominant static friction can be concealed but result in a permanent distance-to-go, e.g., oscillation of the position-controlled axis at zero speed (stick-slip effect) or overshooting in the μm-step method.
Preventing torque bias on mechanically rigid linked axes or spindles (synchronous spindles).

2.2 Speed controller settings

Setting note:
Optimize this data starting from a high value until you find the best compromise.

Note

The integrator feedback becomes active as of the value MD 1421 $\geq$ 1.0
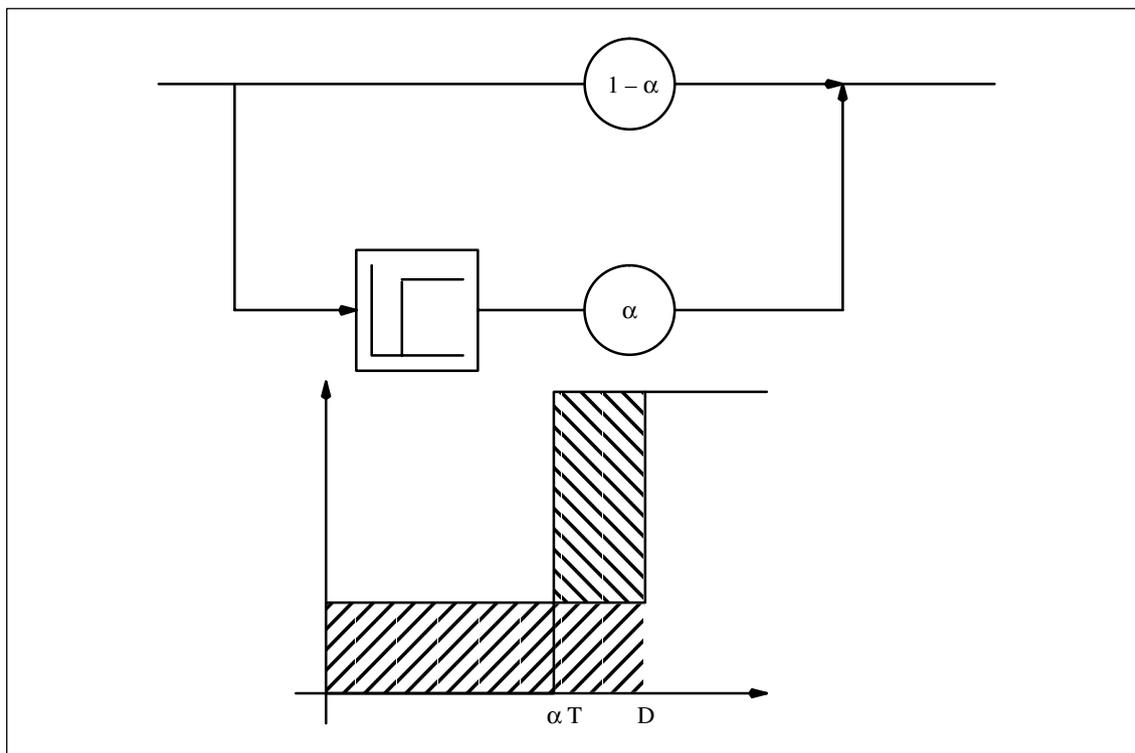

Fig. 2-9   Block diagram of fractional dead time

Using this machine data (input: computation deadtime related to the speed-controller cycle), the setpoint characteristics for the reference model can be adapted to the controlled system behavior of the closed speed control loop.

1665	IPO_SPEEDCTRL_DELAY_FACTOR			840D only	Cross reference: –
	Interpolation-/speed-controller-cycle runtime factor for ramp-function generator			Relevant: FSD/MSD	Protection level: 2/4
Unit: –	Default: 2.0	Minimum: 0.0	Maximum: 20.0	Data type: FLOAT	Active: Immediately

Enter a runtime factor between interpolation- and speed-controller-cycles for the ramp-function generator.

When ramping up, the acceleration, which is specified by the servo ramp input, can be greater than the actual permissible drive acceleration, i.e., for relatively fast reversing procedures, the drive would still be accelerating, while the servo would already be decelerating.

Ramp-function-generator follow-up is available to prevent this. The effect of follow-up is such that, if the acceleration command is too high, the speed setpoint of the servo is tied to the actual speed value of the 611D by means of a tolerance "$\pm$ DELTA".

Example

DELTA = f(t) * MD 1665
f(t): SIMODRIVE 611D computed function

2.3 Setpoint current filter

1200	NUM_CURRENT_FILTERS[n] 0...7 index of parameter set			Cross reference: –	
	Number of current-setpoint filters			Relevant: FSD/MSD	Protection level: 2/4
Unit: – 810D 840D	Default: 0 1	Minimum: 00	Maximum: 4 6	Data type: UNS.WORD	Active: Immediately

Enters the number of current-setpoint filters. You can choose between band-stops and 2nd degree low passes set in MD 1201: CURRENT_FIL-TER_CONFIG.

Table 2-3   Selection of the number of current filters

Value	Meaning
0	No current filter active
1	Filter 1 active
2	Filters 1 and 2 active
3	Filters 1, 2 and 3 active
4	Filters 1, 2, 3 and 4 active
5	Filters 1, 2, 3, 4, and 5 active
6	Filters 1, 2, 3, 4, 5, and 6 active

1201	CURRENT_FILTER_CONFIG[n] 0...7 index of parameter set			Cross reference: –	
	Type of current filter			Relevant: FSD/MSD	Protection level: 2/4
Unit: HEX 810D 840D	Default: Low pass 0 0	Minimum: Low pass 0 0	Maximum: Bandstop 4 6	Data type: UNS.WORD	Active: Immediately

Enters the configuration of 6 current filters. You can choose between bandstops and low passes. The filter parameters are entered in associated machine data.

With a bandstop, a Z transformation (zeroes and poles) is activated by setting bit 15 in MD 1201.

If bit 15 = 0, only one transformation of zeroes is activated.

Bilinear transformation is the default setting.

___

Note

The filter machine data must be assigned before the filter type is configured.

___

1222	CURRENT_FILTER_1_BS_FREQ[n] 0...7 index of parameter set 840D only				Cross reference: –
	BSF natural frequency, current setpoint 1			Relevant: FSD/MSD	Protection level: 2/4
Unit: %	Default: 100.0	Minimum: 1.0	Maximum: 100.0	Data type: FLOAT	Active: Immediately

Enter the general bandstop natural frequency for current-setpoint filter 1.
MD 1222 enables the amplitude for frequencies above the blocking frequency
for current-setpoint filter 1 to be reduced. The filter is activated
via MD 1200: NUM_CURRENT_FILTERS and
MD 1201: CURRENT_FILTER_CONFIG.

1223	CURRENT_FILTER_2_BS_FREQ[n] 0...7 index of parameter set 840D only				Cross reference: –
	BSF natural frequency, current setpoint 2			Relevant: FSD/MSD	Protection level: 2/4
Unit: %	Default: 100.0	Minimum: 1.0	Maximum: 100.0	Data type: FLOAT	Active: Immediately

Enter the general bandstop natural frequency for current-setpoint filter 2.
MD 1223 enables the amplitude for frequencies above the blocking frequency
for current-setpoint filter 2 to be reduced. The filter is activated
via MD 1200: NUM_CURRENT_FILTERS and
MD 1201: CURRENT_FILTER_CONFIG.

1224	CURRENT_FILTER_3_BS_FREQ[n] 0...7 index of parameter set 840D only				Cross reference: –
	BSF natural frequency, current setpoint 3			Relevant: FSD/MSD	Protection level: 2/4
Unit: %	Default: 100.0	Minimum: 1.0	Maximum: 100.0	Data type: FLOAT	Active: Immediately

Enter the general bandstop natural frequency for current-setpoint filter 3.
MD 1224 enables the amplitude for frequencies above the blocking frequency
for current-setpoint filter 3 to be reduced. The filter is activated
via MD 1200: NUM_CURRENT_FILTERS and
MD 1201: CURRENT_FILTER_CONFIG.

1225	CURRENT_FILTER_4_BS_FREQ[n] 0...7 index of parameter set 840D only				Cross reference: –
	BSF natural frequency, current setpoint 4			Relevant: FSD/MSD	Protection level: 2/4
Unit: %	Default: 100.0	Minimum: 1.0	Maximum: 100.0	Data type: FLOAT	Active: Immediately

Enter the general bandstop natural frequency for current-setpoint filter 4.
MD 1225 enables the amplitude for frequencies above the blocking frequency
for current-setpoint filter 4 to be reduced. The filter is activated
via MD 1200: NUM_CURRENT_FILTERS and
MD 1201: CURRENT_FILTER_CONFIG.

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2.3 Setpoint current filter

1272	CURRENT_FILTER_5_BS_FREQUENCY[0...7,DRx]			840D only	Cross reference: –
	Natural frequency, current filter 5			Relevant: FSD/MSD	Protection level: 2/4
Unit: Hz	Default: 2000.0	Minimum: 0.0	Maximum: 8,000.0	Data type: FLOAT	Active: Immediately

Enter the natural frequency for current-setpoint filter 5 (PT2 low pass). An entry with the value < 10 Hz for the natural frequency of the low pass deactivates the filter. The filter is activated via MD 1200: NUM_CURRENT_FILTERS and MD 1201: CURRENT_FILTERS_CONFIG.

1273	CURRENT_FILTER_5_DAMPING[0...7,DRx]			840D only	Cross reference: –
	Damping of current filter 5			Relevant: FSD/MSD	Protection level: 2/4
Unit: –	Default: 0.7	Minimum: 0.05	Maximum: 5.0	Data type: FLOAT	Active: Immediately

Enter the damping factor for current-setpoint filter 5 (PT2 low pass). The filter is activated via MD 1200: NUM_CURRENT_FILTERS and MD 1201: CURRENT_FILTERS_CONFIG.

1274	CURRENT_FILTER_5_SUPPR_FREQ[0...7,DRx]			840D only	Cross reference: –
	Blocking frequency, current filter 5			Relevant: FSD/MSD	Protection level: 2/4
Unit: Hz	Default: 3500.0	Minimum: 1.0	Maximum: 7,999.0	Data type: FLOAT	Active: Immediately

Enters the blocking frequency for current-setpoint filter 5 (bandstop). The filter is activated via MD 1200: NUM_CURRENT_FILTERS and MD 1201: CURRENT_FILTERS_CONFIG.

1275	CURRENT_FILTER_5_BANDWIDTH[0...7,DRx]			840D only	Cross reference: –
	Bandwidth, current filter 5			Relevant: FSD/MSD	Protection level: 2/4
Unit: Hz	Default: 500.0	Minimum: 5.0	Maximum: 7,999.0	Data type: FLOAT	Active: Immediately

Enter the 3dB bandwidth for current-setpoint filter 5 (bandstop). The filter is activated via MD 1200: NUM_CURRENT_FILTERS and MD 1201: CURRENT_FILTERS_CONFIG. An input value of 0 for the bandwidth deactivates the filter.

1276	CURRENT_FILTER_5_BW_NUM[0...7,DRx]			840D only	Cross reference: –
	Numerator bandwidth, current-setpoint filter 5			Relevant: FSD/MSD	Protection level: 2/4
Unit: Hz	Default: 0.0	Minimum: 0.0	Maximum: 7,999.0	Data type: FLOAT	Active: Immediately

Enter the numerator bandwidth for the attenuated bandstop. Entering a value of 0 initializes the filter as an unattenuated bandstop. The filter is activated via MD 1200: NUM_CURRENT_FILTERS and MD 1201: CURRENT_FILTERS_CONFIG.

1277	CURRENT_FILTER_5_BS_FREQ[0...7,DRx]			840D only	Cross reference: –
	Bandstop natural frequency, current-setpoint filter 5			Relevant: FSD/MSD	Protection level: 2/4
Unit: %	Default: 100.0	Minimum: 1.0	Maximum: 100.0	Data type: FLOAT	Active: Immediately

Enter the natural frequency of the general bandstop for current setpoint filter 1. MD 1277 can be used to lower the amplitude for frequencies above the blocking frequency for current setpoint filter 5. Entering a value of 0 initializes the filter as an unattenuated bandstop. The filter is activated via MD 1200: NUM_CUR-RENT_FILTERS and MD 1201: CURRENT_FILTERS_CONFIG.

1278	CURRENT_FILTER_6_FREQUENCY[0...7,DRx]			840D only	Cross reference: –
	Natural frequency, current filter 6			Relevant: FSD/MSD	Protection level: 2/4
Unit: Hz	Default: 2,000.0	Minimum: 0.0	Maximum: 8,000.0	Data type: FLOAT	Active: Immediately

Enter the natural frequency for current-setpoint filter 6 (PT2 low pass). An entry with the value < 10 Hz for the natural frequency of the low pass deactivates the filter. The filter is activated via MD 1200: NUM_CURRENT_FILTERS and MD 1201: CURRENT_FILTERS_CONFIG.

1279	CURRENT_FILTER_6_DAMPING[0...7,DRx]			840D only	Cross reference: –
	Damping of current filter 6			Relevant: FSD/MSD	Protection level: 2/4
Unit: –	Default: 0.7	Minimum: 0.5	Maximum: 5.0	Data type: FLOAT	Active: Immediately

Enter the damping factor for current-setpoint filter 6 (PT2 low pass). The filter is activated via MD 1200: NUM_CURRENT_FILTERS and MD 1201 CURRENT_FILTERS_CONFIG.

1280	CURRENT_FILTER_6_SUPPR_FREQ[0...7,DRx]			840D only	Cross reference: –
	Blocking frequency, current filter 6			Relevant: FSD/MSD	Protection level: 2/4
Unit: Hz	Default: 3500.0	Minimum: 1.0	Maximum: 7999.0	Data type: FLOAT	Active: Immediately

Enters the blocking frequency for current-setpoint filter 6 (bandstop). The filter is activated via MD 1200: NUM_CURRENT_FILTERS and MD 1201 CURRENT_FILTERS_CONFIG.

2.3 Setpoint current filter

1281	CURRENT_FILTER_6_BANDWIDTH[0...7,DRx]			840D only	Cross reference: –
	Bandwidth, current filter 6			Relevant: FSD/MSD	Protection level: 2/4
Unit: Hz	Default: 500.0	Minimum: 5.0	Maximum: 7,999.0	Data type: FLOAT	Active: Immediately

Enter the 3 dB bandwidth for current-setpoint filter 6 (bandstop). The filter is activated via MD 1200: NUM_CURRENT_FILTERS and MD 1201 CURRENT_FILTERS_CONFIG. An input value of 0 for the bandwidth deactivates the filter.

1282	CURRENT_FILTER_6_BW_NUM[0...7,DRx]			840D only	Cross reference: –
	Numerator bandwidth, current-setpoint filter 6			Relevant: FSD/MSD	Protection level: 2/4
Unit: Hz	Default: 0.0	Minimum: 0.0	Maximum: 7,999.0	Data type: FLOAT	Active: Immediately

Enter the numerator bandwidth for the attenuated bandstop. Entering a value of 0 initializes the filter as an unattenuated bandstop. The filter is activated via MD 1200: NUM_CURRENT_FILTERS and MD 1201 CURRENT_FILTERS_CONFIG.

1283	CURRENT_FILTER_6_BS_FREQ[0...7,DRx]			840D only	Cross reference: –
	Bandstop natural frequency, current-setpoint filter 6			Relevant: FSD/MSD	Protection level: 2/4
Unit: %	Default: 100.0	Minimum: 1.0	Maximum: 100.0	Data type: FLOAT	Active: Immediately

Enter the natural frequency of the general bandstop for current-setpoint filter 1. MD 1283 can be used to lower the amplitude for frequencies above the blocking frequency for current-setpoint filter 5. The filter is activated using MD 1200: NUM_CURRENT_FILTERS and MD 1201 CURRENT_FILTERS_CONFIG.

Table 2-4   Type of current filter

1st filter	Bit 0	0	Low pass (see MD 1202/1203)
		1	Bandstop (see MD 1210/1211/1212/1222)
2nd filter	Bit 1	0	Low pass (see MD 1204/1205)
		1	Bandstop (see MD 1213/1214/1215/1223)
3rd filter	Bit 2	0	Low pass (see MD 1206/1207)
		1	Bandstop (see MD 1216/1217/1218/1224)
4th filter	Bit 3	0	Low pass (see MD 1208/1209)
		1	Bandstop (see MD 1219/1220/1221/1225)
5th filter	Bit 4	0	Low pass (see MD 1272/1273)
		1	Bandstop (see MD 1274/1275/1276/1277)
6th filter	Bit 5	0	Low pass (see MD 1278/1279)
		1	Bandstop (see MD 1280/1281/1282/1283)

Table 2-5   Examples of filter combinations

Filter 6	Filter 5	Filter 4	Filter 3	Filter 2	Filter 1	CURRENT_FILTER_CONFIG
PT2 (0)	BS (1)	BS (1)	PT2 (0)	PT2 (0)	BS (1)	19
BS (1)	PT2 (0)	BS (1)	BS (1)	PT2 (0)	PT2 (0)	2C
BS (1)	BS (1)	BS (1)	PT2 (0)	BS (1)	BS (1)	3B

Note

840D/611D:

The bandstop frequency of a current-setpoint filter must be lower than the Shannon frequency (parameterization error). The bandstop frequency for filter 1 (MD 1210), filter 2 (MD 1213), filter 3 (MD 1216), and filter 4 (MD 1219) must be lower than the inverse value of two current-controller cycles.

$$\text{MD 1210, MD 1213, MD 1216, MD 1219} < \frac{1}{2 \times \text{MD 1000} \times 31.25\mu s}$$

810D (CCU1/2):
Current-setpoint filters 2,3 and 4 are calculated in the speed controller cycle. In this case, the following is valid:

$$\text{MD 1213, MD 1216, MD 1219} < \frac{1}{2 \times \text{MD 1001} \times 31.25\mu s}$$

2.3   Setpoint current filter

Using low passes and bandstops

Low passes and bandstops are used to dampen resonant frequencies above or at the stability limit of the speed control loop (see diagrams below).
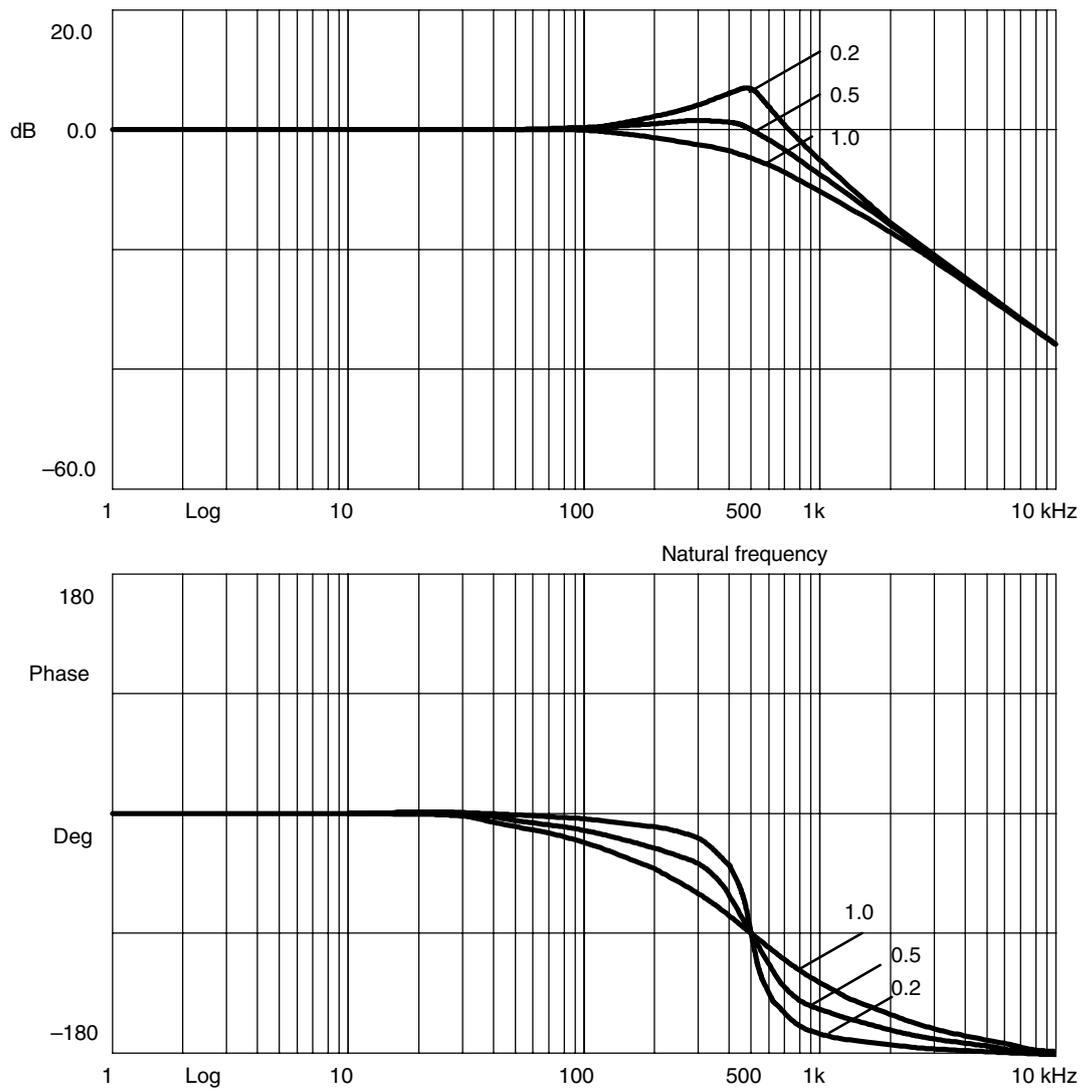
Fig. 2-10   Low-pass characteristic at 500 Hz natural frequency with various damping factors

Bandstop characteristics for Z transformation

When bit 15 is set in MD 1201 and/or MD 1501, the zeroes (blocking frequency) and the poles (bandstop natural frequency) are transformed true to frequency. This is necessary if higher-degree filters (e.g., CAUER filters) are to be used. Several bandstops must be combined in series for this purpose.

The poles and zeroes of the individual bandstopsmust be represented true to frequency in order to arrive at the desired overall transformation function. Bit 15 = 1 must be set for this purpose.
The default setting is bit 15 = 0 due to compatibility reasons.

Example:

A CAUER current-setpoint filter, which produces an amplitude reduction of 20 dB at an amplitude response of 700 Hz or above, is to be configured. This requires, for example, a series circuit with 3 bandstops. The parameters for such filters can, at the present time, only be calculated using external resources (e.g., Matlab).

The parameters were calculated as follows:

Table 2-6   Parameter example

	Filter 1	**Filter 2**	**Filter 3**
Blocking frequency	MD 1210: 705.5 Hz	MD 1213: 789.9 Hz	MD 1216: 1647.6 Hz
Bandwidth	MD 1211: 887.6 Hz	MD 1214: 185.6 Hz	MD 1217: 26.7 Hz
Numerator bandwidth	MD 1212: 0.1 Hz	MD 1215: 32.2 Hz	MD 1218: 659.0 Hz
Bandstop natural frequency	MD 1222: 89.6 %	MD 1223: 85.5 %	MD 1224: 41.5 %

The following figures show the transformation functions of the individual bandstops (Fig. 2-11) and the overall transformation function (series circuit, Fig. 2-12).
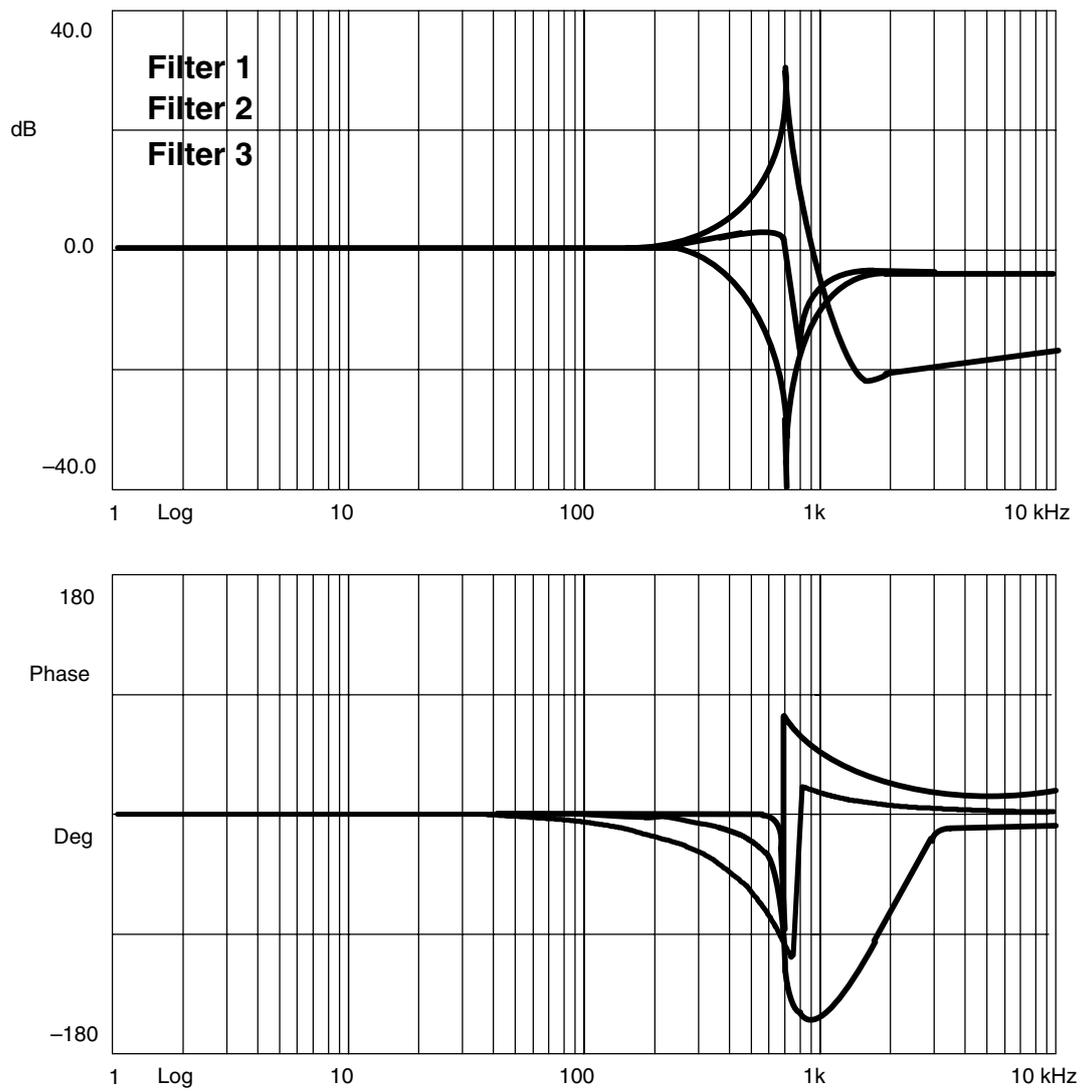
2.3 Setpoint current filter

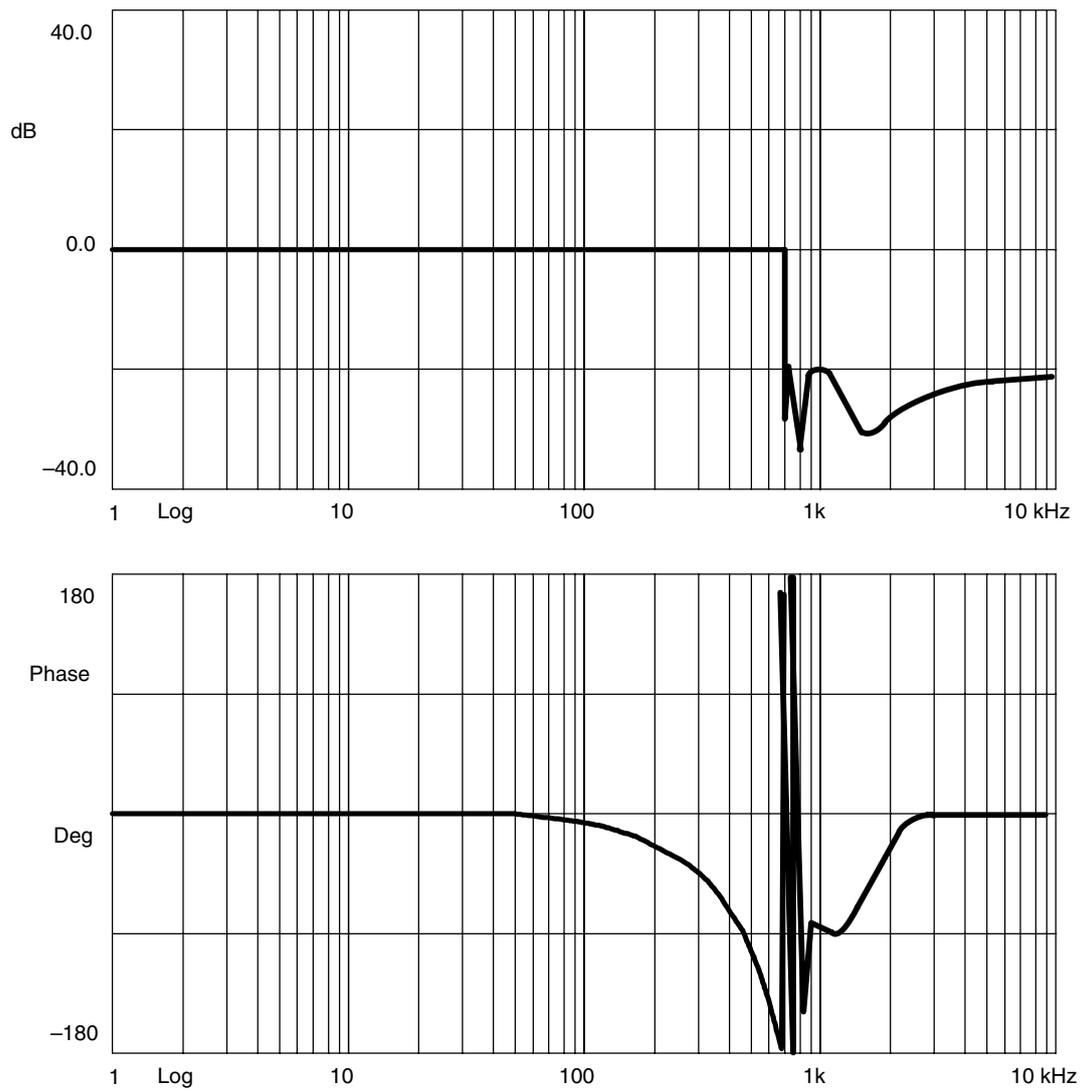Fig. 2-11   Transformation functions of the individual bandstops

Fig. 2-12   Overall transformation function (series circuit)

2.3 Setpoint current filter

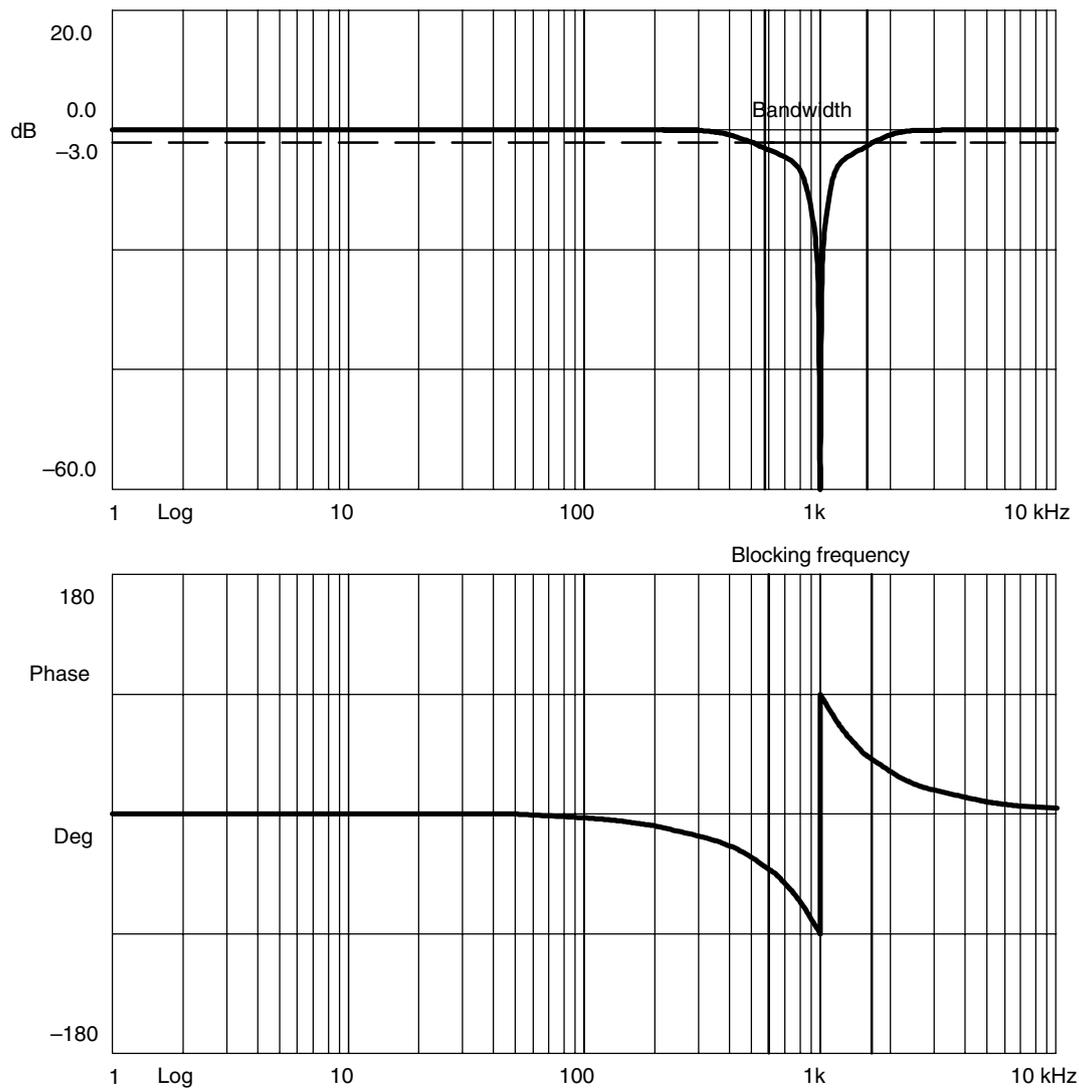**Bandstop** Default: Blocking frequency 1 kHz with 500 Hz and 1 kHz bandwidth

Fig. 2-13 Bandstop characteristic at blocking frequency 1 kHz with 1 kHz bandwidth

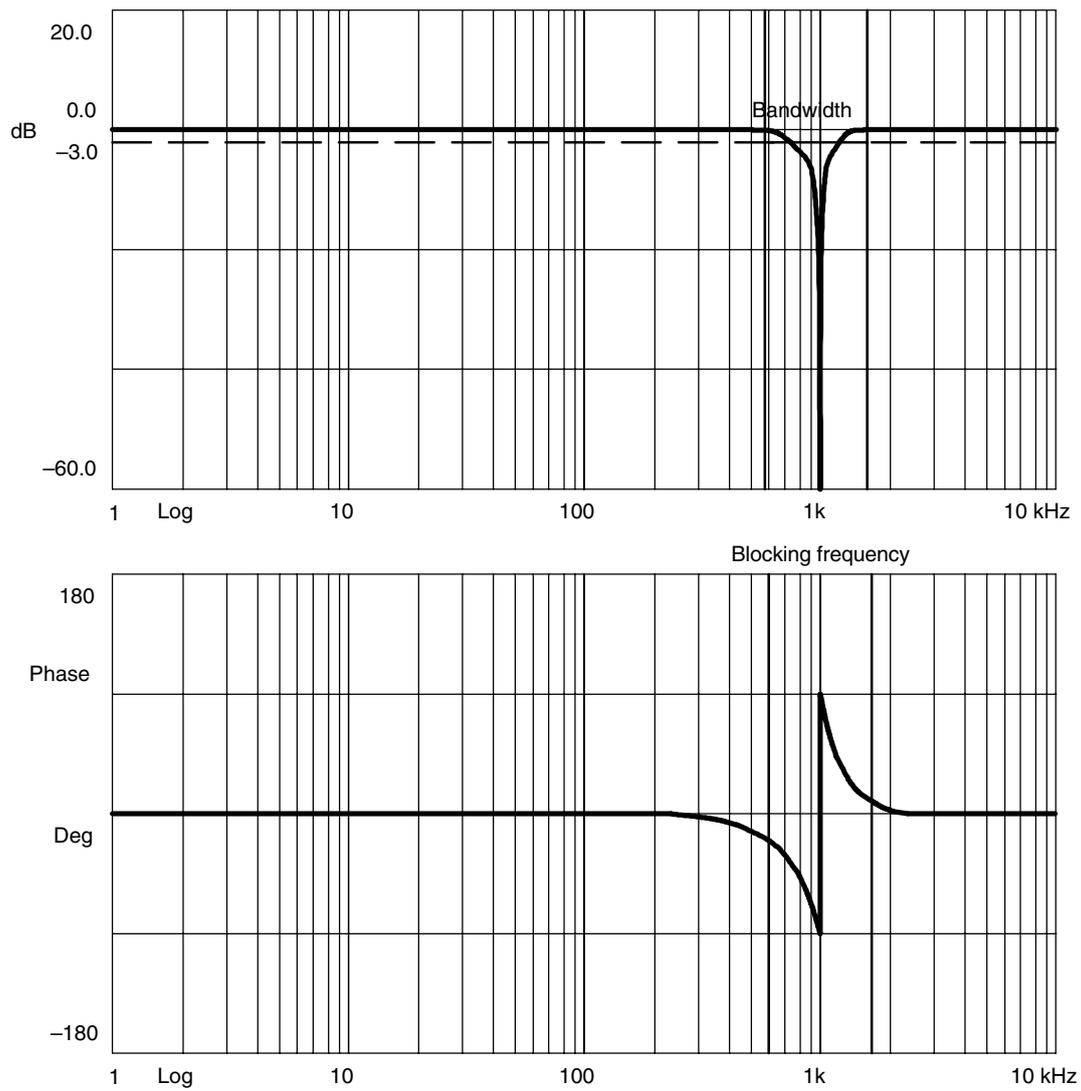The bandwidth is the difference between the two frequencies with 3 dB drop in amplitude.

Fig. 2-14   Bandstop characteristic at blocking frequency 1 kHz with 500 Hz bandwidth

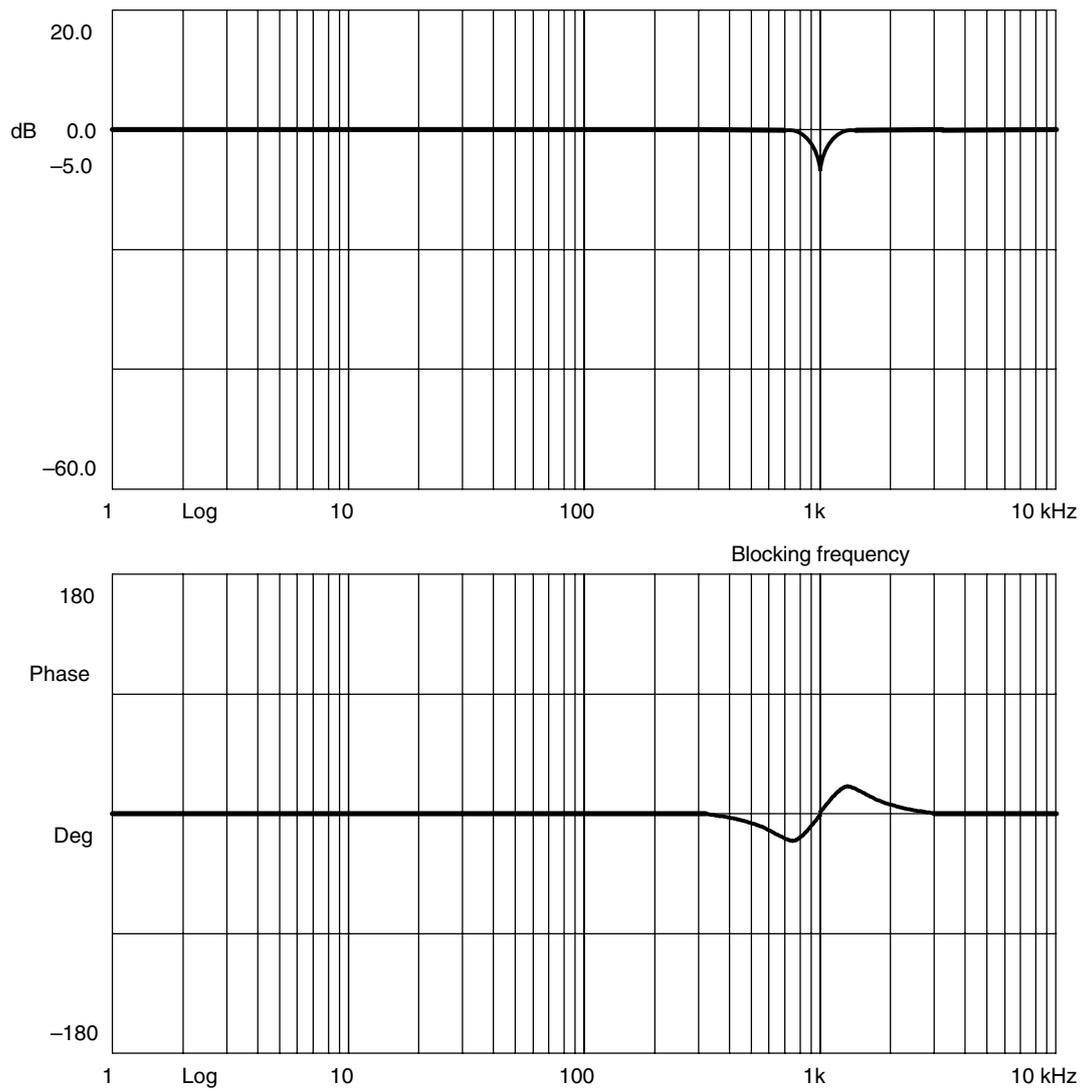## 2.3 Setpoint current filter

Fig. 2-15   Bandstop characteristic at blocking frequency 1 kHz, 500 Hz bandwidth and 250 Hz numerator bandwidth
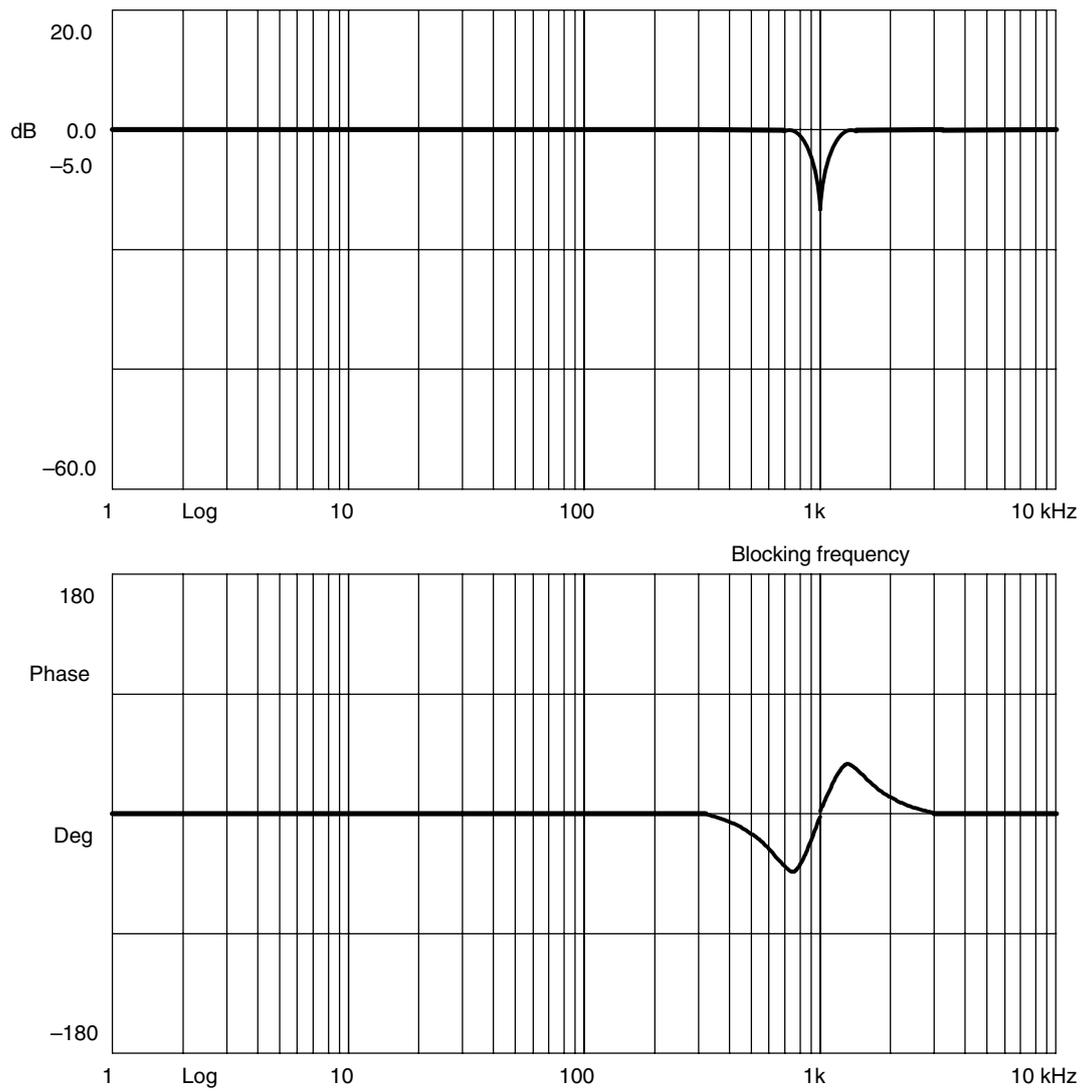
Fig. 2-16   Bandstop characteristic at blocking frequency 1 kHz, 500 Hz bandwidth and 125 Hz numerator bandwidth

2.3 Setpoint current filter

1202	CURRENT_FILTER_1_FREQUENCY[n] 0...7 index of parameter set			Cross reference: –	
	Natural frequency, current filter 1			Relevant: FSD/MSD	Protection level: 2/4
Unit: Hz	Default:	Minimum:	Maximum:	Data type: FLOAT	Active: Immediately
810D	0.0	0.0	3,999.0		
840D	2,000.0	0.0	8,000.0		

Enter the natural frequency for current-setpoint filter 1 (PT2 low pass). An entry with the value < 10 Hz for the natural frequency of the low pass deactivates the filter. The filter is activated via MD 1200: NUM_CURRENT_FILTERS and MD 1201: CURRENT_FILTER_CONFIG.

1203	CURRENT_FILTER_1_DAMPING[n] 0...7 index of parameter set			Cross reference: –	
	Damping of current filter 1			Relevant: FSD/MSD	Protection level: 2/4
Unit: –	Default:	Minimum:	Maximum:	Data type: FLOAT	Active: Immediately
810D	1.0	0.05	5.0		
840D	0.7	0.05	5.0		

Enter the damping factor for current-setpoint filter 1 (PT2 low pass). The filter is activated via MD 1200: NUM_CURRENT_FILTERS and MD 1201: CURRENT_FILTER_CONFIG.

1204	CURRENT_FILTER_2_FREQUENCY[n] 0...7 index of parameter set			Cross reference: –	
	Natural frequency, current filter 2			Relevant: FSD/MSD	Protection level: 2/4
Unit: Hz	Default:	Minimum:	Maximum:	Data type: FLOAT	Active: Immediately
810D	0.0	0.0	1,999.0		
840D	0.0	0.0	8,000.0		

Enter the natural frequency for current-setpoint filter 2 (PT2 low pass). An entry with the value < 10 Hz for the natural frequency of the low pass deactivates the filter. The filter is activated via MD 1200: NUM_CURRENT_FILTERS and MD 1201: CURRENT_FILTER_CONFIG.

1205	CURRENT_FILTER_2_DAMPING[n] 0...7 index of parameter set			Cross reference: –	
	Damping of current filter 2			Relevant: FSD/MSD	Protection level: 2/4
Unit: –	Default: 1.0	Minimum: 0.05	Maximum: 5.0	Data type: FLOAT	Active: Immediately

Enter the damping factor for current-setpoint filter 2 (PT2 low pass). The filter is activated via MD 1200: NUM_CURRENT_FILTERS and MD 1201: CURRENT_FILTER_CONFIG.

1206	CURRENT_FILTER_3_FREQUENCY[n] 0...7 index of parameter set				Cross reference: –	
	Natural frequency, current filter 3				Relevant: FSD/MSD	Protection level: 2/4
Unit: Hz 810D 840D	Default: 0.0 0.0	Minimum: 0.0 0.0	Maximum: 1,999.0 8,000.0	Data type: FLOAT	Active: Immediately	

Enter the natural frequency for current-setpoint filter 3 (PT2 low pass). An entry with the value < 10 Hz for the natural frequency of the low pass deactivates the filter. The filter is activated via MD 1200: NUM_CURRENT_FILTERS and MD 1201: CURRENT_FILTER_CONFIG.

1207	CURRENT_FILTER_3_DAMPING[n] 0...7 index of parameter set				Cross reference: –	
	Damping of current filter 3				Relevant: FSD/MSD	Protection level: 2/4
Unit: –	Default: 1.0	Minimum: 0.05	Maximum: 5.0	Data type: FLOAT	Active: Immediately	

Enter the damping factor for current-setpoint filter 3 (PT2 low pass). The filter is activated via MD 1200: NUM_CURRENT_FILTERS and MD 1201: CURRENT_FILTER_CONFIG.

1208	CURRENT_FILTER_4_FREQUENCY[n] 0...7 index of parameter set				Cross reference: –	
	Natural frequency, current filter 4				Relevant: FSD/MSD	Protection level: 2/4
Unit: Hz 810D 840D	Default: 0.0 0.0	Minimum: 0.0 0.0	Maximum: 1,999.0 8,000.0	Data type: FLOAT	Active: Immediately	

Enter the natural frequency for current-setpoint filter 4 (PT2 low pass). An entry with the value < 10 Hz for the natural frequency of the low pass deactivates the filter. The filter is activated via MD 1200: NUM_CURRENT_FILTERS and MD 1201: CURRENT_FILTER_CONFIG.

2.3 Setpoint current filter

1209	CURRENT_FILTER_4_DAMPING[n] 0...7 index of parameter set				Cross reference: –
	Damping of current filter 4			Relevant: FSD/MSD	Protection level: 2/4
Unit: –	Default: 1.0	Minimum: 0.05	Maximum: 5.0	Data type: FLOAT	Active: Immediately

Enter the damping factor for current-setpoint filter 4 (PT2 low pass). The filter is activated via MD 1200: NUM_CURRENT_FILTERS and MD 1201: CURRENT_FILTER_CONFIG.

1210	CURRENT_FILTER_1_SUPPR_FREQ[n] 0...7 index of parameter set				Cross reference: –
	Blocking frequency, current filter 1			Relevant: FSD/MSD	Protection level: 2/4
Unit: Hz	Default:	Minimum:	Maximum:	Data type: FLOAT	Active: Immediately
810D	1,600.0	1.0	3,999.0		
840D	3,500.0	1.0	7,999.0		

Enters the blocking frequency for current-setpoint filter 1 (bandstop). The filter is activated via MD 1200: NUM_CURRENT_FILTERS and MD 1201: CURRENT_FILTER_CONFIG.

1211	CURRENT_FILTER_1_BANDWIDTH[n] 0...7 index of parameter set				Cross reference: –
	Bandwidth, current filter 1			Relevant: FSD/MSD	Protection level: 2/4
Unit: Hz	Default:	Minimum:	Maximum:	Data type: FLOAT	Active: Immediately
810D	400.0	5.0	3,999.0		
840D	500.0	5.0	7,999.0		

Enter the –3 dB bandwidth for current-setpoint filter 1 (bandstop). The filter is activated via MD 1200: NUM_CURRENT_FILTERS and MD 1201: CURRENT_FILTER_CONFIG. An input value of 0 for the bandwidth deactivates the filter.

1212	CURRENT_FILTER_1_BW_NUM[n] 0...7 index of parameter set				Cross reference: –
	Numerator bandwidth, current filter 1			Relevant: FSD/MSD	Protection level: 2/4
Unit: Hz	Default:	Minimum:	Maximum:	Data type: FLOAT	Active: Immediately
810D	0.0	0.0	3,999.0		
840D	0.0	0.0	7,999.0		

Enter the numerator bandwidth for the attenuated bandstop. Entering a value of 0 initializes the filter as an unattenuated bandstop. The filter is activated via MD 1200: NUM_CURRENT_FILTERS and MD 1201: CURRENT_FILTER_CONFIG.

1213	CURRENT_FILTER_2_SUPPR_FREQ[n] 0...7 index of parameter set			Cross reference: –
Blocking frequency, current filter 2			Relevant: FSD/MSD	Protection level: 2/4
Unit: Hz 810D 840D	Default: 1,200.0 3,500.0	Minimum: 1.0 1.0	Maximum: 1,999.0 7,999.0	Data type: FLOAT	Active: Immediately

Enters the blocking frequency for current-setpoint filter 2 (bandstop). The filter is activated via MD 1200: NUM_CURRENT_FILTERS and MD 1201: CURRENT_FILTER_CONFIG.

1214	CURRENT_FILTER_2_BANDWIDTH[n] 0...7 index of parameter set			Cross reference: –
Bandwidth, current filter 2			Relevant: FSD/MSD	Protection level: 2/4
Unit: Hz 810D 840D	Default: 400.0 500.0	Minimum: 5.0 5.0	Maximum: 1,999.0 7,999.0	Data type: FLOAT	Active: Immediately

Enter the –3 dB bandwidth for current-setpoint filter 2 (bandstop). The filter is activated via MD 1200: NUM_CURRENT_FILTERS and MD 1201: CURRENT_FILTER_CONFIG. An input value of 0 for the bandwidth deactivates the filter.

1215	CURRENT_FILTER_2_BW_NUM[n] 0...7 index of parameter set			Cross reference: –
Numerator bandwidth, current filter 2			Relevant: FSD/MSD	Protection level: 2/4
Unit: Hz 810D 840D	Default: 0.0 0.0	Minimum: 0.0 0.0	Maximum: 1,999.0 7,999.0	Data type: FLOAT	Active: Immediately

Enter the numerator bandwidth for the attenuated bandstop. Entering a value of 0 initializes the filter as an unattenuated bandstop. The filter is activated via MD 1200: NUM_CURRENT_FILTERS and MD 1201: CURRENT_FILTER_CONFIG.

1216	CURRENT_FILTER_3_SUPPR_FREQ[n] 0...7 index of parameter set			Cross reference: –
Blocking frequency, current filter 3			Relevant: FSD/MSD	Protection level: 2/4
Unit: Hz 810D 840D	Default: 1,200.0 3,500.0	Minimum: 1.0 1.0	Maximum: 1,999.0 7,999.0	Data type: FLOAT	Active: Immediately

Enters the blocking frequency for current-setpoint filter 3 (bandstop). The filter is activated via MD 1200: NUM_CURRENT_FILTERS and MD 1201: CURRENT_FILTER_CONFIG.

SIMODRIVE 611 Digital / SINUMERIK 840D/810D Drive Functions (FBA) – 11.05 Edition   DD2/2-39

2.3   Setpoint current filter

1217	CURRENT_FILTER_3_BANDWIDTH[n] 0...7 index of parameter set			Cross reference: –
Bandwidth, current filter 3			Relevant: FSD/MSD	Protection level: 2/4
Unit: Hz 810D 840D	Default: 400.0 500.0	Minimum: 5.0 5.0	Maximum: 1,999.0 7,999.0	Data type: FLOAT	Active: Immediately

Enter the –3 dB bandwidth for current-setpoint filter 3 (bandstop). The filter is activated via MD 1200: NUM_CURRENT_FILTERS and MD 1201: CURRENT_FILTER_CONFIG.

1218	CURRENT_FILTER_3_BW_NUM[n] 0...7 index of parameter set			Cross reference: –
Numerator bandwidth, current filter 3			Relevant: FSD/MSD	Protection level: 2/4
Unit: Hz 810D 840D	Default: 0.0 0.0	Minimum: 0.0 0.0	Maximum: 1,999.0 7,999.0	Data type: FLOAT	Active: Immediately

Enter the numerator bandwidth for the attenuated bandstop. Entering a value of 0 initializes the filter as an unattenuated bandstop. The filter is activated via MD 1200: NUM_CURRENT_FILTERS and MD 1201: CURRENT_FILTER_CONFIG.

1219	CURRENT_FILTER_4_SUPPR_FREQ[n] 0...7 index of parameter set			Cross reference: –
Blocking frequency, current filter 4			Relevant: FSD/MSD	Protection level: 2/4
Unit: Hz 810D 840D	Default: 1,200.0 3,500.0	Minimum: 1.0 1.0	Maximum: 1,999.0 7,999.0	Data type: FLOAT	Active: Immediately

Enters the blocking frequency for current-setpoint filter 4 (bandstop). The filter is activated via MD 1200: NUM_CURRENT_FILTERS and MD 1201: CURRENT_FILTER_CONFIG.

1220	CURRENT_FILTER_4_BANDWIDTH[n] 0...7 index of parameter set			Cross reference: –
Bandwidth, current filter 4			Relevant: FSD/MSD	Protection level: 2/4
Unit: Hz 810D 840D	Default: 400.0 500.0	Minimum: 5.0 5.0	Maximum: 1,999.0 7,999.0	Data type: FLOAT	Active: Immediately

Enter the –3 dB bandwidth for current-setpoint filter 4 (bandstop). The filter is activated via MD 1200: NUM_CURRENT_FILTERS and MD 1201: CURRENT_FILTER_CONFIG. An input value of 0 for the bandwidth deactivates the filter.

1221	CURRENT_FILTER_4_BW_NUM[n] 0...7 index of parameter set			Cross reference: –	
Numerator bandwidth, current filter 4				Relevant: FSD/MSD	Protection level: 2/4
Unit: Hz	Default:	Minimum:	Maximum:	Data type: FLOAT	Active: Immediately
810D	0.0	0.0	1,999.0		
840D	0.0	0.0	7,999.0		

Enter the numerator bandwidth for the attenuated bandstop. Entering a value of 0 initializes the filter as an unattenuated bandstop. The filter is activated via MD 1200: NUM_CURRENT_FILTERS and
MD 1201: CURRENT_FILTER_CONFIG.

Setpoint current filter

Formula

$$\frac{1 + s \times (2 \times \pi \times fbz/(2 \times \pi \times fz)^2) + s^2 \times 1/(2 \times \pi \times fz)^2)}{1 + s \times (2 \times \pi \times fbn/(2 \times \pi \times fn)^2) + s^2 \times 1/(2 \times \pi \times fn)^2)} = .$$

$$\frac{1 + s \times (2 \times Dz/(2 \times \pi \times fz)) + s^2 \times 1/(2 \times \pi \times fz)^2}{1 + s \times (2 \times Dn/(2 \times \pi \times fn)) + s^2 \times 1/(2 \times \pi \times fn)^2}$$

Conversion

fz	: Blocking frequency	MD 1210/1213/1216/1219
Dz	: Numerator damping	
$fbz = 2 \times Dz \times fz$	: Numerator bandwidth	MD 1212/1215/1218/1221
Dn	: Denominator damping	
$fbn = 2 \times Dn \times fn$	: Denominator bandwidth	MD 1211/1214/1217/1220
$fn = $ MD 1222(%) $\times fz$	: Bandstop natural freq.	MD 1222/1223/1224/1225

2.4 Speed-dependent current-setpoint filter

1245	CURRENT_SMOOTH_SPEED		840D only	Cross reference: –
	Threshold, speed-dependent torque setpoint smoothing		Relevant: FSD/MSD	Protection level: 2/4
Unit: 1/min	Default: 0.0	Minimum: 0.0	Maximum: 50,000.0	Data type: FLOAT	Active: Immediately

Enter the speed, above which torque setpoint smoothing, switched-in with the 2nd filter (low pass) in MD 1201: CURRENT_FILTER_CONFIG is activated. The user can reduce the speed ripple at higher speeds using this speed-dependent torque setpoint smoothing (MSD).

The filter remains active as a low pass across the complete speed range if 0 is entered as the threshold value. Two switching speeds are calculated from MD 1245 and MD 1246: CURRENT_SMOOTH_HYSTERESIS:

$$n_{top} = n_{threshold} + n_{hysteresis} = \text{MD } 1245 + \text{MD } 1246$$

$$n_{bottom} = n_{threshold} - n_{hysteresis} = \text{MD } 1245 - \text{MD } 1246$$
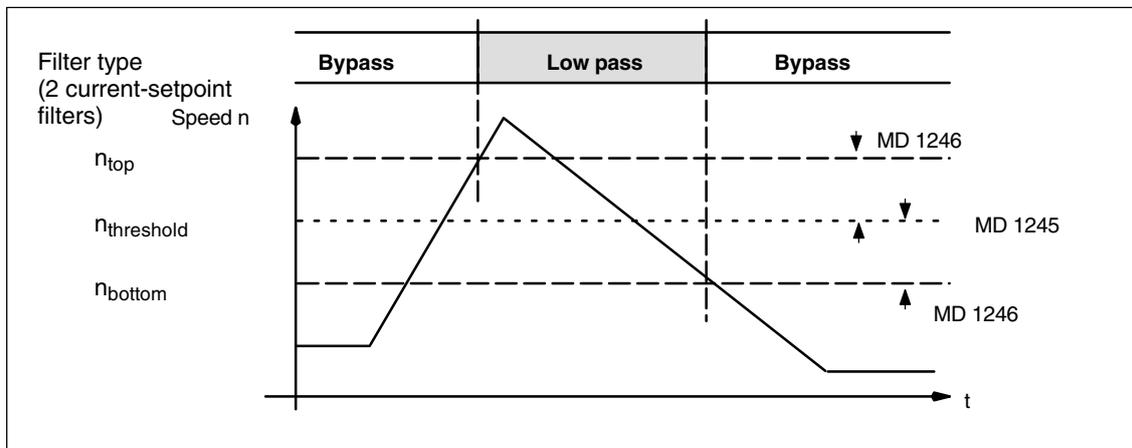

Fig. 2-17   Threshold, speed-dependent torque-setpoint smoothing

Functionality

The changeover from bypass to low pass occurs when the absolute actual speed exceeds n_{top} ($|n_{act}| \geq n_{top}$). Vice versa, bypass is selected instead of low pass if the absolute actual speed is less than n_{bottom} ($|n_{act}| < n_{bottom}$). If 0 is selected for the hysteresis, then both switching speeds are the same.

Note

The speed threshold is only effective if filter 2 is configured as a low pass. This machine data has no effect on the closed-loop control.

1246	CURRENT_SMOOTH_HYSTERESIS			840D only	Cross reference: –
	Hysteresis, speed-dependent torque setpoint smoothing			Relevant: FSD/MSD	Protection level: 2/4
Unit: 1/min	Default: 50.0	Minimum: 0.0	Maximum: 1,000.0	Data type: FLOAT	Active: Immediately

Enter the hysteresis for the switch-in speed set in MD 1245: CUR-RENT_SMOOTH_SPEED.

2.5 Speed-setpoint filters

1500	NUM_SPEED_FILTERS[n] 0...7 index of parameter set				Cross reference: –
	Number of speed-setpoint filters			Relevant: FSD/MSD	Protection level: 2/4
Unit: – 810D 840D	Default: 0 0	Minimum: 0 0	Maximum: 1 2	Data type: UNS.WORD	Active: Immediately

Enter the number of speed-setpoint filters.
810D (CCU1/2):   low pass PT1
840D/611D, 810D (CCU3):   low pass PT1, low pass PT2 or bandstop

Table 2-7   Selecting the number of speed-setpoint filters.

0	No speed-setpoint filter active
1	Filter 1 active
2	Filters 1 and 2 active (840D only)

The first filter as PT1 or PT2 is effective only when activated by the PLC. The speed-setpoint filter is measured during the FFT speed-control-loop measurement. If the 1st filter is configured as a bandstop (and it is active), this filter is always used, regardless of the PLC signal.

Note

On the 840D/611D, filter 1 can also be selected via an interface signal.
IS "Speed-setpoint smoothing" DB 31 ... 48.DBX 20.3
References: /FB/, A2 "Various Interface Signals"

2.5 Speed-setpoint filters

1501	SPEED_FILTER_TYPE[n] 0...7 index of parameter set			840D only	Cross reference: –
	Type of speed-setpoint filters			Relevant: FSD/MSD	Protection level: 2/4
Unit: –	Default: 0000	Minimum: 0000	Maximum: 8,303	Data type: UNS.WORD	Active: Immediately

Enter the configuration of 2 speed-setpoint filters. You can choose between bandstops and low passes (PT2/PT1). The settable filter parameters are entered in the associated machine data.

With a bandstop, a Z transformation (zeroes and poles) is activated by setting bit 15 in MD 1201.

If bit 15 = 0, only one transformation of zeroes is activated.

Bilinear transformation is the default setting.

Applications:

• Damping of mechanical resonant frequencies in position feedback loop (bandstop).
  Depending on requirements, the "Bandstop" function can be set in three configurations:

  – Simple bandstop. MD 1514/MD 1517 and MD 1515/MD 1518.

  – Bandstop with settable damping of amplitude response, in addition MD 1516/MD 1519.

  – Bandstop with settable damping of the amplitude response and increase or decrease of the amplitude response in accordance with the blocking frequency. In addition MD 1520/MD 1521.

• Interpolation of speed-setpoint stairs
  The speed setpoints are output in the position-controller cycle, which can be set significantly higher than the speed-controller cycle (low pass).

