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

06/2009 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 factual changes have been made on the page since the last edition, this is indicated by a new edition coding in the header on that page.

Edition	Order No.	Remarks
12.95	6SN1 197–0AA80–0BP0	A
07.96	6SN1 197–0AA80–0BP1	C
08.97	6SN1 197–0AA80–0BP2	C
12.97	6SN1 197–0AA80–0BP3	C
12.98	6SN1 197–0AA80–0BP4	C
08.99	6SN1 197–0AA80–0BP5	C
10.00	6SN1 197–0AA80–0BP6	C
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
11.05	6SN1 197–0AA80–1BP3	C
08.06	6SN1 197–0AA80–1BP4	C
03.07	6SN1 197–0AA80–1BP5	C
11.07	6SN1 197–0AA80–1BP6	C
08.08	6SN1 197–0AA80–1BP7	C
12.08	6SN1 197–0AA80–1BP8	C
06.09	6SN1 197–0AA80–2BP0	C

Printed in the Federal Republic of Germany

Siemens–Aktiengesellschaft

Preface

Structure of the documentation

The SIMODRIVE 611 documentation is structured in 2 levels:

- General documentation
- Manufacturer/Service documentation

Information on the following topics is available at http://www.siemens.com/motioncontrol/docu:

- Ordering documentation
  Here you can find an up-to-date overview of publications.
- Downloading documentation
  Links to more information for downloading files from Service & Support.
- Researching documentation online
  Information on DOConCD and direct access to the publications in DOConWEB.
- Individually compiling documentation on the basis of Siemens contents with the My Documentation Manager (MDM), refer to http://www.siemens.com/mdm
  My Documentation Manager provides you with a range of features for generating your own machine documentation.
- Training and FAQs
  Information on our range of training courses and FAQs (frequently asked questions) is available via the page navigation.

Target group

This document addresses engineers and technologists (employed with the machinery construction OEM), commissioning engineers (commissioning the system/machine), programmers. The brochure contains a detailed description of the scope of functions offered by SINUMERIK 840D/810D controllers and SIMODRIVE 611 digital drives.

Benefits

This publication describes the functions so that the target group understands these functions and can appropriately select them. It provides the target group with the information required to implement the functions.

Should you wish for additional information or should exceptional problems arise that are not addressed in sufficient detail in this manual, you can request the required information from your local Siemens office.

Standard scope

The scope of the functionality described in this document can differ from the scope of the functionality of the drive system that is actually supplied. Other functions not described in this documentation might be able to be executed in the drive system. However, no claim can be made regarding the availability of these functions when the equipment is first supplied or in the event of servicing. Additions or revisions made by the machine manufacturer are documented by the machine manufacturer.

This document does not purport to cover all details or variations in equipment, nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

The contents of this document are not part of an earlier or existing contract or agreement nor do they change this. The Purchase Agreement contains the complete and exclusive obligations of Siemens. Any statements contained herein neither create new warranties nor modify the existing warranty.

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Internet address

Up-to-date information about our products can be found on the Internet at the following address:

http://www.siemens.com/simodrive

Certificates

You will find the certificates for the products described in this documentation on the Internet: http://www.support.automation.siemens.com

under the Product/Order No. 15257461
or at the relevant branch office of the A&D MC group of Siemens AG.

All declarations of conformity and certificates such as CE, UL, etc., relate to the system components described in the corresponding Configuration Manuals/Catalogs and are, therefore, only valid if these components are used in the device or system.

Notes on how to use this manual

This Function Manual is structured as follows:

- General contents
- Descriptions of functions in alphabetical order according to the function description codes
- Appendix with list 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

Edition of the documentation?

Software release?

What's new?

There is a fixed relationship between the edition of the documentation and the software release of the drive functions.

- The first edition (12/1995) describes the functionality of SW 1.0.
- The 03/2007 edition describes the functionality of SW 1.0 to 6.x.

  What are the essential new functions that have been added for SW 6.08.18?

  - 10 current setpoint filters (not CCU3) (DD2)
  - Expansion of dynamic energy management (DE1)
  - Thermal motor model (not CCU3) (DÜ1)
- The 11/2007 edition describes the functionality of SW 1.0 to 6.x.

  What are the essential new functions that have been added for SW 6.08.19 to SW 6.08.21?

  - Monitoring of the direction of the axis motion (DM1)
  - Motor ground fault test (DÜ1)
  - VDC_min_controller (DÜ1)
- The 08/2008 edition describes the functionality of SW 1.0 to 6.x.

  What are the essential new functions that have been added for SW 6.08.22 to SW 6.08.25?

  - FDD operation with field weakening (DE1)
- The 06/2009 edition describes the functionality of SW 1.0 to 6.x.

  What are the essential new functions that have been added for SW 6.08.26 to SW 6.08.27?

  - Removing the limitations for the combination – brakes/ground fault/RLI
  - Ground fault with a linear motor
  - Increased peak current for power units –0JA

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 safety alert symbol, indicates that property damage can result if proper precautions are not taken.

Notice

means an undesirable result or state can occur if the corresponding instruction is not followed.

In the event of a number of levels of danger prevailing simultaneously, the warning corresponding to the highest level of danger is always used. If a warning notice is used with the safety alert symbol to warn against injury, this same notice may also include a warning regarding property damage.

Qualified personnel

Setup and operation of the device/equipment/system in question must only be performed using this documentation. Only **qualified personnel** should be allowed to commission and operate the device/system. For the purpose of the safety information in this documentation, a “qualified person” is someone who is authorized to energize, ground, and tag equipment, systems, and circuits in accordance with established safety procedures.

Proper use

Please note the following:

Warning

Siemens products must only be used for the applications specified in the catalog and in the technical documentation. If third-party products and components are used, they must be recommended or approved by Siemens. To ensure trouble-free and safe operation of the products, they must be appropriately transported, stored, assembled, installed, commissioned, operated and maintained. The permissible ambient conditions must be adhered to. The notes in the associated documentation must be complied with.

Explanation of symbols

Order data option

In this documentation you will find the symbol shown on the left with a reference to an ordering data option. The function described will only be able to be used if the control contains 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 Chap. 4 and 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 operator 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/, Operating Manual
/FB/, A2, Various Interface Signals

Unit

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

■

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

Operational Messages/Alarm Responses (DB1)

Space for your notes

1 Product Brief

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 Manual Advanced, Chapters 1 and 15.

Alarm response, suppressing alarms

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

■

Space for your notes

Detailed Description 2

2.1 Pulse suppression

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

The default setting depends on the motor type (FDD ≙ 0, MSD ≙ 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 delay times.
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

1404	PULSE_SUPPRESSION_DELAY				Cross reference: –
	Timer, pulse suppression			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: ms	Default: 100.0 MSD: 5 000.0	Minimum: 0.0	Maximum: 8388607.0	Data type: FLOAT	Active: Immediately

The default setting depends on the motor type (FDD ≙ 100, MSD ≙ 5,000) 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 shut down sequentially with different, adjustable delay times.
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: FDD/MSD/SLM	Protection level: 2/4
Unit: 31.25 µs	Default: 3 200	Minimum: 128	Maximum: 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.

1012	FUNC_SWITCH				Cross reference: –
	Function switch			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hex	Default: 0004	Minimum: 0000	Maximum: 00B5	Data type: WORD	Active: Immediately

Entering the configuration for the power–up functionality.

Table 2-1 Function switch

Bit No.	Description	Note	Default setting	
			FDD	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 $\|m\| < m_{dx}$ $\| n_{act} \| < n_{min}$ $\| n_{act} \| < n_x$ $n_{act} = n_{set}$, ramp–up function complete	0	1
Bit 4 840D only	Parameterizing faults	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 towards 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: FDD/MSD/SLM	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.

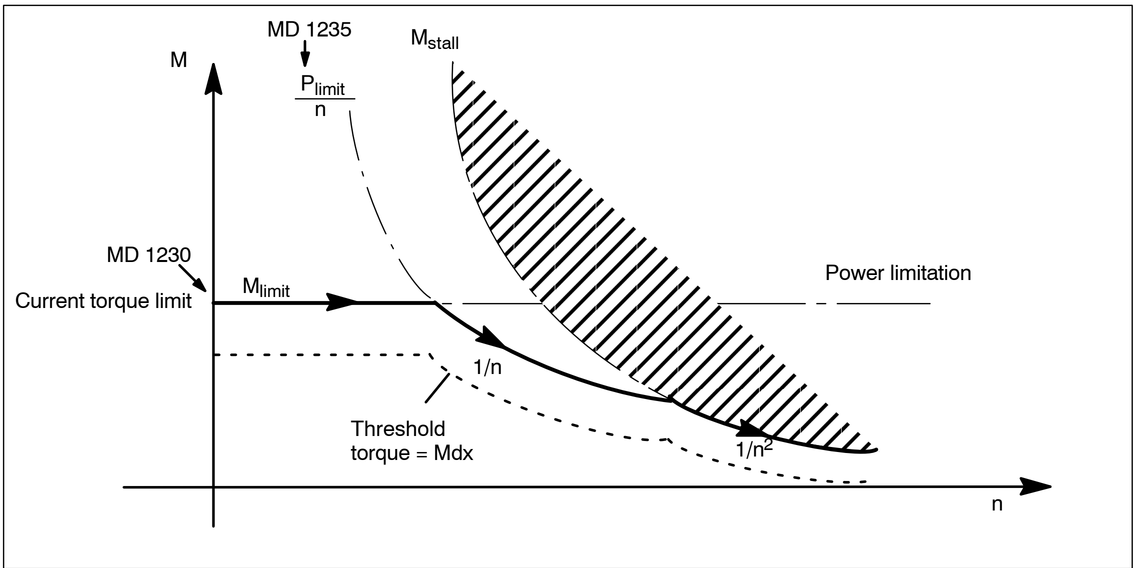

Fig. 2-1 Threshold torque characteristic for $M_d < M_{dx}$ signal

The ”$M_d < M_{dx}$” signal is latched in the active status as long as the interface signal ”Ramp–up function complete” DB31, ... 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.

1429	TORQUE_THRESHOLD_X_DELAY				Cross reference: –
	Delay time $M_d < M_{dx}$ signal			Relevant: FDD/MSD/SLM	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: FDD/MSD/SLM	Protection level: 2/4
Unit: rev/min	Default: 5.0 SLM: 0.3	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.

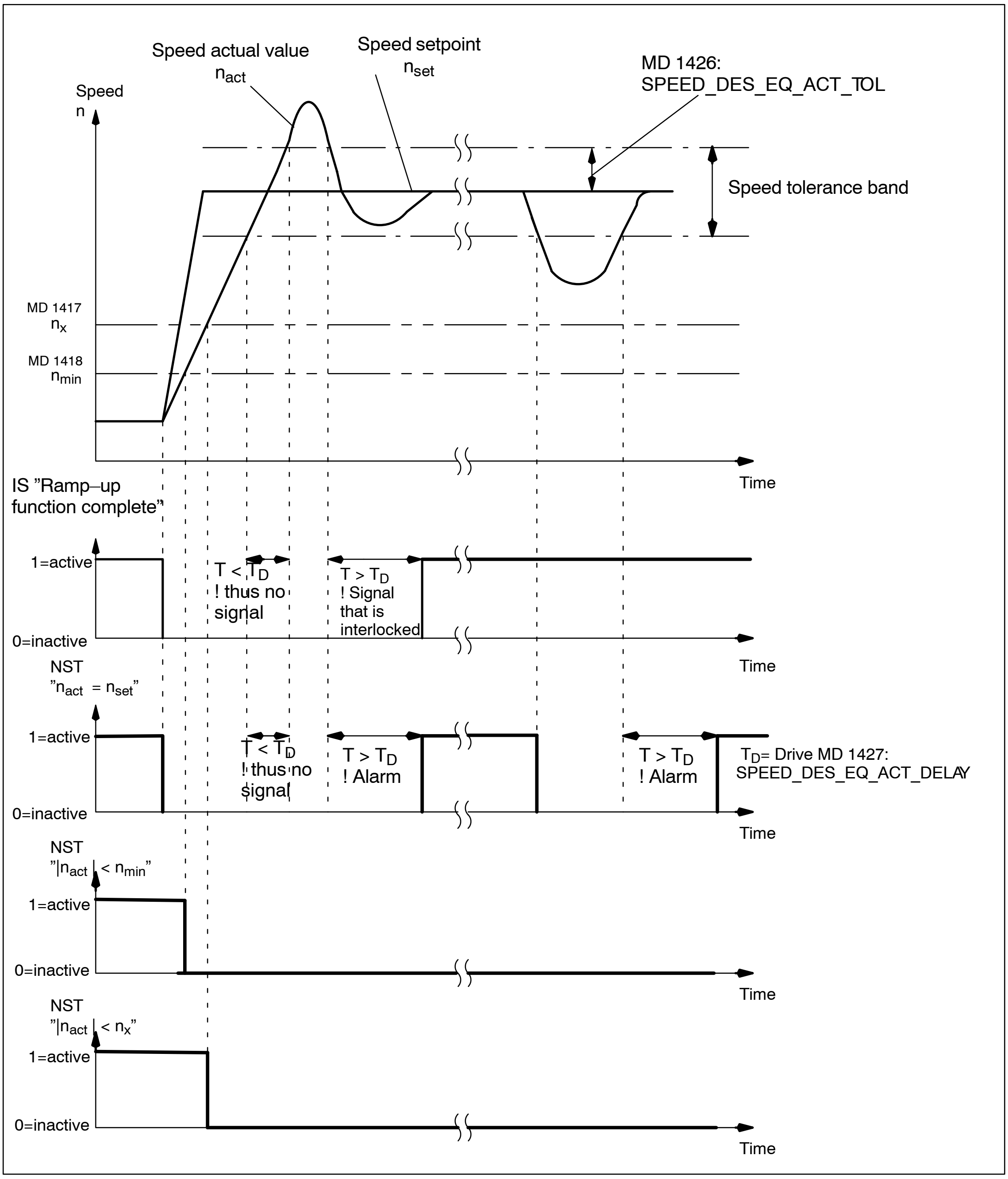

Fig. 2-2 Interface signals (IS)

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 $\lvert n_{act}\rvert < n_x$ message			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: rev/min	Default: 6,000.0 SLM: 120.0	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 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: FDD/MSD/SLM	Protection level: 2/4
Unit: rev/min	Default: 20.0 SLM: 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 signals
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: FDD/MSD/SLM	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: FDD/MSD/SLM	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 q–axis current actual–value smoothing (PT1 low pass) for the display. The time constant T1 of the PT1 filter is obtained from the formula $T1 = 1 /(2 \pi f_o)$. 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.

Filter for the torque–setpoint display

1251	LOAD_SMOOTH_TIME		840D only		Cross reference: –
	Time constant, motor utilization			Relevant: FDD/MSD/SLM	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: FDD/MSD/SLM	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 torque–setpoint smoothing (PT1 low pass) for the display. The time constant T1 of the PT1 filter is obtained from the formula $T1 = 1 /(2 \bullet \pi \bullet f_o)$.
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.

2.4 Alarm response, suppressing alarms

1600	ALARM_MASK_POWER_ON				Cross reference: –
	Concealable alarms (POWER ON)			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hex	Default: 0	Minimum: 0	Maximum: 83BE	Data type: UNS.WORD	Active: Immediately

POWER ON alarms can be suppressed 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.	Description	Alarm No.
Bit 0	Internal error – **cannot be concealed**	
Bit 1	Measuring–circuit error, absolute current value1)	300501
Bit 2, 840D only	Measuring–circuit error, phase current R1)	300502
Bit 3, 840D only	Measuring–circuit error, phase current S1)	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 concealed**	300510
Bit 11	Measured–value memory active – **cannot be concealed**	300511
Bit 12	–	
Bit 13	–	
Bit 14	–	
Bit15	Heatsink temperature exceeded	300515

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

Note

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

!

Important

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

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

Reset alarms can be suppressed 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.	Description	Alarm No.
Bit 0	**Cannot be concealed** using software interlock (configuring 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 suppressed.

1612	ALARM_REACTION_POWER_ON				Cross reference: –
Configurable shutdown responses for PO alarms				Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hex	Default: 2FBC MSD: FFFF	Minimum: 0000	Maximum FFFF	Data type: UNS.WORD	Active: Immediately

Input bit field to changeover the actual 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 (FDD/SLM ≙ 2FBC, MSD ≙ FFFF) and is initialized during startup on the basis of 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.	Description	Alarm No.	Default setting	
			FDD/ SLM	MSD
Bit 0	Pulse disable for system error		0	1
Bit 1	**Not configurable** (measuring–circuit error, absolute current)	300501	0	1
Bit 2	–		1	1
Bit 3	–		1	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	1	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	**Not configurable** (ground fault test detected)	300513	1	1
Bit 14	–		0	1
Bit 15	Pulse disable for heatsink temperature exceeded	300515	0	1

1613	ALARM_REACTION_RESET				Cross reference: –
Configurable shutdown responses for reset alarms				Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hex	Default: 0100 MSD: FFFF	Minimum: 0000	Maximum FFFF	Data type: UNS.WORD	Active: Immediately

Input bit field for changeover of 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 (FDD ≙ 0100, MSD ≙ 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.	Description	Alarm No.	Default setting	
			FDD/ SLM	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: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 65 535	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.

Suppressed 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: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 65 535	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.

Suppressed 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).

■

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Supplementary Conditions 3

None

■

Data Descriptions (MD, SD) 4

See Chapter 2

■

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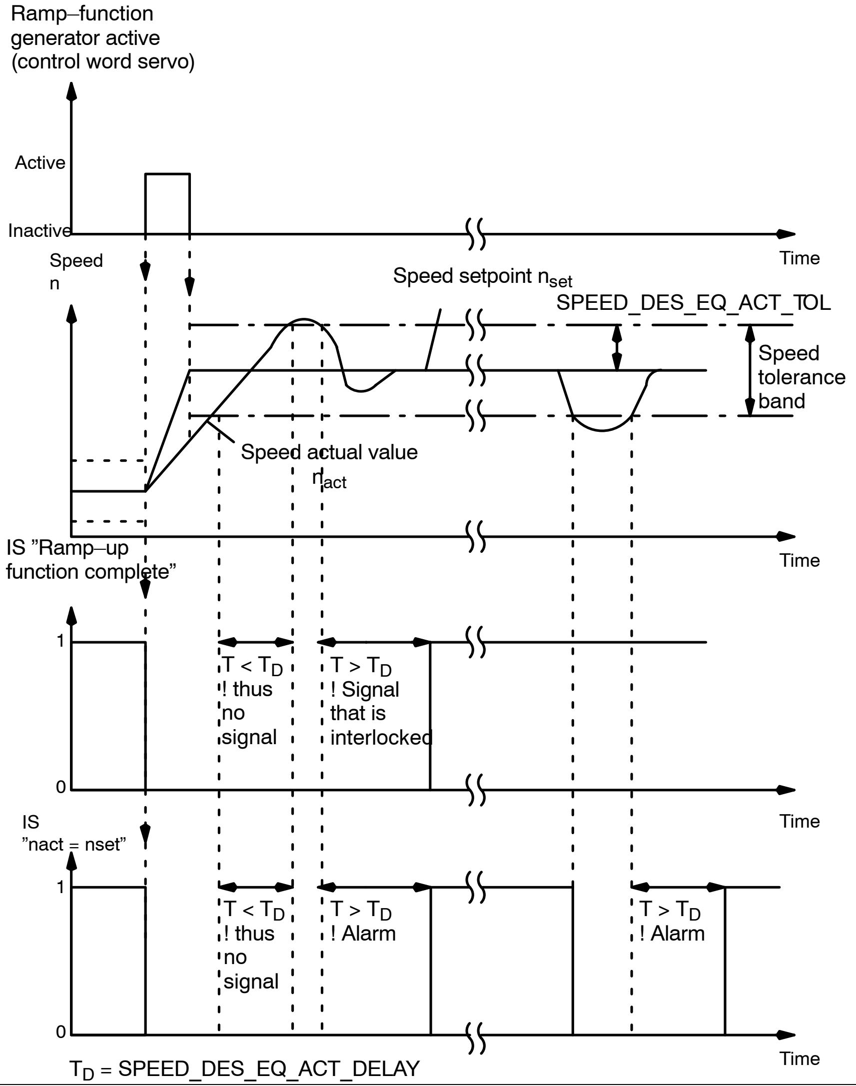
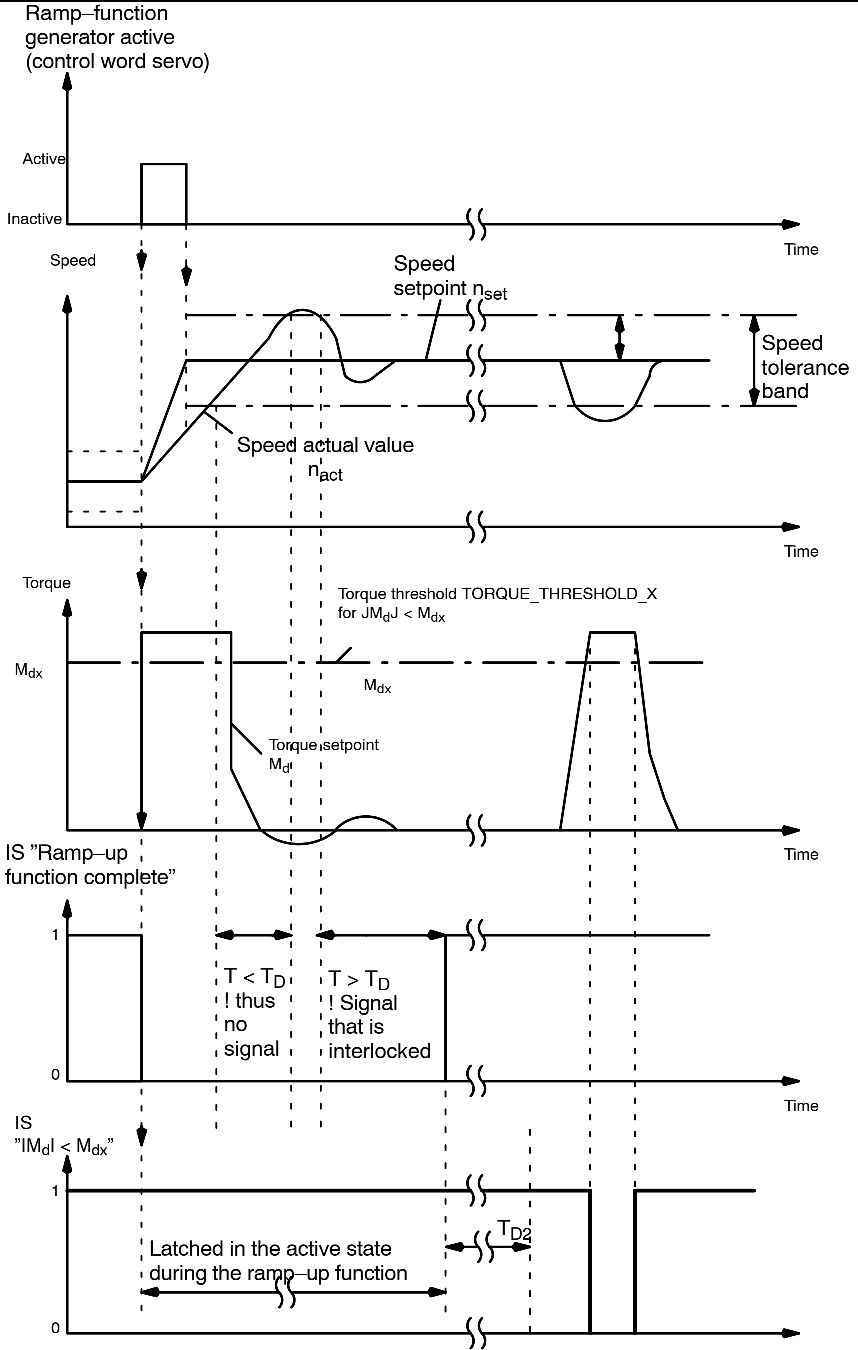
Signal Descriptions 5

DB 31, ... **DBX94.2** Data block	**Ramp–up completed** Signal(s) from axis/spindle (drive → PLC)		
Edge evaluation: No		Signal(s) updated: Cyclic	Signal(s) valid from SW: 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 speed actual value leaves the tolerance band (because of speed fluctuations resulting from changes in load) the "rampup completed" 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, ... **DBX94.2** Data block	**Ramp–up completed** Signal(s) from axis/spindle (drive → PLC)
Fig. 55	
Corresponding to	IS "n_{act} = n_{set}" (DB 31, ... DBX94.6) IS "|M_D| = M_{dx}" (DB 31, ... DBX94.3) 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, ... **DBX94.3** Data block	**$\|M_d\| < M_{dx}$** Signal(s) from axis/spindle (drive → PLC)	
Edge evaluation: No	Signal(s) updated: Cyclic	Signal(s) valid from SW: 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. 57). 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, ... **DBX94.3** Data block	**$\lvert M_d\rvert < M_{dx}$** Signal(s) from axis/spindle (drive → PLC)
Fig. 56	 T_D = SPEED_DES_EQ_ACT_DELAY T_{D2} = TORQUE_THRESHOLD_X_DELAY
Corresponding to	IS ”Rampup function complete” (DB 31, ... DBX94.2) 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, ... **DBX94.4** Data block	**$\lvert n_{act} \rvert < n_{min}$** Signal(s) from axis/spindle (drive → PLC)	
Edge evaluation: No	Signal(s) updated: Cyclic	Signal(s) valid from SW: 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	
Corresponding 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, ... **DBX94.5** Data block	**$\lvert n_{act} \rvert < n_x$** Signal(s) from axis/spindle (drive → PLC)	
Edge evaluation: No	Signal(s) updated: Cyclic	Signal(s) valid from SW: 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	
Corresponding 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, ... **DBX94.6** Data block	**$n_{act} = n_{set}$** Signal(s) from axis/spindle (drive → PLC)	
Edge evaluation: No	Signal(s) updated: Cyclic	Signal(s) valid from SW: 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. 56). If the actual speed value then leaves the tolerance band, the IS "$n_{act} = n_{set}$" is set to 0–signal, contrary to the "Ramp–up function" complete" signal.	
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		
Corresponding 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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6 Example

None

7 Data Fields, Lists

7.1 Pulse suppression

Table 7-1 Machine data

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

7.2 Relay functions

Table 7-2 Machine data

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

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/SLM
1429	TORQUE_THRESHOLD_X_DELAY[DRx]	Delay time, 'Md < Mdx' signal	FDD/MSD/SLM

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/SLM

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/SLM

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/SLM
1427	SPEED_DES_EQ_ACT_DELAY[DRx]	Delay time 'nset = nact' signal	FDD/MSD/SLM

7.3 Filter for 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/SLM
1251	LOAD_SMOOTH_TIME[DRx]	Time constant, motor utilization	FDD/MSD/SLM
1252	TORQUE_FILTER_FREQUENCY[DRx]	Frequency limit, torque–setpoint smoothing	FDD/MSD/SLM

7.4 Alarm response, suppressing alarms

Table 7-8 Machine data

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

■

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

Diagnostic Functions (DD1)

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Product Brief 1

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 (in conjunction with SINUMERIK 840D) test sockets, 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.

■

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Detailed Description 2

2.1 Digital–to–analog converters (DAC)

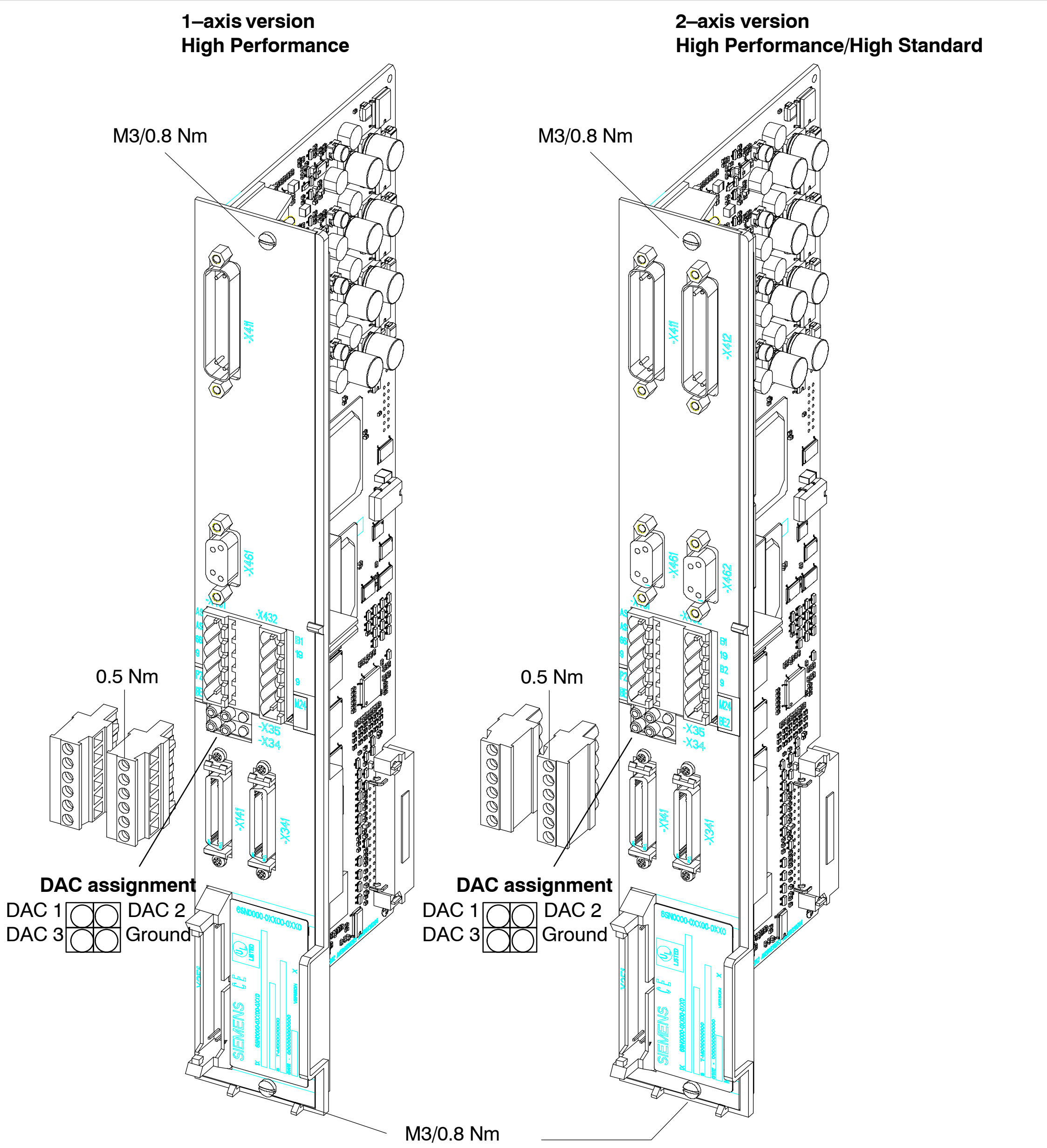


Fig. 2-1 Digital control High Performance and High Standard without direct measuring system

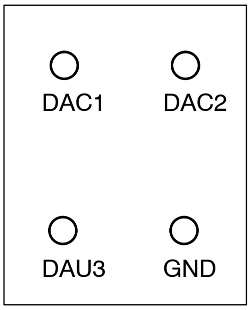
Functionality

Three 8–bit DAC (Digital 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)	



Assignment 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 output for any active axes.

SW 4 and higher

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

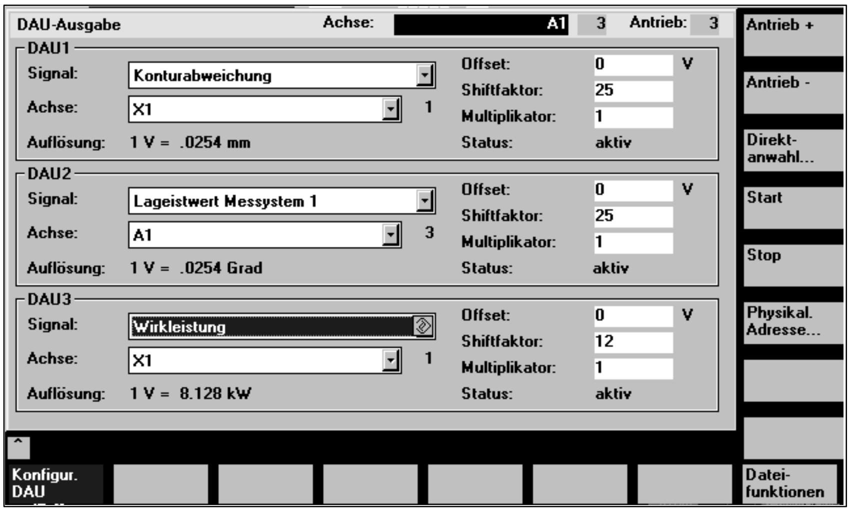


Fig. 2-2 Menu for DAC settings

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 (FDD, MSD, servo).

!