Table 2-8   Type of speed-setpoint filters

Low pass/bandstop	1st filter	Bit 0	0	Low pass (see MD 1502/1506/1507)
			1	Bandstop (see MD 1514/1515/1516)
	2nd filter	Bit 1	0	Low pass (see MD 1502/1508/1509)
			1	Bandstop (see MD 1517/1518/1519)
PT2/PT1 for low pass	1st filter	Bit 8	0	PT2 low pass (see MD 1506/1507)
			1	PT1 low pass (see MD 1502)
	2nd filter	Bit 9	0	PT2 low pass (see MD 1508/1509)
			1	PT1 low pass (see MD 1503)

Note

The filter machine data must be assigned before the filter type is configured.

Table 2-9   Speed-setpoint-filter combinations

Filter 2	Filter 1	SPEED_FILTER_TYPE
PT1	PT1	300
PT1	PT2	200
PT1	RS	201
PT2	PT1	100
PT2	PT2	000
PT2	RS	001
RS	PT1	102
RS	PT2	002
RS	RS	003

1502	SPEED_FILTER_1_TIME [n] 0...7 index of parameter set				Cross reference: –
	Time constant, speed-setpoint filter 1			Relevant: FSD/MSD	Protection level: 2/4
Unit: ms 810D 840D	Default: 0.0 0.0	Minimum: 0.0 0.0	Maximum: 150.0 500.0	Data type: FLOAT	Active: Immediately

Enter the time constant for speed-setpoint filter 1 (PT1 low pass). Entering a value of 0 deactivates the filter.

Note

On the 840D/611D, filter 1 can also be selected via an interface signal.
IS "Speed-setpoint smoothing" DB31 ... DBX 20.3
References: /FB/, A2 "Various Interface Signals"

2.5 *Speed-setpoint filters*

1506	SPEED_FILTER_1_FREQUENCY[n] 0...7 index of parameter set 840D only				Cross reference: –
	Natural freq. setp. speed-setpoint filter			Relevant: FSD/MSD	Protection level: 2/4
Unit: Hz	Default: 2,000.0	Minimum: 10.0	Maximum: 8,000.0	Data type: FLOAT	Active: Immediately

Enter the natural frequency for speed-setpoint filter 1 (PT2 low pass). Entering a value < 10 Hz for the natural frequency of the low pass initializes the filter as a proportional element with a gain of 1 irrespective of the associated damping. The filter is activated via the "Speed-setpoint smoothing" IS, DB 31 ... 48.DBX 20.3.

Note

The speed-setpoint filters for interpolating axes should be configured identically.

1507	SPEED_FILTER_1_DAMPING[n] 0...7 index of parameter set 840D only				Cross reference: –
	Damping, speed-setpoint filter 1			Relevant: FSD/MSD	Protection level: 2/4
Unit: –	Default: 0.7	Minimum: 0.2	Maximum: 5.0	Data type: FLOAT	Active: Immediately

Enter the damping factor for speed-setpoint filter 1 (PT2 low pass).
The filter is activated via the "Speed-setpoint smoothing" IS, DB 31 ... 48.DBX 20.3.

Note

The speed-setpoint filters for interpolating axes should be configured identically.

If damping values are entered in the range of the minimum input limit, this can result in overshoot in the time range up to a factor of ≤ 2. For two configured low passes with the same setting parameters, this effect is significantly increased. In the small signal range, these filters continue to have a linear response. In the large signal range, the filter states can, in certain individual cases, be restricted by the maximum numerical formats (defined by the processor register width). The filter characteristic is non-linear for a short period. Overflows and unstable reactions do not occur.

1514	SPEED_FILTER_1_SUPPR_FREQ[n] 0...7 index of parameter set 840D only				Cross reference: –
Blocking frequency, speed-setpoint filter 1				Relevant: FSD/MSD	Protection level: 2/4
Unit: Hz	Default: 3,500.0	Minimum: 1.0	Maximum: 7,999.0	Data type: FLOAT	Active: Immediately

Enter the blocking frequency for speed-setpoint filter 1 (bandstop). If filter 1 is parameterized as a bandstop, it is always effective, regardless of the Speed setpoint smoothing IS.

Note

The max. blocking frequency input is limited by the sampling frequency of the closed-loop control (MD 1001) (parameterization error).

$$\text{MD } 1514 < \frac{1}{2 \times T_{sample}} = \frac{1}{2 \times \text{MD } 1001}$$

$$\text{MD } 1001 = T_{sample} = \left\{ \begin{array}{c} 62.5\ \mu s \\ 125.0\ \mu s \end{array} \right\} => \text{MD } 1514 < \left\{ \begin{array}{c} 8{,}000\ Hz \\ 4{,}000\ Hz \end{array} \right\}$$

1515	SPEED_FILTER_1_BANDWIDTH[n] 0...7 index of parameter set 840D only				Cross reference: –
Bandwidth, speed-setpoint filter 1				Relevant: FSD/MSD	Protection level: 2/4
Unit: Hz	Default: 500.0	Minimum: 5.0	Maximum: 7,999.0	Data type: FLOAT	Active: Immediately

Enter the –3 dB bandwidth for speed-setpoint filter 1 (bandstop).

Note

When 0 is entered for the bandwidth, this parameterizes the filter as proportional element with gain 1.
The bandwidth must be smaller or equal to 2 · MD 1514 · MD 1520.

2.5 Speed-setpoint filters

1516	SPEED_FILTER_1_BW_NUMERATOR[n] n= 0...7			840D only	Cross reference: –
	Bandwidth numerator, speed-setpoint filter 1			Relevant: FSD/MSD	Protection level: 2/4
Unit: Hz	Default: 0.0	Minimum: 0.0	Maximum: 7,999.0	Data type: FLOAT	Active: Immediately

Enter the numerator bandwidth for the attenuated bandstop. Entering a value of 0 initializes the filter as an unattenuated bandstop.

Note

The value of MD 1516: SPEED_FILTER_1_BW_NUM may only be a maximum of twice MD 1515: SPEED_FILTER_1_BANDWIDTH.

1520	SPEED_FILTER_1_BS_FREQ			840D only	Cross reference: –
	Natural frequency bandstop speed-setpoint filter 1			Relevant: FSD/MSD	Protection level: 2/4
Unit: %	Default: 100.0	Minimum: 1.0	Maximum: 141.0	Data type: FLOAT	Active: Immediately

Enter the natural frequency for the general bandstop as a percentage with reference to MD 1514 (blocking frequency).
For MD 1520 = 100%, the filter is initialized as an attenuated bandstop.

If the resulting natural frequency (MD 1520 · MD 1514) exceeds the Shannon frequency specified by the speed-controller cycle, then the input is rejected with parameterization error.

For more information, see MD 1521: SPEED_FILTER_2_BS_FREQ

1503	SPEED_FILTER_2_TIME[n] 0...7 index of parameter set			840D only	Cross reference: –
	Time constant, speed-setpoint filter 2			Relevant: FSD/MSD	Protection level: 2/4
Unit: ms	Default: 0.0	Minimum: 0.0	Maximum: 500.0	Data type: FLOAT	Active: Immediately

Enter the time constant for speed-setpoint filter 2 (PT1 low pass). Entering a value of 0 deactivates the filter.

1508	SPEED_FILTER_2_FREQUENCY[n] 0...7 index of par. set			840D only	Cross reference: –
	Natural frequency, speed-setpoint filter 2			Relevant: FSD/MSD	Protection level: 2/4
Unit: Hz	Default: 2,000.0	Minimum: 10.0	Maximum: 8,000.0	Data type: FLOAT	Active: Immediately

Enter the natural frequency for speed-setpoint filter 2 (PT2 low pass). Entering a value < 10 Hz for the natural frequency of the low pass initializes the filter as a proportional element with a gain of 1 irrespective of the associated damping.

Note

The speed-setpoint filters for interpolating axes should be configured identically.

1509	SPEED_FILTER_2_DAMPING[n] 0...7 index of parameter set			840D only	Cross reference: –
	Damping, speed-setpoint filter 2			Relevant: FSD/MSD	Protection level: 2/4
Unit: –	Default: 0.7	Minimum: 0.2	Maximum: 5.0	Data type: FLOAT	Active: Immediately

Enter the damping factor for speed-setpoint filter 2 (PT2 low pass).

Note

The speed-setpoint filters for interpolating axes should be configured identically.

If damping values are entered in the range of the minimum input limit, this can result in overshoot in the time range up to a factor of ≤ 2. For two configured low passes with the same setting parameters, this effect is significantly increased. In the small signal range, these filters continue to have a linear response. In the large signal range, the filter states can, in certain individual cases, be restricted by the maximum numerical formats (defined by the processor register width). The filter characteristic is non-linear for a short period. Overflows and unstable reactions do not occur.

2.5 Speed-setpoint filters

1517	SPEED_FILTER_2_SUPPR_FREQ[n] n= 0–7			840D only	Cross reference: –
	Blocking frequency, speed-setpoint filter 2			Relevant: FSD/MSD	Protection level: 2/4
Unit: Hz	Default: 3,500.0	Minimum: 1.0	Maximum: 7,999.0	Data type: FLOAT	Active: Immediately

Enter the blocking frequency for speed-setpoint filter 2 (bandstop).

Note

The max. blocking frequency input is limited by the sampling frequency of the closed-loop control (MD 1001) (parameterization error).

$$\text{MD 1517} < \frac{1}{2 \times T_{sample}} = \frac{1}{2 \times \text{MD 1001}}$$

$$\text{MD 1001} = T_{sample} = \left\{ \begin{array}{l} 62.5\ \mu s \\ 125.0\ \mu s \end{array} \right\} => \text{MD 1517} < \left\{ \begin{array}{l} 8{,}000\ Hz \\ 4{,}000\ Hz \end{array} \right\}$$

1518	SPEED_FILTER_2_BANDWIDTH[n] n= 0–7			840D only	Cross reference: –
	Bandwidth, speed-setpoint filter 2			Related to: FDD/MSD	Protection level: 2/4
Unit: Hz	Default: 500.0	Minimum: 5.0	Maximum: 7,999.0	Data type: FLOAT	Active: Immediately

Enter the –3 dB bandwidth for speed-setpoint filter 2 (bandstop).

Note

When 0 is entered for the bandwidth, this parameterizes the filter as proportional element with gain 1.

The bandwidth must be smaller or equal to 2 · MD 1517 · MD 1521.

1519	SPEED_FILTER_2_BW_NUMERATOR[n] n= 0–7			840D only	Cross reference: –
	Bandwidth numerator, speed-setpoint filter 2			Relevant: FSD/MSD	Protection level: 2/4
Unit: Hz	Default: 0.0	Minimum: 0.0	Maximum: 7,999.0	Data type: FLOAT	Active: Immediately

Enter the numerator bandwidth for the attenuated bandstop. Entering a value of 0 initializes the filter as an unattenuated bandstop.

Note

The value of MD 1519: SPEED_FILTER_2_BW_NUM may only be a maximum of twice MD 1518: SPEED_FILTER_2_BANDWIDTH.

1521	SPEED_FILTER_2_BS_FREQ			840D only	Cross reference: –
	Natural frequency bandstop speed-setpoint filter 2			Relevant: FSD/MSD	Protection level: 2/4
Unit: %	Default: 100.0	Minimum: 1.0	Maximum: 141.0	Data type: FLOAT	Active: Immediately

Description

Enter the natural frequency for the general bandstop as a percentage with reference to MD 1517 (blocking frequency).

For MD 1521 = 100% the filter is initialized as an attenuated bandstop.

If the resulting natural frequency (MD 1521 · MD 1517) exceeds the Shannon frequency specified by the speed-controller cycle, then the input is rejected with parameterization error.

2.5   Speed-setpoint filters

Example
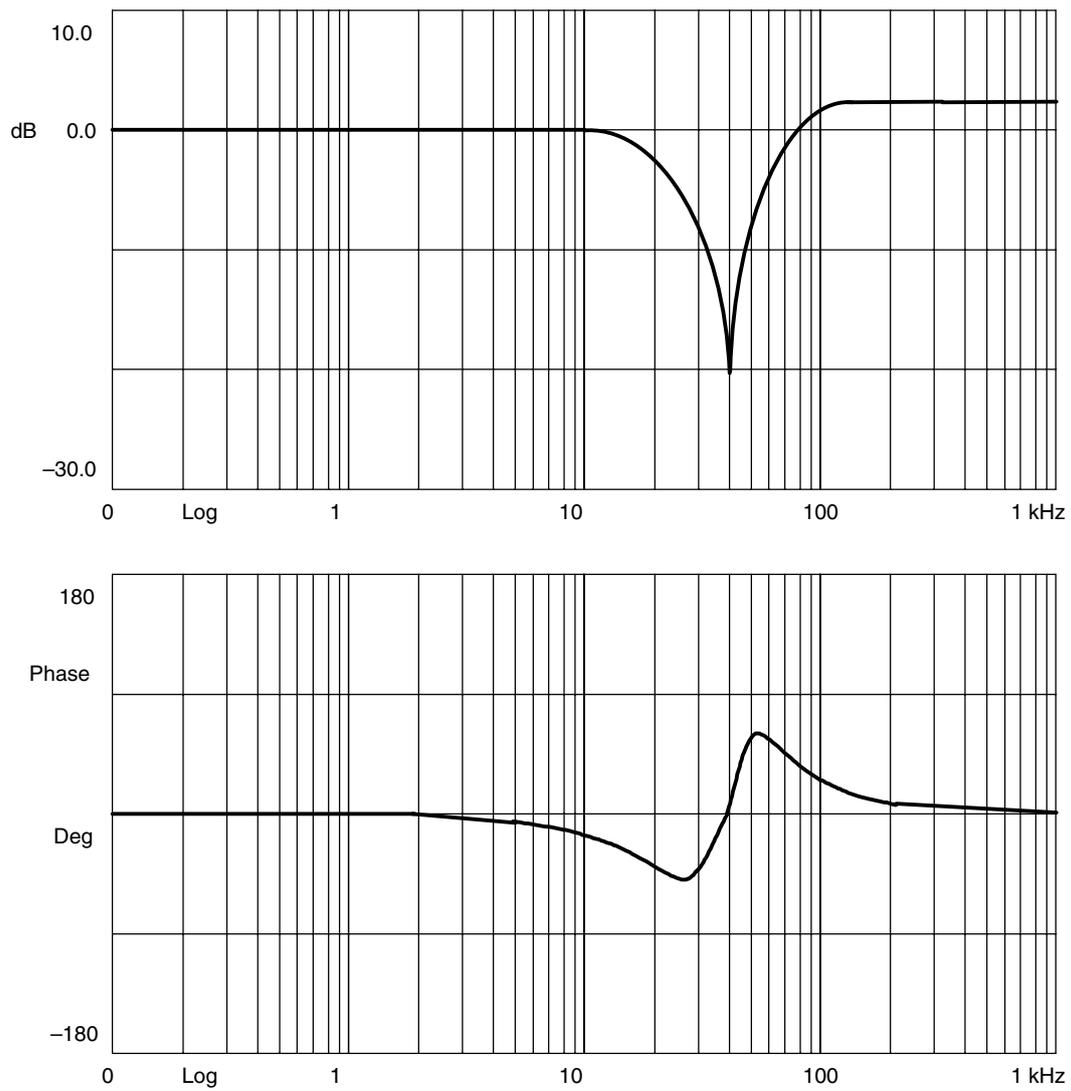
Fig. 2-18   Example 1
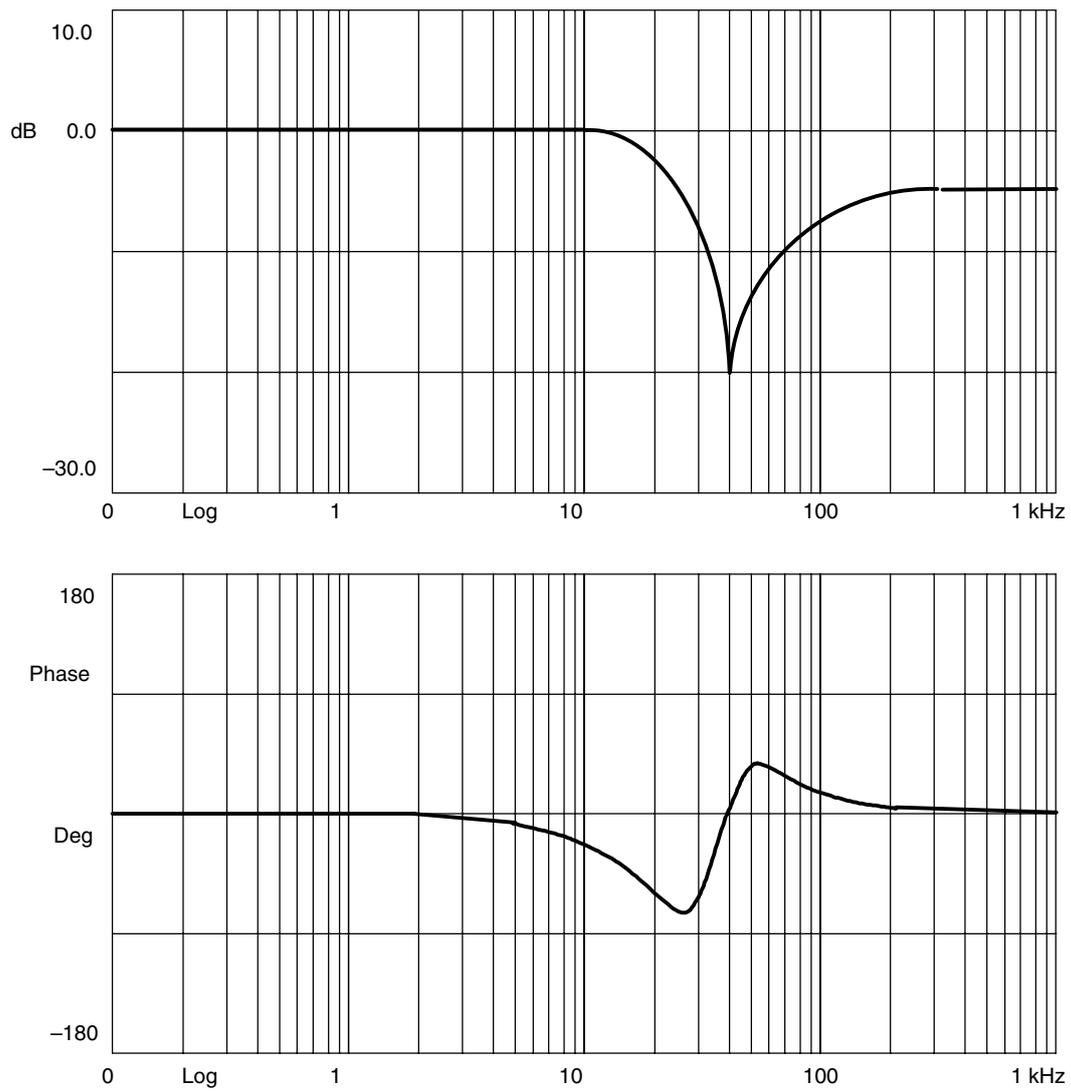
fz = 54 Hz
Dz = 10%
fn = 40 Hz
Dn = 70%

Fig. 2-19   Example 2

fz = 35 Hz
Dz = 6%
fn = 40 Hz
Dn = 70%

2.6 Actual speed filter (as of High Performance/CCU3)

1522	ACT_SPEED_FILTER_TIME			As of SW 6.1	Cross reference: –
Time constant revolutions actual value filter				Relevant: MSD/SLM/FSD	Protection level: 2/4
Unit: ms	Default: 0.0	Minimum: 0.0	Maximum: 500.0	Data type: FLOAT	Active: Immediately

The smoothing time constant is set in MD 1522.

It applies to low-resolution encoders (e.g., 32 increments per revolution (–> T_{GL} ≈ 1 ms).

The input value of MD 1522 is multiplied by the factor 0.001 in order to continue processing internally in seconds.

2.7 Field weakening with MSD

1142	FIELD_WEAKENING_SPEED				Cross reference: –
Threshold speed field weakening				Relevant: MSD	Protection level: 2/4
Unit: 1/min	Default: 0.0	Minimum: 0.0	Maximum: 100,000.0	Data type: FLOAT	Active: POWER ON

Enter the threshold speed for the field weakening from the motor data sheet (third-party motor) or parameterize it automatically by entering and accepting the motor code number in MD 1102: MOTOR_CODE.

2.8   Dynamic Stiffness Control (DSC)

Description   The "dynamic stiffness control" is a quasi position controller implemented in the 611D drive module, which is calculated in the fast speed controller cycle and supplied with setpoint values by the controller in the position control cycle. Higher gain values can thus be achieved compared to a position controller calculated in the control. This also applies to the CCU3.
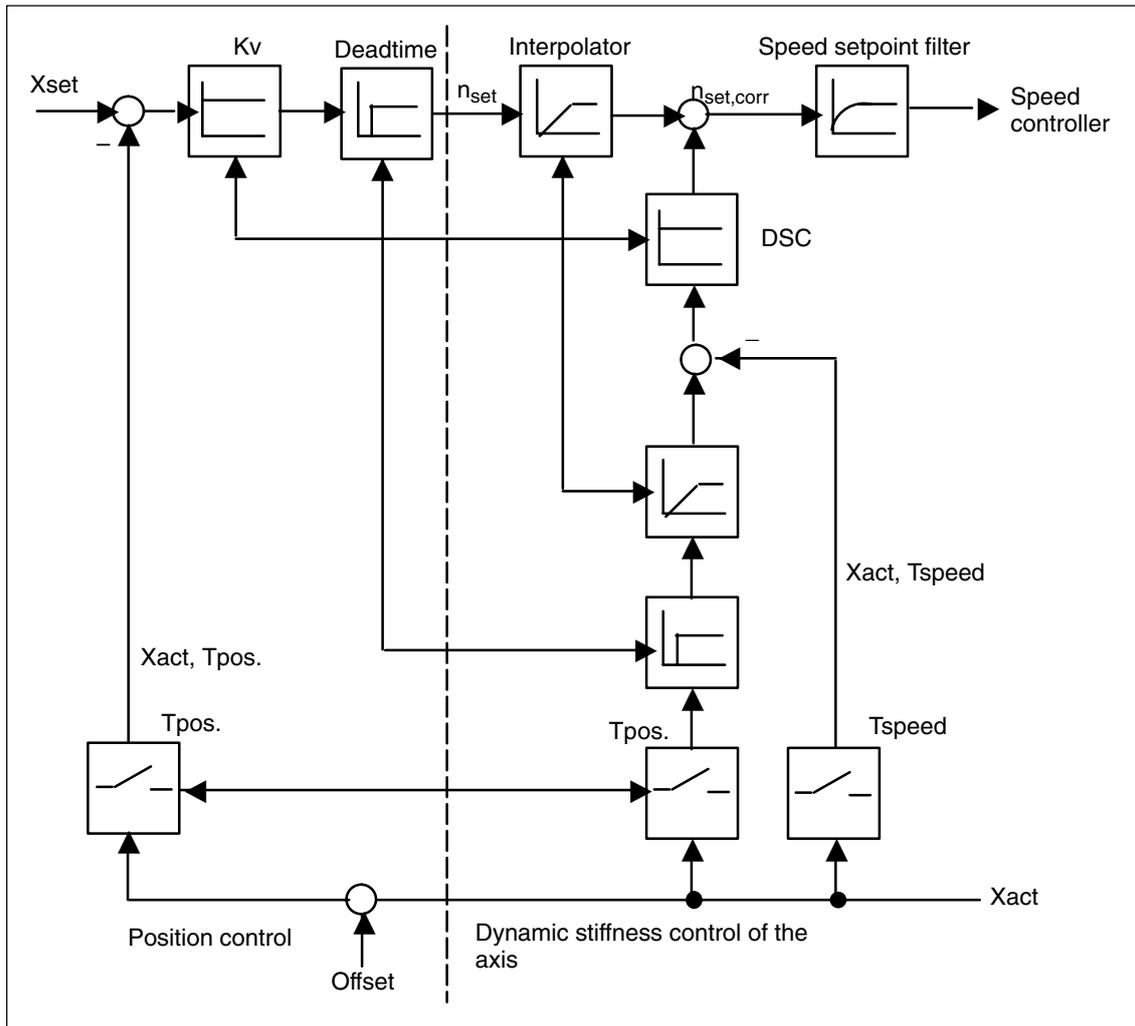

Fig. 2-20   Principle of difference in position feedforward control

Activation   Dynamic stiffness control is activated using NC MD 32640: STIFFNESS_CONTROL_ENABLE

Deactivation   As higher gain factors are set with DSC, if deactivated, the servo loop can become instable. Before deselecting the DSC (e.g., for option tests), the servo gain factor must be reduced.

2.8 Dynamic Stiffness Control (DSC)

Precontrol   The speed and speed/torque feedforward controls can be used as usual. Du-
                        ring balancing, it must be ensured that the control-loop dynamic is increased
                        and the feedback deadtime is reduced.

                        The position controller should be reset when DSC is activated.

**Speed setpoint   When using DSC, a speed-setpoint filter is no longer required to round-off the
filter**   speed setpoint stages.

                        The speed-setpoint filter is then only of any use with difference injection to sup-
                        port the position controller, for example, to conceal resonance.

Measuring system   DSC can only be used in conjunction with the motor measuring system.

**Other NC machine   The following NC machine data influence dynamic stiffness control:
data**
                        • MD 32642 STIFFNESS_CONTROL_CONFIG is used for configuring dy-
                           namic stiffness control.

                        Table 2-10   Coding MD 32642

MD 32642 =	Meaning
0	Standard case: DSC in drive operating with indirect measuring system
1	DSC in drive operating with direct measuring system

                                                                                           ■

Supplementary Conditions

3

None

Data Descriptions (MD, SD)

4

See Chapter 2.

Signal Descriptions

5

None

■

Notes

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Example

6

None

7

Data Fields, Lists

7.1 Speed controller settings

Table 7-1   Machine data

No.	Identifier	Name	Drive
1001	SPEEDCTRL_CYCLE_TIME[DRx]	Speed controller clock cycle	FDD/MSD
1004	CTRL_CONFIG	Configuration structure	FDD/MSD
1406	SPEEDCTRL_TYPE	Speed controller type	FDD/MSD
1414	SPEEDCTRL_REF_MODEL_FREQ [n]	Natural frequency, reference model speed control loop [drive parameter set]: 0...7	FDD/MSD
1415	SPEEDCTRL_REF_MODEL_DAMPING [n]	Damping, reference model speed control loop [drive parameter set]: 0...7	FDD/MSD
1416	SPEEDCTRL_REF_MODEL_DELAY	Balancing, reference model, speed control loop	FDD/MSD
1407	SPEEDCTRL_GAIN_1[0...7,DRx]	P gain, speed controller	FDD/MSD
1409	SPEEDCTRL_INTEGRATOR_TIME_1[0...7,DRx]	Speed controller reset time	FDD/MSD
1413	SPEEDCTRL_ADAPT_ENABLE[DRx]	Selection speed controller adaptation	FDD/MSD
1408	SPEEDCTRL_GAIN_2[0...7,DRx]	P gain, upper adaptation speed	FDD/MSD
1410	SPEEDCTRL_INTEGRATOR_TIME_2[0...7,DRx]	Reset time upper adaptation speed	FDD/MSD
1411	SPEEDCTRL_ADAPT_SPEED_1[DRx]	Lower adaptation speed	FDD/MSD
1412	SPEEDCTRL_ADAPT_SPEED_2[DRx]	Upper adaptation speed	FDD/MSD
1421	SPEEDCTRL_INTEGRATOR_FEEDBK[0...7,DRx]	Time constant integrator feedback	FDD/MSD

7.2   Field weakening with MSD

Table 7-2   Machine data

No.	Identifier	Name	Drive
1142	FIELD_WEAKENING_SPEED[DRx]	Threshold speed field weakening	MSD
1143	LH_CURVE_UPPER_SPEED[DRx]	Upper speed, Lh characteristic	MSD
1144	LH_CURVE_GAIN[DRx]	Gain factor, Lh characteristic	MSD

7.3   Setpoint current filter

Table 7-3   Machine data

No.	Identifier	Name	Drive
1200	NUM_CURRENT_FILTERS[0...7,DRx]	Number of currentsetpoint filters	FDD/MSD
1201	CURRENT_FILTER_CONFIG[0...7,DRx]	Type of current filter	FDD/MSD
1202	CURRENT_FILTER_1_FREQUENCY[0...7,DRx]	Natural frequency, current filter 1	FDD/MSD
1203	CURRENT_FILTER_1_DAMPING[0...7,DRx]	Damping of current filter 1	FDD/MSD
1204	CURRENT_FILTER_2_FREQUENCY[0,..7,DRx]	Natural frequency, current filter 2	FDD/MSD
1205	CURRENT_FILTER_2_DAMPING[0...7,DRx]	Damping of current filter 2	FDD/MSD
1206	CURRENT_FILTER_3_FREQUENCY[0...7,DRx]	Natural frequency, current filter 3	FDD/MSD
1207	CURRENT_FILTER_3_DAMPING[0...7,DRx]	Damping of current filter 3	FDD/MSD
1208	CURRENT_FILTER_4_FREQUENCY[0...7,DRx]	Natural frequency, current filter 4	FDD/MSD
1209	CURRENT_FILTER_4_DAMPING[0...7,DRx]	Damping of current filter 4	FDD/MSD
1210	CURRENT_FILTER_1_SUPPR_FREQ[0...7,DRx]	Blocking frequency, current filter 1	FDD/MSD
1211	CURRENT_FILTER_1_BANDWIDTH[0...7,DRx]	Bandwidth, current filter 1	FDD/MSD
1212	CURRENT_FILTER_1_BW_NUM[0...7,DRx]	Numerat. bandw. setp. current filter 1	FDD/MSD
1213	CURRENT_FILTER_2_SUPPR_FREQ[0...7,DRx]	Blocking frequency, current filter 2	FDD/MSD
1214	CURRENT_FILTER_2_BANDWIDTH[0...7,DRx]	Bandwidth, current filter 2	FDD/MSD
1215	CURRENT_FILTER_2_BW_NUM[0...7,DRx]	Numerat. bandw. setp. current filter 2	FDD/MSD
1216	CURRENT_FILTER_3_SUPPR_FREQ[0...7,DRx]	Blocking frequency, current filter 3	FDD/MSD
1217	CURRENT_FILTER_3_BANDWIDTH[0...7,DRx]	Bandwidth, current filter 3	FDD/MSD
1218	CURRENT_FILTER_3_BW_NUM[0...7,DRx]	Numerat. bandw. setp. current filter 3	FDD/MSD
1219	CURRENT_FILTER_4_SUPPR_FREQ[0...7,DRx]	Blocking frequency, current filter 4	FDD/MSD
1220	CURRENT_FILTER_4_BANDWIDTH[0...7,DRx]	Bandwidth, current filter 4	FDD/MSD
1221	CURRENT_FILTER_4_BW_NUM[0...7,DRx]	Numerat. bandw. setp. current filter 4	FDD/MSD
1222	CURRENT_FILTER_1_BS_FREQ[0...7,DRx]	Bandstop natural frequency of currentsetpoint filter 1	FDD/MSD
1223	CURRENT_FILTER_2_BS_FREQ[0...7,DRx]	Bandstop natural frequency of currentsetpoint filter 2	FDD/MSD
1224	CURRENT_FILTER_3_BS_FREQ[0...7,DRx]	Bandstop natural frequency of currentsetpoint filter 3	FDD/MSD
1225	CURRENT_FILTER_4_BS_FREQ[0...7,DRx]	Bandstop natural frequency of currentsetpoint filter 4	FDD/MSD
1272	CURRENT_FILTER_5_FREQUENCY[0...7,DRx]	Natural frequency, current filter 5	FDD/MSD
1273	CURRENT_FILTER_5_DAMPING[0...7,DRx]	Damping of current filter 5	FDD/MSD
1274	CURRENT_FILTER_5_SUPPR_FREQ[0...7,DRx]	Blocking frequency, current filter 5	FDD/MSD
1275	CURRENT_FILTER_5_BANDWIDTH[0...7,DRx]	Bandwidth, current filter 5	FDD/MSD
1276	CURRENT_FILTER_5_BW_NUM[0...7,DRx]	Numerat. bandw. setp. current filter 5	FDD/MSD
1277	CURRENT_FILTER_5_BS_FREQ[0...7,DRx]	Bandstop natural frequency of current-setpoint filter 5	FDD/MSD
1278	CURRENT_FILTER_6_FREQUENCY[0...7,DRx]	Natural frequency, current filter 6	FDD/MSD
1279	CURRENT_FILTER_6_DAMPING[0...7,DRx]	Damping of current filter 5	FDD/MSD

Table 7-3   Machine data

No.	Identifier	Name	Drive
1280	CURRENT_FILTER_6_SUPPR_FREQ[0...7,DRx]	Blocking frequency, current filter 6	FDD/MSD
1281	CURRENT_FILTER_6_BANDWIDTH[0...7,DRx]	Bandwidth, current filter 5	FDD/MSD
1282	CURRENT_FILTER_6_BW_NUM[0...7,DRx]	Numerat. bandw. setp. current filter 6	FDD/MSD
1283	CURRENT_FILTER_6_BS_FREQ[0...7,DRx]	Bandstop natural frequency of current-setpoint filter 6	FDD/MSD

7.4   Torque-setpoint filter

Table 7-4   Machine data

No.	Identifier	Name	Drive
1245	CURRENT_SMOOTH_SPEED	Threshold, speed-dependent torque-setpoint smoothing	FDD/MSD
1246	CURRENT_SMOOTH_HYSTERESIS	Hysteresis, speed-dependent torque-setpoint smoothing	FDD/MSD

7.5   Speed setpoint filter

Table 7-5   Machine data

No.	Identifier	Name	Drive
1500	NUM_SPEED_FILTERS[0...7,DRx]	Number of speed-setpoint filters	FDD/MSD
1501	SPEED_FILTER_TYPE [n]	Speed-setpoint filter type [drive parameter set]: 0...7	FDD/MSD
1502	SPEED_FILTER_1_TIME[0...7,DRx]	Time constant setpoint speed filter 1	FDD/MSD
1506	SPEED_FILTER_1_FREQUENCY[n]	Speed-setpoint filter natural frequency [drive parameter set]: 0...7	FDD/MSD
1507	SPEED_FILTER_1_DAMPING [n]	Speed-setpoint filter 1 damping [drive parameter set]: 0...7	FDD/MSD
1514	SPEED_FILTER_1_SUPR_FREQ[n]	Speed-setpoint filter 1 blocking frequency [drive parameter set]: 0...7	FDD/MSD
1515	SPEED_FILTER_1_BANDWIDTH [n]	Speed-setpoint filter 1 bandwidth [drive parameter set]: 0...7	FDD/MSD
1516	SPEED_FILTER_1_BW_NUM [n]	Speed-setpoint filter 1 bandwidth numerator [drive parameter set]: 0...7	FDD/MSD
1520	SPEED_FILTER_1_BS_FREQ	Natural frequency bandstop speed-setpoint filter 1	FDD/MSD
1503	SPEED_FILTER_2_TIME [n]	Speed-setpoint filter 2 time constant [drive parameter set]: 0...7	FDD/MSD
1508	SPEED_FILTER_2_FREQUENCY[n]	Speed-setpoint filter 2 natural frequency [drive parameter set]: 0...7	FDD/MSD
1509	SPEED_FILTER_2_DAMPING [n]	Speed-setpoint filter 2 damping [drive parameter set]: 0...7	FDD/MSD
1517	SPEED_FILTER_2_SUPR_FREQ[n]	Speed-setpoint filter type [drive parameter set]: 0...7	FDD/MSD
1518	SPEED_FILTER_2_BANDWIDTH [n]	Speed-setpoint filter 2 bandwidth [drive parameter set]: 0...7	FDD/MSD
1519	SPEED_FILTER_2_BW_NUM [n]	Speed-setpoint filter 2 bandwidth numerator [drive parameter set]: 0...7	FDD/MSD
1521	SPEED_FILTER_2_BS_FREQ	Natural frequency bandstop speed-setpoint filter 2	FDD/MSD

7.6   Speed actual value filter

Table 7-6   Machine data

No.	Identifier	Name	Drive
1522	N_IST_FILTER_T1	Time constant revolutions actual value filter Time constant speed actual value filter	MSD/SLM/ FSD

7.7   Activate dynamic stiffness control

Table 7-7   NC machine data

No.	Identifier	Name	Drive
32640	STIFFNESS_CONTROL_ENABLE	Activate dynamic stiffness control	FSD
32642	STIFFNES_CONTROL_CONFIG	Configuration of dynamic stiffness control	FSD
32644	STIFFNESS_DELAY_TIM	Configuration of a compensation dead time for the dynamic stiffness control with optimum DP cycle	FSD

■

SIMODRIVE 611D/SINUMERIK 840D/810D Drive Functions

Extended Drive Functions (DE1)

■

Brief Description

<div style="text-align: right; font-size: 2em; font-weight: bold;">1</div>

Note

The V/f-operation, AM-mode and star/delta-changeover functions can only be used on the **SINUMERIK 840D/611D**.

AM mode

On the SIMODRIVE 611D main spindle drive, AM mode is used to control the speed of asynchronous motors in 4 quadrants, without using speed or rotor position encoders. AM mode is mainly used in the area of standard motors or high-speed special motors for grinding applications, as well as for punch drives and press drives.

V/f operation

V/f operation allows asynchronous motors and 1FT6 feed motors to be used without encoder evaluation. V/f operation is used for diagnostic purposes on main spindle drives and feed drives.

Motor changeover

Star/delta changeover
Changeover is used to operate main spindle motors in star or delta circuit configurations in order to adapt the torque and speed characteristics of the spindle to the machine requirements. In AM mode, star/delta changeover can be used to switch between two motors, which differ in terms of their physical characteristics.

Motor-dependent pulse frequency changeover
Motor-dependent changeover of the pulse frequency enables the pulse frequency to be more ideally matched to the speed requirements of the motor.
In this way, lower speeds can be achieved at a lower pulse frequency than high speeds, which affords better utilization of the motor characteristics.

Emergency retraction

The emergency-retraction function allows a response that has been specifically adapted to the machine to be defined for use in the event of a dangerous situation. This ensures that the axes can be retracted to a safe position, thus avoiding a collision with the workpiece. Dangerous situations include: power failure, short-time voltage dip or emergency stop.

This function is not available on the CCU3.

Permanently excited spindle

The permanently excited spindle (PE MSD) is a specially designed synchronous motor (similar to FSD motors), optimized for operation on the main spindle motor at high speeds.

■

Notes

Detailed Description

2

Note

The V/f-operation, AM mode and star-/delta-changeover functions can only be used on the **SINUMERIK 840D/611D**.

2.1   AM mode

2.1.1   Description

AM-mode

The AM function supports pure AM mode or mixed MSD/AM-mode.

On the SIMODRIVE 611D main spindle drive, AM mode is used to control the speed of asynchronous motors in 4 quadrants, without using speed or rotor position encoders. AM mode permits higher demands to be fulfilled regarding the dynamic control performance and the stall immunity of conventional converter drives with V/Hz characteristic control. In comparison to drives with rotor position encoder, the speed accuracy is somewhat lower, and thus, in the low speed range, there will be some restriction as far as the dynamic performance and the smooth running characteristics are concerned.

AM mode is mainly used in the area of standard motors or high-speed special motors for grinding applications, as well as for punch drives and press drives.

Closed-loop control

As the dynamic performance in AM operation is less than MSD operation with encoder, a speed torque frequency pre-control is implemented to improve the control dynamic performance. This feedforward control is active only in AM mode. Provided with information regarding the drive torque and taking into account the existing torque and current limits as well as the load, the necessary torque for a required speed change is optimally controlled in respect of time. Thus, with the correct parameterization, overshoot is eliminated and the control dynamic performance enhanced.

A smoothing time for torque feedforward control can be parameterized in MD 1459: TORQUE_ SMOOTH_ TIME_AM. For AM mode, the speed controller is parameterized using its own machine data due to the low dynamic performance (MD 1451 and MD 1453).

2.1 AM mode

At low speeds, for pure AM mode, the actual speed, orientation and actual flux can no longer be computed due to the accuracy of the measured values and the parameter sensitivity of the technique. Thus, an open-loop current/frequency control is selected. The changeover threshold is parameterized in MD 1466: SWITCH_SPD_OPEN_LOOP_AM (the effective hysteresis is 5%). In order to also accept a high load torque in the open-loop controlled range, the motor current can in this case be increased using MD 1458: DES_CURRENT_OPEN_LOOP_AM.

Behavior after pulse suppression

When the pulses are suppressed and in pure AM mode, the drive converter has no information about the actual motor speed. When the pulses are subsequently enabled, the actual speed value must first be searched for.
MD 1012: FUNC_SWITCH, bit 7 can be used to define whether the search starts at the setpoint speed (bit 7 = 0) or at speed 0 (bit 7 = 1).
If the motor is stationary and MD 1012: FUNC_SWITCH, bit 7 = 0 a high setpoint should not be input before the pulses are enabled.

MSD/AM mode

The AM function allows the control behavior to be changed over from MSD to AM control online. This is performed automatically using a speed threshold. The changeover speed is defined in MD 1465: SWITCH_SPEED_MSD_AM.
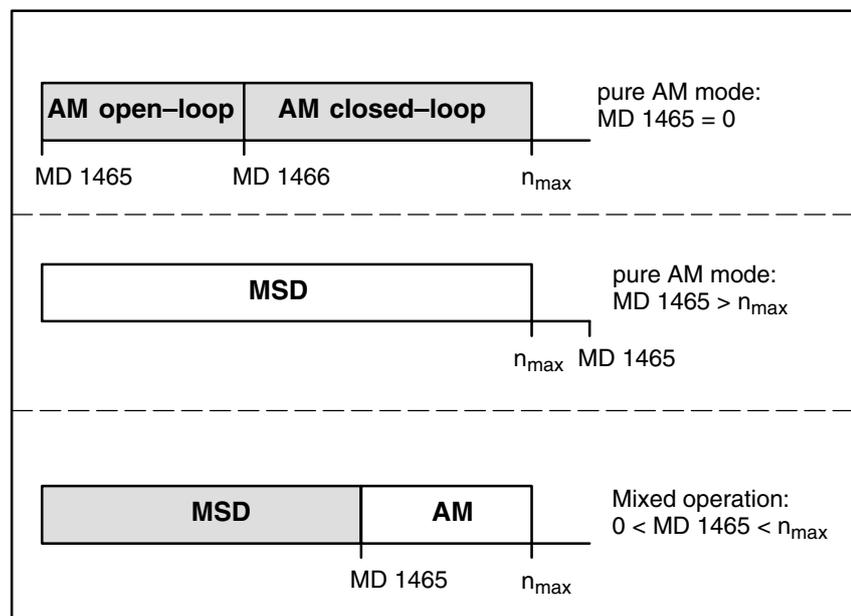
Fig. 2-1   MSD/AM operating ranges

Notes

In pure AM mode, it is possible to operate without a rotor position encoder. In this case, as there is generally no temperature measuring, a fixed temperature must be selected in MD 1608: MOTOR_FIXED_TEMPERATURE and the motor temperature threshold must be assigned accordingly in MD 1602: MOTOR_TEMP_WARN_LIMIT. In AM mode, only pulse frequencies of 4 and 8 kHz may be set in MD 1100: PWM_FREQUENCY.

Operating modes	In MD 1730: OPERATING_MODE indicates the operating modes.

Bit 0: FSD closed-loop controlled
Bit 4: MSD operation
Bit 8: AM open-loop controlled
Bit 9: AM closed-loop controlled
Bit 12: V/f operation

Series reactor	When using special high-speed motors or other low leakage induction motors, a series reactor may be required to provide stable operation of the closed-loop current controller. The reactor is taken into account in the current model through MD 1119: SERIES_INDUCTANCE.
Motor changeover	The star/delta changeover of main-spindle-drive operation can, in AM mode, be used to change over between two motors, which differ in terms of their physical characteristics.

Note

To perform a motor changeover, MD 1401: MOTOR_MAX_SPEED and MD 2401: MOTOR_MAX_SPEED must have the same value for both motors.

2.1.2   Starting up standard motors

Startup of (standard) asynchronous motors without speed or rotor position en-coders, or of main spindle motors with encoder. The drive module is configured as spindle (main spindle drive) in the drive group. Further steps for asynchro-nous-motor startup are described below.

Selecting motors from the MLFB list	The motor/power-section-data display is accessed using the **Diagno-sis\Startup\Machine data\MSD** softkeys.

An MLFB list of the available motors is displayed using the **Motor/controller** and **Select motor** softkeys. Select a motor using the cursor keys and confirm the selection with **OK** (the **Calculate controller data** function is executed auto-matically). The motor-/power-section-specific data must be entered manually if the motor type is not in the list (third-party motor).

Encoder	The encoder type and number of encoder pulses can also be entered under **Select motor**. If neither motor 1 nor motor 2 has an encoder, then "No encoder" must be selected for the encoder type.

Even if there is no encoder, a practical value must be entered for the number of encoder pulses (e.g., 2,048).

Manual entry of motor data (unlisted motor)	If all of the motor data are known (rating plate and equivalent circuit-diagram data), they can be entered in the appropriate parameters.
Rating plate data	If only the motor rating plate data are known (manufacturer's data according to DIN VDE 0530, Part 1), then the equivalent circuit diagram data are calculated approximately using an integrated conversion program.

2.1 *AM mode*

Table 2-1   Rating plate data to be entered

MD no.	Identifier	Description
MD 1103	MOTOR_NOMINAL_CURRENT	Nominal motor current
MD 1119	SERIES_INDUCTANCE	Series reactor inductance
MD 1129	POWER_FACTOR_COS_PHI	cos φ power factor
MD 1130	MOTOR_NOMINAL_POWER	Nominal motor power
MD 1132	MOTOR_NOMINAL_VOLTAGE	Nominal motor voltage
MD 1134	MOTOR_NOMINAL_FREQUENCY	Nominal motor frequency
MD 1146	MOTOR_MAX_ALLOWED_SPEED	Max. motor speed
MD 1400	MOTOR_RATED_SPEED	Rated motor speed

Equivalent circuit diagram data

If the equivalent circuit diagram data are known, they can be entered in the parameters listed below. If the equivalent circuit diagram data are not known, they must be determined from the rating plate data by pressing the **Calculate equivalent circuit diagram data** softkey. The calculated values are then assigned to the following machine data.

Table 2-2   Calculated equivalent circuit diagram data

MD no.	Identifier	Description
MD 1117	MOTOR_INERTIA	Motor moment of inertia
MD 1135	MOTOR_NOLOAD_VOLTAGE	Motor no-load voltage
MD 1136	MOTOR_NOLOAD_CURRENT	Motor no-load current
MD 1137	STATOR_COLD_RESISTANCE	Stator cold resistance
MD 1138	ROTOR_COLD_RESISTANCE	Rotor cold resistance
MD 1139	STATOR_LEAKAGE_REAKTANCE	Stator leakage reactance
MD 1140	ROTOR_LEAKAGE_REAKTANCE	Rotor leakage reactance
MD 1141	MAGNETIZING_REAKTANCE	Magnetizing reactance
MD 1142	FIELD_WEAKENING_SPEED	Threshold speed Field weakening

Calculating the controller data

The controller data are calculated from the motor data (rating plate and equivalent circuit-diagram data) when you press the **Calculate controller data** softkey. These include the controller settings, in particular. If required, the controller parameters can be more precisely adapted to the machine manually, at a later date.

Once the controller data has been calculated, AM mode is activated by entering the MSD/AM changeover speed (MD 1465). The following machine data must also be adapted for AM mode:

- MD 1100: PWM_FREQUENCY

- MD 1602: MOTOR_ TEMP_WARN_LIMIT

- MD 1608: MOTOR_FIXED_TEMPERATURE

Table 2-3   AM mode parameters

MD no.	Identifier	Description
MD 1451	SPEEDCTRL_GAIN_1_AM	P gain, AM speed controller
MD 1453	SPDEECTRL_INTEGR_TIME_1_AM	Integral action time, AM speed controller
MD 1458	DES_CURRENT_OPEN_LOOP_AM	Current setpoint open-loop controlled range, AM
MD 1459	TORQUE_SMOOTH_TIME_AM	Torque smoothing time constant, AM
MD 1465	SWITCH_SPEED_MSD_AM	Changeover speed, MSD/AM
MD 1466	SWITCH_SPD_OPEN_LOOP_AM	Changeover speed Control system AM

Note

The controller data must be re-calculated if the motor data change.

2.1.3   Starting up third-party motors (Self startup)

Note

Self-installation for AM/MSD is possible only in conjunction with HMI Advanced.

Danger

During self-installation, motor movements are initiated, which can reach the maximum motor speed.

The emergency OFF functions must be fully operational during startup. The relevant safety regulations must be observed to exclude danger for man and machine.

Self-installation

Self-installation supports the connection of third-party asynchronous motors to the SIMODRIVE 611D drive system.

The startup engineer often only knows the rating plate data (manufacturer data as per DIN VDE 0530, Part 1) of the motor. Other motor data is calculated from the rating-plate data using the "Calculate equivalent circuit-diagram data" tool.

These calculations only produce an approximate estimate. The self-installation function is used to improve the result.

When self-installing, voltage-, current- and speed-setpoint patterns are output to the motor, and information regarding the equivalent circuit-diagram data is taken from the motor response.

Prerequisites for startup

- Pulse- and servo-enable signals are required.

- Self-startup is possible in MSD and AM modes.
  With MSD, the moment of inertia is not specified.

- Self-installation can be carried out separately for each motor during motor changeover. To do this, the motor must be selected via the PLC.
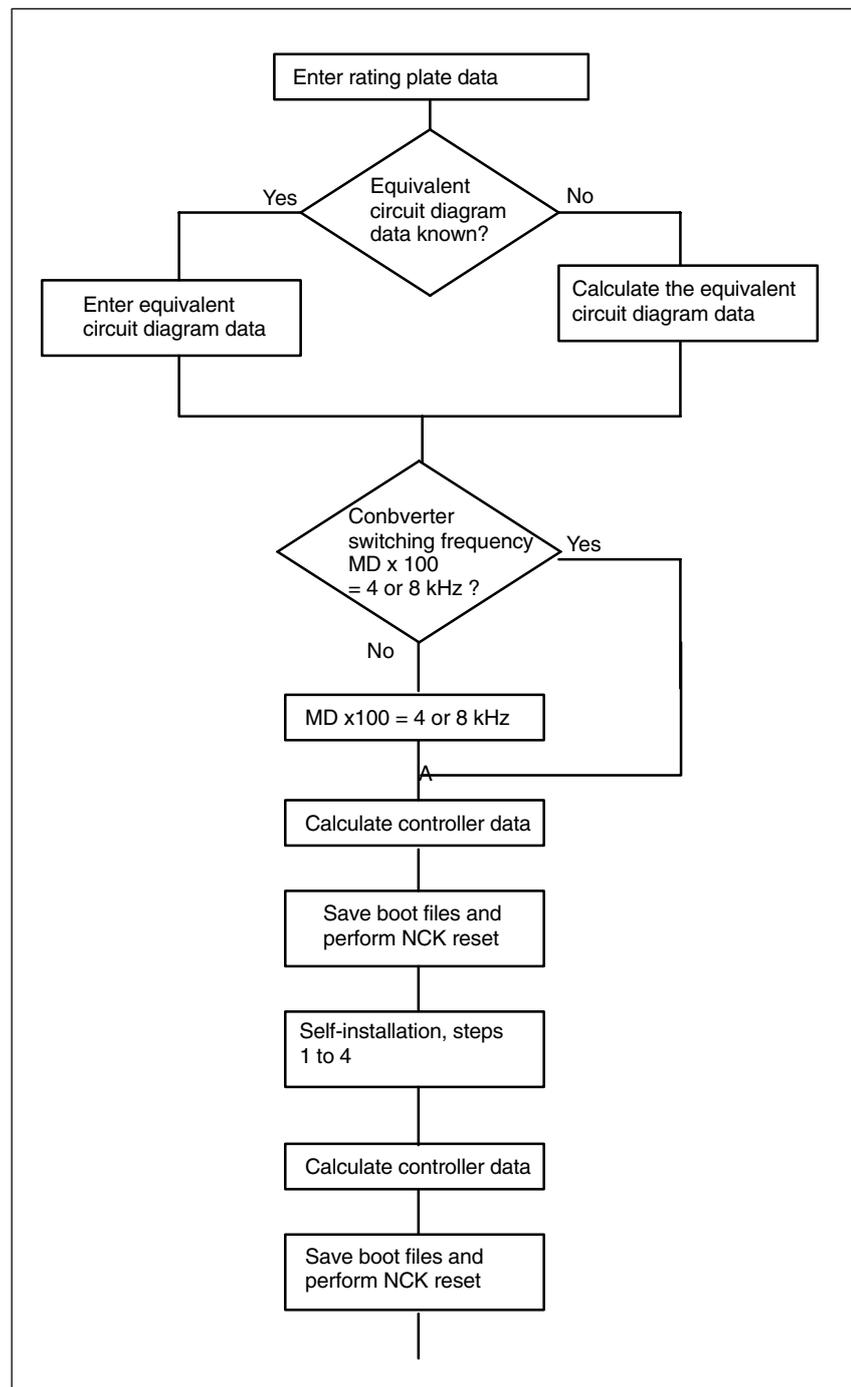 Motor changeover is disabled during self-installation.

Flow chart for starting up third-party motors

Fig. 2-2   Flow chart for starting up third-party motors

2.1.4 Self-installation, steps 1 to 4

Main menu for AM/MSD self-installation AM/MSD

The main menu for self-installation is called up by pressing the **Drives/servo** / **Self-opt. AM/MSD** softkeys.
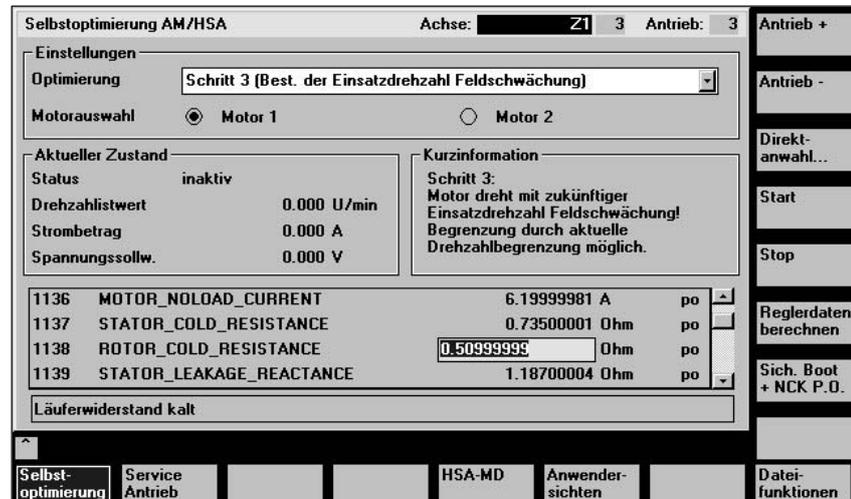
Fig. 2-3   Main menu for AM/MSD self-installation

Parameter assignment

Spindle selection

The axis/spindle can be selected by pressing the **Drive+**, **Drive-** and **Direct selection** softkeys. The axis and drive number are displayed during "Self-optimization AM/MSD".

Selecting the optimization step

The desired optimization step is selected when entering the settings via the "Optimization" list. You can select individual or all optimization steps.

Selecting the motor

The desired motor is selected when entering the settings for the motor selection. You can activate the "Motor 1" or "Motor 2" selection fields with the toggle key when the cursor is positioned on the fields.

A list of machine data is displayed, in which the equivalent circuit diagram data can be entered directly or viewed.

The status of the function (active, inactive) and the startup step are displayed in "Current status" and "Brief information".

Controller data to be calculated

When you press the softkey, a warning is output for "Calculate controller data" . It is then possible to:

- Start or
- Abort the function
- Display further information about the "Calculate controller data" function by pressing the **Help** softkey.

Save Boot + NCK P.O.	The axis/spindle can be selected by pressing the **Drive+**, **Drive–** and **Direct selection** softkeys. The axis and drive number are displayed during "Self-optimization AM/MSD".

View user

The display switches to "User views". You can only revert by pressing the **RE-CALL** softkey.

File functions

A display for loading/deleting/storing the MSD machine data is selected.

Startup step 1

Determine the resistances and reactances of the motor and an improved value for the no-load current.

Note

- The motor is not moved during this measurement.

- Monitoring is not possible due to the lack of an encoder in AM mode.

Supplementary conditions

- The motor must not move during this measurement.
  Repeat this step if necessary.

- Enter the series reactor in MD x119: SERIES_INDUCTANCE.

- AC rectifier pulse frequency = 4 kHz or 8 kHz
  (MD 1100: PWM_FREQUENCY)

- MD x238: CURRENT_LIMIT = 150% for the measurement or maximum possible value. Observe the load limit for the motor winding.

Executing step 1

Start step 1 by pressing the **Start** softkey and the NC Start key. The current status is displayed during startup.

You can abort the optimization procedure by pressing the **Stop** softkey or with RESET.

Changed machine data

The following machine data are calculated/written:

- MD x136: MOTOR_NOLOAD_CURRENT

- MD x136: STATOR_COLD_RESISTANCE

- MD x138: ROTOR_COLD_RESISTANCE

- MD x139: STATOR_LEAKAGE_REACTANCE

- MD x140: ROTOR_LEAKAGE_REACTANCE

- MD x141: MAGNETIZING_REACTANCE

Startup step 2	Determine the no-load current and magnetizing reactance.
	The no-load current is set so that, at rated speed, the no-load voltage is set at the motor terminals.

⚠ **Danger**

The motor is accelerated with positive rotating field direction up to the rated motor speed.

Executing step 2	Start step 2 by pressing the **Start** softkey and the NC Start key. The current status is displayed during startup.
	You can abort the optimization procedure by pressing the **Stop** softkey or with RESET.

Changed machine data	The following machine data are calculated/written:

- MD x136: MOTOR_NOLOAD_CURRENT

- MD x141: MAGNETIZING_REACTANCE

Startup step 3	Determine the threshold speed for field weakening.
	When traveling at the threshold speed and with a DC-link voltage VDC, a converter output voltage of 380 V is set. If VDC < 600 V, the converter output voltage is reduced by a factor of VDC / 600 V.

⚠ **Danger**

The motor is accelerated with positive rotating field direction up to the threshold speed for field weakening, but not higher than the current effective speed limit.

Executing step 3	Start step 3 by pressing the **Start** softkey and the NC Start key. The current status is displayed during startup.
	You can abort the optimization procedure by pressing the **Stop** softkey or with RESET.

Changed machine data	The following machine data is calculated/written:

- MD x142: FIELD_WEAKENING_SPEED

Startup step 4   Determination of the moment of inertia

The moment of inertia is set, so that when the motor accelerates to the maximum speed, no I component is set in the speed controller.

Danger

The motor is accelerated to maximum speed several times with positive rotating field direction.

Note

This step is omitted when self-installation is executed in MSD mode.

Supplementary conditions

- If a significant load moment of inertia is present during later operation, perform the step with linked load.

Executing step 4   Start step 4 by pressing the **Start** softkey and the NC Start key. The current status is displayed during startup.

You can abort the optimization procedure by pressing the **Stop** softkey or with RESET.

Changed machine data   The following machine data is calculated/written:

- MD x117: MOTOR_INERTIA

Errors during self-installation   Errors, which occur during a self-installation routine, cause the function to be aborted. The step must be repeated after remedying the cause of the error.

References: /DA/ Diagnostics Guide SINUMERIK 840D/810D/FM-NC

2.1.5 Messages during self-installation

The following error messages may appear at the start of or during self-installation.

- **Installation step not (currently) permissible**
  You have selected a self-installation step, which has not been defined or is not permissible in the current operational state.

- **A pulse frequency of 4 kHz or 8 kHz is required.**
  An inverter frequency of 4 kHz or 8 kHz is required for step 1 (MD x100: PWM_FREQUENCY).

- **Controller and pulse enable missing**

- **Speed setpoint < > 0**
  A setpoint has been input via the NC or the function generator.

- **Motor changeover active**
  A motor changeover was in progress when identification started.

- **Leakage inductance < 0**
  A value < 0 has been specified for the leakage inductance.
  This may have been caused by an incorrect series reactor entry
  (MD x139: SERIES_INDUCTANCE).

- **V/f operation active**
  If V/f operation is selected (MD 1014: UF_MODE_ENABLE = 1), it is not possible to perform self-installation.

- **Incorrect motor selected**
  The motor selected via the HMI is not the same as the motor selected via the PLC (control word/status word).

- **Nmax too low for measurement**
  The operating speed for the self-installation step must be greater than the currently parameterized maximum speed (MD x146: MOTOR_MAX_ALLOWED_SPEED).

- **Open-loop/closed-loop control changeover speed too high**
  When determining the "threshold speed for field weakening", it was not possible to operate in the speed-controlled range in pure AM mode, due to an excessively high changeover speed setting (MD x466: SWITCH_SPD_OPEN_LOOP_AM).

2.1.6   Machine data

1451	SPEEDCTRL_GAIN_1_AM				840D only	Cross reference: –
	P gain, AM speed controller				Relevant to: AM	Protection level: 2/4
Unit: Nms/rad	Default: 0.3	Minimum: 0.0	Maximum: 100,000.0		Data type: FLOAT	Active: Immediately

Enter the P gain of the speed control loop in AM mode or automatic parameterization (initializing) via operation **Calculate controller data**.

1453	SPDCTRL_INTEGR_TIME_1_AM 0...7 index of parameter set				840D only	Cross reference: –
	Integral action time, AM speed controller				Relevant to: AM	Protection level: 2/4
Unit: ms	Default: 140.0	Minimum: 0.0	Maximum: 6,000.0		Data type: FLOAT	Active: Immediately

Enter the speed-controller reset time in AM mode or set (initialize) it automatically via **Calculate controller data**.

1458	DES_CURRENT_OPEN_LOOP_AM				840D only	Cross reference: –
	Current setpoint open-loop controlled mode, AM				Relevant to: AM	Protection level: 2/4
Unit: %	Default: 90.0	Minimum: 0.0	Maximum: 150.0		Data type: FLOAT	Active: Immediately

In pure AM mode (MD 1465 = 0), the drive operates in the current-frequency open-loop controlled mode below the changeover speed (MD 1466). In order to accept a high load torque, the motor current can be increased in this range using MD 1458. The input is a percentage referred to the rated motor current (MD 1103). The current is limited to 90% of the current limit value (MD 1238).

1459	TORQUE_SMOOTH_TIME_AM				840D only	Cross reference: –
	Torque smoothing time constant AM				Relevant to: AM	Protection level: 2/4
Unit: ms	Default: 4.0	Minimum: 0.0	Maximum: 100.0		Data type: FLOAT	Active: Immediately

In AM mode, a speed/torque frequency-feedforward-control is implemented due to the low dynamic performance. The feedforward control value for the torque is smoothed using MD 1459.

2.1 *AM mode*

1465	SWITCH_SPEED_MSD_AM			840D only	Cross reference: –
	Changeover speed, MSD/AM			Relevant to: AM/MSD	Protection level: 2/4
Unit: rpm	Default: 100,000.0	Minimum: 0.0	Maximum: 100,000.0	Data type: FLOAT	Active: Immediately

The drive operates in AM mode at a speed above the one set here.

$n = 0$ →pure AM mode
$0 < n < n_{max}$ →mixed MSD/AM mode
$n > n_{max}$ →MSD mode only

If AM mode is selected, only pulse frequencies (MD 1100) between 4 kHz and 8 kHz permitted.
MD 1465 preset to 0 in the **Calculate controller data** operation, if in MD 1011.5 Motor measuring system available "No" has been entered.

1466	SWITCH_SPD_OPEN_LOOP_AM			840D only	Cross reference: –
	Changeover speed, Control system AM			Relevant to: AM/MSD	Protection level: 2/4
Unit: rpm	Default: 300.0	Minimum: 150.0	Maximum: 100,000.0	Data type: FLOAT	Active: Immediately

The current-frequency, open-loop controlled mode is used for pure AM mode (MD 1465=0), below the speed set here. MD 1466 is assigned a value with the **Calculate controller data** operator action.

2.2   V/f operation

2.2.1   Description

V/f operation permits the operation of:

- Asynchronous motors without encoder

- 1FK6 feed motors

V/f operation can be used:

- For diagnostic purposes for feed drives and main spindle drives

---

Note

V/f operation can only be used with converter operating frequencies of 4 kHz or 8 kHz. Once the converter operating frequency has been changed in MD 1100: PWM_FREQUENCY, the **Calculate controller data** function must be executed again.

The V/f operation implemented here replaces the diagnostic mode, which it was previously possible to parameterize via MD 1650, bit 8, MD 1660, MD 1661, and MD 1662.

2.2.2 V/f operation with MSD (diagnostics only)

Startup

For V/f operation, standard main-spindle-drive startup should be executed with motor selection in order to obtain practical default values for all machine data. If there is no motor measuring system, "No encoder" should be selected for the encoder type.

As third-party motors are generally used for simple applications, the rating-plate data should be entered as for AM mode and the **Calculate equivalent circuit-diagram data** and **Calculate controller data** functions executed.

V/f operation is then activated via MD 1014: UF_MODE_ENABLE.

Table 2-4   Machine data, V/f operation with main spindle drives

MD no.	Identifier	Description
MD 1014	UF_MODE_ENABLE	Activating V/f operation
MD 1125	UF_MODE_RAMP_TIME_1	Ramp-up time 1 for V/f operation
MD 1126	UF_MODE_RAMP_TIME_2	Ramp-up time 2 for V/f operation
MD 1127	UF_VOLTAGE_AT_F0	Voltage at f=0 V/f operation
MD 1132	MOTOR_NOMINAL_VOLTAGE	Nominal motor voltage
MD 1134	MOTOR_NOMINAL_FREQUENCY	Nominal motor frequency
MD 1146	MOTOR_MAX_ALLOWED_SPEED	Max. motor speed
MD 1103	MOTOR_NOMINAL_CURRENT	Nominal motor current
MD 1238	CURRENT_LIMIT	Current limit value
MD 1400	MOTOR_RATED_SPEED	Rated motor speed
MD 1401	MOTOR_MAX_SPEED [n]	Speed for max. useful motor speed
MD 1405	MOTOR_SPEED_LIMIT	Motor monitoring speed
MD 1730	OPERATING_MODE	Operating mode

V/f characteristic MSD

Fig. 2-4   V/f characteristic MSD

The conversion of the speed setpoint into the frequency to be entered takes into account the pole pair number, which is calculated from the rated motor frequency and rated motor speed, i.e., the synchronous frequency associated with the speed setpoint is output (no slip compensation).

Rampup times   Selection between the two ramp-up times is executed via
"Ramp-up time" interface DB 31, ... DBX 20.0 in the PLC.
Signal state = 0 –> ramp-up time 1 (MD1125) effective
Signal state = 1 –> ramp-up time 2 (MD1126) effective
(see FB Section I, /A2/ Various Interfaces)

Motor changeover/   Motor changeover for main spindle drives is possible in V/f operation.
selection

2.2.3   V/f operation with FSD

On feed spindle drives, V/f operation is only provided as a diagnostics mode. In this case, standard startup must first be executed with motor selection in order to obtain practical default values for all machine data.

V/f operation is then activated via MD 1014: UF_MODE_ENABLE.

Table 2-5   Machine data, V/f operation with 1FT6 motors (feed spindle drives)

MD no.	Identifier	Description
MD 1014	UF_MODE_ENABLE	Activating V/f operation
MD 1104	MOTOR_MAX_CURRENT	Max. motor current
MD 1105	MOTOR_MAX_CURRENT_REDUC-TION	Reduction in max. motor current
MD 1112	NUM_POLE_PAIRS	Motor pole pair number
MD 1114	EMF_VOLTAGE	Voltage constant
MD 1125	UF_MODE_RAMP_TIME_1	Ramp-up time 1 for V/f operation
MD 1126	UF_MODE_RAMP_TIME_2	Ramp-up time 2 for V/f operation
MD 1400	MOTOR_RATED_SPEED	Rated motor speed
MD 1401	MOTOR_MAX_SPEED [n]	Speed for max. useful motor speed
MD 1405	MOTOR_SPEED_LIMIT	Motor monitoring speed

2.2   V/f operation

V/f characteristic FSD

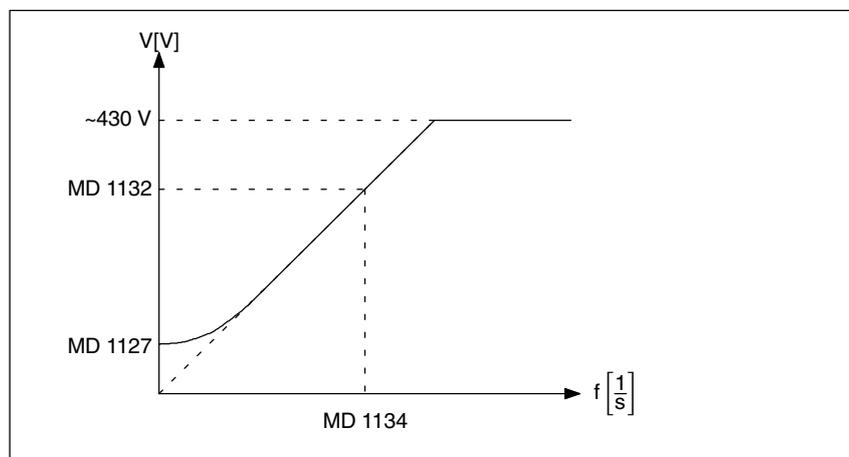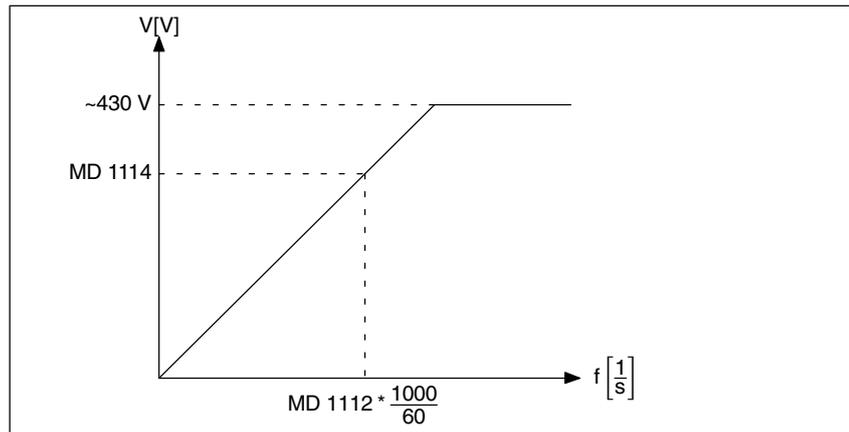

Fig. 2-5   V/f characteristic FSD

The conversion of the speed setpoint into the frequency to be entered is obtained from the pole pair number.

Generally, only speeds up to approx. 25% of the rated speed can be achieved due to the strong tendency of feed-spindle-drive motors to oscillate in V/f operation.

One of the two ramp-up times is selected using an interface signal from the PLC. IS DB 31, ... DBX 20.0.

Motor changeover is not possible on feed drives.

2.2.4   Machine data

1014	UF_MODE_ENABLE			840D only	Cross reference: –
	Activate V/f operation			Relevant to: FDD/MSD/AM	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 1	Data type: UNS.WORD	Active: RESET

Activates V/f operation for feed spindle drives/main spindle drives. The frequency setpoint is entered as a speed setpoint via the digital setpoint interface.

1125	UF_MODE_RAMP_TIME_1			840D only	Cross reference: –
	Ramp-up time 1 for V/f operation			Relevant to: FDD/MSD/AM	Protection level: 2/4
Unit: s	Default: 5.0	Minimum: 0.01	Maximum: 100.0	Data type: FLOAT	Active: Immediately

If V/f operation is selected (MD 1014), this is the time during which the speed setpoint is adjusted from 0 to the maximum motor speed (MD 1146). (Time 1 or time 2 (MD 1126) can be selected using "Ramp-up time" IS DB 31, ... DBX 20.0.)

1126	UF_MODE_RAMP_TIME_2			840D only	Cross reference: –
	Ramp-up time 2 for V/f operation			Relevant to: FDD/MSD/AM	Protection level: 2/4
Unit: s	Default: 5.0	Minimum: 0.01	Maximum: 100.0	Data type: FLOAT	Active: Immediately

If V/f operation is selected (MD 1014), this is the time during which the speed setpoint is adjusted from 0 to the maximum motor speed (MD 1146). (Time 1 or time 2 (MD 1126) can be selected using "Ramp-up time" IS DB 31, ... DBX 20.0.)

1127	UF_VOLTAGE_AT_F0			840D only	Cross reference: –
	Voltage at f=0 V/f operation			Relevant to: AM/MSD	Protection level: 2/4
Unit: V	Default: 2.0	Minimum: 0.0	Maximum: 20.0	Data type: FLOAT	Active: Immediately

When V/f operation is selected (MD 1014) and at a frequency of 0, the voltage to be output is increased by this value. The MD is pre-assigned by selecting **Calculate controller data**.

1650	DIAGNOSIS_CONTROL_FLAGS			840D only	Cross reference: –
	Diagnostic control			Relevant to: FDD/MSD	Protection level: 2/4
Unit: hex	Default: 0	Minimum: 0	Maximum: FFFF	Data type: UNS.WORD	Active: Immediately

Select the diagnostic functions

- Min/max memory

- Open-loop voltage-controlled V/f operation in the diagnostic word

Table 2-6   Diagnostic control

Bit 8 (up to SW 3.1)	Open-loop voltage-controlled V/f operation	0 = Normal operation 1 = V/f operation active

> **!**
>
> **Important**
>
> These diagnostic functions are **only** relevant for Siemens internal purposes and **must not be changed**.

2.2 *V/f operation*

1660	UF_MODE_FREQUENCY			840D only	Cross reference: –
	Motor frequency, V/f operation			Relevant to: FDD/MSD	Protection level: 2/4
Unit: Hz	Default: 0.0	Minimum: –10,000.0	Maximum: 10,000.0	Data type: FLOAT	Active: Immediately

Enter a setpoint frequency (mechanical) for the drive in open-loop voltage-controlled V/f operation. The + or – sign corresponds to the particular direction of rotation of the motor.

Note

This machine data is only used for diagnostics, and may only be used by trained service personnel.

1661	UF_MODE_RATIO			840D only	Cross reference: –
	V/f ratio for V/f operation			Related to: FDD/MSD	Protection level: 2/4
Unit: Vs	Default: 2.4	Minimum: 0.0	Maximum: 100.0	Data type: FLOAT	Active: Immediately

---

Note

This machine data is only used for diagnostics, and may only be used by trained service personnel.

Enter a voltage/frequency ratio for the drive in open-loop voltage-controlled V/f operation.
The following applies to the V_q voltage applied to the drive:

V_q = MD 1661 x MD 1660

1662	UF_MODE_DELTA_FREQUENCY only			840D	Cross reference: –
	Change to motor frequency, V/f operation			Relevant to: FDD/MSD	Protection level: 2/4
Unit: Hz/s	Default: 5.0	Minimum: 0.0	Maximum: 10,000.0	Data type: FLOAT	Active: Immediately

Enter a change in the motor frequency for V/f operation via a frequency increment for V/f ramp-up control for the electrical setpoint frequency of the drive.

Note

This machine data is only used for diagnostics, and may only be used by trained service personnel.

2.3 Motor changeover/selection

2.3.1 Star/delta changeover

Description

Motors with star/delta changeover permit a wide constant power range. At low speeds, the motor is operated in the star circuit configuration (high torque) and at high speeds in the delta circuit configuration (high breakdown torque). Changeover is also possible during operation. When changing over between star and delta operation, it is possible to additionally select between eight drive parameter sets [0...7]. The changeover sequence is controlled via function block FC 17: YDelta star/delta changeover, open loop.
The function block and functional sequence are described in:

    References: /FB1/, P3, Basic PLC Program

External circuitry

1) Safe standstill cannot be guaranteed simply by opening K1 and K2.
For safety reasons, isolation should be carried out using these contactors.
The contactor may only close or open in the no-current condition, i.e., pulse enable must be canceled approximately 40 ms before the contactor opens.
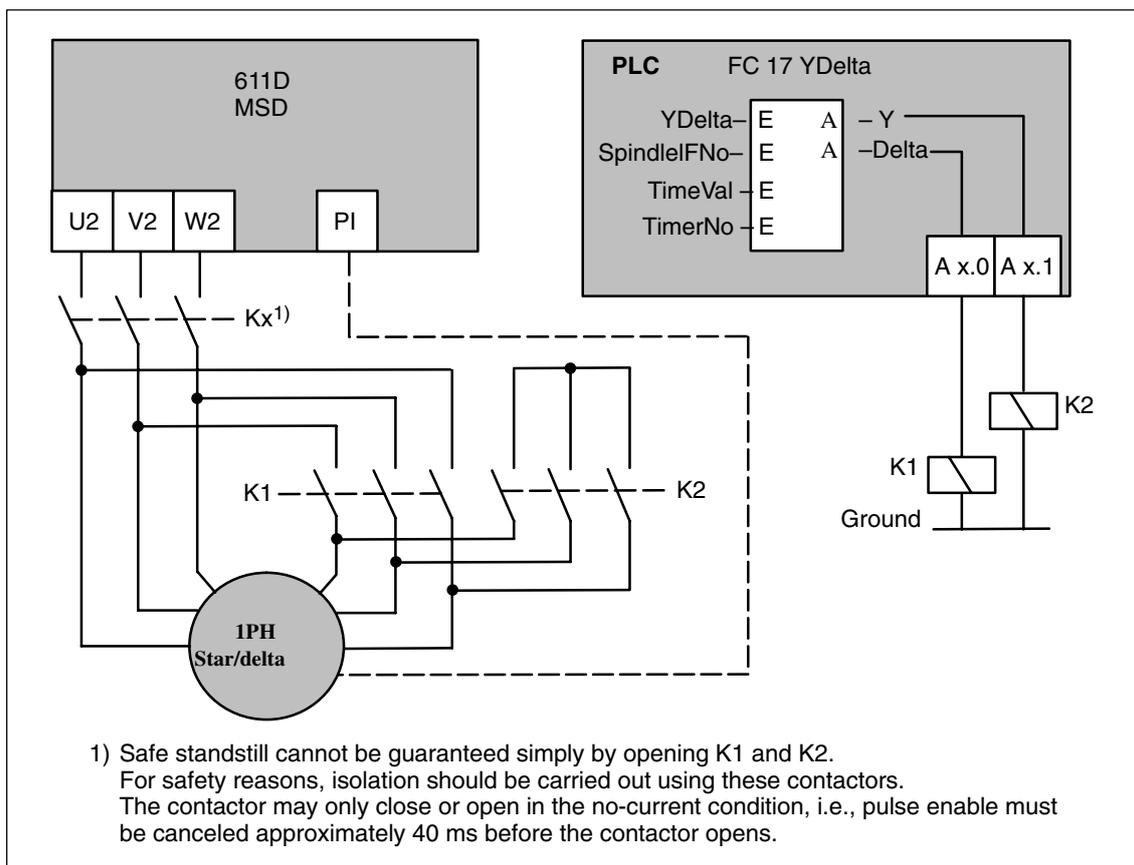
Fig. 2-6   Star/delta-changeover connection diagram

Motor changeover/ selection

In V/f operation or AM mode, motor changeover can also be used to switch between motors, which differ in terms of their physical characteristics.

2.3.2 Motor-dependent pulse frequency changeover (MSD/AM)

General information

Motor-dependent changeover of the pulse frequency enables the pulse frequency to be more ideally matched to the speed requirements of the motor. In this way, lower speeds can be achieved at a lower pulse frequency than high speeds.

The pulse frequency must have approximately 6 times the frequency of the instantaneous motor frequency. High pulse frequencies mean high switching losses in the power sections, which leads to poor utilization.

Only 40% - 55% of the current possible at 3.2 kHz is available at a pulse frequency of 8 kHz.

Note

Major changes to motor data, such as a lower pole pair or encoder pulse number, are not permissible in this mode. Changeover is intended only for the adaptation of the same motor.

An expanded application of this function is the AM functionality, where two motors, which differ in terms of their physical characteristics, can be operated with different pulse frequencies.

Changeover without pulse suppression

Pulse frequency changeover is carried out using the star/delta changeover function implemented in the MSD/AM.

If the appropriate activation bit is not set in MD 1013: ENABLE_STAR_DELTA, and if the motor parameter set is selected via the PLC interface parameterized in FC 17, an immediate changeover to the pulse frequency defined in the parameter set is effected.

Changeover via speed threshold

Changeover is carried out using a speed threshold with hysteresis in the drive, without affecting the PLC.

In order to activate the function, bit 2 must be set in the MD 1013: ENABLE_STAR_DELTA

The speed threshold is entered in MD 1247: MOTOR_SWITCH_SPEED.

The hysteresis is $\geq$ 5% of the speed value from MD 1247: MOTOR_SWITCH_SPEED.

2.4 Motor switchover in the case of asynchronous motors (as of High Performance)

General information

The "SIMODRIVE 611 digital" controller module has motor data sets for a maximum of 4 asynchronous motors. There must be no gaps in the data sets.

1. Motor data set (from MD: 1000)

2. Motor data set (from MD: 2000)

3. Motor data set (from MD: 3000)

4. Motor data set (from MD: 4000)

The motor data set is selected in accordance with the mode in MD 1013 with Bit 3 and Bit 4 in the control word for the drive.

The active motor data set is shown by Bit 3 and Bit 4 in the status word for the drive.

> Motor bit 0 –> Bit 3
> Motor bit 1 –> Bit 4

2.4.1 Variants for motor changeover

1013	ENABLE_STAR_DELTA			840D only	Cross reference: –
	Star/delta-changeover enable			Relevant to: MSD	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 7	Data type: UNS. WORD	Active: Power ON

Depending on the setting of MD 1013 (motor changeover), the following changeovers can be implemented:

Table 2-7   Variants for motor changeover (MD 1013)

MD 1013	Changeover	Description
0	none	**Property:** Motor data set 1 (MD 1xxx) is always selected. The motor bits in the control word are not evaluated.
Bit 0 set	four motors max. with 1 motor data set each M (GND) MD4XX MD3XX MD2XX MD1XX	**Properties:** • Pulse suppression is carried out on each changeover. **Application:** • Changeover of several motors[1)2)] • Selection of the motor data set via control bit, see Subsection 2.4.2

2.4   Motor switchover in the case of asynchronous motors

Table 2-7   Variants for motor changeover (MD 1013), continued

MD 1013	Changeover	Description
Bit 0=1 Bit 1=1 set => 3	1 motor with a maximum of 4 motor data sets M (GND) MD4XX MD3XX MD2XX MD1XX	**Properties:** • A pulse suppression is not carried out for each change-over. **Application:** • Adaptation of the motor and controller data (e.g., frequency/pulse-width-modulation changeover) • Selection of the motor data set via control bit, see Subsection 2.4.3
Bit 0 + Bit 1 + Bit 2 set => 7	Maximum of 2 motors each with 2 motor data sets M (GND) M (GND) MD4XX MD3XX MD2XX MD1XX n n	**Properties:** • If changeovers depend on speed thresholds, pulses are not suppressed within motor 1, data set 1/2 or motor 2, data set 1/2. **Application:** • Speed-dependent adaptation of the motor and controller data (e.g., frequency/pulse-width-modulation change-over) for – one motor – two motors – star/delta operation • Selection of the motor data set via control bit, see subsection 2.4.5.
Bit 0=1 => 1	1 motor/two windings 2 data sets	**Application:** • Star/delta changeover with pulse suppression via PLC block FC17
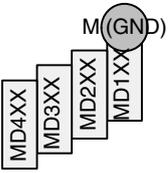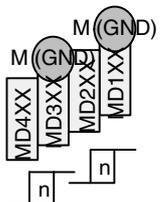
1) Encoder changeover is not possible.
2) Only 1 motor can be used with encoder.

2.4.2 Changeover of up to four motors, each with one motor data set

Description

For this changeover variant (MD 1013: bit 0 set), a maximum of 4 motors each with 1 associated motor data set can be switched.

Note

Pulse suppression is carried out on each changeover.

Note

The motor is viewed via the associated axis DB (DB3x..) and bit 21.3/21.4 (motor bit 0/1).

Changeover is performed by means of a relay between 4 motors with pulse suppression. Each motor has its own data set:

- Motor bit 1 = 0; Motor bit 0 = 0 –> Motor 1, Data set 1

- Motor bit 1 = 0; Motor bit 0 = 1 –> Motor 2, Data set 2

- Motor bit 1 = 1; Motor bit 0 = 0 –> Motor 3, Data set 3

- Motor bit 1 = 1; Motor bit 0 = 1 –> Motor 4, Data set 4

How does a changeover work?

Motor changeover passes through three states:

1. Pulse inhibit

2. Deactivate contactor, allow switch-off interlock time to elapse

3. Allow contactor switch-on time to elapse, then enable pulses

2.4.3 Changeover of one motor with up to four data sets

Description

For this changeover version (MD 1013 = 3), for one motor a maximum of 4 motor data sets can be changed over.

Note

There is no pulse suppression during changeover, i.e., changeover is also carried out when a pulse enable is applied.

This version can be used to adapt the motor and controller data.

Changeover between 4 motor data sets without pulse suppression is performed by means of:

- Motor bit 1 = 0; Motor bit 0 = 0 –> Motor 1, Data set 1

- Motor bit 1 = 0; Motor bit 0 = 1 –> Motor 1, Data set 2

- Motor bit 1 = 1; Motor bit 0 = 0 –> Motor 1, Data set 3

- Motor bit 1 = 1; Motor bit 0 = 1 –> Motor 1, Data set 4

2.4.4 Star/delta changeover with FC17 (SW 6.4 and higher)

Functional description

The block for star/delta changeover controls the timing of the defined switching logic such that the changeover can be performed in either direction even when the spindle is running. This block may be used only for digital main spindle drives and must be called separately for each spindle.

The changeover operation is implemented via 2 separate contactors in a sequence involving 4 steps:

Step 1: Delete the "Motor selection in progress" interface signal in the relevant axis DB (DB 31, ... DBX21.5) and connect the changeover process using "Motor selection" A (DB 31, ... DBX21.3).

Step 2: As soon as checkback signal "Pulses enabled" = 0 (DB 31, ... DBX93.7) and the acknowledgment of the logged on motor selection have appeared from the drive, the currently energized contactor drops out.

Step 3: The other contactor is energized after the time period set by the user in parameter "TimeVal" has elapsed.

Step 4: After a further delay, the changeover is signaled to the drive with "Motor selection in progress" (DB 31, ... DBX21.5).
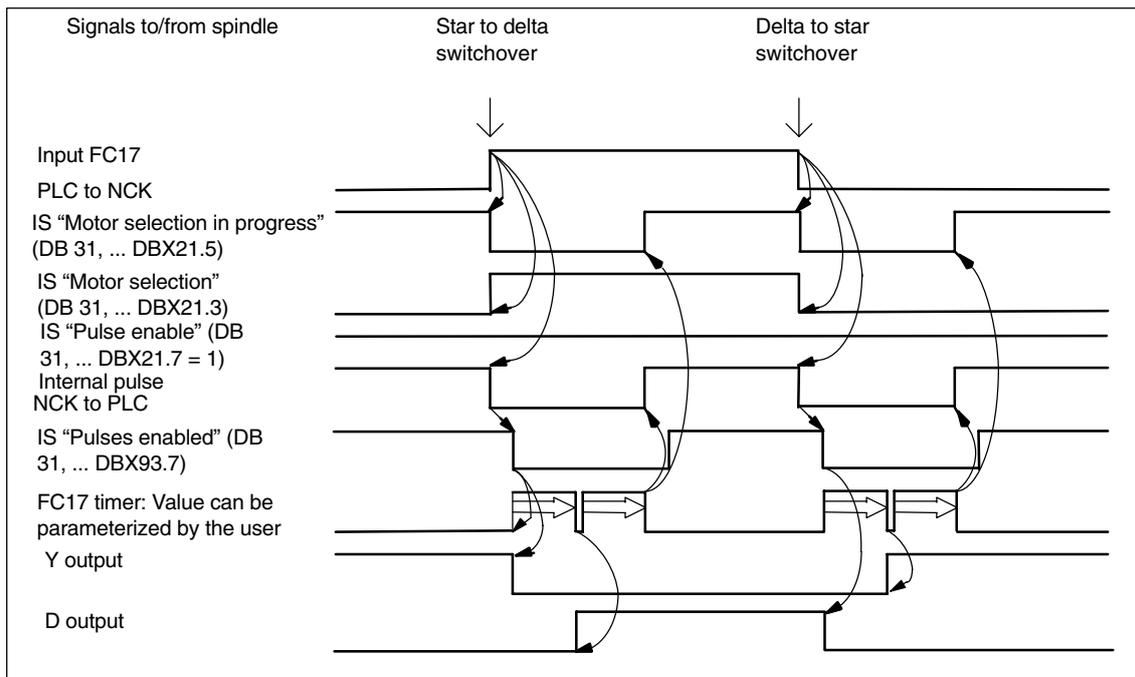
Fig. 2-7   Timing with interface signals with a delay of 500 ms set in FC 17.

For more detailed information about motor speed adjustments, please see:

References: /FB1/, S1, "Spindles" Configurable Gearbox Adjustments
/FB1/, G2, "Velocities, Setpoint/Actual-Value Systems,
Closed-Loop Control"

Alarms

401702	Impermissible channel no. parameter in FC 17
Explanation	The parameterized spindle does not exist
Response	Alarm display and PLC STOP
Remedy	Set parameter correctly
Continuation	After cold restart

Error message   If the parameter "SpindleIFNo" is not in the permissible range, the PLC is stopped with output of alarm message number 401702.

Special features   When parameterizing the "TimeVal" with the value 0, a default value of 100 ms is used. With a value of less than 50 ms, the minimum setting of 50 ms is applied.

The block must be called unconditionally.

Supplementary conditions

Star/delta changeover on digital main spindle drives initiates a process, which contains closed-loop control sequences. Since the closed-loop control system supports automatic star/delta changeover, certain supplementary conditions should be noted.

- Due to the automatic deactivation of the pulses on the drive, IS "Current controller active" (DB 31, ... DBX61.7) and "Speed controller active" (DB 31, ... DBX61.6) are deactivated simultaneously to IS "Pulses enabled" (DB 31, ... DBX93.7).

- If a changeover from star to delta takes place while the spindle is rotating and the spindle position controller is switched on, IS "Position controller active" (DB 31, ... DBX61.5), this triggers alarm 25050 "Contour monitoring".

- Once the star/delta changeover has been initiated with FC17, it cannot be delayed by the user, e.g., by waiting until the star/delta contactors change over during the course of operation. The user can implement this signal interaction with PLC logic.

Call example

```
CALL FC 17 (

        YDelta :=        e 45.7,          //star delta
        SpindleIFNo :=   4,
        TimeVal :=       S5T#150ms,
        TimerNo :=       10,              //Timer 10
        Y :=             a 52.3,          //star contactor
        Delta :=         a 52.4,          //delta contactor
        Ref :=           mw 50);          //instance
```

The function block is described in detail in:

/FB1/   Description of Functions, Basic Machine (Part 1)
         P3, PLC-Basic Program

2.4.5 Changeover of up to two motors, each with two data sets

Description

For this changeover version (MD 1013 = 7), a maximum of 2 motors, each with 2 associated motor data sets, can be changed over.

Note

The motor is viewed via the associated axis DB (DB3x..) and bit 21.3/21.4 (motor bit 0/1).

Motor bit 1 controls changeover with pulse suppression between 2 motors. Speed thresholds act on motor bit 0 and control the changeover between the 2 data sets of a motor without pulse suppression.

Changeover is carried out via appropriately set speed thresholds in MD 1247 or MD 1248.

The speed threshold for Motor 1 is parameterized in MD:1247.
The speed threshold for Motor 2 is parameterized in MD:1248.

A hysteresis of +/– 5% is applied around the speed thresholds to ensure distinct switch-on and switch-off speeds as well as an area, in which changeover does not take place.

1247	MOTOR_SWITCH_SPEED1 only			840D	Cross reference: –
	Speed threshold 1. Motor changeover			Relevant to: FDD/MSD	Protection level: 2/4
Unit: rpm	Default: 100,000.0	Minimum: 0.0	Maximum: 100,000.0	Data type: FLOAT	Active: Immediately

Above the speed entered plus 5% hysteresis, the second motor data set is selected (MD 2xxx).

Below the speed entered minus 5% hysteresis, the first motor data set is selected (MD 1xxx).

The minimum value of MD 1247 can be set to zero to start up the motor with the second set of data. The speed threshold is subsequently increased again.

1248	MOTOR_SWITCH_SPEED2 only			840D	Cross reference: –
	Speed threshold 2. Motor changeover			Relevant to: FDD/MSD	Protection level: 2/4
Unit: rpm	Default: 100,000.0	Minimum: 0.0	Maximum: 100,000.0	Data type: FLOAT	Active: Immediately

Above the speed entered plus 5% hysteresis, the fourth motor data set is selected (MD 4xxx).

Below the speed entered minus 5% hysteresis, the third motor data set is selected (MD 3xxx).

2.4 Motor switchover in the case of asynchronous motors

The following cases result:

- Motor bit 1 = 0; Actual speed < 95% of MD 1247

  –> Motor bit 0 = 0   –> Motor 1, Data set 1 (MD 1xxx)

- Motor bit 1 = 0; Actual speed > 95% and < 105% of MD 1247

  –> Motor bit 0 = const.
  –> Motor 1, Data set 1 or 2 (depending on which is active)

- Motor bit 1 = 0; Actual speed > 105% of MD 1247

  –> Motor bit 0 = 1   –> Motor 1, Data set 2 (MD 2xxx)

- Motor bit 1 = 1; Actual speed < 95% of MD 1248

  –> Motor bit 0 = 0   –> Motor 2, Data set 3 (MD 3xxx)

- Motor bit 1 = 1; Actual speed > 95% and < 105% of MD 1248 –>

  –> Motor bit 0 = const.
  –> Motor 2, Data set 3 or 4

- Motor bit 1 = 1; Actual speed > 105% of MD 1248

  –> Motor bit 0 = 1   –> Motor 2, Data set 4 (MD 4xxx)
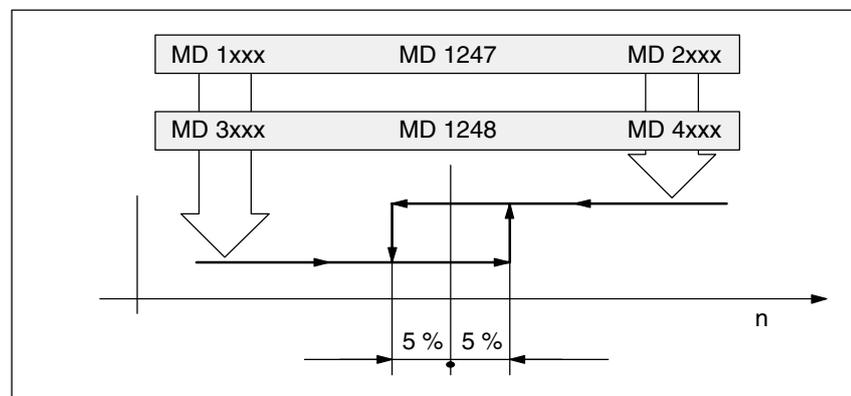
Fig. 2-8   Hysteresis

2.4.6 Motor data sets

Table 2-8   Motor-data-set-dependent machine data

Motor data set				Meaning
1	2	3	4	
1098	2098	3098	4098	Power section derating limit current
1099	2099	3099	4099	Power section limit current derating factor
1100	2100	3100	4100	Pulse width modulation frequency

1102	2102	3102	4102	Motor code number
				Note:
				
				• When operating several list motors, the motor data are not valid until the relevant motor code has been entered and saved, and a POWER ON performed.
				
				• In the case of motor changeover with a "gap" (e.g., from motor 1 to 3), a dummy motor code must be entered for the motor data set in between, i.e., the corresponding parameter must not have the value 0.
				
				• Once the motor code number has been modified manually, the following parameters must be checked and set to appropriate values, if necessary:
				
				  – MD 1401, MD 2401, MD 3401 or MD 4401 (Speed for max. useful motor speed)
				
				  – MD 1147, MD 2147, MD 3147 or MD 4147 (Speed limitation)

1103	2103	3103	4103	Nominal motor current
1117	2117	3117	4117	Motor moment of inertia
1119	2119	3119	4119	Series reactor inductance
1120	2120	3120	4120	P gain, current controller
1121	2121	3121	4121	Integrator time of current controller
1125	2125	3125	4125	Ramp-up time 1 for V/f operation
1126	2126	3126	4126	Ramp-up time 2 for V/f operation
1127	2127	3127	4127	Voltage at f = 0, V/f operation
1129	2129	3129	4129	Cosine Phi power factor
1130	2130	3130	4130	Nominal motor power
1132	2132	3132	4132	Nominal motor voltage
1134	2134	3134	4134	Nominal motor frequency
1135	2135	3135	4135	Motor no-load voltage
1136	2136	3136	4136	Motor no-load current
1137	2137	3137	4137	Stator cold resistance

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2.4 Motor switchover in the case of asynchronous motors

Table 2-8   Motor-data-set-dependent machine data, continued

Motor data set				Meaning
1	**2**	**3**	**4**	
1138	2138	3138	4138	Rotor cold resistance
1139	2139	3139	4139	Stator leakage reactance
1140	2140	3140	4140	Rotor leakage reactance
1141	2141	3141	4141	Magnetizing reactance
1142	2142	3142	4142	Threshold speed field weakening
1143	2143	3143	4143	Upper speed, Lh characteristic
1144	2144	3144	4144	Gain factor, Lh characteristic
1145	2145	3145	4145	Stall torque reduction factor
1146	2146	3146	4146	Max. motor speed
1147	2147	3147	4147	Speed limitation
1148 [1]	2148	3148	4148	Threshold speed, pull-out power
1150	2150	3150	4150	P gain, flux controller
1151	2151	3151	4151	Flux-controller reset time
1160	2160	3160	4160	Threshold speed, flux sensing
1190	2190	3190	4190	Evaluation, torque limit value
1192	2192	3192	4192	Weight
1230:8	2230:8	3230:8	4230:8	1. torque limit value
1231	2231	3231	4231	2. torque limit value
1232	2232	3232	4232	Switching speed from MD 1230 to MD 1231
1233:8	2233:8	3233:8	4233:8	Generator limiting
1234	2234	3234	4234	Hysteresis around MD 1232
1235:8	2235:8	3235:8	4235:8	1. power limit value
1236	2236	3236	4236	2. power limit value
1238	2238	3238	4238	Current limit value
1239	2239	3239	4239	Torque limit for setup mode
1245	2245	3245	4245	Threshold for speed-dep. torque-setpoint smoothing
1246	2246	3246	4246	Hysteresis for speed-dep. torque-setpoint smoothing
1400	2400	3400	4400	Rated motor speed
1401:8	2401:8	3401:8	4401:8	Speed for max. useful motor speed
1403	2403	3403	4403	Shutoff speed for pulse suppression
1405:8	2405:8	3405:8	4405:8	Motor monitoring speed
1407:8	2407:8	3407:8	4407:8	P gain, speed controller
1408:8	2408:8	3408:8	4408:8	P gain, upper adaptation speed
1409:8	2409:8	3409:8	4409:8	Speed controller reset time
1410:8	2410:8	3410:8	4410:8	Integrator time, upper adaptation speed

Table 2-8   Motor-data-set-dependent machine data, continued

Motor data set				Meaning
1	2	3	4	
1411	2411	3411	4411	Lower adaptation speed
1412	2412	3412	4412	Upper adaptation speed
1413	2413	3413	4413	Selection speed controller adaptation
1417:8	2417:8	3417:8	4417:8	nx for "nact < nx" signal
1418:8	2418:8	3418:8	4418:8	nmin for "nact < nmin" signal
1426:8	2426:8	3426:8	4426:8	Tolerance band for "nset=nact" signal
1451:8	2451:8	3451:8	4451:8	P gain, AM speed controller
1453:8	2453:8	3453:8	4453:8	Integral action time, AM speed controller
1458	2458	3458	4458	Current setpoint open-loop controlled range, AM
1459	2459	3459	4459	Torque smoothing time constant, AM
1465	2465	3465	4465	Changeover speed, MSD/AM
1466	2466	3466	4466	Changeover speed, closed-loop/open-loop control, AM
1602	2602	3602	4602	Threshold for motor overtemperature warning
1607	2607	3607	4607	Shutdown limit, motor temperature
1608	2608	3608	4608	Fixed temperature
1711	2711	3711	4711	Significance, speed representation
1712 [1]	2712	3712	4712	Significance, rotor-flux representation
1713 [1]	2713	3713	4713	Significance, torque representation
1714	2714	3714	4714	Significance, rotor position representation
1725 [1]	2725	3725	4725	Normalization, torque setpoint

1) These parameters are read-only.

Pulse frequency-Changeover

A separate power-section-frequency pulse-width-modulation (MD 1100) can be configured for each motor data set.

Changing over the frequency pulse-width-modulation enables the frequency pulse width to be more ideally matched to the speed requirements of the motor. In this way, it is also possible to operate at higher speeds with a higher pulse frequency.

Frequency pulse-width-modulation should always be at least 6 times that of the maximum motor frequency (approximately).

However, high pulse-width-modulation frequencies mean high switching losses in the power sections, which leads to poor utilization.

Only 40% – 55% of the current possible at 3.2 kHz is available with a pulse-width-modulation frequency of 8 kHz.

2.5 Motor changeover on synchronous motors (SW 6.7.5 and higher)

General information

Motor changeover can also be used on synchronous motors. As well as changing over windings, motor/encoder units can also be changed over. However, you cannot change over between synchronous and asynchronous motors or between rotating and linear drives.

Like asynchronous motors, synchronous motors in High-Performance closed-loop control and High-Standard closed-loop control have 4 motor data sets. Like asynchronous motors, they are located in the 1000, 2000, 3000, and 4000 number range and must be allocated in that order.

The motor data set is selected via the motor bit in the drive's control word. The active motor data set is displayed in the drive's status word.

Parameterization

MD 1013 = 0
No motor changeover

MD 1013 = 1
Winding changeover with pulse suppression

Changing over between 4 windings per motor per relay. Each winding has its own data set.

On synchronous motors, the winding may **not** be changed at speeds above the speed at the start of field weakening, as the earthing contacts can spark in spite of the pulse disable. The controlling user program must ensure adherence to this requirement.

The drive does not respond to the changeover request until the actual speed is lower than MD 1142 "Speed at start of field weakening". If the speed is too high, the drive sends the warning "Speed for changeover too high" to the PLC.

Note

When the motor is turning, the pulse disable will only be tolerated by the NC on the spindle. On a feed axis, the pulse disable leads to NC errors such as 21612 "Controller enable reset during movement".

The rotor position is adjusted using the winding-dependent offset values, which are calculated using the formula

new rotor position = old rotor position – offset value[old motor] + offset value[new Motor]

The winding-dependent offset values must be entered by the user in new MD 1074 "Rotor position adjustment". The default value is zero degrees.

Star-connection: offset value =   0 degrees
Delta-connection: offset value =   30 degrees

1074	**ROTORPOS_OFFSET**			**840D only**	**Cross reference: –**
Motor position adjustment				Relevant to: FDD/MSD	Protection level: 2/4
Unit: Degrees	Default: 0.0	Minimum: 0.0	Maximum: 360.0	Data type: FLOAT	Active: Immediately

The winding changeover runs through the following states (FC 29, also applies to asynchronous motors):

- PLC requests motor changeover by changing the motor bit in the drive's control word (DBX 21.3 and 21.4).
- Drive sets status word to CHANGEOVER_ACTIVE and disables pulses.
- Drive signals the pulse disable in the status word to the PLC (DBX 93.7).
- Drive switches to the new data set.
- Drive adjusts the rotor position to the new winding.
- Drive signals the new motor bit in the status word to the PLC (DBX 93.3 and DBX 93.4).
- PLC disconnects the energized contactor.
- PLC waits for duration of the changeover.
- PLC connects the other contactor.
- PLC signals "Changeover complete" in the control word (DBX 21.5) to the drive.
- Drive del. CHANGEOVER_ACTIVE in the status word and enables pulses.
- Drive signals the pulse enable in the status word to the PLC (DB 93.7).

MD 1013 = 3
Data set changeover without pulse suppression

Changing over between 4 motor data sets
Used, for example, to change over pulse frequencies and controller data without suppressing pulses.

MD 1013 = 7
Data set changeover with speed threshold

Changeover between 2 motor data sets controlled by speed thresholds without suppressing pulses.
The speed threshold in MD 1247 switches between data sets 1 and 2, if winding 1 is active.
The speed threshold in MD 1248 switches between data sets 3 and 4, if winding 2 is active.

Used, for example, to change over speed-dependent pulse frequencies and controller data without suppressing pulses.

If the status of motor bit 1 in the control word changes, you can switch between 2 windings with pulse suppression.

MD 1013 = 1
Motor/encoder-unit changeover with pulse suppression

Changeover between a maximum of 4 motor/encoder units per relay. Each motor has its own data set.
Encoder and motor are changed over together, i.e., the encoder remains adjusted to the rotor position of the motor.

Unlike winding changeovers, motor/encoder-unit changeovers require a PLC block, which transfers the drive to the parked status before the changeover takes place.

2.5 Motor changeover on synchronous motors (SW 6.7.5 and higher)

The encoder is changed in the parked status on the same drive-control motor measuring system. Only the same **incremental** encoder type with the same encoder mounting (direction of rotation) may be used, since the drive's encoder data is only read by the NC after Power On and is not motor-dependent.
Due to its unique ID, an absolute-value encoder **cannot** be changed over, as the controller will detect an encoder change and force readjustment.

Two conditions must be maintained for a successful changeover:

1. On synchronous motors, changeovers may not take place at speeds above the speed at the start of field weakening, as the relay contacts can spark in spite of the pulse disable. The controlling user program must ensure adherence to this requirement. The drive does not respond to the changeover request until the actual speed is lower than MD 1142 "Speed at start of field weakening". If the speed is too high, the drive outputs the warning "Speed for changeover too high".

2. Only **stationary** synchronous motors may be **switched to**, otherwise determination of the rotor position will malfunction.

Motor/encoder-unit changeover passes through the following states (FC29, also applies to asynchronous motors):

- PLC requests motor changeover by changing the motor bit in the drive's control word (DBX 21.3 and 21.4).
- Drive sets status word to CHANGEOVER_ACTIVE and disables pulses.
- Drive signals the pulse disable in the status word to the PLC (DBX 93.7).
- Drive switches to the new data set.
- Drive signals the new motor bit in the status word to the PLC (DBX 93.3 and DBX 93.4).
- **PLC requires "parking axis" with 840D.**
- **840D requires "parking axis" in the drive's control word.**
- **Drive signals "parking axis" in the status word to the PLC.**
- PLC disconnects the energized contactor.
- PLC waits for duration of the changeover.
- PLC connects the other contactor.
- **PLC terminates "parking axis" with 840D.**
- **840D terminates "parking axis" in the drive's control word.**
- **Drive signals "parking axis terminated" in the status word to the PLC.**
- PLC signals "Changeover complete" in the control word (DBX 21.5) to the drive.
- Drive deletes CHANGEOVER_ACTIVE in the status word and enables pulses.
- Drive signals the pulse enable in the status word to the PLC (DB 93.7).
- Synchronous motor: Fine synchronization of the rotor position with incremental encoders with zero mark and CD track
- Synchronous motor: Coarse and fine synchronization with incremental encoders with zero mark without CD track

The NC actual position value is invalidated by parking the incremental encoder.

Used, for example, to change over between motors with encoders in an automatic tool changer.

2.5.1   Motor data sets

On synchronous motors, the following machine data below are used for motor changeover:

1013	Star/delta-changeover enable (also applies to asynchronous motors)
1074	Rotor position adjustment (also applies to asynchronous motors)
1247	Speed threshold motor changeover 1 (also applies to asynchronous motors)
1248	Speed threshold motor changeover 2 (also applies to asynchronous motors)

As on asynchronous motors, motor-dependent parameters with 4 data sets are used on synchronous motors. These sets are located in the 1000, 2000, 3000, and 4000 number range.

Motor data set				Meaning
1	**2**	**3**	**4**	
1013	2013	3013	4013	Star/delta-changeover enable
1015	2015	3015	4015	Activate PE-MSD
1016	2016	3016	4016	Commutation angle offset
1019	2019	3019	4019	Current, rotor/pole position identification
1020	2020	3020	4020	Maximum rotation, rotor/pole position identification
1060	2060	3060	4060	Activate brake control
1061	2061	3061	4061	Brake release time
1062	2062	3062	4062	Holding brake closure speed
1063	2063	3063	4063	Deceleration time
1064	2064	3064	4064	Servo disable time
1074	2074	3074	4074	Rotor position adjustment
1075	2075	3075	4075	Technique, rotor/pole position identification
1076	2076	3076	4076	Load moment of inertia factor
1077	2077	3077	4077	Reset time, rotor-position-identification controller
1098	2098	3098	4098	Power section derating limit current
1099	2099	3099	4099	Power section limit current derating factor
1100	2100	3100	4100	Pulse width modulation frequency
1102	2102	3102	4102	Motor code number
1103	2103	3103	4103	Nominal motor current
1104	2104	3104	4104	Max. motor current
1105	2105	3105	4105	Reduction in max. motor current
1112	2112	3112	4112	Motor pole pair number
1113	2113	3113	4113	Torque constant

2.5 Motor changeover on synchronous motors (SW 6.7.5 and higher)

Motor data set				Meaning
1	**2**	**3**	**4**	
1114	2114	3114	4114	Voltage constant
1115	2115	3115	4115	Armature resistance
1116	2116	3116	4116	Armature inductance
1117	2117	3117	4117	Motor moment of inertia
1118	2118	3118	4118	Motor standstill current
1120	2120	3120	4120	P gain, current controller
1121	2121	3121	4121	Integrator time of current controller
1122	2122	3122	4122	Motor limit current
1125	2125	3125	4125	Ramp-up time 1 for V/f operation
1126	2126	3126	4126	Ramp-up time 2 for V/f operation
1128	2128	3128	4128	Optimum load angle
1136	2136	3136	4136	Motor no-load current
1142	2142	3142	4142	Threshold speed field weakening
1145	2145	3145	4145	Stall torque reduction factor
1146	2146	3146	4146	Max. motor speed
1147	2147	3147	4147	Speed limitation
1149	2149	3149	4149	Reluctance torque constant
1150	2150	3150	4150	P gain, flux controller
1151	2151	3151	4151	Flux-controller reset time
1159	2159	3159	4159	Flux-model correction
1160	2160	3160	4160	Threshold speed, flux sensing
1170	2170	3170	4170	Pole-pair pitch
1180	2180	3180	4180	Lower current limit adaptation
1181	2181	3181	4181	Upper current limit adaptation
1182	2182	3182	4182	Factor, current controller adaptation
1183	2183	3183	4183	Current controller adaptation ON
1190	2190	3190	4190	Evaluation, torque limit value
1192	2192	3192	4192	Weight
1230	2230:8	3230:8	4230:8	1. torque limit value
1231	2231	3231	4231	2. torque limit value
1232	2232	3232	4232	Switching speed from MD 1230 to MD 1231
1233	2233:8	3233:8	4233:8	Generator limiting
1234	2234	3234	4234	Hysteresis around MD 1232
1235	2235:8	3235:8	4235:8	1. power limit value
1236	2236	3236	4236	2. power limit value
1239	2239	3239	4239	Torque limit for setup mode

Motor data set				Meaning
1	**2**	**3**	**4**	
1245	2245	3245	4245	Threshold for speed-dep. torque-setpoint smoothing
1246	2246	3246	4246	Hysteresis for speed-dep. torque-setpoint smoothing
1247	2247	3247	4247	Speed threshold motor changeover 1
1248	2248	3248	4248	Speed threshold motor changeover 2
1400	2400	3400	4400	Rated motor speed
1401	2401:8	3401:8	4401:8	Speed for max. useful motor speed
1403	2403	3403	4403	Shutoff speed for pulse suppression
1405	2405:8	3405:8	4405:8	Motor monitoring speed
1407	2407:8	3407:8	4407:8	P gain, speed controller
1408	2408:8	3408:8	4408:8	P gain, upper adaptation speed
1409	2409:8	3409:8	4409:8	Speed controller reset time
1410	2410:8	3410:8	4410:8	Integrator time, upper adaptation speed
1411	2411	3411	4411	Lower adaptation speed
1412	2412	3412	4412	Upper adaptation speed
1413	2413	3413	4413	Selection speed controller adaptation
1417	2417:8	3417:8	4417:8	nx for "nact < nx" signal
1418	2418:8	3418:8	4418:8	nmin for "nact < nmin" signal
1426	2426:8	3426:8	4426:8	Tolerance band for "nset=nact" signal
1602	2602	3602	4602	Threshold for motor overtemperature warning
1607	2607	3607	4607	Shutdown limit, motor temperature
1608	2608	3608	4608	Fixed temperature
1711	2711	3711	4711	Significance, speed representation
1712	2712	3712	4712	Significance, rotor-flux representation
1713	2713	3713	4713	Significance, torque representation
1714	2714	3714	4714	Significance, rotor position representation
1725	2725	3725	4725	Normalization, torque setpoint

2.6 Emergency retraction

The emergency-retraction function allows a response that has been specifically adapted to the machine to be defined for use in the event of a dangerous situation. This ensures that the axes can be retracted to a safe position, thus avoiding a collision with the workpiece. Dangerous situations include: power failure, short-time voltage dip or emergency stop.

Note

The CCU3 does not support the "emergency retraction" function!

2.6.1 Machine data

1631	LINK_VOLTAGE_GEN_ON only			840D	Cross reference: –
Response voltage, generator axis				Relevant to: FDD/MSD	Protection level: 2/4
Unit: V	Default: 450.0	Minimum: 280.0	Maximum: 650.0	Data type: UNS.WORD	Active: Immediately

---

!   **Important**

This machine data is **only** relevant for Siemens internal purposes and **must not be changed**.

Enter the response threshold of the DC link voltage. When this threshold is undershot, a drive (defined as a generator axis) is changed over to generator mode; this is carried out in the NC program.

1632	LINK_VOLTAGE_GEN_HYST			840D only	Cross reference: –
Voltage range for generator control				Relevant to: FDD/MSD	Protection level: 2/4
Unit: V	Default: 30.0	Minimum: 0.0	Maximum: 300.0	Data type: UNS.WORD	Active: Immediately

---

!   **Important**

This machine data is **only** relevant for Siemens internal purposes and **must not be changed**.

Enter the voltage step of the DC link voltage for the two-point controller of the generator mode. The generator control range lies between:
MD 1631: LINK_VOLTAGE_GEN_ON and
MD 1631 + MD 1632: LINK_VOLTAGE_GEN_HYST.

1633	LINK_VOLTAGE_GEN_OFF			840D only	Cross reference: –
Shutdown threshold for generator mode				Relevant to: FDD/MSD	Protection level: 2/4
Unit: V	Default: 510.0	Minimum: 0.0	Maximum: 660	Data type: UNS.WORD	Active: Immediately

!

Important

This machine data is **only** relevant for Siemens internal purposes and **must not be changed**.

Enter the response threshold of the DC link voltage. When this threshold is exceeded, the drive reverts from generator mode back to normal operation.

1634	LINK_VOLTAGE_RETRACT			840D only	Cross reference: –
Response threshold, emergency retraction				Relevant to: FDD/MSD	Protection level: 2/4
Unit: V	Default: 400.0	Minimum: 0.0	Maximum: 660.0	Data type: UNS.WORD	Active: Immediately

!

Important

This machine data is **only** relevant for Siemens internal purposes and **must not be changed**.

Enter the response threshold of the DC link voltage, which, when undershot, initiates the emergency-retraction responses corresponding to the operating modes selected in the NC program. A PLC message is also output when the DC-link voltage falls below this value.

1635	GEN_AXIS_MIN_SPEED			840D only	Cross reference: –
Minimum speed, generator axis				Relevant to: FDD/MSD	Protection level: 2/4
Unit: rpm	Default: 0.0	Minimum: 0.0	Maximum: 100,000.0	Data type: FLOAT	Active: Immediately

!

Important

This machine data is **only** relevant for Siemens internal purposes and **must not be changed**.

Enter the minimum speed for the DC link generator. When this speed is undershot, a PLC message is output. This signal is sent to tell the NC that the drive operated as generator (selected in the NC program) has reached a speed at and above which the NC should initiate emergency retraction.

2.6 Emergency retraction

1636	RETRACT_AND_GENERATOR_MODE only				840D	Cross reference: –
Drive modes, emergency retraction				Relevant to: FDD/MSD		Protection level: 2/4
Unit: –	Default: 0.0	Minimum: 0.0	Maximum: 7.0	Data type: UNS.WORD		Active: Immediately

!

Important

This machine data is **only** relevant for Siemens internal purposes and **must not be changed**.

Various operating modes can be entered in the drive operating mode word. It defines 8 operating modes for fault/error situations:

- Sign of life failure

- DC link voltage < MD 1633 or MD 1631

- Activation of the autonomous drive emergency retraction by the NC

Table 2-9   Drive modes, emergency retraction

Value entry	Mode
0	Normal states
1	Monitoring operation
2	Delayed, regenerative braking
3	Delayed regenerative braking only for sign of life failure
4	Emergency retraction
5	Emergency retraction only for sign of life failure
6	Generator mode with the option to return to normal operation
7	Generator mode without the option to return to normal operation

1637	GEN_STOP_DELAY only				840D	Cross reference: –
Delay, regenerative braking				Relevant to: FDD/MSD		Protection level: 2/4
Unit: ms	Default: 0.0	Minimum: 0.0	Maximum: 10,000.0	Data type: UNS.WORD		Active: Immediately

!

Important

This machine data is **only** relevant for Siemens internal purposes and **must not be changed**.

Enter the delay before regenerative braking is initiated when a fault/error situation occurs.

1638	RETRACT_TIME			840D only	Cross reference: –
	Emergency retraction time			Relevant to: FDD/MSD	Protection level: 2/4
Unit: ms	Default: 0.0	Minimum: 0.0	Maximum: 10,000.0	Data type: UNS.WORD	Active: Immediately

!

Important

This machine data is **only** relevant for Siemens internal purposes and **must not be changed**.

Enter the emergency-retraction time, during which the emergency-retraction speed (MD 1639) is set when a fault/error situation occurs. The axis regeneratively brakes after this time has expired.

1639	RETRACT_SPEED only			840D	Cross reference: –
	Emergency retraction speed			Relevant to: FDD/MSD	Protection level: 2/4
Unit: –	Default: 0.0	Minimum: –4 194 304.0	Maximum: 4,194,304.0	Data type: DWORD	Active: Immediately

!

Important

This machine data is **only** relevant for Siemens internal purposes and **must not be changed**.

Enter the emergency retraction speed, which is set as the setpoint speed during the emergency retraction time (MD 1638) when a fault/error situation occurs.

2.6.2 Dynamic energy management (SW 6.8.3 and higher)

Dynamic energy management enables I/RF-unit dimensioning to be adapted to the plant concept in accordance with requirements.

Regenerative braking of the drives causes the DC-link voltage VDC to rise in the DC link. On certain drives, while braking and related regenerative feedback is taking place, the braking torque must be temporarily reduced in order to ensure that the maximum permissible DC-link voltage is not exceeded.

To activate dynamic energy management, set MD 1165 = 1.

Using axis-dependent configuration, MD 1162 can be used to set a lower DC-link-voltage threshold or MD 1163 can be used to set an upper DC-link-voltage threshold.

If the DC-link voltage exceeds the upper threshold set in MD 1163 during regenerative braking, the torque is reduced to 0%, which counteracts the voltage rise. The torque reduction is not canceled until the DC-link voltage drops below the threshold value set in MD 1162 again.

Thus, the DC-link voltage can rise abruptly while the motor is still rotating. The effect of this can be reduced by setting MD 1096/1097 "Additional reduction of torque limit with regenerative braking".

A prerequisite for this is that the times must lie within the times configured in MD 1403 (Pulse-suppression creep speed) and MD 1404 (Pulse-suppression timer), so that a servo disable is triggered, but not a pulse disable. Furthermore, the servo disable must be configured as a shutdown response when a 611D alarm is output, via MD 1613 "Configurable shutdown responses for reset alarms".

Note

When the upper DC-link-voltage threshold is reached (MD 1163 > MD 1701), reset alarm 300603 "VDC > threshold" is output.

The configuration must ensure that the sum of all feedback motion axes cannot destroy the I/RF unit.

Machine data

1162	LINK_VOLTAGE_MIN only			840D	Cross reference: –
	Minimum DC-link voltage			Relevant to: FDD/MSD/LIM	Protection level: 2/4
Unit: V	Default: 0.0	Minimum: 0.0	Maximum: 800	Data type: UNS.WORD	Active: Immediately

1163	LINK_VOLTAGE_MAX			840D only	Cross reference: –
	Maximum DC-link voltage			Relevant to: FDD/MSD/LIM	Protection level: 2/4
Unit: V	Default: 800	Minimum: 0.0	Maximum: 800	Data type: UNS.WORD	Active: Immediately

1165	DYN_MANAG_ENABLE			840D only	Cross reference: –
	Dynamic energy management active			Relevant to: FDD/MSD/LIM	Protection level: 2/4
Unit:	Default: 0	Minimum: 0 (inactive)	Maximum: 1 (active)	Data type: UNS.WORD	Active: Immediately

1096	RED_TORQUE_LIMIT_GS_ACTIV			840D only	Cross reference: –
	Red. max. torque with regenerative stop active			Relevant to: FDD/MSD/LIM	Protection level: 2/4
Unit:	Default: 0	Minimum: 0	Maximum: 3	Data type: FF16	Active: Immediately

MD 1096, bit 0
Reduction of torque limit with regenerative braking
0: not active (exception: encoderless brakes):
1: (active)

MD 1096, bit 1
Monitoring speed controller at its limit when reducing torque
0: active (exception: encoderless brakes)
1: not active

Monitoring of the speed controller at its endstop can be disabled to prevent regenerative braking, which takes longer to complete due to the reduced torque, being aborted prematurely.

1097	RED_TORQUE_LIMIT_GENSTOP			840D only	Cross reference: –
	Red. max. torque with regenerative stop			Relevant to: FDD/MSD/LIM	Protection level: 2/4
Unit: %	Default: 80	Minimum: 0	Maximum: 100	Data type: FI16	Active: Immediately

---

Note

This function should primarily be used with axes, which are not used in interpolating operation with other axes, e.g., spindles.

2.6   Emergency retraction

Alarm message

300603	VDC > MD 1163
Cause	The current DC-link voltage VDC in MD 1701: $MD_LINK_VOLTAGE is greater than MD 1163: $MD_LINK_VOLTAGE_MAX and MD 1165: $MD_DYN_MANAG_ENABLE has been activated.
Explanation	DC-link voltage exceeds the upper VDC threshold MD 1163: $MD_LINK_VOLTAGE_MAX during regenerative braking.
Remedy	Increase drive machine data MD 1163: $MD_LINK_VOLTAGE_MAX or deactivate machine data MD 1165 $MD_DYN_MANAG_ENABLE.
SIMODRIVE_READY and ANTRIEB_BEREIT are withdrawn.	

Note

When all feed axes have come to a stop, the function can be disabled via FB 87. This allows the axes' deceleration time to be reduced.

2.7 Controlling STOP / service brake via terminals of the closed-loop control module (from SW 6.6.6)

For axes, which have to be secured against unintended movement when disabled, the SIMODRIVE 611D brake-execution control can be used to control braking.

The relay for the holding brake/service brake is controlled via output terminals.

Note

The control of the holding brake via the closed-loop control module terminals is not suitable for Safety Integrated. With SI, the brake control must be wired via the PLC!

SIEMENS motors can be fitted with holding/service brakes as an option.

⚠️ **Warning**

It is not permitted to use holding/service brakes as operating brakes, as they are usually only designed for a limited number of emergency brake operations.

Brake execution control is activated by setting MD 1060 to 1.

The following machine data are available for the holding-/service-brake function:

- MD 1060   Activate brake control
- MD 1061   Brake release time
- MD 1062   Speed, close holding/service brake (SRM, ARM)
  Motor speed, close holding/service brake (SLM)
- MD 1063   Deceleration time
- MD 1064   Servo disable time

Release brake

When "controller enable" is issued, the speed controller becomes active and controls with $n_{set} = 0$.
Speed setpoints can only be accepted after the brake opening time has expired. This is signaled using the "speed controller active" output signal.

The brake opening time should be selected so that after the "controller enable" is issued, the speed controller becomes active when the motor holding brake opens.
For all other settings, the control acts against the brake.

The following applies:
Brake opening time (MD 1061) $\geq$ Time required to open the holding brake

2.7   Controlling STOP / service brake via terminals
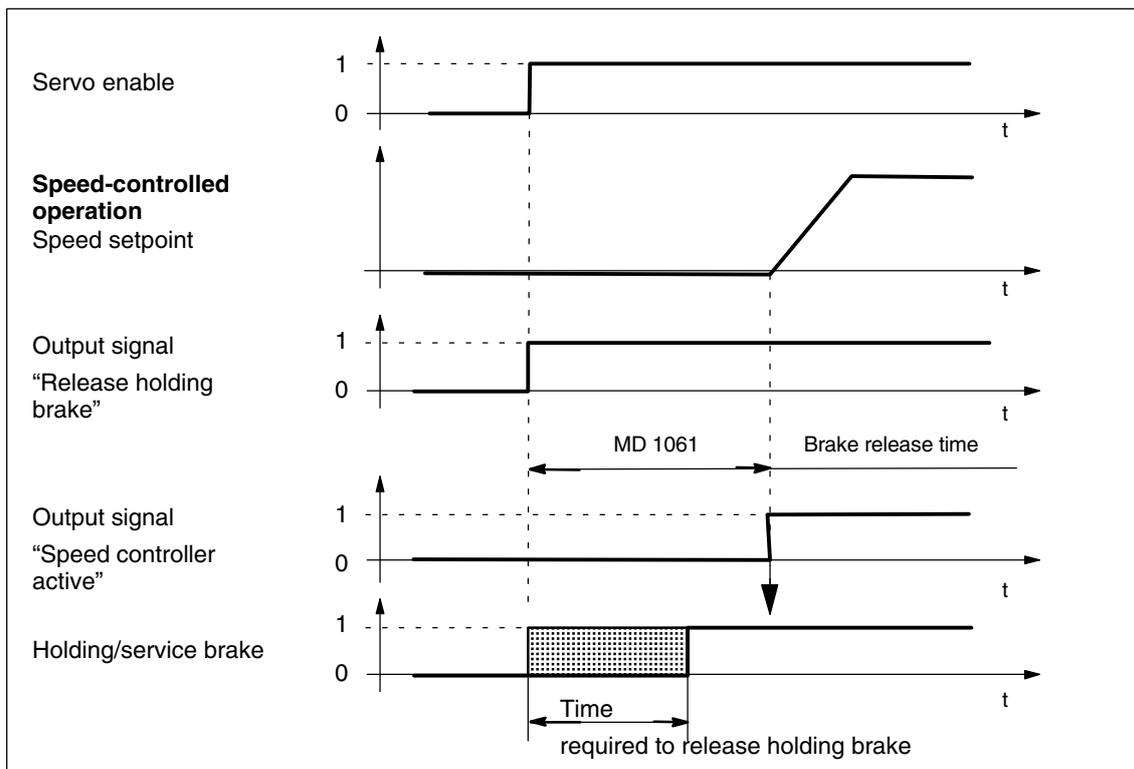
Fig. 2-9   Release brake: Response when "servo enable" is set

Close brake

The axis is actively braked when the "servo enable" is canceled. The deceleration time (MD 1063) starts, i.e., at nset = 0.

At $n = n_{\text{Close holding brake speed}}$ (MD 1062):

- The "Release holding brake" output signal is deleted.

  Note:
  The "Release holding brake" output signal is always deleted once the deceleration time (MD 1063) has expired.

The time required to close the holding/service brake should be set so that closed-loop control is only canceled once the brake has closed. This prevents a vertical axis slumping.
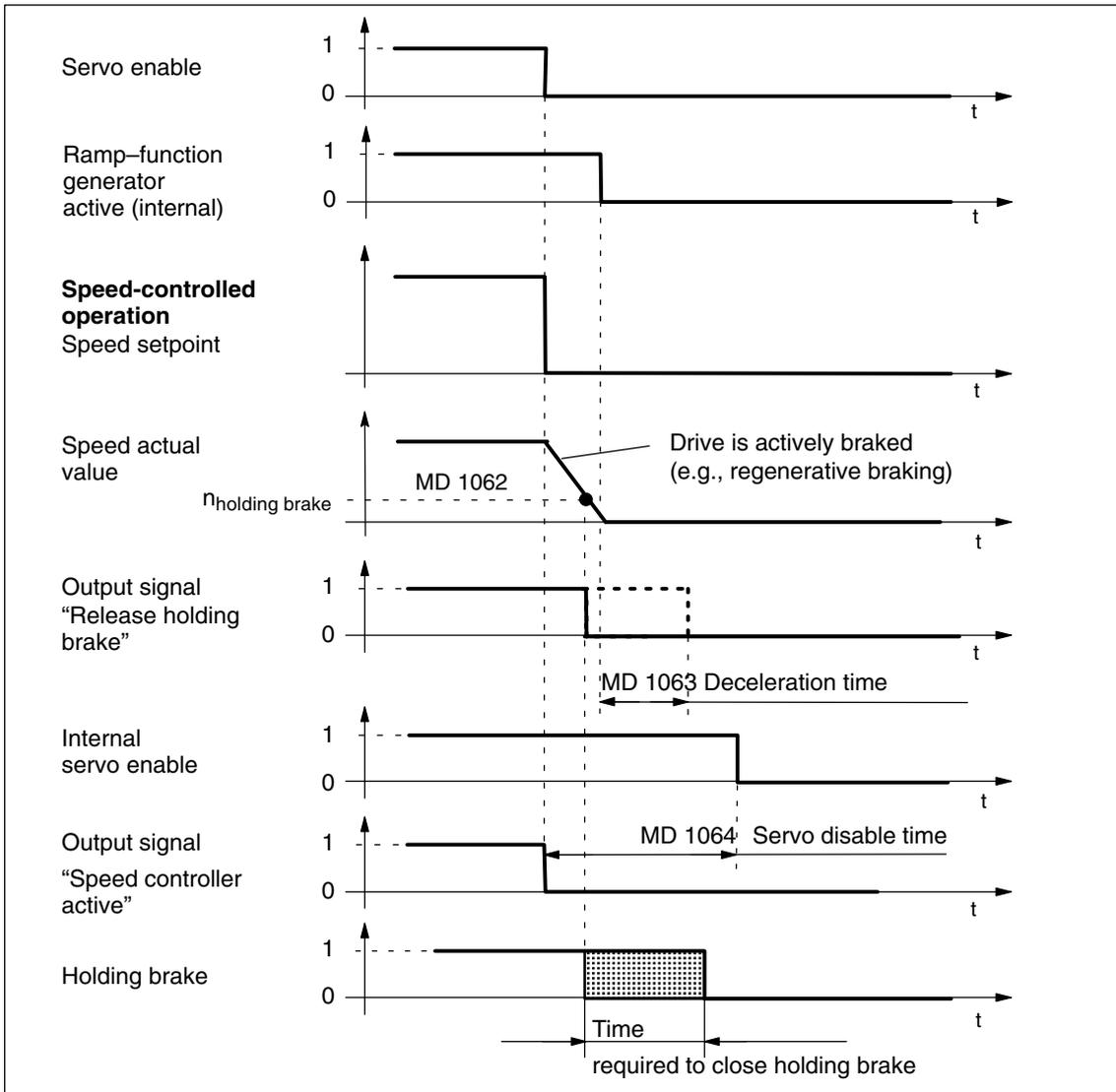
Fig. 2-10   Close brake: Response when servo enable is canceled

Close brake when pulse enable is canceled

When the pulse enable is canceled, the drive "coasts down" and the "Release holding brake" output signal is deleted.