Important

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

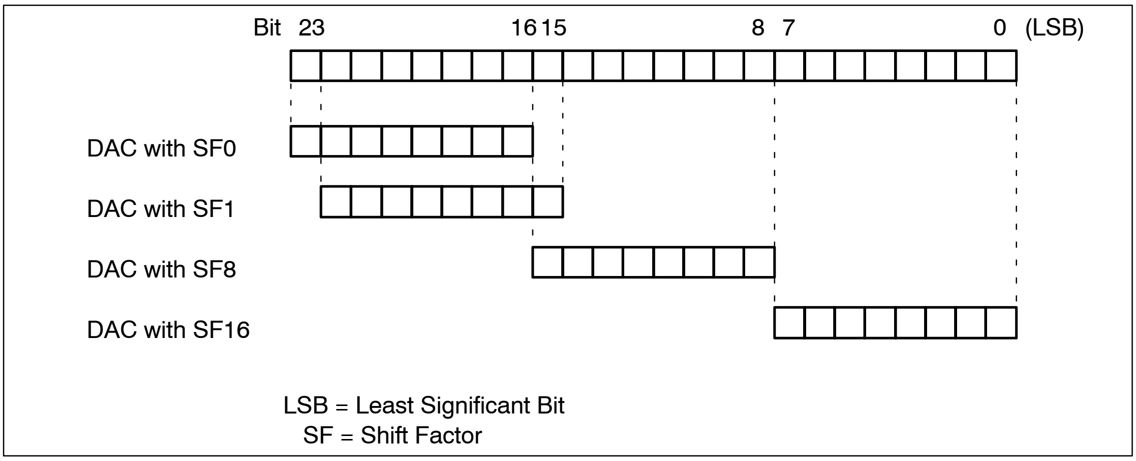


Fig. 2-3 Representation of the shift factor

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.

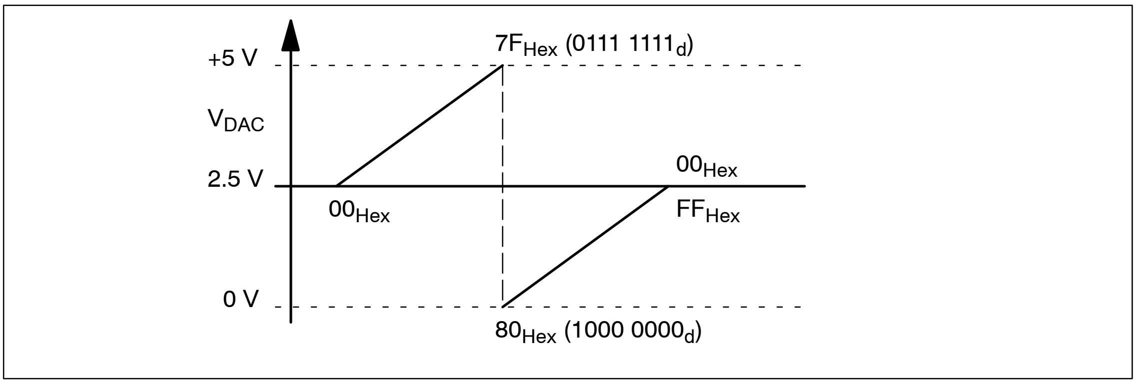


Fig. 2-4 Analog output voltage range

DAC selection list

Table 2-1 DAC selection list

No.	Designation	Unit	Comment
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	Actual absolute speed	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	Actuator voltage, Q input	V	
30	Actuator voltage, D input	V	
31	Rotor position in $10 000 format with extrapolation	Degrees	$10 000 = 360°
32	Absolute voltage setpoint	V	SW 4.2 and higher
33	Absolute current actual value	A	SW 4.2 and higher
34	Actual speed value, direct measuring system	RPM	SW 6.8 and higher

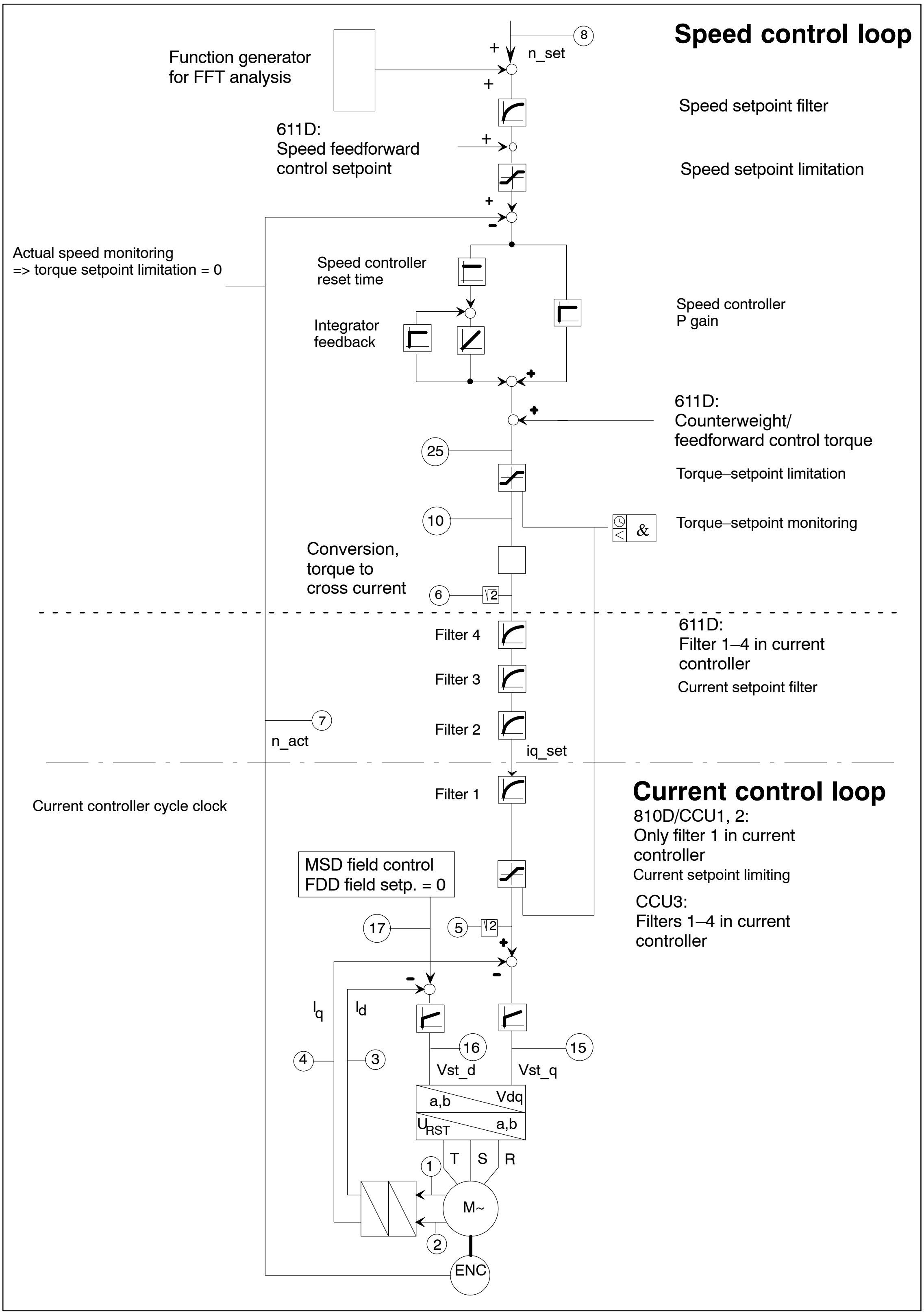


Fig. 2-5 Current and speed control loop, measured variables, which can be represented by the DACs

2.2 Software version

1797	**PBL_VERSION**				**Cross reference:** –
	Data version			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 65 535	Data type: UNS.WORD	Active: Immediately

Output of current data version (machine data list).

1798	**FIRMWARE_DATE**				**Cross reference:** –
	Firmware date			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 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: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 4 294 967 295	Data type: UNS.WORD	Active: Immediately

Output of current software release. The display is decimal, e.g. 21000. 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: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0 MSD: 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	unassigned

1611	DNDT_THRESHOLD			840D only	Cross reference: –
	Response threshold dn/dt			Relevant: FDD/MSD/SLM	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: FDD/MSD/SLM	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/f mode 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	unassigned	
Bit 8 (up to SW 3.1)	Voltage controlled, V/f mode	0 = Normal operation 1 = V/f mode active
Bit 9	Reserved	
Bits 10 –15	unassigned	

!

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			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 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.

Possible cause:

- Encoder shield not grounded
- Defective encoder
- Defective grounding 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 of min/max memory		Relevant: FDD/MSD/SLM	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 ($m_{set}/m_{set,\ limit}$)	8000H ≙ 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 × $V_{DC\ link}/2$
18	Direct voltage V_d	MD 1709 × $V_{DC\ link}/2$
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	Actual absolute speed	MD 1711
25	Slip frequency setpoint	$\frac{2000 \times 2\Pi}{800000H \times 1s^{-1}}$
26	Rotor position (electrical)	MD 1714
27	Torque setpoint, speed controller	MD 1713
28	Feedforward control torque	MD 1713
29	Actuator voltage, Q input	MD 1709 × $V_{DC\ link}/2$
30	Actuator voltage, D input	MD 1709 × $V_{DC\ link}/2$

1652	MINMAX_ADDRESS			840D only	Cross reference: –
Memory location in min/max memory				Relevant: FDD/MSD/SLM	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 of min/max memory			Relevant: FDD/MSD/SLM	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 minimum value, min./max. memory.

1654	MINMAX_MAX_VALUE			840D only	Cross reference: –
	Maximum value of min/max memory			Relevant: FDD/MSD/SLM	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: FDD/MSD/SLM	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: FDD/MSD/SLM	Protection level: 2/4
Unit: Hex	Default: 0	Minimum: 0	Maximum: 00FFFFFF	Data type: UNS.DWORD	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: FDD/MSD/SLM	Protection level: 2/4
Unit: Hex	Default: 0	Minimum: 0	Maximum: 00FFFFFF	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: FDD/MSD/SLM	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: MON-ITOR_INPUT_STROBE is set to 1.

1659	MONITOR_INPUT_STROBE				Cross reference: –
	Monitor value transfer			Relevant: FDD/MSD/SLM	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.

Hardware type display (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: FDD/MSD/SLM	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	Description	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: 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: FDD/MSD/SLM	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/R 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/R unit (setup mode signal)	
Bit 6	Image, terminal 64/63 of the I/R unit (central drive enable, setpoint = 0)	
Bit 7	unassigned	
Bit 8	Image, terminal 5 of the I/R unit (temperature alarm, motor/power section)	0 = OFF 1 = ON
Bit 9	unassigned	
Bit 10	unassigned	
Bit 11	unassigned	
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	

1701	LINK_VOLTAGE				Cross reference: –
	DC link voltage			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: V	Default: 0	Minimum: 0	Maximum: 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 U_{DC} 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: FDD/MSD/SLM	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: FDD/MSD/SLM	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 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: FDD/MSD/SLM	Protection level: 2/4
Unit: rev/min	Default: 0.0	Minimum: –100 000.0	Maximum: 100 000.0	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: FDD/MSD/SLM	Protection level: 2/4
Unit: rev/min	Default: 0.0	Minimum: –100 000.0	Maximum: 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 actual current value			Relevant: FDD/MSD/SLM	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 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 → 100% = 36 A rms).

1719	ABS_ACTUAL_CURRENT			840D only	Cross reference: –
	Actual absolute current (rms)			Relevant: FDD/MSD/SLM	Protection level: Read–only
Unit: A	Default: 0.0	Minimum: –100 000.0	Maximum: 100 000.0	Data type: FLOAT	Active: Immediately

The actual absolute current 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.

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

1720	CRC_DIAGNOSIS				Cross reference: –
	CRC diagnostic parameter			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 65 535	Data type: UNS.WORD	Active: Immediately

This machine data is used to display the identified CRC errors (cyclic redundancy check). 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: FDD/MSD/SLM	Protection level: 2/4
Unit: %	Default: 0	Minimum: –100 000	Maximum: 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: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 65 535	Data type: UNS.WORD	Active: Immediately

This diagnostic machine data provides information about how often the motor temperature and DC link measurement 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: FDD/MSD/SLM	Protection level: 2/4
Unit: %	Default: 0	Minimum: 0	Maximum: 65 535	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 of variable signaling function			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hex	Default: 0	Minimum: 0	Maximum: 000F	Data type: UNS.WORD	Active: Immediately

Input bit field for controlling the variable signaling function.

Table 2-8 Bits of variable signaling function

Bit 0	Variable signaling function	0 = Not active 1 = active
Bit 1	Segment of variable signaling function	0 = Address space X 1 = Address space Y
Bit 2	Comparison of variable signaling function	0 = Comparison without sign 1 = Comparison with sign
Bit 3 (SW 6.08.07 and higher)	Comparison of variable signaling function using absolute values	1 = Absolute–value, signed comparison (only effective when Bit 2 = 1)

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.

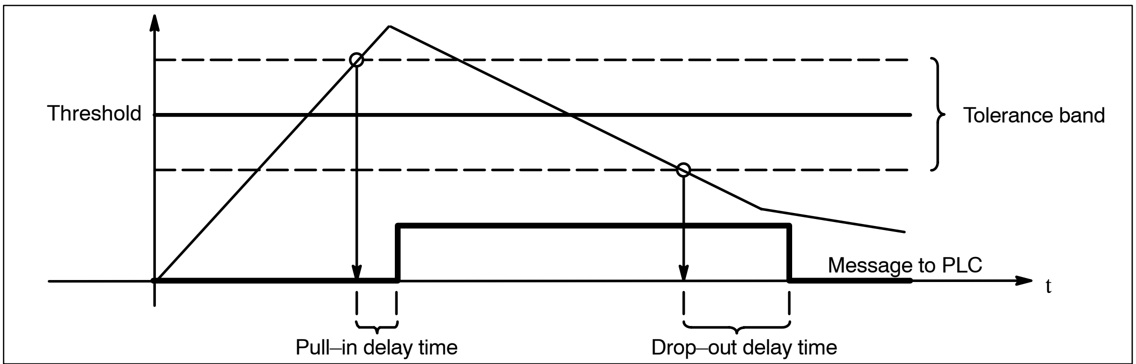


Fig. 2-6 Variable signaling function

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

If changes are made to machine data MD 1621 to MD 1624 while monitoring is already active (≙MD 1620, Bit 0 = 1), they do not automatically reinitialize the PLC message, i.e. reset it to 0. If the message 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: FDD/MSD/SLM	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 of variable signaling 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

Table 2-9 Signal number of variable signaling function

Signal number	Signal designation		Normalization (LSB corresponds to:)
8	Speed actual value motor		MD 1711
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 ($m_{set}/m_{set,\ limit}$)		8000H ≙ 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 × $V_{DC\ link}/2$
18	Direct voltage V_d		MD 1709 × $V_{DC\ link}/2$
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	Actual absolute speed		MD 1711
25	Slip frequency setpoint		$\frac{2000 \times 2\Pi}{800000H \times 1s^{-1}}$
26	Rotor position (electrical)	840D only	MD 1714
27	Torque setpoint, speed controller	840D only	MD 1713
28	Feedforward control torque		MD 1713
29	Actuator voltage, Q input		MD 1709 × $V_{DC\ link}/2$
30	Actuator voltage, D input		MD 1709 × $V_{DC\ link}/2$

1622	**PROG_SIGNAL_ADDRESS**			**840D only**	**Cross reference:** –
	Address of variable signaling function			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 65 535	Data type: UNS.WORD	Active: Immediately

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: FDD/MSD/SLM	Protection level: 2/4

Unit:	Default:	Minimum:	Maximum:	Data type:	Active:
–	0	0	16 777 215	UNS.DWORD	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: FDD/MSD/SLM	Protection level: 2/4

Unit:	Default:	Minimum:	Maximum:	Data type:	Active:
–	0	0	16 777 215	UNS.DWORD	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: FDD/MSD/SLM	Protection level: 2/4

Unit:	Default:	Minimum:	Maximum:	Data type:	Active:
ms	0	0	10 000	UNS.DWORD	Immediately

Enter the pickup delay to set the signal, if the threshold (with hysteresis) is exceeded (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.

1626	PROG_SIGNAL_OFF_DELAY		840D only		Cross reference: –
	Dropout delay of variable signaling function			Relevant: FDD/MSD/SLM	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: FDD/MSD/SLM	Protection level: 2/4
Unit: rev/min	Default: 0.0	Minimum: 0.0	Maximum: 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 FDDs with the rated motor speed according to the motor data sheet, and for MSDs with the maximum speed.

The MD 1401 index has special meaning in the NC. Only its value enters into 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: FDD/MSD/SLM	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 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.

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

1710	CURRENT_LSB				Cross reference: –
	Significance, current representation			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: μA	Default: 0.0	Minimum: –100 000.0	Maximum: 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: FDD/MSD/SLM	Protection level: 2/4
Unit: rev/min	Default: 0.0	Minimum: –100 000.0	Maximum: 100 000.0	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: FDD/MSD/SLM	Protection level: 2/4
Unit: μVs	Default: 0.0	Minimum: –100 000.0	Maximum: 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 (FDD/MSD), FORCE_LSB (SLM)				Cross reference: –
	Significance of torque representation Significance of force representation (SLM)			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: μNm	Default: 0.0	Minimum: –100 000.0 SLM: –1 000 000.0	Maximum: 100 00 SLM: 1 000 000.0	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: FDD/MSD/SLM	Protection level: 2/4
Unit: deg	Default: 0.0	Minimum: –100 000.0	Maximum: 100 000.0	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 (FDD/MSD), MAX_FORCE_FROM_NC (SLM)				Cross reference: –
	Normalization of torque setpoint interface Normalization of force setpoint interface			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Nm SLM: N	Default: 0.0	Minimum: –100 000.0 SLM: –1 000 000.0	Maximum: 100 000.0 SLM: 1 000 000.0	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: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 1	Minimum: 1	Maximum: 65 535	Data type: UNS.WORD	Active: –

This machine data displays the actual operating mode.

Table 2-10 Operating mode (display)

Bit 0	FDD	0 = OFF 1 = ON
Bit 1	unassigned	
Bit 2	unassigned	
Bit 3	unassigned	
Bit 4	MSD	0 = OFF 1 = ON
Bit 5	unassigned	
Bit 6	unassigned	
Bit 7	unassigned	
Bit 8, 840D only	IM, open–loop controlled	0 = OFF 1 = ON
Bit 9, 840D only	IM, closed–loop controlled	0 = OFF 1 = ON
Bit 10	unassigned	
Bit 11	unassigned	
Bit 12, 840D only	V/f operation IM operation 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: FDD/MSD/SLM	Protection level: 2/4
Unit: rev/min SLM: m/min	Default: 2.0 SLM: 0.2	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: FDD/MSD/SLM	Protection level: 2/4
Unit: ms	Default: 0	Minimum: 0	Maximum: 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: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 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.

■

3 Supplementary Conditions

None

4 Data Descriptions (MD, SD)

See Chapter 2

5 Signal Descriptions

None

6 Example

None

■

Space for your notes

7 Data Fields, Lists

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/SLM

7.2 Software version

Table 7-2 Machine data

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

7.3 Diagnostics monitor

Table 7-3 Machine data

No.	Identifier	Name	Drive
1610	DIAGNOSIS_ACTIVATION_FLAGS	Diagnostic functions	FDD/MSD/SLM
1611	DNDT_THRESHOLD	Response threshold dn/dt	FDD/MSD/SLM
1650	DIAGNOSIS_CONTROL_FLAGS	Diagnostic control	FDD/MSD/SLM
1651	MINMAX_SIGNAL_NR	Signal number of min/max memory	FDD/MSD/SLM
1652	MINMAX_ADDRESS	Memory location in min/max memory	FDD/MSD/SLM
1653	MINMAX_MIN_VALUE	Minimum value of min/max memory	FDD/MSD/SLM
1654	MINMAX_MAX_VALUE	Maximum value of min/max memory	FDD/MSD/SLM
1655	MONITOR_SEGMENT	Monitor memory location segment	FDD/MSD/SLM
1656	MONITOR_ADDRESS	Monitor memory location address	FDD/MSD/SLM
1657	MONITOR_DISPLAY	Monitor value display	FDD/MSD/SLM
1658	MONITOR_INPUT_MONITOR	Monitor value input	FDD/MSD/SLM
1659	MONITOR_INPUT_STROBE	Value acceptance monitor	FDD/MSD/SLM
1721	ACCEL_DIAGNOSIS	Diagnosis, speed actual value	FDD/MSD/SLM

7.4 Other diagnostic parameters

Table 7-4 Machine data

No.	Identifier	Name	Drive
1448	ACTUAL_STALL_POWER_SPEED	Speed at the start of the stall power	MSD
1700	TERMINAL_STATE	Status of the binary inputs	FDD/MSD/SLM
1701	LINK_VOLTAGE	DC link voltage	FDD/MSD/SLM
1702	MOTOR_TEMPERATURE	Motor temperature	FDD/MSD/SLM
1705	DESIRED_VOLTAGE	Voltage setpoint (rms)	FDD/MSD/SLM
1706	DESIRED_SPEED	Speed setpoint	FDD/MSD/SLM
1707	ACTUAL_SPEED	Actual speed value	FDD/MSD/SLM
1708	ACTUAL_CURRENT	Smoothed actual current value	FDD/MSD/SLM
1719	ABS_ACTUAL_CURRENT	Actual absolute current (rms)	FDD/MSD/SLM
1720	CRC_DIAGNOSIS	CRC diagnostic parameter	FDD/MSD/SLM
1722	LOAD	Machine statistic	FDD/MSD/SLM
1733	LPFC_DIAGNOSIS	LPFC diagnostic counter	FDD/MSD/SLM
1735	PROCESSOR_LOAD	Processor capacity utilization	FDD/MSD/SLM

7.5 Variable signaling function

Table 7-5 Machine data

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

7.6 Normalization of internal variables

Table 7-6 Machine data

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

7.7 Load test parameters

Table 7-7 Machine data

No.	Identifier	Name	Drive
1615	SMOOTH_RUN_TOL	Tolerance, rotational accuracy monitoring	FDD/MSD/SLM
1723	ACTUAL_RAMP_TIME	Diagnosis, ramp–up time	FDD/MSD/SLM
1724	SMOOTH_RUN_DIAGNOSIS	Diagnosis, rotational accuracy monitoring	FDD/MSD/SLM

■

Space for your notes

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

Speed Control Loop (DD2)

Space for your notes

1 Product Brief

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.

Current setpoint 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.

■

Space for your notes

Detailed Description 2

2.1 General

2.1.1 Speed control loop in block diagram

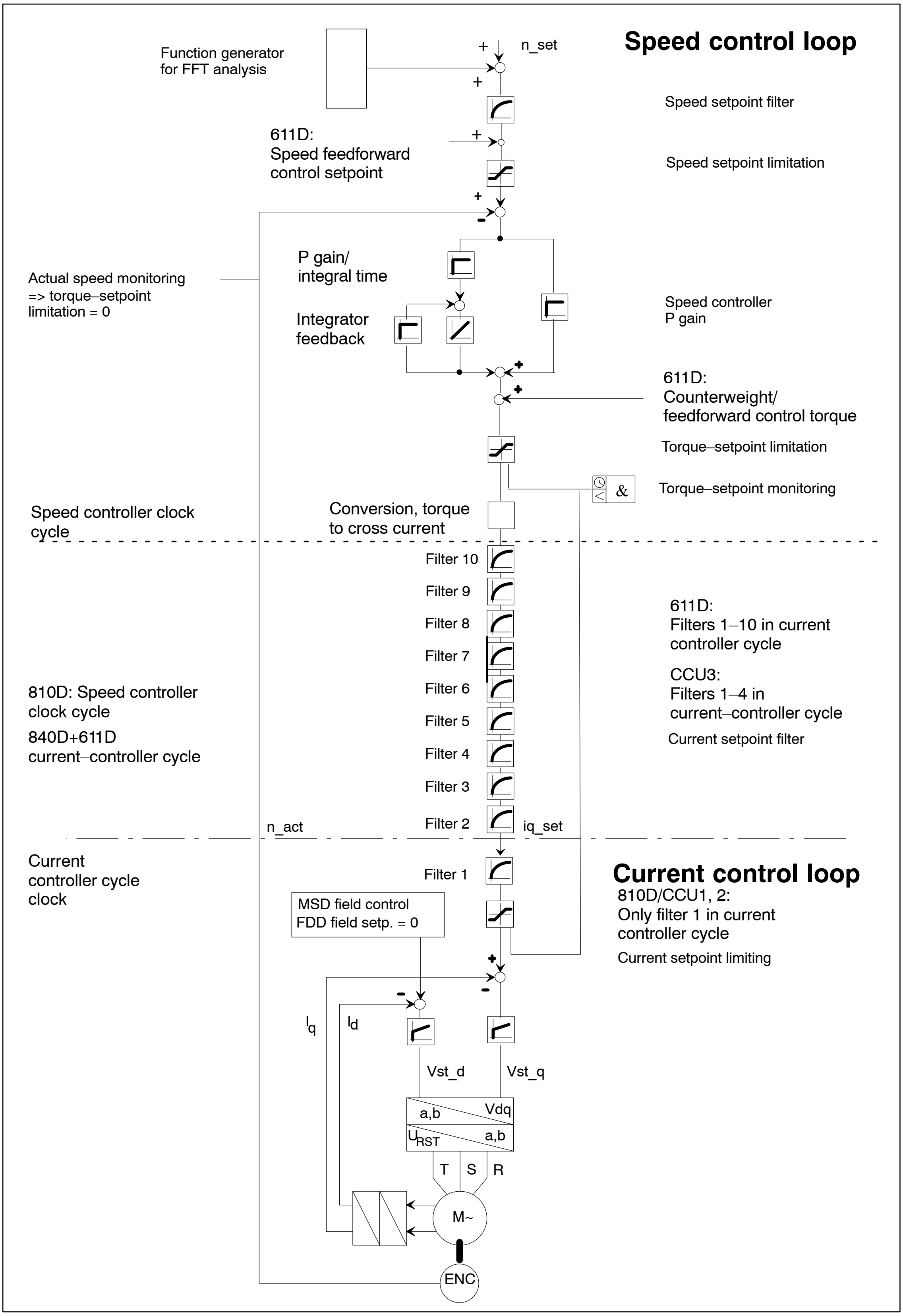


Fig. 2-1 Speed and current control loop

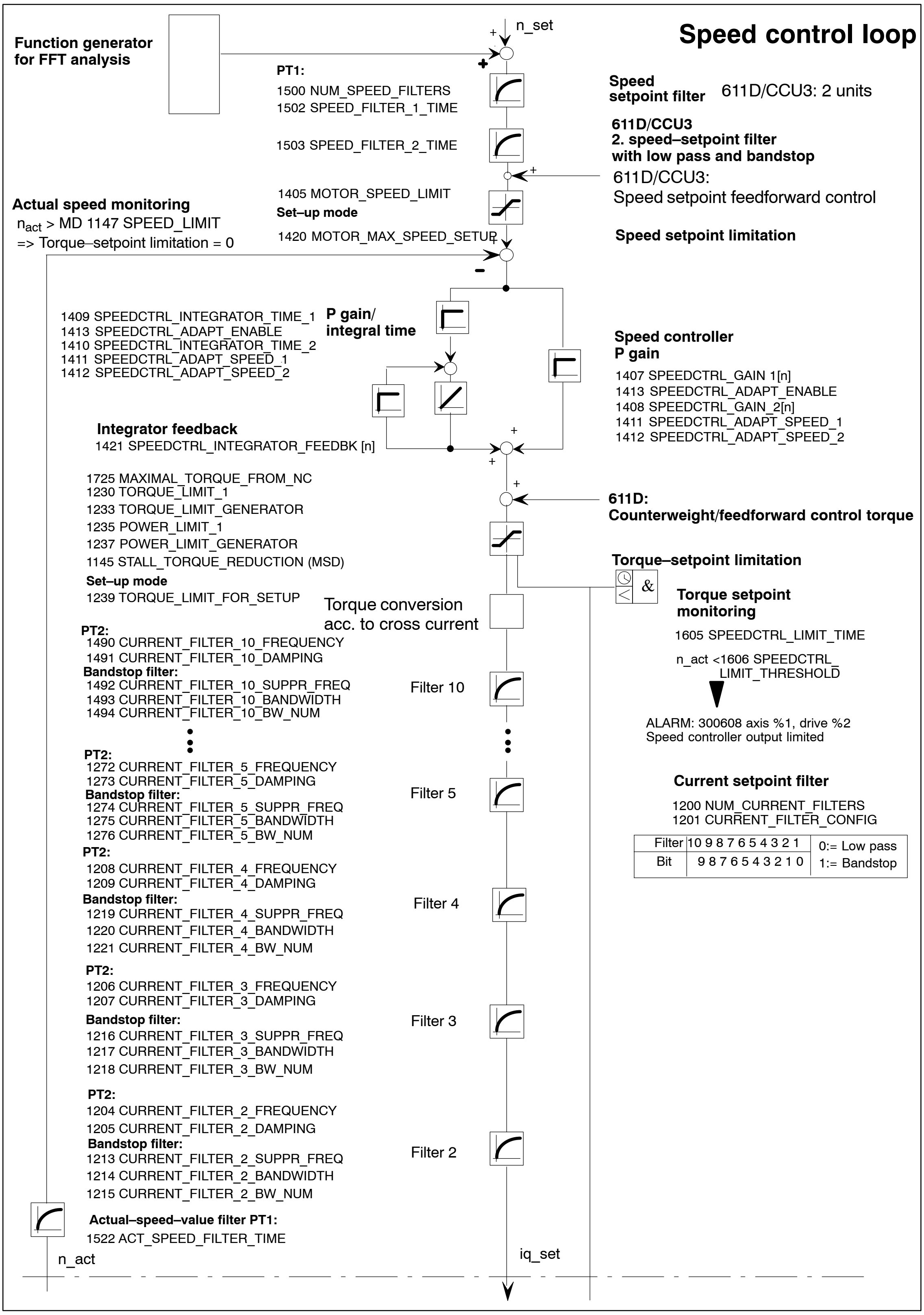


Fig. 2-2 Speed control loop

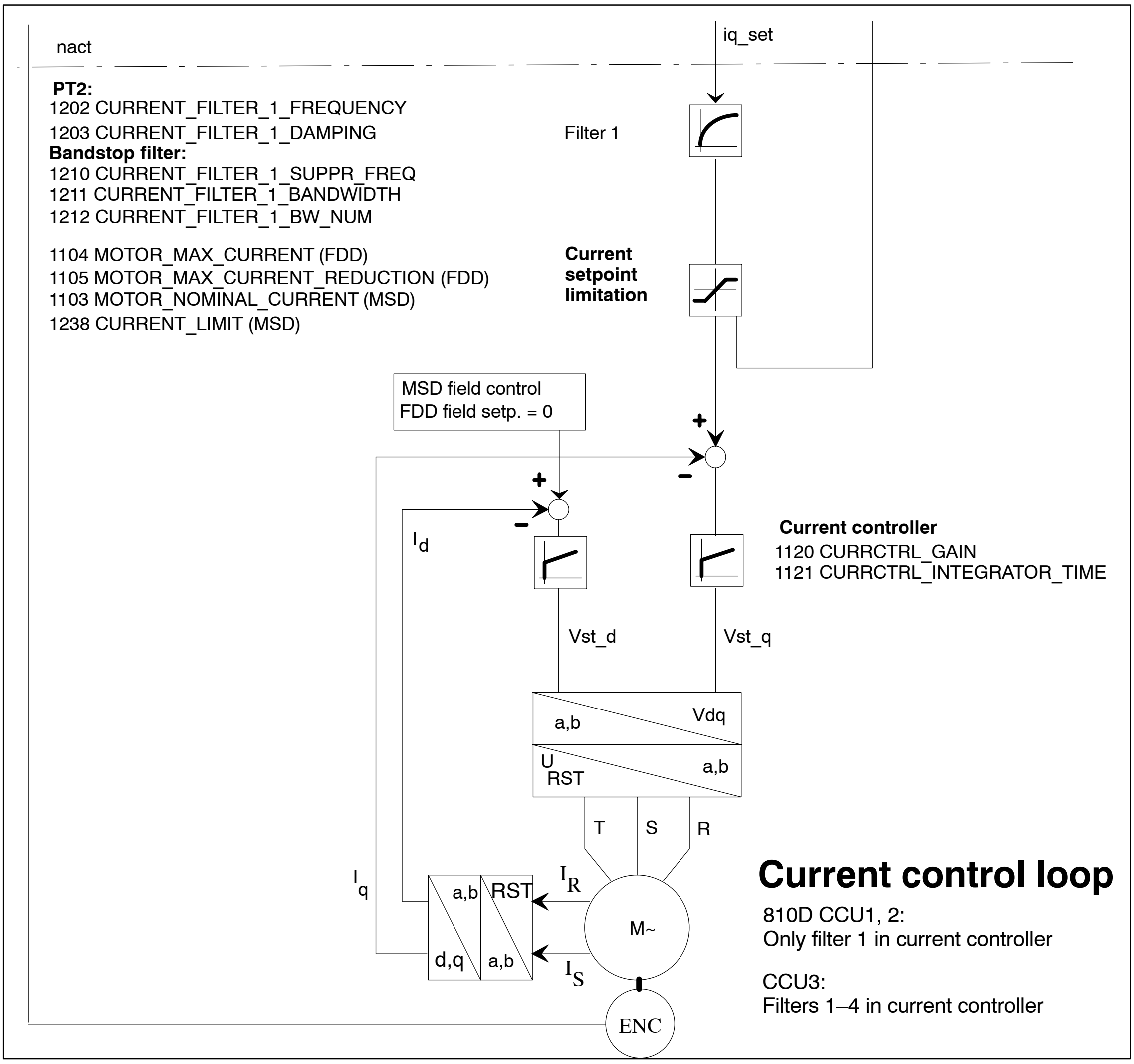


Fig. 2-3 Current control loop

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.

$$\text{Max. band width} = \frac{1}{2 \text{ x } \text{ speed controller cycle}}$$

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:

$$\text{Measuring period[s]} = \frac{\text{512 x number of averagings}}{\text{band width [Hz]}} + \text{settling time}$$

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.

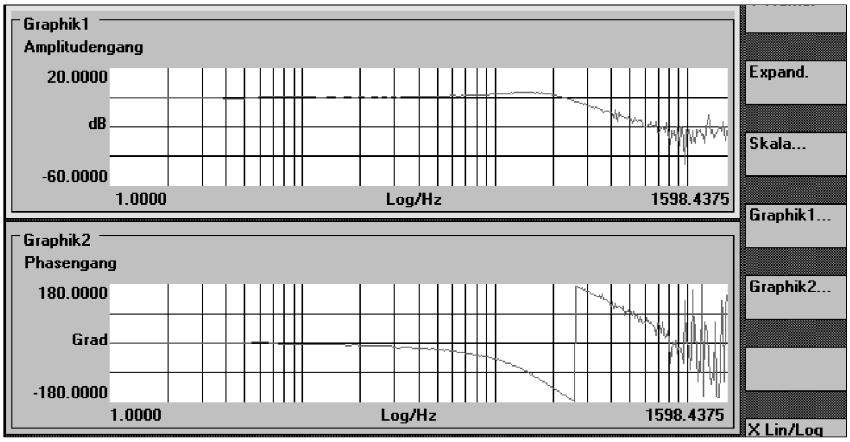


Fig. 2-4 Speed reference frequency response with no mechanical system connected

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. Reduce the P gain if the amplitude increases 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).

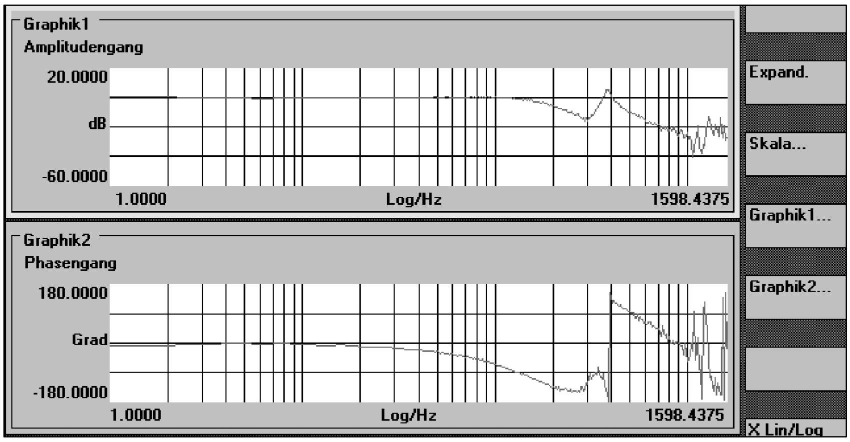


Fig. 2-5 Speed reference frequency response with optimized proportional gain

If the proportional gain were to be further increased, the amplitude would start to increase excessively (see Fig. 2-6 below).

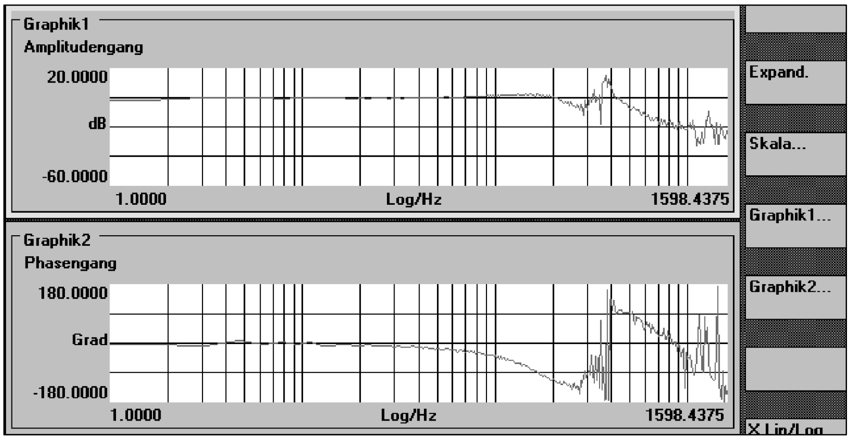


Fig. 2-6 Speed reference frequency response with excessive P gain

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).

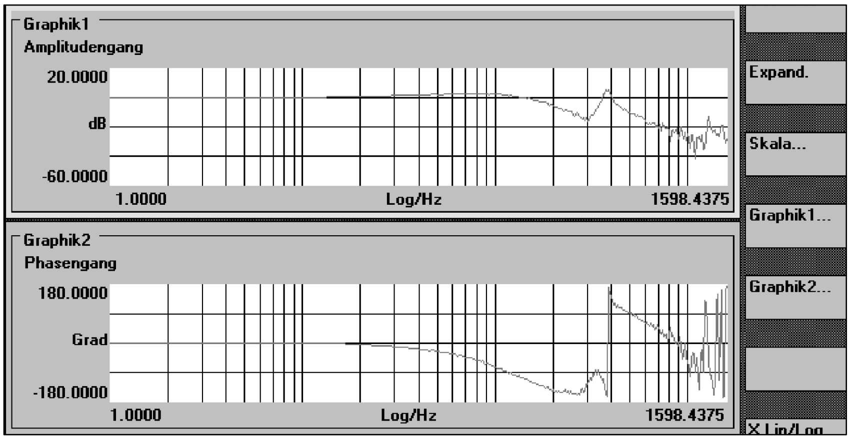


Fig. 2-7 Speed reference frequency response of a speed controller with optimum setting

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, at which the phase turns through –180 degrees; this frequency range should be 200 – 300 Hz.

A **bandstop filter** 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: FDD/MSD/SLM	Protection level: 2/4
Unit: 31.25 µs 810D 840D	Default: 10 4	Minimum: 2 1	Maximum: 40 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 FDDs 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	Comment
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)	SW 4.2 and higher
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

---

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 fault). 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: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 3115	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	Function	Description
Bit 0	Speed–torque feedforward control	0 = Not active 1 = active
Bit 1	unassigned	
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 limitation. 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 setpoints	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 = Suppress mid–frequency error ("current detection of power section missing"). Module starts up without power section.
Bits 5–11, 14, 15	unassigned	

!

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: FDD/MSD/SLM	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 Velocity controller P gain			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Nms/rad SLM: Ns/m	Default: 0.3 SLM: 2000.0	Minimum: 0.0	Maximum: 1 000 000.0	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).

1409	SPEEDCTRL_INTEGRATOR_TIME_1[n] 0...7 index of parameter set				Cross reference: –
	Speed controller reset time			Relevant: FDD/MSD/SLM	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 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 of speed controller adaptation Selection of velocity controller adaptation			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 1	Data type: UNS.WORD	Active: Immediately

This machine data can be used to adapt the speed controller machine data as a function of the speed.

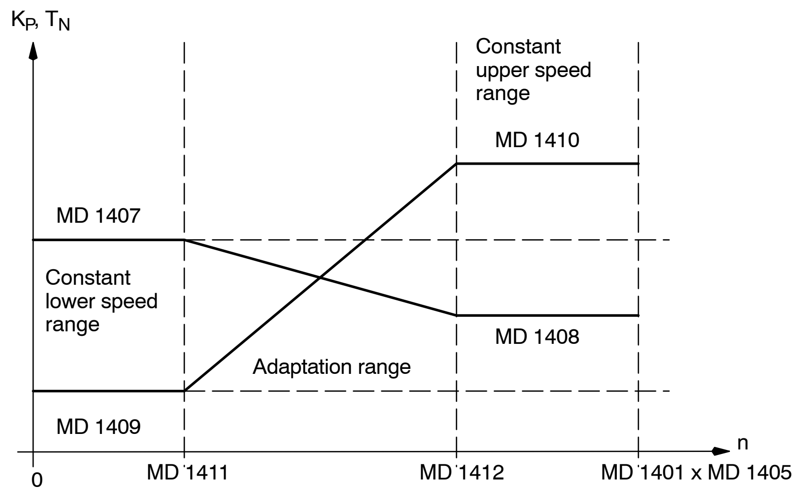


Fig. 2-8 Adaptation of the speed controller machine data based on characteristic

Input 0

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**.

1408	SPEEDCTRL_GAIN_2[n] 0...7 index of parameter set				Cross reference: –
	P gain of upper adaptation speed P gain of upper adaptation velocity			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Nms/rad SLM: Ns/m	Default: 0.3 SLM: 2 000.0	Minimum: 0.0	Maximum: 1 000 000.0	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 1413 = 0).

1410	SPEEDCTRL_INTEGRATOR_TIME_2[n] 0...7 index of parameter set				Cross reference: –
	Reset time of upper adaptation speed Reset time of upper adaptation velocity			Relevant: FDD/MSD/SLM	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 adaptation is active, the integral component should not be deactivated for just one speed range (MD 1409 = 0 and MD 1410 $\neq$ 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 Lower adaptation velocity			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: rev/min SLM: 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 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 Upper adaptation velocity			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: rev/min SLM: 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 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: FDD/MSD/SLM	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 velocity 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 suppressed 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).

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

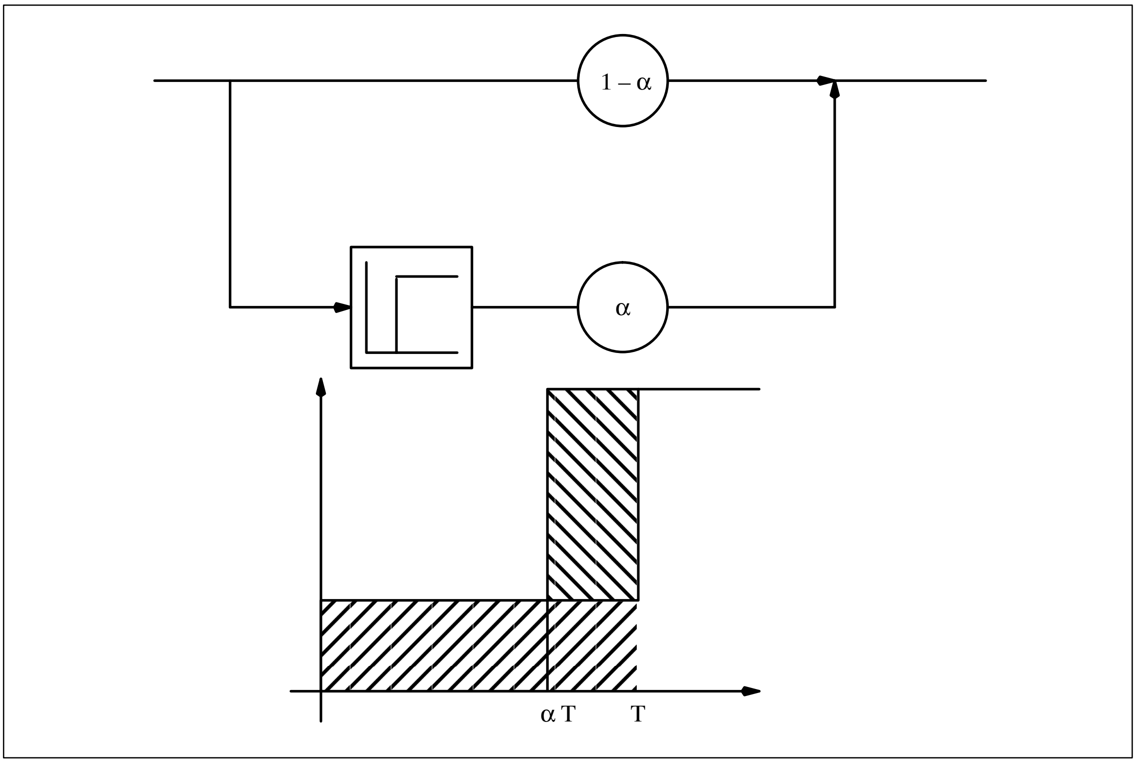


Fig. 2-9 Block diagram of fractional dead time

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: –
Interpolator/speed controller cycle for RFG				Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 2.0	Minimum: 0.0	Maximum: 20.0	Data type: FLOAT	Active: Immediately

Enter a run–time 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 "± 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: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default:	Minimum:	Maximum:	Data type: UNS.WORD	Active: Immediately
810D	1	0	4		
840D	1	0	10		

Enters the number of current–setpoint filters. You can choose between band-stop filters and 2nd degree low–pass filters set in MD 1201: CURRENT_FILTER_CONFIG.

From SW 6.08.17 and higher
The number of current setpoint filters has been increased from 6 to 10, but using current setpoint filters 7 to 10 assumes that the ”APC” option has been activated (for more on APC, see the description of functions for DS1).
If the option has not been activated, alarm 8037, ”Activate APC option not set”, is output.
The current setpoint filters 7 – 10 are active when MD 1560 bit 2 = 1.
If MD 1560 bit 2 = 0, a maximum of 6 current setpoint filters are cleared.

Note

Processor capacity utilization MD 1735: PROCESSOR_LOAD increases with the number of current setpoint filters. For this reason, the resulting computing capacity should be checked.

Table 2-3 Selection of the number of current filters

Value	Description
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
7	Filters 1, 2, 3, 4, 5, 6, and 7 active
8	Filters 1, 2, 3, 4, 5, 6, 7, and 8 active
9	Filters 1, 2, 3, 4, 5, 6, 7, 8, and 9 active
10	Filters 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10 active

1201	CURRENT_FILTER_CONFIG[n] 0...7 index of parameter set				Cross reference: –
	Type of current filter			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hex	Default:	Minimum:	Maximum:	Data type: UNS.WORD	Active: Immediately
810D	0	0	800F		
840D	0	0	83FF		

Enters the configuration of 10 current filters. You can choose between bandstop filters and low–pass filters. The filter parameters are entered in associated machine data.

With a bandstop filter, 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.

The relevant filter is activated via MD 1200: NUM_CURRENT_FILTERS and MD 1201: CURRENT_FILTER_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)
7th filter	Bit 6	0	Low–pass (see MD 1472/1473)
		1	Bandstop (see MD 1474/1475/1476/1477)
8th filter	Bit 7	0	Low–pass (see MD 1478/1479)
		1	Bandstop (see MD 1480/1481/1482/1483)
9th filter	Bit 8	0	Low–pass (see MD 1484/1485)
		1	Bandstop (see MD 1486/1487/1488/1489)
10th filter	Bit 9	0	Low–pass (see MD 1490/1491)
		1	Bandstop (see MD 1492/1493/1494/1495)

- Current setpoint filter 1 (MD 1201 bit 0)

1202	**CURRENT_FILTER_1_FREQUENCY[n] 0...7 index of parameter set**				**Cross reference:** –
	Natural frequency, current filter 1			Relevant: FDD/MSD/SLM	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 1 (PT2 low pass).
An entry with the value < 10 Hz for the natural frequency of the low pass deactivates the filter.

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

Enter the damping for current–setpoint filter 1 (PT2 low pass).

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

Enters the blocking frequency for current–setpoint filter 1 (bandstop).

1211	**CURRENT_FILTER_1_BANDWIDTH[n] 0...7 index of parameter set**				**Cross reference:** –
	Bandwidth, current filter 1			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 500.0	Minimum: 1.0	Maximum: 7 999.0	Data type: FLOAT	Active: Immediately

Enter the 3dB bandwidth for current setpoint filter 1 (bandstop).
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–setpoint filter 1			Relevant: FDD/MSD/SLM	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 of the attenuated bandstop filter for current setpoint filter 1. Entering a value of 0 initializes the filter as an unattenuated bandstop filter.

1222	CURRENT_FILTER_1_BS_FREQ[n] 0...7 index of parameter set 840D only				Cross reference: –
	Bandstop natural frequency, current–setpoint filter 1			Relevant: FDD/MSD/SLM	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 1222 can be used to lower the amplitude for frequencies above the blocking frequency for current setpoint filter 1.

- Current setpoint filter 2 (MD 1201 bit 1)

1204	CURRENT_FILTER_2_FREQUENCY[n] 0...7 index of parameter set				Cross reference: –
	Natural frequency, current filter 2			Relevant: FDD/MSD/SLM	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 current–setpoint filter 2 (PT2 low pass). An entry with the value < 10 Hz for the natural frequency of the low pass deactivated the filter.

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

Enter the damping for current–setpoint filter 2 (PT2 low pass).

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

Enters the blocking frequency for current–setpoint filter 2 (bandstop).

1214	CURRENT_FILTER_2_BANDWIDTH[n] 0...7 index of parameter set				Cross reference: –
	Bandwidth, current filter 2			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 500.0	Minimum: 1.0	Maximum: 7 999.0	Data type: FLOAT	Active: Immediately

Enter the 3dB bandwidth for current setpoint filter 2 (bandstop). 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–setpoint filter 2			Relevant: FDD/MSD/SLM	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 of the attenuated bandstop filter for current setpoint filter 2. Entering a value of 0 initializes the filter as an unattenuated bandstop filter.

1223	CURRENT_FILTER_2_BS_FREQ[n] 0...7 index of parameter set				Cross reference: –
	Bandstop natural frequency, current–setpoint filter 2			Relevant: FDD/MSD/SLM	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 2. MD 1223 can be used to lower the amplitude for frequencies above the blocking frequency for current setpoint filter 2.

- Current setpoint filter 3 (MD 1201 bit 2)

1206	CURRENT_FILTER_3_FREQUENCY[n] 0...7 index of parameter set				Cross reference: –
	Natural frequency, current filter 3			Relevant: FDD/MSD/SLM	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 current–setpoint filter 3 (PT2 low pass).
An entry with the value < 10 Hz for the natural frequency of the low pass deactivated the filter.

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

Enter the damping for current–setpoint filter 3 (PT2 low pass).

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

Enters the blocking frequency for current–setpoint filter 3 (bandstop).

1217	CURRENT_FILTER_3_BANDWIDTH[n] 0...7 index of parameter set				Cross reference: –
	Bandwidth, current filter 3			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 500.0	Minimum: 1.0	Maximum: 7 999.0	Data type: FLOAT	Active: Immediately

Enter the 3dB bandwidth for current setpoint filter 3 (bandstop).

1218	CURRENT_FILTER_3_BW_NUM[n] 0...7 index of parameter set				Cross reference: –
	Numerator bandwidth, current–setpoint filter 3			Relevant: FDD/MSD/SLM	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 of the attenuated bandstop filter for current setpoint filter 3. Entering a value of 0 initializes the filter as an unattenuated bandstop filter.

1224	CURRENT_FILTER_3_BS_FREQ[n] 0...7 index of parameter set 840D only				Cross reference: –
	BSF natural frequency, current setpoint 3			Relevant: FDD/MSD/SLM	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 3. MD 1224 can be used to lower the amplitude for frequencies above the blocking frequency for current setpoint filter 3.

- Current setpoint filter 4 (MD 1201 bit 3)

1208	CURRENT_FILTER_4_FREQUENCY[n] 0...7 index of parameter set				Cross reference: –
	Natural frequency, current filter 4			Relevant: FDD/MSD/SLM	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 current–setpoint filter 4 (PT2 low pass). An entry with the value < 10 Hz for the natural frequency of the low pass deactivated the filter.

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

Enter the damping for current–setpoint filter 4 (PT2 low pass).

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

Enters the blocking frequency for current–setpoint filter 4 (bandstop).

1220	CURRENT_FILTER_4_BANDWIDTH[n] 0...7 index of parameter set				Cross reference: –
	Bandwidth, current filter 4			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 500.0	Minimum: 1.0	Maximum: 7 999.0	Data type: FLOAT	Active: Immediately

Enter the 3dB bandwidth for current setpoint filter 4 (bandstop filter).
Entering a 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–setpoint filter 4			Relevant: FDD/MSD/SLM	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 of the attenuated bandstop filter for current setpoint filter 4. Entering a value of 0 initializes the filter as an unattenuated bandstop filter.

1225	CURRENT_FILTER_4_BS_FREQ[n] 0...7 index of parameter set 840D only				Cross reference: –
	BSF natural frequency, current setpoint 4			Relevant: FDD/MSD/SLM	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 4. MD 1225 can be used to lower the amplitude for frequencies above the blocking frequency for current setpoint filter 4.

- Current setpoint filter 5 (MD 1201 bit 4)

1272	CURRENT_FILTER_5_BS_FREQUENCY[0...7,DRx]		840D only		Cross reference: –
	Natural frequency, current filter 5			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 0.0	Minimum: 0.0	Maximum: 8000.0	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 deactivated the filter.

1273	CURRENT_FILTER_5_DAMPING[0...7,DRx]		840D only		Cross reference: –
	Damping of current filter 5			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 1.0	Minimum: 0.05	Maximum: 5.0	Data type: FLOAT	Active: Immediately

Enter the damping for current–setpoint filter 5 (PT2 low pass).

1274	CURRENT_FILTER_5_SUPPR_FREQ[0...7,DRx]		840D only		Cross reference: –
	Blocking frequency, current filter 5			Relevant: FDD/MSD/SLM	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 5 (bandstop).

1275	CURRENT_FILTER_5_BANDWIDTH[0...7,DRx]		840D only		Cross reference: –
	Bandwidth, current filter 5			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 500.0	Minimum: 1.0	Maximum: 7999.0	Data type: FLOAT	Active: Immediately

Enter the 3dB bandwidth for current setpoint filter 5 (bandstop).
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: FDD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 0.0	Minimum: 0.0	Maximum: 7999.0	Data type: FLOAT	Active: Immediately

Enter the numerator bandwidth of the attenuated bandstop filter for current setpoint filter 5. Entering a value of 0 initializes the filter as an unattenuated bandstop filter.

1277	CURRENT_FILTER_5_BS_FREQ[0...7,DRx]		840D only		Cross reference: –
	Bandstop natural frequency, current–setpoint filter 5			Relevant: FDD/MSD/SLM	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 5. MD 1277 can be used to lower the amplitude for frequencies above the blocking frequency for current setpoint filter 5.

- Current setpoint filter 6 (MD 1201 bit 5)

1278	CURRENT_FILTER_6_FREQUENCY[0...7,DRx]		840D only		Cross reference: –
	Natural frequency, current filter 6			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 0.0	Minimum: 0.0	Maximum: 8000.0	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 deactivated the filter.

1279	CURRENT_FILTER_6_DAMPING[0...7,DRx]		840D only		Cross reference: –
	Damping of current filter 6			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 1.0	Minimum: 0.05	Maximum: 5.0	Data type: FLOAT	Active: Immediately

Enter the damping for current–setpoint filter 6 (PT2 low pass).

1280	CURRENT_FILTER_6_SUPPR_FREQ[0...7,DRx]		840D only		Cross reference: –
	Blocking frequency, current filter 6			Relevant: FDD/MSD/SLM	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).

1281	CURRENT_FILTER_6_BANDWIDTH[0...7,DRx]		840D only		Cross reference: –
	Bandwidth, current filter 6			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 500.0	Minimum: 1.0	Maximum: 7999.0	Data type: FLOAT	Active: Immediately

Enter the 3dB bandwidth for current setpoint filter 6 (bandstop).
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: FDD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 0.0	Minimum: 0.0	Maximum: 7999.0	Data type: FLOAT	Active: Immediately

Enter the numerator bandwidth of the attenuated bandstop filter for current setpoint filter 6. Entering a value of 0 initializes the filter as an unattenuated bandstop filter.

1283	CURRENT_FILTER_6_BS_FREQ[0...7,DRx]		840D only		Cross reference: –
	Bandstop natural frequency, current–setpoint filter 6			Relevant: FDD/MSD/SLM	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 6. MD 1283 can be used to lower the amplitude for frequencies above the blocking frequency for current setpoint filter 6.

- Current setpoint filter 7 (MD 1201 bit 6)

1472	CURRENT_FILTER_7_FREQUENCY[0...7,DRx]		840D only		Cross reference: –
	Natural frequency, current filter 7			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 0.0	Minimum: 0.0	Maximum: 8000.0	Data type: FLOAT	Active: Immediately

Enter the natural frequency for current–setpoint filter 7 (PT2 low pass).
An entry with the value < 10 Hz for the natural frequency of the low pass deactivated the filter.

1473	CURRENT_FILTER_7_DAMPING[0...7,DRx]		840D only		Cross reference: –
	Damping of current filter 7			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 1.0	Minimum: 0.05	Maximum: 5.0	Data type: FLOAT	Active: Immediately

Enter the damping for current–setpoint filter 7 (PT2 low pass).

1474	CURRENT_FILTER_7_SUPPR_FREQ[0...7,DRx]		840D only		Cross reference: –
	Blocking frequency, current filter 7			Relevant: FDD/MSD/SLM	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 7 (bandstop).

1475	CURRENT_FILTER_7_BANDWIDTH[0...7,DRx] 840D only				Cross reference: –
	Bandwidth, current filter 7			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 500.0	Minimum: 1.0	Maximum: 7999.0	Data type: FLOAT	Active: Immediately

Enter the 3dB bandwidth for current setpoint filter 7 (bandstop).
An input value of 0 for the bandwidth deactivates the filter.

1476	CURRENT_FILTER_7_BW_NUM[0...7,DRx] 840D only				Cross reference: –
	Numerator bandwidth, current–setpoint filter 7			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 0.0	Minimum: 0.0	Maximum: 7999.0	Data type: FLOAT	Active: Immediately

Enter the numerator bandwidth of the attenuated bandstop filter for current setpoint filter 7. Entering a value of 0 initializes the filter as an unattenuated bandstop filter.

1477	CURRENT_FILTER_7_BS_FREQ[0...7,DRx] 840D only				Cross reference: –
	Bandstop natural frequency, current–setpoint filter 7			Relevant: FDD/MSD/SLM	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 7. MD 1477 can be used to lower the amplitude for frequencies above the blocking frequency for current setpoint filter 7.

- Current setpoint filter 8 (MD 1201 bit 7)

1478	CURRENT_FILTER_8_FREQUENCY[0...7,DRx] 840D only				Cross reference: –
	Natural frequency, current filter 8			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 0.0	Minimum: 0.0	Maximum: 8000.0	Data type: FLOAT	Active: Immediately

Enter the natural frequency for current–setpoint filter 8 (PT2 low pass).
An entry with the value < 10 Hz for the natural frequency of the low pass deactivated the filter.

1479	CURRENT_FILTER_8_DAMPING[0...7,DRx] 840D only				Cross reference: –
	Damping of current filter 8			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 1.0	Minimum: 0.05	Maximum: 5.0	Data type: FLOAT	Active: Immediately

Enter the damping for current–setpoint filter 8 (PT2 low pass).

1480	CURRENT_FILTER_8_SUPPR_FREQ[0...7,DRx]		840D only		Cross reference: –
	Blocking frequency, current filter 8			Relevant: FDD/MSD/SLM	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 8 (bandstop).

1481	CURRENT_FILTER_8_BANDWIDTH[0...7,DRx]		840D only		Cross reference: –
	Bandwidth, current filter 8			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 500.0	Minimum: 1.0	Maximum: 7999.0	Data type: FLOAT	Active: Immediately

Enter the 3dB bandwidth for current setpoint filter 8 (bandstop). An input value of 0 for the bandwidth deactivates the filter.

1482	CURRENT_FILTER_8_BW_NUM[0...7,DRx]		840D only		Cross reference: –
	Numerator bandwidth, current–setpoint filter 8			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 0.0	Minimum: 0.0	Maximum: 7999.0	Data type: FLOAT	Active: Immediately

Enter the numerator bandwidth of the attenuated bandstop filter for current setpoint filter 8. Entering a value of 0 initializes the filter as an unattenuated bandstop filter.

1483	CURRENT_FILTER_8_BS_FREQ[0...7,DRx]		840D only		Cross reference: –
	Bandstop natural frequency, current–setpoint filter 8			Relevant: FDD/MSD/SLM	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 8. MD 1483 can be used to lower the amplitude for frequencies above the blocking frequency for current setpoint filter 8.

- Current setpoint filter 9 (MD 1201 bit 8)

1484	CURRENT_FILTER_9_FREQUENCY[0...7,DRx]		840D only		Cross reference: –
	Natural frequency, current filter 9			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 0.0	Minimum: 0.0	Maximum: 8000.0	Data type: FLOAT	Active: Immediately

Enter the natural frequency for current–setpoint filter 9 (PT2 low pass).
An entry with the value < 10 Hz for the natural frequency of the low pass deactivated the filter.

1485	CURRENT_FILTER_9_DAMPING[0...7,DRx]		840D only		Cross reference: –
	Damping of current filter 9			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 1.0	Minimum: 0.05	Maximum: 5.0	Data type: FLOAT	Active: Immediately

Enter the damping for current–setpoint filter 9 (PT2 low pass).

1486	CURRENT_FILTER_9_SUPPR_FREQ[0...7,DRx]		840D only		Cross reference: –
	Blocking frequency, current filter 9			Relevant: FDD/MSD/SLM	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 9 (bandstop).

1487	CURRENT_FILTER_9_BANDWIDTH[0...7,DRx]		840D only		Cross reference: –
	Bandwidth, current filter 9			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 500.0	Minimum: 1.0	Maximum: 7999.0	Data type: FLOAT	Active: Immediately

Enter the 3dB bandwidth for current setpoint filter 9 (bandstop).
An input value of 0 for the bandwidth deactivates the filter.

1488	CURRENT_FILTER_9_BW_NUM[0...7,DRx]		840D only		Cross reference: –
	Numerator bandwidth, current–setpoint filter 9			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 0.0	Minimum: 0.0	Maximum: 7999.0	Data type: FLOAT	Active: Immediately

Enter the numerator bandwidth of the attenuated bandstop filter for current setpoint filter 9. Entering a value of 0 initializes the filter as an unattenuated bandstop filter.

1489	CURRENT_FILTER_9_BS_FREQ[0...7,DRx]		840D only		Cross reference: –
	Bandstop natural frequency, current–setpoint filter 9			Relevant: FDD/MSD/SLM	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 9. MD 1489 can be used to lower the amplitude for frequencies above the blocking frequency for current setpoint filter 9.

- Current setpoint filter 10 (MD 1201 bit 9)

1490	CURRENT_FILTER_10_FREQUENCY[0...7,DRx]		840D only		Cross reference: –
	Natural frequency, current filter 10			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 0.0	Minimum: 0.0	Maximum: 8000.0	Data type: FLOAT	Active: Immediately

Enter the natural frequency for current–setpoint filter 10 (PT2 low pass). An entry with the value < 10 Hz for the natural frequency of the low pass deactivated the filter.

1491	CURRENT_FILTER_10_DAMPING[0...7,DRx]		840D only		Cross reference: –
	Damping of current filter 10			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 1.0	Minimum: 0.05	Maximum: 5.0	Data type: FLOAT	Active: Immediately

Enter the damping for current–setpoint filter 10 (PT2 low pass).

1492	CURRENT_FILTER_10_SUPPR_FR.[0...7,DRx]		840D only		Cross reference: –
	Blocking frequency, current filter 10			Relevant: FDD/MSD/SLM	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 10 (bandstop).

1493	CURRENT_FILTER_10_BANDWIDTH[0...7,DRx]		840D only		Cross reference: –
	Bandwidth, current filter 10			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 500.0	Minimum: 1.0	Maximum: 7999.0	Data type: FLOAT	Active: Immediately

Enter the 3dB bandwidth for current setpoint filter 10 (bandstop). An input value of 0 for the bandwidth deactivates the filter.

1494	CURRENT_FILTER_10_BW_NUM[0...7,DRx]		840D only		Cross reference: –
	Numerator bandwidth, current–setpoint filter 10			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 0.0	Minimum: 0.0	Maximum: 7999.0	Data type: FLOAT	Active: Immediately

Enter the numerator bandwidth of the attenuated bandstop filter for current setpoint filter 10. Entering a value of 0 initializes the filter as an unattenuated bandstop filter.

1495	CURRENT_FILTER_10_BS_FREQ[0...7,DRx]		840D only		Cross reference: –
Bandstop natural frequency, current–setpoint filter 10				Relevant: FDD/MSD/SLM	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 10. MD 1495 can be used to lower the amplitude for frequencies above the blocking frequency for current setpoint filter 10.

Table 2-5 Examples of filter combinations

Filter 10	Filter 9	Filter 8	Filter 7	Filter 6	Filter 5	Filter 4	Filter 3	Filter 2	Filter 1	CURRENT_FILTER_CONFIG
PT2 (0)	BS (1)	BS (0)	BS (0)	BS (0)	BS (1)	BS (1)	PT2 (0)	PT2 (0)	BS (1)	119
BS (1)	PT2 (0)	PT2 (0)	PT2 (1)	PT2 (1)	PT2 (0)	BS (1)	BS (1)	PT2 (0)	PT2 (0)	26C
BS (1)	BS (1)	BS (0)	BS (1)	BS (1)	BS (1)	BS (1)	PT2 (0)	BS (1)	BS (1)	37B

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:

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

Using low–pass and bandstop filters

Low–pass and bandstop filters are used to dampen resonant frequencies above or at the stability limit of the speed control loop (see diagrams below).