Once the time required to close the brake has elapsed, the drive is braked by the holding/service brake.
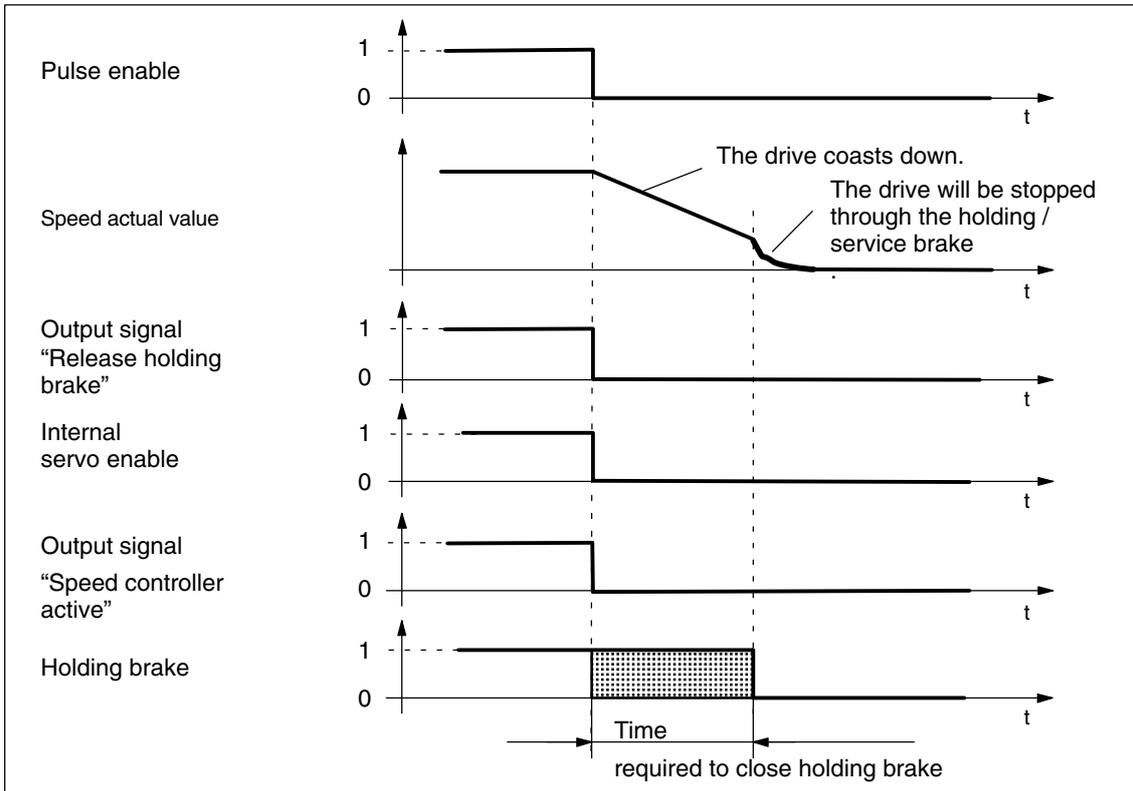
Fig. 2-11   Close brake: Response when pulse enable is canceled

Machine data

1060	MD_BREAK_ACTIVE				Cross reference: –	
	Activate brake control				Relevant to: FSD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 1	Data type: UNS.WORD	Active: Immediately	

With High Performance, High Standard, brake execution control is activated or deactivated on this axis using this MD.
1   Brake execution control is activated
0   Brake execution control is deactivated

Note

Pulse suppression cannot be controlled via MD 1403 (pulse-suppression creep speed) and MD 1404 (pulse-suppression timer) when the motor holding brake is active.

1061	MD_BREAK_OPEN_TIME				Cross reference: –	
	Brake release time				Relevant to: FSD/MSD/SLM	Protection level: 2/4
Unit:	Default: 600.0 MSD: 5,000.0	Minimum: 10.0	Maximum: 10,000.0	Data type: FLOAT	Active: Immediately	

Once the "servo enable" has been set, the setpoint is not applied until after this time has elapsed.

Speed control is already active internally with $n_{set} = 0$ during this time, in order to prevent any movement of the axis during the brake opening time.
Once this period has expired, speed control is active and setpoints can be transferred.

1062	MD_N_BREAK				Cross reference: –	
	Close speed holding brake SLM: Close motor speed holding brake				Related to: FSD/MSD/SLM	Protection level: 2/4
Unit:	Default: 500.0 SLM: 10.0	Minimum: 0.0	Maximum: 10,000.0	Data type: FLOAT	Active: Immediately	

2.7 Controlling STOP / service brake via terminals

1063	MD_BREAK_DELAY_TIME				Cross reference: –
	Deceleration time			Relevant to: FSD/MSD/SLM	Protection level: 2/4
Unit:	Default: 400.0 MSD: 5,000.0	Minimum: 10.0	Maximum: 60,0000.0	Data type: FLOAT	Active: Immediately

MD 1062 and 1063 provide the criterion for closing the motor holding brake. Once the "servo enable" has been canceled, the drive brakes at $n_{set} = 0$

If brake execution control is active, the "Release holding brake" output signal is reset if the following conditions are met:

- $|n_{act}|$ < Close speed holding brake (MD 1062) or

- Deceleration time (MD 1063) has expired

1064	MD_BREAK_LOCK_TIME				Cross reference: –
	Servo disable time			Relevant to: FSD/MSD/SLM	Protection level: 2/4
Unit:	Default: 600.0	Minimum: 10.0	Maximum: 10,000.0	Data type: FLOAT	Active: Immediately

If the "holding brake open" output signal is canceled, the drive is actively controlled with $n_{set} = 0$ (internal controller enable) for the duration of the servo disable time (MD 1064).
This allows the brake time to close, to prevent a suspended axis from sagging, for example. The pulses are then disabled.

2.7.1 Reduction of torque limit with regenerative braking (as from SW 6.7.5)

If reduction of the torque limit is activated with regenerative braking, it has an effect in the following cases:

- Safety Stop C (see Safety Integrated Description of Functions)
- Safety Stop B (see Safety Integrated Description of Functions)
- Regenerative stop
- Emergency retraction
- Generator operation

The reduction of the torque limit is automatically active if the "Electrical braking in case of encoder failure" function is used.

1096					Cross reference: –
	Activates/deactivates reduction of torque limit with regenerative braking			Relevant to: FSD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0 (deactivated)	Maximum: 3 (activated)	Data type: UNS.WORD	Active: Immediately

Bit 0: Reduction of torque limit with regenerative braking
    0 = Not active (exception: "Electrical braking in case of encoder failure")
    1 = Active

Reduction of the torque limit is always active with "Electrical braking in case of encoder failure", irrespective of MD 1096.

Bit 1: Monitoring speed controller at its limit when reducing torque
    0 = Active (exception: "Electrical braking in case of encoder failure")
    1 = Not active

Monitoring of the speed controller at its endstop is always inactive with "Electrical braking in case of encoder failure", irrespective of MD 1096.

Monitoring of the speed controller at its endstop can be disabled to prevent regenerative braking, which takes longer to complete due to the reduced torque, being aborted prematurely.

1097					Cross reference: −
	Factor for reducing torque limit with regenerative braking			Relevant to: FSD/MSD/SLM	Protection level: 2/4
Unit: %	Default: 80	Minimum: 0	Maximum: 100	Data type: SIGNED WORD	Active: Immediately

2.8 Electrical braking in case of encoder failure (available soon)

An electrical brake has been implemented for use in the event of an encoder failure for the FSD and SLM machine classes. If an encoder fails, deceleration is performed to the changeover speed/velocity stored in machine data MD 1466, without using encoder information. The pulses are then disabled and the motor costs down. If, at the instant that the encoder fails, the motor velocity is below the changeover speed/velocity defined in MD 1466, then the pulses are immediately disabled and the motor coasts down.

Braking sequence

If an encoder fails during operation and "Braking in case of an encoder failure" is activated via MD 1049 EMF_BREAK_ENABLE, braking is initiated via the following steps:

- First, the "pulse disable" fault reaction is suppressed.
- The speed-controller enable used to initiate braking is simultaneously withdrawn.
- The "pulse disable" is triggered once the changeover speed/velocity is undershot or the pulse-disable period has expired.

Note

Pulse-disable period MD 1404: PULSE_SUPRESSION_DELAY should be longer than the braking period and shutdown speed/velocity MD 1403: PULSE_SUPRESSION_SPEED should be lower than the changeover-speed/velocity value in MD 1466.

Deceleration is performed without an encoder until an internal threshold is reached. If the threshold in MD 1466 is set too low, alarm 300405 is output.

Note

The following criteria apply when using the "Braking in case of encoder failure" function:
Rotary machine: MD 1466 > 40000/MD 1114
Linear machine: MD 1466 > 1386/MD 1114

1049	EMF_BREAK_ENABLE				Cross reference: –
Activate braking in case of encoder failure				Related to: MSD/ SLM	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 1	Data type: UNS.WORD	Active: Power ON

Note

This braking can withdraw a large proportion of the kinetic energy from the system. This means that at the end the motor coasts down with a low amount of energy and, depending on the particular application and the motors selected, the machine OEM should provide additional protective measures.

2.9   Permanently excited spindle

2.9.1   Description

The permanently-excited spindle (PE-MSD) is a specially designed synchronous motor (similar to FSD motors) with high armature inductance.

Weakening the magnetic field of the permanently excited armature achieves high speeds for spindle operation (analogous to the field weakening in inductance motors).

The advantages of the PE-MSD are:

• Higher power density

• Virtually no rotor losses and, therefore, low thermal load on the entire motor construction
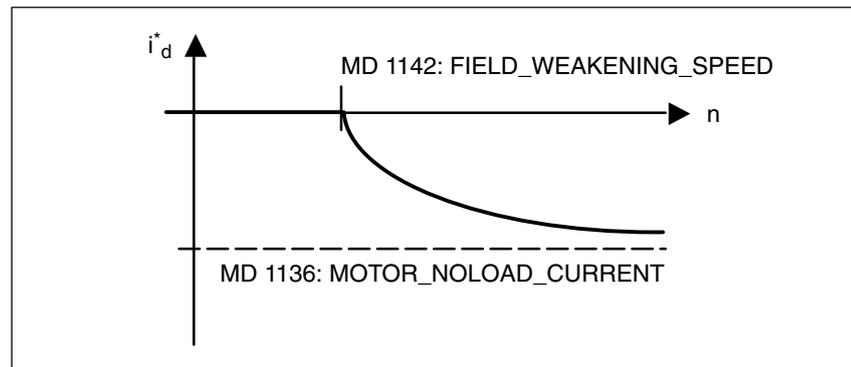
Fig. 2-12   Field weakening characteristic

2.9.2   PE-MSD with MSD power-section data (SW 6 and higher)

The PE-MSD is started up with drive type SRM (synchronous rotary motor).

When you select the power section, the FSD power-section data are initialized

• MD 1108 Thermal limit current for power section

• MD 1111 Rated current for power section

in addition to the following additional MSD power-section data for PE-MSD operation (MD 1015=1):

• MD 1175 (equivalent to MD 1108 for drive type ARM)

• MD 1176 (equivalent to MD 1109 for drive type ARM)

• MD 1177 (equivalent to MD 1111 for drive type ARM)

In PE-MSD operation (MD 1015=1), machine data MD 1175, MD 1176 and MD 1177 must contain valid values. If they do not, error message 301719: "Power section data incomplete" will appear.

These data are initialized on each new startup when you select the power section.

To enable PE-MSD operation (MD 1015=1) with the 120 A power section, this power section has been included in the FSD power-section selection with power-section code number 18H.

In FSD operation (MD 1015=0), drive alarm 301718 "Motor/power-section combination invalid" is output with this power section.

2.9.3   Control parameters

If the PE-MSD is enabled (MD 1015) and a motor is selected from the list, the following machine data are initialized when you run the "Calculate controller data" function:

- MD 1147: SPEED_LIMIT

- MD 1401: MOTOR_MAX_SPEED

- MD 1403: PULSE_SUPPRESSION_SPEED

- MD 1404: PULSE_SUPPRESSION_DELAY

- MD 1405: MOTOR_SPEED_LIMIT[n]

- MD 1606: SPEEDCTRL_LIMIT_THRESHOLD

- MD 1610: DIAGNOSIS_ACTIVATION_FLAGS

- MD 1612: ALARM_REACTION_POWER_ON

- MD 1613: ALARM_REACTION_RESET

2.9.4   Encoder

Encoder types

The following types of encoder can be used:

- Incremental encoders

- Absolute encoder (e.g., EQN 1325)

- Toothed wheel encoder

Rotor position synchronization

- Encoders must have a C/D track.
  The rotor position is synchronized after ramp-up.

- For encoders that have no C/D track (e.g., gear encoder), rotor/pole position identification must be activated.

  References: /DG1/, Rotor/Pole Position Identification

2.9.5   Machine data

1015	PEMSD_MODE_ENABLE only			840D	Cross reference: –
	Activate PE-MSD			Relevant to: FDD/MSD	Protection level: 2/4
Unit: –	Default: 0.0	Minimum: 0.0	Maximum: 1.0	Data type: UNS.WORD	Active: Power ON

Bit 0	PE-MSD function	0: Function inactive 1: Function active

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Note

Field-weaking operation can be activated with MD 1015 when using synchronous motors.

1142	FIELD_WEAKENING_SPEED				Cross reference: –
	Threshold speed field weakening			Relevant to: FDD/MSD	Protection level: 2/4
Unit: rpm 810D 840D	Default: 0.0 0.0	Minimum: 0.0 0.0	Maximum: 50,000.0 100,000.0	Data type: FLOAT	Active: Immediately

The speed at the start of field weakening is assigned when selecting the motor from the motor list, or according to the motor manufacturer's data sheet.

If the motor manufacturer has made no specifications regarding the speed at the start of field weakening, it can be calculated according to the following formula:

MD 1142 = 380 V $\times$ 1000 [rpm] / MD 1114

MD 1114: EMF_VOLTAGE

■

Notes

Supplementary Conditions   **3**

None

Data Descriptions   **4**

See Section 2

Signal Descriptions   **5**

None

Example   **6**

None

Notes

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Data Fields, Lists

7

7.1   AM mode

Table 7-1   Machine data

No.	Identifier	Name	Drive
1451	SPEEDCTRL_GAIN_1_AM	P gain, AM speed controller	FDD/MSD
1453	SPDCTRL_INTEGR_1_AM	Integral action time, AM speed controller	FDD/MSD
1458	DES_CURRENT_OPEN_LOOP_AM	Current setpoint open–loop controlled mode, AM	FDD/MSD
1459	TORQUE_SMOOTH_TIME_AM	Torque smoothing time constant, AM	FDD/MSD
1465	SWTICH_SPEED_MSD_AM	Changeover speed, MSD/AM	FDD/MSD
1466	SWITCH_SPD_OPEN_LOOP_AM	Changeover speed, control system AM	FDD/MSD

7.2   V/f operation

Table 7-2   Machine data

No.	Identifier	Name	Drive
1014	UF_MODE_ENABLE	Activating V/f operation	FDD/MSD
1125	UF_MODE_RAMP_TIME_1	Ramp–up time 1 for V/f operation	FDD/MSD
1126	UF_MODE_RAMP_TIME_1	Ramp–up time 2 for V/f operation	FDD/MSD
1127	UF_VOLTAGE_AT_F0	Voltage at f=0 V/f operation	FDD/MSD
1650	DIAGNOSIS_CONTROL_FLAGS	Diagnostic control	FDD/MSD
1660	UF_MODE_FREQUENCY	Motor frequency, V/f operation	FDD/MSD
1661	UF_MODE_RATIO	V/f ratio for V/f operation	FDD/MSD
1662	UF_MODE_DELTA_FREQUENCY	Change to motor frequency, V/f operation	FDD/MSD

7.3 Motor changeover

Table 7-3 Machine data

No.	Identifier	Name	Drive
1013	ENABLE_STAR_DELTA	Enable star/delta changeover	FDD/MSD
1247	MOTOR_SWITCH_SPEED1	Speed threshold motor changeover 1	FDD/MSD
1248	MOTOR_SWITCH_SPEED2	Speed threshold motor changeover 2	FDD/MSD

7.4 Emergency retraction

Note

The CCU3 does not support the "emergency retraction" function!

Table 7-4 Machine data

No.	Identifier	Name	Drive
1631	LINK_VOLTAGE_GEN_ON	Response voltage, generator axis	FDD/MSD
1632	LINK_VOLTAGE_GEN_HYST	Voltage range for generator control	FDD/MSD
1633	LINK_VOLTAGE_GEN_OFF	Shutdown threshold for generator operation	FDD/MSD
1634	LINK_VOLTAGE_RETRACT	Response threshold, emergency retraction	FDD/MSD
1635	GEN_AXIS_MIN_SPEED	Minimum speed, generator axis	FDD/MSD
1636	RETRACT_AND_GENERATOR_MODE	Drive modes, emergency retraction	FDD/MSD
1637	GEN_STOP_DELAY	Delay, regenerative braking	FDD/MSD
1638	RETRACT_TIME	Emergency retraction time	FDD/MSD
1639	RETRACT_SPEED	Emergency retraction speed	FDD/MSD

■

SIMODRIVE 611D/SINUMERIK 840D/810D Drive Functions

Enables (DF1)

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Notes

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Brief Description

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Mains supply module terminals

1. Terminal 48 (contactor control)

2. Terminal 63 (pulse enable)

3. Terminal 64 (drive enable)

4. Terminal 112 (setup mode/normal operation)

5. Terminals NS1 and NS2 (coil contact, mains precharging contactor and mains contactor)

Terminals on SINUMERIK 810D (CCU)

1. Terminal 663 (pulse enable)

2. Terminal AS1/terminal AS2 (signaling contact (NC contact) of the pulse enable)

3. Terminal 19 (reference potential 0 V)

4. Terminal 9 (enable voltage +24 V)

5. BERO

Terminals, 611D closed-loop control modules

1. Terminal 663 (pulse enable)

2. Terminal AS1/terminal AS2 (signaling contact (NC contact) of the pulse enable)

3. Terminal 19 (reference potential 0 V)

4. Terminal 9 (enable voltage +24 V)

5. BERO 1

6. BERO 2 (2-axis module)

Enable signals from the NC

- Servo enable, drive

Enable signals from the PLC

1. Pulse enable (DB31, ... DBX21.7)

2. Servo enable (DB31, ... DBX2.1)

■

Notes

Detailed Description

2

2.1   **Mains supply module terminals**

Terminal 48   Contactor actuation
The enable voltage is +24 V (terminal 9). Terminal 48 has highest priority; a defined power-up and power-down sequence is initiated via terminal 48. If terminal 48 is used, terminals 63 and 64 can be directly connected to terminal 9. If the supply voltage is present and terminal 48 enabled, the precharging contactor closes internally, and the DC link is precharged via NTC resistors. When the DC link voltages reach a specific value, the precharging contactor is switched off, and after several milliseconds, the main contactor is switched on. If terminal 63 is controlled, the DC-link voltage is controlled to 600 V, otherwise the DC-link voltage assumes the value of the rectified supply voltage (for 400 V AC => 565 V DC). If the power-supply module is isolated from the supply, e.g., through a main switch, terminal 48 must activated approximately 10 ms beforehand. The pulses are immediately disabled at the step-up controller of the power-supply module, and the internal line contactor drops out. When terminal 48 is deactivated, the pulses are immediately suppressed for all of the drives connected to the drive bus. The status can be checked in the **Service Drive** service display ("Pulse enable (terminal 63/48)" line).

Terminal 63   Pulse enable
The enable voltage is +24 V (terminal 9). Terminal 63 has the highest priority for enabling the pulses for all of the connected power sections (mains step-up controller, drives). When the pulse enable is canceled, the drives coast down without deceleration, and the DC-link voltage drops to the rectified supply-voltage value (for 400 V AC => 565 V DC) as the step-up controller is inhibited. The status can be checked in the **Service Drive** service display ("Pulse enable (terminal 63/48)" and "Pulse enable (terminal 64/63)" line).

Terminal 64   Drive enable
The enable voltage is +24 V (terminal 9). The enable acts simultaneously on all power sections without a delay. When the drive enable signal is canceled, all of the drives decelerate with speed setpoint = 0 along their torque limit. The power section pulses are inhibited after a timer has expired, or if a speed threshold is undershot (see MD 1605 and MD 1606 FB /DÜ1/ Monitoring functions, limits). The status can be checked in the **Service Drive** service display ("Pulse enable (terminal 64/63)" line).

2.1 Mains supply module terminals

Terminal 112

Setup mode/normal mode
The enable voltage is +24 V (terminal 9). Under normal operating conditions, terminal 112 is permanently connected to terminal 9. The step-up controller is disabled when the enable (setup mode) is canceled. The drives are operated with limited speed and torque setpoints (MD 1420 and MD 1239). The status can be checked in the **Service Drive** service display ("Setup mode" line).

**Terminals
NS1 and NS2**

Coil contact, mains precharging contactor and mains contactor
The internal contactors are controlled via terminals NS1, NS2. The NS1, NS2 connection must be present before terminal 48 is controlled, otherwise the DC link is not loaded.
The connection may be broken when terminal 48 is canceled. Using this connection, a power-on interlock can be configured after an EMERGENCY STOP has been initiated.

2.2 Terminals, SINUMERIK 810D (CCU)/611D control

Terminal 663

Pulse enable
The enable voltage is +24 V (terminal 9). The enable signal is instantaneous and acts simultaneously on the 3 internal drives, as well as the 3 possible external axis extensions. When the pulse enable is canceled, the drives immediately coast down without deceleration. The status can be checked in the **Service Drive** service display ("Pulse enable (terminal 663)" line).

**Terminal AS1/
terminal AS2**

Signaling contact (NC contact) of the pulse enable. If the contact is closed, the power transistor triggering pulses are inhibited.

Terminal 19

Reference potential 0 V
Terminal 19 is the reference potential (0 V) for the enable voltage (terminal 9) and thus for all enable terminals. If the enable signals are to be controlled from an external voltage source, the reference potential (ground) of the external source must be connected to terminal 19.

Terminal 9

Enable voltage +24 V
The enable voltage is +24 V for terminal 19.

BERO 1

The input voltage is +24 V. The BERO input serves as an external zero mark for the encoder. The BERO can be evaluated by all of the connected drives (1-axis closed-loop control module).

BERO 2

The input voltage is +24 V. The BERO input serves as an external zero mark for the encoder. The BERO can be evaluated by all of the connected drives (2-axis closed-loop control module).

2.3 Enable signals from the NC

Servo enable, drive

The NC must output a drive enable signal to the drive. If the NC cancels the drive enable signal, the appropriate drive decelerates with speed setpoint = 0 along its selected torque limit. The power-section pulses are inhibited after a timer has expired or if a speed threshold is undershot (see MD 1605 and MD 1606 FB/DÜ1/Monitoring Functions, Limits).
The drive servo enable can be disabled by the NC in the case of a fault or if "Servo enable" IS DB 31, ... DBX2.1 is missing.

2.4 Enable signals from the PLC

Pulse enable

The pulse enable of each individual drive is enabled using the "Pulse enable" IS DB 31, ... DBX 21.7.

If the pulses are enabled, the drive acknowledges this with the "Pulses enabled" IS DB 31, ... DBX 93.7, if all necessary terminals (48/63/64/663) are enabled.

The status can be checked in the **Service Drive** service display ("Pulse enable PLC" line).

Servo enable

The "Servo enable" IS DB 31, ... DBX 2.1 affects the NC, which then sets or deletes the drive servo enable (drive enable), taking other conditions into account (no errors, position measuring system is selected).

The status can be checked in the **Service Drive** service display ("Speed controller enable NC" line).

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Supplementary Conditions 3

None

Data Descriptions 4

None

Signal Descriptions 5

None

Example 6

None

Data Fields, Lists 7

None

Notes

SIMODRIVE 611D/SINUMERIK 840D/810D Drive Functions

Encoder Parameterization (DG1)

■

Notes

Brief Description

1

**Encoder
configuration**

The encoder configuration parameters of the motor measuring system are transferred to the drive and stored in the corresponding machine data when the operator selects **Motor selection**. The motor-measuring-system connection is permanently assigned.

References   /PHG/ 810D Planning Guide

References   /IAD/ 840D Installation & Startup Guide

For the direct position measuring system, the drive machine data only have to be changed if an absolute-value encoder is used:

MD 1030: ACTUAL_VALUE_CONFIG_DIRECT

- Bit 3 = 0 incremental measuring system

- Bit 3 = 1 absolute measuring system

- Bit 4 = 1 linear measuring system

- Bit 4 = 0 rotary measuring system

The actual position-measuring-system parameterization is set in the axis-specific machine data.

■

Notes

Detailed Description

2

2.1   Motor measuring system

1005	ENC_RESOL_MOTOR					Cross reference: –
	No. of encoder pulses, motor measuring system				Related to: FDD/MSD	Protection level: 2/4
Unit: – 810D 840D	Default: 2 048.0 2 048.0	Minimum: 1 1	Maximum: 8,192 65,535		Data type: UNS. WORD	Active: POWER ON

Enter the encoder increments per motor revolution of the motor measuring system.
The machine data is parameterized via "Select motor".

Note

The actual-value assignment of the motor measuring system for FSD/MSD must be the same as the drive configuration (axis-specific MD31020 [0]: ENC_RESOL).

1008	ENC_PHASE_ERROR_CORRECTION					Cross reference: –
	Encoder phase error compensation				Relevant: FSD/MSD	Protection level: 2/4
Unit: Degrees	Default: 0.0	Minimum: –20.0	Maximum: 20.0		Data type: FLOAT	Active: Immediately

The phase error of the motor measuring system is compensated using this machine data. For raw signal encoders (e.g., ERN 1387), phase errors can occur between tracks A and B. They are manifest by a rougher speed actual value, i.e., in the event of an error, twice the encoder mark frequency is superimposed on the actual value. On gear encoders in particular, phase errors can occur, which affect closed-loop control quality.

Adjustment

n_{set} = 30 1/min input
Monitor n_{act} on oscilloscope (via DAC). The ripple is reduced by varying the correction angle. Find the minimum by trial and error.

2.1 Motor measuring system

Note

This machine data is activated using bit 1 of machine data
MD 1011: ACTUAL_VALUE_CONFIG.

1011	ACTUAL_VALUE_CONFIG				Cross reference: –
	Configuration, actual-value sensing, motor measuring system			Related to: FDD/MSD	Protection level: 2/4
Unit: Hex	Default: 0.0	Minimum: 0.0	Maximum: FFFF	Data type: UNS.WORD	Active: POWER ON

Enter the configuration for the motor measuring system.
The machine data is parameterized via "Select motor".

Table 2-1   Configuration, actual-value sensing, motor measuring system

Bit no.	Meaning	Note
Bit 0	Adjustment of direction of rotation Sign of actual speed value	0 = Positive motor direction (clockwise) 1 = Negative motor direction (counterclockwise)
Bit 1	Phase error compensation	0 = Not active 1 = Active
Bit 2		Reserved
Bit 3	Encoder type	0 = Incremental encoder 1 = Absolute encoder with EnDat/SSI interface
Bit 4	Linear measuring system	0 = Shaft encoder 1 = Linear encoder as motor measuring system
Bit 5, 840D only	Motor measuring system	0 = Available 1 = Not available
Bit 6	C/D track electrical revolution	0 = C/D track (mechanical revolution) 1 = Hall sensors (electrical revolution)
Bit 7	Distance-coded reference scale	0: No distance-coded measuring system 1: Distance-coded measuring system
Bit 8	Zero mark selection by NC	0 = No selection from NC 1 = Selection from NC, the drive does not sharpen fine synchronization during ramp-up or following a parking axis. The NC must activate fine synchronization during referencing.
Bit 9		not assigned
Bit 10	0: Automatic rotor position identification switched off 1: Automatic rotor position identification switched on	
Bit 11		not assigned
Bit 12	Identify coarse position see FB, Drive Functions, DM1, Section 2.3.	0 = Not active 1 = Coarse synchronization via C/D track or Hall sensors is replaced by rotor/pole position identification.

Table 2-1   Configuration, actual-value sensing, motor measuring system

Bit no.	Meaning	Note
Bit 13	Identify fine position See FB, Drive Functions, DM1, Section 2.3.	0 = Not active 1 = Coarse and fine synchronization are replaced by rotor/pole position identification regardless of bit 12.
Bit 14, 15	Data transmission rate, EnDat	00 = 100 kHz (default) 01 = 500 kHz 10 = 1 MHz 11 = 2 MHz With rotating encoders, the MD 1005 value is compared with the resolution read from the EnDat encoder and, in the event of a deviation, alarm 300799 "Save boot" is output. With EnDat linear scales, the read graduation value is written directly to MD 1024 and MD 1005.

Note

The configuration is set in the startup tool (HMI Advanced) in the "Measuring-system data" display.

1016	COMMUTATION_ANGLE_OFFSET			840D only	Cross reference: –
	Commutation angle offset			Relevant: FSD	Protection level: 2/4
Unit: Degrees	Default: 0.0	Minimum: −360.0	Maximum: 360.0	Data type: FLOAT	Active: POWER ON

For more information see Function Description, Linear Motor

1017	STARTUP_ASSISTANCE			840D only	Cross reference: –
	Assistance for startup			Relevant: FSD	Protection level: 2/4
Unit: –	Default: 0.0	Minimum: −1.0	Maximum: 1.0	Data type: WORD	Active: Immediately

For more information see MD 1025

2.1 Motor measuring system

Values	Meaning
0	Default setting
1	Determine the commutation offset angle For linear synchronous motors with EnDat linear scales, a rotor/pole position identification is always performed initially if this has not already been done. Whether this is necessary is determined on the basis of the stored serial number of the linear scale; MD 1017 is then set to 1.
−1	If 1FN3 motors are connected, alarm 300604 "Motor encoder is not calibrated" may be output. Whenever this error is signaled, you must calibrate any connected 1FN3 motors manually and then set MD 1017 to "−1" to store the serial numbers.

Further notes:

Value 1 is only initialized for 1FN1 if the measuring-system serial numbers do not match MD 1025, i.e., not if an identification procedure has yet to be performed.

Once the rough position identification procedure has been performed, value 1 can be set to determine the commutation angle offset for fine synchronization under **Supplementary conditions** even for 1FN3.

With value −1, the serial number can be read out when alarm 300604 is active; the commutation angle offset MD 1016 **must** be determined by measurement.

1021	ENC_ABS_TURNS_MOTOR				Cross reference: –
	Multiturn resolution, absolute encoder, motor			Relevant: FSD/MSD	Protection level: 2/4
Unit:	Default: 4,096	Minimum: 0.0	Maximum: 65,535	Data type: UNS.WORD	Active: POWER ON

Number of displayable revolutions of absolute-value encoder in motor measuring system. The value is read-only.

1022	ENC_ABS_RESOL_MOTOR				Cross reference: –
	Measuring steps of absolute track in motor			Relevant: FSD/MSD	Protection level: 2/4
Unit:[1)] – 810D 840D	Default: 8,192 8,192	Minimum: 512 0	Maximum: 65,535 2,147,483,647	Data type: UNS.WORD	Active: POWER ON

1) Resolution of motor absolute-value encoder
   Rotary: Measuring pulses per revolution
   Linear: nm

1023	ENC_ABS_DIAGNOSIS_MOTOR				Cross reference: –
Measuring circuit motor absolute track, diagnostics				Relevant: FSD/MSD	Protection level: 2/4
Unit: – 810D 840D	Default: 0.0 0.0	Minimum: 0.0 0.0	Maximum: 65,535 49,151	Data type: UNS.WORD	Active: POWER ON

Diagnostic bits of the absolute-value encoder, motor measuring system:

Table 2-2   Diagnostic bits, absolute value encoder

Bit no.	Meaning	Note
Bit 0	Lighting failed	
Bit 1	Signal amplitude too small	
Bit 2	Position value incorrect	
Bit 3	Overvoltage	
Bit 4	Undervoltage	
Bit 5	Overcurrent	
Bit 6	Battery change necessary	
Bit 7	Checksum error	SW 4.2 and higher, synchronous linear motor As of SW 6.1 If bit 7 and bit 13 are set, the "Encoder tracks do not match" state has been detected (encoder defective).
Bit 8	EnDat encoder: Incorrect overlap	SW 4.2 and higher, synchronous linear motor
Bit 9	C/D track error on encoder ERN1387 or EQN encoder connected or incorrectly configured (not on EQN, MD 1011)	
Bit 10	Log cannot be aborted or old hardware	
Bit 11	SSI level detected on data line or no encoder connected or incorrect encoder cable (ERN instead of EQN)	
Bit 12	Timeout while reading measuring value	
Bit 13	CRC error	If bit 7 and bit 13 are set, the "Encoder tracks do not match" state has been detected (encoder defective).
Bit 14	Incorrect IPU submodule for direct measuring signal Encoder signals alarm	Only for 611D expansion
Bit 15	Encoder faulty	

Note

In the event of inversion when ERN 1387 (previous incremental system) and
EQN 1325 (absolute value system) are parameterized or connected, this is
acknowledged by the system aborting measured-value acquisition. The
following incorrect combinations are possible:

- ERN 1387 present, EQN 1325 parameterized:
  Program abort via detection of missing EnDat interface with ERN 1387
  (MD 1023 bit 11 or bit 12 set)

- 810D/FSD only:
  EQN 1325 present, ERN 1387 parameterized:
  Program abort via detection of missing C/D tracks for EQN 1325 (MD 1023,
  bit 9 set)

1025	SERIAL_NO_ENCODER			840D only	Cross reference: –
	Serial number of motor measuring system			Related to: FSD/MSD ROT/LIN	Protection level: 1/1
Unit: –	Default: 0.0	Minimum: 0.0	Maximum: 2,147,483,647	Data type: UNS. DWORD	Active: POWER ON

The serial number of the indirect, absolute measuring system is read from the
encoder in desired state 3 at boot and entered in MD 1025. (Exception: Linear
encoder.) If an incremental measuring system is provided, 0 will be entered in
MD 1025. This encoder ID notifies the NC if the encoder has been replaced
and, if it has been replaced, the NC resets the calibration identifier.

With linear encoders, the serial number of the encoder is compared with the
number entered in MD 1025, as previously during ramp-up. In the event of non-
compliance, rotor/pole position identification is initiated and 0 is entered in
MD 1025. Only after successful rotor/pole position identification in ramp-up con-
dition 5, the encoder serial number is entered in MD 1025, and "Save boot file"
is initiated. Alarm 300604 "Motor encoder is not calibrated" indicates an excep-
tional circumstance,
i.e., that the serial number of an EnDat motor measuring system does not tally
with the stored serial number, in other words, the EnDat encoder has never op-
erated with this particular drive.

Remedy for 1FN3 linear motors:
Measure the rotor position offset in relation to the electromotive force of the U-R
phase and add the value to MD 1016: MD_COMMUTATION_ANGLE_OFFSET
(commutation angle offset). Then set
MD 1017: STARTUP_ASSISTANCE to "-1" in order to save the serial number of
the EnDat encoder. Then save the boot files and reset the NCK.

To determine the commutation angle offset in MD 1016, start rotor/pole position
identification by setting MD 1017 to 1. The identification run will start as soon as
you acknowledge the alarm.

1703	LEAD_TIME_MOTOR_ENC				Cross reference: –
	Lead time for conversion, motor measuring system			Relev.: FSD/MSD	Protect. level: 2/4
Unit: μs 810D 840D	Default: 0.0 0.0	Minimum: 0.0 0.0	Maximum: 32,767 65,535	Data type: UNS.WORD	Active: Immediately

The machine data is used to display and provide diagnosis for the lead time for the motor-measuring-system converter. The lead time for the converter is required if the converter times exceed the ASIC clock cycle time. This machine data is only valid for indirect measuring systems.

1790	ENC_TYPE_MOTOR				Cross reference: –
	Measuring-circuit type of indirect measuring system			Relev.: FSD/MSD	Prot. level: 2/4
Unit: – 810D 840D	Default: 0.0 0.0	Minimum: 0.0 −1.0	Maximum: 32,767 32,767	Data type: WORD	Active: Immediately

This machine data indicates the measuring-circuit code number of the **indirect** measuring system (motor).

Table 2-3   Measuring-circuit type of indirect measuring system

0	IPU (V) unconditioned voltage signals
1–15	Reserved
16	EnDat encoder

A detailed description of the two machine data below can be found in Chapter DM1/2 2.5.3.

1055	MARKER_DIST			840D only	Cross reference: –
	Reference-mark distance with a distance-coded measuring system			Related to: FSD/LIM	Protection level: 2/4
Unit: Rot: Degrees Lin: mm	Default: 20 20	Minimum: 0 0	Maximum: 90 1,000	Data type: FLOAT	Effective: Power ON

Drive machine data MD 1055 corresponds to the NC machine data MD 34300: ENC_REFP_MARKER_DIST.
MD 1055 is motor-side, MD 34300 is load-side.

1056	MARKER_DIST_DIFF			840D only	Cross reference: –
	Distance difference			Related to: FSD/LIM	Protection level: 2/4
Unit: Rot: Degrees Lin: mm	Default: 0,02 0,02	Minimum: 0 0	Maximum: 45 500	Data type: FLOAT	Effective: Power ON

2.2 Direct position measuring system

1007	ENC_RESOL_DIRECT				Cross reference: –
No. of encoder pulses, direct measuring system				Relevant: FSD/MSD	Protection level: 2/4
Unit: –	Default:	Minimum:	Maximum:	Data type:	Active: POWER ON
810D	0.0	0.0	65,535	UNS.WORD	
840D	0.0	0.0	2,147,483,647	UNS.DWORD	

Enter the encoder increments per revolution for a direct linear or rotary measuring system.

MD 1034 is read from the encoder for synchronous machines with a linear En-Dat encoder as a direct measuring system.
MD 1034 is preset to 0 for synchronous machines with a rotary EnDat encoder as a direct measuring system.

Note

On an EnDat encoder, MD 1007, MD 1031 and MD 1032 are read from the encoder.

1030	ACTUAL_VALUE_CONFIG_DIRECT				Cross reference: –
Configuration, actual-value sensing, direct measuring system				Relevant: FSD/MSD	Protection level: 2/4
Unit: Hex	Default:	Minimum:	Maximum:	Data type: UNS.WORD	Active: POWER ON
810D	0.0	0.0	FFFF		
840D	0.0	0.0	c018		

Enter the configuration of the actual-value function related to the SIMODRIVE system 611D, direct measuring system.

Table 2-4   Configuration, actual-value sensing, direct measuring system

Bit no.	Meaning	Note
Bits 0 – 2		Reserved
Bit 3	Encoder type	0 = Incremental encoder 1 = Absolute encoder with EnDat/SSI interface
Bit 4	Type of measuring system	0 = Rotary measuring system 1 = Linear measuring system

Table 2-4   Configuration, actual-value sensing, direct measuring system

Bit no.	Meaning	Note
Bits 5–13		not assigned
Bit 14 Bit 15 As of SW 4.2	Data transmission rate, EnDat	00 = 100 kHz (default) 01 = 500 kHz 10 = 1 MHz 11 = 2 MHz • With rotating encoders, the MD 1005 value is compared with the resolution read from the EnDat encoder and, in the event of a deviation, alarm 300799 "Save boot" is output. • With EnDat linear scales, the read graduation value is written directly to MD 1005.

1031	ENC_ABS_TURNS_DIRECT					Cross reference: –
	Multiturn resolution, absolute encoder, motor				Relevant: FSD/MSD	Protection level: 2/4
Unit: U 810D 840D	Default: 4,096.0 4,096.0	Minimum: 0.0 0.0	Maximum: 65,535.0 65,535.0		Data type: UNS.WORD	Active: POWER ON

Number of revolutions of the absolute-value encoder, direct measuring system, which can be represented. The value is read-only.

1032	ENC_ABS_RESOL_DIRECT					Cross reference: –
	Measuring steps of absolute track in motor				Relevant: FSD/MSD	Protection level: 2/4
Unit:[1] – 810D 840D	Default: 8,192 8,192	Minimum: 0 0	Maximum: 65,535 2,147,483,647		Data type: UNS.WORD	Active: POWER ON

1) Resolution of motor absolute-value encoder
    Rotary: Measuring pulses per revolution.
    Linear: nm

1033	ENC_ABS_DIAGNOSIS_DIRECT					Cross reference: –
	Direct measuring circuit absolute track, diagnostics				Relevant: FSD/MSD	Protection level: 2/4
Unit: – 810D 840D	Default: 0.0 0.0	Minimum: 0.0 0.0	Maximum: 65,535 64,767		Data type: UNS.WORD	Active: Immediately

2.2 Direct position measuring system

Table 2-5   Diagnostics bits, direct measuring circuit

Bit no.	Meaning	Note
Bit 0	Lighting failed	
Bit 1	Signal amplitude too small	
Bit 2	Position value incorrect	
Bit 3	Overvoltage	
Bit 4	Undervoltage	
Bit 5	Overcurrent	
Bit 6	Battery change necessary	
Bit 7	Checksum error	SW 4.2 and higher, synchronous linear motor As of SW 6.1 If bit 7 and bit 13 are set, the "Encoder tracks do not match" state has been detected (encoder defective).
Bit 8	EnDat encoder: Incorrect overlap	SW 4.2 and higher, synchronous linear motor
Bit 9	C/D track error on encoder ERN1387 or EQN encoder connected or incorrectly configured (not on EQN, MD 1011)	
Bit 10	Log cannot be aborted or old hardware	
Bit 11	SSI level detected on data line or no encoder connected or incorrect encoder cable (ERN instead of EQN)	
Bit 12	Timeout while reading measuring value	If bit 12 **and** bit 15 are set, the "Zero-level monitoring SSI" error is triggered.
Bit 13	CRC error	If bit 7 and bit 13 are set, the "Encoder tracks do not match" state has been detected (encoder defective).
Bit 14	Incorrect IPU submodule for direct measuring signal Encoder signals alarm	Only for 611D expansion If bit 14 **and** bit 15 are set, the "Idle-level monitoring SSI" error is triggered.
Bit 15	Encoder faulty	If bit 12 **and** bit 15 are set, the "Zero-level monitoring SSI" error is triggered. If bit 14 **and** bit 15 are set, the "Idle-level monitoring SSI" error is triggered.

1038	SERIAL_NO_ENCODER_DM			840D only	Cross reference: –
	Serial number of direct measuring system			Relevant: FSD/MSD/ ROT/LIN	Protection level: 1/1
Unit: –	Default: 0	Minimum: 0	Maximum: 2,147,483,647	Data type: UNS.DWORD	Active: POWER ON

The serial number of the direct absolute measuring system is read from the encoder when ramping up to desired state 3 and entered in MD 1038. If an incremental measuring system is provided, 0 will be entered in MD 1038.

1704	LEAD_TIME_DIRECT_ENC				Cross reference: –
Lead time, conversion, direct meas. system				Relevant: FSD/MSD	Protection level: 2/4
Unit: µs 810D 840D	Default: 0.0 0.0	Minimum: 0.0 0.0	Maximum: 32,767 65,535	Data type: UNS.WORD	Active: Immediately

This machine data is used to display and diagnose the lead time for the converter for the direct measuring system. The lead time for the converter is required if the converter times exceed the ASIC clock cycle time. This machine data is only valid for direct measuring systems.

1791	ENC_TYPE_DIRECT				Cross reference: –
Measuring-circuit type of direct measuring system				Relevant: FSD/MSD	Protection level: 2/4
Unit: —- 810D 840D	Default: 0.0 0.0	Minimum: 0.0 −1.0	Maximum: 32,767 32,767	Data type: WORD	Active: Immediately

This machine data indicates the measuring-circuit code number of the **direct** measuring system, if connected.

Table 2-6   Measuring-circuit type of direct measuring system

−1	No measuring system installed
0	IPU (V) unconditioned voltage signals
1	IPU (C) raw current signals (feed drives)
2–15	Reserved
16	EnDat encoder
48	SSI encoder

2.3   SSI encoder

**611D software
version
5.01.06 and higher**

1027	**ENC_CONFIG**		**840D only**	**Cross reference: –**
	Configuration encoder IM		Relevant: FSD/MSD	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: FFFF	Data type: UNS.WORD	Active: POWER ON

Bit	Value	Meaning
9		Reserved
10	0	SSI encoder, measured-value code Gray code
	1	Dual code (= binary code)
11	0	SSI encoder Right-justified
	1	Fir tree profile
12	0	SSI encoder, parity active No
	1	Yes
13	0	SSI encoder Odd parity
	1	Even parity
14	0	SSI encoder Without alarm bit
	1	With alarm bit
15	0	SSI encoder No SSI encoder installed
	1	SSI encoder installed

1028	**NO_TRANSMISSION_BITS**		**840D only**	**Cross reference: –**
	IM message frame length SSI		Relevant: FSD/MSD	Protection level: 2/4
Unit: –	Default: 25	Minimum: 0	Maximum: 25	Data type: UNS.WORD	Active: POWER ON

The length defines the total transferred message length including all parity or alarm bits. If, for example, "24 bits plus 1 alarm bit" is specified, then 25 must be entered here. Every encoder manufacturer has his own name for the alarm bit. Some call it, for example, the "Power Failure Bit".

1037	ENC_CONFIG_DIRECT			840D only	Cross reference: –
Configuration encoder DM				Relevant: FSD/MSD	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: FFFF	Data type: UNS.WORD	Active: POWER ON

Bit	Value	Meaning
9	0	SSI encoder SSI encoder has incremental tracks
	1	SSI encoder has no incremental tracks
10	0	SSI encoder, measured-value code Gray code
	1	Dual code (= binary code)
11	0	SSI encoder Right-justified
	1	Fir tree profile
12	0	SSI encoder, parity active No
	1	Yes
13	0	SSI encoder Odd parity
	1	Even parity
14	0	SSI encoder Without alarm bit
	1	With alarm bit
15	0	SSI encoder No SSI encoder installed
	1	SSI encoder installed

1041	NO_TRANSMISSION_BITS_DM			840D only	Cross reference: –
DM message frame length SSI				Relevant: FSD/MSD	Protection level: 2/4
Unit: –	Default: 25	Minimum: 0	Maximum: 25	Data type: UNS.WORD	Active: POWER ON

The length defines the total transferred message length including all parity or alarm bits. If, for example, "24 bits plus 1 power failure bit" is specified, then 25 must be entered here.

2.3.1   Setting the SSI encoder parameters

SSI-encoder evaluation is performed with a closed-loop control module, e.g., 6SN1118-0DG21-0AA1.

Switch on SSI encoder

In order to parameterize an SSI encoder, MD 1027/MD 1037 bit 15 must first be set.

Parity bit

If a parity bit is transmitted in the SSI protocol, then it is automatically assumed that this will be the last bit in the message frame. SSI encoders with a parity bit that is not the last bit cannot be evaluated.
Motor measuring system: MD 1027 bit 12 = 1
Direct measuring system: MD 1037 bit 12 = 1
The type of parity is set in MD 1027 bit 13. In the case of even parity, the bit is extended to make the sum of all set bits, including the parity bit, an even number. The same applies analogously to uneven parity.

Alarm bit

Some SSI encoders also transfer an alarm bit. It is automatically assumed that the alarm bit is the last bit in the message frame. If the message frame also includes a parity bit, the alarm bit is at the last but one bit position. The system is not capable of evaluating more than one alarm bit, or alarm bits, which are not positioned as described above.
Motor measuring system: MD 1027 bit 14 = 1
Direct measuring system: MD 1037 bit 14 = 1

Resolution per revolution

The resolution per revolution refers to one revolution of the encoder. This must be entered in machine data MD 1022 (1032 for a direct measuring system), e.g., if the encoder data on the data sheet specify: Resolution = 12 bits, then 2^{12} = 4096 must be set in MD 1022. For multiturn encoders, a value equal to 2^n (n is an integer) must be set in this MD. The setting for single-turn encoders is optional.

Resolution of linear measurement system

The resolution of the linear measurement system is entered in machine data MD 1022 in nanometers. This data has a different meaning for shaft encoders. The set resolution always refers to the least significant bit of the data bit, which comes directly after the parity or alarm bit. Even if zero bits are inserted between the parity/alarm bit and the data bit's least significant bit, the resolution still refers to the bit positioned immediately after the parity/alarm bit. Furthermore, leading zero bits are always assumed to be zeros, i.e., they are not masked out internally.

Number of revolutions

A "0" or "1" must always be entered in machine data MD 1021 (1031 for the direct measuring system) for single-turn encoders. The number of resolvable revolutions is entered in this MD for multiturn encoders. The number of resolvable revolutions does not need to equal 2^n (where n is an integer), e.g., if a data sheet states: "4096 increments/revolution and 4096 revolutions (24-bit)", then the correct parameter setting is
MD 1021 = 4096, MD 1022 = 4096.

Right-justified format (MD 1027/MD 1037, bit 11 = 0)

All relevant data bits are right-justified in the message frame, i.e., they are positioned last chronologically, except for the parity and the alarm bit. If the frame includes fixed zero bits, they are positioned at the beginning, i.e., they are first chronologically. The total number of relevant bits results from MD 1027/1037, bit 12 (parity, last bit in the message frame),
MD 1027/1037, bit 14 (alarm, last/penultimate bit in the message frame), from MD 1022/1032 (number of increments per revolution) and
MD 1021/1031 (number of resolvable revolutions). The total number of prefixed zero bits results from:
Message length – number of single-turn bits – number of multiturn bits – number of parity bits – number of alarm bits
If there are no zero bits between the singleturn bits and the parity/alarm bit or the end of the message frame, "0" can be entered into bit 11 of MD 1027. The messages for linear measuring systems are always assumed to have a right-justified format.

Fir-tree format (MD 1027/MD 1037 bit11 = 1)

Messages with a fir tree format may include both leading and trailing zero bits. Generally speaking, the transition from single-turn to multiturn information in this type of format remains at the same bit position with a constant message length. The fir tree format is used widely for 25-bit message lengths. The division of the data field between multiturn and single-turn information (including alarm/parity bit) is 12/13, i.e., the multiturn information can be read in the top 12 bits regardless of whether the number of resolvable revolutions actually equals 12 bits (leading zero bits may be included).

For the commonly used message lengths of 21, 24 and 25 bits, the division of the data field into single-turn/multiturn information is assumed to be as follows:

Message length	Division of multiturn/single-turn information
25	12/13
24	12/12
21	9/12

Any unspecified message lengths have a practical left-justified format on the basis that multiturn = 0 is assumed.

If MD 1022/1032 (+parity+alarm) does not fit into the assumed single-turn information length, then the message space allocated to single-turn information is increased accordingly, with a corresponding decrease in the space for multiturn information; this is to allow the parameters of other encoder types to be set.

Example: Message length = 25, multiturn = 16 revs., single-turn = 2^{17} incr/rev, one alarm bit, no parity bit:

With fir-tree format 17+1 = 1 8 bits of single-turn information and 25-18 = 7 bits of multiturn information are assumed. Since the multiturn information has only 4 bits, the first 3 bits are leading zero bits.

If MD 1021/1031 does not fit into the assumed multiturn information length, then the message space allocated to multiturn info is increased accordingly, with a corresponding decrease in the space for single-turn info; this is to allow the parameters of other encoder types to be set.

Example 2: Message length = 25, multiturn = 8,192 revs., single-turn = 64, no alarm bit, 1 parity bit:

The multiturn information length is 13 bits, one more than automatically assumed. As a result, the single-turn information is shortened by one and the data field divided into 13/12. Since the single-turn information length is 6 bits, the field is divided up as follows: 13 bits multiturn/6 bits single-turn/5 zero bits/parity bit.

Dual/gray code   Most SSI encoders are available in Gray code. This is the default setting in MD 1027/1037, bit 10 = 0.

2.3.2   Cyclic initiation of SSI transmission

Switch on   Cyclic transmission initiation is only permitted in conjunction with direct measuring systems. It is switched on via the bit below:
Direct measuring system: MD 1037 bit 9 = 1

2.3.3   SSI encoder monitoring (SW 5.01.06 and higher)

If an absolute encoder with SSI interface is used as a direct measuring system, proper communication between the drive and the encoder is checked continuously.

There are two types of monitoring:

* Idle level monitoring

  The data line is checked for a "high" signal when no data traffic is present.

* Zero level monitoring (active level monitoring)

  The data line is checked for a "low" signal after the message frame and during the monoflop time.

The two monitoring functions enable detection of a wire break (data, CLK, supply).

In the event of an error, power-on error 300505 "Measuring-circuit error, absolute track" is output.

The cause of the error is shown in MD 1033:

* Bit 12 **and** bit 15: Zero-level monitoring SSI error

* Bit 14 **and** bit 15: Idle-level monitoring SSI error

2.3.4 Supplementary conditions

Listen-in systems

Caution!
The SIDA-ASIC can process SSI protocol lengths of 14 or 26 bits only, i.e., even with a 25-bit protocol, an additional clock is actually output; this normally generates a request for a second data word from the encoder. The failure of other clocks to appear then results in abortion of the second protocol. If other systems want to listen in to the protocols via an extra T connector, the external system might generate an error message. This error state is caused by the fact that many systems still check the level of the data line after the last data bit. It must remain at "0" for a certain period following the transmission.

Gear ratios/ resolution reduction/modulo calculation

Some SSI encoders can be programmed such that mechanical gears installed between the motor and load can be calculated back to the motor. Programming options are also available, particularly in relation to rotary tables, to perform a modulo calculation in the encoder. It is neither permissible not necessary to use these options since the NC is capable of performing all these functions itself.

Linear measuring systems

Since there are not multiturn or single-turn bits for linear measuring systems, all bits have the significance of one length. The length resolution of the bit to the left of the alarm/parity bit must be entered as a parameter (MD 1022/1032). In this instance it is irrelevant whether it is the first data bit or just a zero bit. It is therefore assumed that any zero bits included in the frame, either before or after the actual data bits, are preset to "0".

2.3.5 Alarms

Table 2-7   Parameterization errors

Error number	Meaning
301710	Error occurs if nothing has been entered in MD 1022 (resolution single-turn) for an SSI encoder as IM.
301711	Error occurs if the total number of parameterized bits (MD 1027, MD 1021, MD 1022) for an SSI encoder as IM is greater than the message length (MD 1028).
301712	Error occurs if the multiturn information (MD 1021) for a linear SSI encoder as IM (MD 1027 bit 4 = 1) contains something that is greater than 1.
301713	Error occurs if nothing has been entered in MD 1032 (resolution single-turn) for an SSI encoder as DM.
301714	Error occurs if the total number of parameterized bits (MD 1037, MD 1031, MD 1032) for an SSI encoder as DM is greater than the message length (MD 1041).
301715	Error occurs if the multiturn information (MD 1031) for a linear SSI encoder as DM (MD 1037 bit 4 = 1) contains something that is greater than 1.
301716	Error occurs if an encoder without incremental tracks has been set (MD 1037 bit 9 = 1) as the DM SSI encoder, but the correct hardware is not installed.
301717	Error occurs in connection with an SSI encoder as DM without incremental tracks if the clock cycle of the NC is so fast that an SSI transmission does not coincide with a clock-cycle period. Remedy in this case is to accelerate the SSI transmission via MD 1030.bit 14-15.

■

Supplementary Conditions   3

■

Data Descriptions (MD, SD)   4

See Section 2

■

Signal Descriptions   5

■

Example   6

■

Notes

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7

Data Fields, Lists

7.1 Motor measuring system

Table 7-1 Machine data

No.	Identifier	Name	Drive
1005	ENC_RESOL_MOTOR[DRx]	No. of encoder pulses, motor measuring system	FDD/MSD
1008	ENC_PHASE_ERROR_CORRECTION[DRx]	Encoder phase error correction IM	FDD/MSD
1011	ACTUAL_VALUE_CONFIG[DRx]	Configuration, actual value sensing IM	FDD/MSD
1016	COMMUTATION_ANGLE_OFFSET	Commutation angle offset	FSD
1017	STARTUP_ASSISTANCE	Determine the commutation offset angle	FSD
1021	ENC_ABS_TURNS_MOTOR	Multiturn resol., abs.-value encoder, motor	FDD/MSD
1022	ENC_ABS_RESOL_MOTOR	Measuring steps of absolute track in motor	FDD/MSD
1023	ENC_ABS_DIAGNOSIS_MOTOR	Diagnosis meas. circ. motor abs. track	FDD/MSD
1024	DIVISION_LIN_SCALE	Graduation, motor measuring system	FSD
1025	SERIAL_NO_ENCODER	Serial number of motor measuring system	FDD/MSD
1703	LEAD_TIME_MOTOR_ENC	Lead time, conversion, motor meas. system	FDD/MSD
1790	ENC_TYPE_MOTOR	Measuring-circuit type of indirect measuring system	FDD/MSD

7.2 Direct position measuring system

Table 7-2 Machine data

No.	Identifier	Name	Drive
1007	ENC_RESOL_DIRECT[DRx]	No. of encoder pulses, direct measuring system	FDD/MSD
1030	ACTUAL_VALUE_CONFIG_DIRECT	Configuration, actual-value sensing DM	FDD/MSD
1031	ENC_ABS_TURNS_DIRECT	Multiturn resolution, absolute-value encoder DM	FDD/MSD
1032	ENC_ABS_RESOL_DIRECT	Measuring steps of the absolute track DM	FDD/MSD
1033	ENC_ABS_DIAGNOSIS_DIRECT	Diagnosis, dir. meas. system, abs. track	FDD/MSD
1038	SERIAL_NO_ENCODER_DM	Serial number of direct measuring system	FDD/MSD
1704	LEAD_TIME_DIRECT_ENC	Lead time, conversion, direct meas. system	FDD/MSD
1791	ENC_TYPE_DIRECT	Measuring-circuit type of direct measuring system	FDD/MSD

7.3   SSI encoder

Table 7-3   Machine data

No.	Identifier	Name	Drive
1027	ENC_CONFIG	Configuration encoder IM	FDD/MSD
1028	NO_TRANSMISSION_BITS	IM message frame length SSI	FDD/MSD
1037	ENC_CONFIG_DIRECT	Configuration encoder DM	FDD/MSD
1041	NO_TRANSMISSION_BITS_DM	DM message frame length SSI	FDD/MSD

■

SIMODRIVE 611D/SINUMERIK 840D/810D Drive Functions

Parameters for Linear Motors (DL1)

Notes

SIMODRIVE 611 Digital / SINUMERIK 840D/810D Drive Functions (FBA) – 11.05 Edition

Brief Description

<div style="text-align: right">1</div>

Notes

Detailed Description

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2.1 Parameters of linear motors

1019	CURRENT_ROTORPOS_IDENT			840D only	Cross reference: –
Current, rotor/pole position identification				Relevant: FSD	Protection level: 2/4
Unit: %	Default: 12.0	Minimum: 0.0	Maximum: 100.0	Data type: FLOAT	Active: Immediately

The percentage entered for MD 1019 refers to
MD 1104: MOTOR_MAX_CURRENT

The rotor/pole position identification is carried out at the current entered. The
current must be selected so that a clear measuring signal is produced for the
motor that is used.

⚠ **Warning**

Increasing the current enhances the accuracy of the measurement but also
increases the motor motion.

To obtain an optimum setting for MD 1019, we recommend that you start the
measurement with MD 1736: TEST_ROTORPOS_IDENT and check the accu-
racy in MD 1737: DIFF_ROTORPOS_IDENT.

1020	MAX_MOVE_ROTORPOS_IDENT			840D only	Cross reference: –
Max. movement for rotor position identification				Relevant: FSD	Protection level: 2/4
Unit: mm	Default: 5.0	Minimum: 0.0	Maximum: 30.0	Data type: FLOAT	Active: Immediately

The rotor/pole position identification can cause a considerably large rotation in
non-braked motors. If the rotation is greater than the value entered in the ma-
chine data, alarm 300611, "Impermissible movement for rotor/pole position iden-
tification", is issued.

2.1 Parameters of linear motors

1024	DIVISION_LIN_SCALE			840D only	Cross reference: –
Graduation, motor measuring system				Related to: FSD	Protection level: 2/4
Unit: nm	Default: 20,000	Minimum: 0	Maximum: 2,147,483,647	Data type: UNS.DWORD	Active: PowerOn

Graduation of the motor measurement system (not 810D)

The graduation entered by the user is compared with the graduation read directly from the encoder. If a difference is detected, error 300799 "Back-up boot" is output. Valid only for EnDat measuring system.

1034	DIVISION_LIN_SCALE_DM			840D only	Cross reference: –
Graduation for direct measuring system				Relevant: FSD	Protection level: 2/4
Unit: nm	Default: 20 000	Minimum: 0	Maximum: 2,147,483,647	Data type: UNS.DWORD	Active: PowerOn

Graduation of the direct measuring system (not 810D)

The drive reads the graduation automatically and writes it in MD 1034.

1113	FORCE_CURRENT_RATIO				Cross reference: –
Force constant				Relevant: FSD	Protection level: 2/4
Unit: N/A	Default: 0.0	Minimum: 0.0	Maximum: 2,000.0	Data type: FLOAT	Active: PowerOn

Enter the force constant from the motor data sheet (third-party motor) or parameterize it automatically by entering and accepting the motor code number in MD 1102: MOTOR_CODE. The force constant is the quotient of rated force/ rated current (RMS) for synchronous linear motors.

1114	EMF_VOLTAGE				Cross reference: –
Voltage constant				Relevant: FSD	Protection level: 2/4
Unit: Vs/m	Default: 0.0	Minimum: 0.0	Maximum: 10,000.0	Data type: FLOAT	Active: PowerOn

Enter the voltage constant from the motor data sheet (third-party motor) or parameterize it automatically by entering and accepting the motor code number in MD 1102: MOTOR_CODE.

1117	MOTOR_MASS				Cross reference: –
Motor mass				Relevant: FSD	Protection level: 2/4
Unit: kg	Default: 0.0	Minimum: 0.0	Maximum: 500.0	Data type: FLOAT	Active: Immediately

Enter the motor mass from the motor data sheet (third-party motor) or parameterize it automatically by entering and accepting the motor code number in MD 1102: MOTOR_CODE.

Note

If the primary side is fixed and the secondary side moves, the mass of the secondary side must be entered here.

The MD is used in the controller data calculation.

1146	MOTOR_MAX_ALLOWED_SPEED				Cross reference: –
Maximum motor speed				Relevant: FSD	Protection level: 2/4
Unit: m/min	Default: 0.0	Minimum: 0.0	Maximum: 100,000.0	Data type: FLOAT	Active: PowerOn

Enter the maximum motor speed from the motor data sheet (third-party motor) or parameterize it automatically by entering and accepting the motor code number in MD 1102: MOTOR_CODE.

This MD is used in the controller data calculation.

If the actual speed value exceeds the speed limit (MD 1147) by more than 4 percent, the motive force limit is set to zero internally, i.e., acceleration is prevented.

If the speed is less than the value of MD 1146 + 2%, the force limit is also reset to its original value.

With an appropriate setting, "Speed controller at its limit" monitoring may respond (response threshold MD 1606 > MD 1146 and response time > MD 1605).

2.1   Parameters of linear motors

1147	SPEED_LIMIT				Cross reference: –
Speed limitation				Relevant: FSD	Protection level: 2/4
Unit: m/min	Default: 120.0	Minimum: 0.0	Maximum: 100,000.0	Data type: FLOAT	Active: Immediately

Enter the maximum permissible speed of the motor or parameterize (initialize) it automatically by selecting Calculate controller data by means of the machine data.

FSD: MD 1400: MOTOR_RATED_SPEED x 110%

is substituted. If the speed exceeds the speed limitation (MD 1147) by more than 4 percent, the motive force limit is set to zero internally, i.e., further acceleration is prevented.

If the actual speed of the motor is less than the value of MD 1147 + 2%, the force limit is also reset to its original value.

With an appropriate setting, "Speed controller at its limit" monitoring may respond (response threshold MD 1606 > MD 1147 and response time > MD 1605).

1170	POLE_PAIR_PITCH				Cross reference: –
Pole-pair pitch				Relevant: FSD	Protection level: 2/4
Unit: mm	Default: 72.0	Minimum: 0.0	Maximum: 1,000.0	Data type: FLOAT	Active: PowerOn

Pole-pair pitch (not 810D)

Entry of the pole-pair pitch of the secondary side for synchronous linear motors.

1192	FORCE_LIMIT_WEIGHT			840D only	Cross reference: –
Weight				Relevant: FSD	Protection level: 2/4
Unit: %	Default: 0.0	Minimum: −100.0	Maximum: 100.0	Data type: FLOAT	Active: Immediately

In MD 1192, the weight force or the torque corresponding to the weight force is set and the torque/force limit in the NC acts symmetrically upwards and downwards from this weight torque/force. MD 1192 uses the same unit as the NC machine data (MD 32460) for electronic weight counterbalance, i.e., percentage with reference to static torque/force ($=kT*I0$, for synchronous motors) or rated torque (for asynchronous motors). Setting is easy thanks to MD 1728, which indicates the current torque/force setpoint in the same format as MD 1192 and MD 32460. If only the weight force is effective, the appropriate value can be read and transferred to MD 1192 and MD 32460.

1230	FORCE_LIMIT_1				Cross reference: –
1st force limit value				Relevant: FSD	Protection level: 2/4
Unit: %	Default: 100.0	Minimum: 5.0	Maximum: 900.0	Data type: FLOAT	Active: Immediately

Enter the maximum force related to the stall force (FSD) or rated motor force (MSD) of the motor.

FSD: Stall force = MD 1118 x MD 1113

MD 1118: MOTOR_STANDSTILL_CURRENT

MD 1113: FORCE_CURRENT_RATIO

The applicable limit is always either the force limit or power limit, whichever is lower. For feed drives, it is implemented when the operator selects Calculate controller data, whereby the value is obtained from the following formula:

FSD: MD 1230 = (MD 1104/MD 1118) x 100%

As the current limit (FSD - MD 1104) also limits the maximum torque, which can be entered, any increase of the force limit results in a higher force only if a higher current can also flow. It may be necessary to then additionally adapt the current limit.

Note

If the motor is overloaded for a longer period of time, its temperature rise may be inadmissible (shutdown with motor overtemperature), and the motor could be destroyed.

1231	FORCE_LIMIT_2				Cross reference: –
2nd force limit value				Relevant: FSD	Protection level: 2/4
Unit: %	Default: 100.0	Minimum: 5.0	Maximum: 100.0	Data type: FLOAT	Active: Immediately

Enter the 2nd force limit, which is interpreted as the reduction factor in relation to the 1st force limit (MD 1230). It is only effective if the 2nd force limit is selected via the "Torque limit 2" IS DB 31, ... DBX 20.2 and the motor speed exceeds the value set in MD 1232: FORCE_LIMIT_SWITCH_SPEED with hysteresis (MD 1234).

2.1 Parameters of linear motors

1232	FORCE_LIMIT_SWITCH_SPEED				Cross reference: –
Switching speed from MD 1230 to MD 1231				Relevant: FSD	Protection level: 2/4
Unit: m/min	Default: 120.0	Minimum: 0.0	Maximum: 100,000.0	Data type: FLOAT	Active: Immediately

Enter the changeover speed, above which the 2nd force limit (MD 1231) can be selected. With the changeover, an adjustable hysteresis becomes effective (MD 1234). The 2nd force limit is only effective if the motor speed exceeds the speed threshold with hysteresis, and the 2nd force limit was selected via the "Torque limit 2".
IS DB 31, ... DBX 20.2.

1233	LIMIT_GENERATOR				Cross reference: –
Generator limiting				Relevant: FSD	Protection level: 2/4
Unit: %	Default: 100.0	Minimum: 5.0	Maximum: 100.0	Data type: FLOAT	Active: Immediately

This machine data limits the force when decelerating (generator force limiting). The limiting is implemented in relation to the maximum motor force.

MD 1230: FORCE_LIMIT_1.

If the 2nd force limit is active, the reference value is obtained from

MD 1230: FORCE_LIMIT_1 and MD 1231: FORCE_LIMIT_2.

1234	FORCE_LIMIT_SWITCH_HYST				Cross reference: –
Hysteresis, MD 1232				Related to: FSD	Protection level: 2/4
Unit: m/min	Default: 3.0	Minimum: 0.0	Maximum: 1,000.0000	Data type: FLOAT	Effective: Immediately

Enter the hysteresis for the switch-in speed set in MD 1232: FORCE_LI-MIT_SWITCH_SPEED.

1239	FORCE_LIMIT_FOR_SETUP				Cross reference: –
Force limit setup mode				Relevant: FSD	Protection level: 2/4
Unit: %	Default: 1.0000	Minimum: 0.5000	Maximum: 1,000.0	Data type: FLOAT	Active: Immediately

The force limit in setup mode refers to the stall force (FSD) of the motor (for calculation, see MD 1230).

MD 1239 is ineffective in normal operation. In setup mode, the minimum from the limit values of normal operation and the value set in this machine data is effective as the force limit (see the graphical representation for MD 1230). Setup mode is selected via terminal 112 of the infeed/regenerative feedback unit.

1245	CURRENT_SMOOTH_SPEED				Cross reference: –
	Threshold speed-dep. F-setpoint smoothing			Relevant: FSD	Protection level: 2/4
Unit: m/min	Default: 0.0	Minimum: 0.0	Maximum: 100,000.0	Data type: FLOAT	Active: Immediately

Enter the speed, at which the force-setpoint smoothing, switched on in MD 1201: CURRENT_FILTER_CONFIG with the 2nd filter (low pass), is activated. The user can reduce the speed ripple at higher velocities using this speed-dependent force setpoint smoothing (MSD).

The filter remains active as a low pass across the entire speed range if 0 is entered as the threshold value. Two switching speeds are calculated from MD 1245 and MD 1246: CURRENT_SMOOTH_HYSTERESIS:

$v\_upper = v\_threshold + v\_hysteresis = MD\ 1245 + MD\ 1246$

$v\_lower = v\_threshold + v\_hysteresis = MD\ 1245 - MD\ 1246$

Functionality:

Changeover from bypass to low pass takes place when the absolute actual speed exceeds the value v_upper ($|v\_act| >= v\_upper$). Conversely, bypass is selected instead of low pass if the absolute actual speed is less than v_lower ($|v\_act| < v\_lower$). If 0 is selected for the hysteresis, both changeover velocities are the same.

Note

The speed threshold is only effective if filter 2 is configured as a low pass. This machine data has no effect on the closed-loop control.

1246	CURRENT_SMOOTH_HYSTERESIS		840D only	Cross reference: –
	Hysteresis speed-dep. F-setpoint smoothing		Relevant: FSD	Protection level: 2/4
Unit: m/min	Default: 3.0	Minimum: 0.0	Maximum: 1,000.0	Data type: FLOAT	Active: Immediately

Enter the hysteresis for the switch-in speed set in MD 1245: CURRENT_SMOOTH_SPEED.

2.1 Parameters of linear motors

1252	FORCE_FILTER_FREQUENCY				Cross reference: –
	Frequency limit for force setpoint smoothing			Relevant: FSD	Protection level: 2/4
Unit: Hz	Default: 100.0	Minimum: 0.0	Maximum: 8,000.0	Data type: FLOAT	Active: Immediately

Enter the 3 dB frequency limit f_o for force-setpoint smoothing (PT1 low pass) for the display. The time constant T1 of the PT1 filter is obtained from the formula

T1 = 1 /(2 pi f_o).

The filter is calculated in the speed controller cycle.

This machine data has no effect on the closed-loop control.

Note

The filter is disabled when values < 1 Hz are entered.

1400	MOTOR_RATED_SPEED				Cross reference: –
	Rated motor speed			Relevant: FSD	Protection level: 2/4
Unit: m/min	Default: 0.0	Minimum: 0.0	Maximum: 100,000.0	Data type: FLOAT	Active: PowerOn

Enter the rated speed for the motor from the motor data sheet (third-party motor) or parameterize it automatically by entering and accepting the motor code number in MD 1102: MOTOR_CODE.

This MD is used in the controller data calculation.

1401	MOTOR_MAX_SPEED				Cross reference: –
	speed for max. useful motor speed			Relevant: FSD	Protection level: 2/4
Unit: m/min	Default: 0.0	Minimum: 0.0	Maximum: 100,000.0	Data type: FLOAT	Active: PowerOn

This machine data defines the maximum motor operating speed. It serves as a reference value for the speed setpoint interface as well as for machine data MD 1405: MOTOR_SPEED_LIMIT. The default setting is calculated when the operator selects Calculate controller data with the rated motor speed according to the motor data sheet.

The 1401 index has a particular significance in the NC. Only the value of this index is included in the normalization of the speed-setpoint interface.
To retain the normalization value after the machine data set is changed, all of the array's indices must be assigned the value from MD 1401[0].
If the changeover is to be between motors with the lowest possible maximum speeds, MD 1401, MD 2401, MD 3401, MD 4401 must be used.

1403	PULSE_SUPPRESSION_SPEED				Cross reference: –
Creep speed for pulse suppression				Relevant: FSD	Protection level: 2/4
Unit: m/min	Default: 0.0	Minimum: 0.0	Maximum: 7,200.0	Data type: FLOAT	Active: Immediately

The default setting depends on the motor type (feed drive = 0, main spindle drive = 2) and is parameterized at startup using the drive configuration. The default value 0 means that the machine data is inactive. Pulses are now exclusively suppressed via

MD 1404: PULSE_SUPPRESSION_DELAY.

When the drive servo enable is canceled (this is possible using terminal 64, from the NC or when a fault develops), the drives decelerate along their force limit. If the absolute speed actual value falls below the specified speed threshold during shutdown, the pulse enable is suppressed and the drives coast down.

The pulses are deleted before this if the timer, set in MD 1404, has expired.

The functionality of machine data MD 1403 is necessary if the overshoot is to be suppressed when zero speed is reached after the drive servo enable signal has been canceled.

Note

When the PLC cancels the servo-enable interface signal, the NC and drives are sequentially shut down with different, adjustable timers.

Axis-specific MD 36620: SERVO_DISABLE_DELAY_TIME and
MD 36060: STANDSTILL_VELO_TOL.

If the drive develops a fault or terminal 64 is deactivated, then the drive is only shut down with MD 1403 and MD 1404.

Reference: /FB/, A2, Description of Functions

1405	MOTOR_SPEED_LIMIT				Cross reference: –
Monitoring speed for motor				Relevant: FSD	Protection level: 2/4
Unit: %	Default: 110.0	Minimum: 100.0	Maximum: 110.0	Data type: FLOAT	Active: Immediately

Enter the maximum permissible speed setpoint as a percentage. The reference value is MD 1401: MOTOR_MAX_SPEED. If the speed setpoint is exceeded, it is limited to the specified value.

The MD is parameterized using Calculate controller data.

1407	SPEEDCTRL_GAIN_1				Cross reference: –
P gain, speed controller				Relevant: FSD	Protection level: 2/4
Unit: Ns/m	Default: 2,000.0	Minimum: 0.0	Maximum: 1,000,000.0	Data type: FLOAT	Active: Immediately

2.1   Parameters of linear motors

Enter the speed-control-loop P gain for the complete speed range (exception: with adaptation enabled, see MD 1413) or parameterize (initialize) it automatically using Calculate controller data.

Note

Entering a P gain of 0 automatically deactivates the associated integral component (MD 1409).

1408	**SPEEDCTRL_GAIN_2**				**Cross reference: –**
P gain, upper adaptation speed				Relevant: FSD	Protection level: 2/4
Unit: Ns/m	Default: 2,000.0	Minimum: 0.0	Maximum: 1,000,000.0	Data type: FLOAT	Active: Immediately

Enter the speed-control-loop P gain in the upper speed range (n > MD 1412: SPEEDCTRL_ADAPT_SPEED_2) or automatically parameterize (initialize) it using Calculate controller data. The gains in the lower speed range (MD 1407) and in the upper speed range (MD 1408) are not subject to mutual restriction.

Note

Entering a P gain of 0 automatically deactivates the associated integral component (MD 1409). MD 1408 is not active when speed-controller adaptation is deactivated (MD 1413 = 0).

1409	SPEEDCTRL_INTEGRATOR_TIME_1				Cross reference: –
	Reset time of speed controller			Relevant: FSD	Protection level: 2/4
Unit: ms	Default: 10.0	Minimum: 0.0	Maximum: 500.0	Data type: FLOAT	Active: Immediately

Enter the speed control loop reset time for the complete speed range (exception: with adaptation enabled, see MD 1413) or parameterize (initialize) it automatically using Calculate controller data.

Note

If a reset time of 0 is entered, the I component is disabled for the appropriate speed range (if the integral gain and the integrator contents are deleted = > torque jumps cannot be completely excluded).

!

Important

If the adaptation is active, the integral component should not be deactivated for just one speed range (MD 1409 = 0 and MD 1410 = 0 or vice versa) (problem due to torque jumps when resetting the integral value at the transition from the adaptation range to the constant range).

1410	SPEEDCTRL_INTEGRATOR_TIME_2				Cross reference: –
	Reset time, upper adaptation speed			Relevant: FSD	Protection level: 2/4
Unit: ms	Default: 10.0	Minimum: 0.0	Maximum: 500.0	Data type: FLOAT	Active: Immediately

Enter the speed control loop reset time in the upper speed range (n > MD 1412: SPEEDCTRL_ADAPT_SPEED_2) or automatically parameterize (initialize) it using Calculate controller data. The reset times in the lower speed range (MD 1409) and in the upper speed range (MD 1410) are not subject to any mutual restriction.

!

Important

If the adaptation is active, the integral component should not be deactivated for just one speed range (MD 1409 = 0 and MD 1410 = 0 or vice versa) (problem due to torque jumps when resetting the integral value at the transition from the adaptation range to the constant range).

2.1   Parameters of linear motors

Note

Enter a reset time of 0 to deactivate the integral component for the range, which is greater than the machine data MD 1412: SPEEDCTRL_ADAPT_SPEED_2 (see also the information in MD 1409).

MD 1410 is not active when speed adaptation is deactivated (MD 1413 = 0).

1411	SPEEDCTRL_ADAPT_SPEED_1				Cross reference: –
Lower adaptation speed				Relevant: FSD	Protection level: 2/4
Unit: m/min	Default: 0.0	Minimum: 0.0	Maximum: 100,000.0	Data type: FLOAT	Active: Immediately

Enter the lower speed threshold to adapt the speed-controller machine data or parameterize (initialize) it automatically by selecting Calculate controller data. If adaptation is active, the control machine data MD 1407 and MD 1409 are active for velocities v < MD 1411.
The characteristic between the two control machine data sets is linearly interpolated in the adaptation range MD 1411 < v < MD 1412.

1412	SPEEDCTRL_ADAPT_SPEED_2				Cross reference: –
Upper adaptation speed				Relevant: FSD	Protection level: 2/4
Unit: m/min	Default: 0.0	Minimum: 0.0	Maximum: 100,000.0	Data type: FLOAT	Active: Immediately

Enter the upper speed threshold to adapt the speed controller machine data or parameterize (initialize) it automatically by selecting Calculate controller data. If adaptation is active, the control machine data MD 1408 and MD 1410 are active for velocities v > MD 1412. The characteristic between the two control machine data sets is linearly interpolated in the center range MD 1411 < v < MD 1412.

1413	SPEEDCTRL_ADAPT_ENABLE				Cross reference: –
Select adaptation for speed controller				Relevant: FSD	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 1	Data type: UNS.WORD	Active: Immediately

This machine data can be used to control adaptation of the speed-controller machine data as a function of the speed.

Input 0:

Adaptation is not active. The speed controller settings (MD 1407 and MD 1409) are valid for the complete speed range. Machine data MD 1408 and MD 1410 are not taken into account.

Input 1:

Adaptation is active. For a description, see machine data MD 1408, MD 1410, MD 1411 and MD 1412.

Note

For main spindle drives, adaptation is automatically activated using Calculate controller data.

1414	**SPEEDCTRL_REF_MODEL_FREQ**			**840D only**	**Cross reference: –**
Natural frequency of speed ref. model				Relevant: FSD	Protection level: 2/4
Unit: Hz	Default: 0.0	Minimum: 0.0	Maximum: 8,000.0	Data type: FLOAT	Active: Immediately

Enter the natural frequency for the reference model, speed control loop. The filter is deactivated by entering a value < 10 Hz (proportional element with gain 1).

Note

For interpolating axes, machine data MD 1414 must have the same value for all axes. This is also valid for MD 1415 and MD 1416.

1415	**SPEEDCTRL_REF_MODEL_DAMPING**				**Cross reference: –**
Damping for speed ref. model				Relevant: FSD	Protection level: 2/4
Unit: –	Default: 1.0	Minimum: 0.5	Maximum: 5.0	Data type: FLOAT	Active: Immediately

Enter the damping for the reference model, speed control loop. This is a reference model (PT2) for the speed control loop for PIR controller types. Damping increases as the input value increases.

Note

For interpolating axes, machine data MD 1415 must have the same value for all axes. This is also valid for MD 1414 and MD 1416.

2.1 Parameters of linear motors

1416	SPEEDCTRL_REF_MODEL_DELAY			840D only	Cross reference: –
Balancing for speed ref. model				Relevant: FSD	Protection level: 2/4
Unit: –	Default: 0.0	Minimum: 0.0	Maximum: 1.0	Data type: FLOAT	Active: Immediately

Enter the balancing capability for the reference model, speed control loop. This machine data simulates the computation deadtime of the speed control loop. The simulation is calculated as an approximation of a fractional deadtime. The deadtime of the reference model can be adapted to the controlled system behavior of the closed P-controlled speed control loop (actual-speed-value sensing) by increasing the value of MD 1416. Typical values are approx. 0.5 and can be checked by comparing the DAC signals

- Actual speed value and

- Speed-setpoint reference model.

The speed-control-loop integrator can then be enabled (non-zero entries in the reset-time parameters MD 1409, MD 1410).

Note

For interpolating axes, machine data MD 1416 must have the same value for all axes. This is also valid for MD 1415 and MD 1415.

1417	SPEED_THRESHOLD_X				Cross reference: –
vx for 'vact < vx' signal				Relevant: FSD	Protection level: 2/4
Unit: m/min	Default: 120.0	Minimum: 0.0	Maximum: 100,000.0	Data type: FLOAT	Active: Immediately

The speed threshold is entered for monitoring purposes. If the actual speed falls below the set speed threshold (absolute value), the following signal is sent to the PLC:
("v_act <v_x" IS DB 31, ... DBX 94.5).

1418	SPEED_THRESHOLD_MIN				Cross reference: –
vmin for 'vact < vmin' signal				Relevant: FSD	Protection level: 2/4
Unit: m/min	Default: 0.3	Minimum: 0.0	Maximum: 100,000.0	Data type: FLOAT	Active: Immediately

The speed threshold is entered for monitoring purposes. If the actual speed falls below the set speed threshold (absolute value), the following signal is sent to the PLC: "|v_act| < v_min"
IS DB 31, ... DBX 94.4.

1420	MOTOR_MAX_SPEED_SETUP				Cross reference: –
	Max. motor speed, setup mode			Relevant: FSD	Protection level: 2/4
Unit: m/min	Default: 2.0	Minimum: 0.0	Maximum: 100,000.0	Data type: FLOAT	Active: Immediately

For setup mode (terminal 112), the absolute speed setpoint is limited to the specified value.

1424	SPEED_FFW_FILTER_TIME				Cross reference: –
	Balanc. speed feedforward control channel			Relevant: FSD	Protection level: 2/4
Unit: us	Default: 0.0	Minimum: 0.0	Maximum: 50,000.0	Data type: FLOAT	Active: Immediately

Enter the time constant of the 1st order balancing filter in the speed-feedforward-control channel of the speed/torque feedforward control. This time can be used to adapt the setpoint characteristics of the closed current control loop. The higher-level speed control loop is thus balanced. When initializing the balancing filter, the time constants of the active current-setpoint filter (only low pass) are taken into account.

Note

The filter is only deactivated (proportional element with gain 1) when 0 is entered if no low passes are active as current-setpoint filters.

1426	SPEED_DES_EQ_ACT_TOL				Cross reference: –
	Tolerance band for 'vset=vact' signal			Relevant: FSD	Protection level: 2/4
Unit: m/min	Default: 1.0	Minimum: 0.0	Maximum 10,000.0	Data type: FLOAT	Active: Immediately

Enter the response value for the tolerance band of the PLC status messages

"nact = nset" IS DB 31, ... DBX 94.6 and

IS "Ramp-up function complete" DB 31, ... DBX 94.2.

The "nact = nset" signal becomes active, if the speed actual value enters the selected tolerance band around the speed setpoint, and remains within this band for at least of the delay time (MD 1427). The signal becomes inactive immediately when the tolerance band is exited.

The "Ramp-up function complete" signal becomes active simultaneously with the "v_act = v_set" signal, although it is latched in the active state until the next setpoint change, even if the actual speed value exits the tolerance band. The "ramp-up function complete" signal becomes inactive immediately if the setpoint changes.

2.1 Parameters of linear motors

1427	SPEED_DES_EQ_ACT_DELAY				Cross reference: –
Delay time 'vset=vact' signal				Relevant: FSD	Protection level: 2/4
Unit: ms	Default: 200.0	Minimum: 0.0	Maximum: 500.0	Data type: FLOAT	Active: Immediately

Enter the delay time, after which the v_act = v_set signal should respond after the tolerance band is entered (MD 1426) here.

1428	FORCE_THRESHOLD_X				Cross reference: –
Threshold force Fdx				Relevant: FSD	Protection level: 2/4
Unit: %	Default: 90.0	Minimum: 0.0	Maximum: 100.0	Data type: FLOAT	Active: Immediately

The machine data specifies the force limit, which, when exceeded, deactivates the PLC signal IS "F_d < F_dx" DB 31, ... DBX 94.3. The input value refers to the current force limit. Analog to this value, above the speed in the constant-power range (field-weakening operation), the maximum permissible force is dependent on the operating point. This produces a threshold force characteristic dropping in proportion to $1/n$ or dropping from breakdown torque $1/n^2$.

The "F_d < F_dx" signal is latched in the active state as long as the "Ramp-up function complete" IS DB 31, ... DBX 94.2 is not active.

If "Ramp-up function complete" is active, a delay time (MD 1429) is applied before the "F_d < F_dx" signal can become inactive.

1429	TORQUE_THRESHOLD_X_DELAY				Cross reference: –
Delay time 'Fd < Fdx' signal				Relevant: FSD	Protection level: 2/4
Unit: ms	Default: 800.0	Minimum: 0.0	Maximum: 1,000.0	Data type: FLOAT	Active: Immediately

Enter the delay time, which must expire before the "F_d < F_dx" signal can become inactive after the "Ramp-up function complete" signal. As long as "ramp-up function complete" is not active and the delay time has still not expired, the "F_d < F_dx" signal is set to "HIGH", regardless of the force.

1500	NUM_SPEED_FILTERS				Cross reference: –
No. of speed-setpoint filters				Relevant: FSD	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 2	Data type: UNS.WORD	Active: Immediately

Enter the number of speed-setpoint filters.

810D: PT1 low pass

840D/611D: PT1 low pass, PT2 low pass or bandstop

Table 2-1   Selecting the number of speed-setpoint filters.

Value	Meaning
0	No speed-setpoint filter active
1	Filter 1 active
2	Filters 1 and 2 active (840D only)

The first filter as PT1 or PT2 is effective only when activated by the PLC. The speed-setpoint filter is measured during the FFT speed-control-loop measurement. If the 1st filter is configured as a bandstop (and it is active), this filter is always used, regardless of the PLC signal.

Note

On the 840D/611D, filter 1 can also be selected via an interface signal ("Speed-setpoint smoothing" IS DB 31, ... DBX 20.3).

References: /FB/, A2 "Various Interface Signals"

1501	**SPEED_FILTER_TYPE**			**Cross reference: –**	
Type of speed-setpoint filter				Relevant: FSD	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 8,303	Data type: UNS. WORD	Active: Immediately

Enter the configuration of 2 speed-setpoint filters. You can choose between bandstops and low passes (PT2/PT1). The settable filter parameters are entered in the associated machine data.

Applications:

- Damping of mechanical resonant frequencies in position feedback loop (bandstop).
  Depending on requirements, the "Bandstop" function can be set in three configurations:

  – Simple bandstop. MD 1514/MD 1517 and MD 1515/MD 1518.

  – Bandstop with settable damping of amplitude response, in addition MD 1516/MD 1519.

  – Bandstop with settable damping of the amplitude response and increase or decrease of the amplitude response after the blocking frequency. In addition MD 1520/MD 1521.

- Interpolation of speed-setpoint stairs
  The speed setpoints are output in the position-controller cycle, which can be set significantly higher than the speed-controller cycle (low pass).

2.1　Parameters of linear motors

Table 2-2　　　　Type of speed-setpoint filters

Type	Filter	Bit	0/1	MD
Low pass/bandstop	1	0	0	Low pass (see MD 1502/1506/1507)
			1	Bandstop (see MD 1514/1515/1516)
	2	1	0	Low pass (see MD 1502/1508/1509)
			1	Bandstop (see MD 1517/1518/1519)
PT2/PT1 for low pass	1	8	0	PT2 low pass (see MD 1506/1507
			1	PT1 low pass (see MD 1503)
	2	9	0	PT2 low pass (see MD 1508/1509
			1	PT1 low pass (see MD 1503)

Note

The filter machine data must be assigned before the filter type is configured.

1502	SPEED_FILTER_1_TIME				Cross reference: –
Time constant for speed-setpoint filter 1				Relevant: FSD	Protection level: 2/4
Unit: ms	Default: 0.0	Minimum: 0.0	Maximum: 500.0	Data type: FLOAT	Active: Immediately

Enter the time constant for speed-setpoint filter 1 (PT1 low pass). Entering a value of 0 deactivates the filter.

Note

On the 840D/611D, filter 1 can also be selected via an interface signal. "Speed-setpoint smoothing" IS DB 31. ... DBX 20.3

References:　　/FB/, A2 "Various Interface Signals"

1503	SPEED_FILTER_2_TIME				Cross reference: –
	Time constant for speed-setpoint filter 2			Relevant: FSD	Protection level: 2/4
Unit: ms	Default: 0.0	Minimum: 0.0	Maximum: 500.0	Data type: FLOAT	Active: Immediately

Enter the time constant for speed-setpoint filter 2 (PT1 low pass). Entering a value of 0 deactivates the filter.

1506	SPEED_FILTER_1_FREQUENCY				Cross reference: –
	Natural frequency of speed-setpoint filter 1			Relevant: FSD	Protection level: 2/4
Unit: Hz	Default: 2,000.0	Minimum: 10.0	Maximum: 8,000.0	Data type: FLOAT	Active: Immediately

Enter the natural frequency for speed-setpoint filter 1 (PT2 low pass). Entering a value < 10 Hz for the natural frequency of the low pass initializes the filter as a proportional element with a gain of 1 irrespective of the associated damping.

The filter is activated via the "Speed-setpoint smoothing" IS DB 31, ... DBX 20.3.

Note

The speed-setpoint filters for interpolating axes should be configured identically.

1507	SPEED_FILTER_1_DAMPING				Cross reference: –
	Damping for speed-setpoint filter 1			Relevant: FSD	Protection level: 2/4
Unit: –	Default 0.7000	Minimum: 0.2000	Maximum: 5,0000	Data type: FLOAT	Active: Immediately

Enter the natural frequency for speed-setpoint filter 1 (PT2 low pass). Entering a value < 10 Hz for the natural frequency of the low pass initializes the filter as a proportional element with a gain of 1 irrespective of the associated damping.

The filter is activated via the "Speed-setpoint smoothing" IS DB 31, ... DBX 20.3.

Note

The speed-setpoint filters for interpolating axes should be configured identically.

2.1 Parameters of linear motors

If damping values are entered in the range of the minimum input limit, this can

result in overshoot in the time range up to a factor of ≤ 2. For two configured low passes with the same setting parameters, this effect is significantly increased. In the small signal range, these filters continue to have a linear response. In the large signal range, the filter states can, in certain individual cases, be restricted by the maximum numerical formats (defined by the processor register width). The filter characteristic is non-linear for a short period. Overflows and unstable reactions do not occur.

1508	SPEED_FILTER_2_FREQUENCY				Cross reference: –
Natural frequency of speed-setpoint filter 2				Relevant: FSD	Protection level: 2/4
Unit: Hz	Default: 2,000.0000	Minimum: 10,0000	Maximum: 8,000,0000	Data type: FLOAT	Active: Immediately

Enter the natural frequency for speed-setpoint filter 2 (PT2 low pass). Entering a value < 10 Hz for the natural frequency of the low pass initializes the filter as a proportional element with a gain of 1 irrespective of the associated damping.

Note

The speed-setpoint filters for interpolating axes should be configured identically.

1509	SPEED_FILTER_2_DAMPING				Cross reference: –
Damping for speed-setpoint filter 2				Relevant: FSD	Protection level: 2/4
Unit: –	Default: 0.7000	Minimum: 0.2000	Maximum: 5,0000	Data type: FLOAT	Active: Immediately

Enter the damping factor for speed-setpoint filter 2 (PT2 low pass).

Note

The speed-setpoint filters for interpolating axes should be configured identically.

If damping values are entered in the range of the minimum input limit, this can

result in overshoot in the time range up to a factor of ≤ 2. For two configured low passes with the same setting parameters, this effect is significantly increased. In the small signal range, these filters continue to have a linear response. In the large signal range, the filter states can, in certain individual cases, be restricted by the maximum numerical formats (defined by the processor register width). The filter characteristic is non-linear for a short period. Overflows and unstable reactions do not occur.

1514	SPEED_FILTER_1_SUPPR_FREQ				Cross reference: –
	Blocking frequency of speed-setpoint filter 1			Relevant: FSD	Protection level: 2/4
Unit: Hz	Default: 3,500.0000	Minimum: 1.0000	Maximum: 7,999.0000	Data type: FLOAT	Active: Immediately

Enter the blocking frequency for speed-setpoint filter 1 (bandstop). If filter 1 is parameterized as a bandstop, it is always effective, regardless of the Speed setpoint smoothing IS.

Note

The max. blocking frequency input is limited by the sampling frequency of the closed-loop control (MD 1001) (parameterization error).

MD 1514 < 1 / (2 x T_samp) = 1 / (2x MD 1001)

MD 1001 = T_samp = 62.5 µs => MD 1514 < 8,000 Hz

                125.0 µs => MD 1514 < 4,000 Hz

1515	SPEED_FILTER_1_BANDWIDTH				Cross reference: –
	Bandwidth for speed-setpoint filter 1			Relevant: FSD	Protection level: 2/4
Unit: Hz	Default: 500.0000	Minimum: 5.0000	Maximum: 7,999.0000	Data type: FLOAT	Active: Immediately

Enter the –3 dB bandwidth for speed-setpoint filter 1 (bandstop).

Note

When 0 is entered for the bandwidth, this parameterizes the filter as proportional element with gain 1.

The bandwidth must be less than or equal to 2 x MD 1514 x MD 1520.

1516	SPEED_FILTER_1_BW_NUMERATOR				Cross reference: –
	Bandwidth numerator speed-setpoint filter 1			Relevant: FSD	Protection level: 2/4
Unit: Hz	Default: 0.0000	Minimum: 0.0000	Maximum: 7,999.0000	Data type: FLOAT	Active: Immediately

Enter the numerator bandwidth for the attenuated bandstop. Entering a value of 0 initializes the filter as an unattenuated bandstop.

Note

The value of MD 1516: SPEED_FILTER_1_BW_NUM may only be a maximum of twice MD 1515: SPEED_FILTER_1_BANDWIDTH.

2.1   Parameters of linear motors

1517	SPEED_FILTER_2_SUPPR_FREQ			840D only	Cross reference: –
Blocking frequency of speed-setpoint filter 2				Relevant: FSD	Protection level: 2/4
Unit: Hz	Default: 3,500.0000	Minimum: 1,0000	Maximum: 7,999.0000	Data type: FLOAT	Active: Immediately

Enter the blocking frequency for speed-setpoint filter 2 (bandstop).

Note

The max. blocking frequency input is limited by the sampling frequency of the closed-loop control (MD 1001) (parameterization error).

MD 1514 < 1 / (2 x T_samp) = 1 / (2x MD 1001)

MD 1001 = T_samp = 62.5 μs => MD 1514 < 8,000 Hz

125.0 μs => MD 1514 < 4,000 Hz

1518	SPEED_FILTER_2_BANDWIDTH				Cross reference: –
Bandwidth for speed-setpoint filter 2				Relevant: FSD	Protection level: 2/4
Unit: Hz	Default: 500.0000	Minimum: 5,0000	Maximum: 7,999.0000	Data type: FLOAT	Active: Immediately

Enter the –3 dB bandwidth for speed-setpoint filter 2 (bandstop).

Note

When 0 is entered for the bandwidth, this parameterizes the filter as proportional element with gain 1.

The bandwidth must be less than or equal to 2 x MD 1517 x MD 1521.

1519	SPEED_FILTER_2_BW_NUMERATOR				Cross reference: –
Bandwidth numerator speed-setpoint filter 2				Relevant: FSD	Protection level: 2/4
Unit: Hz	Default: 0.0000	Minimum: 0.0000	Maximum: 7,999.0000	Data type: FLOAT	Active: Immediately

Enter the numerator bandwidth for the attenuated bandstop. Entering a value of 0 initializes the filter as an unattenuated bandstop.

Note

The value of MD 1519: SPEED_FILTER_2_BW_NUM may only be a maximum of twice MD 1518: SPEED_FILTER_2_BANDWIDTH.

1520	SPEED_FILTER_1_BS_FREQ				Cross reference: –
	Bandstop natural frequency, speed-setpoint filter 1			Relevant: FSD	Protection level: 2/4
Unit: %	Default: 100.0000	Minimum: 1.0000	Maximum: 141.0000	Data type: FLOAT	Active: Immediately

Enter the natural frequency for the general bandstop as a percentage with reference to MD 1514 (blocking frequency).

For MD 1520 = 100% the filter is initialized as an attenuated bandstop. If the resulting natural frequency (MD 1520 * MD 1514) exceeds the Shannon frequency specified by the speed controller cycle, then the input is rejected with parameterization error.

For more information, see MD 1521: SPEED_FILTER_2_BS_FREQ

1521	SPEED_FILTER_2_BS_FREQ				Cross reference: –
	Bandstop natural frequency, speed-setpoint filter 2			Relevant: FSD	Protection level: 2/4
Unit: %	Default: 100.0000	Minimum: 1.0000	Maximum: 141.0000	Data type: FLOAT	Active: Immediately

Enter the natural frequency for the general bandstop as a percentage with reference to MD 1517 (blocking frequency).

For MD 1521 = 100% the filter is initialized as an attenuated bandstop. If the resulting natural frequency (MD 1521 x MD 1517) exceeds the Shannon frequency defined by the speed controller sampling rate, the input is rejected and a parameter error is indicated.

1606	SPEEDCTRL_LIMIT_THRESHOLD				Cross reference: –
	Threshold speed controller at its endstop			Relevant: FSD	Protection level: 2/4
Unit: m/min	Default: 500.0000	Minimum: 0.0000	Maximum: 100 000.0000	Data type: FLOAT	Active: Immediately

Enter the speed threshold for alarm 300608 "Speed controller output limited" (see also MD 1605). The monitoring function is active over the complete speed range.

1615	SMOOTH_RUN_TOL				Cross reference: –
	Tolerance, rotational accuracy monitoring			Relevant: FSD	Protection level: 0/0
Unit: m/min	Default: 0.2000	Minimum: 0.0000	Maximum: 100.0000	Data type: FLOAT	Active: Immediately

Load test: Sets the tolerance band for rotational-accuracy monitoring. When the tolerance band is violated (exceeded or fallen short of), the "Diagnosis, rotational-accuracy monitoring" MD 1724 counter is incremented by the actual speed.

2.1 Parameters of linear motors

1635	GEN_AXIS_MIN_SPEED				Cross reference: –
Minimum speed generator axis				Relevant: FSD	Protection level: 2/4
Unit: m/min	Default: 0.0000	Minimum: 0.0000	Maximum: 100,000,0000	Data type: FLOAT	Active: Immediately

> **!**
>
> **Important**
>
> This machine data is only relevant for Siemens internal purposes and must not be changed.

Enter the minimum speed for the DC-link generator. When this speed is under-shot, a PLC signal is output. This signal is sent to tell the NC that the drive oper-ated as generator (selected in the NC program) has reached a speed at and above which the NC should initiate emergency retraction.

1639	RETRACT_SPEED				Cross reference: –
Emergency retraction speed				Relevant: FSD	Protection level: 2/4
Unit: –	Default: 0	Minimum: −4,194,304	Maximum: 4,194,304	Data type: DWORD	Active: Immediately

> **!**
>
> **Important**
>
> This machine data is only relevant for Siemens internal purposes and must not be changed.

Enter the emergency retraction speed, which is entered as the setpoint speed during the emergency retraction time (MD 1638) when a fault/error situation occurs.

1706	DESIRED_SPEED				Cross reference: –
Speed setpoint				Relevant: FSD	Protection level: 2/4
Unit: m/min	Default: 0.0000	Minimum: −100,000.0000	Maximum: 100,000,0000	Data type: FLOAT	Active: Immediately

This machine data is used to display the speed setpoint. The speed setpoint represents the unfiltered summed setpoint. It is made up of the position control-ler output component and the speed feedforward branch. Machine data MD 1706, MD 1707 and MD 1708 are not picked up in synchronism. The data are picked up by the read request of the non-cyclic communications protocol.

1707	ACTUAL_SPEED				Cross reference: –
Speed actual value				Relevant: FSD	Protection level: 2/4
Unit: m/min	Default: 0.0000	Minimum: −100,000,0000	Maximum: 100,000,0000	Data type: FLOAT	Active: Immediately

This machine data is used to display the speed actual value. It represents the non-filtered speed actual value. Machine data MD 1706, MD 1707 and MD 1708 are not picked up in synchronism. The specific machine data is picked up by the "Read variables" HMI request via the STF-ES communications interface.

1711	SPEED_LSB				Cross reference: –
	Signif. for speed representation			Relevant: FSD	Protection level: 2/4
Unit: m/min	Default: 0.0000	Minimum: −100 000.0000	Maximum: 100 000.0000	Data type: FLOAT	Active: Immediately

This machine data is used to display the significance of the speed representation. The significance of bit 0 is displayed to assign the internal significance of the speed states to the physical speed values.

1713	FORCE_LSB				Cross reference: –
	Significance of force representation			Relevant: FSD	Protection level: 2/4
Unit: μN	Default: 0.0000	Minimum: −100,0000.0000	Maximum: 100,0000.0000	Data type: FLOAT	Active: Immediately

This machine data is used to display the significance of the force representation.

1725	MAX_FORCE_FROM_NC				Cross reference: –
	Normalization, force setpoint			Relevant: FSD	Protection level: 2/4
Unit: N	Default: 0.0000	Minimum: −1,000,000.0000	Maximum: 1 000 000.0000	Data type: FLOAT	Active: Immediately

This machine data includes the reference value of the force values and force limit values transferred from the NC to the drive.

■

Notes

Supplementary Conditions   **3**

None

■

Data Descriptions (MD, SD)   **4**

See Chapter 2

■

Signal Descriptions   **5**

None

■

Example   **6**

None

■

Notes

Data Fields, Lists

7

Notes

SIMODRIVE 611D/SINUMERIK 840D/810D Drive Functions

Calculating Motor/Power-Section/Controller Data (DM1)

■

Notes

Brief Description

1

Motor and power-section selection

The motor and power-section parameters are selected from the MLFB lists during startup, using the startup tool (HMI Advanced), and stored in the appropriate drive machine data. The controller data is calculated automatically.

Calculate controller data

The parameters for the current/speed controller and the torque/power-section limits are calculated from the motor and power-section data when the operator selects **Calculate controller data**.

This is always necessary if a machine data used in the calculation is subsequently changed manually.
If the speed controller has already been optimized, the data is lost and overwritten with the recalculated setting values (save beforehand, if possible).

Exception: Changing MD 1104: MOTOR_MAX_CURRENT. In this case, if the torque and power limit have been adapted, it is not necessary to calculate the controller data.

■

Notes

Detailed Description

2

2.1   Parameters for motor and power-section selection

2.1.1   Motor data

1102	MOTOR_CODE					Cross reference: –
	Motor code number				Relevant: FSD/MSD	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 65,535		Data type: UNS.WORD	Active: POWER ON

Enter the motor code number corresponding to the motor MLFB (machine-readable product designation for Siemens motors). The motor code number is automatically generated from the motor MLFB when using the startup tool. The user does not have to make the entry (see also MD 1106: INVERTER_CODE). For the startup tool, the following motor data are automatically transferred from an internal motor table using the motor code number. If your system is not equipped with a startup tool, you can enter data manually.

Table 2-1   Machine data, which are assigned when entering the motor code

No.	Identifier	Name	Drive
1103	MOTOR_NOMINAL_CURRENT[DRx]	Nominal motor current	FDD/MSD
1104	MOTOR_MAX_CURRENT[DRx]	Max. motor current	FSD
1112	NUM_POLE_PAIRS[DRx]	Motor pole pair number	FSD
1113	TORQUE_CURRENT_RATIO[DRx]	Torque constant	FSD
1114	EMF_VOLTAGE[DRx]	Voltage constant	FSD
1115	ARMATURE_RESISTANCE[DRx]	Armature resistance	FSD
1116	ARMATURE_INDUCTANCE[DRx]	Armature inductance	FSD
1117	MOTOR_INERTIA[DRx]	Motor moment of inertia	FDD/MSD
1118	MOTOR_STANDSTILL_CURRENT[DRx]	Motor standstill current	FSD
1130	MOTOR_NOMINAL_POWER[DRx]	Nominal motor power	MSD
1132	MOTOR_NOMINAL_VOLTAGE[DRx]	Nominal motor voltage	MSD
1134	MOTOR_NOMINAL_FREQUENCY[DRx]	Nominal motor frequency	MSD
1135	MOTOR_NOLOAD_VOLTAGE[DRx]	Motor no-load voltage	MSD
1136	MOTOR_NOLOAD_CURRENT[DRx]	Motor no-load current	MSD

2.1 Parameters for motor and power-section selection

Table 2-1   Machine data, which are assigned when entering the motor code

No.	Identifier	Name	Drive
1137	STATOR_COLD_RESISTANCE[DRx]	Stator cold resistance	MSD
1138	ROTOR_COLD_RESISTANCE[DRx]	Rotor cold resistance	MSD
1139	STATOR_LEAKAGE_REACTANCE[DRx]	Stator leakage reactance	MSD
1140	ROTOR_LEAKAGE_REACTANCE[DRx]	Rotor leakage reactance	MSD
1141	MAGNETIZING_REACTANCE[DRx]	Magnetizing reactance	MSD
1142	FIELD_WEAKENING_SPEED[DRx]	Threshold speed field weakening	MSD
1143	LH_CURVE_UPPER_SPEED[DRx]	Upper speed, Lh characteristic	MSD
1144	LH_CURVE_GAIN[DRx]	Gain factor, Lh characteristic	MSD
1145	M_KIPP_RV	Stall torque reduction factor	MSD
1146	MOTOR_MAX_ALLOWED_SPEED[DRx]	Max. motor speed	FDD/MSD
1400	MOTOR_RATED_SPEED[DRx]	Rated motor speed	FDD/MSD
1602	MOTOR_TEMP_WARN_LIMIT[DRx]	Motor temp. warning threshold	FDD/MSD

Note

If no valid motor MLFB (code number) is specified in MD 1102
(e.g., "0" $\Rightarrow$ third-party motors), then all of the machine data must be entered manually.

1103	MOTOR_NOMINAL_CURRENT		Cross reference: –
	Rated motor current		Relevant: FSD/MSD	Protection level: 2/4
Unit: A	Default: 0.0	Minimum: 0.0	Maximum: 500.0	Data type: FLOAT	Active: POWER ON

Enter the nominal current (RMS value), which is drawn during operation at nominal torque and nominal motor speed. Enter the value from the motor data sheet (third-party motor) or parameterize it automatically by entering and accepting the motor code number in MD 1102: MOTOR_CODE.

1104	MOTOR_MAX_CURRENT		Cross reference: –
	Max. motor current		Relevant: FSD	Protection level: 2/4
Unit: A	Default: 0.04	Minimum: 0.0	Maximum: 500.0	Data type: FLOAT	Active: POWER ON

Enter the motor current (RMS value) from the motor data sheet (third-party motor), or parameterize it automatically by entering and accepting the motor code number in MD 1102: MOTOR_CODE. This machine data should not be reduced for reasons of safe monitoring and limiting (see also MD 1105).

The limit current is entered when the motor is selected.

The limit current is the current, which can be applied at rated speed. Thus, constant acceleration is possible over the complete speed range.

If reduced torque at higher speed is possible (lower speed range or jerk limiting), the current can be increased up to the peak current.
If the maximum motor current is increased, the
torque limit (MD 1230 = MD 1104/MD 1118 · 100) and the power
limit (MD 1235 = MD 1104/MD 1118 · 100) must be adapted.

This MD is used in the controller data calculation.

1112	NUM_POLE_PAIRS					Cross reference: –
	Motor pole pair number				Relevant: FSD	Protection level: 2/4
Unit: – 810D 840D	Default: 0 0	Minimum: 0 0	Maximum: 4 4,096		Data type: UNS.WORD	Active: POWER ON

Enter the motor pole pair number from the motor data sheet (third-party motor) or parameterize it automatically by entering and accepting the motor code number in MD 1102: MOTOR_CODE. Pole pair number 0 is entered when an attempt is made to load unreleased motor/power-section combinations.

1113	TORQUE_CURRENT_RATIO					Cross reference: –
	Torque constant				Relevant: FSD	Protection level: 2/4
Unit: Nm/A	Default: 0.0	Minimum: 0.0	Maximum: 300.0	Data type: FLOAT	Active: POWER ON	

Enter the torque constant from the motor data sheet (third-party motor) or parameterize it automatically by entering and accepting the motor code number in MD 1102: MOTOR_CODE. The torque constant is the quotient of rated torque/rated current (RMS) for permanently excited synchronous motors.

1114	EMF_VOLTAGE					Cross reference: –
	Voltage constant				Relevant FSD	Protection level: 2/4
Unit: V	Default: 0.0	Minimum: 0.0	Maximum: 10,000.0	Data type: FLOAT	Active: POWER ON	

Enter the voltage constant from the motor data sheet (third-party motor) or parameterize it automatically by entering and accepting the motor code number in MD 1102: MOTOR_CODE. The voltage constant is measured as induced voltage (EMF) under no-load conditions at n = 1000 rpm as RMS value at the motor terminals (chained).

2.1 Parameters for motor and power-section selection

1115	ARMATURE_RESISTANCE				Cross reference: –
	Armature resistance			Relevant: FSD	Protection level: 2/4
Unit: Ω	Default: 0.0	Minimum: 0.0	Maximum: 1,000.0	Data type: FLOAT	Active: POWER ON

Enter the ohmic resistance of the armature winding (phase value) from the motor data sheet (third-party motor) or parameterize it automatically by entering and accepting the motor code number in MD 1102: MOTOR_CODE.

1116	ARMATURE_INDUCTANCE				Cross reference: –
	Armature inductance			Relevant: FSD	Protection level: 2/4
Unit: mH	Default: 0.0	Minimum: 0.0	Maximum: 300.0	Data type: FLOAT DWORD	Active: POWER ON

Enter the armature rotating-field inductance from the motor data sheet (third-party motor) or parameterize it automatically by entering and accepting the motor code number in MD 1102: MOTOR_CODE.

This MD is used in the controller data calculation.

1117	MOTOR_INERTIA				Cross reference: –
	Motor moment of inertia			Relevant: FSD/MSD	Protection level: 2/4
Unit: kgm^2	Default: 0.0 MSD: 0.0010	Minimum: 0.0	Maximum: 32.0	Data type: FLOAT	Active: Immediately

Enter the motor moment of inertia from the motor data sheet (third-party motor) or parameterize it automatically by entering and accepting the motor code number in MD 1102: MOTOR_CODE (for motors without holding brake).

This MD is used in the controller data calculation.

1118	MOTOR_STANDSTILL_CURRENT				Cross reference: –
	Motor standstill current			Relevant: FSD	Protection level: 2/4
Unit: A	Default: 0.0	Minimum: 0.0	Maximum: 500.0	Data type: FLOAT	Active: POWER ON

Enter the motor standstill current (RMS) from the motor data sheet (third-party motor) or parameterize it automatically by entering and accepting the motor code number in MD 1102: MOTOR_CODE. This machine data corresponds to the thermally permissible continuous current when the motor is at standstill, with an overtemperature of 100 Kelvin.

This MD is used in the controller data calculation.

1129	POWER_FACTOR_COS_PHI			840D only	Cross reference: –
	cos φ power factor			Relevant: MSD/AM	Protection level: 2/4
Unit: –	Default: 0.8	Minimum: 0.0	Maximum: 1.0	Data type: FLOAT	Active: POWER ON

cos φ is required to calculate the equivalent circuit diagram data from the rating plate data.

1130	MOTOR_NOMINAL_POWER				Cross reference: –
	Rated motor power			Relevant: MSD	Protection level: 2/4
Unit: kW	Default: 0.0	Minimum: 0.0	Maximum: 1,500.0	Data type: FLOAT	Active: POWER ON

Enter the rated motor power from the motor data sheet (third-party motor) or parameterize it automatically by entering and accepting the motor code number in MD 1102: MOTOR_CODE.

1132	MOTOR_NOMINAL_VOLTAGE				Cross reference: –
	Rated motor voltage			Relevant: MSD	Protection level: 2/4
Unit: V 810D 840D	Default: 0.0 380.0	Minimum: 0.0 0.0	Maximum: 5,000.0 5,000.0	Data type: FLOAT	Active: POWER ON

Enter the rated motor voltage from the motor data sheet (third-party motor) or parameterize it automatically by entering and accepting the motor code number in MD 1102: MOTOR_CODE.

1134	MOTOR_NOMINAL_FREQUENCY				Cross reference: –
	Rated motor frequency			Relevant: MSD	Protection level: 2/4
Unit: Hz 810D 840D	Default: 0.0 50.0	Minimum: 0.0 0.0	Maximum: 3,000.0 3,000.0	Data type: FLOAT DWORD	Active: POWER ON

Enter the rated motor frequency from the motor data sheet (third-party motor) or parameterize it automatically by entering and accepting the motor code number in MD 1102: MOTOR_CODE.

This MD is used in the controller data calculation.

2.1 *Parameters for motor and power-section selection*

1135	MOTOR_NOLOAD_VOLTAGE				Cross reference: –
	Motor no-load voltage			Relevant: MSD	Protection level: 2/4
Unit: V	Default: 0.0	Minimum: 0.0	Maximum: 500.0	Data type: FLOAT	Active: Immediately

Enter the motor no-load voltage from the motor data sheet (third-party motor) or parameterize it automatically by entering and accepting the motor code number in MD 1102: MOTOR_CODE.

1136	MOTOR_NOLOAD_CURRENT				Cross reference: –
	Motor no-load current			Relevant: MSD	Protection level: 2/4
Unit: A	Default: 0.0	Minimum: 0.0	Maximum: 500.0	Data type: FLOAT	Active: Immediately

Enter the motor no-load current (RMS) from the motor data sheet (third-party motor) or parameterize it automatically by entering and accepting the motor code number in MD 1102: MOTOR_CODE.

The no-load current is set by selecting the motor from the motor list or according to the motor manufacturer's data sheet.

If the motor manufacturer has made no specifications regarding the no-load current, it can be calculated according to the following formula:

MD 1136 = MD 1114 $\times$ 60 [sec] / ($2\pi \times \sqrt{3} \times$ MD 1112 $\times$ MD 1116)

MD 1112: NUM_POLE_PAIRS
MD 1114: EMF_VOLTAGE
MD 1116: ARMATURE_INDUCTANCE

1137	STATOR_COLD_RESISTANCE				Cross reference: –
	Stator resistance, cold			Relevant: MSD	Protection level: 2/4
Unit: Ω	Default:	Minimum:	Maximum:	Data type: FLOAT	Active: Immediately
810D	0.0	0.0	120.0		
840D	0.0	0.0	120.0		

Enter the stator resistance (cold condition) from the motor data sheet (third-party motor) or parameterize it automatically by entering and accepting the motor code number in MD 1102: MOTOR_CODE.

1138	ROTOR_COLD_RESISTANCE				Cross reference: –
	Rotor resistance, cold			Relevant: MSD	Protection level: 2/4
Unit: Ω 810D 840D	Default: 0.0 0.0	Minimum: 0.0 0.0	Maximum: 20.0 120.0	Data type: FLOAT	Active: Immediately

Enter the rotor resistance (cold condition) from the motor data sheet (third-party motor) or parameterize it automatically by entering and accepting the motor code number in MD 1102: MOTOR_CODE.

This MD is used in the controller data calculation.

1139	STATOR_LEAKAGE_REACTANCE				Cross reference: –
	Stator leakage reactance			Relevant: MSD	Protection level: 2/4
Unit: Ω	Default: 0.0	Minimum: 0.0	Maximum: 100.0	Data type: FLOAT DWORD	Active: Immediately

Enter the stator leakage reactance from the motor data sheet (third-party motor) or parameterize it automatically by entering and accepting the motor code number in MD 1102 MOTOR_CODE.

This MD is used in the controller data calculation.

1140	ROTOR_LEAKAGE_REACTANCE				Cross reference: –
	Rotor leakage reactance			Relevant: MSD	Protection level: 2/4
Unit: Ω	Default: 0.0	Minimum: 0.0	Maximum: 100.0	Data type: FLOAT	Active: Immediately

Enter the rotor leakage reactance from the motor data sheet (third-party motor) or parameterize it automatically by entering and accepting the motor code number in MD 1102: MOTOR_CODE.

This MD is used in the controller data calculation.

1141	MAGNETIZING_REACTANCE				Cross reference: –
	Magnetizing reactance			Relevant: MSD	Protection level: 2/4
Unit: Ω	Default: 0.0	Minimum: 0.0	Maximum: 1,000.0	Data type: FLOAT	Active: Immediately

Enter the magnetizing reactance from the motor data sheet (third-party motor) or parameterize it automatically by entering and accepting the motor code number in MD 1102: MOTOR_CODE.

This MD is used in the controller data calculation.

2.1   Parameters for motor and power-section selection

1142	FIELD_WEAKENING_SPEED				Cross reference: –
	Threshold speed field weakening			Relevant: MSD	Protection level: 2/4
Unit: 1/min	Default: 0.0	Minimum: 0.0	Maximum: 100,000.0	Data type: FLOAT DWORD	Active: Immediately

Enter the threshold speed for the field weakening from the motor data sheet (third-party motor) or parameterize it automatically by entering and accepting the motor code number in MD 1102: MOTOR_CODE. In the field-weakening range, the magnetizing inductance L_h linearly increases from the saturated value at the threshold speed for field weakening to the non-saturated value at the upper speed of the L_h characteristic (see the graphic for MD 1144).

This MD is used in the controller data calculation.

1143	LH_CURVE_UPPER_SPEED				Cross reference: –
	Upper speed, L_h characteristic			Relevant: MSD	Protection level: 2/4
Unit: 1/min 810D 840D	Default: 0.0 0.0	Minimum: 0.0 0.0	Maximum: 50,000.0 100,000.0	Data type: FLOAT	Active: POWER ON

Enter the upper speed for the L_h characteristic (magnetizing inductance L_h) from the motor data sheet (third-party motor) or parameterize it automatically by entering and accepting the motor code number in MD 1102: MOTOR_CODE. In the field-weakening range, the magnetizing inductance L_h linearly increases from the saturated value at the threshold speed for field weakening to the non-saturated value at the upper speed of the L_h characteristic (see the graphic for MD 1144).

1144	LH_CURVE_GAIN				Cross reference: –
	Gain factor, L_h characteristic			Relevant: MSD	Protection level: 2/4
Unit: %	Default: 100	Minimum: 100.0	Maximum: 500.0	Data type: FLOAT DWORD	Active: Power On

Enter the gain factor (L_{h2}/L_{h1}) of the L_h characteristic (magnetizing inductance) from the motor data sheet (third-party motor) or parameterize it automatically by entering and accepting the motor code number in MD 1102: MOTOR_CODE. In the field-weakening range, the magnetizing inductance L_h linearly increases from the saturated value at the threshold speed for field weakening to the non-saturated value at the upper speed of the L_h characteristic.

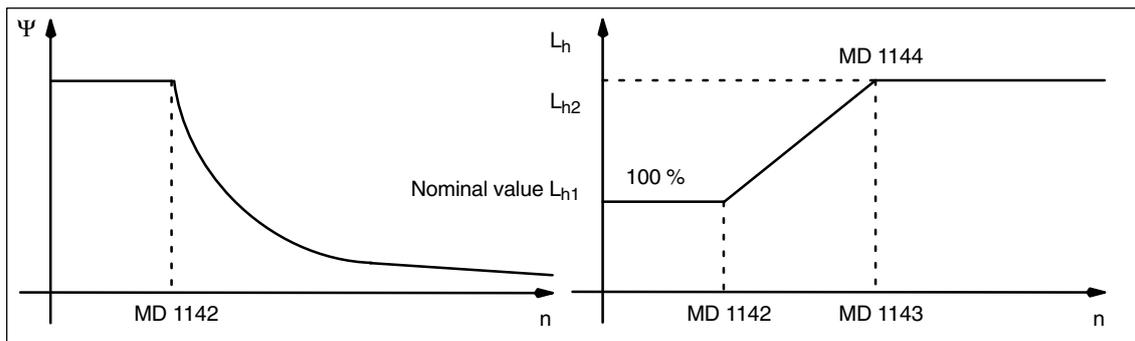Fig. 2-1   Field-weakening characteristic and L_h characteristic (magnetizing inductance)

Note

100% should be entered if the value is not known, so that the magnetizing inductance is constant over the complete speed range.

1145	STALL_TORQUE_REDUCTION				Cross reference: –
	Breakdown torque reduction factor			Relevant: MSD	Protection level: 2/4
Unit: %	Default: 100.0	Minimum: 5.0	Maximum: 1,000.0	Data type: FLOAT DWORD	Active: Immediately

Enter the breakdown torque factor from the motor data sheet. The starting points for the breakdown torque limit can be changed using this machine data. For settings greater than 100%, the starting point is increased and for settings smaller than 100%, the starting point is reduced.

1146	MOTOR_MAX_ALLOWED_SPEED				Cross reference: –
	Max. motor speed			Relevant: FSD/MSD	Protection level: 2/4
Unit: 1/min 810D 840D	Default: 0.0 0.0	Minimum: 0.0 0.0	Maximum: 50,000.0 100,000.0	Data type: FLOAT	Active: POWER ON

Enter the maximum motor speed from the motor data sheet (third-party motor) or parameterize it automatically by entering and accepting the motor code number in MD 1102: MOTOR_CODE.

This MD is used in the controller data calculation.

References: /IAD/ SINUMERIK 840D Installation & Startup Guide

2.1 Parameters for motor and power-section selection

1400	MOTOR_RATED_SPEED				Cross reference: –
	Rated motor speed			Relevant: FSD/MSD	Protection level: 2/4
Unit: 1/min	Default: 0.0	Minimum: 0.0	Maximum: 100,000.0	Data type: FLOAT	Active: POWER ON

Enter the rated speed for the motor from the motor data sheet (third-party motor) or parameterize it automatically by entering and accepting the motor code number in MD 1102: MOTOR_CODE.

This MD is used in the controller data calculation.

1602	MOTOR_TEMP_WARN_LIMIT				Cross reference: –
	Motor temperature warning threshold			Relevant: FSD/MSD	Protection level: 2/4
Unit: °C	Default: 120 1501FE1 Motor	Minimum: 0	Maximum: 200	Data type: UNS.WORD	Active: Immediately

Enter the permissible thermal steady-state motor temperature or parameterize it automatically by entering and accepting the motor code number in MD 1102: MOTOR_CODE. The motor temperature is sensed via the temperature sensor and evaluated on the drive side. A signal is output to the NC when the warning limit is reached (see MD 1603 and MD 1607).

Reference: /FB, DÜ1/ Monitoring Functions, Limits

2.1.2   Power section data

1106	INVERTER_CODE					Cross reference: –
	Power section code number				Relevant: FSD/MSD	Protection level: 2/4
Unit: Hex	Default: 0000	Minimum: 0000	Maximum FFFF		Data type: UNS.WORD	Active: POWER ON

The MLFB (**M**aschinen**l**esbare **F**abrikate**b**ezeichnung in German, machine-readable product designation on Siemens power sections) is converted into a code number by entering the power-section MLFB when the drive is started up, using the startup tool/HMI Advanced (the user does not have to enter anything). The following machine data (power section data) is automatically transferred from an internal power section table by entering the code number:

No.	Identifier	Name	Drive
1107	INVERTER_MAX_CURRENT	Transistor limit current, power section	FDD/MSD
1108	INVERTER_MAX_THERMAL_CURRENT	Thermal limit current, power section	FDD/MSD
1109	INVERTER_MAX_S6_CURRENT	Limit current, power section S6	MSD
1111	INVERTER_RATED_CURRENT	Rated power section current	FDD/MSD

Table 2-2   Power code number

Code	Drive type	Amperage	PS	Comments
6	MSD	24/32/102 A	50 A	
7	MSD	30/40/51 A	80 A	
8	MSD	45/60/76 A	120 A	
9	MSD	60 / 80 / 102A	160 A	
A	MSD	85/110/127 A	200 A	
B	MSD	120/150/193 A	300A	
C	MSD	200/250/257 A	400 A	
D	MSD	45/60/76 A	108 A	
E	MSD	24/32/102 A	50 A	810D internal
11	FSD	3/6 A	8 A	
12	FSD	5 / 10A	15 A	
13	FSD	6/12 A	15 A	810D internal
14	FSD	9/18 A	25 A	
15	FSD	9/18 A	25 A	810D internal
16	FSD	18/36 A	50 A	
17	FSD	28/56 A	80 A	
19	FSD	56/112 A	160 A	
1A	FSD	70/140 A	200 A	
1E	FSD	18/36 A	50 A	810D internal
28	FSD	140/210 A	400 A	As of SW 4.2

2.1   Parameters for motor and power-section selection

1107	INVERTER_MAX_CURRENT				Cross reference: –
	Transistor limit current, power section			Relevant: FSD/MSD	Protection level: 2/4
Unit: A	Default: 200.0	Minimum: 1.0	Maximum: 500.0	Data type: FLOAT	Active: POWER ON

Enter the maximum transistor limit current for the power section as a peak value. MD 1106: INVERTER_CODE is used to automatically parameterize the Siemens power sections for this machine data.

Example

Power section 50 A   FSD: 18/36A   MSD: 24/32/32 A
LT 50 A   MD 1107: INVERTER_MAX_CURRENT for MSD and FSD
FSD **18**/xxA   MD 1111: INVERTER_RATED_CURRENT
FSD xx/**36**A   MD 1108: INVERTER_MAX_THERMINAL_CURRENT
MSD **24**/xxA   MD 1111: INVERTER_RATED_CURRENT
MSD xx/**32**/xxA   MD 1109: INTERNER_MAX_S6_CURRENT
MSD xx/xx/**32**A   MD 1108: INVERTER_MAX_THERMINAL_CURRENT

!   **Important**

This data is used as normalization basis for the current actual-value sensing and it is **not permissible that the user changes it after automatic default setting.**

1108	INVERTER_MAX_THERMAL_CURRENT				Cross reference: –
	Thermal limit current, power section			Relevant: FSD/MSD	Protection level: 2/4
Unit: A	Default: 200.0	Minimum: 1.0	Maximum: 500.0	Data type: FLOAT	Active: POWER ON

Enter the maximum permissible power section current as an rms value. This function is defined with MD 1106: INVERTER_CODE, which automatically parameterizes the Siemens power sections for this machine data.

!   **Important**

This data is the upper limit of the thermal loading and **must not be changed** by the user following automatic default selection.

1109	INVERTER_MAX_S6_CURRENT				Cross reference: –
Limit current, power section S6				Relevant: MSD	Protection level: 2/4
Unit: A	Default: 200.0	Minimum: 1.0	Maximum: 500.0	Data type: FLOAT	Active: POWER ON

This machine data is used to enter the maximum permissible power section current for an S6 load cycle (intermittent operation) as an rms value. This function is defined with MD 1106: INVERTER_CODE, which automatically parameterizes the Siemens power sections for this machine data.

> **!**
>
> **Important**
>
> The user change **must not change this value following automatic default selection.**

1111	INVERTER_RATED_CURRENT				Cross reference: –
Rated power section current				Relevant: FSD/MSD	Protection level: 2/4
Unit: A	Default: 200.0	Minimum: 1.0	Maximum: 500.0	Data type: FLOAT	Active: POWER ON

The machine data is used to enter the maximum permissible power-section continuous current as an rms value. MD 1106: INVERTER_CODE is used to automatically parameterize the Siemens power sections for this machine data.

> **!**
>
> **Important**
>
> The user **must not change this value** following automatic default selection.

2.1 Parameters for motor and power-section selection

1119	SERIES_INDUCTANCE				Cross reference: –
	Inductance of the series reactor			Relevant: MSD/AM	Protection level: 2/4
Unit: mH 810D 840D	Default: 0.0 0.0	Minimum: 0.0 0.0	Maximum: 65.0 65.0	Data type: FLOAT	Active: POWER ON

For special high-speed asynchronous motors or low-leakage reactance asynchronous motors, generally a series reactor is required to ensure stable current controller operation. The inductance of the reactor is taken into account in the current model.

2.2   Calculate controller data

The Calculate controller data function is automatically initiated after motor selection. This can also be explicitly executed via the **Calculate controller data** softkey.

The machine data below are used to calculate the controller data:

Table 2-3   Input machine data

MD no.	MD name	Description	Drive
1000	CURRCTRL_CYCLE_TIME	Current controller cycle	FDD/MSD
1001	SPEEDCTRL_CYCLE_TIME	Speed controller clock cycle	FDD/MSD
1003	STS_CONFIG	Configuration STS	FDD/MSD
1104	MOTOR_MAX_CURRENT	Max. motor current	FSD
1116	ARMATURE_INDUCTANCE	Armature inductance	FSD
1117	MOTOR_INERTIA	Motor moment of inertia	FDD/MSD
1118	MOTOR_STANDSTILL_CURRENT	Motor standstill current	FSD
1119	SERIES_INDUCTANCE	Series reactor inductance	**MSD/AM**
1134	MOTOR_NOMINAL_FREQUENCY	Nominal motor frequency	MSD
1138	ROTOR_COLD_RESISTANCE	Rotor cold resistance	MSD
1139	STATOR_LEAKAGE_REACTANCE	Stator leakage reactance	MSD
1140	ROTOR_LEAKAGE_REACTANCE	Rotor leakage reactance	MSD
1141	MAGNETIZING_REACTANCE	Magnetizing reactance	MSD
1142	FIELD_WEAKENING_SPEED	Threshold speed field weakening	MSD
1146	MOTOR_MAX_ALLOWED_SPEED	Max. motor speed	MSD
1400	MOTOR_RATED_SPEED	Rated motor speed	FSD

2.2 Calculate controller data

The following machine data are changed using the **Calculate controller data** softkey:

Table 2-4   Output machine data

MD no.	MD name	Description	Drive
1120	CURRCTRL_GAIN[DRx]	P gain, current controller	FDD/MSD
1121	CURRCTRL_INTEGRATOR_TIME[DRx]	Integrator time of current controller	FDD/MSD
1147	SPEED_LIMIT[DRx]	Speed limitation	FDD/MSD
1150	FIELDCTRL_GAIN	P gain, flux controller	MSD
1151	FIELDCTRL_INTEGRATOR_TIME	Flux-controller reset time	MSD
1230	TORQUE_LIMIT_1	1st torque limit value	FSD
1235	POWER_LIMIT_1	1st power limit value	FSD
1401	MOTOR_MAX_SPEED	Speed for max. useful motor speed	FDD/MSD
1405	MOTOR_SPEED_LIMIT	Motor monitoring speed	FDD/MSD
1407	SPEEDCTRL_GAIN_1[0...7,DRx]	P gain, speed controller	FDD/MSD
1408	SPEEDCTRL_GAIN_2[0...7,DRx]	P gain, upper adaptation speed	MSD
1409	SPEEDCTRL_INTEGRATOR_TIME_1[0...7,DRx]	Speed controller reset time	FDD/MSD
1410	SPEEDCTRL_INTEGRATOR_TIME_2[0...7,DRx]	Reset time upper adaptation speed	MSD
1411	SPEEDCTRL_ADAPT_SPEED_1	Lower adaptation speed	MSD
1412	SPEEDCTRL_ADAPT_SPEED_2	Upper adaptation speed	MSD
1413	SPEEDCTRL_ADAPT_ENABLE	Selection speed controller adaptation	MSD

2.3   Power-section derating (SW 5.01.06 and higher)

Derating is the reduction in current supplied by the power section as a function of the converter frequency.