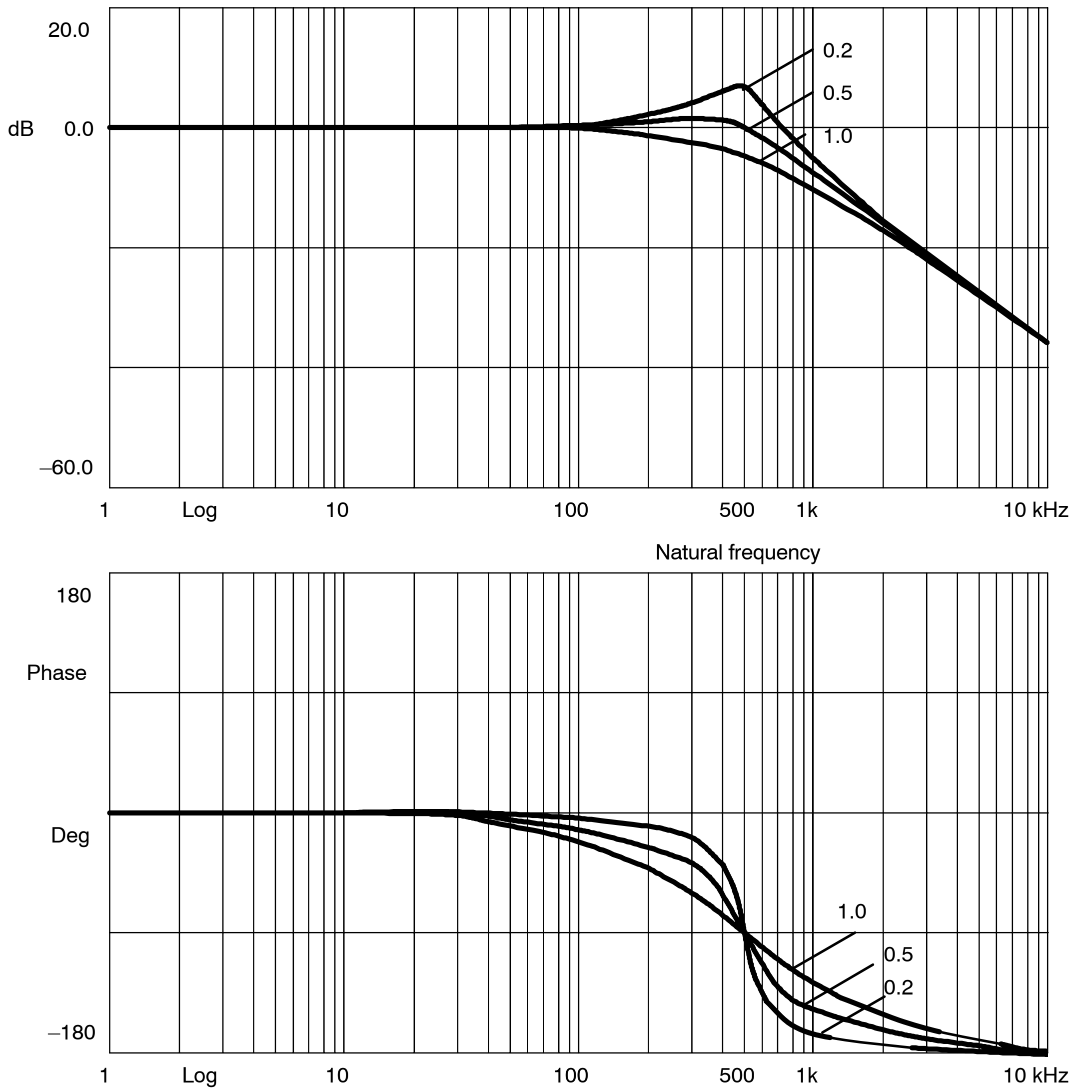


Fig. 2-10 Low–pass characteristic at 500 Hz natural frequency with various damping factors

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 bandstop filters must be combined in series for this purpose.

The poles and zeroes of the individual bandstop filters must be represented true to frequency in order to arrive at the desired overall transformation. 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 frequencies of 700 Hz and above, is to be configured. This requires, for example, a series circuit with 3 bandstop filters. 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
BSF 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).

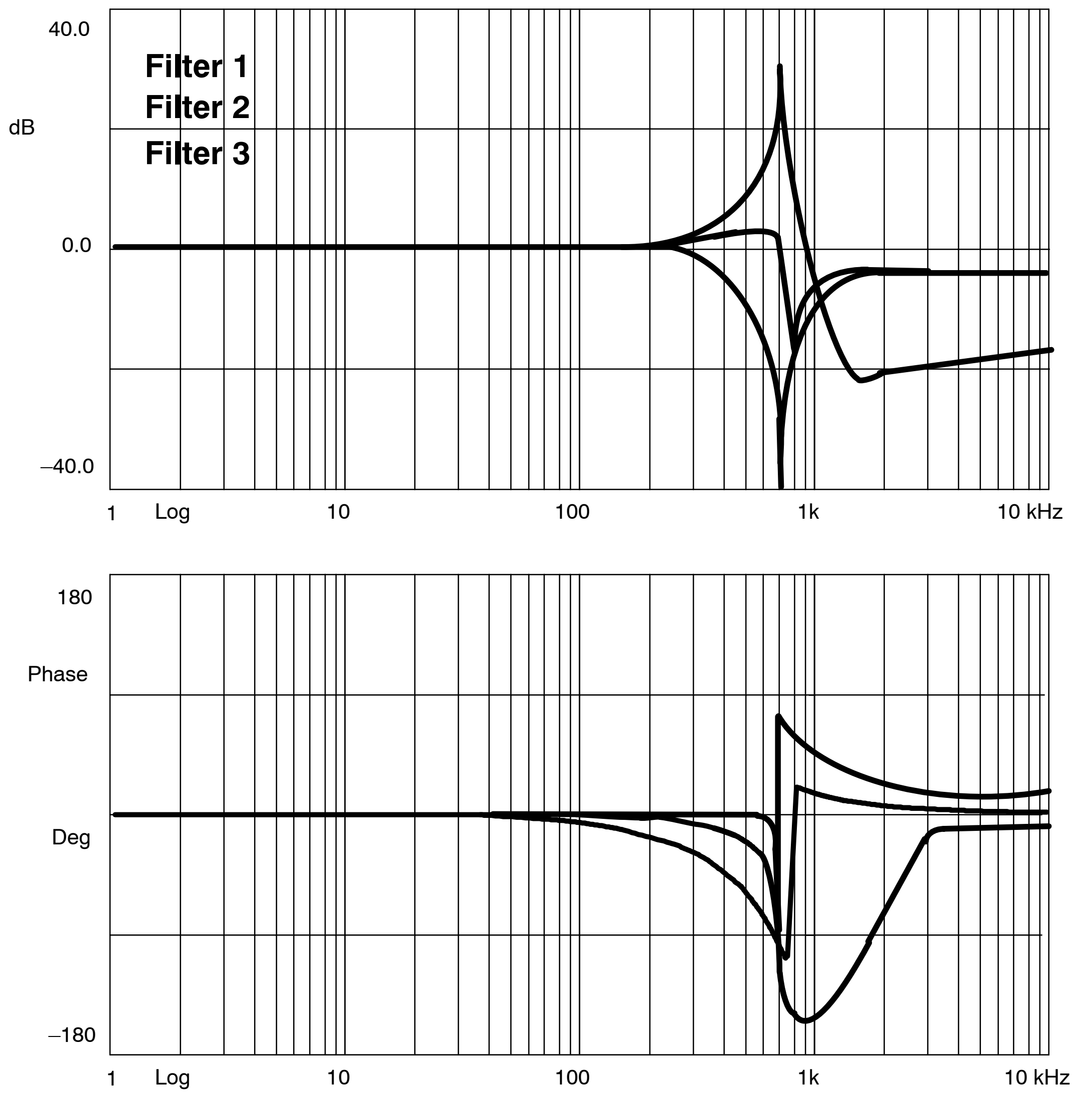


Fig. 2-11 Transformation functions of the individual bandstop filters

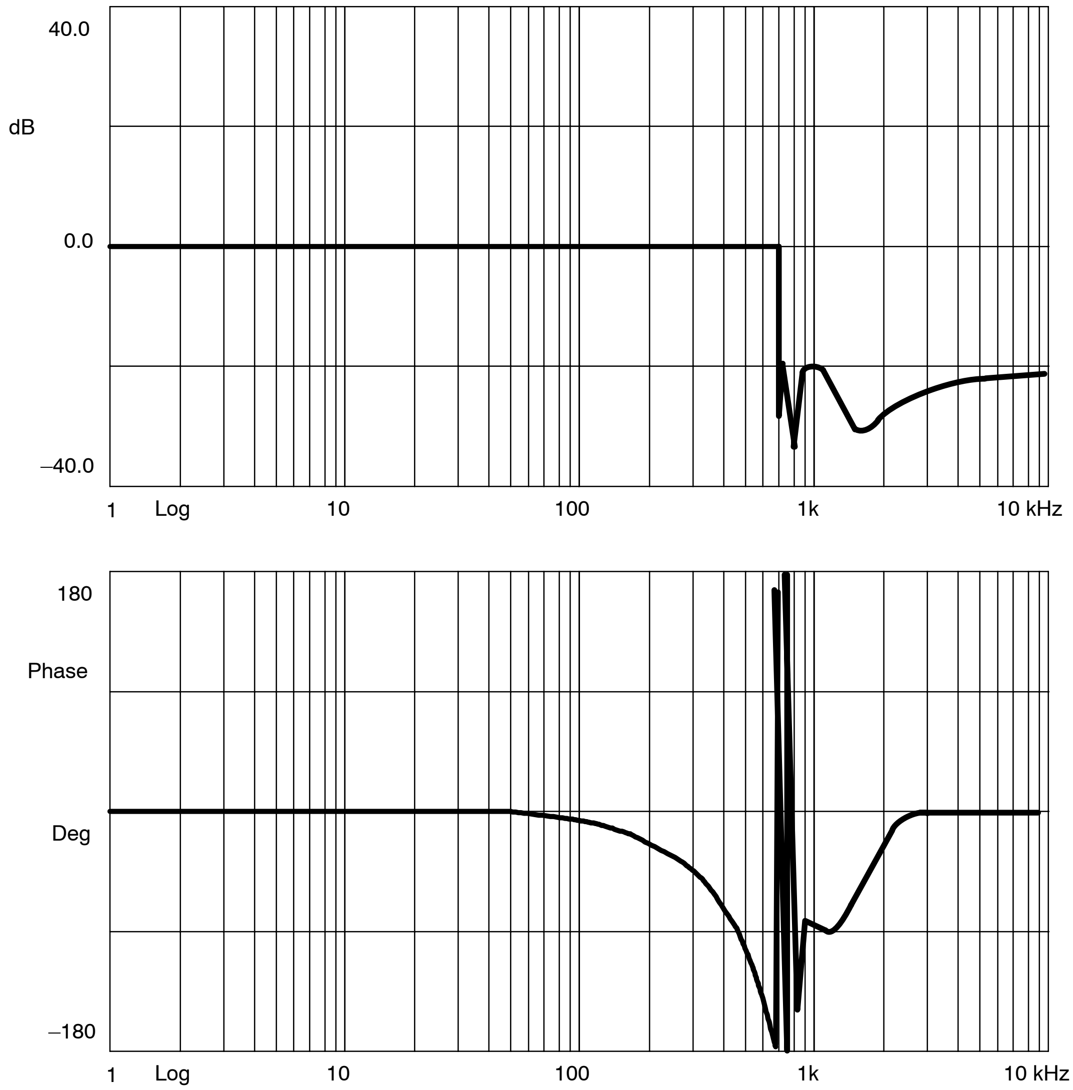


Fig. 2-12 Overall transformation function (series circuit)

Bandstop filter

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

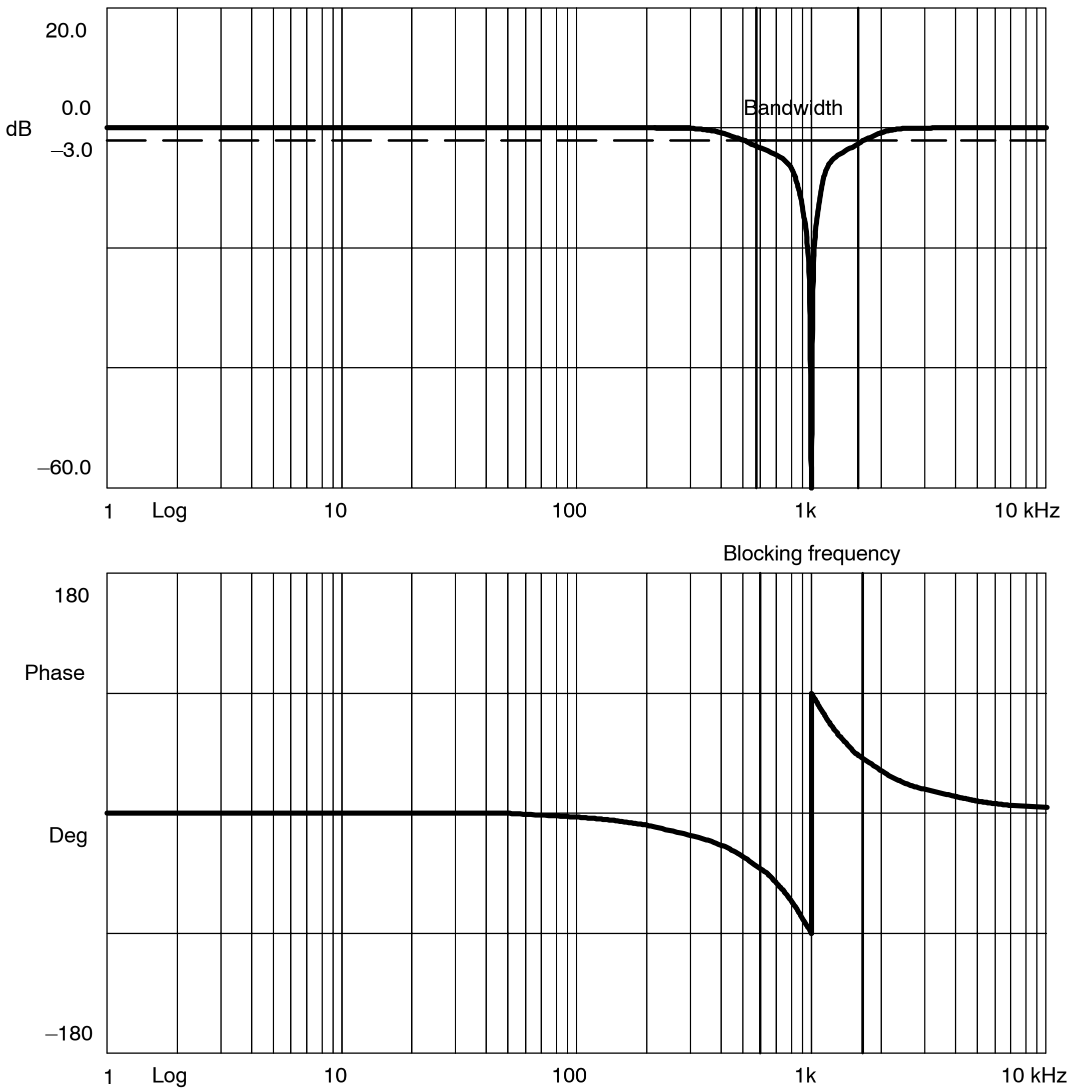


Fig. 2-13 Bandstop characteristic at blocking frequency 1 kHz with 1 kHz bandwidth

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

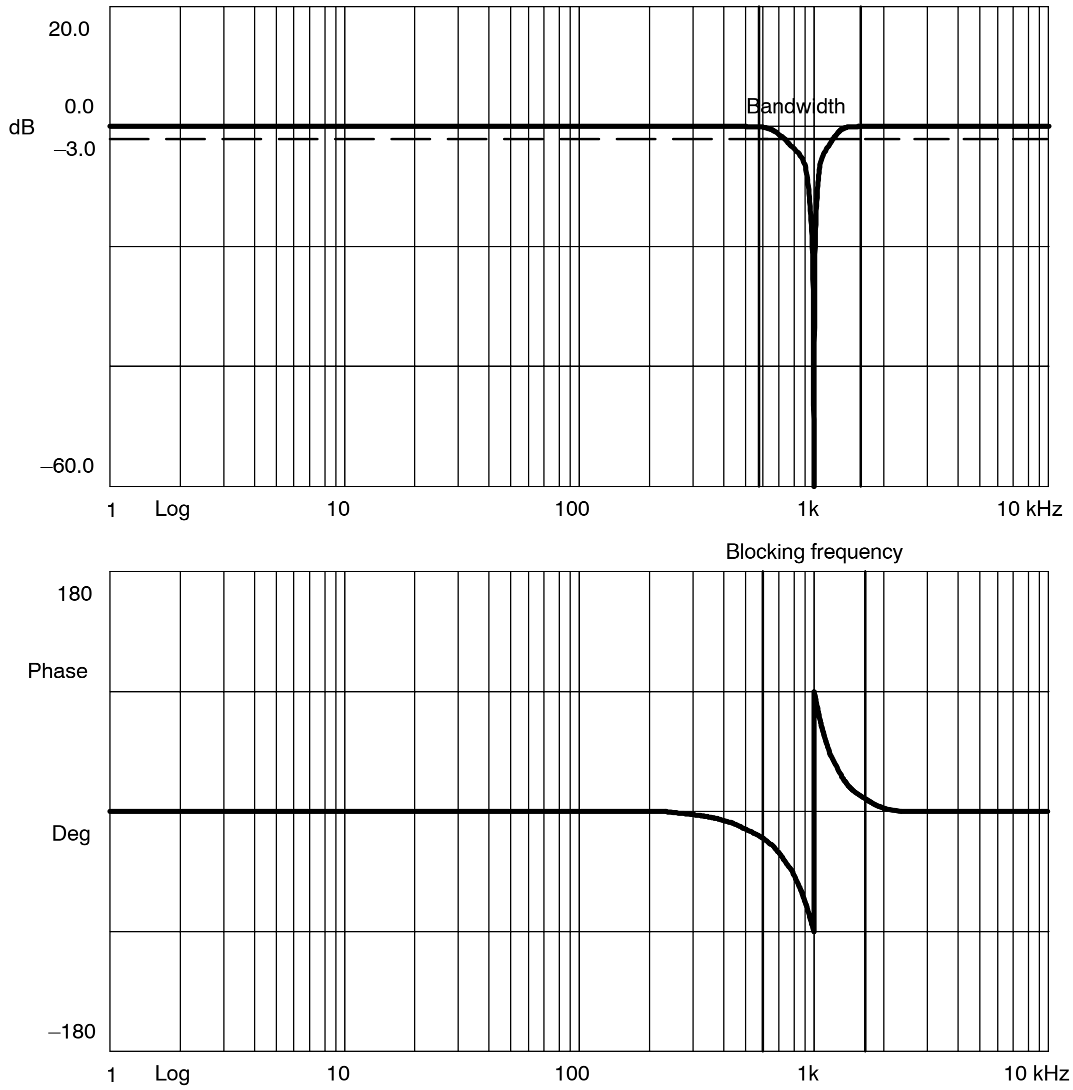


Fig. 2-14 Bandstop characteristic at blocking frequency 1 kHz with 500 Hz bandwidth

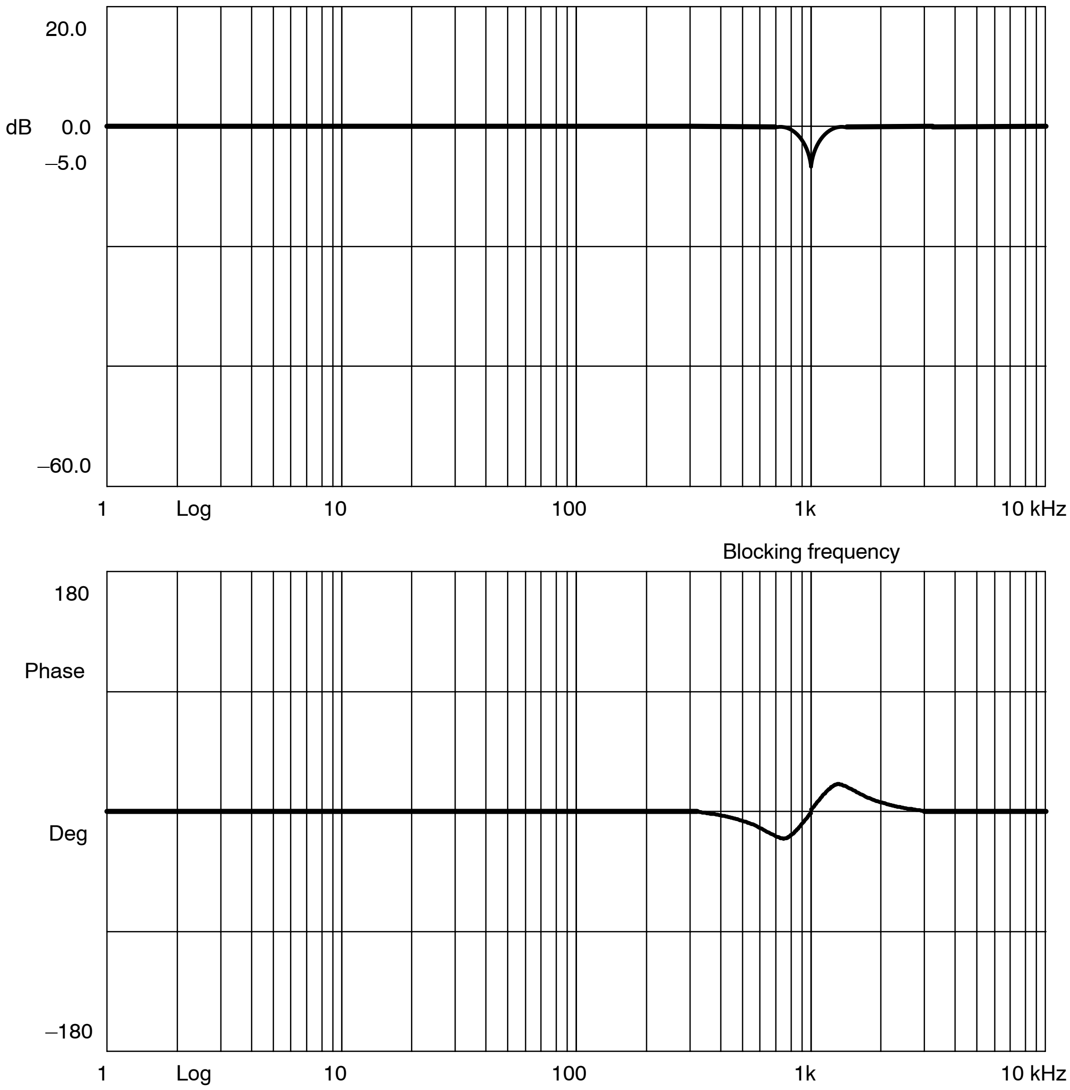


Fig. 2-15 Bandstop characteristic at blocking frequency 1 kHz, 500 Hz bandwidth and 250 Hz numerator bandwidth

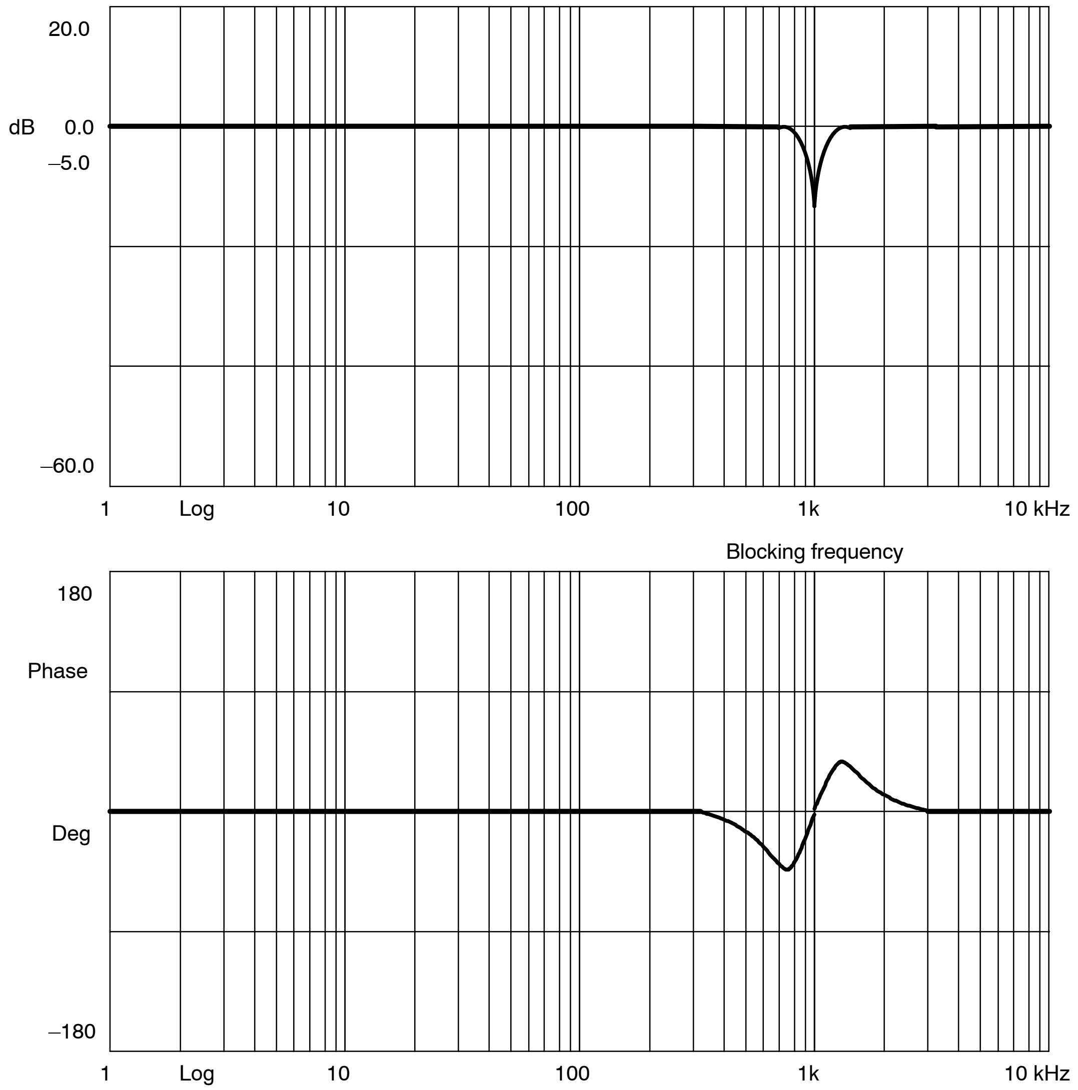


Fig. 2-16 Bandstop characteristic at blocking frequency 1 kHz, 500 Hz bandwidth and 125 Hz numerator bandwidth

Current setpoint 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 × Dz × fz	: Numerator bandwidth	MD 1212/1215/1218/1221
Dn	: Denominator damping	
fbn = 2 × Dn × fn	: Denominator bandwidth	MD 1211/1214/1217/1220
fn = MD 1222(%) × fz	: Bandstop natural frequency	MD 1222/1223/1224/1225

2.4 Speed–dependent current–setpoint filter

1245	CURRENT_SMOOTH_SPEED		840D only		Cross reference: –
	Threshold of speed–dependent torque setpoint smoothing Threshold of velocity–dependent force setpoint smoothing			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: rev/min SLM: m/min	Default: 0.0	Minimum: 0.0	Maximum: 100,000.0	Data type: FLOAT	Active: Immediately

Enter the speed, above which torque setpoint smoothing, switched–in with the 2nd filter (low–pass filter) 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:

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

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

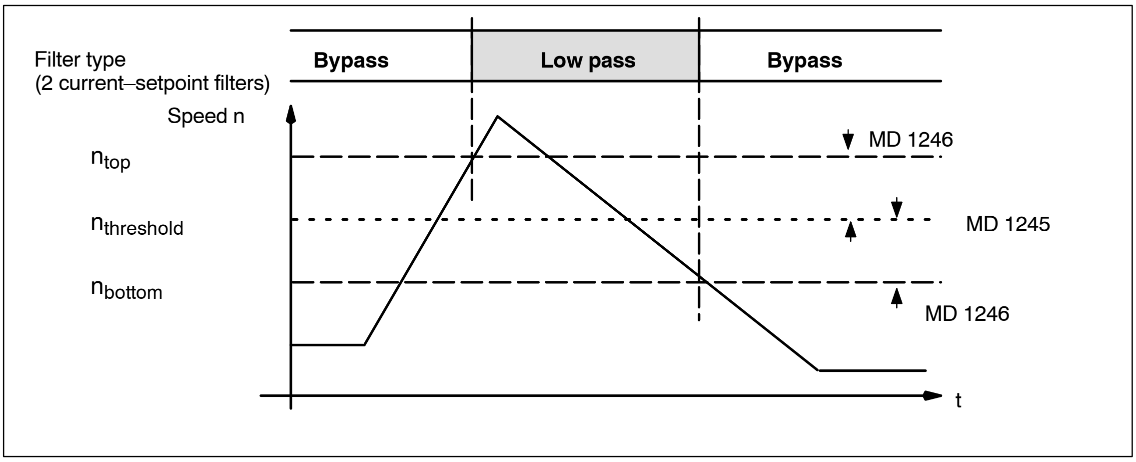


Fig. 2-17 Threshold, speed–dependent torque–setpoint smoothing

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 filter characteristics 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 of speed–dependent torque setpoint smoothing Hysteresis of velocity–dependent force setpoint smoothing			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: rev/min SLM: m/min	Default: 50.0 SLM: 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.

2.5 Speed setpoint filter

1500	NUM_SPEED_FILTERS [n] 0...7 index of parameter set				Cross reference: –
	Number of speed setpoint filters Number of velocity setpoint filters			Relevant: FDD/MSD/SLM	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 (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 filter (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”

1501	SPEED_FILTER_TYPE[n] 0...7 index of parameter set		840D only		Cross reference: –
	Type of speed–setpoint filters			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0000	Minimum: 0000	Maximum: 8303	Data type: UNS.WORD	Active: Immediately

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

With a bandstop filter, 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 filter).
  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).

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 of speed setpoint filter 1 Time constant of velocity setpoint filter 1			Relevant: FDD/MSD/SLM	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.
IS ”Speed–setpoint smoothing” DB31 ... DBX 20.3
References: /FB/, A2 ”Various Interface Signals”

1506	SPEED_FILTER_1_FREQUENCY[n] 0...7 index of parameter set 840D only				Cross reference: –
	Natural frequency of speed setpoint filter 1 Natural frequency of velocity setpoint filter 1			Relevant: FDD/MSD/SLM	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 of speed setpoint filter 1 Damping of velocity setpoint filter 1			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0.7	Minimum: 0.2	Maximum: 5.0	Data type: FLOAT	Active: Immediately

Enter the damping 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 $\leq$ 2. For two configured low–pass filters 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 of speed setpoint filter 1 Blocking frequency of velocity setpoint filter 1			Relevant: FDD/MSD/SLM	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 filter). If filter 1 is parameterized as a bandstop filter, 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).

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

$$\text{MD 1001} = T_{sample} = \left\{ \begin{matrix} 62.5\ \mu s \\ 125.0\ \mu s \end{matrix} \right\} => \text{MD 1514} < \left\{ \begin{matrix} 8000\ \text{Hz} \\ 4000\ \text{Hz} \end{matrix} \right\}$$

1515	SPEED_FILTER_1_BANDWIDTH[n] 0...7 index of parameter set 840D only				Cross reference: –
	Bandwidth of speed setpoint filter 1 Bandwidth of velocity setpoint filter 1			Relevant: FDD/MSD/SLM	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 filter).

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.

1516	SPEED_FILTER_1_BW_NUMERATOR[n] n= 0...7 840D only				Cross reference: –
	Bandwidth numerator of speed setpoint filter 1 Bandwidth numerator of velocity setpoint filter 1			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 0.0	Minimum: 0.0	Maximum: 7999.0	Data type: FLOAT	Active: Immediately

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

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 bandstop filter frequency of speed setpoint filter 1 Natural bandstop filter frequency of velocity setpoint filter 1			Relevant: FDD/MSD/SLM	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 filter as a percentage with reference to MD 1514 (blocking frequency).
For MD 1520 = 100%, the filter is initialized as an attenuated bandstop filter.

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 of speed setpoint filter 2 Time constant of velocity setpoint filter 2			Relevant: FDD/MSD/SLM	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 parameter set		840D only		Cross reference: –
	Natural frequency of speed setpoint filter 2 Natural frequency of velocity setpoint filter 2			Relevant: FDD/MSD/SLM	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 of speed setpoint filter 2 Damping of velocity setpoint filter 2			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0.7	Minimum: 0.2	Maximum: 5.0	Data type: FLOAT	Active: Immediately

Enter the damping 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 $\leq$ 2. For two configured low–pass filters 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.

1517	SPEED_FILTER_2_SUPPR_FREQ[n] n= 0–7		840D only		Cross reference: –
	Blocking frequency of speed setpoint filter 2 Blocking frequency of velocity setpoint filter 2			Relevant: FDD/MSD/SLM	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 filter).

Note

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

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

$$\text{MD 1001} = T_{sample} = \begin{Bmatrix} 62.5\ \mu s \\ 125.0\ \mu s \end{Bmatrix} => \text{MD 1517} < \begin{Bmatrix} 8000\ \text{Hz} \\ 4000\ \text{Hz} \end{Bmatrix}$$

1518	SPEED_FILTER_2_BANDWIDTH[n] n= 0–7		840D only		Cross reference: –
	Bandwidth of speed setpoint filter 2 Bandwidth of velocity setpoint filter 2			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 500.0	Minimum: 5.0	Maximum: 7999.0	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 of speed setpoint filter 2 Bandwidth numerator of velocity setpoint filter 2			Relevant: FDD/MSD/SLM	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 filter. Entering a value of 0 initializes the filter as an unattenuated bandstop filter.

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 bandstop filter frequency of speed setpoint filter 2 Natural bandstop filter frequency of velocity setpoint filter 2			Relevant: FDD/MSD/SLM	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 filter as a percentage with reference to MD 1517 (blocking frequency).

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

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.