2.3.1   Derating characteristic

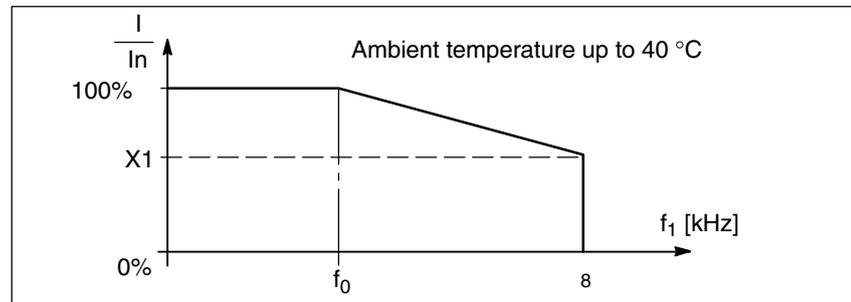For SIMODRIVE 611D, the derating characteristic is determined as follows:

Fig. 2-2   Derating characteristic

If pulse frequency f1 (MD 1100) is greater than frequency f0 (FSD: 4 kHz, MSD and PE-MSD: 3.2 kHz), the maximum permissible current of the power section (MD 1108 or MD 1175) reduces linearly in accordance with the above characteristic.

The gradient of the characteristic is defined by the derating factor X1 associated with the 8 kHz pulse frequency.

The derating factor X1 depends on the operating mode of the power section and is:

- FSD   (MD 1015 = 0)   in MD 1178

- PE-MSD   (MD 1015 = 1) and MSD   in MD 1179

The derating factor affects the following currents:

- MSD   MD 1108, MD 1109   and MD 1111

- FSD   MD 1108   and MD 1111

- PE-MSD   MD 1175, MD 1176   and MD 1177

The derating factor X1 is preassigned when the power section is selected during commissioning. MD 1178 and MD 1179 are preassigned for an FSD power section, MD 1179 for an MSD power section.

The currently active derating factor is calculated during ramp-up as a function of the pulse frequency and the derating factor X1. It can be read from display MD 1099.

When software is updated, the new derating factor (FSD MD 1178, MSD and PE-MSD MD 1179) is preset to zero. Error message 301719: "Incomplete power-section data", which either prompts you to enter the missing power-section data or to recommission the device, is only output for a missing derating factor if the pulse frequency MD 1100 is greater than 4 kHz for FSD or 3.2 kHz for MSD and PE-MSD. Otherwise, a derating factor of 100% is displayed in MD 1099.

2.3   Power-section derating (SW 5.01.06 and higher)

2.3.2   Machine data

The following machine data are available for i^{2}t derating:

1098	INVERTER_MAX_CURR_DERAT					Cross reference: –
	Power-section derating limit current				Relevant: MSD/SLM/FSD	Protection level: 2/4
Unit: A	Default: 200.0	Minimum: 0.0	Maximum: 500.0		Data type: FLOAT	Active: POWER ON

1099	INVERTER_DERATING_FACT					Cross reference: –
	PS limit-current derating factor				Related to: MSD/SLM/FSD	Protection level: 2/4
Unit: %	Default: 0.0	Minimum: 0.0	Maximum: 100.0		Data type: FLOAT	Active: POWER ON

1175	INVERTER_THERM_CURR_ASYN					Cross reference: –
	Limit current, power section ASYN				Related to: SLM/FSD	Protection level: 2/4
Unit: A	Default: 200.0	Minimum: 0.0	Maximum: 500.0		Data type: FLOAT	Active: POWER ON

1176	INVERTER_MAX_S6_CURR_ASYN					Cross reference: –
	Limit current, power section S6 ASYN				Relevant: SLM/FSD	Protection level: 2/4
Unit: A	Default: 200.0	Minimum: 0.0	Maximum: 500.0		Data type: FLOAT	Active: POWER ON

1177	INVERTER_RATED_CURR_ASYN					Cross reference: –
	Rated current, power section ASYN				Relevant: SLM/FSD	Protection level: 2/4
Unit: A	Default: 200.0	Minimum: 0.0	Maximum: 500.0		Data type: FLOAT	Active: POWER ON

1178	INVERTER_DERATING_SYN					Cross reference: –
	Power section, derating SYN				Relevant: SLM/FSD	Protection level: 2/4
Unit: %	Default: 200.0	Minimum: 0.0	Maximum: 100.0		Data type: FLOAT	Active: POWER ON

1179	INVERTER_DERATING_ASYN				Cross reference: –
	Power section, derating ASYN			Relevant: SLM/FSD	Protection level: 2/4
Unit: %	Default: 0.0	Minimum: 0.0	Maximum: 100.0	Data type: FLOAT	Active: POWER ON

2098	INVERTER_MAX_CURR_DERAT_M2			840D only	Cross reference: –
	Power-section derating limit current			Relevant: MSD/SLM/FSD	Protection level: 2/4
Unit: A	Default: 200.0	Minimum: 0.0	Maximum: 500.0	Data type: FLOAT	Active: POWER ON

2099	INVERTER_DERATING_FACT_M2			840D only	Cross reference: –
	PS limit-current derating factor			Related to: MSD/SLM/FSD	Protection level: 2/4
Unit: %	Default: 0.0	Minimum: 0.0	Maximum: 100.0	Data type: FLOAT	Active: POWER ON

2.3.3 Power section data

The power section data are initialized with the following default values:

MSD

Table 2-5   Power section data for MSD

MD 1106 (hexadeci-mal)	MD 1107	MD 1108	MD 1109	MD 1111	MD 1179
01	8.0	3.0	3.0	3.0	50.0
02	15.0	8.0	5.0	5.0	50.0
04	25.0	16.0	10.0	8.0	55.0
06	50.0	32.0	32.0	24.0	40.0
07	80.0	51.0	40.0	30.0	55.0
08	160.0	76.0	60.0	45.0	55.0
09	160.0	102.0	80.0	60.0	50.0
A	200.0	127.0	110.0	85.0	55.0
B	300.0	193.0	150.0	120.0	50.0
C	400.0	257.0	250.0	200.0	50.0
D	120.0	76.0	60.0	45.0	55.0
E	67.0	40.0	32.0	24.0	0.0

2.3 Power-section derating (SW 5.01.06 and higher)

FSD

Table 2-6   Power section data for FSD

MD 1106 (hexa-decimal)	MD 1107	MD 1108	MD 1111	MD 1175	MD 1176	MD 1177	MD 1178	MD 1179
11	8.0	6.0	3.0	3.0	3.0	3.0	55.0	50.0
12	15.0	10.0	5.0	8.0	5.0	5.0	55.0	50.0
14	25.0	18.0	9.0	16.0	10.0	8.0	55.0	55.0
16	50.0	36.0	18.0	32.0	32.0	24.0	40.0	40.0
17	80.0	56.0	28.0	51.0	40.0	30.0	50.0	55.0
18	160.0	70.0	45.0	76.0	60.0	45.0	55.0	55.0
19	160.0	112.0	56.0	102.0	80.0	60.0	55.0	50.0
1A	200.0	140.0	70.0	127.0	110.0	85.0	55.0	55.0
1B	300.0	100.0	100.0	193.0	150.0	120.0	50.0	50.0
1C	400.0	210.0	140.0	257.0	250.0	200.0	50.0	50.0
1D	120.0	64.0	42.0	76.0	60.0	45.0	55.0	55.0
1E	67.0	36.0	18.0	40.0	32.0	24.0	0.0	0.0

2.4 i^{2}t power section limitation (SW 6 and higher)

Note

The function is taken from SIMODRIVE 611 universal.

See also Description of Functions "SIMODRIVE 611 universal Control Components for Speed Controller and Positioning" 05.2000 Edition, Chapter A2.

i^{2}t power-section limit

This limitation protects the power section against constant overload.

If operated too long above the permissible load limit, the power section current is limited according to a characteristic curve. The load limit can be reduced still further by means of parameters (MD 1260 and MD 1261).

The limitation is removed again gradually when the power section is no longer operated above the load limit.
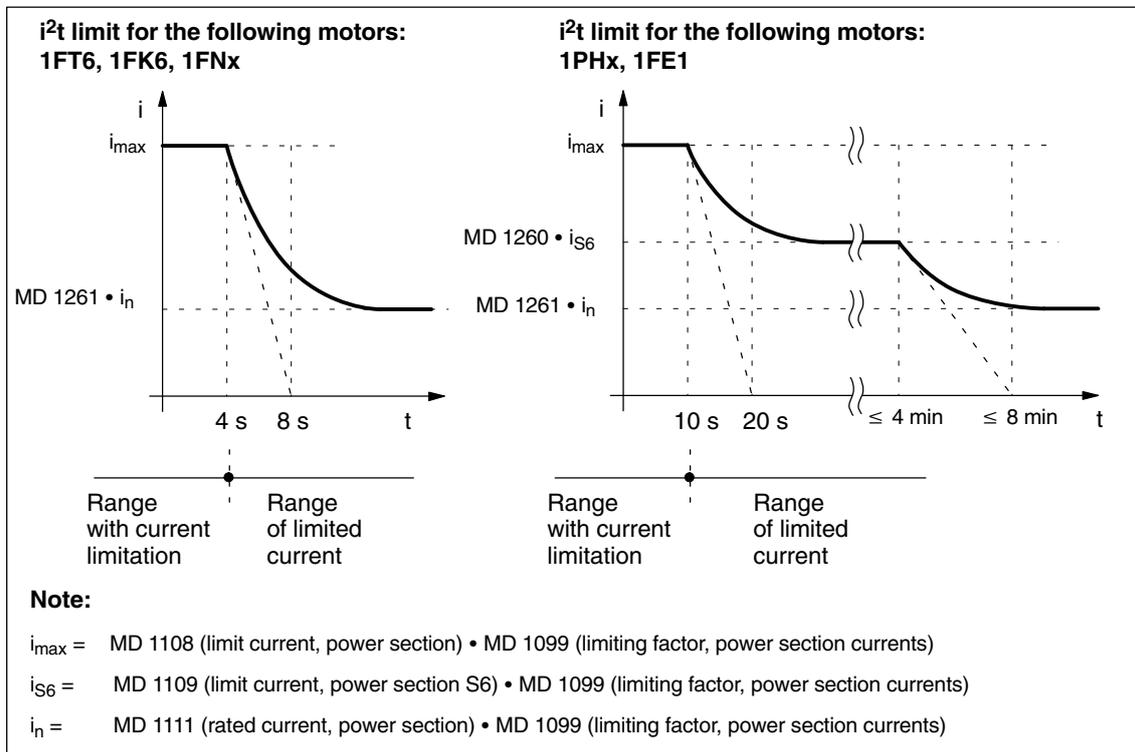

i^{2}t limit for the following motors: 1FT6, 1FK6, 1FNx

i^{2}t limit for the following motors: 1PHx, 1FE1

Note:

i_{max} =   MD 1108 (limit current, power section) • MD 1099 (limiting factor, power section currents)

i_{S6} =   MD 1109 (limit current, power section S6) • MD 1099 (limiting factor, power section currents)

i_n =   MD 1111 (rated current, power section) • MD 1099 (limiting factor, power section currents)

Fig. 2-3   Behavior at continued operation at current limit

Output signals

The limit status is displayed via ZK3, bit 10.

ZK3 bit 10 = 1: Power section within i^{2}t limit

ZK3 bit 10 = 0: Power section not within i^{2}t limit

2.4   i2t power section limitation (SW 6 and higher)

2.4.1 Machine data

The following machine data are available for the "i^{2}t power-section limit" function:

Settable MD

These MDs are preset to protect the power section. Reducing the parameter values can also protect the motor against continuous overload.

1260	I2T_S6_REDUCTION				Cross reference: –
	i^{2}t limitation, limit current, power section S6			Relevant: MSD/SLM/FSD	Protection level: 2/4
Unit: %	Default: 100.0	Minimum: 25.0	Maximum: 100.0	Data type: FLOAT	Active: Immediately

1261	I2T_NOMINAL_REDUCTION				Cross reference: –
	i^{2}t limitation, rated current, power section S6			Relevant: MSD/SLM/FSD	Protection level: 2/4
Unit: %	Default: ROT: 110.0 LIN: 110.0	Minimum: 25.0	Maximum: ROT: 110.0 LIN: 110.0	Data type: FLOAT	Active: Immediately

Note

The maximum value of MD 1261 is

- For 1FT6, 1FK6 and 1FNx = 110%,

- For 1PHx and 1FE1 = 100%.

The maximum value is also preset as the default value.

In principle, values between 100% and 110% may also be entered for 1FE1. The limit is then set internally to 100%.

MD for diagnostics

1262	DIAGNOSIS_I2T				Cross reference: –
	i²t time in limit			Relevant: MSD/SLM/FSD	Protection level: 2/4
Unit: s	Default: 0.0	Minimum: 0.0	Maximum: 100,000.0	Data type: FLOAT	Active: Immediately

1263	LIMIT_I2T				Cross reference: –
	i²t current limitation factor			Relevant: MSD/SLM/FSD	Protection level: 2/4
Unit: %	Default: 0.0	Minimum: 0.0	Maximum: 100.0	Data type: FLOAT	Active: Immediately

1264	LOAD_I2T				Cross reference: –
	i²t current load factor			Relevant: MSD/SLM/FSD	Protection level: 2/4
Unit: %	Default: 0.0	Minimum: 0.0	Maximum: 100.0	Data type: FLOAT	Active: Immediately

MD 1264 shows the current load for the i^2t power-section limit. The difference between it and 100% indicates the level of resources remaining. When the load reaches 100%, the current limit is reduced.

MDs 1262, 1263 and 1264 describe the current status as follows:

Table 2-7   Status

Status	Time MD 1262	Current limitation MD 1263	Load MD 1264
Not limited (ZK3 bit 10 = 0)	Constant	100%	< 100%
Limited (ZK3 bit 10 = 1)	Running	< 100%	100%

Note

For PE-MSD (MD 1015 = 1), machine data MD 1176 (Limit current, power section S6) must contain valid values. If they do not, error message 301719: "Power section data incomplete" will appear.

This data is preassigned during re-commissioning when the power section is selected.

2.5   Rotor position synchronization/rotor/pole position identification

Rotor/pole position identification determines the absolute position of the rotor in the motor independently on power-up.

Rotor/pole position identification is used for:

- Determining the rotor position (coarse synchronization or fine synchronization)

- Support during startup in determining the commutation angle offset.

Rotor/pole position identification is possible using three techniques:

- Saturation-based technique

- Motion-based technique (drive software version 05.01.10, 06.03.09 and higher)

- Elasticity technique (drive software version 06.07.05 and higher)

The required technique is selected using MD 1075 ALGORITHM_ROTORPOS_IDENT.

The following machine data is available for parameterization and diagnosis:

Machine data	MD 1075 = 1	MD 1075 = 3	MD 1075 = 6
MD 1011: ACTUAL_VALUE_CONFIG	X	X	X
MD 1016: ANGLE_OFFSET	X	X	X
MD 1017: STARTUP_ASSISTANCE	X	X	X
MD 1019: CURRENT_ROTORPOS_IDENT	X	X	X
MD 1020: MAX_TURN_ROTORPOS_IDENT MD 1020: MAX_MOVE_ROTORPOS_IDENT	X X	X X	X X
MD 1070: RLI_RAMP_TIME	–	–	X
MD 1071: RLI_WAIT_TIME	–	–	X
MD 1072: RLI_AMOUNT	–	–	X
MD 1073: POSS_TURN_ROTORPOS_IDENT	–	–	X
MD 1076: FACTOR_INERTIA (SRM)FACTOR_MASS (SLM)	–	X	–
MD 1077: RLI_INTEGRATOR_TIME	–	X	–
MD 1078: MAX_TIME_ROTORPOS_ID	–	X	–
MD 1729: ACTUAL_ELECTRIC_ROTORPOS	X	X	X
MD 1734: DIAG_ROTOROS_IDENT	X	X	X
MD 1736: TEST_ROTORPOS_IDENT	X	X	X
MD 1737: DIFF_ROTORPOS_IDENT	X	X	X
X means that MD is assigned			

Coarse synchronization

Rotor position identification

Rotor/pole position identification determines the position of the rotor in the motor independently. This means that the motor encoder does not require any additional position information from the encoder (C/D track). In the case of linear motors, the Hall-effect sensors can be omitted provided that the supplementary conditions are met (see Subsection 2.5.1).

When using an absolute motor measuring system, rotor/pole position identification can only be used to determine the commutation angle offset (MD 1016) and for plausibility checks (see Subsection 2.5.4).

Fine synchronization

Exceeding the zero mark

Thanks to the accuracy of the identification technique, the rotor position determined can be used for fine synchronization at the zero mark.

Alternative to encoder adjustment

If rotor/pole position identification is used for coarse and fine synchronization, encoder adjustment may be omitted.

2.5.1 Supplementary conditions

Different supplementary conditions apply to the saturation-based technique and the motion-based technique.

Saturation-based technique (MD 1075 = 1)

When using the saturation-based technique for rotor/pole position identification, the following supplementary conditions must be observed:

- The technique can be used on braked and non-braked motors.

- The technique cannot be applied to motors that are in motion.

- The specified current level must be sufficient to produce a significant measuring signal.

- The technique can only be started when the controller and pulses are enabled, as current must flow through the motor.

- The measurement and evaluation take approximately 250 ms.

Motion-based technique (MD 1075 = 3)

When using the motion-based technique for rotor/pole position identification, the following supplementary conditions must be observed (as of FSD 06.03.09, 05.01.10):

- Tested on 1FE1052-4H..., 1FE1053-4H and 1FE104-6W motors as well as 1FW6.

- Due to differences in mechanical construction, the result of motion-based rotor/pole position identification must be checked once on initial startup. The deviation in measured rotor position should be < 10° 10 electrical.

- The technique is only permitted for use on a freely moveable horizontal axis without a brake.

- There must be no external forces acting on the motor during rotor/pole position identification.

- If the previous supplementary conditions are not fulfilled, then 1FN3 motors can only be operated with Hall sensor boxes or with absolute measuring systems.

- The technique can only be started when the controller and pulses are enabled, as current must flow through the motor.

- With this technique, under worst-case conditions, movement of about ± 5 mm can occur.

- The axis to be identified must be placed in follow-up mode until identification has been completed, to conceal alarm 25040 (Zero-speed monitoring).

- In conjunction with Safety Integrated, perform the following steps in the order given:

   1. Place the axis in follow-up mode until identification has been completed.

   2. Deselect SBH (safe operational stop) and SG (safe velocity).

   3. When SBH and SG have been deselected, set the servo enable for the axis to be identified.

   4. Following successful identification, cancel follow-up mode.

   5. Select SBH and SG.

Note

It is only permitted to start rotor/pole position identification in conjunction with Safety Integrated for test purposes via MD 1736 on deselection of SBH/SG.

- In the case of coupled axes with a gantry, the coupled axes must be disconnected during identification as follows:

   1. Do not release the leading axis and following axis of the gantry combination, e.g., no servo enable on the interface (DB 3x.DBx2.1) or terminal 663.

   2. Write a 1 to MD 37140 Gantry Break Up using the PLC.

   3. Perform a RESET using the PLC to activate Gantry Break Up.

   4. Release the leading axis once identification has been completed successfully. Then cancel release of the leading axis again.

   5. Release the following axis once identification has been completed successfully. Then cancel release of the following axis again.

   6. Write a 0 to MD 37140 Gantry Break Up using the PLC.

   7. Perform a RESET using the PLC to activate the gantry.

   8. Release the leading and following axes.

   9. Gantry coupling must be possible now, start synchronization if necessary.

- On starting rotor/pole position identification for test purposes by means of MD 1736:

 – On activation for test purposes, alarm 25040 (zero-speed monitoring), which must be acknowledged using the RESET key, may occur.

 – It is only permitted to start rotor position identification in conjunction with Safety Integrated for test purposes on deselection of SBH/SG.

 – It is not permitted to activate rotor/pole position identification for test purposes on coupled axes.

Note

In the case of technique 3 with enabled brake control, identification for test purposes is not started via MD 1736[0] = 1. To start this technique, as well as bit 0 the user also has to set bit 1: MD 1736 = 3. This prevents incorrect operation with a suspended axis.

Note

Measuring systems with coarser encoder resolution are being increasingly used. This is the reason that when carrying out a rotor-position-identification routine,
technique 3 (P1075 = 3), it is possible to enter a time constant for acutal-speed-value filtering using MD 1523 during the rotor-position-identification routine. This makes MD 1522 ineffective.

Parameter settings for the motion-based technique

For the parameterization of rotor/pole position identification for the motion-based technique, initially, a rotor-/pole-position-identification routine must be performed with standard parameterization.

The resulting noise should sound like a series of quiet knocks.

In the event of a fault, proceed as follows:

- If alarm 300611 (Illegal motion) occurs, the setting for the load mass parameter (MD 1076) should be increased and the maximum permissible movement (MD 1020) should be checked and increased if necessary.

- If alarm 300610 (RPI failed) occurs and the diagnosis parameter MD 1734 contains the value "–4" (current increase too small), the motor terminals are not connected correctly: The motor power supply connection should be checked.

- If alarm 300610 (RPI failed) occurs and the diagnosis parameter MD 1734 contains the value "–6" (max. permissible duration exceeded), the possible reasons are:

  – External forces have disturbed the identification procedure (e.g., coupled axes were not disconnected, knocks occurred, etc.)

  – If the drive emitted a loud whistle during identification, the identification procedure has become unstable: MD 1076 should be reduced

  – Very low encoder resolution; use encoders with higher resolution and/or a high-performance closed-loop control module

  – Encoder mount not rigid; improve mount.

- If alarm 300610 (RPI failed) occurs and the diagnosis parameter MD 1734 contains the value "–7" (no unique rotor position found), the possible reasons are:

  – The axis cannot move freely (e.g., motor is braked solid)

  – External forces have disturbed the identification procedure (see above)

  – The axis has very high friction; the identification current (MD 1019) must be increased.

Once rotor/pole position identification has been performed successfully, the rotor position found must be checked. The test function can determine the difference between the rotor position angle identified and the rotor position angle currently used by the control.

The following procedure must be performed several times:

1. Activate the test function with MD 1736
   (Test rotor/pole position identification) = 1.

2. Analyze the difference in MD 1737 (rotor-/pole-position-identification difference); measured values less than 10 degrees are acceptable. If this is not the case, a higher current must be used for identification (MD 1019).

Elasticity technique (MD 1075 = 6)

The elasticity of the system is utilized with rotor-/pole-position-identification technique 6.

Supplementary conditions

High Performance controller with FSD software $\geq$ 06.07.07

Note

The axis must be securely braked.

2.5.2   Machine data

1011	ACTUAL_VALUE_CONFIG				Cross reference: –
	Configuration, actual-value sensing IM			Related to: FDD/MSD ROT/LIN	Protection level: 2/4
Unit: HEX	Default: 0	Minimum: 0	Maximum: F1FF	Data type: UNS.WORD	Effective: Power ON

In this machine data, bit 12 (*Identify coarse position*) is set to cause the RPI procedure to be initiated when the drive is switched on. Furthermore, when bit 13 (*Identify fine position*) is set, rotor/pole position identification is performed regardless of the setting of bit 12.

1016	COMMUTATION_ANGLE_OFFSET				Cross reference: –
	Commutation angle offset			Related to: FSD	Protection level: 2/4
Unit: HEX	Default: 0	Minimum: 0	Maximum: F1FF	Data type: UNS.WORD	Effective: Power ON

1017	STARTUP_ASSISTANCE				Cross reference: –
	Assistance for startup			Related to: FSD ROT/LIN	Protection level: 2/4
Unit: –	Default: 0	Minimum: –1	Maximum: 1	Data type: WORD	Effective: Immediately

When MD 1017 is set to 1, the determined commutation angle offset is stored in MD 1016. On an incremental measuring system, the offset is calculated by crossing the zero mark and on an absolute measuring system, by evaluating the absolute position.

1019	CURRENT_ROTORPOS_IDENT			840D only	Cross reference: –
	Current, rotor/pole position identification			Relevant: FSD/MSD	Protection level: 2/4
Unit: %	Default: ROT: 50 LIN: 12	Minimum: 0	Maximum: 100	Data type: FLOAT	Active: Immediately

The percentage entered for MD 1019 refers to MD 1104: MOTOR_MAX_CURRENT.

The rotor/pole position identification is carried out at the current entered. The current must be selected so that a clear measuring signal is produced for the motor that is used.

⚠ **Warning**

Increasing the current enhances the accuracy of the measurement but also increases the motor rotation/motion.

To obtain an optimum setting for MD 1019, we recommend that you start the measurement with MD 1736: TEST_ROTORPOS_IDENT and check the accuracy in MD 1737: DIFF_ROTORPOS_IDENT.

1020	MAX_TURN_ROTORPOS_IDENT (SRM) MAX_MOVE_ROTORPOS_IDENT (SLM)				Cross reference: –
	ROT: Maximum rotation, rotor/pole position identification LIN: Maximum movement, rotor/pole position identification			Related to: FDD/MSD	Protection level: 2/4
Unit: ROT: Degrees LIN: mm	Default: 10 (ROT) 5 (LIN)	Minimum: 0	Maximum: ROT: 90 LIN: 30	Data type: FLOAT	Effective: Immediately

The rotor/pole position identification can cause a considerably large movement in non-braked motors. If the rotation is greater than the value entered in the machine data, alarm 300611, "Impermissible movement for rotor/pole position identification", is issued.

1075	ALGORITHM_ROTORPOS_IDENT		Cross reference: –
	Rotor-/pole-position-identification technique used	Related to: SRM/SLM?	Protection level: 1/1
Unit: –	Default: 1	Minimum: 1	Maximum: 6	Data type: UNS.WORD	Effective: Immediately

The technique is set in MD 1075.

Table 2-8   Coding in MD 1075

MD 1075 =	Traversing
1	Rotor/pole position identification using the saturation-based technique
3	Rotor/pole position identification using the motion-based technique
6	Elasticity technique

For each "Calculate controller data", MD 1075 is preset as follows:

- 1FN3 motors: MD 1075 = 3
- All other motors: MD 1075 = 1

Following successful rotor/pole position identification, the contents of MD 1075 are copied to MD 1734 for diagnostic purposes.

Note

MD 1075 is effective immediately. If, however, the drive is waiting for the enables before performing rotor/pole position identification, any change in MD 1075 will only become effective during the next attempt (the identification is already running in the waiting state).

1070	RLI_RAMP_TIME		Cross reference: –
	Current increase time with current/elasticity technique 6	Related to: FSD	Protection level: 2/4
Unit: ms	Default: 500	Minimum: 0.0	Maximum: 10,000.0	Data type: FLOAT	Effective: Immediately

With the RPI process (MD 1075 = 6), the maximum current for rotor/pole position identification is achieved in the time specified here.

1071	RLI_WAIT_TIME		Cross reference: –
	Delay until the next measurement with elasticity technique 6	Related to: FSD	Protection level: 2/4
Unit: ms	Default: 20	Minimum: 0.0	Maximum: 10,000.0	Data type: FLOAT	Effective: Immediately

With the RPI process (MD 1075 = 6), the delay between two measurements.

1072	RLI_AMOUNT				Cross reference: –
	Number of measurements with current/elasticity technique 6			Related to: FSD	Protection level: 2/4
Unit: –	Default: 12	Minimum: 6	Maximum: 60	Data type: UNS.WORD	Effective: Immediately

1073	POSS_MOVE_ROTORPOSS_IDENT				Cross reference: –
	Maximum movement with current/movement technique 6			Related to: FSD	Protection level: 2/4
Unit: degrees	Default: 1.0	Minimum: 0.0	Maximum: 90.0	Data type: FLOAT	Effective: Immediately

1076	FACTOR_INERTIA (SRM) / FACTOR_MASS (SLM)				Cross reference: –
	LROT: Load moment of inertia (SRM) LIN: Load mass (SLM)			Related to: SRM/SLM	Protection level: 1/1
Unit: ROT: kg m^2 LIN: kg	Default: 0.0	Minimum: 0.0	Maximum: ROT: 500.0 LIN: 10,000.0	Data type: FLOAT	Effective: Immediately

Additional moment of inertia (SRM) or additional mass (SLM) that is used for setting the controller parameters for motion-based rotor/pole position identification.

1077	RLI_INTEGRATOR_TIME				Cross reference: –
	Reset time, rotor-position-identification controller			Related to: MSD/SLM	Protection level: 1/1
Unit: ms	Default: 3.7	Minimum: 0.0	Maximum: 500	Data type: FLOAT	Effective: Immediately

The RPI-controller reset time is specified via MD 1077. If MD 1077 is set to 0, the I component is switched off.
MD 1077 is recalculated and initialized when the "Calculate controller data" function is selected.

1078	MAX_TIME_ROTOROS_ID				Cross reference: –
	Max. time of rotor/pole position identification			Related to: SRM/SLM	Protection level: 1/1
Unit: ms	Default: 800.0	Minimum: 100.0	Maximum: 1,000.0	Data type: FLOAT	Effective: Immediately

The maximum time for one measurement is specified in MD 1078.

1523	ACT_SPEED_FILTER_TIME_RLI				Cross reference: –
	Time constant, actual-speed-value filter, RPI			Related to: SRM	Protection level: 1/1
Unit: –	Default: 0.0	Minimum: 0.0	Maximum: 500.0	Data type: FLOAT	Effective: Immediately

Time constant of actual-speed-value filter during rotor position identification, technique 3. This MD is effective with SW 8.8.5 and higher.

2.5 *Rotor position synchronization/rotor/pole position identification*

1729	ACTUAL_ELECTRIC_ROTORPOS				Cross reference: –
Current rotor position, electrical				Related to: FSD	Protection level: 2/4
Unit: degrees	Default: 0.0	Minimum: −100,000.0	Maximum: 100,000.0	Data type: FLOAT	Effective: Immediately

1734	DIAG_ROTORPOS_IDENT				Cross reference: –
Diagnostics, rotor/pole position identification				Related to: FSD ROT/LIN	Protection level: 2/4
Unit: –	Default: 0	Minimum: −1018	Maximum: 6	Data type: WORD	Effective: Immediately

Table 2-9   Coding in MD 1734

MD 1734 =	Meaning	Remedy	Process MD 1075 =
0	Function was not selected or is not yet completed		1
1, 3, 6	Each function has been successfully completed		1, 3, 6
−1	Measurement has not provided a significant result	Increase current	1
−2	The current could not be reduced in time during measurement	Check armature inductance (MD 1116) and increase it if necessary	1
−3	Motor has moved more during measurement than MD 1020 permits	Increase permissible rotation (MD 1020) or reduce current	1 + 3
−4	Current increase too small, presumably due to poor connection of the motor terminals	Check motor terminals	1 + 3
−5	The current limit of the motor or power section was overshot	Check current limits or reduce armature inductance (MD 1116)	1
−6	Timeout for RPI, a steady value for rotor position was not reached during the permitted period	See 2.5.1, "Parameter settings for the motion-based technique".	3
−7	A definite rotor position was not found, the motor is presumably not free to move (e.g., braked solid or at endstop)	See 2.5.1, "Parameter settings for the motion-based technique".	3
−11	Error in ATAN calculation		6
−12	Too few measuring points		6
−13	Maverick in series of measurements		6
−14	Maximum rotation/movement without current		6
−15	No positive edge found		6

Table 2-9   Coding in MD 1734

MD 1734 =	Meaning	Remedy	Process MD 1075 =
−16	The Fourier transformation result deviates by more than 30 degrees from the rough estimate.		6
−17	Results test has failed.	Check brake, possibly released?	6
−18	No negative measured value found		6
−10xx	Too many attempts	Reduce MD 1073 or Identification current too low, increase MD 1019	6

1736	TEST_ROTORPOS_IDENT			840D only	Cross reference: −
Test, rotor/pole position identification				Related to: FDD/MSD	Protection level: 2/4
Unit: −	Default: 0	Minimum: 0	Maximum: 3	Data type: UNS.WORD	Effective: Immediately

Setting MD 1736 = 1 performs a test rotor/pole position identification. The rotor angle used by the controller does not change.
MD 1737: DIFF_ROTORPOS_IDENT is described; in the event of an error, an alarm is issued. After measurement, the MD 1736 is set to 0.

The test function is used to optimize the accuracy in conjunction with MD 1019: CURRENT_ROTORPOS_IDENT.

If the holding brake is controlled via closed-loop-control-module terminals, the brake must be closed during all rotor-/pole-position-identification processes, for safety reasons.
The brake can be opened using MD 1736 = 3 with process 3.

1737	DIFF_ROTORPOS_IDENT			840D only	Cross reference: −
Difference, rotor/pole position identification				Related to: FDD/MSD ROT/LIN	Protection level: 2/4
Unit: degrees	Default: 0.000	Minimum: −100,000.0	Maximum: 100,000.0	Data type: FLOAT	Effective: Immediately

After performing rotor/pole position identification, the difference between the rotor angle determined and that currently used by the control is entered in the machine data and displayed.

2.5.3   Fine synchronization with distance-coded measuring system (SW 6.7.5 and higher)

The "fine synchronization" function has been expanded with a distance-coded motor measuring system. Both linear and rotary measuring systems can be used.

The current position of the moveable part must be identified after ramping up a synchronized machine. Rotor/pole position identification is necessary if not working with an absolute measuring system.

With this process, fine synchronization is carried out within strictly defined distances, irrespective of the current location of the axis.

Supplementary conditions

Only encoders compatible with Heidenhain encoders are supported.

Fine synchronization can only be carried out if the NC itself has approached a reference point. Up to this point, the drive is synchronized coarsely.

Machine data

1011	ACTUAL_VALUE_CONFIG					Cross reference: –
	Configuration, actual-value sensing IM				Related to: FDD/MSD ROT/LIN	Protection level: 2/4
Unit: HEX	Default: 0	Minimum: 0	Maximum: F1FF	Data type: UNS.WORD	Effective: Power ON	

Bit 7: Distance-coded linear measurement system
      0 No distance-coded reference marks available

1055	MARKER_DIST			840D only		Cross reference: –
system	Reference-mark distance with a distance-coded measuring				Related to: FSD/LIM	Protection level: 2/4
Unit: Rot: De- grees Lin: mm	Default: 20 20	Minimum: 0 0	Maximum: 90 1,000	Data type: FLOAT	Effective: Power ON	

Drive machine data 1055 corresponds to the NC machine data 34300 ENC_REFP_MARKER_DIST. MD 1055 is motor-side, MD 34300 is load-side.

1056	MARKER_DIST_DIFF			840D only		Cross reference: –
	Distance difference				Related to: FSD/LIM	Protection level: 2/4
Unit: Rot: De- grees Lin: mm	Default: 0.02 0.02	Minimum: 0 0	Maximum: 45 500	Data type: FLOAT	Effective: Power ON	

Drive machine data 1056 corresponds to NC machine data 34310 ENC_REFP_MARKER_INC. MD 1056 is motor-side, MD 34310 is load-side.

Alarms   Errors discovered during fine synchronization are output with alarm signal
                    300507.

                    The following errors are detected.

                    • The calculated new rotor position differs by over 45 degrees to the position
                      calculated by rotor/pole position identification.

                    • There is a difference of over 45 electrical degrees between the current rotor
                      position (coarse position from rotor/pole position identification) and the new
                      rotor position determined by fine synchronization (see alarm 300507).

2.5.4   Encoder plausibility check (SW 6.6.6 and higher)

To increase the ruggedness of the drive as regards incorrect encoder informa-
tion, rotor/pole position identification is carried out after every ramp-up function
and each time a parking axis is deselected. The result is compared with the
rotor position calculated using the absolute encoder information. If the deviation
is more than 45 degrees, an error is recorded. Although the new function can be
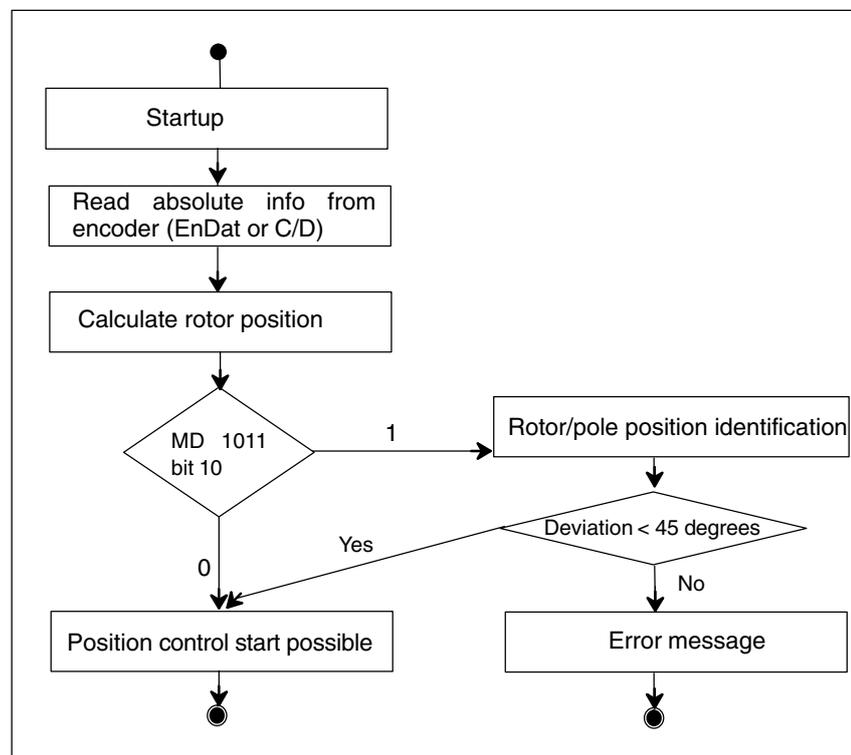enabled and disabled, it is disabled by default.

Fig. 2-4   Plausibility monitoring for absolute value encoder

2.5 *Rotor position synchronization/rotor/pole position identification*

Parameterization   Bit 10 of MD 1011, which was previously not used, activates and deactivates the function. A detailed description of this MD can be found in DG1 Section 2.1.

1011	MD_KONF_ISTWERT				Cross reference: –
	Configuration, actual-value sensing IM			Related to: FSD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0	Minimum: not applicable	Maximum: not applicable	Data type: UNS.WORD	Effective: Power On

MD_KONF_ISTWERT[10] = 0
Plausibility monitoring is switched off

MD_KONF_ISTWERT[10] = 1
Plausibility monitoring is switched on. Rotor/pole position identification takes place after each ramp-up.

Note

MD 1019 must be adapted on the motor:

Movements can occur during technique 2 (movement-based).
Noise can occur during techniques 1 (saturation-based) and 6 (elasticity-based).

Please observe the supplementary conditions in Subsection 2.5.1.

Alarm

300512	Plausibility monitoring: Position detection fault
Cause	The rotor position information from the absolute value encoder and the rotor position information from rotor position identification differ by more than 45 degrees (electrical).
Explanation	The current rotor position and the position information read from the encoder were compared during ramp-up and a deviation of more than 45 degrees identified.
Remedy	The deviation may be due to local contamination on the encoder or the encoder may not have been installed correctly. Check the encoder.
Operation may only resume once the fault has been remedied, otherwise there is a risk of uncontrollable movement.	

■

Supplementary Conditions   **3**

None

Data Descriptions (MD, SD)   **4**

See Chapter 2

Signal Descriptions   **5**

None

Example   **6**

None

Notes

7

Data Fields, Lists

7.1   Motor data

Table 7-1   Machine data

No.	Identifier	Name	Drive
1102	MOTOR_CODE[DRx]	Motor code number	FDD/MSD
1103	MOTOR_NOMINAL_CURRENT	Nominal motor current	FDD/MSD
1104	MOTOR_MAX_CURRENT	Max. motor current	FSD
1112	NUM_POLE_PAIRS[DRx]	Motor pole pair number	FSD
1113	TORQUE_CURRENT_RATIO[DRx]	Torque constant	FSD
1114	EMF_VOLTAGE[DRx]	Voltage constant	FSD
1115	ARMATURE_RESISTANCE[DRx]	Armature resistance	FSD
1116	ARMATURE_INDUCTANCE[DRx]	Armature inductance	FSD
1117	MOTOR_INERTIA[DRx]	Motor moment of inertia	FDD/MSD
1118	MOTOR_STANDSTILL_CURRENT[DRx]	Motor standstill current	FSD
1129	POWER_FACTOR_COS_PHI	cos φ power factor	MSD
1130	MOTOR_NOMINAL_POWER[DRx]	Nominal motor power	MSD
1132	MOTOR_NOMINAL_VOLTAGE[DRx]	Nominal motor voltage	MSD
1134	MOTOR_NOMINAL_FREQUENCY[DRx]	Nominal motor frequency	MSD
1135	MOTOR_NOLOAD_VOLTAGE[DRx]	Motor no-load voltage	MSD
1136	MOTOR_NOLOAD_CURRENT[DRx]	Motor no-load current	MSD
1137	STATOR_COLD_RESISTANCE[DRx]	Stator cold resistance	MSD
1138	ROTOR_COLD_RESISTANCE[DRx]	Rotor cold resistance	MSD
1139	STATOR_LEAKAGE_REACTANCE[DRx]	Stator leakage reactance	MSD
1140	ROTOR_LEAKAGE_REACTANCE[DRx]	Rotor leakage reactance	MSD
1141	MAGNETIZING_REACTANCE[DRx]	Magnetizing reactance	MSD
1142	FIELD_WEAKENING_SPEED[DRx]	Threshold speed field weakening	MSD
1143	LH_CURVE_UPPER_SPEED[DRx]	Upper speed, Lh characteristic	MSD
1144	LH_CURVE_GAIN[DRx]	Gain factor, Lh characteristic	MSD
1145	STALL_TORQUE_REDUCTION	Stall torque reduction factor	MSD
1146	MOTOR_MAX_ALLOWED_SPEED[DRx]	Max. motor speed	MSD
1400	MOTOR_RATED_SPEED[DRx]	Rated motor speed	FDD/MSD
1602	MOTOR_TEMP_WARN_LIMIT[DRx]	Motor temp. warning threshold	FDD/MSD

7.2   Power section data

Table 7-2   Machine data

No.	Identifier	Name	Drive
1106	INVERTER_CODE[DRx]	Power section code number	FDD/MSD
1107	INVERTER_MAX_CURRENT[DRx]	Limit current transistor current	FDD/MSD
1108	INVERTER_MAX_THERMAL_CURR[DRx]	Limit current power section current	FDD/MSD
1109	INVERTER_MAX_S6_CURRENT[DRx]	Limit current, power section S6	MSD
1111	INVERTER_RATED_CURRENT[DRx]	Rated power section current	FDD/MSD
1119	SERIES_INDUCTANCE (SW 3.1 and higher)	Series reactor inductance	MSD/AM

7.3   Power-section derating

Table 7-3   Machine data

No.	Identifier	Name	Drive
1098	LT_GENZ_DERATING	Power-section derating limit current	FSD/MSD/SLM
1099	LT_DERATING_FAKT	PS limit-current derating factor	FSD/MSD/SLM
1175	I_LT_THERM_ASYN	Limit current, power section ASYN	MSD/SLM
1176	I_LT_S&_ASYN	Limit current, power section S6 ASYN	MSD/SLM
1177	I_LT_NENN_ASYN	Nominal current, power section ASYN	MSD/SLM
1178	LT_DERATING_SYN	Power section, derating SYN	MSD/SLM
1179	LT_DERATING_ASYN	Power section, derating ASYN	MSD/SLM
2098	INVERTIERTER_MAX_CURR_DERAT_M2	Power-section derating limit current	FSD/MSD/SLM
2099	INVERTIERTER_DERATING_FACT_M2	PS limit-current derating factor	FSD/MSD/SLM

7.4 i^2t power module limitation

Table 7-4   Machine data

No.	Identifier	Name	Drive
1260	S6RED_I2T	i^2t limitation, limit current, power section S6	FSD/MSD/SLM
1261	NENNRED_I2T	^2t limitation, nominal current, power section S6	FSD/MSD/SLM
1262	ZEIT_I2T	i^2t time in limit	FSD/MSD/SLM
1263	LIMIT_I2T	i^2t current limitation factor	FSD/MSD/SLM
1264	LOAD_I2T	i^2t current load factor	FSD/MSD/SLM

7.5 Rotor position synchronization

Table 7-5   Machine data

No.	Identifier	Name	Drive
1011	ACTUAL_VALUE_CONFIG	Configuration, actual value sensing IM	FDD/MSD
1017	STARTUP_ASSISTANCE	Startup assistance	FDD/MSD
1019	CURRENT_ROTORPOS_IDENT	Current, rotor/pole position identification	FDD/MSD
1020	MAX_TURN_ROTORPOS_IDENT	Maximum rotation, rotor/pole position identification	FDD/MSD
1075	ALGORITHM_ROTORPOS_IDENT	Rotor/pole position identification used	FDD/MSD
1076	FACTOR_INTERIA (SRM)/FACTOR_MASS (SLM)	Load inertia (SRM)/Load mass (SLM)	FDD/MSD
1523	ACT_SPEED_FILTER_TIME_RLI	Time constant, actual-speed-value filter, RPI	FDD/MSD
1734	DIAG_ROTORPOS_IDENT	Diagnostics, rotor/pole position identification	FDD/MSD
1736	TEST_ROTORPOS_IDENT	Test, rotor/pole position identification	FDD/MSD
1737	DIFF_ROTORPOS_IDENT	Difference, rotor/pole position identification	FDD/MSD

■

Notes

SIMODRIVE 611D/SINUMERIK 840D/810D Drive Functions

Current Control Loop (DS1)

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SIMODRIVE 611 Digital / SINUMERIK 840D/810D Drive Functions (FBA) – 11.05 Edition

Brief Description

<div style="text-align: right; font-size: 3em; font-weight: bold;">1</div>

Current controller   The current-controller parameters are set when the operator selects **Motor selection** or **Calculate controller data** (startup tool/HMI Advanced) and should not be changed by the user.

Flux controller with MSD   The flux controller is optimized when the operator selects **Motor selection** or **Calculate controller data** and should not be changed by the user.

Inverter pulse frequency   **The following applies for 810D (CCU1/2):**
The switching frequency of the power section is fixed in accordance with the current controller cycle. With MSD, an alternative frequency is fixed, which cannot be changed by the user.

The following applies for 840D/611D and CCU3:
The switching frequency can be set via a machine data, but should not be reset by the user.

■

Notes

Detailed Description

<div style="text-align: right; font-size: 2em;">**2**</div>

2.1 Current controller setting

1000	CURRCTRL_CYCLE_TIME			Cross reference: –
	Current controller cycle		Relevant: FSD/MSD	Protection level: 2/4
Unit: 31.25μs 810D/Perf.2 840D	Default: 5 4	Minimum: 2 2	Maximum: 8 4	Data type: UNS.WORD	Active: POWER ON

The basic module cycle is derived from the current controller cycle of the axis: Current controller cycle = basic module cycle. Additional cycles are derived per software from this basic cycle. This machine data is used in the controller data calculation.

The values entered in MD 1000 are multiplied internally by 31.25 μs (e.g., 5 x 31.25 μs = 156.25 μs).

Table 2-1

Control type and drive control	Axes used	Minimum current control-ler cycle settable	Standard
810D	–	5 (156.25 μs)	5 (156.25 μs)
810D	< 4	4 (5 (125 μs)	5 (156.25 μs)
840D with 611D 1-axis per-formance control	1	2 (62.5 μs)	4 (125 μs)
840D with 611D 2-axis per-formance control	1	2 (62.5 μs)	4 (125 μs)
840D with 611D 2-axis per-formance control	2	4 (125 μs)	4 (125 μs)
840D with 611D standard control	1	4 (125 μs)	4 (125 μs)
840D with 611D standard control	2	4 (125 μs)	4 (125 μs)
810D with 611D perfor-mance or standard control	1 or 2	5 (156.25 μs)	5 (156.25 μs)
CCU3	6	4 (125 μs)[1]	5 (156.25 μs)
CCU3 software on an exter-nal closed-loop control mo-dule	2	2 (62.5 μs)	5 (156.25 μs)

1) This value can be activated as an option on the NC, although the default setting is 5 (156.25 μs).

Note

It is not permissible to exceed the computation time in the current-controller-cycle level. If this time is exceeded, the drive will shut down (system error). The 300500.20 "IR computation time overflow" alarm is output.
All drives of a controller plug-in should be parameterized with the same current controller cycle.

1101	CTRLOUT_DELAY		840D only	Cross reference: –
	Computation deadtime, current control loop		Relevant: FSD/MSD	Protection level: 2/4
Unit: μs	Default: 62	Minimum: 0	Maximum: 124	Data type: WORD	Active: POWER ON

The computation deadtime is the time between the start of a current-controller cycle (current setpoint input) and the activation of the control voltage setpoints on the gating unit ASIC.

The default setting is automatically loaded during initial startup in MD 1102: MOTOR_CODE. In order to simultaneously switch all of the setpoints on the power sections into the valid status (to unify the dynamic performance), the time required for the axis requiring the most computation is entered (double axis).

Setpoint (worst case) run time: 50 μs

The default value of MD 1101 for High Performance is 32 μs.

Note

If the computation deadtime is violated, the software internally sets valid minimum and maximum values.

Computation deadtime limits:

MD 1101 < MD 1000 x 31.25 μs (= current controller cycle)

$$\text{MD 1101} < \frac{1}{\text{MD 1100}} \quad ; \quad \frac{1}{\text{MD 1100}} = T_{PBM}$$

Exception: The following applies to old modules (pre-1995), which cannot be identified by an MLFB number, but by setting bit 2 in MD 1656 = C0BC (can be read via MD 1657):

$$\text{MD 1101} < \frac{1}{4 \times \text{MD 1100}} \quad ; \quad \frac{1}{4 \times \text{MD 1100}} = \frac{T_{PBM}}{4}$$

The default setting is made via the "Calculate controller data" softkey as a function of the hardware.

1120	CURRCTRL_GAIN				Cross reference: –
	P gain, current controller			Relevant: FSD/MSD	Protection level: 2/4
Unit: V/A	Default: 10.0	Minimum: 0.0	Maximum: 10,000.0	Data type: FLOAT	Active: Immediately

> Enter the current-controller proportional gain or parameterize (initialize) it automatically using **Calculate controller data** (from the motor and power-section data).

1121	CURRCTRL_INTEGRATOR_TIME				Cross reference: –
	Reset time, current controller			Relevant: FSD/MSD	Protection level: 2/4
Unit: μs	Default: 2,000.0	Minimum: 0.0	Maximum: 8,000.0	Data type: FLOAT	Active: Immediately

> Enter the current controller reset time or parameterize (initialize) it automatically using **Calculate controller data.**

Note

The integral component can be disabled by entering $T_N = 0$.

1124	CURRCTRL_REF_MODEL_DELAY				Cross reference: –
	Balancing, reference model, current control loop			Relevant: FSD/MSD	Protection level: 2/4
Unit: – 810D 840D	Default: 0.0 0.5	Minimum: 0.0 0.0	Maximum: 1.0 1.0	Data type: FLOAT	Active: Immediately

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!   **Important**

This machine data is **only** relevant for Siemens internal purposes and **must not be changed**.

> Enter the balancing of the current control loop reference model. This machine data simulates the computation deadtime of the current control loop. This allows the characteristics of the computation model to be adapted to the controlled system behavior of the closed P-controlled current control loop.

2.1 Current controller setting

Current controller adaptation (from SW 5)

The P gain in the D and Q current controller are adapted depending on the Iq current actual value.
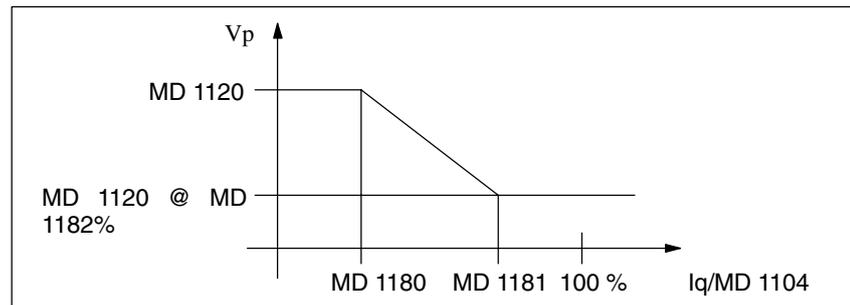

Fig. 2-1 Overview of limits

1122	MOTOR_LIMIT_CURRENT			840D only	Cross reference: –
	Motor limit current			Relevant: FSD/MSD	Protection level: 2/4
Unit: A	Default: 0.0	Minimum: 0.0	Maximum: 500.0	Data type: FLOAT	Active: Immediately

1180	CURRCTRL_ADAPT_CURRENT_1			840D only	Cross reference: –
	Adaptation of lower current limit			Relevant: FSD/ROT/LIN	Protection level: 2/4
Unit: %	Default: 0.0000	Minimum: 0.0000	Maximum: 100.0000	Data type: FLOAT	Active: Immediately

1181	CURRCTRL_ADAPT_CURRENT_2			840D only	Cross reference: –
	Adaptation of upper current limit			Relevant: FSD/ROT/LIN	Protection level: 2/4
Unit: %	Default: 100.0	Minimum: 0.0	Maximum: 100.0	Data type: FLOAT	Active: Immediately

1182	REDUCE_ARMATURE_INDUCTANCE			840D only	Cross reference: –
	Factor of current controller adaptation			Relevant: FSD/ROT/LIN	Protection level: 2/4
Unit: %	Default: 100.0	Minimum: 1.0	Maximum: 100.0	Data type: FLOAT	Active: Immediately

The current-controller adaptation (MD 1180, MD 1181 and MD 1182) can be used to reduce the P gain of the current controller (MD 1120) depending on the current.

MD 1180 defines the lower current value, from which the adaptation reduces the P gain linearly to the upper current value (MD 1181).

Apart from the current values MD 1180 or MD 1181, MD 1182 (current controller adaptation factor) also defines the adaptation straight line.

Note

MD 1180, MD 1181:	Percentage in relation to MD 1104 (maximum current)
MD 1182:	Percentage in relation to MD 1120 (current-controller P gain)

The following applies: MD 1180 (adaptation of lower current limit) < MD 1181 (adaptation of upper current limit)

1183	CURRCTRL_ADAPT_ENABLE			840D only	Cross reference: –
	Current controller adaptation ON			Relevant: FSD/ROT/LIN	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 1	Data type: UNS.WORD	Active: POWER ON

MD 1183 can be used to provide a code overlay in the current controller to save runtime for the case "Current-controller adaptation OFF".

MD 1183=1: Current controller adaptation ON
$\Rightarrow$ No overlay: IREG code is not recopied, as it is already stored in P-RAM

MD 1183=0: Current controller adaptation OFF
$\Rightarrow$ With overlay: IREG code is recopied from buffer to P-RAM and the checksum adapted.

Runtime difference: 10 commands more in the current controller cycle with adaptation.

SIMODRIVE 611 Digital / SINUMERIK 840D/810D Drive Functions (FBA) – 11.05 Edition   DS1/2-9

2.1   Current controller setting

2.1.1   Current- and speed-controller cycle for CCU3

General information

For the CCU3, the standard setting is a current-controller cycle of 156.25 μs (MD1000) and speed-controller cycle of 312.5 μs (MD1001).

Within CCU3 the current- and speed-controller cycle is identical for all axes. The cycles depends on the number of axes and the motor types you have set (see Table 2-1).

If the processing power of the CCU3 is not sufficient, you can add external 611D closed-loop control modules to the CCU3 (currently High Performance closed-loop control module). The minimum current- and speed-controller cycle here is 62.5 μs.

Time slice management/ cycle times

There is uniform time slice management for all axes within CCU3. Here, both the current- and speed-controller cycles are identical for all axes. The cycles for externally connected closed-loop control modules can be set within the permissible value range independently of the cycles of the CCU3 (see following example in Fig. 2-2).
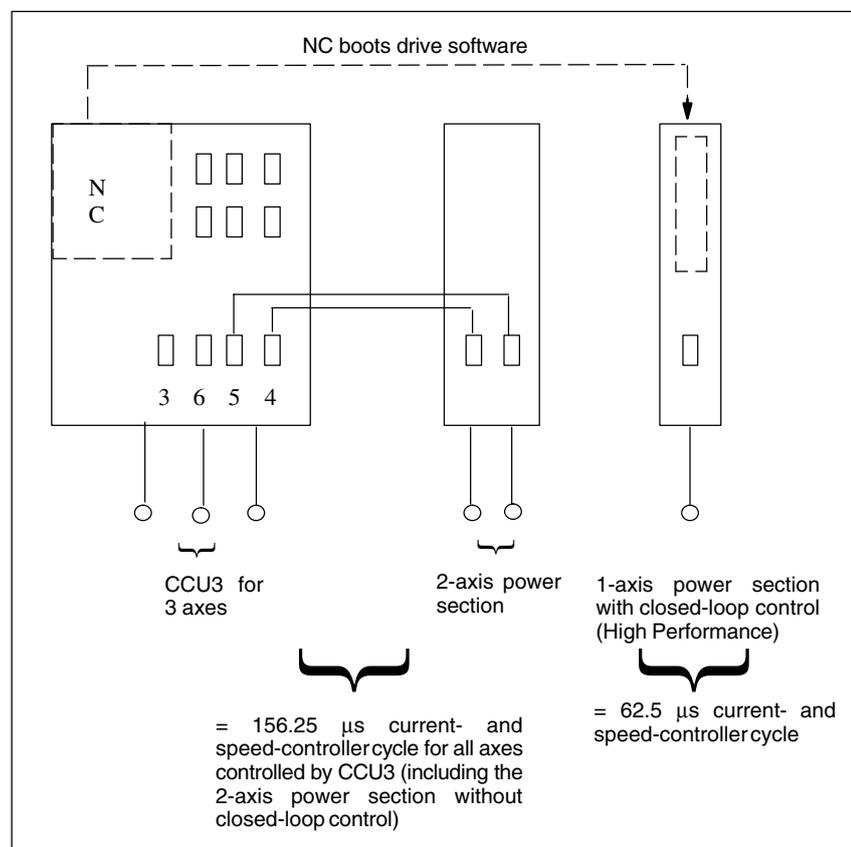

Fig. 2-2   Example

Current controller cycle

You can set a current-controller cycle of min. 125 µs and max. 156.25 µs on the CCU3 module. In addition, a current-controller cycle of 62.5 µs is possible on externally connected performance modules.

For software version 6.03.06 and higher, 156.25 µs is the default value.

Speed controller clock cycle

One speed-controller cycle on the CCU3 module is a 1-, 2-, 4-, or 8-factor multiple of the current-controller cycle within the limit range of 125 µs to 1.25 ms. In addition, a speed-controller cycle of 62.5 µs is possible on externally connected performance modules.

For software version 6.03.06 and higher, 312.5 µs is the default value.

Position control cycle

The position controller cycle is set on the NC and is an integral multiple of the speed controller cycle within the limit range of 1 ms to 16 ms. It must not be smaller than the speed controller cycle.

2.2 Torque feedforward control

1004	CTRL_CONFIG			840D only	Cross reference: –
	Configuration structure			Relevant: FSD/MSD	Protection level: 2/4
Unit: Hex	Default: 0000	Minimum: 0000	Maximum: 2115	Data type: UNS.WORD	Active: POWER ON

Enter the configuration for control structures, speed measuring systems and functionality related to the SIMODRIVE 611D system.

Table 2-2   Configuration structure

Bit 0	Speed/torque feedforward control	0 = Not active 1 = Active
Bit 1	Not assigned	
Bit 2	Higher dynamic performance (single-axis module)	0 = Current control before speed control 1 = Speed control before current control
Bit 3	Reserved	
Bits 4 – 15	Not assigned	

!

Important

Speed control before current control is **only possible for one active axis** on the module!
The default is: Current control before speed control (bit 2 = 0).

1424	SPEED_FFW_FILTER_TIME			840D only	Cross reference: –
	Balancing, speed feedforward control channel			Relevant: FSD/MSD	Protection level: 2/4
Unit: µs	Default: 0.0	Minimum: 0.0	Maximum: 50,000.0	Data type: FLOAT	Active: Immediately

Enter the time constant of the 1st order balancing filter in the speed-feedforward-control channel of the speed/torque feedforward control. This time can be used to adapt the setpoint characteristics of the closed current control loop. The higher-level speed control loop is thus balanced. When initializing the balancing filter, the time constants of the active current-setpoint filter (only low pass) are taken into account.

Note

The filter is only deactivated (proportional element with gain 1) when 0 is entered if no low passes are active as current-setpoint filters.

1425	**SPEED_FFW_DELAY**			**840D only**	**Cross reference:** –
Balancing, computation deadtime, current control loop				Relevant: FSD/MSD	Protection level: 2/4
Unit: –	Default: 0.0	Minimum: 0.0	Maximum: 1.0	Data type: FLOAT	Active: Immediately

Select a filter in the speed feedforward control channel, which simulates the computation deadtime of the current control loop. The simulation in this case is calculated as approximation of an interrupted deadtime (see the graphic for MD 1416). Only effective if speed/torque feedforward control is active.

Using this machine data (input: computation deadtime related to the speed-controller cycle), the setpoint characteristics in the speed-feedforward-control channel of the speed controller can be adapted to the controlled system behavior of the closed speed control loop; the higher-level speed control loop is thus balanced.

2.3 Flux sensing and flux controller for MSD

1150	FIELDCTRL_GAIN					Cross reference: –
	P gain, flux controller				Relevant: MSD	Protection level: 2/4
Unit: A/Vs	Default: 400.0	Minimum: 0.0	Maximum: 100,000.0		Data type: FLOAT	Active: Immediately

Enter the flux-controller proportional gain or parameterize (initialize) it automatically using **Calculate controller data**.

1151	FIELDCTRL_INTEGRATOR_TIME					Cross reference: –
	Flux-controller reset time				Relevant: MSD	Protection level: 2/4
Unit: ms	Default: 10.0	Minimum: 0.0	Maximum: 500.0		Data type: FLOAT	Active: Immediately

Enter the flux-controller reset time (closed-loop control variable) or parameterize (initialize) it automatically using **Calculate controller data**.

1160	FLUX_ACQUISITION_SPEED					Cross reference: –
	Threshold speed, flux sensing				Relevant: MSD	Protection level: 2/4
Unit: 1/min	Default: 1500.0	Minimum: 200.0	Maximum: 100,000.0		Data type: FLOAT	Active: POWER ON

Enter the threshold speed of the flux sensing or parameterize (initialize) it automatically using **Calculate controller data**.

! **Important**

This machine data is **only** relevant for Siemens internal purposes and **must not be changed**.

1161	FIELDVAL_FIXED_LINK_VOLTAGE					Cross reference: –
	Fixed DC-link voltage				Relevant: FSD/MSD	Protection level: 2/4
Unit: V	Default:	Minimum:	Maximum:		Data type: UNS.WORD	Active: Immediately
810D	0	0	700			
840D	0	0	700			

Specifying a fixed DC-link voltage > 0 V deactivates the DC-link measurement, i.e., MD 1701: LINK_VOLTAGE (DC link voltage display) is inactive (display: "#").

The voltage specification is used in the following instead of the measurement:

- DC link adaptation
- Flux sensing (MSD)
- Field weakening and breakdown torque (only for main spindle drives)

It is monitored as to whether it is permissible to activate the DC-link measurement (MD 1161 = 0) as a function of the hardware expansion level (parameterization error).

The DC link is measured in the I/RF module and transferred as an analog signal to the 611D modules via the unit bus. This signal is only evaluated in the drive module.

Note

With SW 4.2 and higher, measuring of the DC-link voltage is activated as standard by changing the default value from 600 V to 0 V.
In order to ensure that older hardware versions without DC-link measurement are set up correctly, MD 1161 = 600 V is set under "Calculate controller data".

Increased phase current for current-controller cycle MD 1000=2

The flux model for asynchronous machines has been extended:

In the event of oversampling (e.g., current controller cycle 62.5 μs, operating frequency 4 kHz), more than two current measurements are made during half a switching cycle.

The current is now derived not only from the last two current values but also with reference to older measured values. This has an impact on the model leakage inductance.

This modification improves matching between the flux models for low and high speeds. The difference in no-load current above and below the duty limit (MD 1160) is reduced, and the calculated flux value is smoother and more accurate.

This correction is activated by default per MD 1159 = 1. The old status can be restored per MD 1159 = 0.

An improvement in the difference with reference to the no-load current should also be noticed in the case of "unrounded" ratios (e.g., 5.33 kHz, 62.5 μs).

1159	FLUX_MODEL_CORRECTION			840D only	Cross reference: –
	Flux-model correction			Relevant: MSD	Protection level: 1/4
Unit: –	Default: 1	Minimum: 0	Maximum: 1	Data type: UNS.WORD	Active: Immediately

The same problem may also occur on the 611D and 611U with the corresponding settings.

  2.3 Flux sensing and flux controller for MSD

Calculation of the voltage drop due to reduced leakage inductance depending on operating frequency and current controller cycle (see Table 2-3):

$$V_{L\sigma 1} = \frac{i_k - i_{k-1}}{L_\sigma * D_{Samp}} \quad \text{(original status)} \qquad 1$$

$$V_{L\sigma 2} = \frac{i_k - i_{k-2}}{2 * L_\sigma * D_{Samp}} \qquad 2$$

$$V_{L\sigma 4} = \frac{i_k - i_{k-4}}{4 * L_\sigma * D_{Samp}} \qquad 4$$

Table 2-3   Calculation of the voltage drop due to reduced leakage inductance

	Operating frequency [kHz]					
	2	2.666	3.2	4	5.333	8
Current controller cycle [kHz]						
31.25	4	4	4	4	4	2
62.5	4	4	2	2	2	1
125	2	2	1	1	1	1
156.25	2	1	1	1	1	1

Current-controller cycle 31.25 kHz not available at present.