Example

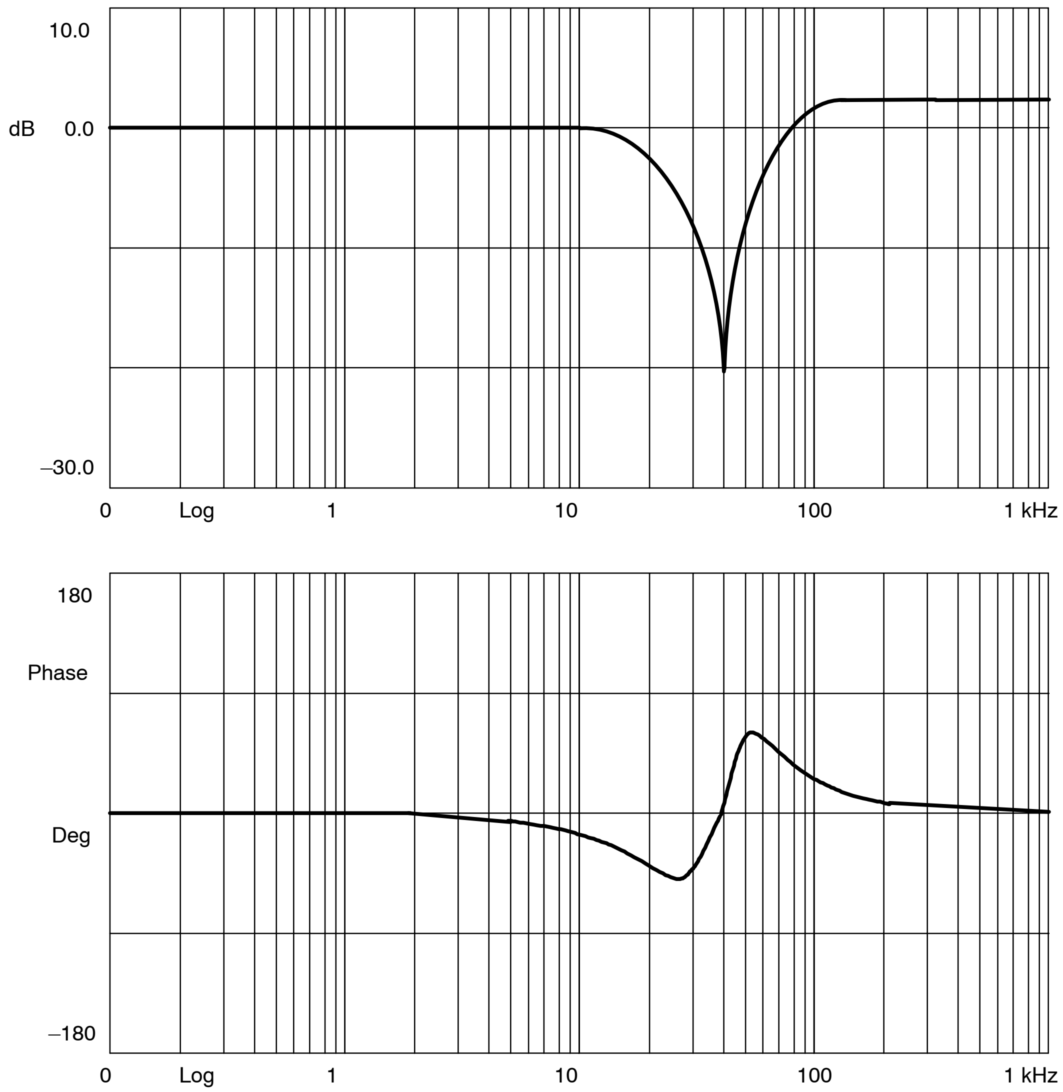


Fig. 2-18 Example 1

fz = 54 Hz
Dz = 10%
fn = 40 Hz
Dn = 70%

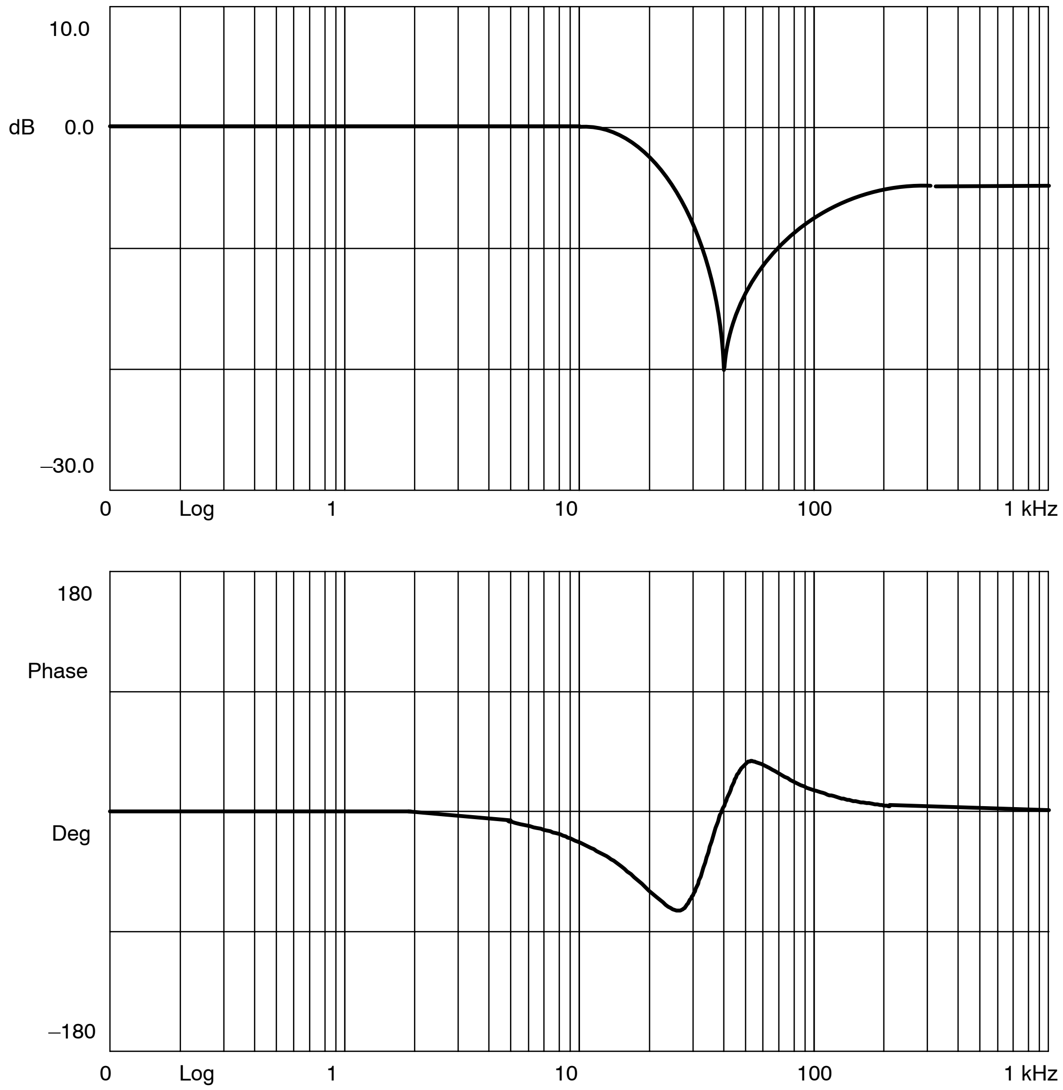


Fig. 2-19 Example 2

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			SW 6.1 and higher	Cross reference: –
	Time constant of speed actual value filter Time constant of velocity actual value filter			Relevant: MSD/FDD/SLM	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 (–> $T_{GL} \approx$ 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: –
	Speed at the start of field weakening			Relevant: MSD	Protection level: 2/4
Unit: rev/min	Default: 0.0	Minimum: 0.0	Maximum: 100000.0	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.

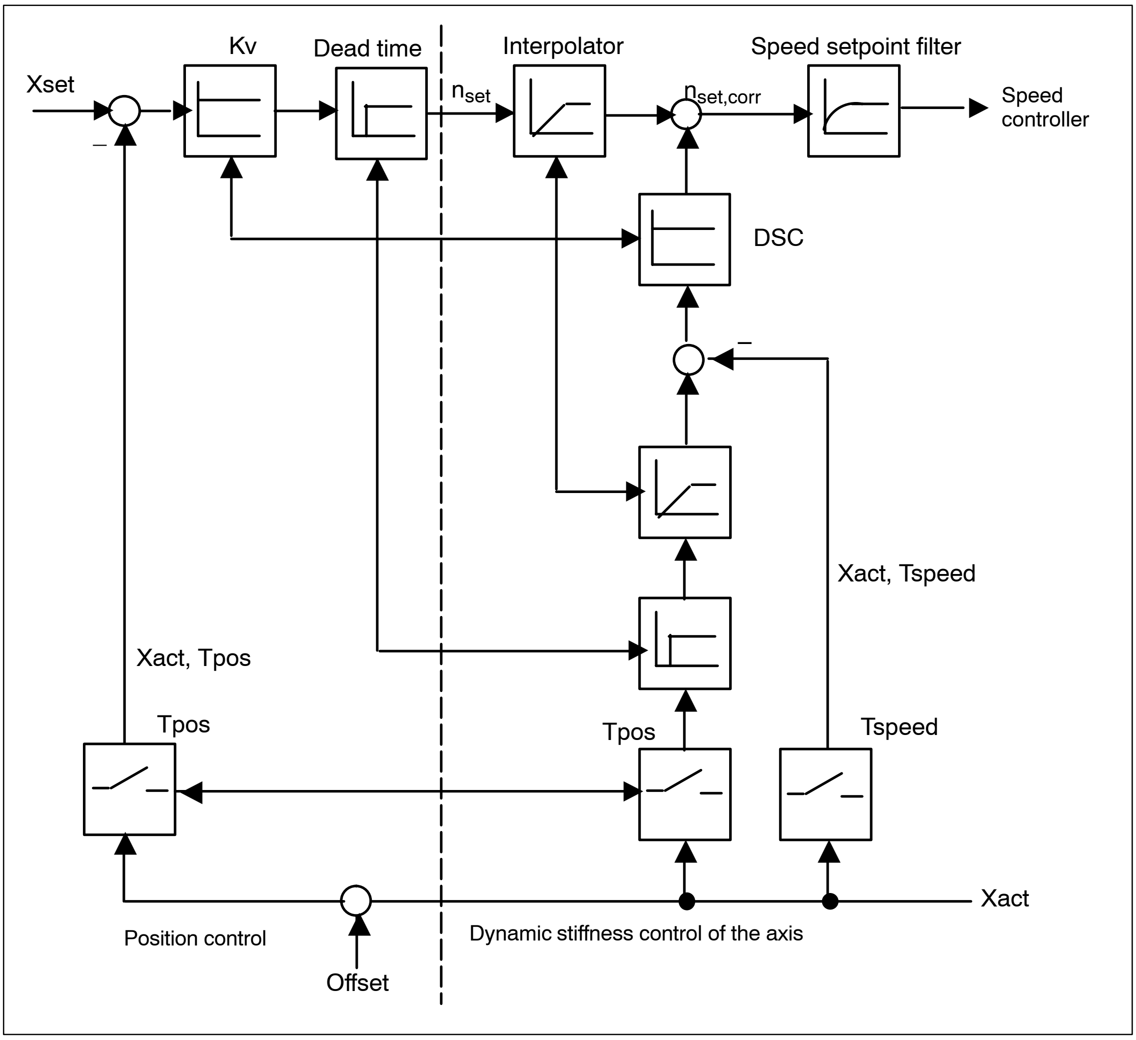


Fig. 2-20 Principle of difference in position feedforward control

Activating

Dynamic Stiffness Control is activated by NC MD 32640: STIFFNESS_CONTROL_ENABLE

Deactivating

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.

Feedforward control

The speed and speed torque feedforward controls can be used as usual. During 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 filter

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

The speed–setpoint filter is then only of any use with difference injection to support the position controller, for example, to suppress resonance.

Measuring system

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

Additional NC machine data

The following NC machine data influence dynamic stiffness control:

- MD 32642 STIFFNESS_CONTROL_CONFIG is used for configuring dynamic stiffness control.

Table 2-10 Coding MD 32642

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

■

Space for your notes

3 Supplementary Conditions

None

4 Data Descriptions (MD, SD)

See Chapter 2

5 Signal Descriptions

None

■

Space for your notes

6 Example

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/SLM
1004	CTRL_CONFIG	Configuration structure	FDD/MSD/SLM
1406	SPEEDCTRL_TYPE	Speed controller type	FDD/MSD/SLM
1407	SPEEDCTRL_GAIN_1[0...7,DRx]	P gain of speed controller	FDD/MSD/SLM
1409	SPEEDCTRL_INTEGRATOR_TIME_1[0...7,DRx]	Integral time of speed controller	FDD/MSD/SLM
1413	SPEEDCTRL_ADAPT_ENABLE[DRx]	Selection, speed controller adaptation	FDD/MSD/SLM
1408	SPEEDCTRL_GAIN_2[0...7,DRx]	P gain, upper adaptation speed	FDD/MSD/SLM
1410	SPEEDCTRL_INTEGRATOR_TIME_2[0...7,DRx]	Reset time upper adaptation speed	FDD/MSD/SLM
1411	SPEEDCTRL_ADAPT_SPEED_1[DRx]	Lower adaptation speed	FDD/MSD/SLM
1412	SPEEDCTRL_ADAPT_SPEED_2[DRx]	Upper adaptation speed	FDD/MSD/SLM
1421	SPEEDCTRL_INTEGRATOR_FEEDBK[0...7,DRx]	Time constant integrator feedback	FDD/MSD/SLM
1665	IPO_SPEEDCTRL_DELAY_FACTOR	Interpolator/speed controller cycle for RFG	FDD/MSD/SLM

7.2 Field weakening with MSD

Table 7-2 Machine data

No.	Identifier	Name	Drive
1142	FIELD_WEAKENING_SPEED[DRx]	Speed at the start of field weakening	MSD

7.3 Current setpoint filter

Table 7-3 Machine data

No.	Identifier	Name	Drive
1200	NUM_CURRENT_FILTERS[0...7,DRx]	Number of current–setpoint filters	FDD/MSD/SLM
1201	CURRENT_FILTER_CONFIG[0...7,DRx]	Type of current filter	FDD/MSD/SLM
1202	CURRENT_FILTER_1_FREQUENCY[0...7,DRx]	Natural frequency, current filter 1	FDD/MSD/SLM
1203	CURRENT_FILTER_1_DAMPING[0...7,DRx]	Damping of current filter 1	FDD/MSD/SLM
1204	CURRENT_FILTER_2_FREQUENCY[0,..7,DRx]	Natural frequency, current filter 2	FDD/MSD/SLM
1205	CURRENT_FILTER_2_DAMPING[0...7,DRx]	Damping of current filter 2	FDD/MSD/SLM
1206	CURRENT_FILTER_3_FREQUENCY[0...7,DRx]	Natural frequency, current filter 3	FDD/MSD/SLM
1207	CURRENT_FILTER_3_DAMPING[0...7,DRx]	Damping of current filter 3	FDD/MSD/SLM
1208	CURRENT_FILTER_4_FREQUENCY[0...7,DRx]	Natural frequency, current filter 4	FDD/MSD/SLM
1209	CURRENT_FILTER_4_DAMPING[0...7,DRx]	Damping of current filter 4	FDD/MSD/SLM
1210	CURRENT_FILTER_1_SUPPR_FREQ[0...7,DRx]	Blocking frequency, current filter 1	FDD/MSD/SLM
1211	CURRENT_FILTER_1_BANDWIDTH[0...7,DRx]	Bandwidth, current filter 1	FDD/MSD/SLM
1212	CURRENT_FILTER_1_BW_NUM[0...7,DRx]	Numerat. bandw. setp. current filter 1	FDD/MSD/SLM
1213	CURRENT_FILTER_2_SUPPR_FREQ[0...7,DRx]	Blocking frequency, current filter 2	FDD/MSD/SLM
1214	CURRENT_FILTER_2_BANDWIDTH[0...7,DRx]	Bandwidth, current filter 2	FDD/MSD/SLM
1215	CURRENT_FILTER_2_BW_NUM[0...7,DRx]	Numerat. bandw. setp. current filter 2	FDD/MSD/SLM
1216	CURRENT_FILTER_3_SUPPR_FREQ[0...7,DRx]	Blocking frequency, current filter 3	FDD/MSD/SLM
1217	CURRENT_FILTER_3_BANDWIDTH[0...7,DRx]	Bandwidth, current filter 3	FDD/MSD/SLM
1218	CURRENT_FILTER_3_BW_NUM[0...7,DRx]	Numerat. bandw. setp. current filter 3	FDD/MSD/SLM
1219	CURRENT_FILTER_4_SUPPR_FREQ[0...7,DRx]	Blocking frequency, current filter 4	FDD/MSD/SLM
1220	CURRENT_FILTER_4_BANDWIDTH[0...7,DRx]	Bandwidth, current filter 4	FDD/MSD/SLM
1221	CURRENT_FILTER_4_BW_NUM[0...7,DRx]	Numerat. bandw. setp. current filter 4	FDD/MSD/SLM
1222	CURRENT_FILTER_1_BS_FREQ[0...7,DRx]	BSF natural frequency of current–setpoint filter 1	FDD/MSD/SLM
1223	CURRENT_FILTER_2_BS_FREQ[0...7,DRx]	BSF natural frequency of current–setpoint filter 2	FDD/MSD/SLM
1224	CURRENT_FILTER_3_BS_FREQ[0...7,DRx]	BSF natural frequency of current–setpoint filter 3	FDD/MSD/SLM
1225	CURRENT_FILTER_4_BS_FREQ[0...7,DRx]	BSF natural frequency of current–setpoint filter 4	FDD/MSD/SLM
1272	CURRENT_FILTER_5_FREQUENCY[0...7,DRx]	Natural frequency, current filter 5	FDD/MSD/SLM
1273	CURRENT_FILTER_5_DAMPING[0...7,DRx]	Damping of current filter 5	FDD/MSD/SLM
1274	CURRENT_FILTER_5_SUPPR_FREQ[0...7,DRx]	Blocking frequency, current filter 5	FDD/MSD/SLM
1275	CURRENT_FILTER_5_BANDWIDTH[0...7,DRx]	Bandwidth, current filter 5	FDD/MSD/SLM
1276	CURRENT_FILTER_5_BW_NUM[0...7,DRx]	Numerat. bandw. setp. current filter 5	FDD/MSD/SLM
1277	CURRENT_FILTER_5_BS_FREQ[0...7,DRx]	Bandstop natural frequency of current–setpoint filter 5	FDD/MSD/SLM
1278	CURRENT_FILTER_6_FREQUENCY[0...7,DRx]	Natural frequency, current filter 6	FDD/MSD/SLM
1279	CURRENT_FILTER_6_DAMPING[0...7,DRx]	Damping of current filter 5	FDD/MSD/SLM
1280	CURRENT_FILTER_6_SUPPR_FREQ[0...7,DRx]	Blocking frequency, current filter 6	FDD/MSD/SLM
1281	CURRENT_FILTER_6_BANDWIDTH[0...7,DRx]	Bandwidth, current filter 5	FDD/MSD/SLM
1282	CURRENT_FILTER_6_BW_NUM[0...7,DRx]	Numerat. bandw. setp. current filter 6	FDD/MSD/SLM
1283	CURRENT_FILTER_6_BS_FREQ[0...7,DRx]	Bandstop natural frequency of current–setpoint filter 6	FDD/MSD/SLM
1472	CURRENT_FILTER_7_FREQUENCY[0...7,DRx]	Natural frequency, current filter 7	FDD/MSD/SLM

Table 7-3 Machine data, continued

No.	Identifier	Name	Drive
1473	CURRENT_FILTER_7_DAMPING[0...7,DRx]	Damping of current filter 7	FDD/MSD/SLM
1474	CURRENT_FILTER_7_SUPPR_FREQ[0...7,DRx]	Blocking frequency, current filter 7	FDD/MSD/SLM
1475	CURRENT_FILTER_7_BANDWIDTH[0...7,DRx]	Bandwidth, current filter 7	FDD/MSD/SLM
1476	CURRENT_FILTER_7_BW_NUM[0...7,DRx]	Numerator bandwidth, current setpoint filter 7	FDD/MSD/SLM
1477	CURRENT_FILTER_7_BS_FREQ[0...7,DRx]	Bandstop natural frequency of current setpoint filter 7	FDD/MSD/SLM
1478	CURRENT_FILTER_8_FREQUENCY[0...7,DRx]	Natural frequency, current filter 8	FDD/MSD/SLM
1479	CURRENT_FILTER_8_DAMPING[0...7,DRx]	Damping of current filter 8	FDD/MSD/SLM
1480	CURRENT_FILTER_8_SUPPR_FREQ[0...7,DRx]	Blocking frequency, current filter 8	FDD/MSD/SLM
1481	CURRENT_FILTER_8_BANDWIDTH[0...7,DRx]	Bandwidth, current filter 8	FDD/MSD/SLM
1482	CURRENT_FILTER_8_BW_NUM[0...7,DRx]	Numerator bandwidth, current setpoint filter 8	FDD/MSD/SLM
1483	CURRENT_FILTER_8_BS_FREQ[0...7,DRx]	Bandstop natural frequency of current setpoint filter 8	FDD/MSD/SLM
1484	CURRENT_FILTER_9_FREQUENCY[0...7,DRx]	Natural frequency, current filter 9	FDD/MSD/SLM
1485	CURRENT_FILTER_9_DAMPING[0...7,DRx]	Damping of current filter 9	FDD/MSD/SLM
1486	CURRENT_FILTER_9_SUPPR_FREQ[0...7,DRx]	Blocking frequency, current filter 9	FDD/MSD/SLM
1487	CURRENT_FILTER_9_BANDWIDTH[0...7,DRx]	Bandwidth, current filter 9	FDD/MSD/SLM
1488	CURRENT_FILTER_9_BW_NUM[0...7,DRx]	Numerator bandwidth, current setpoint filter 9	FDD/MSD/SLM
1489	CURRENT_FILTER_9_BS_FREQ[0...7,DRx]	Bandstop natural frequency of current setpoint filter 9	FDD/MSD/SLM
1490	CURRENT_FILTER_10_FREQUENCY[0...7,DRx]	Natural frequency, current filter 10	FDD/MSD/SLM
1491	CURRENT_FILTER_10_DAMPING[0...7,DRx]	Damping of current filter 10	FDD/MSD/SLM
1492	CURRENT_FILTER_10_SUPPR_FREQ[0...7,DRx]	Blocking frequency, current filter 10	FDD/MSD/SLM
1493	CURRENT_FILTER_10_BANDWIDTH[0...7,DRx]	Bandwidth, current filter 10	FDD/MSD/SLM
1494	CURRENT_FILTER_10_BW_NUM[0...7,DRx]	Numerator bandwidth, current setpoint filter 10	FDD/MSD/SLM
1496	CURRENT_FILTER_10_BS_FREQ[0...7,DRx]	Bandstop natural frequency of current setpoint filter 10	FDD/MSD/SLM

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/SLM
1246	CURRENT_SMOOTH_HYSTERESIS	Hysteresis, speed–dependent torque–setpoint smoothing	FDD/MSD/SLM

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/SLM
1501	SPEED_FILTER_TYPE [n]	Type of speed–setpoint filters	FDD/MSD/SLM
1502	SPEED_FILTER_1_TIME[0...7,DRx]	Time constant setpoint speed filter 1	FDD/MSD/SLM
1506	SPEED_FILTER_1_FREQUENCY[n]	Natural frequency, speed setpoint filter 1	FDD/MSD/SLM
1507	SPEED_FILTER_1_DAMPING [n]	Damping, speed setpoint filter 1	FDD/MSD/SLM
1514	SPEED_FILTER_1_SUPR_FREQ[n]	Blocking frequency, speed setpoint filter 1	FDD/MSD/SLM
1515	SPEED_FILTER_1_BANDWIDTH [n]	Bandwidth, speed setpoint filter 1	FDD/MSD/SLM
1516	SPEED_FILTER_1_BW_NUM [n]	Bandwidth numerator, speed setpoint filter 1	FDD/MSD/SLM
1520	SPEED_FILTER_1_BS_FREQ	Natural frequency bandstop speed–setpoint filter 1	FDD/MSD/SLM
1503	SPEED_FILTER_2_TIME [n]	Time constant, speed setpoint filter 2	FDD/MSD/SLM
1508	SPEED_FILTER_2_FREQUENCY[n]	Natural frequency, speed setpoint filter 2	FDD/MSD/SLM
1509	SPEED_FILTER_2_DAMPING [n]	Damping, speed setpoint filter 2	FDD/MSD/SLM
1517	SPEED_FILTER_2_SUPR_FREQ[n]	Type of speed–setpoint filters	FDD/MSD/SLM
1518	SPEED_FILTER_2_BANDWIDTH [n]	Bandwidth, speed setpoint filter 2	FDD/MSD/SLM
1519	SPEED_FILTER_2_BW_NUM [n]	Bandwidth numerator, speed setpoint filter 2	FDD/MSD/SLM
1521	SPEED_FILTER_2_BS_FREQ	Natural frequency bandstop speed–setpoint filter 2	FDD/MSD/SLM

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/FDD/SLM

7.7 Dynamic Stiffness Control (DSC)

Table 7-7 NC machine data

No.	Identifier	Name	Drive
32640	STIFFNESS_CONTROL_ENABLE	Dynamic Stiffness Control	FDD
32642	STIFFNES_CONTROL_CONFIG	Configuration of dynamic stiffness control	FDD
32644	STIFFNESS_DELAY_TIM	Configuration of a compensation delay time for the dynamic stiffness control with optimum DP cycle	FDD

■

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

Extended Drive Functions (DE1)

1 Product Brief

Note

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

IM operation

The IM operation of the SIMODRIVE 611D main spindle drive is used to control the speed of induction motors in 4 quadrants, without using speed or rotor position encoders. IM operation is mainly used in the area of standard motors or high–speed special motors, for grinding applications and for punch drives and press drives.

V/f mode

V/f operation allows induction motors and 1FT6 feed motors to be used without encoder evaluation. V/f operation is used for troubleshooting 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, to adapt the torque and speed characteristics of the spindle to the machine requirements. In IM operation, 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.

Permanent–magnet spindle

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

■

Space for your notes

Detailed Description 2

Note

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

2.1 IM operation

2.1.1 Description

IM operation

The IM function supports pure IM operation (MD 1465 = 0) or mixed MSD/IM operation.

The IM operation of the SIMODRIVE 611D digital is used to control the speed of induction motors in 4 quadrants, without using speed or rotor position encoders.

Induction motor operation permits higher demands to be fulfilled regarding the dynamic control performance and the stall immunity of conventional converter drives with V/f 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.

Applications

IM operation is used primarily in the area of standard motors, high–speed special motors, for grinding applications and for punch drives and press drives.

MSD operation:
MSD operation with encoder is for high speed accuracy, dynamics and positioning, MD 1465 > n_{max}.
Application: Spindles, spindle positioning

Closed–loop control

As the dynamic performance in IM mode is less than in the main spindle drive mode with speed controller a speed torque frequency pre–control is implemented, in order to improve the dynamic performance. This pre–control is only active in induction motor operation. 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 controlled optimally from a time perspective. This means, that when correctly parameterized, overshoot is prevented and the controlled dynamic performance is enhanced.

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

At low speeds, for pure IM operation, 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. For this reason, 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.

Note

The value in MD 1458 should be taken into account when dimensioning the power section, particularly in those cases where the controlled operational state lasts for a long time. The maximum current specified with MD 1458 is also used with low speeds and torques; this can lead to long–term damage or to a power section whose dimensions are too small being destroyed.

Behavior after pulse suppression

When the pulses are suppressed and the drive is in pure IM operation, the drive converter does not have any information regarding the motor actual 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/IM operation

The MSD/IM function enables the control response to be switched during operation from MSD to IM control for high speeds, depending on the speed.
Machine data: MD 1465 > 0, < n_{max}. The switchover takes place automatically, depending on the setting of the speed threshold in MD 1465.
A switchover via a digital input, for example, is not possible.

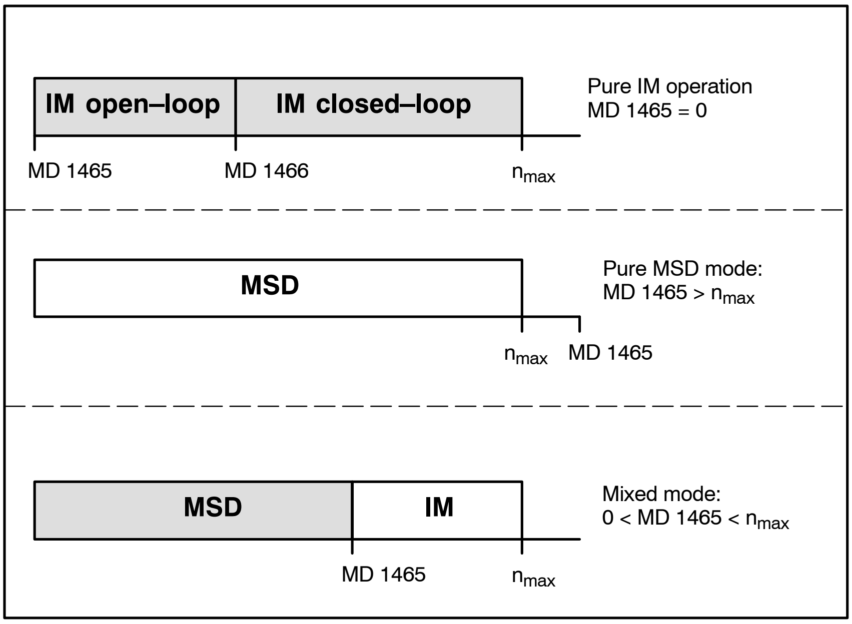


Fig. 2-1 Operating ranges, MSD/IM

Notes

In pure IM operation, 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 IM operation, 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: FDD closed–loop controlled
Bit 4: MSD operation
Bit 8: IM open–loop controlled
Bit 9: IM 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 mode can, in IM 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) induction motors without speed and rotor position encoders or main spindle motors with encoder. The drive module is configured as spindle (main spindle drive) in the drive group. Further steps for induction motor startup are described below.

Selecting motors from the MLFB list

The motor/power section data display is accessed using the **Diagnosis\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 automatically). 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.

Table 2-1 Rating plate data to be entered

MD No.	Identifier	Description
MD 1103	MOTOR_NOMINAL_CURRENT	Rated motor current
MD 1119	SERIES_INDUCTANCE	Inductance of the series reactor
MD 1129	POWER_FACTOR_COS_PHI	cos φ power factor
MD 1130	MOTOR_NOMINAL_POWER	Rated motor output
MD 1132	MOTOR_NOMINAL_VOLTAGE	Rated motor voltage
MD 1134	MOTOR_NOMINAL_FREQUENCY	Rated motor frequency
MD 1146	MOTOR_MAX_ALLOWED_SPEED	Maximum 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 resistance, cold
MD 1138	ROTOR_COLD_RESISTANCE	Rotor resistance, cold
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	Speed at the start of 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, IM operation is activated by entering the MSD/IM changeover speed (MD 1465). The following machine data must also be adapted for IM operation:

- MD 1100: PWM_FREQUENCY
- MD 1602: MOTOR_ TEMP_WARN_LIMIT
- MD 1608: MOTOR_FIXED_TEMPERATURE

Table 2-3 IM operation parameters

MD No.	Identifier	Description
MD 1451	SPEEDCTRL_GAIN_1_AM	P gain, speed controller IM
MD 1453	SPDEECTRL_INTEGR_TIME_1_AM	Integral action time, speed controller IM
MD 1458	DES_CURRENT_OPEN_LOOP_AM	Current setpoint, open–loop controlled range IM
MD 1459	TORQUE_SMOOTH_TIME_AM	Torque smoothing time constant IM
MD 1465	SWITCH_SPEED_MSD_AM	Changeover speed, MSD/IM
MD 1466	SWITCH_SPD_OPEN_LOOP_AM	Changeover speed, closed–loop/ open–loop control, IM

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–startup for IM/MSD is possible only in conjunction with HMI Advanced.

Danger

During self–startup, motor movements are initiated, which can reach the maximum motor speed.

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

Self–startup

Self–startup supports the connection of third–party induction 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–startup function is used to improve the result.

During self–startup, voltage, current and speed setpoint patterns are sent to the motor and the reaction of the motor used to obtain data for the equivalent circuit diagram data.

Prerequisites for commissioning

- Pulse and servo enable signals are required
- Self–startup is possible in MSD and IM operation.
  With MSD, the moment of inertia is not specified.
- Self–startup 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–startup.

Flow chart for starting up third–party motors

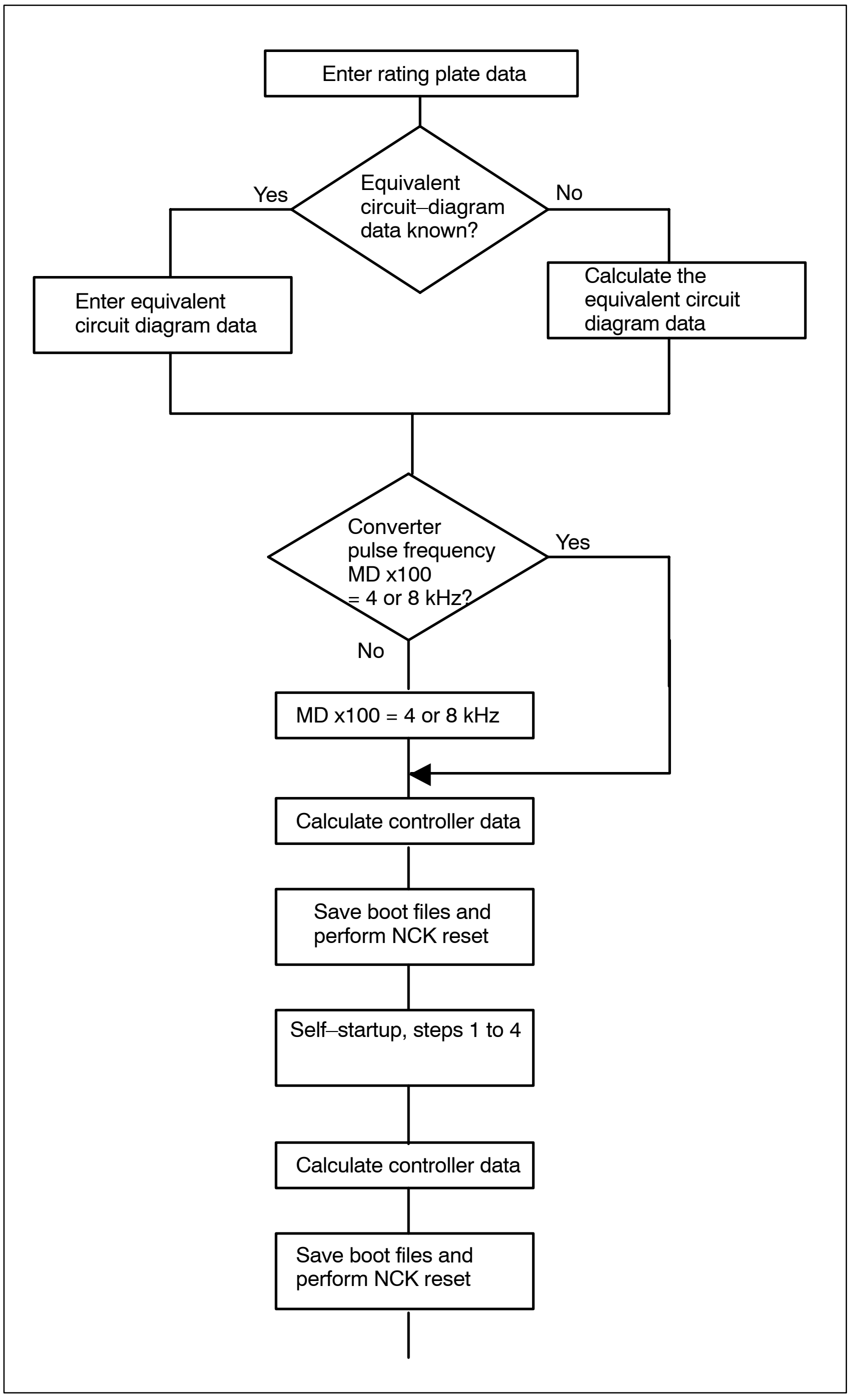


Fig. 2-2 Flow chart for starting up third–party motors

2.1.4 Self–startup, steps 1 to 4

Main menu for IM/MSD self–startup

The main menu for self–startup is called up by pressing the **Drives/Servo/Self–opt. IM/MSD** softkeys

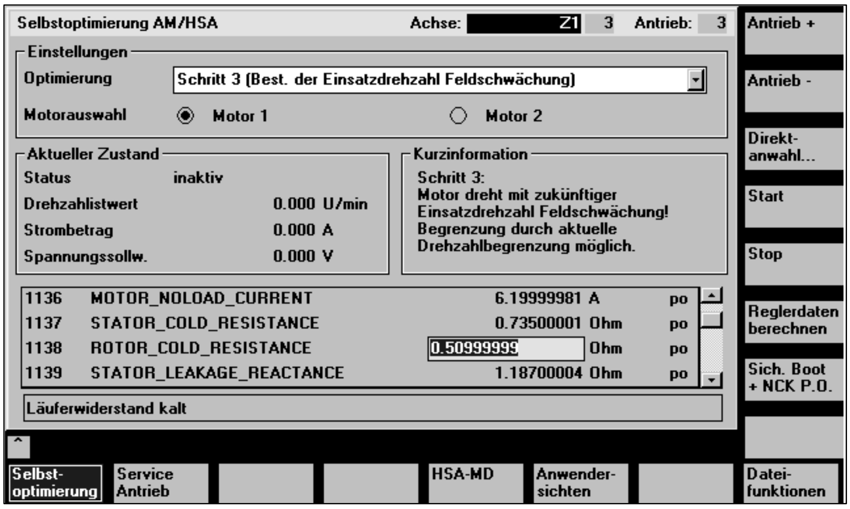


Fig. 2-3 Main menu for IM/MSD self–startup

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 IM/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 ”Actual state” and ”Brief information”.

Calculate controller data

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 IM/MSD”.

User views

The display switches to ”User views”. You can only revert by pressing the **RECALL** 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 IM operation.

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.

Modified machine data

The following machine data are calculated/written:

- MD x136: MOTOR_NOLOAD_CURRENT
- MD x137: 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 a positive rotating field, up to the rated 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.

Modified 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 $V_{DC\ link}$, a converter output voltage of 380 V is set.
If $V_{DC\ link}$ < 600 V, the converter output voltage is reduced by a factor of $V_{DC\ link}$ / 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.

Modified 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 such that there is no I component in the speed controller when accelerating to maximum speed.

Danger

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

Note

This step is omitted when self–startup 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.

Modified machine data

The following machine data is calculated/written:

- MD x117: MOTOR_INERTIA

Errors during self–startup

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

References: /DA/ SINUMERIK/SIMODRIVE Diagnostics Manual

2.1.5 Messages during self–startup

The following error messages may appear at the start of or during self–startup.

- **Startup step not (currently) permissible**
  You have selected a self–startup 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.**
  In step 1, an inverter frequency of 4 kHz or 8 kHz is required (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 x119: SERIES_INDUCTANCE).

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

- **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–startup 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 IM operation, 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, IM speed controller			Relevant: MSD	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 IM operation or set (initialize) it automatically by selecting **Calculate controller data**.

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

Enter the speed controller integral action time in IM operation or set (initialize) it automatically via the **Calculate controller data** operator action.

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

In pure IM operation (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 IM			Relevant: MSD	Protection level: 2/4
Unit: ms	Default: 4.0	Minimum: 0.0	Maximum: 100.0	Data type: FLOAT	Active: Immediately

In IM operation, speed torque frequency feedforward control is implemented on account of the low dynamics. The feedforward control value for the torque is smoothed using MD 1459.

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

The drive operates in IM operation above the speed set here.

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

If IM operation is selected, only pulse frequencies (MD 1100) of 4 kHz and 8 kHz are permissible.
If **Calculate controller data** is selected, MD 1465 is set to 0 if ”No” is entered in MD 1011.5 Motor measuring system available.

1466	SWITCH_SPD_OPEN_LOOP_AM		840D only		Cross reference: –
	Changeover speed, open–loop/closed–loop control, IM Changeover velocity, open–loop/closed–loop control, IM			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: rev/min SLM: m/min	Default: 300.0 SLM: 20.0	Minimum: 5.0 SLM: 3.0	Maximum 100,000.0	Data type: FLOAT	Active: Immediately

The current frequency, open–loop controlled mode is used for pure IM operation (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 mode

2.2.1 Description

V/f mode permits the operation of:

- Asynchronous motors without encoder
- 1FK6 feed motors

V/f mode can be used:

- For diagnostic purposes for feed drives and main spindle drives

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Note

V/f mode 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 mode 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 mode with MSD (diagnostics only)

Commissioning

For V/f mode, 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 IM operation and the **Calculate equivalent circuit diagram data** and **Calculate controller data** functions executed.

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

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

MD No.	Identifier	Description
MD 1014	UF_MODE_ENABLE	Activates V/f mode
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 mode
MD 1132	MOTOR_NOMINAL_VOLTAGE	Rated motor voltage
MD 1134	MOTOR_NOMINAL_FREQUENCY	Rated motor frequency
MD 1146	MOTOR_MAX_ALLOWED_SPEED	Maximum motor speed
MD 1103	MOTOR_NOMINAL_CURRENT	Rated 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 the max. useful motor speed
MD 1405	MOTOR_SPEED_LIMIT	Monitoring speed, motor
MD 1730	OPERATING_MODE	Operating mode

V/f characteristic, MSD

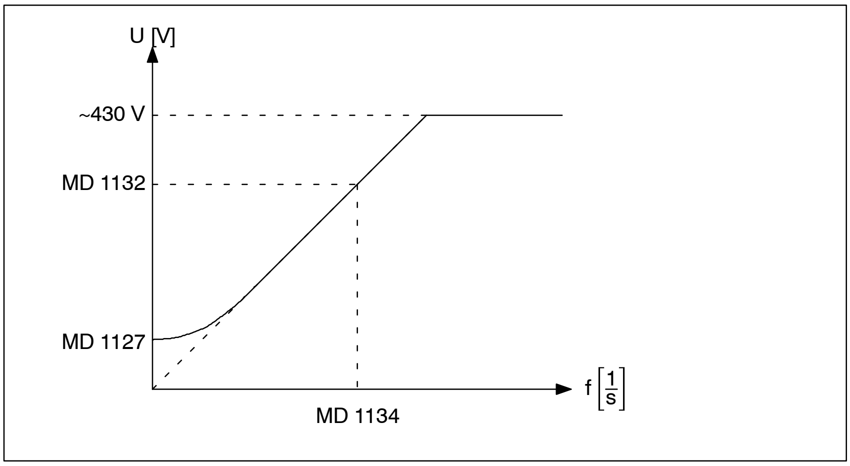


Fig. 2-4 V/f characteristic, MSD

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

One of the two ramp–up times is selected via the ”Ramp–up time” IS 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 mode.

2.2.3 V/f mode with FDD

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

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

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

MD No.	Identifier	Description
MD 1014	UF_MODE_ENABLE	Activates V/f mode
MD 1104	MOTOR_MAX_CURRENT	Max. motor current
MD 1105	MOTOR_MAX_CURRENT_REDUCTION	Reduced maximum 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 the max. useful motor speed
MD 1405	MOTOR_SPEED_LIMIT	Monitoring speed, motor

V/f characteristic, FDD

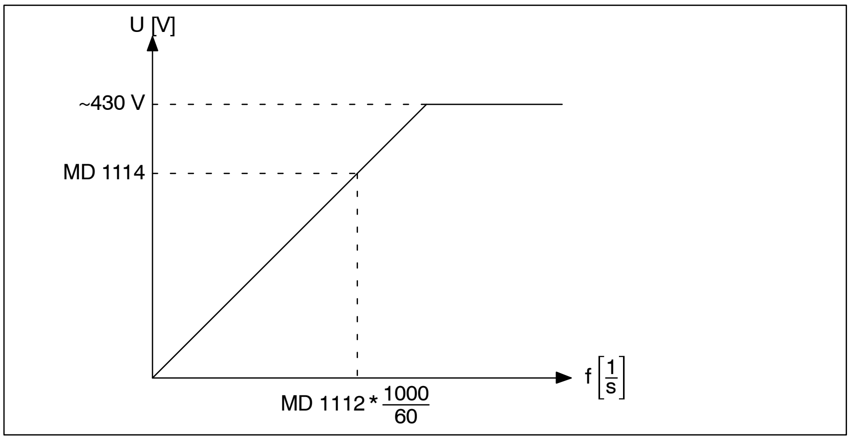


Fig. 2-5 V/f characteristic, FDD

The speed setpoint conversion into the frequency to be used as reference 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 drive motors to oscillate in V/f mode.

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

2.2.4 Machine data

1014	UF_MODE_ENABLE			840D only	Cross reference: –
	Activates V/f mode			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 1	Data type: UNS.WORD	Effective: Reset

Activates V/f mode for feed 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 mode			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: s	Default: 5.0	Minimum: 0.01	Maximum: 100.0	Data type: FLOAT	Active: Immediately

If V/f mode 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 mode			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: s	Default: 5.0	Minimum: 0.01	Maximum: 100.0	Data type: FLOAT	Active: Immediately

If V/f mode 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 mode			Relevant: MSD	Protection level: 2/4
Unit: V	Default: 2.0	Minimum: 0.0	Maximum: 20.0	Data type: FLOAT	Active: Immediately

When V/f mode 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: FDD/MSD/SLM	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/f mode in the diagnostic word

Table 2-6 Diagnostic control

Bit 8 (up to SW 3.1)	Voltage controlled, V/f mode	0 = Normal operation 1 = V/f mode active

!

Important

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

1660	UF_MODE_FREQUENCY		840D only		Cross reference: –
	Motor frequency, V/f mode			Relevant: FDD/MSD/SLM	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 the voltage controlled V/f mode. 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 mode			Relevant: FDD/MSD/SLM	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 the voltage controlled V/f mode. The following applies to the V_q voltage applied to the drive:

V_q = MD 1661 x MD 1660

1662	UF_MODE_DELTA_FREQUENCY		840D only		Cross reference: –
	Motor frequency change, V/f mode			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hz/s	Default: 5.0	Minimum: 0.0	Maximum: 10000.0	Data type: FLOAT	Active: Immediately

Enter a change in the motor frequency for V/f mode 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

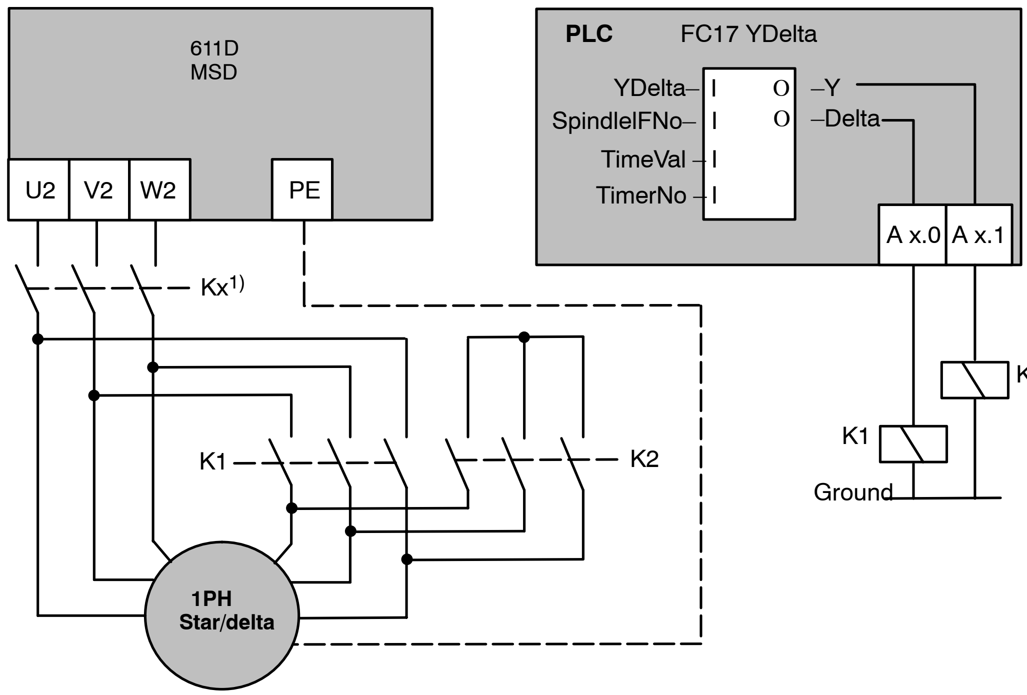
2.3.1 Star/delta changeover

Description

Motors with star/delta changeover support a wide constant power range. At lower speeds, the motor is operated in the star circuit configuration (high torque) and at higher speeds, in the delta circuit configuration (high stall torque). Changeover is also possible during operation. When changing over between star and delta mode, it is possible to additionally select between eight drive parameter sets [0...7]. The changeover sequence is controlled via function block FC17: 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 Terminal connection diagram, star/delta changeover

Motor changeover

In V/f mode or IM 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/IM)

General

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 approx. 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 IM 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/IM.

If the appropriate activation bit is not set in MD 1013: Setting ENABLE_STAR_DELTA, bit 1 and selecting the motor parameter set via the PLC interface parameterized in FC17 effects an immediate changeover to the pulse frequency defined in the parameter set.

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 ±5% of the speed value from MD 1247: MOTOR_SWITCH_SPEED.

2.4 Motor changeover for asynchronous motors

General

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), from SW 6.3.11
4. Motor data set (from MD: 4000), from SW 6.3.11

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.

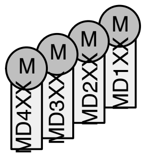
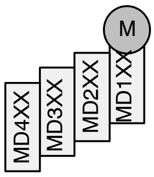
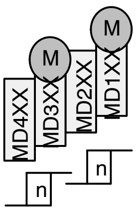
Motor bit 0 –> Bit 3
Motor bit 1 –> Bit 4

2.4.1 Motor changeover versions

1013	**ENABLE_STAR_DELTA**				**Cross reference:** –
	Enable motor/data set changeover			Relevant: FDD/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	**Feature:** Motor data set 1 (MD 1xxx) is always selected. The motor bits in the control word are not evaluated.
Bit 0 set	Max. 4 motors, each with 1 motor data set 	**Features:** • The pulses are canceled at each changeover operation. **Application:** • Changeover of several motors[1)] • Selection of the motor data set via control bit, see Section 2.4.2.
Bit 0=1 Bit 1=1 set => 3	1 motor with a maximum of 4 motor data sets 	**Features:** • The pulses are not canceled when changing 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 Section 2.4.3.
Bit 0 + Bit 1 + Bit 2 set => 7	Max. 2 motors each with 2 motor data sets 	**Features:** • 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 changeover) – one motor – two motors – star/delta mode • Selection of the motor data set via control bit, see Section 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 only possible for identical incremental encoders.

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 1 = 0 –> Motor 2, Data set 2
- Motor bit 1 = 0; Motor bit 1 = 0 –> Motor 3, Data set 3
- Motor bit 1 = 1; Motor bit 1 = 0 –> 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 variant can be use 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 1 = 0 –> Motor 1, Data set 2
- Motor bit 1 = 0; Motor bit 1 = 0 –> Motor 1, Data set 3
- Motor bit 1 = 1; Motor bit 1 = 0 –> Motor 1, Data set 4

2.4.4 Star/delta switchover with FC17 (SW 6.4 and higher)

Description of functions

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 the ”Pulses enabled” = 0 (DB 31, ... DBX93.7) checkback signal and the acknowledgment of the announced 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).

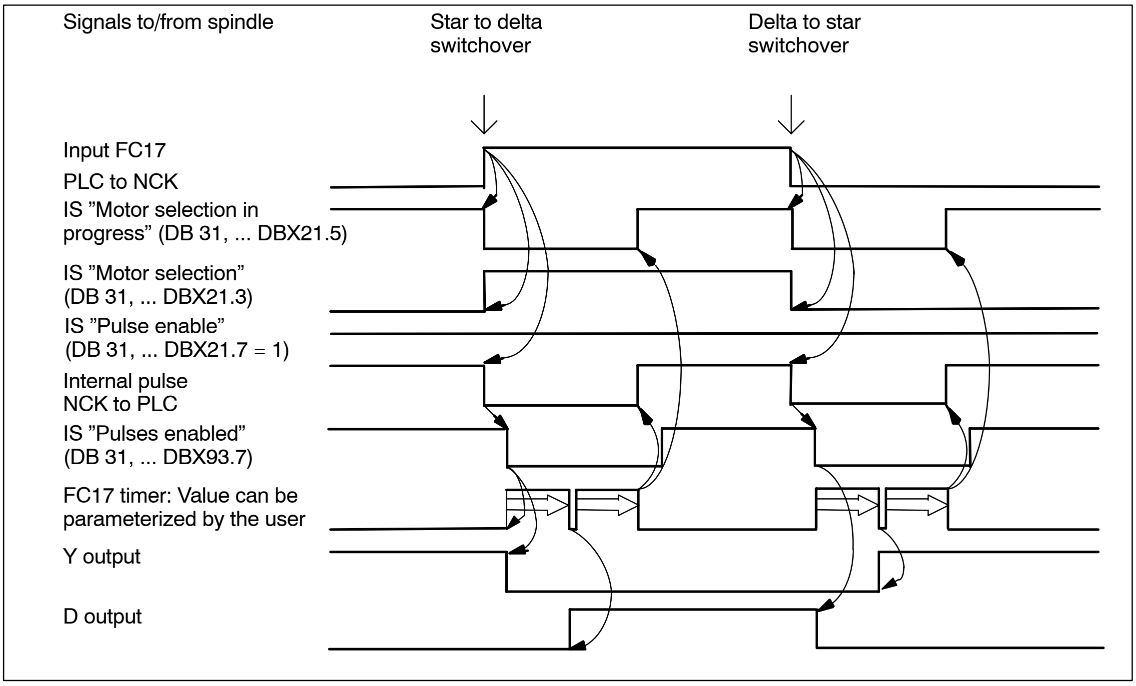


Fig. 2-7 Timing with interface signals with a delay of 500 ms set in FC17

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”

Interrupts

401702	Impermissible channel no. parameter in FC17
Explanation	The parameterized spindle does not exist
Reaction	Interrupt 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 characteristics

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 switchover, certain restrictions 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 FC17 (
        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 Machine

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 MD1247.
The speed threshold for Motor 2 is parameterized in MD1248.

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**				**Cross reference:** –
	Speed threshold motor changeover 1			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: rev/min	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**				**Cross reference:** –
	Speed threshold motor changeover 2			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: rev/min	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).

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)

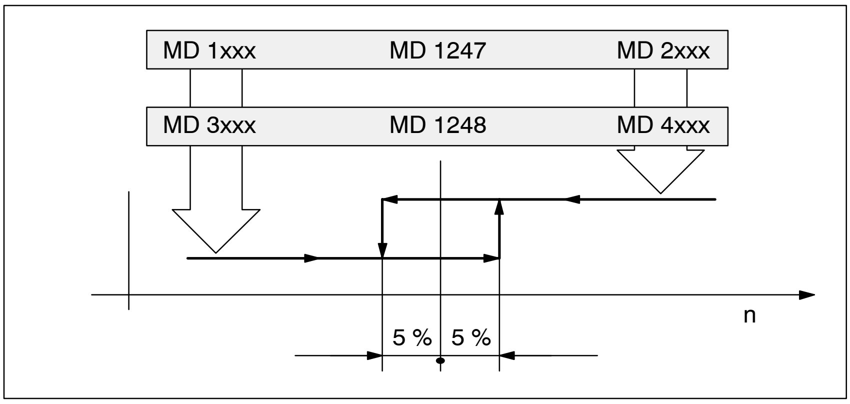


Fig. 2-8 Hysteresis

2.4.6 Motor data sets

Table 2-8 Motor–data–set–dependent machine data

Motor data set				Description
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	Frequency, pulse–width modulation
1102	2102	3102	4102	Motor code number **Note:** • When using several catalog motors, the motor data is only valid after first entering the appropriate motor code, followed by data save and POWER ON. • 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. • After manually changing the motor code number, the following parameters must be checked, and if required, set to practical values: – MD 1401, MD 2401, MD 3401 or MD 4401 (speed for maximum useful motor speed) – MD 1147, MD 2147, MD 3147 or MD 4147 (speed limit)
1103	2103	3103	4103	Rated motor current
1117	2117	3117	4117	Motor moment of inertia
1119	2119	3119	4119	Inductance of the series reactor
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 mode
1129	2129	3129	4129	cos phi power factor
1130	2130	3130	4130	Rated motor output
1132	2132	3132	4132	Rated motor voltage
1134	2134	3134	4134	Rated motor frequency
1135	2135	3135	4135	Motor no–load voltage
1136	2136	3136	4136	Motor no–load current
1137	2137	3137	4137	Stator resistance, cold

Table 2-8 Motor–data–set–dependent machine data, continued

Motor data set				Description
1	2	3	4	
1138	2138	3138	4138	Rotor resistance, cold
1139	2139	3139	4139	Stator leakage reactance
1140	2140	3140	4140	Rotor leakage reactance
1141	2141	3141	4141	Magnetizing reactance
1142	2142	3142	4142	Speed at the start of field weakening
1143	2143	3143	4143	Upper speed, Lh characteristic
1144	2144	3144	4144	Gain factor, Lh characteristic
1145	2145	3145	4145	Stall (standstill) torque reduction factor
1146	2146	3146	4146	Maximum motor speed
1147	2147	3147	4147	Speed limitation
1148 1)	2148	3148	4148	Speed at the start of the stall power
1150	2150	3150	4150	Flux controller P gain
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	Force due to weight
1230:8	2230:8	3230:8	4230:8	1st torque limit value
1231	2231	3231	4231	2nd torque limit value
1232	2232	3232	4232	Switching speed from MD 1230 to MD 1231
1233:8	2233:8	3233:8	4233:8	Regenerative limiting
1234	2234	3234	4234	Hysteresis around MD 1232
1235:8	2235:8	3235:8	4235:8	1st power limit value
1236	2236	3236	4236	2nd 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. Mset smoothing
1246	2246	3246	4246	Hysteresis for speed–dep. Mset smoothing
1288	2288	3288	4288	Shutdown threshold, thermal motor model
1400	2400	3400	4400	Rated motor speed
1401:8	2401:8	3401:8	4401:8	Speed for the max. useful motor speed
1403	2403	3403	4403	Shutoff speed for pulse suppression
1405:8	2405:8	3405:8	4405:8	Monitoring speed, motor
1407:8	2407:8	3407:8	4407:8	P gain of speed controller
1408:8	2408:8	3408:8	4408:8	P gain, upper adaptation speed
1409:8	2409:8	3409:8	4409:8	Integral time of speed controller

Table 2-8 Motor–data–set–dependent machine data, continued

Motor data set				Description
1	2	3	4	
1410:8	2410:8	3410:8	4410:8	Integral action 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
1417:8	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 bandwidth for ”nset = nact” signal
1451:8	2451:8	3451:8	4451:8	P gain, speed controller IM
1453:8	2453:8	3453:8	4453:8	Integral action time, speed controller IM
1458	2458	3458	4458	Current setpoint, open–loop controlled range IM
1459	2459	3459	4459	Torque smoothing time constant IM
1465	2465	3465	4465	Changeover speed, MSD/IM
1466	2466	3466	4466	Changeover speed, closed–loop/open–loop control IM
1602	2602	3602	4602	Warning threshold, motor overtemperature
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. With a higher pulse frequency, higher speeds can be achieved.

Frequency pulse width modulation should always be approx. 6 times that of the maximum motor frequency at least.

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)

2.5.1 Description

General

Motor changeover can also be used for synchronous motors with incremental encoders. In addition to the winding changeover, it is also possible to change between identical encoders in motor encoder units with a software–controlled relay. However, you **cannot** change over between synchronous and asynchronous motors.

Synchronous motors have four motor data sets. 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.

The motor changeover function **cannot** be used for linear motors!

Parameterization

Variants for the motor changeover (MD 1013), also refer to Table 2-7.

1013	ENABLE_STAR_DELTA				Cross reference: –
	Enable motor/data set changeover			Relevant: FDD/MSD	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 7	Data type: UNS. WORD	Active: Power On

Depending on the setting in MD 1013 (motor changeover) the following changeover functions can be implemented:

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. <u>The controlling user program must ensure adherence to this requirement.</u>

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**				**Cross reference:** –
	Rotor position adjustment			Relevant: FDD/MSD	Protection level: 2/4
Unit: Degr.	Default: 0.0	Minimum: 0.0	Maximum: 360.0	Data type: FLOAT	Active: Immediately

The winding changeover runs 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 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 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).

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 identical motor/encoder units via an external 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 first 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.

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 (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 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.

2.5.2 Motor data sets

On synchronous motors, the following machine data below are used for motor changeover:

1013	Enable motor/data set changeover (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				Description
1	**2**	**3**	**4**	
1013	2013	3013	4013	Enable motor/data set changeover
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	Process of rotor/pole position identification
1076	2076	3076	4076	Load moment of inertia factor
1077	2077	3077	4077	Integrator time for RLI controller
1098	2098	3098	4098	Power section derating limit current
1099	2099	3099	4099	Power section limit current derating factor
1100	2100	3100	4100	Frequency, pulse–width modulation
1102	2102	3102	4102	Motor code number
1103	2103	3103	4103	Rated motor current
1104	2104	3104	4104	Max. motor current
1105	2105	3105	4105	Reduced maximum motor current
1112	2112	3112	4112	Motor pole pair number
1113	2113	3113	4113	Torque constant

Motor data set				Description
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 limiting 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 short–circuit current
1142	2142	3142	4142	Speed at the start of field weakening
1145	2145	3145	4145	Stall (standstill) torque reduction factor
1146	2146	3146	4146	Maximum motor speed
1147	2147	3147	4147	Speed limitation
1149	2149	3149	4149	Reluctance torque constant
1150	2150	3150	4150	Flux controller P gain
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 width
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	Force due to weight
1230	2230:8	3230:8	4230:8	1st torque limit value
1231	2231	3231	4231	2nd torque limit value
1232	2232	3232	4232	Switching speed from MD 1230 to MD 1231
1233	2233:8	3233:8	4233:8	Regenerative limiting
1234	2234	3234	4234	Hysteresis around MD 1232
1235	2235:8	3235:8	4235:8	1st power limit value
1236	2236	3236	4236	2nd power limit value
1239	2239	3239	4239	Torque limit for setup mode

Motor data set				Description
1	2	3	4	
1245	2245	3245	4245	Threshold for speed–dep. Mset smoothing
1246	2246	3246	4246	Hysteresis for speed–dep. Mset 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 the max. useful motor speed
1403	2403	3403	4403	Shutoff speed for pulse suppression
1405	2405:8	3405:8	4405:8	Monitoring speed, motor
1407	2407:8	3407:8	4407:8	P gain of speed controller
1408	2408:8	3408:8	4408:8	P gain, upper adaptation speed
1409	2409:8	3409:8	4409:8	Integral time of speed controller
1410	2410:8	3410:8	4410:8	Integral action 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 bandwidth for ”nset = nact” signal
1602	2602	3602	4602	Warning threshold, motor overtemperature
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		840D only		Cross reference: –
	Response voltage, generator axis			Relevant: FDD/MSD/SLM	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: FDD/MSD/SLM	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: FDD/MSD/SLM	Protection level: 2/4
Unit: V	Default: 510.0	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. 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: FDD/MSD/SLM	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 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: FDD/MSD/SLM	Protection level: 2/4
Unit: rev/min	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.

1636	RETRACT_AND_GENERATOR_MODE		840D only	Cross reference: –	
	Drive modes, emergency retraction			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default:	Minimum:	Maximum:	Data type: UNS.WORD	Active: Immediately
810D	0.0	0.0	0.0		
840D	0.0	0.0	7.0		

!

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	Operating mode
0	Normal status
1	Monitoring mode
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 mode
7	Generator mode without the option to return to normal mode

1637	GEN_STOP_DELAY		840D only	Cross reference: –	
	Delay, regenerative braking			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: ms	Default: 0	Minimum: 0	Maximum: 65 535	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: FDD/MSD/SLM	Protection level: 2/4
Unit: ms	Default: 0	Minimum: 0	Maximum: 65 535	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		840D only		Cross reference: –
	Emergency retraction speed			Relevant: FDD/MSD/SLM	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 V_{DC} 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 ”V_{DC} > threshold” is output.

The configuration must ensure that the sum of all feedback motion axes cannot destroy the I/RF unit.

Alarm 300603 can be influenced by MD 1601 or MD 1613 Bit 3.

Machine data

1162	LINK_VOLTAGE_MIN		840D only		Cross reference: –
	Minimum DC–link voltage			Relevant: FDD/MSD	Protection level: 2/4
Unit: V	Default: 0.0	Minimum: 0.0	Maximum: 800.0	Data type: UNS.WORD	Active: Immediately

1163	LINK_VOLTAGE_MAX		840D only		Cross reference: –
	Maximum DC–link voltage			Relevant: FDD/MSD	Protection level: 2/4
Unit: V	Default: 800.0	Minimum: 0.0	Maximum: 800.0	Data type: UNS.WORD	Active: Immediately

1164	LINK_VOLTAGE_SPEED_SETUP		840D only		Cross reference: –
	Only V_{DC} monitoring from motor speed			Relevant: FDD/MSD	Protection level: 2/4
Unit: rev/min	Default: 0	Minimum: 0	Maximum: 100000.0	Data type: FLOAT	Active: Immediately

MD 1164
Only V_{DC} monitoring from motor speed
= 0: Not active
> 0: Active (dynamic energy management)

Enter the speed setpoint that, if exceeded, will lead to only the DC–link voltage (V_{DC}) being monitored, and the motor temperature no longer being monitored. A 3% ”hysteresis” around the speed threshold prevents continual switching between the monitoring functions.
If the response threshold (0.97 • MD 1164) is undershot again, standard functionality is re–established.

MD 1164 is only effective if, in MD 1165, bit 0 = 1.

Note

DC link sensing acceleration

The DC–link voltage is measured by a multiplexer, which is also used to detect the motor temperature for Motor 1 and Motor 2 and an internal reference measurement. These ”switching dead times” are incorporated into the DC link sensing response. To enable DC–link voltage monitoring to respond faster, it is possible to stop switching the multiplexer over when a speed threshold (entered in MD 1164) is exceeded, i.e. to only continue monitoring the DC–link voltage.
The motor temperature monitoring and reference measurement are only interrupted while the DC–link voltage is being measured. The effect of this measure is that, if the maximum DC–link voltage (MD 1163) is exceeded, this will be detected with the shortest possible delay time.

Notice

At the same time, the machine concept must be used to ensure that the speed limit is also undershot from time to time. Otherwise, the following alarms/messages may not be output, or there may be no response to them:

- Alarm 300613 ”Maximum permissible motor temperature exceeded”
- Alarm 300614 ”Motor temperature exceeded”
- Message (DB31,...DBX94.0) ”Motor temperature prewarning”

Here, it is worth protecting the motor from overload via the thermal motor protection function (MD 1265,...).

Note:

Switching off the multiplexer affects both axes in a module and a SIDA pair of axes in the case of 810D/CCU3.

1165	DYN_MANAG_ENABLE		840D only		Cross reference: –
	Dynamic energy management active			Relevant: FDD/MSD	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 3	Data type: UNS.WORD	Active: Immediately

MD 1165, bit 0
Dynamic energy management function
0: Not active
1: Active

MD 1165, bit 1
Dynamic energy management function; only effective with regenerative braking
0: Not active
1: Active

When the upper monitoring threshold (MD 1163) of the DC–link voltage is reached, a torque reduction is only carried out if MD 1165, bit 1 = 1 and if the drive is undergoing regenerative braking.