2.4 Inverter pulse frequency

810D:

1003	STS_CONFIG				Cross reference: –
	Configuration STS			Relevant: FSD/MSD	Protection level: 2/4
Unit: Hex 810D 840D	Default: 0330 0330	Minimum: 0.0 0.0	Maximum: FFFF 7f0	Data type: UNS.WORD	Active: POWER ON

!

Important

This machine data is **only** relevant for Siemens internal purposes and **must not be changed**.

This machine data is used to configure the command register of the gating unit ASIC (module-specific).

This machine data is used in the controller data calculation.

Depending on the current-controller cycle, there is a standard switching frequency and an alternative frequency. The alternative frequency is selected using MD 1003, bit11. Generally, the alternative frequency worsens the properties of the current controller characteristics, and should therefore only be used in special cases.

Table 2-4   Switching frequencies, alternative frequencies

Current controller cycle	Switching rate	Alternative frequency
125 μs	4,000 Hz	3.2 kHz
156.25 μs	3,200 Hz	2.56 kHz
187.5 μs	2,660 Hz	2.13 kHz

Since on MSD a 4 kHz pulse frequency reduces the power, the alternative frequency must be selected for a current-controller cycle of 125 μs. This setting is made automatically by the drive for **Calculate controller data** (initial startup).

 2.4   Inverter pulse frequency

840D/611D:

1100	PWM_FREQUENCY			840D only	Cross reference: –
	Pulse-width-modulation frequency (PWM)			Relevant: FSD/MSD	Protection level: 2/4
Unit: Hz	Default: FSD/MSD 4,000 / 3,200	Minimum: 2,000	Maximum: 8,000	Data type: FLOAT	Active: POWER ON

Using this machine data, the sampling frequency is determined in the PWM inverter. The default setting is dependent on the motor type (FSD $\doteq$ 4000, MSD $\doteq$ 3200) and is configured by the drive configuration during startup. The frequency value setting is carried out on the HMI side (see the attached table).

Although various intermediate stages can be set, only the following frequencies are practical:

- Operation with encoder: 2,000, 2,666, 3,200, 4,000, 5,333, 6,400, 8,000 Hz.
- Operation without encoder: 4,000 and 8,000 Hz only (AM mode)

If possible, the synchronous switching frequencies should be selected (4,000, 8,000Hz). If a frequency is selected, which exceeds the default frequency, it must be taken into account that the current carrying capacity of the converter will drop (for derating characteristic, see DM1 Subsection 2.3.1).
It is practical to increase the switching frequency for low-leakage or high-speed third-party drives (motor frequency > 500 Hz); this must be taken into account when configuring power sections. Also, it may be practical to modify the standard switching frequency in order to reduce motor noise.

Table 2-5   Pulse-width-modulation frequency (PWM)

Default value	f_{PBM} in Hz	T_{PBM} in μs
MSD	3,200	312.5
FSD	4,000	250.0
–	5,333.3....	187.5
–	8,000	125

Note

The pulse frequency can only be entered in the value steps specified above in the table. Other frequencies are rounded-off to the next value in the table (e.g., 3,150 Hz becomes 3,200 Hz).

Note

In SW 6/5.1.8 and higher, the derating characteristic is taken into account by the software (see DM1 Subsection 2.3.1).

2.5 Advanced Position Control (APC)

APC is a control function for damping mechanical vibrations in machine tools and production machines. This is achieved by means of feedback or feedforward control of suitable signals from the direct measuring system of an axis to the speed setpoint.

APC is an option.

Supplementary conditions

2 measuring systems must be available. The motor and direct measuring systems must be on the same axis.

APC is only run in conjunction with High Performance and High Standard modules (611 D).

The mechanical components to be dampened must be suitable.

Note

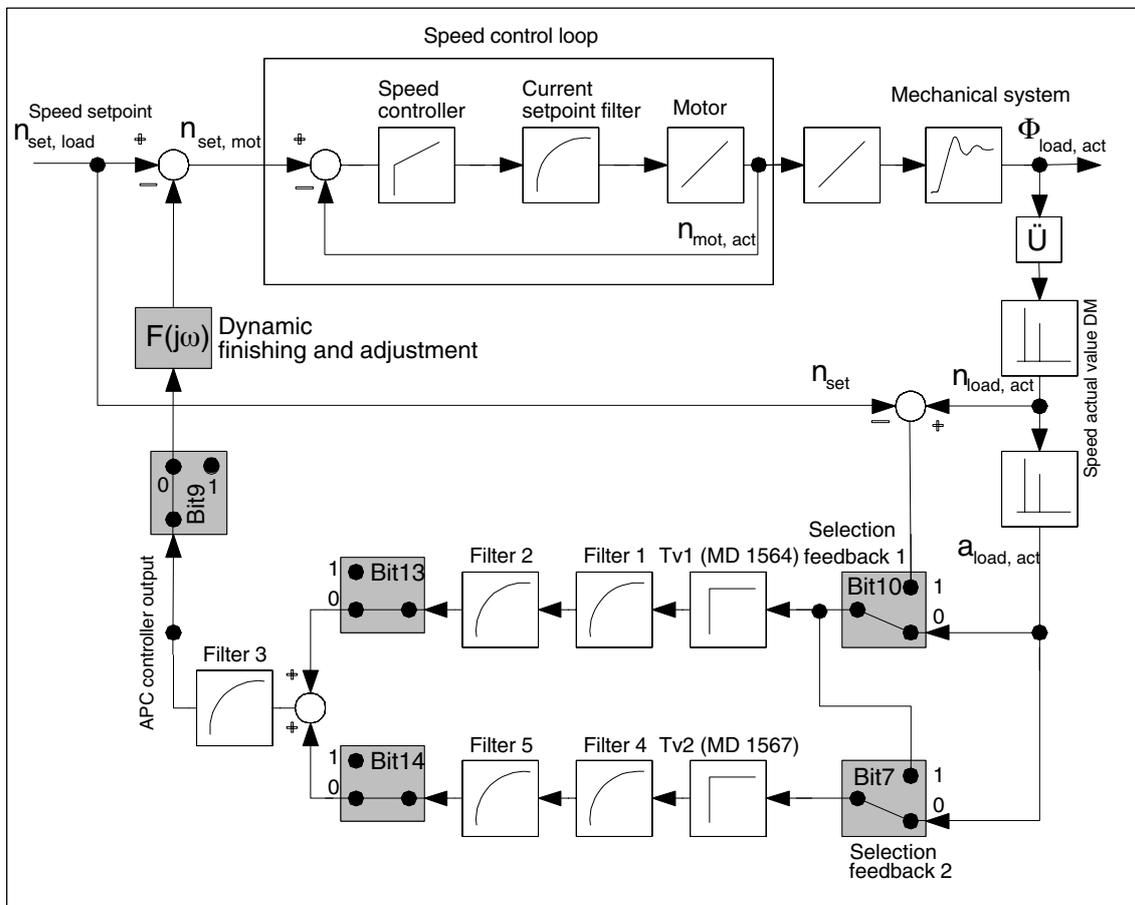Exercise caution with axes carrying workpieces and axes with a changing mass.

Fig. 2-3   Basic structure of block diagram

2.5 Advanced Position Control (APC)

There are two feedback cascades, each with two universal filters, which can be sub-sampled (PT1, PT2, general bandstop), and their own derivative action time. In addition, each cascade also has a shared filter, which is not sub-sampled.

The first cascade can be input from the following sources:

1. Differentiated load position multiplied by 2 (this requires the universal filter to subsequently be used for smoothing). This is the standard case.

2. Speed setpoint – load speed actual value

The 2nd cascade must have the same input as the first cascade, or the differentiated load position multiplied by 2.

Relevant machine data

1560	ACC_MODE				Cross reference: –
	Acceleration evaluation mode			Relevant: FSD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0.0	Minimum: 0.0	Maximum: 01FFF	Data type: UNS.WORD	Active: Immediately

Bit4 = 1:	Evaluation of the direct measuring system in the drive
Bit5 = 1:	Activate active damping. Bit 4 must be set and MD 1562 must be appropriately preassigned.
Bit7 = 1:	Selecting the input for 2nd cascade: same input as for cascade 1.
Bit7 = 0:	Selecting the input for 2nd cascade: input is acceleration from direct measuring system.
Bit8 = 1:	The speed controller function generator is switched to the acceleration filter input. This allows the filter frequency responses to be measured.
Bit9 = 1:	The acceleration filter output (both cascades) is not applied to the speed setpoint. This allows the filter frequency responses to be measured. The filter output itself is, however, updated.
Bit10 = 1:	The speed difference (load speed actual value – motor speed setpoint) is used as the acceleration filter input, not the acceleration. If the available phase margin is sufficient to correct an increase in natural vibration, you can use a filter (which greatly increases this frequency alone) to cancel the increase.
Bit12 = 1:	DSC with direct measuring system. If the "DSC" function is activated, the direct measuring system, not the motor measuring system, is evaluated for position feedback. Bit 4 must be set and MD 1562 must be appropriately preassigned. The MD below must be set for DSC with direct measuring system: MD 32640: STIFFNES_CONTROL_ENABLE = 1 MD 1562: FACTOR_MM_DM preassigned correctly MD 1560: ACC_MODE Bit 4 = 1 and Bit 12 = 1 The APC option bit does not have to be set for DSC.
Bit13 = 1:	1st cascade must not be switched to filter 3, filter output (1 and 2) is updated. This allows the filter frequency responses for filters 1 and 2 to be measured.
Bit14 = 1:	2nd cascade must not be switched to filter 3, filter output (4 and 5) is updated. This allows the filter frequency responses for filters 4 and 5 to be measured.

1562	FACTOR_MM_DM				Cross reference: –
	Ratio of motor measuring system to direct measuring system			Relevant: FSD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 1.0	Minimum: −1,000,000.0000	Maximum: 1,000,000.0	Data type: FLOAT	Active: Immediately

The ratio is entered as a factor, by which the direct-measuring-system pulse frequency must be multiplied with uniform movement, in order to obtain the motor-measuring-system pulse frequency. This involves the measuring-system resolution differentials and any gearbox or measuring gearbox, which may be present. A differing direction of rotation is taken into account with a negative sign.

Example 1:

Rotating motor, 2,048 pulses/rev, with ball screw leadscrew pitch 10 mm/rev, direct measuring system 20 μm.
Conversion to motor-side: (10 mm/rev)/(20 μm)= 500 pulses per motor revolution on load-side; factor: 2,048/500 = 4.096

Example 2:

Rotating motor, 2,048 pulses/rev, gearbox for load with ratio 25:1,
rotating load with load measuring system 8,192 pulses/rev.
Conversion to motor-side: 8192/25 pulses per motor revolution on load-side; factor: 2,048/ 8,192*25= 6.25

Example 3:

Rotating motor, 2,048 pulses/rev, load directly linked with direct measuring system 1,024 pulses/rev.
Conversion to motor-side: 1,024 pulses per motor revolution on load-side; factor: 2,048/1,024 = 2.0

1563	ACC_HIGH_PASS_TIME				Cross reference: –
	Smoothing time, high-pass filter or PT1 integration			Relevant: FSD/MSD/SLM	Protection level: 2/4
Unit: ms	Default: 1,000.0	Minimum: 0.0	Maximum: 5,000.0	Data type: FLOAT	Active: Immediately

The high-pass filter has a transformation function: $\dfrac{s\, D_{gl}}{1+s\, D_{gl}}$. The smoothing time for the high-pass filter must be selected to be at least 4 times greater than the vibration period.

Caution: If the smoothing time is set to 0, you will always receive the derived signal.

2.5 Advanced Position Control (APC)

1564	LOAD_SPEEDCTRL_DIFF_TIME				Cross reference: –
	Acceleration feedforward control (derivative-action time of load-speed controller), 1st cascade			Relevant: FSD/MSD/SLM	Protection level: 2/4
Unit: ms	Default: 0.0	Minimum: −1,000.0	Maximum: 1,000.0	Data type: FLOAT	Active: Immediately

> The load-speed controller derivative-action time corresponds to the APC gain Tv.

1567	LOAD_SPEEDCTRL_DIFF_TIME2				Cross reference: –
	Acceleration feedforward control (derivative-action time of load-speed controller), 2nd cascade			Relevant: FSD/MSD/SLM	Protection level: 2/4
Unit: ms	Default: 0.0	Minimum: −1,000.0	Maximum: 1,000.0	Data type: FLOAT	Active: Immediately

1569	ACC_FIL_DOWNSCAN				Cross reference: –
	Sub-sampling of acceleration filter			Relevant: FSD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 1	Minimum: 1	Maximum: 64	Data type: UNS.WORD	Active: Immediately

> The sub-sampling factor is entered here for filters 1, 2, 4, and 5.
> 1 = no sub-sampling (default).
>
> Sub-sampling should be carried out for filters with a low blocking frequency. It is generally recommended that
>
> Blocking frequency * sampling interval * sub-sampling factor should be $\geqq$ 1/160.
>
> This can easily be ensured using the sub-sampling factor, which is effective for filters 1, 2, 4, and 5. The 3rd filter is always executed in the speed controller cycle and can serve to interpolate the filters, which have been sub-sampled. All filters can only be deactivated by being suitably parameterized (e.g., using default values); there is no on/off switch.

1570	ACC_FILTER_TYPE				Cross reference: –
	Type of acceleration filter			Relevant: FSD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0x0000	Minimum: 0x0000	Maximum: 0x0307	Data type: UNS.WORD	Active: Immediately

> Bit 0=0/1: Low pass (PT1/PT2)/general bandstop for 1st filter
>
> Bit 1=0/1: Low pass (PT1/PT2)/general bandstop for 2nd filter
>
> Bit 2=0/1: Low pass (PT1/PT2)/general bandstop for 3rd filter
>
> Bit 3=0/1: Low pass (PT1/PT2)/general bandstop for 4th filter
>
> Bit 4=0/1: Low pass (PT1/PT2)/general bandstop for 5th filter
>
> Bit 8= 0/1: PT2 low pass/PT1 low pass, if low pass is selected, 1st filter
>
> Bit 9= 0/1: PT2 low pass/PT1 low pass, if low pass is selected, 2nd filter

Bit 11=0/1: PT2 low pass/PT1 low pass, if low pass is selected, 4th filter

Bit 12=0/1: PT2 low pass/PT1 low pass, if low pass is selected, 5th filter

Remark: The 3rd filter cannot be executed as PT1.

1571	ACC_FILTER_TIME1				Cross reference: –
	Time constant, 1st acceleration filter			Relevant: FSD/MSD/SLM	Protection level: 2/4
Unit: ms	Default: 1.0	Minimum: 0.0	Maximum: 500.0	Data type: FLOAT	Active: Immediately

If PT1 is selected, the time constant is set here.

1572	ACC_DENOM_FILTER_FREQU1				Cross reference: –
	Denominator natural frequency, 1st acceleration filter			Relevant: FSD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 2 000.0	Minimum: 2.0	Maximum: 8,000.0	Data type: FLOAT	Active: Immediately

If PT2 or general bandstop is selected, the denominator natural frequency is set here.

1573	ACC_DENOM_FILTER_DAMP1				Cross reference: –
	Denominator damping, 1st filter			Relevant: FSD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0.5	Minimum: 0.0	Maximum: 10.0	Data type: FLOAT	Active: Immediately

If PT2 or general bandstop is selected, the denominator damping is set here.

1574	ACC_NOM_FILTER_FREQU1				Cross reference: –
	Numerator natural frequency, 1st filter			Relevant: FSD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 2 000.0	Minimum: 2.0	Maximum: 8,000.0	Data type: FLOAT	Active: Immediately

If general bandstop is selected, the numerator natural frequency is set here.

1575	ACC_NOM_FILTER_DAMP1				Cross reference: –
	Numerator damping, 1st filter			Relevant: FSD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0.5	Minimum: 0.0	Maximum: 10.0	Data type: FLOAT	Active: Immediately

2.5 Advanced Position Control (APC)

If general bandstop is selected, the numerator damping is set here.

1576	ACC_FILTER_TIME2				Cross reference: –
	Time constant, 2nd acceleration filter			Relevant: FSD/MSD/SLM	Protection level: 2/4
Unit: ms	Default: 1.0	Minimum: 0.0	Maximum: 500.0	Data type: FLOAT	Active: Immediately

If PT1 is selected, the time constant is set here.

1577	ACC_DENOM_FILTER_FREQU2				Cross reference: –
	Denominator natural frequency, 2nd acceleration filter			Relevant: FSD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 2,000.0	Minimum: 2.0	Maximum: 8,000.0	Data type: FLOAT	Active: Immediately

If PT2 or general bandstop is selected, the denominator natural frequency is set here.

1578	ACC_DENOM_FILTER_DAMP2				Cross reference: –
	Denominator damping, 2nd acceleration filter			Relevant: FSD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0.5	Minimum: 0.0	Maximum: 10.0	Data type: FLOAT	Active: Immediately

If PT2 or general bandstop is selected, the denominator damping is set here.

1579	ACC_NOM_FILTER_FREQU2				Cross reference: –
	Numerator natural frequency, 2nd acceleration filter			Relevant: FSD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 2,000.0	Minimum: 2.0	Maximum: 8,000.0	Data type: FLOAT	Active: Immediately

If general bandstop is selected, the numerator natural frequency is set here.

1580	ACC_NOM_FILTER_DAMP2				Cross reference: –
	Numerator damping, 2nd acceleration filter			Relevant: FSD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0.5	Minimum: 0.0	Maximum: 10.0	Data type: FLOAT	Active: Immediately

If general bandstop is selected, the numerator damping is set here.

1581	ACC_DENOM_FILTER_FREQU3				Cross reference: –
	Denominator natural frequency, 3rd acceleration filter			Relevant: FSD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 2,000.0	Minimum: 2.0	Maximum: 8,000.0	Data type: FLOAT	Active: Immediately

If PT2 or general bandstop is selected, the denominator natural frequency is set here.

1582	ACC_DENOM_FILTER_DAMP3				Cross reference: –
	Denominator damping, 3rd acceleration filter			Relevant: FSD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0.5	Minimum: 0.0	Maximum: 10.0	Data type: FLOAT	Active: Immediately

If PT2 or general bandstop is selected, the denominator damping is set here.

1583	ACC_NOM_FILTER_FREQU3				Cross reference: –
	Numerator natural frequency, 3rd acceleration filter			Relevant: FSD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 2,000.0	Minimum: 2.0	Maximum: 8,000.0	Data type: FLOAT	Active: Immediately

If general bandstop is selected, the numerator natural frequency is set here.

1584	ACC_NOM_FILTER_DAMP3				Cross reference: –
	Numerator damping, 3rd acceleration filter			Relevant: FSD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0.5	Minimum: 0.0	Maximum: 10.0	Data type: FLOAT	Active: Immediately

If general bandstop is selected, the numerator damping is set here.

1585	ACC_FILTER_TIME4				Cross reference: –
	Time constant, 4th acceleration filter			Relevant: FSD/MSD/SLM	Protection level: 2/4
Unit: ms	Default: 1.0	Minimum: 0.0	Maximum: 500.0	Data type: FLOAT	Active: Immediately

If PT1 is selected, the time constant is set here.

2.5 Advanced Position Control (APC)

1586	ACC_DENOM_FILTER_FREQU4				Cross reference: –
	Denominator natural frequency, 4th acceleration filter			Relevant: FSD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 2,000.0	Minimum: 2.0	Maximum: 8,000.0	Data type: FLOAT	Active: Immediately

If PT2 or general bandstop is selected, the denominator natural frequency is set here.

1587	ACC_DENOM_FILTER_DAMP4				Cross reference: –
	Denominator damping, 4th acceleration filter			Relevant: FSD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0.5	Minimum: 0.0	Maximum: 10.0	Data type: FLOAT	Active: Immediately

If PT2 or general bandstop is selected, the denominator damping is set here.

1588	ACC_NOM_FILTER_FREQU4				Cross reference: –
	Numerator natural frequency, 4th acceleration filter			Relevant: FSD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 2,000.0	Minimum: 2.0	Maximum: 8,000.0	Data type: FLOAT	Active: Immediately

If general bandstop is selected, the numerator natural frequency is set here.

1589	ACC_NOM_FILTER_DAMP4				Cross reference: –
	Numerator damping, 4th acceleration filter			Relevant: FSD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0.5	Minimum: 0.0	Maximum: 10.0	Data type: FLOAT	Active: Immediately

If general bandstop is selected, the numerator damping is set here.

1590	ACC_FILTER_TIME5				Cross reference: –
	Time constant, 5th acceleration filter			Relevant: FSD/MSD/SLM	Protection level: 2/4
Unit: ms	Default: 1.0	Minimum: 0.0	Maximum: 500.0	Data type: FLOAT	Active: Immediately

If PT1 is selected, the time constant is set here.

1591	ACC_DENOM_FILTER_FREQU5				Cross reference: –
	Denominator natural frequency, 5th acceleration filter			Relevant: FSD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 2,000.0	Minimum: 2.0	Maximum: 8,000.0	Data type: FLOAT	Active: Immediately

If PT2 or general bandstop is selected, the denominator natural frequency is set here.

1592	ACC_DENOM_FILTER_DAMP5				Cross reference: –
	Denominator damping, 5th acceleration filter			Relevant: FSD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0.5	Minimum: 0.0	Maximum: 10.0	Data type: FLOAT	Active: Immediately

If PT2 or general bandstop is selected, the denominator damping is set here.

1593	ACC_NOM_FILTER_FREQU5				Cross reference: –
	Numerator natural frequency, 5th acceleration filter			Relevant: FSD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 2,000.0	Minimum: 2.0	Maximum: 8,000.0	Data type: FLOAT	Active: Immediately

If general bandstop is selected, the numerator natural frequency is set here.

1594	ACC_NOM_FILTER_DAMP5				Cross reference: –
	Numerator damping, 5th acceleration filter			Relevant: FSD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0.5	Minimum: 0.0	Maximum: 10.0	Data type: FLOAT	Active: Immediately

If general bandstop is selected, the numerator damping is set here.

Note

Please note that filters 1 and 2 or 4 and 5 can be shut down by selecting PT1 and setting the time constant to zero. Filter 3 cannot be configured as PT1 and cannot, therefore, be shut down.

2.5   Advanced Position Control (APC)

Note

SimoCom U (the SIMODRIVE 611 universal startup program) can be used to display the filter frequency responses.

■

Supplementary Conditions

3

None

■

Data Descriptions (MD, SD)

4

See Chapter 2

■

Signal Descriptions

5

None

■

Example

6

None

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Notes

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Data Fields, Lists

7

7.1 Current controller setting

Table 7-1   Machine data

No.	Identifier	Name	Drive
1000	CURRCTRL_CYCLE_TIME[DRx]	Current controller cycle	FDD/MSD
1101	CTRLOUT_DELAY	Dead time of current control loop	FDD/MSD
1120	CURRCTRL_GAIN[DRx]	P gain, current controller	FDD/MSD
1121	CURRCTRL_INTEGRATOR_TIME[DRx]	Integrator time of current controller	FDD/MSD
1122	MOTOR_LIMIT_CURRENT	Motor limit current	FDD/MSD
1124	CURRCTRL_REF_MODEL_DELAY[DRx]	Balancing, current reference model	FDD/MSD
1180	CURRCTRL_ADAPT_CURRENT_1	Adaptation of lower current limit (840D only)	FSD
1181	CURRCTRL_ADAPT_CURRENT_2	Adaptation of upper current limit (840D only)	FSD
1182	REDUCE_ARMATURE_ENABLE	Current controller adaptation factor (840D only)	FSD
1183	CURRCTRL_ADAPT_ENABLE	Current controller adaptation ON (840D only)	FSD

7.2 Torque feedforward control

Table 7-2   Machine data

No.	Identifier	Name	Drive
1004	CTRL_CONFIG	Configuration structure	FDD/MSD
1424	SPEED_FFW_FILTER_TIME	Balancing, speed feedforward control channel	FDD/MSD
1425	SPEED_FFW_DELAY	Balancing, computation deadtime, current control loop	FDD/MSD

7.3 Flux sensing and flux controller for MSD

Table 7-3   Machine data

No.	Identifier	Name	Drive
1150	FIELDCTRL_GAIN[DRx]	P gain, flux controller	MSD
1151	FIELDCTRL_INTEGRATOR_TIME[DRx]	Flux-controller reset time	MSD
1160	FLUX_ACQUISITION_SPEED[DRx]	Threshold speed, flux sensing	MSD
1161	FIXED_LINK_VOLTAGE[DRx]	Fixed DC-link voltage	FDD/MSD

7.4 Inverter pulse frequency

Table 7-4   Machine data

No.	Identifier	Name	Drive
1000	CURRCTRL_CYCLE_TIME[DRx]	Current controller cycle	FDD/MSD
1003	STS_CONFIG[DRx]	Configuration STS	FDD/MSD
1100	PWM_FREQUENCY	Pulse width modulation frequency	FDD/MSD

7.5 Advanced Position Control (APC)

Table 7-5   Machine data

No.	Identifier	Name	Drive
1560	ACC_MODE	Acceleration evaluation mode	FDD/MSD
1562	FACTOR_MM_DM	Ratio of motor to DM	FDD/MSD
1563	ACC_HIGH_PASS_TIME	Time cons. acc. high pass	FDD/MSD
1564	LOAD_SPEEDCTL_DIFF_TIME	Derivative-action time, load-speed controller	FDD/MSD
1567	LOAD_SPEEDCTL_DIFF_TIME2	Derivative-action time, load-speed cont. 2	FDD/MSD
1569	ACC_FIL_DOWNSCAN	Sub-sampling of acceleration filter	FDD/MSD
1570	ACC_FILTER_TYPE	Type of acceleration filter	FDD/MSD
1571	ACC_FILTER_TIME1	Time constant, acc. filter 1	FDD/MSD
1572	ACC_DENOM_FILTER_FREQU1	Denominator natural freq., acc. filter 1	FDD/MSD
1573	ACC_DENOM_FILTER_DAMP1	Denominator damping, acc. filter 1	FDD/MSD
1574	ACC_NOM_FILTER_FREQU1	Numerator natural freq., acc. filter 1	FDD/MSD
1575	ACC_NOM_FILTER_DAMP1	Numerator damping, acc. filter 1	FDD/MSD
1576	ACC_FILTER_TIME2	Time constant, acc. filter 2	FDD/MSD
1577	ACC_DENOM_FILTER_FREQU2	Denominator natural freq., acc. filter 2	FDD/MSD
1578	ACC_DENOM_FILTER_DAMP2	Denominator damping, acc. filter 2	FDD/MSD
1579	ACC_NOM_FILTER_FREQU2	Numerator natural freq., acc. filter 2	FDD/MSD
1580	ACC_NOM_FILTER_DAMP2	Numerator damping, acc. filter 2	FDD/MSD
1581	ACC_DENOM_FILTER_FREQU3	Denominator natural freq., acc. filter 3	FDD/MSD

Table 7-5   Machine data

No.	Identifier	Name	Drive
1582	ACC_DENOM_FILTER_DAMP3	Denominator damping, acc. filter 3	FDD/MSD
1583	ACC_NOM_FILTER_FREQU3	Numerator natural freq., acc. filter 3	FDD/MSD
1584	ACC_NOM_FILTER_DAMP3	Numerator damping, acc. filter 3	FDD/MSD
1585	ACC_FILTER_TIME4	Time constant, acc. filter 4	FDD/MSD
1586	ACC_DENOM_FILTER_FREQU4	Denominator natural freq., acc. filter 4	FDD/MSD
1587	ACC_DENOM_FILTER_DAMP4	Denominator damping, acc. filter 4	FDD/MSD
1588	ACC_NOM_FILTER_FREQU4	Numerator natural freq., acc. filter 4	FDD/MSD
1589	ACC_NOM_FILTER_DAMP4	Numerator damping, acc. filter 4	FDD/MSD
1590	ACC_FILTER_TIME5	Time constant, acc. filter 5	FDD/MSD
1591	ACC_DENOM_FILTER_FREQU5	Denominator natural freq., acc. filter 5	FDD/MSD
1592	ACC_DENOM_FILTER_DAMP5	Denominator damping, acc. filter 5	FDD/MSD
1593	ACC_NOM_FILTER_FREQU5	Numerator natural freq., acc. filter 5	FDD/MSD
1594	ACC_NOM_FILTER_DAMP5	Numerator damping, acc. filter 5	FDD/MSD

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SIMODRIVE 611 Digital / SINUMERIK 840D/810D Drive Functions (FBA) – 11.05 Edition   DS1/7-33

Notes

SIMODRIVE 611D/SINUMERIK 840D/810D Drive Functions

Monitoring Functions, Limits (DÜ1)

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Notes

Brief Description

<div style="text-align: right; font-size: 2em; font-weight: bold;">1</div>

Motor temperature monitoring	The motor is protected by monitoring the thermal overload. The limit values for the selected motor are preset when the operator selects *Motor selection* and should not be changed by the user. If the limit value is exceeded, the "Alarm-temperature shutdown limit" signal appears. A configurable shutdown response is initiated and a message is output to the PLC.
DC link monitoring	The drive system DC link is monitored for undervoltage. The default value can be changed using the machine data. If the selected threshold is undershot, a signal is output to the PLC. The user can configure a separate response by scanning this message. General monitoring of the DC link voltage is carried out in the mains supply (I/R, UE). If the fixed monitoring limits are exceeded, the mains supply automatically initiates shutdown responses.
Torque-setpoint limitation	The maximum torque for the FSD is calculated from the motor data. On MSDs, the default setting is 100%. Limiting is carried out via the speed controller output.
Power limit	The power for FSDs is calculated from the motor data using the "Calculate controller data" function. On MSDs, the default setting is 100%. Limiting is carried out via the speed controller output.
Current limit	The current is limited to a maximum value.
Torque-setpoint monitoring	The monitoring system checks whether the torque setpoint or the current is being limited, i.e., whether the drive is overloaded. If the condition is maintained for longer than a set time, the "Speed controller output limited" alarm (= speed controller at its limit) is output and the pulse enable is cancelled.
Speed setpoint monitoring	The speed setpoint is limited to the maximum value set in the machine data.
Actual speed limitation	If the speed actual value exceeds the limit setting by more than 4%, the torque is set to 0. It is no longer possible to accelerate the drive. Torque limiting is canceled when the speed actual value falls back below the limit value.

Note

See the block diagram, control loop Chapter DD2, Fig. 2-2.

<div style="text-align: right;">■</div>

Notes

Detailed Description

2

2.1   Motor temperature monitoring

1602	MOTOR_TEMP_WARN_LIMIT			Cross reference: –	
	Motor temperature warning threshold			Relevant: FSD/MSD	Protection level: 2/4
Unit: °C	Default: FSD: 120	Minimum: 0	Maximum: 200	Data type: UNS.WORD	Active: Immediately

Enter the permissible thermal steady-state motor temperature or parameterize it automatically by entering and accepting the motor code number in MD 1102: MOTOR_CODE. The motor temperature is sensed using a temperature sensor (KTY84) and evaluated on the drive side. A signal ("Motor temperature prewarning" IS DB 31, ... DBX94.0) is output to the PLC when the warning limit is reached (see also MD 1603 and MD 1607). Terminal X121.5.x on the I/RF module is energized, independent of MD 1601, bit 14: ALARM_MASK_RESET and signals the motor overtemperature condition.

2.1   Motor temperature monitoring

**Temperature
sensor**
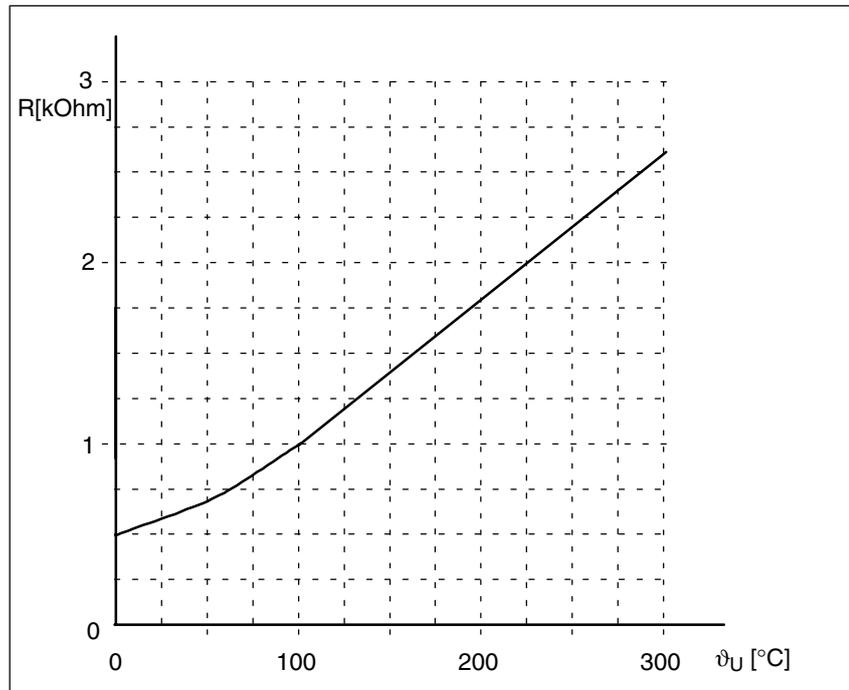
Thermistor type   KTY 84
Resistance when cold (20°C)   approx. 580 Ohm
Resistance when hot (100°C)   approx. 1,000 Ohm
On encoder connector
module-side   PINs 13/25

Note

For correct polarity of the temperature sensor only.

1603	MOTOR_TEMP_ALARM_TIME				Cross reference: –
	Timer, motor temperature alarm			Relevant: FSD/MSD	Protection level: 2/4
Unit: s	Default: 240	Minimum: 0	Maximum: 600	Data type: UNS. WORD	Active: Immediately

Enter the timer for the motor temperature alarm.

When MD 1602 is exceeded: MOTOR_TEMP_WARN_LIMIT, a signal is issued to the PLC, and the time monitoring function is started.

If the timer expires but the motor temperature still has not dropped below the temperature warning threshold, the drive generates a configurable reset alarm (see MD 1601, bit 14). If the fault is not concealed, the "300614 axis %1, drive %2 motor temperature exceeded" alarm is output. Depending on the configured response (MD 1613, bit 14), the alarm shuts down the unit:

- The pulse enable is immediately cancelled and the drive coasts down.

or

- The servo enable is cancelled. In this case, the drive decelerates along the torque limit, until MD 1404: PULSE_SUPPRESSION_DELAY or MD 1403: PULSE_SUPPRESSION_SPEED becomes active and the pulse enable is cancelled.

Note

When the timer is changed, this has no influence on an already running time monitoring function. It is valid if the motor temperature lies below the temperature warning threshold.

1607	MOTOR_TEMP_SHUTDOWN_LIMIT				Cross reference: –
	Shutdown limit, motor temperature			Relevant: FSD/MSD	Protection level: 2/4
Unit: °C	Default: 155 160 1FE1 Motor	Minimum: 0	Maximum: 200	Data type: UNS.WORD	Active: Immediately

The motor temperature is sensed via the temperature sensor and evaluated on the drive side. When the shutdown limit is reached, the drive generates a configurable reset alarm (see MD 1601, bit 13). If the fault is not concealed, the "300613 axis %1, drive %2 max. permissible motor temperature exceeded" alarm is output. Depending on the configured response (MD 1613, bit 13), the alarm shuts down the unit:

- The pulse enable is immediately cancelled and the drive coasts down.

or

- The servo enable is cancelled. In this case, the drive decelerates along the torque limit, until MD 1404: PULSE_SUPPRESSION_DELAY or MD 1403: PULSE_SUPPRESSION_SPEED becomes active and the pulse enable is cancelled.

Note

The temperature monitoring function (warning MD 1602 + timer MD 1603 or MD 1607) are not subject to any mutual restrictions. This means that MD 1607 can be < MD 1602. In this case, there is no warning before shutdown.

The motor-temperature sensing accuracy lies in the range of 3 – 5%.

Terminal 5.x at the power-supply module is only influenced by MD 1602.

1608	MOTOR_FIXED_TEMPERATURE				Cross reference: –
	Fixed temperature			Relevant: FSD/MSD	Protection level: 2/4
Unit: °C	Default: 0	Minimum: 0	Maximum: 200	Data type: UNS.WORD	Active: Immediately

If a value > 0 is entered, the temperature-dependent adaptation of the rotor resistor is executed with this fixed temperature.

Note

Subroutines configured in MD 1602: MOTOR_TEMP_WARN_LIMIT and MD 1607: MOTOR_TEMP_SHUTDOWN_LIMIT is then no longer effective.

2.2   DC link monitoring

1604	LINK_VOLTAGE_WARN_LIMIT				Cross reference: –	
	DC-link undervoltage warning threshold				Relevant: FSD/MSD	Protection level: 2/4
Unit: V	Default: 200	Minimum: 0	Maximum: 680	Data type: UNS. WORD	Active: Immediately	

MD 1604 is evaluated axially as of SW 5.01.04.

If undershot, a message is sent to the PLC
("$U_{DC\ link}$ < warning threshold" IS DB 31, ... DBX 95.0).

Note

The DC link-voltage is only sensed by a power-supply module or a monitoring module. The DC link voltage is made available to the drive modules as an analog signal (0 – 10 V) via the device bus.

1630	LINK_VOLTAGE_MON_THRESHOLD			840D only	Cross reference: –	
	Response threshold, DC link monitoring only				Relevant: FSD/MSD	Protection level: 2/4
Unit: V	Default: 550	Minimum: 0	Maximum: 680	Data type: UNS.WORD	Active: Immediately	

!   **Important**

This machine data is **only** relevant for Siemens internal purposes and **must not be changed**.

Enter the response threshold of the DC link voltage; if this is exceeded, only the DC link voltage is monitored and no longer the motor temperatures. If the response threshold is exceeded again, the standard functionality is re-established.

2.3   Current value monitoring

1254	CURRENT_MONITOR_FILTER_TIME				Cross reference: –	
	Time constant, current monitoring			Relevant: FSD/MSD	Protection level: 2/4	
Unit: ms	Default: 0.5	Minimum: 0.0	Maximum: 2.0	Data type: FLOAT	Active: Immediately	

Description

Enter the time constant T_1 to smooth the absolute current value (PT_1 low pass). The frequency limit f_0 of the PT_1 filter is determined by $f_0 = 1/(2\pi T_1)$.

Supplementary conditions

The smoothed actual absolute current acts as an input quantity for a function that monitors the maximum absolute value of the actual-current space vector $|i_{RZ}| = + \sqrt{(i_d^2 + i_q^2)}$.

If the monitoring function is activated, alarm 300607, "Current controller output limited" is output.

2.4 Limitations

2.4.1 Torque-setpoint limitation

1145	STALL_TORQUE_REDUCTION					Cross reference: –
	Breakdown torque reduction factor				Relevant: MSD	Protection level: 2/4
Unit: %	Default: 100.0	Minimum: 5.0	Maximum: 1,000.0		Data type: FLOAT	Active: Immediately

The starting points for the breakdown torque limit can be changed using this machine data.
With settings

- \> 100%, the starting point is increased, and

- < 100%, the starting point is reduced (see the graphic for MD 1230).

1190	TORQUE_LIMIT_FROM_NC					Cross reference: –
	Evaluation, torque limit value				Relevant: FSD/MSD	Protection level: 2/4
Unit: Nm	Default: 100.0	Minimum: 0.0	Maximum: 10,000.0		Data type: FLOAT	Active: Immediately

This machine data is not relevant for SINUMERIK 810D; it is not permissible to change the default setting.

1191	TORQUE_LIMIT_ADAPT_SERVO					Cross reference: –
	Adaption factor, servo limiting torque				Relevant: FSD/MSD	Protection level: 2/4
Unit: –	Default: 1.0	Minimum: 0.0	Maximum: 100.0		Data type: FLOAT	Active: Immediately

This machine data is not relevant for SINUMERIK 810D; it is not permissible to change the default setting.

1192	TORQUE_LIMIT_WEIGHT			840D only	Cross reference: –
	Weight torque			Relevant: FSD/MSD	Protection level: 2/4
Unit: %	Default: 0.0	Minimum: −100.0	Maximum: 100.0	Data type: FLOAT	Active: Immediately

This machine data (MD 1192) is not relevant for SINUMERIK 810D; it is not permissible to change the default setting.

The torque/force limit is specified in percent (%) to ensure compatibility between SIMODRIVE digital (FSD/MSD), linear motors (FSD) and hydraulic drives (HLA module).

As of NC SW 6 and 611 digital SW 5.1, a torque/force limit is evaluated by the NC for travel to fixed stop; this is applied additionally to the limits set in the drive:

- Current,

- Force/torque,

- Power, pullout power,

- Setup mode

The drive machine data MD 1192 has the same unit (%) as NC machine data MD 32460: TORQUE_OFFSET[n] "Additional torque for electronic counter-weight" and are thus mutually comparable.

Reference: /FB/, K3 "Electronic Counterweight"
                       /IAD/, "Linear Motors (1FN1 and 1FN3 Motors)"
                       /FBHLA/, Description of Functions "HLA Module"

1230	TORQUE_LIMIT_1[n] 0...7 index of parameter set				Cross reference: –
	1st torque limit value			Relevant: FSD/MSD	Protection level: 2/4
Unit: %	Default: 100.0	Minimum: 5.0	Maximum: 900.0	Data type: FLOAT	Active: Immediately

Input of the maximum torque with reference to the stall torque (FSD) or rated motor torque (MSD) of the motor.

- **FSD:** Static torque = MD 1118 · MD 1113
  MD 1118: MOTOR_STANDSTILL_CURRENT
  MD 1113: TORQUE_CURRENT_RATIO

- **MSD:** Rated motor torque = 9549 · MD 1130/MD 1400
  MD 1130: MOTOR_NOMINAL_POWER
  MD 1400: MOTOR_RATED_SPEED

The applicable limit is always either the torque, power or breakdown-torque limit, whichever is lower (see Fig. 2-1).The default setting for MSD is 100%. For feed drives, limiting is implemented by selecting **Calculate controller data**, whereby the value is obtained from the following formula:

$$\text{VSA}: \text{ MD 1230} = \frac{\text{MD 1104}}{\text{MD 1118}} \times 100\%$$

As the current limit (MSD – MD 1238, FSD – MD 1104) additionally limits the maximum torque, which can be entered, any increase of the torque limit results in a higher torque only if a high current can also flow. It may be necessary to then additionally adapt the current limit.

For main spindle drives, the following is especially valid: In order to achieve significantly shorter ramp-up times up to the maximum speed, the power and current limits must also be increased.

2.4 Limitations

! **Important**

If the motor is overloaded for a longer period of time, its temperature rise may be inadmissible (shutdown with motor overtemperature), and the motor could be destroyed.
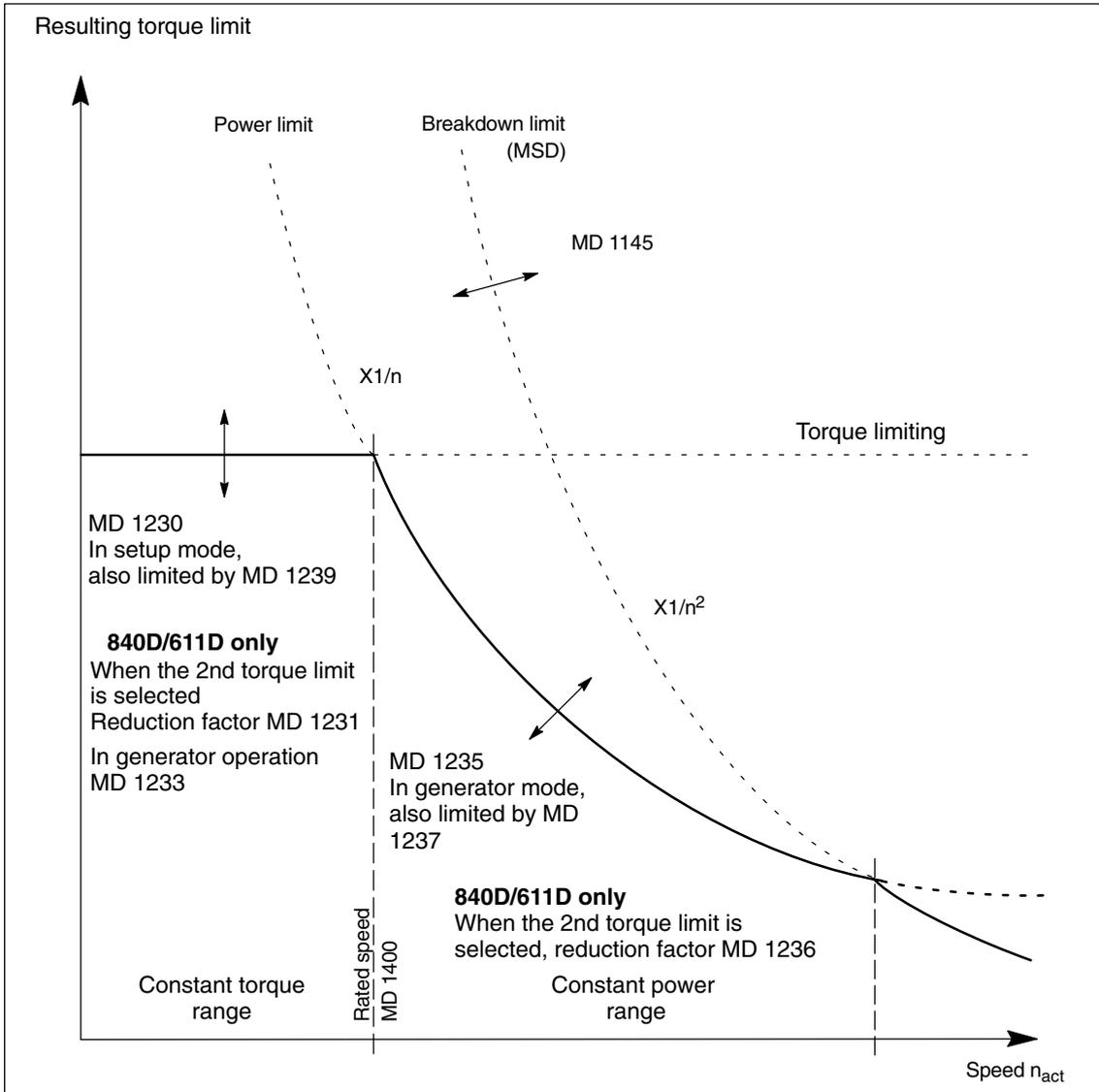

Resulting torque limit

Power limit   Breakdown limit (MSD)

MD 1145

X1/n

Torque limiting

MD 1230
In setup mode,
also limited by MD 1239

840D/611D only
When the 2nd torque limit
is selected
Reduction factor MD 1231

In generator operation
MD 1233

X1/n^2

MD 1235
In generator mode,
also limited by MD 1237

840D/611D only
When the 2nd torque limit is
selected, reduction factor MD 1236

Rated speed MD 1400

Constant torque range   Constant power range

Speed n$_{act}$

Fig. 2-1   Torque limitation

1231	**TORQUE_LIMIT_2**			**840D only**	**Cross reference:** –
	2nd torque limit			Relevant: FSD/MSD	Protection level: 2/4
Unit: %	Default: 100.0	Minimum: 5.0	Maximum: 100.0	Data type: FLOAT DWORD	Active: Immediately

Enter the 2nd torque limit, which is interpreted as the reduction factor in relation to the 1st torque limit (MD 1230). It is only effective if the 2nd torque limit is selected via the "Torque limit 2" IS DB 31, ... DBX20.2 and the motor speed exceeds the value set in MD 1232: TORQUE_LIMIT_SWITCH_SPEED with hysteresis (MD 1234).

1232	**TORQUE_LIMIT_SWITCH_SPEED**			**840D only**	**Cross reference:** –
	Switching speed from MD 1230 to MD 1231			Relevant: FSD/MSD	Protection level: 2/4
Unit: 1/min	Default: 6,000.0	Minimum: 0.0	Maximum: 100,000.0	Data type: FLOAT	Active: Immediately

Enter the changeover speed, above which the 2nd torque limit (MD 1231) can be selected. With the changeover, an adjustable hysteresis becomes effective (MD 1234). The 2nd torque limit is only effective if the motor speed exceeds the speed threshold with hysteresis, and the 2nd torque limit has been selected via the "Torque limit 2" IS DB 31, ... DBX20.2.

1233	**TORQUE_LIMIT_GENERATOR[n] 0...7 index of parameter set**			**840D only**	**Cross reference:** –
	Regenerative limiting			Relevant: FSD/MSD	Protection level: 2/4
Unit: %	Default: 100.0	Minimum: 5.0	Maximum: 100.0	Data type: FLOAT	Active: Immediately

This machine data limits the torque when decelerating (generator torque limiting). The limiting is implemented in relation, referred to the maximum motor torque MD 1230: TORQUE_LIMIT_1. If the 2nd torque limit is active, the reference value is obtained from MD 1230: TORQUE_LIMIT_1 and MD 1231: TORQUE_LIMIT_2.

1234	**TORQUE_LIMIT_SWITCH_HYST**			**840D only**	**Cross reference:** –
	Hysteresis, MD 1232			Relevant: FSD/MSD	Protection level: 2/4
Unit: 1/min	Default: 50.0	Minimum: 0.0	Maximum: 1,000.0	Data type: FLOAT	Active: Immediately

Enter the hysteresis for the switch-in speed set in MD 1232: TORQUE_LIMIT_SWITCH_SPEED.

2.4 Limitations

1239	TORQUE_LIMIT_FOR_SETUP				Cross reference: –
	Torque limit, setup mode			Relevant: FSD/MSD	Protection level: 2/4
Unit: %	Default: 1.0	Minimum: 0.5	Maximum: 100.0	Data type: FLOAT	Active: Immediately

The torque limit in setup mode refers to the rated torque (MSD) or the static torque (FSD) of the motor (calculation, see MD 1230).

MD 1239 is ineffective in normal operation. In setup mode, the minimum from the limit values of normal operation and the value set in this machine data is effective as torque limit (see the graphic for MD 1230). Setup mode is selected via terminal 112 of the infeed/regenerative feedback unit.

Reference: /FB/, K3 "Electronic Counterweight"

2.4.2   Power limit

1235	POWER_LIMIT_1[n]0...7 index of parameter set				Cross reference: –
	1st power limit			Relevant: FSD/MSD	Protection level: 2/4
Unit: %	Default: 100.0	Minimum: 5.0	Maximum: 900.0	Data type: FLOAT	Active: Immediately

Enter the maximum permissible power in relation to the motor output (FSD) respective to the rated motor output
(MSD – MD 1130: MOTOR_NOMINAL_POWER).

Motor power [kW] (FSD) = $1/9,549 \cdot$ (MD 1118 $\cdot$ MD 1113) $\cdot$ MD 1400
MD 1118: MOTOR_STANDSTILL_CURRENT
MD 1113: TORQUE_CURRENT_RATIO
MD 1400: MOTOR_RATED_SPEED

Power limiting (constant power) can be used to limit the torque as shown in Fig. 2-1 ($P = 2\pi \cdot M \cdot n/60$; where P = const. $\Rightarrow M \sim 1/n$).
The applicable limit is always either the torque, power or breakdown-torque limit, whichever is lower (see Fig. 2-1).

The default setting for MSD is 100%.

For feed drives, this machine data is automatically pre-assigned with **Calculate controller data**, whereby the value is obtained from the following formula:

$$\text{VSA} : \text{MD 1235} = \frac{\text{MD 1104}}{\text{MD 1118}} \times 100\%$$

For main spindle drives, the following is especially valid: If the threshold speed of the field weakening is greater than the rated speed, then the ramp-up times can be shortened, and the power yield increased, if only the power limit is increased (the current limit remains the same). As the current limit (MD 1238) can additionally limit the entered torque, an increased torque may only be possible if the current limit can also be increased.

! **Important**

If the motor is overloaded for a longer period of time, its temperature can rise to an inadmissible value (shutdown with motor temperature) and can even destroy the motor. Corresponding machine data are MD 1104, MD 1145 and MD 1231 to MD 1239.

2.4 Limitations

1236	POWER_LIMIT_2				840D only	Cross reference –
	2nd power limit				Relevant: FSD/MSD	Protection level: 2/4
Unit: %	Default: 100.0	Minimum: 5.0	Maximum: 100.0	Data type: FLOAT	Active: Immediately	

Enter the 2nd power limit, which is interpreted as the reduction factor in relation to the 1st power limit (MD 1236). It is only effective if the 2nd torque limit is selected via the "Torque limit 2"
IS DB 31, ... DBX20.2 and the motor speed exceeds the value set in
MD 1232: TORQUE_LIMIT_SWITCH_SPEED with hysteresis (MD 1234).

1237	POWER_LIMIT_GENERATOR					Cross reference: –
	Max. generator power				Relevant: FSD/MSD	Protection level: 2/4
Unit: kW	Default: 100.0	Minimum: 0.1	Maximum: 500.0	Data type: FLOAT	Active: Immediately	

This machine data allows the regenerative power for the infeed/regenerative feedback module to be limited. An appropriately small value should be entered here especially when an uncontrolled power supply is used.

2.4.3   Current limit

for FSD

1104	MOTOR_MAX_CURRENT				Cross reference: –
	Max. motor current			Relevant: FSD	Protection level: 2/4
Unit: A	Default: 0.0	Minimum: 0.0	Maximum: 500.0	Data type: FLOAT	Active: POWER ON

Enter the maximum permissible motor current (RMS value) from the motor data sheet (third-party motor), or parameterize it automatically by entering and accepting the motor code number in MD 1102: MOTOR_CODE. This machine data should not be reduced for reasons of safe monitoring and limiting (see also MD 1105).

The limit current is entered when the motor is selected.

The limit current is the current, which can be applied at rated speed. Thus, constant acceleration is possible over the complete speed range.

If the maximum motor current is increased, the torque limit
(MD 1230 = MD 1104/MD 1118 · 100) and the power limit
(MD 1235 = MD 1104/MD 1118 · 100) must be adapted.

This MD is used in the controller data calculation.

1105	MOTOR_MAX_CURRENT_REDUCTION				Cross reference: –
	Reduction, max. motor current			Relevant: FSD	Protection level: 2/4
Unit: %	Default: 100	Minimum: 0	Maximum: 100	Data type: WORD	Active: Immediately

Reference value for the percentage input is MD 1104: MOTOR_MAX_CURRENT.

If the motor current is at its limit as a result of torque/power limits being too high, then the monitoring function is triggered with MD 1605/MD 1606.

To compensate for the higher value in MD 1104, the current reduction factor MD 1105 is initialized with a ratio of 1122/1104 during controller data calculation.

2.4 Limitations

For MSD

1103	MOTOR_NOMINAL_CURRENT				Cross reference: –
	Rated motor current			Relevant: FSD/MSD	Protection level: 2/4
Unit: A	Default: 0.0	Minimum: 0.0	Maximum: 500.0	Data type: FLOAT	Active: POWER ON

Enter the nominal current (RMS value), which is drawn during operation at nominal torque and nominal motor speed. Enter the value from the motor data sheet (third-party motor) or parameterize it automatically by entering and accepting the motor code number in MD 1102: MOTOR_CODE.

1238	CURRENT_LIMIT				Cross reference: –
	Current limit			Relevant: MSD	Protection level: 2/4
Unit: % 810D 840D	Default: 150.0 150.0	Minimum: 0.0 0.0	Maximum: 300.0 400.0	Data type: FLOAT	Active: Immediately

Enter the maximum permissible motor current in relation to the rated motor current, MD 1103: MOTOR_NOMINAL_CURRENT.

In order to shorten the ramp-up times, it may be practical to set the current limit to values > 100% and to additionally increase the power and torque limits (MD 1230, MD 1235).

If the motor current is at its limit as a result of torque/power limits being too high, then the monitoring function is triggered with MD 1605/MD 1606.

!

Important

If the motor is overloaded for a longer period of time, its temperature rise may be inadmissible (shutdown with motor overtemperature), and the motor could be destroyed.

2.5   Torque-setpoint monitoring

1605	SPEEDCTRL_LIMIT_TIME					Cross reference: –
	Timer, speed controller at its limit				Relevant: FSD/MSD	Protection level: 2/4
Unit: ms	Default: 200.0	Minimum: 20.0	Maximum: 10,000.0	Data type: FLOAT DWORD	Active: Immediately	

The speed-controller output (torque setpoint) is monitored.
If the output remains at the torque, power, stability or current limit for longer than the time setting and if the absolute actual speed is lower than the value set in MD 1606, alarm "300608 axis %1, drive %2 speed-controller output limited" is triggered and the motor pulses are suppressed.

!

Important

If the value set in MD 1605 < MD 1404: PULSE_SUPPRESSION_DELAY, generator deceleration may be aborted with the error message "300608 axis %1, drive %2 speed-controller output limited", causing the drive to coast down.

1606	SPEEDCTRL_LIMIT_THRESHOLD					Cross reference: –
	Threshold, speed controller at its limit				Relevant: FSD/MSD	Protection level: 2/4
Unit: 1/min	Default: (FSD/MSD) 8,000.0/30.0	Minimum: 0.0	Maximum: 100,000.0	Data type: FLOAT	Active: Immediately	

Enter the speed threshold for alarm 300608 "Speed controller output limited" (see also MD 1605). The default setting is dependent on the motor type (FSD $\doteq$ 8000, MSD $\doteq$ 30) and is parameterized during startup based on the drive configuration. This means that on feed drives, the monitoring function is active throughout the speed range.

1728	DESIRED_TORQUE			840D only	Cross reference: –
	Torque setpoint			Relevant: FSD/MSD	Protection level: 2/4
Unit: %	Default: 0.0	Minimum: −100,000.0	Maximum: 100,000.0	Data type: FLOAT	Active: Immediately

This machine data is not relevant for SINUMERIK 810D.

The torque setpoint is adjusted manually between drive machine data MD 1728: DESIRED_TORQUE and NC machine data MD 32460: TORQUE_OFFSET[n] ".

2.6 Speed setpoint monitoring

1405	MOTOR_SPEED_LIMIT[n]0...7 index of parameter set			Cross reference: –	
	Motor speed limit			Relevant: FSD/MSD	Protection level: 2/4
Unit: %	Default: 110.0	Minimum: 100.0	Maximum: 110.0	Data type: FLOAT	Active: Immediately

Enter the maximum permissible speed setpoint as a percentage. The reference value is MD 1401: MOTOR_MAX_SPEED. If the speed setpoint is exceeded, it is limited to the specified value.

The MD is parameterized using **Calculate controller data**.

Note

As of SW 4.2:
For FSD/AM speed setpoint limitation, the speed limit parameterized in MD 1147: SPEED_LIMIT is taken into account as well as MD 1405.
The speed-setpoint limit is defined as follows:
$N_{max1} = 1.02 \cdot$ (lower of MD 1146, MD 1147)
$N_{max2} = $ MD 1401 $\cdot$ MD 1405

$N_{setmax} = $ minimum from N_{max1}, N_{max2}

1420	MOTOR_MAX_SPEED_SETUP			Cross reference: –	
	Max. motor speed for setup mode			Relevant: FSD/MSD	Protection level: 2/4
Unit: 1/min	Default: 30.0	Minimum: 0.0	Maximum: 100,000.0	Data type: FLOAT	Active: Immediately

For setup mode (terminal 112), the absolute speed setpoint is limited to the specified value.

2.7   Actual speed limitation

The actual speed limit is calculated as follows:

FSD:

1.02 · Lower of (MD 1147 and 1.2 · MD 1400)

MSD and SLM:

1.02 · Lower of (MD 1147 and MD 1146)

If the actual speed exceeds the limit, the torque is limited to zero.

If the actual speed falls below the limit, the torque limit corresponds to the operational state.

With an appropriate setting, "Speed controller at its limit" monitoring may respond (response threshold MD 1606 > MD 1146 and response time > MD1605).

1147	SPEED_LIMIT					Cross reference: –
	Speed limiting				Relevant: FSD/MSD	Protection level: 2/4
Unit: 1/min	Default: (FSD/MSD) 7,000.0/8,000.0	Minimum: 0.0	Maximum: 100,000.0	Data type: FLOAT	Active: Immediately	

The maximum permissible speed of the motor is entered in this MD.

In the case of automatic parameterization (initialization) using **Calculate controller data**, the following values are entered in MD 1147:

- **FSD,** the value MD 1400: MOTOR_RATED_SPEED · 110% and

- **MSD,** the value MD 1146: MOTOR_MAX_ALLOWED_SPEED

is substituted.

1146	MOTOR_MAX_ALLOWED_SPEED					Cross reference: –
	Max. motor speed				Relevant: FSD/MSD	Protection level: 2/4
Unit: 1/min	Default: 0.0 MSD: 1,500.0	Minimum: 0.0	Maximum: 100,000.0	Data type: FLOAT	Active: POWER ON	

Enter the maximum motor speed from the motor data sheet (third-party motor) in this MD.

This generates automatic parameterization by entering and accepting the motor code number in MD 1102: MOTOR_CODE.

Notes

■

Supplementary Conditions

3

None

■

Data Descriptions (MD, SD)

4

See Chapter 2

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Notes

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Signal Descriptions

5

DB 31, ... **DBX94.0** Data block	**Motor temperature prewarning** Signal(s) from axis/spindle (drive → PLC)		
Edge evaluation: No		Signal(s) updated: Cyclic	Signal(s) valid as of software version: 1.1
Signal state 1 or signal transition 0 ——> 1	The drive module sends "Motor temperature prewarning" to the PLC. In this case, the motor temperature has exceeded the defined warning threshold MD 1602: MOTOR_TEMP_WARN_LIMIT (motor-temperature warning threshold; default value 120˚C) (see Fig. 5-1 ②). If the motor temperature remains too high, once a time defined in MD 1603: MOTOR_TEMP_ALARM_TIME (timer motor temperature alarm; default value 240 s) has expired, the drive is regeneratively braked and the pulses suppressed (see Fig. 5-1 ③). Alarm 300614 is then output and the "DRIVE ready" IS is canceled. If the motor temperature rises still further and the shutdown threshold defined in MD 1607: MOTOR_TEMP_SHUTDOWN_LIMIT (motor-temperature shutdown limit, default value 155˚C) is reached, the drive is stopped immediately (see Fig. 5-1 ④). An alarm is also output and the "DRIVE ready" IS is canceled. However, if the motor temperature falls back below the warning threshold before this, the interface signal is reset to 0 (see Fig. 5-1 ②). Special case: If no temperature sensor signal is measured, this is interpreted as a fault in the motor PTC thermistor and the "Motor temperature prewarning" IS is set. Procedure continues as above.		
Signal state 0 or signal transition 1 ——> 0	The motor temperature is below the warning threshold. The current motor temperature is displayed in the axis/spindle service display in the Diagnosis operating area. The display corresponds to MD 1702: MOTOR_TEMPERATURE (motor temperature).		
Signal irrelevant for	SINUMERIK FM-NC		

5 *Signal Descriptions*

DB 31, ... **DBX94.0**	**Motor temperature prewarning**		
Data block	Signal(s) from axis/spindle (drive → PLC)		
Fig. 5-1	 Fig. 5-1		
Application example(s)	As soon as "Motor temperature warning" has been signaled, the PLC can, for example, initiate controlled shutdown of the drives.		
Related to	"DRIVE Ready" IS (DB 31, ..., DBX93.5) MD 1602: MOTOR_TEMP_WARN_LIMIT MD 1603: MOTOR_TEMP_ALARM_TIME MD 1607: MOTOR_TEMP_SHUTDOWN_LIMIT		
Additional references	/DA/, "Diagnostics Guide" /IAD/, SINUMERIK 840D Installation and StartUp Guide, Section SIMODRIVE 611D or /IAG/, SINUMERIK 810D Installation and Startup Guide		

DB 31, ... **DBX94.1**	**Heatsink temperature prewarning**		
Data Block	Signal(s) from axis/spindle (drive → PLC)		
Edge evaluation: No		Signal(s) updated: Cyclic	Signal(s) valid as of software version: 1.1
Signal state 1 or signal transition 0 ——> 1	The drive module sends "Heatsink temperature prewarning" to the PLC. This triggers the following: • Terminal 5 on the infeed/regenerative feedback module is activated immediately. • The drive module is switched off after 20 seconds. The drives are stopped when the impulse enable is removed. Then alarm 300515 is triggered.		

DB 31, ... **DBX94.1**	**Heatsink temperature prewarning**
Data Block	Signal(s) from axis/spindle (drive → PLC)
Signal state 0 or signal transition 1 ——> 0	The drive-module heatsink-temperature-monitoring-function has not responded.
Signal irrelevant for	SINUMERIK FM-NC
Application example(s)	As soon as "Heatsink temperature prewarning" has been signaled, the PLC can, for example, initiate controlled shutdown of the drives.
Additional references	/DA/, "Diagnostics Guide"

DB 31, ... **DBX94.7**	**Variable signaling function**	
Data Block	Signal(s) from axis/spindle (drive → PLC)	
Edge evaluation: No	Signal(s) updated: Cyclic	Signal(s) valid as of software version: 1.1

Signal state 1	SIMODRIVE 611D signals to the PLC that the threshold value of the quantity to be monitored has been exceeded. Using the variable signaling function, it is possible to monitor for any axis any quantity from SIMODRIVE 611D, which can be parameterized, to check if it violates a certain threshold and to signal as interface signal to the PLC. The parameters for the variables being monitored are set in the following 611D machine data:
	• MD 1620: PROG_SIGNAL_FLAGS (bits variable signal function)
	• MD 1621: PROG_SIGNAL_NR (signal number variable signal function)
	• MD 1622: PROG_SIGNAL_ADDRESS (address variable signal function)
	• MD 1623: PROG_SIGNAL_THRESHOLD (threshold variable signal function)
	• MD 1624: PROG_SIGNAL_HYSTERESIS (hysteresis variable signal function)
	• MD 1625: PROG_SIGNAL_ON_DELAY (ON delay variable signal function)
	• MD 1626: PROG_SIGNAL_OFF_DELAY(OFF delay variable signal function)
	
	Monitoring:
	    The parameterized variable is monitored to check whether it exceeds a defined threshold. In addition, a tolerance band (hysteresis) can be defined, which is considered when scanning for violation of the threshold value. The signal "Threshold exceeded" can be also be combined with an ON delay and OFF delay time (see Fig. 5-8).
	