1096	RED_TORQUE_LIMIT_GS_ACTIV		840D only		Cross reference: –
	Red. max. torque with regenerative stop active			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 7	Data type: UNS.WORD	Active: Immediately

MD 1096, bit 0
Reduces the torque limit with regenerative braking
0: not active (exception: encoderless brakes)
1: Active

Reduction of the torque limit is always active with encoderless braking, irrespective of MD 1096.

MD 1096, bit 1
Monitors the speed controller at its endstop for torque reduction
0: active (exception: encoderless brakes)
1: Not active

Monitoring of the speed controller at its limit is always inactive with encoderless braking, irrespective of MD 1096.

MD 1096, bit 2
Torque reduction (MD 1097) is only active during STOP B or STOP C. At the same time, monitoring of the "speed controller at its endstop" is suppressed, regardless of bit 0 and bit 1.
0: Not active
1: active (exception: encoderless brakes)

If bit 0 and bit 2 are set simultaneously, torque reduction will always be active during regenerative braking. However, during STOP B/C, monitoring of the "speed controller at its endstop" will be switched off. I

Note

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: FDD/MSD/SLM	Protection level: 2/4
Unit: %	Default: 80	Minimum: 0	Maximum: 100	Data type: WORD	Active: Immediately

Note

This function should primarily be used with axes, which are not used in interpolating operation with other axes, e.g. spindles.

Alarm message

300603	DC link voltage too high
Cause	The current DC–link voltage V_{DC} 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 V_{DC} threshold MD 1163: $MD_LINK_VOLTAGE_MAX during regenerative braking.
Remedy	Increase drive machine data MD 1163: $MD_LINK_VOLTAGE_MAX or disable MD 1165: $MD_DYN_MANAG_ENABLE.
DRIVE Ready and 611D Ready are cancelled.	

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 Control of the holding brake/service brake via the closed–loop control module terminals (SW 6.6.6 and higher)

2.7.1 Description

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)
  Close motor speed holding/service brake (SLM)
- MD 1063 Deceleration time
- MD 1064 Servo disable time

Open 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

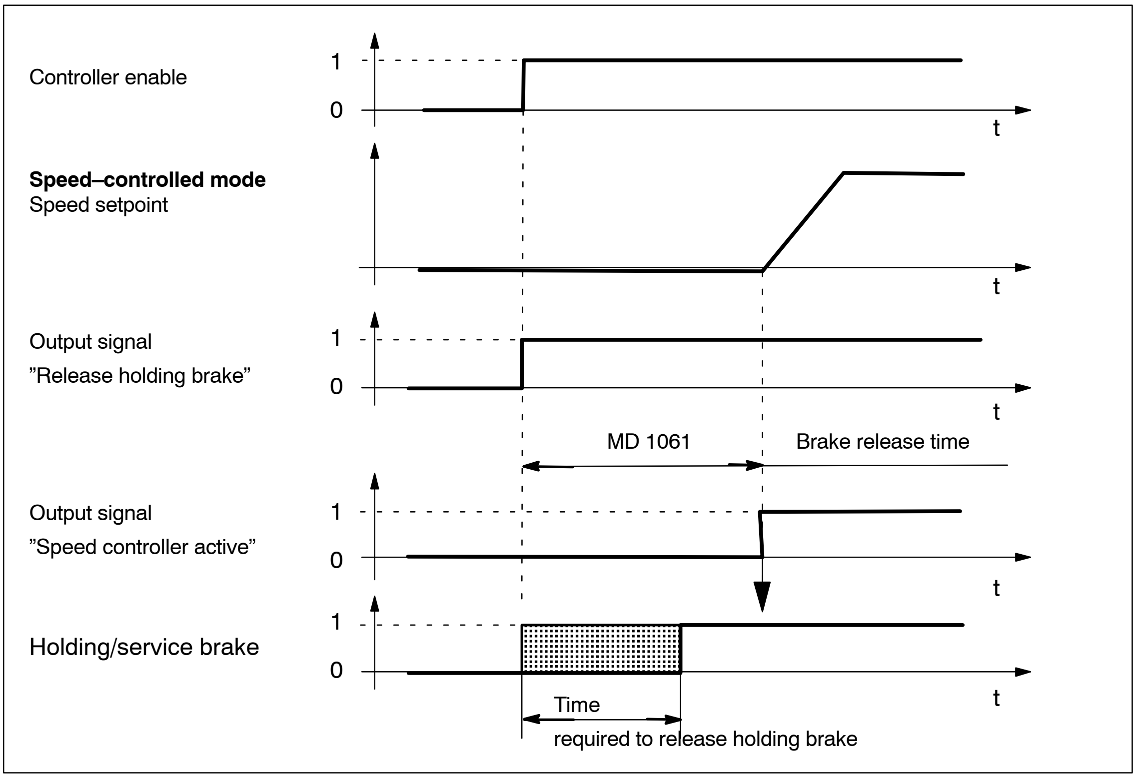


Fig. 2-9 Release brake: Characteristics when issuing ”controller enable”

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 ”open 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.

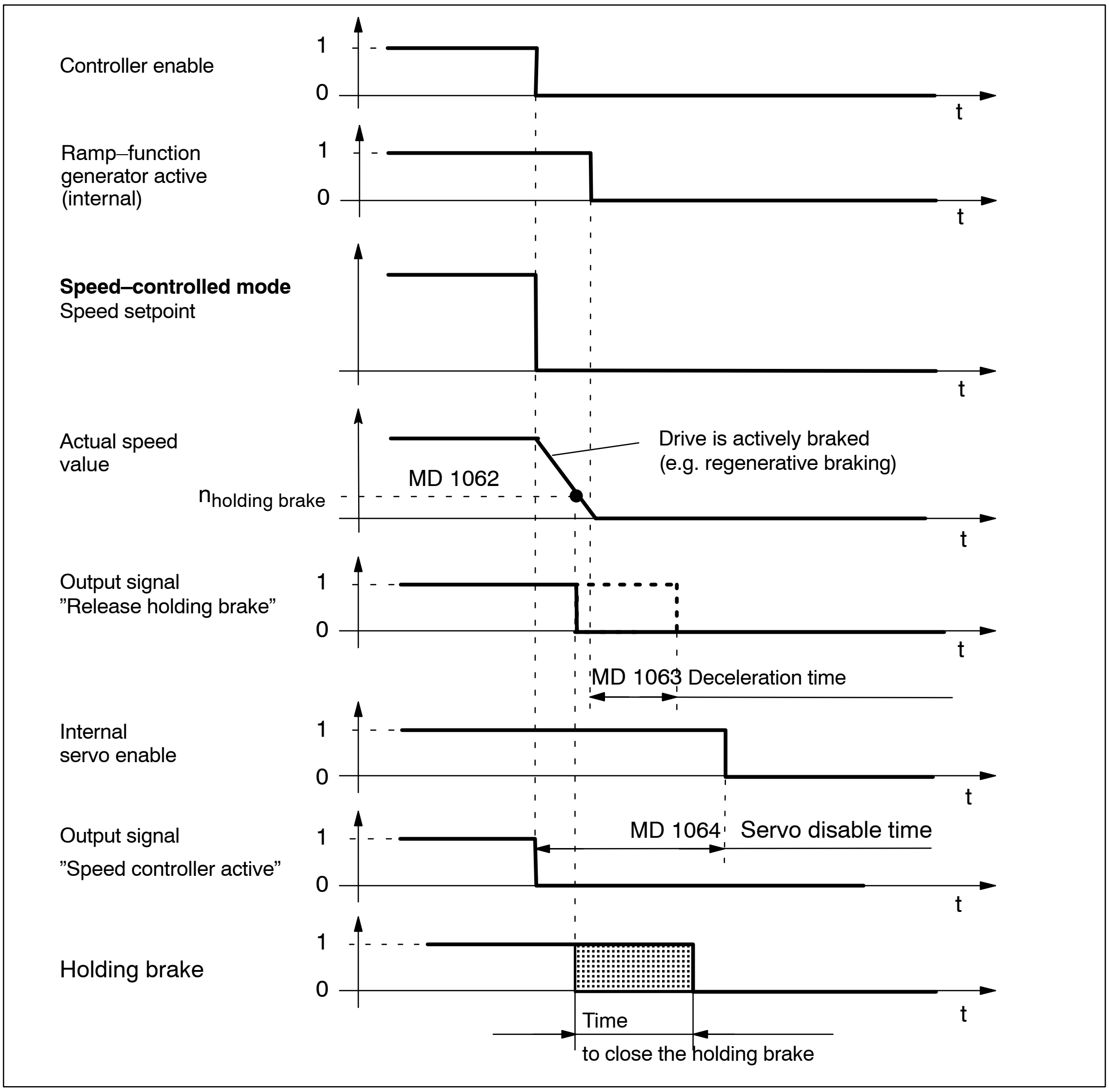


Fig. 2-10 Closing the brake: Response when servo enable is canceled

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.

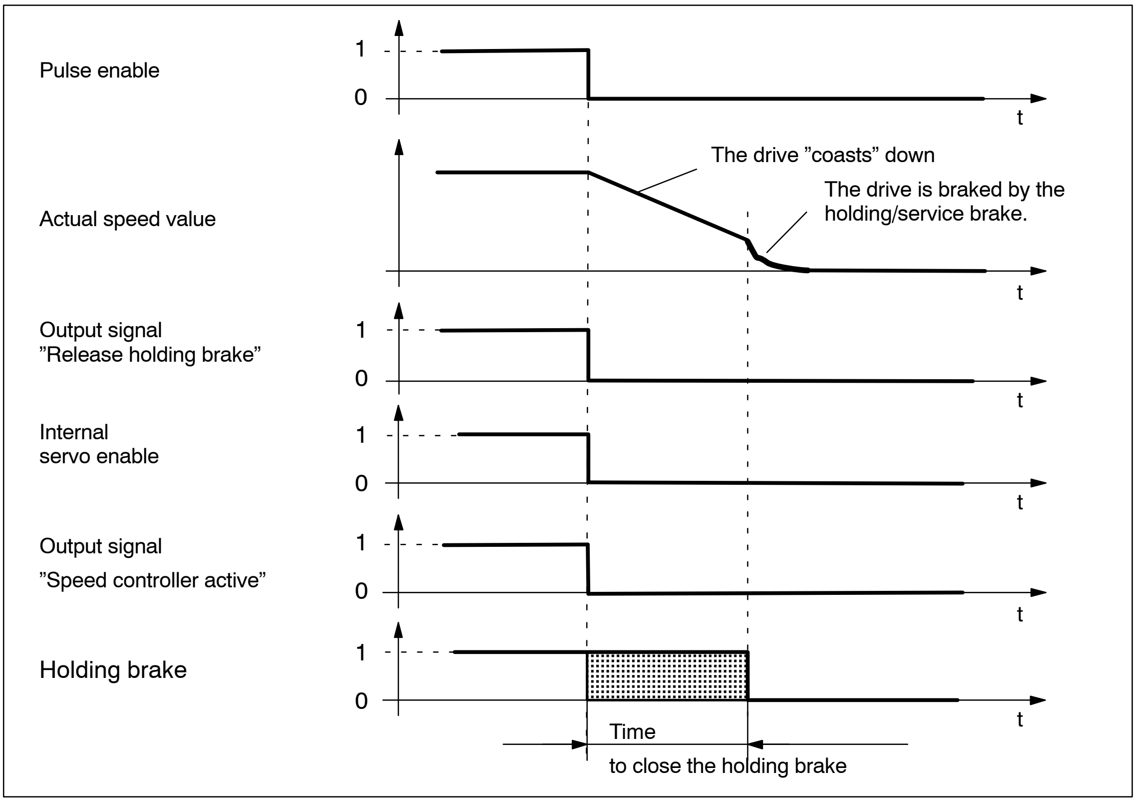


Fig. 2-11 Closing the brake: Response when pulse enable is canceled

Machine data

1060	ACTIVATE_BRAKE_CONTROL				Cross reference: –
	Activate brake control			Relevant: FDD/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 MD 1060.
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	BRAKE_RELEASE_TIME				Cross reference: –
	Brake release time			Relevant: FDD/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	BRAKE_CLOSE_SPEED				Cross reference: –
	Close speed holding brake Close motor velocity holding brake			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit:	Default: 500.0 SLM: 10.0	Minimum: 0.0	Maximum: 10 000.0	Data type: FLOAT	Effective: Immediately

1063	BREAK_DELAY_TIME				Cross reference: –
	Brake delay time			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit:	Default: 400.0 MSD: 5 000.0	Minimum: 10.0	Maximum: 600 000.0	Data type: FLOAT	Active: Immediately

MD 1062 and MD 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	CONTROLLER_DISABLE_TIME				Cross reference: –
	Servo disable time			Relevant: FDD/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.

2.7.2 Reducing the torque limit with regenerative braking (SW 6.7.5 and higher)

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	RED_TORQUE_LIMIT_GS_ACTIV				Cross reference: –
	Reduction of max. torque with regenerative stop active			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 7	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: Monitors the speed controller at its endstop for torque reduction
0 = Active (exception: ”Electrical braking in case of encoder failure”)
1 = Not active

Bit 2: Torque reduction (MD 1097) is only active during STOP B or STOP C. At the same time, monitoring of the ”speed controller at its endstop” is suppressed, regardless of bit 0 and bit 1.
0 = Not active
1 = Active (exception: ”Electrical braking in case of encoder failure”)

Monitoring of the speed controller at its endstop is always inactive with ”Electrical braking in case of encoder failure”, irrespective of MD 1096.

If bit 0 and bit 2 are set simultaneously, torque reduction will always be active during regenerative braking. However, during STOP B/C, monitoring of the ”speed controller at its endstop” will be switched off.

Note

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**				**Cross reference:** –
	Reduction of max. torque with regenerative stop			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: %	Default: 80	Minimum: 0	Maximum: 100	Data type: WORD	Active: Immediately

2.8 Electrical braking when the encoder fails (from SW 6.8)

An electrical brake has been implemented for use in the event of an encoder failure for the FDD 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.

Note

Electrical braking when the encoder fails has **not** been designed for operation with coupled axes!

Braking sequence

If an encoder fails during operation and ”Braking in case of an encoder failure” is activated via MD 1049 EMF_BRAKE_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 down to the internal threshold: this equals approx. 40 V_{rms} of the motor EMF. If the threshold in MD 1466 is set too low, alarm 300790 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_BRAKE_ENABLE**				**Cross reference:** –
	Activating the EMF brake			Relevant: FDD/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 Permanent–magnet spindle

2.9.1 Description

The permanently excited spindle (PE–MSD) is a specially designed synchronous motor (similar to FDD motors) with high armature inductance.

Weakening the magnetic field of the permanently excited armature achieves high speeds for spindle mode (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

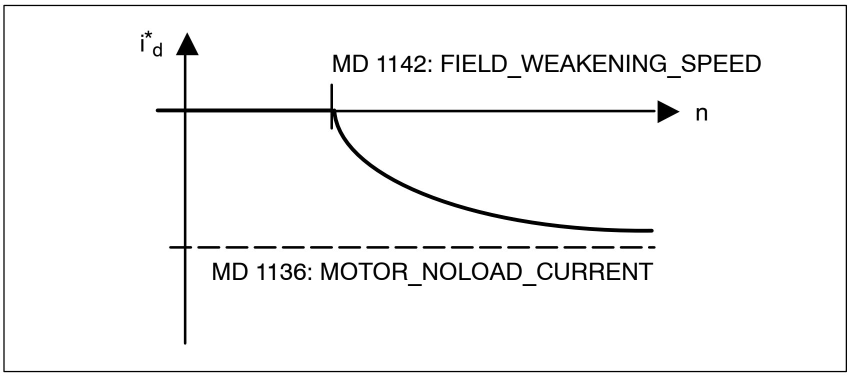


Fig. 2-12 Field weakening characteristic

2.9.2 PE–MSD with MSD power section data (from SW 6)

The PE–MSD is started up with drive type SRM (synchronous rotating motor).

When you select the power section, the FDD 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 mode (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 mode (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 mode (MD 1015=1) with the 120 A power section, this power section has been included in the FDD power section selection with power section code number 18H.

In FDD mode (MD 1015 = 0), drive alarm 301718 ”Motor/power section combination invalid” is output with this power section.

Note

From SW 6.08.24, MD 1172 must be 0.

2.9.3 Control parameters

If the PE–MSD was enabled (MD 1015) and a motor was selected from the list, then when you run the ”Calculate controller data” function (refer to DM1/Chapter 2.2, Table 2-4 “Output machine data”) the following machine data are additionally pre–assigned:

- MD 1121: CURRCTRL_INEGRATOR_TIME
- 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				Cross reference: –
	Activate PE–MSD			Relevant: FDD/SLM	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

Note

Field–weakening mode can be activated with MD 1015 when using synchronous motors.

After changing the machine data setting, “Calculate controller data” must be initiated!

1142	FIELD_WEAKENING_SPEED				Cross reference: –
	Speed at the start of field weakening			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: rev/min	Default: 0.0	Minimum: 0.0	Maximum: 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.

The speed at the start of field weakening can be calculated according to the following formula if the motor manufacturer has not specified it:

MD 1142 = 380 V $\times$ 1000 [rpm] / MD 1114

MD 1114: EMF_VOLTAGE

2.10 FDD operation with field weakening (from SW 6.8.25)

2.10.1 Description

In order to also be able to use field weakening with FDD machine data assignments, e.g. for 1FT7 motors, then this can be activated by setting MD 1172 = 1 in addition to MD 1015 = 1.

2.10.2 Control parameters

If MD 1015 and MD 1172 were enabled and a motor selected from the list, then with the "Calculate controller data" function the following machine data are additionally pre–assigned (refer to DM1/Chapter 2.2, Table 2-4 "Output machine data"):

- MD 1121: CURRCTRL_INEGRATOR_TIME
- 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

2.10.3 Machine data

1015	**PEMSD_MODE_ENABLE**				**Cross reference:** –
	Activate PE-MSD			Relevant: FDD/SLM	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

Note

Field–weakening mode can be activated with MD 1015 when using synchronous motors.

After changing the machine data setting, "Calculate controller data" must be initiated!

1142	FIELD_WEAKENING_SPEED				Cross reference: –
	Speed at the start of field weakening			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: rev/min	Default: 0.0	Minimum: 0.0	Maximuml: 100 000.0	Data type: FLOAT	Active: sofort

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

1172	PEMSD_VSA				Cross reference: –
	FDD operation with field weakening			Relevant: FDD/SLM	Protection level: 2/4
Unit: –	Default: 0.0	Minimum: 0.0	Maximum: 1.0	Data type: UNS.WORD	Active: Power On

Bit 0	FDD operation with field weakening	0: Function inactive 1: Function active

Note

MD 1172 is only effective if MD 1015 = 1 "Activate PE-MSD" has been set.

After changing the machine data setting, "Calculate controller data" must be initiated!

■

Space for your notes

3 Supplementary Conditions

None

■

4 Data Descriptions

See Chapter 2

■

5 Signal Descriptions

None

■

6 Example

None

■

Space for your notes

Data Fields, Lists 7

7.1 IM operation

Table 7-1 Machine data

No.	Identifier	Name	Drive
1451	SPEEDCTRL_GAIN_1_AM	P gain, speed controller IM	MSD
1453	SPDCTRL_INTEGR_1_AM	Integral action time, speed controller IM	MSD
1458	DES_CURRENT_OPEN_LOOP_AM	Current setpoint open–loop controlled mode, IM	MSD
1459	TORQUE_SMOOTH_TIME_AM	Torque smoothing time constant IM	MSD
1465	SWTICH_SPEED_MSD_AM	Changeover speed, MSD/IM	MSD
1466	SWITCH_SPD_OPEN_LOOP_AM	Changeover speed, closed–loop/open–loop control, IM	MSD

7.2 V/f mode

Table 7-2 Machine data

No.	Identifier	Name	Drive
1014	UF_MODE_ENABLE	Activates V/f mode	FDD/MSD/SLM
1125	UF_MODE_RAMP_TIME_1	Ramp–up time 1 for V/f operation	FDD/MSD/SLM
1126	UF_MODE_RAMP_TIME_2	Ramp–up time 2 for V/f operation	FDD/MSD/SLM
1127	UF_VOLTAGE_AT_F0	Voltage at f = 0 V/f mode	FDD/MSD/SLM
1650	DIAGNOSIS_CONTROL_FLAGS	Diagnostic control	FDD/MSD/SLM
1660	UF_MODE_FREQUENCY	Motor frequency, V/f mode	FDD/MSD/SLM
1661	UF_MODE_RATIO	V/f ratio for V/f mode	FDD/MSD/SLM
1662	UF_MODE_DELTA_FREQUENCY	Motor frequency change, V/f mode	FDD/MSD/SLM

7.3 Motor changeover

Table 7-3 Machine data

No.	Identifier	Name	Drive
1013	ENABLE_STAR_DELTA	Enable motor/data set 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
1074	ROTORPOS_OFFSET	Rotor position adjustment	FDD/MSD

7.4 Emergency retraction

7.4.1 General

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/SLM
1632	LINK_VOLTAGE_GEN_HYST	Voltage range for generator control	FDD/MSD/SLM
1633	LINK_VOLTAGE_GEN_OFF	Shutdown threshold for generator mode	FDD/MSD/SLM
1634	LINK_VOLTAGE_RETRACT	Response threshold, emergency retraction	FDD/MSD/SLM
1635	GEN_AXIS_MIN_SPEED	Minimum speed, generator axis	FDD/MSD/SLM
1636	RETRACT_AND_GENERATOR_MODE	Drive modes, emergency retraction	FDD/MSD/SLM
1637	GEN_STOP_DELAY	Delay time of regenerative braking	FDD/MSD/SLM
1638	RETRACT_TIME	Emergency retraction time	FDD/MSD/SLM
1639	RETRACT_SPEED	Emergency retraction speed	FDD/MSD/SLM

7.4.2 Dynamic energy management

Table 7-5 Machine data

No.	Identifier	Name	Drive
1096	RED_TORQUE_LIMIT_GS_ACTIV	Red. max. torque with regenerative stop active	FDD/MSD/SLM
1097	RED_TORQUE_LIMIT_GENSTOP	Red. max. torque with regenerative stop	FDD/MSD/SLM
1162	LINK_VOLTAGE_MIN	Minimum DC link voltage	FDD/MSD
1163	LINK_VOLTAGE_MAX	Maximum DC link voltage	FDD/MSD
1164	LINK_VOLTAGE_SPEED_SETUP	Only V_{DC} monitoring from motor speed	FDD/MSD
1165	DYN_MANAG_ENABLE	Dynamic energy management active	FDD/MSD

7.5 Control of the holding brake/service brake via the closed–loop control module terminals

7.5.1 General

Table 7-6 Machine data

No.	Identifier	Name	Drive
1060	MD_BREAK_ACTIVE	Activate brake control	FDD/MSD/SLM
1061	MD_BREAK_OPEN_TIME	Brake release time	FDD/MSD/SLM
1062	MD_N_BREAK	Close speed holding brake Close motor velocity holding brake	FDD/MSD SLM
1063	MD_BREAK_DELAY_TIME	Deceleration time	FDD/MSD/SLM
1064	MD_BREAK_LOCK_TIME	Servo disable time	FDD/MSD/SLM

7.5.2 Reduction of torque limit with regenerative braking

Table 7-7 Machine data

No.	Identifier	Name	Drive
1096	RED_TORQUE_LIMIT_GS_ACTIV	Red. max. torque with regenerative stop active	FDD/MSD/SLM
1097	RED_TORQUE_LIMIT_GENSTOP	Red. max. torque with regenerative stop	FDD/MSD/SLM

7.6 Electrical braking in case of encoder failure

Table 7-8 Machine data

No.	Identifier	Name	Drive
1049	EMF_BRAKE_ENABLE	Activating the EMF brake	FDD/SLM

7.7 Permanent–magnet spindle

Table 7-9 Machine data

No.	Identifier	Name	Drive
1015	PEMSD_MODE_ENABLE	Activate PE–MSD	FDD/SLM
1142	FIELD_WEAKENING_SPEED	Speed at the start of field weakening	FDD/MSD/SLM

7.8 FDD operation with field weakening

Table 7-10 Machine data

No.	Identifier	Name	Drive
1015	PEMSD_MODE_ENABLE	Activate PE-MSD	FDD/SLM
1142	FIELD_WEAKENING_SPEED	Speed at the start of field weakening	FDD/MSD/SLM
1172	PEMSD_VSA	FDD operation with field weakening	FDD/SLM

■

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

Enables (DF1)

Space for your notes

1 Product Brief

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)

■

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Detailed Description 2

2.1 Mains supply module terminals

Terminal 48

Contactor control
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 internal precharging contactor closes, 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 be activated 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 signal is instantaneous and acts simultaneously on all power sections. 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).

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 on 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 line ”Pulse enable” (terminal 663) in service display **Service drive**. The terminal can be enabled after the Ready to Operate message of the supply feed. If ”Shutdown in case of power failure” is required, locking must be provided up until the shutdown.

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 therefore 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, ... DBX21.7.
If the pulses are enabled, the drive acknowledges this with the ”Pulses enabled” IS DB 31, ... DBX93.7, 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).

Controller enable

The ”Servo enable” IS DB 31, ... DBX2.1 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).

■

Space for your notes

3 Supplementary Conditions

None

■

4 Data Description

None

■

5 Signal Descriptions

None

■

6 Example

None

■

7 Data Fields, Lists

None

■

Space for your notes

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

Encoder Parameterization (DG1)

Space for your notes

Product Brief 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 Configuration Manual

References /IAD/ 840D Commissioning Manual

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.

■

Space for your notes

Detailed Description 2

2.1 Motor measuring system

1005	ENC_RESOL_MOTOR				Cross reference: –
	No. of encoder pulses, motor measuring system			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 2 048.0	Minimum: 1	Maximum: 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 FDD/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: FDD/MSD/SLM	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.

Comparison

n_{set} = 30 rev/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.

Note

This machine data is activated using bit 1 of machine data MD 1011: ACTUAL_VALUE_CONFIG.

1011	ACTUAL_VALUE_CONFIG				Cross reference: –
(IM)	Configuration, actual value sensing, motor measuring system			Relevant: FDD/MSD/SLM	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.	Description	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 = Disable active
Bit 2	–	Reserved
Bit 3	Encoder type	0 = Incremental encoder 1 = Absolute encoder with EnDat/SSI interface
Bit 4	Linear measuring system	0 = Rotary encoder 1 = Linear encoder as motor measuring system
Bit 5, 840D only	Motor measuring system	0 = Available 1 = Not available
Bit 6	CD track electrical revolution	0 = CD track (mechanical revolution) 1 = Hall sensors (electrical revolution)
Bit 7	Distance–coded measuring system	0 = Not available 1 = Available
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	–	unassigned
Bit 10	Plausibility monitoring	0 = Plausibility monitoring is switched off 1 = Plausibility monitoring is switched on Rotor/pole position identification takes place after each ramp–up.
Bit 11	–	unassigned
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.	Description	Note
Bit 13	Fine synchronization See FB, Drive Functions, DM1, Section 2.3.	0 = Accept fine position from MD 1016 with zero mark 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 (standard) 01 = 500 kHz 10 = 1 MHz 11 = 2 MHz For rotary 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: FDD/SLM	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 Manual, Linear Motor

1017	STARTUP_ASSISTANCE		840D only		Cross reference: –
	Assistance for startup			Relevant: FDD/SLM	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

Values	Description
0	Default setting
1	Determine the angular commutation offset 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 information:
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 and then entered and checked.

1021	**ENC_ABS_TURNS_MOTOR**				**Cross reference:** –
	Multiturn resolution, absolute encoder, motor			Relevant: FDD/MSD/SLM	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: FDD/MSD/SLM	Protection level: 2/4
Unit:1) –	Default: 8 192	Minimum: 0	Maximum: 2 147 483 647	Data type: UNS.DWORD	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: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0.0	Minimum: 0.0	Maximum: 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.	**Description**	**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	

Table 2-2 Diagnostic bits, absolute value encoder

Bit No.	Description	Note
Bit 7	Checksum error	SW 4.2 and higher, synchronous linear motor SW 6.1 and higher 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/FDD 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: –	Cross reference:
Serial number of motor measuring system			Relevant: FDD/MSD/SLM	Protection level: 1/1	Protection level:
Unit: –	Default: 0.0	Minimum: 0.0	Maximum: 4 294 967 295	Data type: UNS. DWORD	Active: POWER ON	

The serial number of the indirect, absolute measuring system is read from the encoder in set 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 condition 5, the encoder serial number is entered in MD 1025, and Back up Boot file is initiated. Alarm 300604 ”Motor encoder is not calibrated” indicates an exceptional 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 operated 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				Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: µs	Default: 0.0	Minimum: 0.0	Maximum: 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				Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0.0	Minimum: –1.0	Maximum: 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
48	SSI encoder

A detailed description of the two machine data below can be found in Chapter DM1/2 2.5.4.

1055	MARKER_DIST		840D only		Cross reference: –
Reference–mark distance with a distance–coded measuring system				Relevant: FDD/SLM	Protection level: 2/4
Unit: Rot: Degrees Lin: mm	Default: 20.0 20.0	Minimum: 0.0 0.0	Maximum: 90.0 1 000.0	Data type: FLOAT	Active: POWER ON

Drive machine data 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				Relevant: FDD/SLM	Protection level: 2/4
Unit: Rot: Degrees Lin: mm	Default: 0.02 0.02	Minimum: 0.0 0.0	Maximum: 45.0 500.0	Data type: FLOAT	Active: POWER ON

2.2 Direct position measuring system

1007	ENC_RESOL_DIRECT				Cross reference: –
	No. of encoder pulses, direct measuring system (DM)			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 2 147 483 647	Data type: UNS.DWORD	Active: POWER ON

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 EnDat encoder as a direct measuring system.
MD 1034 is predefined as 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 of actual value acquisition, direct measuring system (DM)			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hex	Default: 0000	Minimum: 0000	Maximum: C018	Data type: UNS.WORD	Active: POWER ON

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.	Description	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
Bits 5 –13		unassigned
Bit 14 Bit 15 SW 4.2 and higher	Data transmission rate, EnDat	00 = 100 kHz (default) 01 = 500 kHz 10 = 1 MHz 11= 2 MHz • For rotary 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 (DM)			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: U	Default: 4 096.0	Minimum: 0.0	Maximum: 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: FDD/MSD/SLM	Protection level: 2/4
Unit:1) –	Default: 8 192	Minimum: 0	Maximum: 2 147 483 647	Data type: UNS.DWORD	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: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 64 767	Data type: UNS.WORD	Active: Immediately

Table 2-5 Diagnostics bits, direct measuring circuit

Bit No.	Description	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 SW 6.1 and higher 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).

Table 2-5 Diagnostics bits, direct measuring circuit

Bit No.	Description	Note
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: FDD/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: FDD/MSD/SLM	Protection level: 2/4
Unit: µs	Default: 0	Minimum: 0	Maximum: 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: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0	Minimum: –1	Maximum: 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
SW 5.01.06 and higher

1027	ENC_CONFIG			840D only	Cross reference: –
	Configuration encoder IM			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hex	Default: 0	Minimum: 0	Maximum FFFF	Data type: UNS.WORD	Active: POWER ON

Bit	Value	Description
9		Reserved
10	0	SSI encoder, measuring 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	With SSI encoder

1028	NO_TRANSMISSION_BITS			840D only	Cross reference: –
	IM message frame length SSI			Relevant: FDD/MSD/SLM	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 frame 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: FDD/MSD/SLM	Protection level: 2/4
Unit: Hex	Default: 0	Minimum: 0	Maximum FFFF	Data type: UNS.WORD	Active: POWER ON

Bit	Value	Description
9	0	SSI encoder SSI encoder has incremental tracks
	1	SSI encoder has no incremental tracks
10	0	SSI encoder, measuring 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	With SSI encoder

1041	NO_TRANSMISSION_BITS_DM		840D only		Cross reference: –
	DM message frame length SSI			Relevant: FDD/MSD/SLM	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 frame 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. 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 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 measuring system

The resolution of the linear measuring 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 LSB of the data bit directly after the parity or alarm bit. Even if zero bits are inserted between the parity/alarm bit and the LSB of the data 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 data 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 frame 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=8192 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: Error in zero–level monitoring SSI
- Bit 14 **and** bit 15: Error in idle–level monitoring SSI

2.3.4 Supplementary conditions

Listen–in systems

Important!
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 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 Parameterizing faults

Error number	Description
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.