	Selection:
	    The variable to be monitored can be selected by entering a signal number or by entering a symbolic address. The variable signaling function can be enabled/disabled for each specific axis using PROG_SIGNAL_FLAGS (bits, variable signaling function). It is also possible to determine whether the threshold value comparison is to be signed or unsigned.
	
	For further information see References.	

Signal state 0	SIMODRIVE 611D signals to the PLC that the threshold value of the variable being monitored has not been exceeded or that the conditions defined in the above 611D machine data are not fulfilled. If the variable signaling function is disabled (PROG_SIGNAL_FLAGS), signal state "0" is output to the PLC.	
Signal irrelevant for	SINUMERIK FM-NC	

SIMODRIVE 611 Digital / SINUMERIK 840D/810D Drive Functions (FBA) – 11.05 Edition   **DÜ1/5-27**

5 Signal Descriptions

DB 31, ... DBX94.7 Data Block	Variable signaling function Signal(s) from axis/spindle (drive → PLC)
Fig. 5-2	Threshold PROG_SIGNAL_THRES–HOLD Tolerance band PROG_SIGNAL_HYSTERESIS Signal "Threshold value exceeded" Pickup delay time PROG_SIGNAL_ON_DELAY Dropout delay time PROG_SIGNAL_OFF_DELAY
Application example(s)	With the variable signaling function, the machine OEM can monitor one additional threshold value for specific applications for each axis/spindle and evaluate the result in the PLC user program. Example: IS "Variable signaling function" is to be set to 1 when the motor torque exceeds 50% of the rated torque.
Related to	MD 1620: PROG_SIGNAL_FLAGS (bits variable signal function) MD 1621: PROG_SIGNAL_NR (signal number variable signal function) MD 1622: PROG_SIGNAL_ADDRESS (address variable signal function) MD 1623: PROG_SIGNAL_THRESHOLD (threshold variable signal function) MD 1624: PROG_SIGNAL_HYSTERESIS (hysteresis variable signal function) MD 1625: PROG_SIGNAL_ON_DELAY (ON delay variable signal function) MD 1626: PROG_SIGNAL_OFF_DELAY (OFF delay variable signal function)
Additional references	/IAD/, SINUMERIK 840D Installation and StartUp Guide, Section SIMODRIVE 611D or /IAG/, SINUMERIK 810D Installation and Startup Guide

DB 31, ... DBX95.0 Data Block	$U_{DC\ link}$ < warning threshold Signal(s) from axis/spindle (drive → PLC)	
Edge evaluation: No	Signal(s) updated: Cyclic	Signal(s) valid as of software version: 1.1
Signal state 1 or signal transition 0 ——> 1	The drive signals to the PLC that the DC-link voltage V_{DC} has dropped below the DC-link undervoltage warning threshold. The DC-link undervoltage warning threshold is defined with MD 1604: LINK_VOLTAGE_WARN_LIMIT. The DC-link undervoltage warning threshold should be defined as greater than 400 V, depending on the application case. If the DC-link voltage drops below 280 V, it is switched off by the hardware.	
Signal state 0 or signal transition 1 ——> 0	The DC link voltage V_{DC} is greater than the DC-link undervoltage warning threshold.	
Signal irrelevant for	SINUMERIK FM-NC	
Application example(s)	If a warning signal is given, measures can be taken by the PLC user program, for example, to stop machining safely (e.g., start tool retraction) or to buffer the DC-link voltage.	

DB 31, ...	**U$_{DC\ link}$ < warning threshold**
DBX95.0	
Data Block	Signal(s) from axis/spindle (drive $\rightarrow$ PLC)
Related to	MD 1604: LINK_VOLTAGE_WARN_LIMIT (DC-link undervoltage warning threshold)
Additional references	/IAD/, SINUMERIK 840D Installation and StartUp Guide, Section SIMODRIVE 611D or /IAG/, SINUMERIK 810D Installation and Startup Guide

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Notes

Example

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None

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7

Data Fields, Lists

7.1 Motor temperature monitoring

Table 7-1 Machine data

No.	Identifier	Name	Drive
1602	MOTOR_TEMP_WARN_LIMIT[DRx]	Motor temp. warning threshold	FDD/MSD
1603	MOTOR_TEMP_ALARM_TIME[DRx]	Timer for motor temperature alarm	FDD/MSD
1607	MOTOR_TEMP_SHUTDOWN_LIMIT[DRx]	Shutdown limit, motor temperature	FDD/MSD
1608	MOTOR_FIXED_TEMPERATURE[DRx]	Fixed temperature	FDD/MSD

7.2 DC link monitoring

Table 7-2 Machine data

No.	Identifier	Name	Drive
1604	LINK_VOLTAGE_WARN_LIMIT[DRx]	DC-link undervoltage warning threshold	FDD/MSD
1630	LINK_VOLTAGE_MON_THRESHOLD	Response threshold, only DC-link monitoring	FDD/MSD

7.3 Current value monitoring

Table 7-3   Machine data

No.	Identifier	Name	Drive
1254	CURRENT_MONITOR_FILTER_TIME[DRx]	Time constant, current monitoring	FDD/MSD

7.4 Limitations

7.4.1 Torque-setpoint limitation

Table 7-4   Machine data

No.	Identifier	Name	Drive
1145	STALL_TORQUE_REDUCTION[DRx]	Stall torque reduction factor	MSD
1190	TORQUE_LIMIT_FROM_NC	Evaluation, torque limit value	FDD/MSD
1191	TORQUE_LIMIT_ADAPT_SERVO	Adaption factor, servo limiting torque	FDD/MSD
1230	TORQUE_LIMIT_1[0...7,DRx]	1st torque limit value	FDD/MSD
1231	TORQUE_LIMIT_2[0...7,DRx]	2nd torque limit value	FDD/MSD
1232	TORQUE_LIMIT_SWITCH_SPEED	Switch speed from Md1 to Md2	FDD/MSD
1233	TORQUE_LIMIT_GENERATOR[0...7,DRx]	Generator limiting	FDD/MSD
1234	TORQUE_LIMIT_SWITCH_HYST	Hysteresis, MD 1232	FDD/MSD
1239	TORQUE_LIMIT_FOR_SETUP[DRx]	Torque limit for setup mode	FDD/MSD

7.4.2 Power limit

Table 7-5   Machine data

No.	Identifier	Name	Drive
1235	POWER_LIMIT_1[0...7,DRx]	1st power limit	FDD/MSD
1236	POWER_LIMIT_2[0...7,DRx]	2nd power limit	FDD/MSD
1237	POWER_LIMIT_GENERATOR[DRx]	Maximum power generator mode	FDD/MSD

7.4.3 Current limit

Table 7-6   Machine data

No.	Identifier	Name	Drive
1103	MOTOR_NOMINAL_CURRENT[DRx]	Nominal motor current	FDD/MSD
1104	MOTOR_MAX_CURRENT[DRx]	Max. motor current	FSD
1105	MOTOR_MAX_CURRENT_REDUCTION[DRx]	Reduction in max. motor current	FSD
1238	CURRENT_LIMIT[DRx]	Current limit value	MSD

7.5 Torque-setpoint monitoring

Table 7-7   Machine data

No.	Identifier	Name	Drive
1605	SPEEDCTRL_LIMIT_TIME[DRx]	Timer, n controller at its limit	FDD/MSD
1606	SPEEDCTRL_LIMIT_THRESHOLD[DRx]	Threshold speed controller at its endstop	FDD/MSD

7.6 Speed setpoint monitoring

Table 7-8   Machine data

No.	Identifier	Name	Drive
1405	MOTOR_SPEED_LIMIT[0...7,DRx]	Motor monitoring speed	FDD/MSD
1420	MOTOR_MAX_SPEED_SETUP[DRx]	Max. motor speed, setup mode	FDD/MSD

7.7 Actual speed limitation

Table 7-9   Machine data

No.	Identifier	Name	Drive
1146	MOTOR_MAX_ALLOWED_SPEED[DRx]	Max. motor speed	FDD/MSD
1147	SPEED_LIMIT[DRx]	Speed limitation	FDD/MSD

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Abbreviations

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A

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AC	Adaptive Control
ACKNLG	Acknowledge from printer
ADF	Autofeed printer
ARM	Asynchronous Rotating Motor
ASCII	American Standard Code for Information Interchange: American Standard Code for Information Interchange
ASUB	Asynchronous subprogram (see also Interrupt routine)
AuxF	Auxiliary function
Basic axis	Axis whose setpoint or actual-value position forms the basis of the calculation of a compensation value.
BB	Ready
BCD	Binary Coded Decimals: Decimals with each digit coded in binary
BCS	Basic Coordinate System
BIN	**Bin**ary Files
BO	Mode
BOT	Boot Files: Boot files for SIMODRIVE 611D
BP	Basic Program
BUSY	Busy from printer
CAM	Reference cam
CC	Compile Cycles
Compensation axis	Axis with a setpoint or actual value modified by the compensation value

Compensation table	Table of interpolation points It provides the compensation values of the compensation axis for selected positions on the basic axis.
Compensation value	Difference between the axis position measured by the encoder and the desired, programmed axis position.
COR	Coordinate Rotation
CPA	**C**ompiler **P**rojecting Dat**a**
CPU	Central Processing Unit
CR	Carriage return
CRC	Cutter Radius Correction
CTS	Clear To Send: Signal from serial data interfaces indicating that they are clear to send
CUTCOM	**Cut**ter radius **com**pensation
DAC	Digital Analog Converter
DATA	Printer data bit x (x is index from 0 to 7)
DB	Data block in the PLC
DBB	Data block in the PLC
DBW	Data Block Word in the PLC
DBX	Data Block Bit in the PLC
DC	Direct Control: Movement of the rotary axis across the shortest path to the absolute position within one revolution
DCD	Carrier detect
DIO	Data Input/Output: data-transfer display
DIR	Directory Contents
DOE	Data Transmission Equipment
DPR	Dual Port RAM
DRF	Differential Resolver Function
DRY	Dry Run: Dry run feedrate

DSB	Decoding Single Block
DSR	Data set ready
DSR	Data Send Ready: Signal from serial data interfaces indicating that they are ready to operate
DTE	Data Terminal Equipment
DTR	Data Terminal Ready
EIA-code	Special punched tape code: Number of holes per character always odd
EMF	Electromotive force
ENC	Encoder (actual-value sensor)
EPROM	Erasable Programmable Read-Only Memory
ERROR	Error from printer
FC	Function Call, function block on the PLC
FIFO	First In first Out: Memory, which works without address specification where data are read in the same order, in which they were stored.
FIPO	Fine-Interpolator
FSD	Feed Drive
FST	Feed Stop
GEO	Geometry
GIA	**G**ear **I**nterpolation Dat**a**
GND	Signal ground
GUD	**G**lobal **U**ser **D**ata
GWPS	Grinding Wheel Peripheral Speed
HEX	Hexadecimal number
HMI	Human Machine Interface: Operator function of SINUMERIK for operation, programming and simulation. HMI means the same as MMC.
HW limit switch	Hardware limit switch

ICA	**I**nterpolative Compens**a**tion
IF	Pulse enable of the drive module
IK (GD)	Implicit communication (global data)
INC	Increment
INI	**Ini**tializing Data
INIT	Initialize printer
Interpolation point	A position of the base axis and the corresponding compensation value of the compensation axis.
IPO	Interpolator
I/R	Infeed/regenerative feedback unit of SIMODRIVE 611(D)
IS	Interface Signal
ISO-code	Special punched tape code, number of holes per character always even
JOG	Jogging: Setup mode
K$_{UE}$	Transmission ratio
K$_V$	Servo gain factor
LC	Line feed
LEC	Leadscrew Error Compensation
LED	Light Emitting Diode: Diode
LR	Position controller
LUD	User data (local) (**L**ocal **U**ser **D**ata)
Machine axis	Physical axis on the machine tool
MCP	Machine Control Panel
MCS	Machine Coordinate System
MD	Machine Data
MDA	Manual Data Automatic: Manual input

MM	Millimeter
MMC	Man-Machine Communication: User interface on numerical control systems for operator control, programming and simulation. HMI means the same as MMC.
Mode group	Mode groups
MPF	Main Program File: NC part program (main program)
MSD	Main Spindle Drive
NC	Numerical Control
NCK	Numerical Control Kernel: NC kernel with block preparation, traversing range, etc.
OB	Organization block on the PLC
OP	Operator Panel
OPI	Operator Panel Interface
OPT	**Opt**ions
Order No. [MLFB]	Machine-readable product designation
Path axes	Path axes are all the machining axes in the channel which are controlled by the interpolator such that they start, accelerate, stop and reach their end positions simultaneously (the same feedrate is used for all path axes).
PC	Personal Computer
PG	Programming device
PI	Paper error
PLC	Programmable Logic Control
PMS1	Position Measuring System 1
PMS2	Position Measuring System 2
PRAL	Process Alarm
PRT	Program Test
PS	Power Section
PTP	Point to Point

SIMODRIVE 611 Digital / SINUMERIK 840D/810D Drive Functions (FBA) – 11.05 Edition   A-5

RAM	Random Access Memory, i.e. program memory that can be read and written to
REF	Reference-point approach function
REPOS	REPOSition function
RI	Ring indicator
ROV	Rapid OVerride
RPA	R Parameter Active: Memory area on the NCK for R parameter numbers
RPY	Roll Pitch Yaw (type of rotation of a coordinate system)
RTS	Request To Send: Request to send, control signal on serial data interfaces
RxD	Receive data
SBL	Single Block
SD	Setting data
SEA	Setting Data Active: Memory area for setting data on the NCK
SIDA	SIMODRIVE Double-Axis ASIC
SKP	SKiP: Block skip
SLCT	Select from printer
SLM	Synchronous Linear Motor
SM	Stepper motor
SPF	Sub Program File: Subprogram
SRM	Synchronous Rotating Motor
STROBE	Data strobe to printer
SW limit switch	Software limit switch
SYF	**Sy**stem **F**iles
SYNACT	Synchronized Action
T	Tool
TEA	Testing Data Active: Refers to machine data

TLC	**T**ool **L**ength **C**ompensation
TNRC	Tool nose radius compensation
TO	Tool Offset
TOA	Tool Offset Active: Memory area for tool offsets
TxD	Transmit data
UFR	User Frame: Zero point offset
V.24	Definition of the exchange lines between DTE and DCE
V.28	Definition of the electrical behavior of the signals
WCS	Workpiece coordinate system
WPD	**W**ork **P**iece **D**irectory
WZ	Tool
Xy	Connector designation (y is index)
ZO	Zero Offset
450	Type of modern interface controller
550	Type of modern interface controller
75188	Driver module for serial interface

■

Notes

Explanation of Terms

B

A

Absolute dimensions	A destination for an axis movement is defined by a dimension that refers to the origin of the currently active coordinate system. See also →incremental dimension.
Approach machine (fixed-point	Approach motion towards one of the predefined →fixed machine points.
AUTOMATIC	Block sequence mode (DIN): Mode in NC systems, in which a →part program is selected and continuously executed.
Auxiliary functions	Auxiliary functions can be used to transfer parameters to the PLC in part programs, where they trigger reactions, which are defined by the machine OEM.
Axis address	See axis identifier
Axis identifier	In accordance with DIN 66217, axes for a right-handed, rectangular →coordinate system are identified using X, Y, Z, the identifiers A, B, C are used for →rotary axes turning around X, Y, Z. Other letters can be used to identify additional parallel axes.
Axis name	See axis identifier

B

Basic coordinate system	In the →part program, the programmer uses the axis names of the basic coordinate system. The basic coordinate system exists in parallel to the →machine coordinate system when no →transformation is active. The difference between the systems relates only to the axis identifiers.
Blank	Workpiece as it is before a part is machined.

Block   ”Block” is the term given to any files required for creating and processing pro-
                             grams.

C

C axis   Axis, around which the tool spindle describes a controlled rotational and positio-
                             ning movement.

Channel   A channel can execute a →part program independently of other channels. A
                             channel exclusively controls the axes and spindles assigned to it. Part
                             programs run on various channels can be coordinated by →synchronization.

Circular   The →tool is required to travel in a circle between defined points on the contour
interpolation   at a specified feed while machining the workpiece.

COM   Component of the NC control for the implementation and coordination of com-
                             munication.

Command channel   The PLC program can transfer or invoke NC functions (e.g., S-external,
                             transformation) via the command channel.

Compensation   Data range in the control, in which the tool offset data are stored.
memory

Continuous-path   The purpose of continuous-path mode is to prevent excessive deceleration of
mode   the →path axes at the part-program block boundaries and to effect the transition
                             to the next block at as uniform a path speed as possible.

Contour   Outline of the →workpiece

Coordinate system   See →Machine coordinate system, →Workpiece coordinate system.

Cut-to-cut time   The cut-to-cut time is the period that elapses when a tool is changed between
                             retraction from the interruption point on the contour (from cut) and repositioning
                             on the interruption point (return to cut) with the new tool when the spindle is
                             rotating.

D

Data block   Data unit on the →PLC, which can be accessed by →HIGHSTEP programs.
                             Data blocks contain data definitions. These data can be initialized directly when
                             they are defined.

Data word   A data unit, two bytes in size, within a →data block.

DRF   Differential Resolver Function: An NC function, which generates an incremental zero offset in AUTOMATIC mode in conjunction with an electronic handwheel.

E

Exact stop   With a programmed exact stop instruction, the position stated in a block is approached precisely and very slowly, if necessary. In order to reduce the approach time, →exact stop limits are defined for rapid traverse and feed.

Exact stop limit   When all path axes reach their exact stop limits, the control responds as if it had reached its destination point precisely. The →part program continues execution at the next block.

F

Finished-part contour   Contour of the finished workpiece. See also →blank.

Fixed machine point   A point defined uniquely by the machine tool, e.g., the machine reference point.

Fixed-point approach   Machine tools can approach fixed points such as a tool change point, loading point, pallet change point, etc., in a defined way. The coordinates of these points are stored in the control. Where possible, the control moves these axes in →rapid traverse.

Frame   A frame is an arithmetic rule that transforms one Cartesian coordinate system into another Cartesian coordinate system. A frame contains the following components: →zero offset, →rotation, →scaling, →mirroring.

G

Gantry axes   Gantry axes comprise at least one pair of machine axes: the →leading axis and the →synchronized axis. As these are mechanically coupled, they must always be traversed simultaneously by the NC. The difference between the actual positions of the axes is monitored continuously.

Gantry axis grouping   The gantry axis grouping defines which synchronized axes are controlled by which →leading axis, based on machine data settings. Leading and →synchronized axes cannot be traversed separately.

Geometry Description of a →workpiece in the →workpiece coordinate system.

Geometry axis Geometry axes are used to describe a 2- or 3-dimensional range in the workpiece coordinate system.

H

HIGHSTEP Combination of the programming features for the →PLC in the AS300/AS400 system.

I

Inch dimension system Measurement system which defines distances in "inches" and fractions of inches.

Increment Distance traversed (number of increments x increment length). The number of increments can be stored as →setting data or selected using keys labeled with 10, 100, 1000, 10,000.

Incremental dimension Also incremental dimension: A destination for axis traversal is defined by a distance to be covered and a direction referenced to a point already reached. See also →absolute dimension.

Initialization block Initialization blocks are special program blocks. They contain value assignments that are performed before program execution.

Interpolator Logical unit on the →NCK, which determines intermediate values for the movements to be traversed on the individual axes on the basis of destination positions specified in the part program.
Initialization blocks are mainly used to initialize predefined data.

J

JOG Control operating mode: Setup mode: Manual operating mode, which can be used by the user to control axis traversing motions in feed or in →rapid traverse manually.

K

Keywords   Words with a specific notation, which have a defined meaning in the program-
                         ming language for →part programs.

K$_{ue}$ Transmission ratio

K$_v$ Servo gain factor, a control variable in a control loop.

L

Leading axis   The leading axis is the →gantry axis, which actually exists from the point of the
                         view of the user and programmer and can be controlled accordingly in the same
                         way as a normal NC axis.

Leadscrew-error   Compensation for the mechanical inaccuracies of a ball screw participating in
compensation   the feed. The control uses stored deviation values for the compensation.

Limit speed   Max. (spindle) speed: The maximum speed of a spindle can be limited by va-
                         lues defined in the machine data, the →PLC or setting data.

Linear axis   The linear axis is an axis, which, in contrast to a rotary axis, describes a straight
                         line.

Linear   The tool travels along a straight line to the destination point while machining the
interpolation   workpiece.

M

Machine axes   Axes, which exist physically on the machine tool.

Machine control   An operator panel on a →machine tool with operating elements such as keys,
panel   rotary switches, etc., and simple indicators such as LEDs. It is used to control
                         the machine tool directly via the PLC.

Machine   System of coordinates based on the axes of the →machine tool.
coordinate system

Machine zero   A fixed point on the machine tool, which can be referenced by all (derived) mea-
                         suring systems.

Macro techniques   Grouping of a set of instructions under a single identifier. The identifier repre-
                           sents the set of consolidated instructions in the program.

Main block   A block prefixed by ":" containing all the parameters required to start execution
                           of a →part program.

Main program   Part program identified by a number or identifier, in which further main pro-
                           grams, subroutines or cycles may be called.

MDA   Control operating mode: Manual Data Automatic, manual input of blocks with
                           processing.

**Metric
measuring system**   Standardized system of units: for lengths in millimeters (mm), meters (m), etc.

Mirroring   Mirroring inverts the signs of the coordinate values of a contour with respect to
                           an axis. It is possible to mirror with respect to more than one axis at a time.

Mode   An operating concept on a SINUMERIK control. The following modes have
                           been defined: →JOG, →MDA, →AUTOMATIC.

Mode group   Axes and spindles that are technologically related can be combined into one
                           mode group. Axes and spindles in the same mode group can be controlled by
                           one or more →channels. The same →mode is always assigned to the channels
                           in a mode group.

N

NC   Numerical control, NC control incorporates all the components of the of the ma-
                           chine-tool control system: →NCK, →PLC, →HMI, →COM.
                           Note: CNC (Computerized Numerical Control) is a more accurate term for
                           MARS and Merkur controls.

NCK   Numerical Control Kernel: Component of the NC control, which executes →part
                           programs and essentially coordinates the movements on the machine tool.

O

**Oriented spindle
stop**   Stops the workpiece spindle with a specified orientation angle, e.g., to perform
                           an additional machining operation at a specific position. In accordance with DIN
                           66025, the special function M19 is permanently assigned to this function.

Override

Manual control feature, which enables the user to override programmed feedrates or speeds in order to adapt them to a specific workpiece or material.

P

Parts programs

A sequence of instructions to the NC control, which combine to produce a specific →workpiece. Likewise, performing a certain machining operation on a specific →blank.

Path axis

Path axes are all the machining axes in the →channel, which are controlled by the →interpolator so that they start, accelerate, stop, and reach their end positions simultaneously.

Path feed

Path feed acts on →path axes. It represents the geometrical sum of the feeds on the participating geometry axes.

PLC

Programmable Logic Control Programmable Logic Controller: Component of the →NC control: Programmable controller for processing the control logic of the machine tool.

Polar coordinates

A coordinate system, which defines the position of a point on a plane in terms of its distance from the zero point and the angle formed by the radius vector with a defined axis.

Pole position identification

See Rotor position identification.

Positioning axis (posAxis)

Axis, which performs an auxiliary movement on a machine tool (e.g., tool magazine, pallet transport). Positioning axes are axes that do not interpolate with path axes.

Pre-coincidence

Block change occurs once the path reaches a defined delta distance from the end position.

Program block

Program blocks contain main programs and subprograms for part programs.

Programmable frames

Programmable →frames can be used to define new coordinate-system starting points dynamically while the part program is running. A distinction is made between absolute definition using a new frame and additive definition with reference to an existing starting point.

Programmable working area limitation

Limitation of the motion space of the tool to a space defined by programmed limitations.

Programming key	Characters and character sequences, which have a defined meaning in the programming language →for - part programs.
Protection zone	Three-dimensional area within a →working area, which the tool tip is not permitted to enter.

Q

R

Rapid traverse	The highest speed of an axis. It is used for example to move the tool from rest to the →workpiece contour or retract the tool from the contour. Rapid traverse is set specifically for each machine via machine data.
Reference point	Point on the machine tool used to reference the measuring system of the →machine axes.
Rotary axis	Rotary axes rotate a workpiece or tool to a defined angular position.
Rotation	Component of a →frame, which defines a rotation of the coordinate system through a specific angle.
Rotor position identification	Rotor/pole position identification determines the absolute position of the rotor in the motor independently on power-up.
R parameters	Arithmetic parameter, for which the programmer of the part program can assign or request values as required.
Rounding axis	Rounding axes rotate a workpiece or tool to an angular position corresponding to an indexing grid. When a grid index is reached, the rounding axis is "in position".

S

Scaling	Component of a →frame, which causes axis-specific scale modifications.
Set	A section of a →part program terminated with a line feed. A distinction is made between →main blocks and →subblocks.

Setting data   Data that communicates the properties of the machine tool to the NC control in a way defined by the system software.

Softkey   A key, whose name appears on an area of the screen. The choice of softkeys displayed is dynamically adapted to the operating situation. The freely assign-able function keys (softkeys) are assigned defined functions in the software. Softkeys appear in menus and vary depending on the menu selected.

Subblock   Block prefixed by "N" containing information for a machining step such as posi-tion data.

Subprogram   A sequence of instructions of a →part program which can be called repetitively with different parameters. →Cycles are a type of subroutine.

Synchronization   Instructions in →part programs for coordination of sequences in different →channels at specific machining points.

Synchronized axes   Synchronized axes take the same time to traverse as the geometry axes for their path.

Synchronized axis   The synchronized axis is the →gantry axis, for which the setpoint position is always derived from the traversing motion of the →leading axis. It therefore moves in exact synchronism with the leading axis. From the point of view of the programmer and operator, the synchronized axis "does not exist".

System variables   A variable, which exists although it has not been programmed by the →part program programmer. It is defined by a data type and the variable name preceded by the character $. See also →user-defined variable.

T

Tool   A part used on the machine tool for machining. Examples of tools include turn-ing tools, mills, drills, laser beams, etc.

Tool Nose Radius   Contour programming assumes that the tool is pointed. Since this is not actually
Compensation   the case in practice, the curvature radius of the tool used must be communi-cated to the control, which then takes it into account. The curvature center is maintained equidistantly around the contour, offset by the curvature radius.

Tool offset   The tool dimensions are considered when calculating the path.

Tool radius compensation	In order to program a desired →workpiece contour directly, the control must traverse a path equidistant to the programmed contour, taking into account the radius of the tool used.
Transformation	Additive or absolute zero offset of an axis.

U

User-defined variable	The user can declare user-defined variables for optional use in the →part program or data block. A definition contains a data type specification and the variable name. See also →system variable.

V

Variable definition	A variable definition includes the specification of a data type and a variable name. The variable names can be used to access the value of the variables.
Velocity control	In order to be able to achieve an acceptable traversing velocity on very short traverse movements, predictive velocity control can be set over several blocks.

W

Working area	Three-dimensional zone, into which the tool tip could be moved on account of the physical design of the machine tool. See also →protection zone
Workpiece	Part to be made / machined by the machine tool.
Workpiece contour	Setpoint contour of the →workpiece to be created/machined.
Workpiece coordinate system	The starting position of the workpiece coordinate system is the →workpiece zero. In machining operations programmed in the workpiece coordinate system, the dimensions and directions refer to this system.
Workpiece zero	The workpiece zero is the starting point for the →workpiece coordinate system. It is defined in terms of the distance from the machine zero.

X

Y

Z

Zero point offset	Specification of a new reference point for a coordinate system through reference to an existing zero point and a →frame.

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Notes

References

C

Documentation

An overview of publications that is updated monthly is provided in a number of languages in the Internet at:

http://www.siemens.com/motioncontrol

Follow menu items –> "Support" –> "Technical Documentation" –> "Overview of Publications" or "DOConWEB".

Notes

List of Drive Machine Data

D

The following table lists all the machine data described in this publication in ascending order with cross reference to the corresponding manual.

MD number	MD identifier	Cross reference:
1000	CURRCTRL_CYCLE_TIME	/DS1/
1001	SPEEDCTRL_CYCLE_TIME	/DD2/
1002	MONITOR_CYCLE_TIME	/DB1/
1003	STS_CONFIG	/DS1/
1004	CTRL_CONFIG	/DS1/ + /DD2/
1005	ENC_RESOL_MOTOR	/DG1/
1007	ENC_RESOL_DIRECT	/DG1/
1008	ENC_PHASE_ERROR_CORRECTION	/DG1/
1011	ACTUAL_VALUE_CONFIG	/DG1/ + /DM1/
1012	FUNC_SWITCH	/DB1/
1013	ENABLE_STAR_DELTA	/DE1/
1014	UF_MODE_ENABLE	/DE1/
1015	PEMSD_MODE_ENABLE	/DE1/
1016	COMMUTATION_ANGLE_OFFSET	/DL1/
1017	STARTUP_ASSISTANCE	/DL1/ + /DM1/
1019	CURRENT_ROTORPOS_IDENT	/DM1/ + /DL1/
1020	MAX_TURN_ROTORPOS_IDENT	/DM1/ + /DL1/
1021	ENC_ABS_TURNS_MOTOR	/DG1/
1022	ENC_ABS_RESOL_MOTOR	/DG1/
1023	ENC_ABS_DIAGNOSIS_MOTOR	/DG1/
1024	DIVISION_LIN_SCALE	/DG1/
1025	SERIAL_NO_ENCODER	/DG1/
1030	ACTUAL_VALUE_CONFIG_DIRECT	/DG1/
1031	ENC_ABS_TURNS_DIRECT	/DG1/
1032	ENC_ABS_RESOL_DIRECT	/DG1/
1033	ENC_ABS_DIAGNOSIS_DIRECT	/DG1/
1034	DIVISION_LIN_SCALE_DM	/DG1/
1038	SERIAL_NO_ENCODER_DM	/DG1/
1060	MD_BREAK_ACTIVE	/DB1/
1061	MD_BREAK_OPEN_TIME	/DB1/
1062	MD_N_BREAK	/DB1/

MD number	MD identifier	Cross reference:
1030	ACTUAL_VALUE_CONFIG_DIRECT	/DG1/
1049	EMK_BREAK_ENABLE	/DG1/
1055	MARKER_DIST	/DM1/
1056	MARKER_DIST_DIFF	/DM1/
1060	ACTIVATE_BRAKE_CONTROL	/DE1/
1061	BRAKE_RELEASE_TIME	/DE1/
1062	BREAK_CLOSE_SPEED	/DE1/
1063	BREAK_DELAY_TIME	/DE1/
1064	BREAK_LOCK_TIME	/DE1/
1070	RLI_RAMP_TIME	/DM1/
1071	RLI_WAIT_TIME	/DM1/
1072	RLI_AMOUNT	/DM1/
1073	POSS_TURN_ROTORPOS_IDENT	/DM1/
1074	ROTORPOS_OFFSET	/DM1/
1075	ALGORITHM_ROTORPOS_IDENT	/DM1/
1076	FACTOR_INTERTIA (SRM)/FACTOR_MASS (SLM)	/DM1/
1077	RLI_INTEGRATOR_TIME	/DM1/
1078	MAX_TIME_ROTORPOS_ID	/DM1/
1096	RED_TORQUE_LIMIT_GS_ACTIV	/DM1/ +/DE1/
1097	RED_TORQUE_LIMIT_GENSTOP	/DE1/
1098	INVERTER_MAX_CURR_DERAT	/DE1/
1099	INVERTER_DERATING_FACT	/DM1/
1100	PWM_FREQUENCY	/DS1/
1101	CTRLOUT_DELAY	/DS1/
1102	MOTOR_CODE	/DM1/
1103	MOTOR_NOMINAL_CURRENT	/DM1/ + /DÜ1/
1104	MOTOR_MAX_CURRENT	/DM1/ + /DÜ1/
1105	MOTOR_MAX_CURRENT_REDUCTION	/DÜ1/
1106	INVERTER_CODE	/DM1/
1107	INVERTER_MAX_CURRENT	/DM1/
1108	INVERTER_MAX_THERMAL_CURRENT	/DM1/
1109	INVERTER_MAX_S6_CURRENT	/DM1/
1111	INVERTER_RATED_CURRENT	/DM1/
1112	NUM_POLE_PAIRS	/DM1/
1113	TORQUE_CURRENT_RATIO	/DM1/
1113	FORCE_CURRENT_RATIO	/DM1/
1114	EMF_VOLTAGE	/DM1/ + /DL1/
1115	ARMATURE_RESISTANCE	/DM1/
1116	ARMATURE_INDUCTANCE	/DM1/
1117	MOTOR_INERTIA	/DM1/
1117	MOTOR_MASS	/DM1/

MD number	MD identifier	Cross reference:
1118	MOTOR_STANDSTILL_CURRENT	/DM1/
1119	SERIES_INDUCTANCE (SW 3.1 and higher)	/DM1/
1120	CURRCTRL_GAIN	/DS1/
1121	CURRCTRL_INTEGRATOR_TIME	/DS1/
1122	MOTOR_LIMIT_CURRENT	/DS1/
1124	CURRCTRL_REF_MODEL_DELAY	/DS1/
1125	UF_MODE_RAMP_TIME_1	/DE1/
1126	UF_MODE_RAMP_TIME_2	/DE1/
1127	UF_VOLTAGE_AT_F0	/DE1/
1129	POWER_FACTOR_COS PHI	/DM1/
1130	MOTOR_NOMINAL_POWER	/DM1/
1132	MOTOR_NOMINAL_VOLTAGE	/DM1/
1134	MOTOR_NOMINAL_FREQUENCY	/DM1/
1135	MOTOR_NOLOAD_VOLTAGE	/DM1/
1136	MOTOR_NOLOAD_CURRENT	/DM1/
1137	STATOR_COLD_RESTISTANCE	/DM1/
1138	ROTOR_COLD_RESTISTANCE	/DM1/
1139	STATOR_LEAKAGE_REACTANCE	/DM1/
1140	ROTOR_LEAKAGE_REACTANCE	/DM1/
1141	MAGNETIZING_REACTANCE	/DM1/
1142	FIELD_WEAKENING_SPEED	/DM1/ + /DD2/
1143	LH_CURVE_UPPER_SPEED	/DM1/ + /DD2/
1144	LH_CURVE_GAIN	/DM1/ + /DD2/
1145	STALL_TORQUE_REDUCTION	/DM1/ + /DÜ1/
1146	MOTOR_MAX_ALLOWED_SPEED	/DM1/ + /DÜ1/
1147	SPEED_LIMIT	/DÜ1/ + /DL1/
1148	ACTUAL_STALL_POWER_SPEED	/DD1/
1150	FIELDCTRL_GAIN	/DS1/
1151	FIELDCTRL_INTEGRATOR_TIME	/DS1/
1159	FLUX_MODEL_CORRECTION	/DS1/
1160	FLUX_ACQUISITION_SPEED	/DS1/
1161	FIELDVAL_FIXED_LINK_VOLTAGE	/DS1/
1162	LINK_VOLTAGE_MIN	/DE1/
1163	LINK_VOLTAGE_MAX	/DE1/
1165	DYN_MANAG_ENABLE	/DE1/
1170	POLE_PAIR_PITCH	/DS1/
1175	INVERTER_THERM_CURR_ASYN	/DM1/
1176	INVERTER_MAX_S6_CURR_ASYN	/DM1/
1177	INVERTER_RATED_CURR_ASYN	/DM1/
1178	INVERTER_DERATING_SYN	/DM1/
1179	INVERTER_DERATING_ASYN	/DM1/
1180	CURRCTRL_ADAPT_CURRENT_1	/DS1/
1181	CURRCTRL_ADAPT_CURRENT_2	/DS1/

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MD number	MD identifier	Cross reference:
1182	**REDUCE_ARMATURE_INDUCTANCE**	**/DS1/**
1183	**CURRCTRL_ADAPT_ENABLE**	**/DS1/**
1190	**TORQUE_LIMIT_FROM_NC**	**/DÜ1/**
1191	**TORQUE_LIMIT_ADAPT_SERVO**	**/DÜ1/**
1192	**FORCE_LIMIT_WEIGHT**	**/DL1/**
1200	**NUM_CURRENT_FILTERS**[n]	**/DD2/**
1201	**CURRENT_FILTER_CONFIG**[n]	**/DD2/**
1202	**CURRENT_FILTER_1_FREQUENCY**[n]	**/DD2/**
1203	**CURRENT_FILTER_1_DAMPING**[n]	**/DD2/**
1204	**CURRENT_FILTER_2_FREQUENCY**[n]	**/DD2/**
1205	**CURRENT_FILTER_2_DAMPING**[n]	**/DD2/**
1206	**CURRENT_FILTER_3_FREQUENCY**[n]	**/DD2/**
1207	**CURRENT_FILTER_3_DAMPING**[n]	**/DD2/**
1208	**CURRENT_FILTER_4_FREQUENCY**[n]	**/DD2/**
1209	**CURRENT_FILTER_4_DAMPING**[n]	**/DD2/**
1210	**CURRENT_FILTER_1_SUPPR_FREQ**[n]	**/DD2/**
1211	**CURRENT_FILTER_1_BANDWIDTH**[n]	**/DD2/**
1212	**CURRENT_FILTER_1_BW_NUM**[n]	**/DD2/**
1213	**CURRENT_FILTER_2_SUPPR_FREQ**[n]	**/DD2/**
1214	**CURRENT_FILTER_2_BANDWIDTH**[n]	**/DD2/**
1215	**CURRENT_FILTER_2_BW_NUM**[n]	**/DD2/**
1216	**CURRENT_FILTER_3_SUPPR_FREQ**[n]	**/DD2/**
1217	**CURRENT_FILTER_3_BANDWIDTH**[n]	**/DD2/**
1218	**CURRENT_FILTER_3_BW_NUM**[n]	**/DD2/**
1219	**CURRENT_FILTER_4_SUPPR_FREQ**[n]	**/DD2/**
1220	**CURRENT_FILTER_4_BANDWIDTH**[n]	**/DD2/**
1221	**CURRENT_FILTER_4_BW_NUM**[n]	**/DD2/**
1222	**CURRENT_FILTER_1_BS_FREQ**[n]	**/DD2/**
1223	**CURRENT_FILTER_2_BS_FREQ**[n]	**/DD2/**
1224	**CURRENT_FILTER_3_BS_FREQ**[n]	**/DD2/**
1225	**CURRENT_FILTER_4_BS_FREQ**[n]	**/DD2/**
1230	**TORQUE_LIMIT_1**[n]	**/DÜ1/**
1230	**FORCE_LIMIT_1**[n]	**/DL1/**
1231	**TORQUE_LIMIT_2**	**/DÜ1/**
1231	**FORCE_LIMIT_2**	**/DL1/**
1232	**TORQUE_LIMIT_SWITCH_SPEED**	**/DÜ1/**
1232	**FORCE_LIMIT_SWITCH_SPEED**	**/DL1/**
1233	**TORQUE_LIMIT_GENERATOR**[n]	**/DÜ1/**
1233	**LIMIT_GENERATOR**	**/DL1/**
1234	**TORQUE_LIMIT_SWITCH_HYST**	**/DÜ1/**
1234	**FORCE_LIMIT_SWITCH_HYST**	**/DL1/**
1235	**POWER_LIMIT_1**[n]	**/DÜ1/**
1236	**POWER_LIMIT_2**	**/DÜ1/**

MD number	MD identifier	Cross reference:
1237	**POWER_LIMIT_GENERATOR**	**/DÜ1/**
1238	**CURRENT_LIMIT**	**/DÜ1/**
1239	**TORQUE_LIMIT_FOR_SETUP**	**/DÜ1/**
1239	**FORCE_LIMIT_FOR_SETUP**	**/DL1/**
1245	**CURRENT_SMOOTH_SPEED**	**/DD2/ + /DL1/**
1246	**CURRENT_SMOOTH_HYSTERESIS**	**/DD2/ + /DL1/**
1247	**MOTOR_SWITCH_SPEED1**	**/DE1/**
1248	**MOTOR_SWITCH_SPEED2**	**/DE1/**
1250	**ACTUAL_CURRENT_FILTER_FREQ**	**/DB1/**
1251	**LOAD_SMOOTH_TIME**	**/DD1/**
1252	**TORQUE_FILTER_FREQUENCY**	**/DB1/**
1252	**FORCE_FILTER_FREQUENCY**	**/DL1/**
1254	**CURRENT_MONITOR_FILTER_TIME**	**/DÜ1/**
1260	**I2T_S6_REDUCTION**	**/DM1/**
1261	**I2T_NOMINAL_REDUCTION**	**/DM1/**
1262	**DIAGNOSIS_I2T**	**/DM1/**
1263	**LIMIT_I2T**	**/DM1/**
1264	**LOAD_I2T**	**/DM1/**
1272	**CURRENT_FILTER_5_FREQUENCY**	**/DD2/**
1273	**CURRENT_FILTER_5_DAMPING**	**/DD2/**
1274	**CURRENT_FILTER_5_SUPPR_FREQ**	**/DD2/**
1275	**CURRENT_FILTER_5_BANDWIDTH**	**/DD2/**
1276	**CURRENT_FILTER_5_BW_NUM**	**/DD2/**
1277	**CURRENT_FILTER_5_BS_FREQ**	**/DD2/**
1278	**CURRENT_FILTER_6_FREQUENCY**	**/DD2/**
1279	**CURRENT_FILTER_6_DAMPING**	**/DD2/**
1280	**CURRENT_FILTER_6_SUPPR_FREQ**	**/DD2/**
1281	**CURRENT_FILTER_6_BANDWIDTH**	**/DD2/**
1282	**CURRENT_FILTER_6_BW_NUM**	**/DD2/**
1283	**CURRENT_FILTER_6_BS_FREQ**	**/DD2/**
1300	**SAFETY_CYCCLE_TIME**	**/FBSI/**
1301	**SAFE_FUNCTION_ENABLE**	**/FBSI/**
1302	**SAFE_IS_ROT_AX**	**/FBSI/**
1305	**SAFE_MODULO_RANGE**	**/FBSI/**
1316	**SAFE_ENC_CONFIG**	**/FBSI/**
1317	**SAFE_ENC_GRID_POPINT_DIST**	**/FBSI/**
1318	**SAFE_ENC_RESOL**	**/FBSI/**
1320	**SAFE_ENC_GEAR_PITCH**	**/FBSI/**
1321	**SAFE_ENC_GEAR_DENOM** [n] 0...7 index of parameter set	**/FBSI/**
1322	**SAFE_ENC_GEAR_NUMERA** [n] 0...7 index of parameter set	**/FBSI/**
1326	**SAFE_ENC_FREQ_LIMIT**	**/FBSI/**
1330	**SAFE_STANDSTILL_TOL**	**/FBSI/**
1331	**SAFE_VELO_LIMIT** [n] 0...3 index of parameter set	**/FBSI/**

MD number	MD identifier	Cross reference:
1332	**SAFE_VELO_OVR_FACTOR** [n] 0...15 index of parameter set	**/FBSI/**
1334	**SAFE_POS_LIMIT_PLUS** [n] 0...1 index of parameter set	**/FBSI/**
1335	**SAFE_POS_LIMIT_MINUS** [n] 0...1 index of parameter set	**/FBSI/**
1336	**SAFE_CAM_POS_PLUS** [n] 0...3 index of parameter set	**/FBSI/**
1337	**SAFE_CAM_POS_MINUS** [n] 0...3 index of parameter set	**/FBSI/**
1340	**SAFE_CAM_TOL**	**/FBSI/**
1342	**SAFE_POS_TOL**	**/FBSI/**
1344	**SAFE_REPP_POS_TOL**	**/FBSI/**
1346	**SAFE_VELO_X**	**/FBSI/**
1348	**SAFE_STOP_VELO_TOL**	**/FBSI/**
1350	**SAFE_MODE_SWITCH_TIME**	**/FBSI/**
1351	**SAFE_VELO_SWITCH_DELAY**	**/FBSI/**
1352	**SAFE_STOP_SWITCH_TIME_C**	**/FBSI/**
1353	**SAFE_STOP_SWITCH_TIME_D**	**/FBSI/**
1354	**SAFE_STOP_SWITCH_TIME_E**	**/FBSI/**
1356	**SAFE_PULSE_DISABLE_DELAY**	**/FBSI/**
1357	**SAFE_PULSE_DIS_CHECK_TIME**	**/FBSI/**
1360	**SAFE_STANDSTILL_VELO_TOL**	**/FBSI/**
1361	**SAFE_VELO_STOP_MODE**	**/FBSI/**
1362	**SAFE_POS_STOP_MODE**	**/FBSI/**
1363	**SAFE_VELO_STOP_REACTION** [n] 0...3 index of parameter set	**/FBSI/**
1391	**SAFE_DIAG_NC_RESULTLIST1**	**/FBSI/**
1392	**SAFE_DIAG_611D_RESULTLIST1**	**/FBSI/**
1393	**SAFE_DIAG_NC_RESULTLIST2**	**/FBSI/**
1394	**SAFE_DIAG_611D_RESULTLIST2**	**/FBSI/**
1395	**SAFE_STOP_F_DIAGNOSIS**	**/FBSI/**
1396	**SAFE_ACKN_WRITE**	**/FBSI/**
1397	**SAFE_ACKN_READ**	**/FBSI/**
1398	**SAFE_ACT_CHECKSUM**	**/FBSI/**
1399	**SAFE_DES_CHECKSUM**	**/FBSI/**
1400	**MOTOR_RATED_SPEED**	**/DM1/ + /DL1/**
1401	**MOTOR_MAX_SPEED**[n]	**/DD1/ + /DL1/**
1403	**PULSE_SUPPRESSION_SPEED**	**/DB1/ + /DL1/**
1404	**PULSE_SUPPRESSION_DELAY**	**/DB1/**
1405	**MOTOR_SPEED_LIMIT**[n]	**/DÜ1/ + /DL1/**
1406	**SPEEDCTRL_TYPE**	**/DD2/**
1407	**SPEEDCTRL_GAIN_1**[n]	**/DD2/ + /DL1/**
1408	**SPEEDCTRL_GAIN_2**[n]	**/DD2/ + /DL1/**
1409	**SPEEDCTRL_INTEGRATOR_TIME_1**[n]	**/DD2/ + /DL1/**
1410	**SPEEDCTRL_INTEGRATOR_TIME_2**[n]	**/DD2/ + /DL1/**
1411	**SPEEDCTRL_ADAPT_SPEED_1**	**/DD2/ + /DL1/**
1412	**SPEEDCTRL_ADAPT_SPEED_2**	**/DD2/ + /DL1/**

MD number	MD identifier	Cross reference:
1413	SPEEDCTRL_ADAPT_ENABLE	/DD2/ + /DL1/
1414	SPEEDCTRL_REF_MODEL_FREQ[n]	/DD2/ + /DL1/
1415	SPEEDCTRL_REF_MODEL_DAMPING[n]	/DD2/ + /DL1/
1416	SPEEDCTRL_REF_MODEL_DELAY	/DD2/ + /DL1/
1417	SPEED_THRESHOLD_X[n]	/DB1/ + /DL1/
1418	SPEED_THRESHOLD_MIN[n]	/DB1/ + /DL1/
1420	MOTOR_MAX_SPEED_SETUP	/DÜ1/ + /DL1/
1421	SPEEDCTRL_INTEGRATOR_FEEDBK[n]	/DD1/
1424	SPEED_FFW_FILTER_TIME	/DS1/ + /DL1/
1425	SPEED_FFW_DELAY	/DS1/
1426	SPEED_DES_EQ_ACT_TOL[n]	/DB1/ + /DL1/
1427	SPEED_DES_EQ_ACT_DELAY	/DB1/ + /DL1/
1428	TORQUE_THRESHOLD_X[n]	/DB1/
1428	FORCE_THRESHOLD_X	/DL1/
1429	TORQUE_THRESHOLD_X_DELAY	/DB1/ + /DL1/
1451	SPEEDCTRL_GAIN_1_AM	/DE1/
1453	SPEEDCTRL_INTEGR_TIME_1_AM	/DE1/
1458	DES_CURRENT_OPEN_LOOP_AM	/DE1/
1459	TORQUE_SMOOTH_TIME_AM	/DE1/
1465	SWITCH_SPEED_MSD_AM	/DE1/
1466	SWITCH_SPD_OPEN_LOOP_AM	/DE1/

MD number	MD identifier	Cross reference:
1500	NUM_SPEED_FILTERS[n]	/DD2/ + /DL1/
1501	SPEED_FILTER_TYPE[n]	/DD2/ + /DL1/
1502	SPEED_FILTER_1_TIME[n]	/DD2/ + /DL1/
1503	SPEED_FILTER_2_TIME[n]	/DD2/ + /DL1/
1506	SPEED_FILTER_1_FREQUENCY[n]	/DD2/ + /DL1/
1507	SPEED_FILTER_1_DAMPING[n]	/DD2/ + /DL1/
1508	SPEED_FILTER_2_FREQUENCY[n]	/DD2/ + /DL1/
1509	SPEED_FILTER_2_DAMPING[n]	/DD2/ + /DL1/
1514	SPEED_FILTER_1_SUPPR_FREQ[n]	/DD2/ + /DL1/
1515	SPEED_FILTER_1_BANDWIDTH[n]	/DD2/ + /DL1/
1516	SPEED_FILTER_1_BW_NUM[n]	/DD2/ + /DL1/
1517	SPEED_FILTER_2_SUPPR_FREQ[n]	/DD2/ + /DL1/
1518	SPEED_FILTER_2_BANDWIDTH[n]	/DD2/ + /DL1/
1519	SPEED_FILTER_2_BW_NUM[n]	/DD2/ + /DL1/
1520	SPEED_FILTER_1_BS_FREQ	/DD2/ + /DL1/
1521	SPEED_FILTER_2_BS_FREQ	/DD2/ + /DL1/
1522	N_IST_FILTER_T1	/DD2/
1523	ACT_SPEED_FILTER_TIME_RLI	/DM1/

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MD identifier	MD number	MD identifier	Cross reference:
1550	ACC_SENS_REF		/DS1/
1560	ACC_MODE		/DS1/
1561	ACC_SENS_RESOL		/DS1/
1562	FACTOR_MM_DM		/DS1/
1563	ACC_HIGH_PASS_TIME		/DS1/
1564	LOAD_SPEEDCTL_DIFF_TIME		/DS1/
1565	LOAD_SPEEDCTL_GAIN		/DS1/
1566	LOAD_SPEEDCTL_LIMIT		/DS1/
1569	ACC_FIL_DOWNSCAN		/DS1/
1570	ACC_FILTER_TYPE		/DS1/
1571	ACC_FILTER_TIME1		/DS1/
1572	ACC_DENOM_FILTER_FREQU1		/DS1/
1573	ACC_DENOM_FILTER_DAMP1		/DS1/
1574	ACC_NOM_FILTER_FREQU1		/DS1/
1575	ACC_NOM_FILTER_DAMP1		/DS1/
1576	ACC_FILTER_TIME2		/DS1/
1577	ACC_DENOM_FILTER_FREQU2		/DS1/
1578	ACC_DENOM_FILTER_DAMP2		/DS1/
1579	ACC_NOM_FILTER_FREQU2		/DS1/
1580	ACC_NOM_FILTER_DAMP2		/DS1/
1581	ACC_DENOM_FILTER_FREQU3		/DS1/
1582	ACC_DENOM_FILTER_DAMP3		/DS1/
1583	ACC_NOM_FILTER_FREQU3		/DS1/
1584	ACC_NOM_FILTER_DAMP3		/DS1/
1585	ACC_FILTER_TIME4		/DS1/
1586	ACC_DENOM_FILTER_FREQ4		/DS1/
1587	ACC_DENOM_FILTER_DAMP4		/DS1/
1588	ACC_NOM_FILTER_FREQ4		/DS1/
1589	ACC_NOM_FILTER_DAMP4		/DS1/
1590	ACC_FILTER_TIME5		/DS1/
1591	ACC_DENOM_FILTER_FREQ5		/DS1/
1592	ACC_DENOM_FILTER_DAMP5		/DS1/
1593	ACC_NOM_FILTER_FREQ5		/DS1/
1594	ACC_NOM_FILTER_DAMP5		/DS1/

MD number	MD identifier	Cross reference:
1600	ALARM_MASK_POWER_ON	/DB1/
1601	ALARM_MASK_RESET	/DB1/
1602	MOTOR_TEMP_WARN_LIMIT	/DÜ1/
1603	MOTOR_TEMP_ALARM_TIME	/DÜ1/
1604	LINK_VOLTAGE_WARN_LIMIT	/DÜ1/

MD number	MD identifier	Cross reference:
1605	SPEEDCTRL_LIMIT_TIME	/DÜ1/
1606	SPEEDCTRL_LIMIT_THRESHOLD	/DÜ1/ + /DL1/
1607	MOTOR_TEMP_SHUTDOWN_LIMIT	/DÜ1/
1608	MOTOR_FIXED_TEMPERATURE	/DÜ1/
1610	DIAGNOSIS_ACTIVATION_FLAGS	/DD1/
1611	DNDT_THRESHOLD	/DD1/
1612	ALARM_REACTION_POWER_ON	/DB1/
1613	ALARM_REACTION_RESET	/DB1/
1615	SMOOTH_RUN_TOL	/DD1/ + /DL1/
1620	PROG_SIGNAL_FLAGS	/DD1/
1621	PROG_SIGNAL_NR	/DD1/
1622	PROG_SIGNAL_ADDRESS	/DD1/
1623	PROG_SIGNAL_THRESHOLD	/DD1/
1624	PROG_SIGNAL_HYSTERESIS	/DD1/
1625	PROG_SIGNAL_ON_DELAY	/DD1/
1626	PROG_SIGNAL_OFF_DELAY	/DD1/
1630	LINK_VOLTAGE_MON_THRESHOLD	/DÜ1/
1631	LINK_VOLTAGE_GEN_ON	/DE1/
1632	LINK_VOLTAGE_GEN_HYST	/DE1/
1633	LINK_VOLTAGE_GEN_OFF	/DE1/
1634	LINK_VOLTAGE_RETRACT	/DE1/
1635	GEN_AXIS_MIN_SPEED	/DE1/ + /DL1/
1636	RETRACT_AND_GENERATOR_MODE	/DE1/
1637	GEN_STOP_DELAY	/DE1/
1638	RETRACT_TIME	/DE1/
1639	RETRACT_SPEED	/DE1/ + /DL1/
1650	DIAGNOSIS_CONTROL_FLAGS	/DD1/ + /DE1/
1651	MINMAX_SIGNAL_NR	/DD1/
1652	MINMAX_ADDRESS	/DD1/
1653	MINMAX_MIN_VALUE	/DD1/
1654	MINMAX_MAX_VALUE	/DD1/
1655	MONITOR_SEGMENT	/DD1/
1656	MONITOR_ADDRESS	/DD1/
1657	MONITOR_DISPLAY	/DD1/
1658	MONITOR_INPUT_VALUE	/DD1/
1659	MONITOR_INPUT_STROBE	/DD1/
1660	UF_MODE_FREQUENCY	/DE1/
1661	UF_MODE_RATIO	/DE1/
1662	UF_MODE_DELTA_FREQUENCY	/DE1/
1665	IPO_SPEEDCTRL_DELAY_FACTOR	//

MD number	MD identifier	Cross reference:
1700	TERMINAL_STATE	/DD1/
1701	LINK_VOLTAGE	/DD1/
1702	MOTOR_TEMPERATURE	/DD1/
1703	LEAD_TIME_MOTOR_ENC	/DG1/
1704	LEAD_TIME_DIRECT_ENC	/DG1/
1705	DESIRED_VOLTAGE	/DD1/
1706	DESIRED_SPEED	/DD1/ + /DL1/
1707	ACTUAL_SPEED	/DD1/ + /DL1/
1708	ACTUAL_CURRENT	/DD1/
1709	VOLTAGE_LSB	/DD1/
1710	CURRENT_LSB	/DD1/
1711	SPEED_LSB	/DD1/ + /DL1/
1712	ROTOR_FLUX_LSB	/DD1/
1713	TORQUE_LSB	/DD1/
1713	FORCE_LSB	/DD1/
1714	ROTOR_POS_LSB	/DD1/
1719	ABS_ACTUAL_CURRENT	/DD1/
1720	CRC_DIAGNOSIS	/DD1/
1721	ACCEL_DIAGNOSIS	/DD1/
1722	LOAD	/DD1/
1723	ACTUAL_RAMP_TIME	/DD1/
1724	SMOOTH_RUN_DIAGNOSIS	/DD1/
1725	MAX_TORQUE_FROM_NC	/DD1/
1725	MAX_FORCE_FROM_NC	/DL1/
1730	OPERATING_MODE	/DD1/
1731	CL1_PO_IMAGE	/DB1/
1732	CL1_RES_IMAGE	/DB1/
1733	LPFC_DIAGNOSIS	/DD1/
1734	DIAG_ROTORPOS_IDENT	/DM1/
1735	PROCESSOR_LOAD	/DD1/
1736	TEST_ROTORPOS_IDENT	/DM1/
1737	DIFF_ROTORPOS_IDENT	/DM1/
1790	ENC_TYPE_MOTOR	/DG1/
1791	ENC_TYPE_DIRECT	/DG1/
1797	PBL_VERSION	/DD1/
1798	FIRMWARE_DATE	/DD1/
1799	FIRMWARE_VERSION	/DD1/

The drive machine data, MSD, of the 2nd motor are listed below.

The meaning of the MD of the 2nd motor is identical to the MDs of the same name for the 1st motor: See explanation for 1st motor.

Table D-1   Drive machine data, MSD, of the 2nd motor

MD number	Title
2005	ENC_RESOL_MOTOR_M2
2098	INVERTER_MAX_CURR_DERAT_M2
2099	INVERTER_DERATING_FACT_M2
2100	PWM_FREQUENCY_M2
2102	MOTOR_CODE_M2
2103	MOTOR_NOMINAL_CURRENT_M2
2117	MOTOR_INERTIA_M2
2119	SERIES_INDUCTANCE_M2
2120	CURRCTRL_GAIN_M2
2121	CURRCTRL_INTEGRATOR_TIME_M2
2125	UF_MODE_RAMP_TIME_1_M2
2126	UF_MODE_RAMP_TIME_2_M2
2127	UF_VOLTAGE_AT_F0_M2
2129	POWER_FACTOR_COS_PHI_M2
2130	MOTOR_NOMINAL_POWER_M2
2132	MOTOR_NOMINAL_VOLTAGE_M2
2134	MOTOR_NOMINAL_FREQUENCY_M2
2135	MOTOR_NOLOAD_VOLTAGE_M2
2136	MOTOR_NOLOAD_CURRENT_M2
2137	STATOR_COLD_RESISTANCE_M2
2138	ROTOR_COLD_RESISTANCE_M2
2139	STATOR_LEAKAGE_REACTANCE_M2
2140	ROTOR_LEAKAGE_REACTANCE_M2
2141	MAGNETIZING_REACTANCE_M2
2142	FIELD_WEAKENING_SPEED_M2
2143	LH_CURVE_UPPER_SPEED_M2
2144	LH_CURVE_GAIN_M2
2145	STALL_TORQUE_REDUCTION_M2
2146	MOTOR_MAX_ALLOWED_SPEED_M2
2147	SPEED_LIMIT_M2
2148	ACTUAL_STALL_POWER_SPEED_M2
2150	FIELDCTRL_GAIN_M2
2151	FIELDCTRL_INTEGR_TIME_M2
2160	FIELDVAL_WEAKENING_SPEED_M2
2190	TORQUE_LIMIT_FROM_NC_M2
2230	TORQUE_LIMIT_1_M2
2231	TORQUE_LIMIT_2_M2
2232	TORQUE_LIMIT_SWITCH_SPD_M2
2233	TORQUE_LIMIT_GENERATOR_M2

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Table D-1   Drive machine data, MSD, of the 2nd motor

MD number	Title
2234	TORQUE_LIMIT_SWITCH_HYST_M2
2235	POWER_LIMIT_1_M2
2236	POWER_LIMIT_2_M2
2238	CURRENT_LIMIT_M2
2239	TORQUE_LIMIT_FOR_SETUP_M2
2245	CURRENT_SMOOTH_SPEED_M2
2246	CURRENT_SMOOTH_HYST_M2
2400	MOTOR_RATED_SPEED_M2
2401	MOTOR_MAX_SPEED_M2
2403	PULSE_SUPPRESSION_SPEED_M2
2405	MOTOR_SPEED_LIMIT_M2
2407	SPEEDCTRL_GAIN_1_M2
2408	SPEEDCTRL_GAIN_2_M2
2409	SPEEDCTRL_INTEGR_TIME_1_M2
2410	SPEEDCTRL_INTEGR_TIME_2_M2
2411	SPEEDCTRL_ADAPT_SPEED_1_M2
2412	SPEEDCTRL_ADAPT_SPEED_2_M2
2413	SPEEDCTRL_ADAPT_ENABLE_M2
2417	SPEED_THRESHOLD_X_M2
2418	SPEED_THRESHOLD_MIN_M2
2426	SPEED_DES_EQ_ACT_TOL_M2
2451	SPEEDCTRL_GAIN_1_AM_M2
2453	SPEEDCTRL_INTEGR_1_AM_M2
2458	DES_CURRENT_OPEN_LOOP_AM_M2
2459	TORQUE_SMOOTH_TIME_AM_M2
2465	SWITCH_SPEED_MSD_AM_M2
2466	SWITCH_SPD_OPEN_LOOP_AM_M2
2602	MOTOR_TEMP_WARN_LIMIT_M2
2607	MOTOR_TEMP_SHUTDOWN_LIM_M2
2608	MOTOR_FIXED_TEMPERATURE_M2
2711	SPEED_LSB_M2
2712	ROTOR_FLUX_LSB_M2
2713	TORQUE_LSB_M2
2714	ROTOR_POS_LSB_M2
2725	MAX_TORQUE_FROM_NC_M2

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SIMODRIVE 611 digital Drive Functions

E

The following table shows drive functions and values, which differ from module to module.
In the "High Performance" column, please note the supplementary conditions listed at the end of the table for the value 420 kHz.

Table E-1   Function differences for SIMODRIVE 611 digital

Function	Standard 2		High Standard		Performance 1		High Per-formance	CCU3	Cross refe-rence
	1-axis	2-axis (FSD only)	1-axis	2-axis (FSD only)	1-axis	2-axis (FSD only)	1-axis or 2-axis	(6-axis/810D)	
Safety Integrated with internal pulse suppression via drive bus	No	No	Yes	Yes	No	No	Yes	No	/DB1/
Encoder limit frequency of motor measuring system	200 kHz	200 kHz	200 kHz	200 kHz	300 kHz	300 kHz	350 kHz (420 kHz[1])	200 kHz	/DB1/
Encoder limit frequency for motor measuring system with Safety	200 kHz	200 kHz	200 kHz	200 kHz	300 kHz	300 kHz	350 kHz (420 kHz[1])	—	/DB1/
Encoder limit frequency, direct measuring system	200 kHz	200 kHz	200 kHz	200 kHz	300 kHz	300 kHz	350 kHz (420 kHz[1])	200 kHz	/DB1/
Encoder limit frequency for direct measuring system with Safety	200 kHz	200 kHz	200 kHz	200 kHz	300 kHz	300 kHz	300 kHz (420 kHz[1])	—	/DB1/
Motor data sets, expansion from 2 to 4 MSD	No	—	Yes	—	No	—	Yes	Yes	/DE1/
Speed actual-value filter for analog 611U	No	No	Yes	Yes	No	No	Yes	Yes	/DD2/
i^{2}t power module limitation	No	No	Yes	Yes	No	No	Yes	Yes	/DM1/
Minimum current controller cycle	125 μs	125 μs	125 μs	125 μs	62.5 μs	125 μs	62.5 μs	Default 156.5 μs (minimum 125 μs)	/DS1/
Minimum speed controller cycle	125 μs	500 μs	125 μs	500 μs	62.5 μs	125 μs	62.5 μs	Default 312 μs (minimum 125 μs)	/DS1/

Function	Standard 2		High Standard		Performance 1		High Per-for-mance	CCU3	Cross refe-rence
	1-axis	2-axis (FSD only)	1-axis	2-axis (FSD only)	1-axis	2-axis (FSD only)	1-axis or 2-axis	(6-axis/ 810D)	
Minimum posi-tion controller cycle	2 ms	4 ms	2 ms	4 ms	0.5 ms	1.0 ms	0.5 ms	ms up to 2 axes; 2.5 ms 4 axes and above (2.5 ms default)	
Speed controller rise time	1.4 ms	4 ms	1.4 ms	4 ms	0.8 ms	1.4 ms	0.8 ms	1,4 ms	
Rated frequency of closed speed control loop	550 Hz	160 Hz	550 Hz	160 Hz	1 kHz	550 Hz	1 kHz	550 Hz at 125 μs; 300 Hz at 312 μs	
Max. motor speed (4-pole)	18,000 rpm	18,000 rpm	18,000 rpm	18,000 rpm	36,000 rpm	18,000 rpm	42,000 rpm	18,000 rpm	/DÜ1/
Max. electrical fundamental fre-quency for motor	600 Hz	600 Hz	600 Hz	600 Hz	1,200 Hz	600 Hz	1,400 Hz	600 Hz	
Smooth running	0.2 μm	01.5 μm	0.2 μm	1.5 μm	0.1 μm	0.2 μm	0.1 μm	1.5 μm	
Pulse multiplica-tion factor	128	128	128	128	2,048	2,048	2,048	128	

1) The following supplementary conditions apply at 420 kHz:
   1. Cables to be used: Siemens cable, MLFB: 6FX2002-2CA31-1CFO
   2. Maximum permissible encoder cable length: 20 m
   3. Encoder property: "–3dB cutoff frequency" greater than or equal to 500 kHz
      Examples of the encoders used: ERA 180 with 9000 pulses/rev and ERA 180 with 3600 pulses/rev from Heidenhain
   4. Amplitude monitoring is active up to 420 kHz.

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Notes

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Suggestions

Corrections

For Publication/Manual:

SIMODRIVE 611D
SINUMERIK 840D/810D
Drive Functions
Function Manual

Manufacturer/service documentation

Description of functions

Order No.:   6SN1197-0AA80-1BP3
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Suggestions and/or corrections