■

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3 Supplementary Conditions

None

■

4 Data Descriptions (MD, SD)

See Chapter 2

■

5 Signal Descriptions

None

■

6 Example

None

■

Space for your notes

Data Fields, Lists

7

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/SLM
1008	ENC_PHASE_ERROR_CORRECTION[DRx]	Encoder phase error correction IM	FDD/MSD/SLM
1011	ACTUAL_VALUE_CONFIG[DRx]	Configuration, actual value sensing IM	FDD/MSD/SLM
1016	COMMUTATION_ANGLE_OFFSET	Commutation angle offset	FDD/SLM
1017	STARTUP_ASSISTANCE	Determine the commutation offset angle	FDD/SLM
1021	ENC_ABS_TURNS_MOTOR	Multiturn resol., abs. value encoder, motor	FDD/MSD/SLM
1022	ENC_ABS_RESOL_MOTOR	Measuring steps of absolute track in motor	FDD/MSD/SLM
1023	ENC_ABS_DIAGNOSIS_MOTOR	Diagnosis meas. circ. motor abs. track	FDD/MSD/SLM
1025	SERIAL_NO_ENCODER	Serial number of motor measuring system	FDD/MSD/SLM
1055	MAKER_DIST	Reference mark distance with a distance–coded measuring system	FDD/SLM
1056	MAKER_DIST_DIFF	Distance difference	FDD/SLM
1703	LEAD_TIME_MOTOR_ENC	Lead time, conversion, motor meas. system	FDD/MSD/SLM
1790	ENC_TYPE_MOTOR	Measuring–circuit type of indirect measuring system	FDD/MSD/SLM

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/SLM
1030	ACTUAL_VALUE_CONFIG_DIRECT	Configuration, actual–value sensing DM	FDD/MSD/SLM
1031	ENC_ABS_TURNS_DIRECT	Multiturn resolution, absolute encoder DM	FDD/MSD/SLM
1032	ENC_ABS_RESOL_DIRECT	Measuring steps of the absolute track DM	FDD/MSD/SLM
1033	ENC_ABS_DIAGNOSIS_DIRECT	Diagnosis, dir. meas. system, abs. track	FDD/MSD/SLM
1038	SERIAL_NO_ENCODER_DM	Serial number of direct measuring system	FDD/MSD/SLM
1704	LEAD_TIME_DIRECT_ENC	Lead time, conversion, direct meas. system	FDD/MSD/SLM
1791	ENC_TYPE_DIRECT	Measuring–circuit type of direct measuring system	FDD/MSD/SLM

7.3 SSI encoder

Table 7-3 Machine data

No.	Identifier	Name	Drive
1027	ENC_CONFIG	IM configuration, encoder	FDD/MSD/SLM
1028	NO_TRANSMISSION_BITS	IM message frame length SSI	FDD/MSD/SLM
1037	ENC_CONFIG_DIRECT	Configuration encoder DM	FDD/MSD/SLM
1041	NO_TRANSMISSION_BITS_DM	DM message frame length SSI	FDD/MSD/SLM

■

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

Parameters for Linear Motors (DL1)

Space for your notes

Product Brief 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/velocity 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 velocity 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.

■

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Detailed Description 2

2.1 Parameters of linear motors

1019	CURRENT_ROTORPOS_IDENT		840D only		Cross reference: –
	Current, rotor/pole position identification			Relevant: FDD/SLM	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 accuracy in MD 1737: DIFF_ROTORPOS_IDENT.

1020	MAX_MOVE_ROTORPOS_IDENT		840D only		Cross reference: –
	Maximum motion, rotor/pole position identification			Relevant: FDD/SLM	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 machine data, alarm 300611, ”Impermissible movement for rotor/pole position identification”, is issued.

1024	DIVISION_LIN_SCALE			840D only	Cross reference: –
	Graduation, motor measuring system			Relevant: FDD/SLM	Protection level: 2/4
Unit: nm	Default: 20 000	Minimum: 0	Maximum: 2 147 483 647	Data type: UNS.DWORD	Active: POWER ON

Graduation of the motor measuring 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: FDD/SLM	Protection level: 2/4
Unit: nm	Default: 20 000	Minimum: 0	Maximum: 2 147 483 647	Data type: UNS.DWORD	Active: POWER ON

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: FDD/SLM	Protection level: 2/4
Unit: N/A	Default: 0.0	Minimum: 0.0	Maximum: 2000.0	Data type: FLOAT	Active: POWER ON

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: FDD/SLM	Protection level: 2/4
Unit: Vs/m	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.

1117	MOTOR_MASS				Cross reference: –
	Motor weight			Relevant: FDD/SLM	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 velocity			Relevant: FDD/SLM	Protection level: 2/4
Unit: m/min	Default: 0.0	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) 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 velocity falls below 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).

1147	SPEED_LIMIT				Cross reference: –
	Velocity limitation			Relevant: FDD/SLM	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.

FDD: MD 1400: MOTOR_RATED_SPEED x 110%

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 motor velocity falls below 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 width			Relevant: FDD/SLM	Protection level: 2/4
Unit: mm	Default: 72.0	Minimum: 0.0	Maximum: 1 000.0	Data type: FLOAT	Active: POWER ON

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: –
	Force due to weight			Relevant: FDD/SLM	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., percent 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 force due to weight is effective, then the matching value can be read and transferred into MD 1192 and MD 32460.

1193	BALANCE_BY_STOP_C		840D only		Cross reference: –
	Counterweight with Stop C			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 1	Data type: UNS.WORD	Active: POWER ON

In MD 1193, the target behavior of the torque and force compensation during Safety Stop C is set.

- MD 1193 = 0: Stop C cancels the electronic compensation.
- MD 1193 = 1: During Stop C, the speed and torque feedforward control signals are not suppresed internally.

1230	FORCE_LIMIT_1				Cross reference: –
	1st force limit value			Relevant: FDD/SLM	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 of the motor.

Stall force = MD 1118 • MD 1113

MD 1118: MOTOR_STANDSTILL_CURRENT

MD 1113: FORCE_CURRENT_RATIO

The applicable limit is always either the force limit or output limit, whichever is lower. For feed drives, limiting is implemented by selecting Calculate controller data, whereby the value is obtained from the following formula:

MD 1230 = (MD 1104/MD 1118) • 100 %

As the current limit (FDD – MD 1104) additionally limits the maximum torque, which can be entered, any increase of the force limit results in a higher force only if a high current can also flow. It may be necessary to also adapt the current limit.

Note

If the motor is overloaded for a longer period of time, this can result in an impermissible temperature rise (the drive is shut down as a result of a motor overtemperature condition); the motor can also be destroyed.

1231	FORCE_LIMIT_2				Cross reference: –
	2nd force limit value			Relevant: FDD/SLM	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, ... DBX20.2 and the motor speed exceeds the value set in MD 1232: FORCE_LIMIT_SWITCH_SPEED with hysteresis (MD 1234).

1232	FORCE_LIMIT_SWITCH_SPEED				Cross reference: –
	Switching speed from MD 1230 to MD 1231			Relevant: FDD/SLM	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, ... DBX20.2.

1233	LIMIT_GENERATOR				Cross reference: –
	Regenerative limiting			Relevant: FDD/SLM	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			Relevant: FDD/SLM	Protection level: 2/4
Unit: m/min	Default: 3.0	Minimum: 0.0	Maximum: 1000.0000	Data type: FLOAT	Active: Immediately

Enter the hysteresis for the switch–in speed set in MD 1232: FORCE_LIMIT_SWITCH_SPEED.

1239	FORCE_LIMIT_FOR_SETUP				Cross reference: –
	Force limit setup mode			Relevant: FDD/SLM	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 (FDD) 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. Setup mode is selected via terminal 112 of the infeed/ regenerative feedback unit.

1245	CURRENT_SMOOTH_SPEED				Cross reference: –
Threshold of velocity–dependent Fset smoothing				Relevant: FDD/SLM	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 velocity ripple at higher velocities using this velocity–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 filter if the absolute actual speed is less than v_lower (lv_actl < 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 of velocity–dependent Fset smoothing				Relevant: FDD/SLM	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.

1252	FORCE_FILTER_FREQUENCY				Cross reference: –
	Frequency limit of force setpoint smoothing			Relevant: FDD/SLM	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

$T1 = 1/(2 \cdot \pi \cdot f_o)$.

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 velocity			Relevant: FDD/SLM	Protection level: 2/4
Unit: m/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.

1401	MOTOR_MAX_SPEED[n] 0...7 index of parameter set				Cross reference: –
	Velocity for maximum useful motor velocity			Relevant: FDD/SLM	Protection level: 2/4
Unit: m/min	Default: 0.0	Minimum: 0.0	Maximum: 100,000.0	Data type: FLOAT	Active: POWER ON

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 special meaning in the NC. Only its value enters into 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: –
	Pulse suppression shutdown velocity			Relevant: FDD/SLM	Protection level: 2/4
Unit: m/min	Default: 0.0	Minimum: 0.0	Maximum: 7 200.0	Data type: FLOAT	Active: Immediately

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 delay times.

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

1405	MOTOR_SPEED_LIMIT[n] 0...7 index of parameter set				Cross reference: –
	Monitoring velocity, motor			Relevant: FDD/SLM	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[n] 0...7 index of parameter set				Cross reference: –
	P gain of speed controller			Relevant: FDD/SLM	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 over 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[n] 0...7 index of parameter set				Cross reference: –
	P gain, upper adaptation velocity			Relevant: FDD/SLM	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 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.

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[n] 0...7 index of parameter set				Cross reference: –
	Reset time of speed controller			Relevant: FDD/SLM	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[n] 0...7 index of parameter set				Cross reference: –
	Reset time, upper adaptation velocity			Relevant: FDD/SLM	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.

!

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).

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 velocity			Relevant: FDD/SLM	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 velocity			Relevant: FDD/SLM	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:** –
	Selection of velocity controller adaptation			Relevant: FDD/SLM	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 1	Data type: UNS.WORD	Active: Immediately

This machine data can be used to adapt the velocity controller machine data as a function of the velocity.

Input 0:

Adaptation is not active. The velocity controller settings (MD 1407 and MD 1409) are valid for the complete velocity 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.

1414	**SPEEDCTRL_REF_MODEL_FREQ[n] 0...7 index of the parameter set 840D only**				**Cross reference: –**
	Natural frequency of reference model velocity			Relevant: FDD/SLM	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, velocity 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[n] 0...7 index of the parameter set**				**Cross reference: –**
	Reference model damping velocity			Relevant: FDD/SLM	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, velocity control loop. This is a reference model (PT2) for the velocity 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.

1416	SPEEDCTRL_REF_MODEL_DELAY			840D only	Cross reference: –
	Balancing, reference model, velocity			Relevant: FDD/SLM	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, velocity control loop. This machine data simulates the computation deadtime of the velocity 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 velocity control loop (velocity actual value sensing) by increasing the value of MD 1416. Typical values are approx. 0.5 and can be checked by comparing the DAC signals

- Velocity actual value and
- Velocity setpoint reference model.

The velocity 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[n] 0...7 index of parameter set				Cross reference: –
	vx for 'vact < vx' signal			Relevant: FDD/SLM	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[n] 0...7 index of parameter set				Cross reference: –
	vmin for 'vact < vmin' signal			Relevant: FDD	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: IS "|v_act| < v_min" DB 31, ... DBX 94.4.

1420	**MOTOR_MAX_SPEED_SETUP**				**Cross reference:** –
	Maximum motor velocity setup mode			Relevant: FDD/SLM	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:** –
	Balancing filter for velocity feedforward control channel			Relevant: FDD/SLM	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 velocity feedforward control channel of the velocity/torque feedforward control. This time can be used to adapt the setpoint characteristics of the closed current control loop. The higher–level velocity 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–pass filters are active as current–setpoint filters.

1426	**SPEED_DES_EQ_ACT_TOL[n] 0...7 index of parameter set**				**Cross reference:** –
	Tolerance band for 'vset = vact' signal			Relevant: FDD/SLM	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 signals

"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 velocity actual value enters the selected tolerance band around the velocity setpoint and remains within this band for the duration of at least the delay time (MD 1427). The signal becomes inactive immediately when the tolerance band is exited.

The "Ramp–up function complete" signal becomes active at the same time as the "v_act = v_set" signal, although it is locked in the active state until the next setpoint change, even if the velocity actual value exits the tolerance band. The "ramp–up function complete" signal becomes inactive immediately if the setpoint changes.

1427	SPEED_DES_EQ_ACT_DELAY				Cross reference: –
	Delay time for 'vset = vact' signal			Relevant: FDD/SLM	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[n] 0...7 index of the parameter set				Cross reference: –
	Threshold force Fdx			Relevant: FDD/SLM	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: FDD/SLM	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 [n]				Cross reference: –
	Number of velocity setpoint filters			Relevant: FDD/SLM	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 2	Data type: UNS.WORD	Active: Immediately

Enter the number of velocity setpoint filters.

810D: PT1 low pass

840D/611D: PT1 low pass, PT2 low pass or bandstop

Table 2-1 Selection of the number of velocity setpoint filters

Value	Description
0	No velocity 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 velocity setpoint filter is measured during the FFT velocity control loop measurement. If the 1st filter is configured as a bandstop filter (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[n] 0...7 index of the parameter set				Cross reference: –
	Type of speed–setpoint filter			Relevant: FDD/SLM	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 8 303	Data type: UNS. WORD	Active: Immediately

Enter the configuration of 2 velocity setpoint filters. You can choose between bandstop filters 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 filter).
  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 velocity setpoint stairs
  The velocity setpoints are output in the position controller cycle, which can be set significantly higher than the velocity controller cycle (low pass).

Table 2-2 Type of speed–setpoint filter

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[n] 0...7 index of the parameter set				Cross reference: –
Time constant of velocity setpoint filter 1				Relevant: FDD/SLM	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 velocity 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[n] 0...7 index of the parameter set				Cross reference: –
	Time constant of velocity setpoint filter 2			Relevant: FDD/SLM	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 velocity setpoint filter 2 (PT1 low pass). Entering a value of 0 deactivates the filter.

1506	SPEED_FILTER_1_FREQUENCY[n] 0...7 index of the parameter set				Cross reference: –
	Natural frequency of velocity setpoint filter 1			Relevant: FDD/SLM	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 velocity 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 velocity setpoint filters for interpolating axes should be configured identically.

1507	SPEED_FILTER_1_DAMPING[n] 0...7 index of the parameter set				Cross reference: –
	Damping of velocity setpoint filter 1			Relevant: FDD/SLM	Protection level: 2/4
Unit: –	Default 0.7000	Minimum: 0.2000	Maximum: 5.0000	Data type: FLOAT	Active: Immediately

Enter the natural frequency for velocity 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 velocity 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–pass filters 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[n] 0...7 index of the parameter set**				**Cross reference:** –
	Natural frequency of velocity setpoint filter 2			Relevant: FDD/SLM	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 velocity 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 velocity setpoint filters for interpolating axes should be configured identically.

1509	**SPEED_FILTER_2_DAMPING[n] 0...7 index of the parameter set**				**Cross reference:** –
	Damping of velocity setpoint filter 2			Relevant: FDD/SLM	Protection level: 2/4
Unit: –	Default: 0.7000	Minimum: 0.2000	Maximum: 5.0000	Data type: FLOAT	Active: Immediately

Enter the damping for velocity setpoint filter 2 (PT2 low pass).

Note

The velocity 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–pass filters 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 the parameter set**				**Cross reference:** –
	Blocking frequency of velocity setpoint filter 1			Relevant: FDD/SLM	Protection level: 2/4
Unit: Hz	Default: 3 500.0000	Minimum: 1.0000	Maximum: 7999.0000	Data type: FLOAT	Active: Immediately

Enter the blocking frequency for velocity setpoint filter 1 (bandstop filter). If filter 1 is parameterized as a bandstop filter, 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[n] 0...7 index of the parameter set**				**Cross reference:** –
	Bandwidth of velocity setpoint filter 1			Relevant: FDD/SLM	Protection level: 2/4
Unit: Hz	Default: 500.0000	Minimum: 5.0000	Maximum: 7999.0000	Data type: FLOAT	Active: Immediately

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

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[n] 0...7 index of the parameter set**				**Cross reference:** –
	Bandwidth numerator speed–setpoint filter 1			Relevant: FDD/SLM	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 filter. Entering a value of 0 initializes the filter as an unattenuated bandstop filter.

Note

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

1517	SPEED_FILTER_2_SUPPR_FREQ[n] 0...7 index of the parameter set 840D only				Cross reference: –
	Blocking frequency of velocity setpoint filter 2			Relevant: FDD/SLM	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 velocity setpoint filter 2 (bandstop filter).

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[n] 0...7 index of the parameter set				Cross reference: –
	Bandwidth of velocity setpoint filter 2			Relevant: FDD/SLM	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 velocity setpoint filter 2 (bandstop filter).

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[n] 0...7 index of the parameter set				Cross reference: –
	Numerator bandwidth of velocity setpoint filter 2			Relevant: FDD/SLM	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 filter. Entering a value of 0 initializes the filter as an unattenuated bandstop filter.

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[n] 0...7 index of the parameter set				Cross reference: –
	Bandstop filter natural frequency for velocity setpoint filter 1			Relevant: FDD/SLM	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 filter as a percentage with reference to MD 1514 (blocking frequency).

For MD 1520 = 100% the filter is initialized as an attenuated bandstop filter. If the resulting natural frequency (MD 1520 • MD 1514) exceeds the Shannon frequency specified by the velocity controller cycle, then the input is rejected with a parameterization error.

For more information, see MD 1521: SPEED_FILTER_2_BS_FREQ

1521	SPEED_FILTER_2_BS_FREQ[n] 0...7 index of the parameter set				Cross reference: –
	Bandstop filter natural frequency for velocity setpoint filter 2			Relevant: FDD/SLM	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 filter as a percentage with reference to MD 1517 (blocking frequency).

For MD 1521 = 100% the filter is initialized as an attenuated bandstop filter. If the resulting natural frequency (MD 1521 • MD 1517) exceeds the Shannon frequency specified by the velocity controller cycle, then the input is rejected with a parameterization error.

1606	SPEEDCTRL_LIMIT_THRESHOLD				Cross reference: –
	Threshold, speed controller at its limit			Relevant: FDD/SLM	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: FDD/SLM	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 undershot), the ”Diagnosis, rotational accuracy monitoring” MD 1724 counter is incremented by the actual speed.

1635	GEN_AXIS_MIN_SPEED				Cross reference: –
	Minimum speed generator axis			Relevant: FDD/SLM	Protection level: 2/4
Unit: m/min	Default: 0.0000	Minimum: 0.0000	Maximum: 100 000.0000	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 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.

1639	RETRACT_SPEED				Cross reference: –
	Emergency retraction speed			Relevant: FDD/SLM	Protection level: 2/4
Unit: –	Default: 0	Minimum: –4 194 304	Maximum: 4 194 304	Data type: DWORD	Active: Immediately

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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: FDD/SLM	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 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 are picked up by the read request of the non–cyclic communications protocol.

1707	ACTUAL_SPEED				Cross reference: –
	Speed actual value			Relevant: FDD/SLM	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 actual velocity value. It represents the non–filtered velocity actual value. Machine data MD 1706, MD 1707 and MD 1708 are not picked up in synchronism. The respective machine data are picked up by the HMI request ”Read variables” via the STF–ES communications interface.

1711	**SPEED_LSB**				**Cross reference:** **–**
	Significance of speed representation			Relevant: FDD/SLM	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: FDD/SLM	Protection level: 2/4
Unit: μN	Default: 0.0000	Minimum: –1 000 000.0000	Maximum: 1 000 000.0000	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: FDD/SLM	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 setpoint limit values and force limit values transferred from the NC to the drive.

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3 Supplementary Conditions

None

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4 Data Descriptions (MD, SD)

See Chapter 2

■

5 Signal Descriptions

None

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6 Example

None

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7 Data Fields, Lists

Table 7-1 Machine data

No.	Identifier	Name	Drive
1019	CURRENT_ROTORPOS_IDENT	Current, rotor/pole position identification	FDD/SLM
1020	MAX_MOVE_ROTORPOS_IDENT	Max. movement for rotor position identification	FDD/SLM
1024	DIVISION_LIN_SCALE	Graduation, motor measuring system	FDD/SLM
1034	DIVISION_LIN_SCALE_DM	Graduation for direct measuring system	FDD/SLM
1113	FORCE_CURRENT_RATIO	Force constant	FDD/SLM
1114	EMF_VOLTAGE	Voltage constant	FDD/SLM
1117	MOTOR_MASS	Motor weight	FDD/SLM
1146	MOTOR_MAX_ALLOWED_SPEED	Maximum motor velocity	FDD/SLM
1147	SPEED_LIMIT	Velocity limitation	FDD/SLM
1170	POLE_PAIR_PITCH	Pole pair width	FDD/SLM
1192	FORCE_LIMIT_WEIGHT	Force due to weight	FDD/SLM
1193	BALANCE_BY_STOP_C	Counterweight with Stop C	FDD/SLM
1230	FORCE_LIMIT_1	1st force limit	FDD/SLM
1231	FORCE_LIMIT_2	2nd force limit	FDD/SLM
1232	FORCE_LIMIT_SWITCH_SPEED	Switching speed from MD 1230 to MD 1231	FDD/SLM
1233	LIMIT_GENERATOR	Regenerative limiting	FDD/SLM
1234	FORCE_LIMIT_SWITCH_HYST	Hysteresis, MD 1232	FDD/SLM
1239	FORCE_LIMIT_FOR_SETUP	Force limit setup mode	FDD/SLM
1245	CURRENT_SMOOTH_SPEED	Threshold of velocity–dependent Fset smoothing	FDD/SLM
1246	CURRENT_SMOOTH_HYSTERESIS	Hysteresis of velocity–dependent Fset smoothing	FDD/SLM
1252	FORCE_FILTER_FREQUENCY	Frequency limit of force setpoint smoothing	FDD/SLM
1400	MOTOR_RATED_SPEED	Rated motor velocity	FDD/SLM
1401	MOTOR_MAX_SPEED	Velocity for maximum useful motor velocity	FDD/SLM
1403	PULSE_SUPPRESSION_SPEED	Pulse suppression shutdown velocity	FDD/SLM
1405	MOTOR_SPEED_LIMIT	Monitoring velocity, motor	FDD/SLM
1407	SPEEDCTRL_GAIN_1	P gain of speed controller	FDD/SLM
1408	SPEEDCTRL_GAIN_2	P gain, upper adaptation velocity	FDD/SLM
1409	SPEEDCTRL_INTEGRATOR_TIME_1	Reset time of speed controller	FDD/SLM
1410	SPEEDCTRL_INTEGRATOR_TIME_2	Reset time, upper adaptation velocity	FDD/SLM
1411	SPEEDCTRL_ADAPT_SPEED_1	Lower adaptation velocity	FDD/SLM
1412	SPEEDCTRL_ADAPT_SPEED_2	Upper adaptation velocity	FDD/SLM
1413	SPEEDCTRL_ADAPT_ENABLE	Select adaptation for speed controller	FDD/SLM
1414	SPEEDCTRL_REF_MODEL_FREQ	Natural frequency of reference model velocity	FDD/SLM

Table 7-1 Machine data, continued

No.	Identifier	Name	Drive
1415	SPEEDCTRL_REF_MODEL_DAMPING	Reference model damping velocity	FDD/SLM
1416	SPEEDCTRL_REF_MODEL_DELAY	Balancing, reference model, velocity	FDD/SLM
1417	SPEED_THRESHOLD_X	vx for 'vist < vx' signal	FDD/SLM
1418	SPEED_THRESHOLD_MIN	vmin for 'vist < vmin' signal	FDD/SLM
1420	MOTOR_MAX_SPEED_SETUP	Maximum motor velocity setup mode	FDD/SLM
1424	SPEED_FFW_FILTER_TIME	Balancing filter for velocity feedforward control channel	FDD/SLM
1426	SPEED_DES_EQ_ACT_TOL	Tolerance band for 'vset=vact' signal	FDD/SLM
1427	SPEED_DES_EQ_ACT_DELAY	Delay time 'vset=vact' signal	FDD/SLM
1428	FORCE_THRESHOLD_X	Threshold force Fdx	FDD/SLM
1429	TORQUE_THRESHOLD_X_DELAY	Delay time 'Fd < Fdx' signal	FDD/SLM
1500	NUM_SPEED_FILTERS	Number of velocity setpoint filters	FDD/SLM
1501	SPEED_FILTER_TYPE	Type of speed–setpoint filter	FDD/SLM
1502	SPEED_FILTER_1_TIME	Time constant of velocity setpoint filter 1	FDD/SLM
1503	SPEED_FILTER_2_TIME	Time constant of velocity setpoint filter 2	FDD/SLM
1506	SPEED_FILTER_1_FREQUENCY	Natural frequency of velocity setpoint filter 1	FDD/SLM
1507	SPEED_FILTER_1_DAMPING	Damping of velocity setpoint filter 1	FDD/SLM
1508	SPEED_FILTER_2_FREQUENCY	Natural frequency of velocity setpoint filter 2	FDD/SLM
1509	SPEED_FILTER_2_DAMPING	Damping of velocity setpoint filter 2	FDD/SLM
1514	SPEED_FILTER_1_SUPPR_FREQ	Blocking frequency of velocity setpoint filter 1	FDD/SLM
1515	SPEED_FILTER_1_BANDWIDTH	Bandwidth of velocity setpoint filter 1	FDD/SLM
1516	SPEED_FILTER_1_BW_NUMERATOR	Bandwidth numerator of velocity setpoint filter 1	FDD/SLM
1517	SPEED_FILTER_2_SUPPR_FREQ	Blocking frequency of velocity setpoint filter 2	FDD/SLM
1518	SPEED_FILTER_2_BANDWIDTH	Bandwidth of velocity setpoint filter 2	FDD/SLM
1519	SPEED_FILTER_2_BW_NUMERATOR	Bandwidth numerator of velocity setpoint filter 2	FDD/SLM
1520	SPEED_FILTER_1_BS_FREQ	Bandstop filter natural frequency for velocity setpoint filter 1	FDD/SLM
1521	SPEED_FILTER_2_BS_FREQ	Bandstop filter natural frequency for velocity setpoint filter 2	FDD/SLM
1606	SPEEDCTRL_LIMIT_THRESHOLD	Threshold, speed controller at its limit	FDD/SLM
1615	SMOOTH_RUN_TOL	Tolerance, rotational accuracy monitoring	FDD/SLM
1635	GEN_AXIS_MIN_SPEED	Minimum velocity of generator axis	FDD/SLM
1639	RETRACT_SPEED	Emergency retraction speed	FDD/SLM
1706	DESIRED_SPEED	Speed setpoint	FDD/SLM
1707	ACTUAL_SPEED	Speed actual value	FDD/SLM
1711	SPEED_LSB	Significance of velocity representation	FDD/SLM
1713	FORCE_LSB	Significance of force representation	FDD/SLM
1725	MAX_FORCE_FROM_NC	Normalization of force setpoint interface	FDD/SLM

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

Calculating Motor/Power Section and Controller Data (DM1)

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1 Product Brief

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.

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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: FDD/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 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
1015	PEMSD_MODE_ENABLE	Activate PE–MSD	FDD/SLM
1019	CURRENT_ROTORPOS_IDENT	Current, rotor/pole position identification	FDD/SLM
1100	PWM_FREQUENCY	Frequency, pulse–width modulation	FDD/MSD/SLM
1102	MOTOR_CODE	Motor code number	FDD/MSD/SLM
1103	MOTOR_NOMINAL_CURRENT[DRx]	Rated motor current	FDD/MSD/SLM
1104	MOTOR_MAX_CURRENT[DRx]	Max. motor current	FDD/SLM
1112	NUM_POLE_PAIRS[DRx]	Motor pole pair number	FDD/SLM
1113	TORQUE_CURRENT_RATIO[DRx]	Torque constant	FDD/SLM
1114	EMF_VOLTAGE[DRx]	Voltage constant	FDD/SLM
1115	ARMATURE_RESISTANCE[DRx]	Armature resistance	FDD/SLM
1116	ARMATURE_INDUCTANCE[DRx]	Armature inductance	FDD/SLM
1117	MOTOR_INERTIA[DRx]	Motor moment of inertia	FDD/MSD/SLM
1118	MOTOR_STANDSTILL_CURRENT[DRx]	Motor standstill current	FDD/SLM
1122	MOTOR_LIMIT_CURRENT	Motor limiting current	FDD/SLM

Table 2-1 Machine data, which are assigned when entering the motor code

No.	Identifier	Name	Drive
1128	OPT_LOAD_ANGEL	Optimum load angle	FDD/SLM
1130	MOTOR_NOMINAL_POWER[DRx]	Rated motor output	MSD
1132	MOTOR_NOMINAL_VOLTAGE[DRx]	Rated motor voltage	MSD
1134	MOTOR_NOMINAL_FREQUENCY[DRx]	Rated motor frequency	MSD
1135	MOTOR_NOLOAD_VOLTAGE[DRx]	Motor no–load voltage	MSD
1136	MOTOR_NOLOAD_CURRENT[DRx]	Motor no–load current	FDD/MSD/SLM
1137	STATOR_COLD_RESISTANCE[DRx]	Stator resistance, cold	MSD
1138	ROTOR_COLD_RESISTANCE[DRx]	Rotor resistance, cold	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]	Speed at the start of field weakening	FDD/MSD/SLM
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 (standstill) torque reduction factor	FDD/MSD/SLM
1146	MOTOR_MAX_ALLOWED_SPEED[DRx]	Maximum motor speed	FDD/MSD/SLM
1149	RELUCT_TORQUE_RATIO	Reluctance torque constant	FDD/SLM
1170	POLE_PAIR_PITCH	Pole pair width	FDD/SLM
1172	PEMSD_VSA	FDD operation with field weakening	FDD/SLM
1180	CURRCTRL_ADAPT_CURRENT_1	Lower current limit adaptation	FDD/SLM
1181	CURRCTRL_ADAPT_CURRENT_2	Upper current limit adaptation	FDD/SLM
1182	REDUCE_ARMATURE_INDUCTANCE	Factor, current controller adaptation	FDD/SLM
1183	CURRCTRL_ADAPT_ENABLE	Current controller adaptation ON	FDD/SLM
1185	STARTUP_FACT_CURRCTRL	Startup factor P_IREG	MSD
1268	TAU_TIME	Winding time constant	FDD/MSD/SLM
1400	MOTOR_RATED_SPEED[DRx]	Rated motor speed	FDD/MSD/SLM
1602	MOTOR_TEMP_WARN_LIMIT[DRx]	Motor temperature warning threshold	FDD/MSD/SLM
1607	MOTOR_TEMP_SHUTDOWN_LIMIT[DRx]	Shutdown limit, motor temperature	FDD/MSD/SLM

Note

If no valid motor MLFB (code number) is specified in MD 1102
(e.g. ”0”⇒ third–party motors), then all of the machine data must be entered manually.

1103	MOTOR_NOMINAL_CURRENT				Cross reference: –
	Rated motor current			Relevant: FDD/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: FDD	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: FDD	Protection level: 2/4
Unit: –	Default:	Minimum:	Maximum:	Data type: UNS.WORD	Active: POWER ON
810D	0	0	4		
840D	0	0	4 096		

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: FDD	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: FDD	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).

1115	ARMATURE_RESISTANCE				Cross reference: –
	Armature resistance			Relevant: FDD	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: FDD	Protection level: 2/4
Unit: mH	Default: 0.0	Minimum: 0.0	Maximum: 300.0	Data type: FLOAT DWORD	Active: POWER ON

From the motor data sheet (third–party motor), enter the armature inductance in the armature circuit for the single–phase equivalent circuit diagram, 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: FDD/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: FDD/SLM	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	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:** –
	Nominal 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 nominal 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: –
	Nominal motor voltage			Relevant: MSD	Protection level: 2/4
Unit: V	Default: 380.0	Minimum: 0.0	Maximum: 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: –
	Nominal motor frequency			Relevant: MSD	Protection level: 2/4
Unit: Hz	Default: 50.0	Minimum: 0.0	Maximum: 3 000.0	Data type: 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.

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 (MSD) Motor short–circuit current (FFD/SLM)			Relevant: MSD/FDD/SLM	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 • 60 [sec] / (2π • $\sqrt{3 \bullet}$ MD 1112 • MD 1116)

MD 1112: NUM_POLE_PAIRS

MD 1114: EMF_VOLTAGE

MD 1116: ARMATURE_INDUCTANCE

1137	STATOR_COLD_RESISTANCE				Cross reference: –
	Stator cold resistance			Relevant: MSD	Protection level: 2/4
Unit: Ω	Default: 0.0	Minimum: 0.0	Maximum: 120.0	Data type: FLOAT	Active: Immediately

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 cold resistance			Relevant: MSD	Protection level: 2/4
Unit: Ω	Default: 0.0	Minimum: 0.0	Maximum: 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	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.

1142	FIELD_WEAKENING_SPEED				Cross reference: –
	Speed at the start of field weakening			Relevant: MSD/FDD	Protection level: 2/4
Unit: rev/min	Default: 0.0	Minimum: 0.0	Maximum: 100,000.0	Data type: FLOAT	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 reactance L_h linearly increases from the saturated value at the threshold speed for the 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.

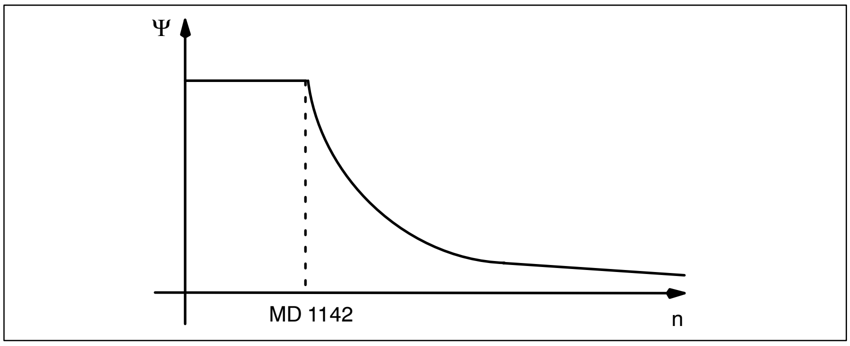


Fig. 2-1 Field weakening characteristic

The following machine data MD 1143 and MD 1144 only apply for software version 3.00.08:

1143	LH_CURVE_UPPER_SPEED				Cross reference: –
	Upper speed L_h characteristic			Relevant: MSD	Protection level: 2/4
Unit: rev/min	Default: 0.0	Minimum: 0.0	Maximum: 100,000.0	Data type: FLOAT	Active: POWER ON

Enter the upper speed for the L_h characteristic (magnetizing reactance 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 reactance L_h linearly increases from the saturated value at the threshold speed for the 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: 100.0	Minimum: 100.0	Maximum: 500.0	Data type: FLOAT	Effective: Power on

Enter the gain factor (L_{h2}/L_{h1}) of the L_h characteristic (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. In the field–weakening range, the magnetizing inductance L_h linearly increases from the saturated value at the threshold speed for the field weakening to the non–saturated value at the upper speed of the L_h characteristic.

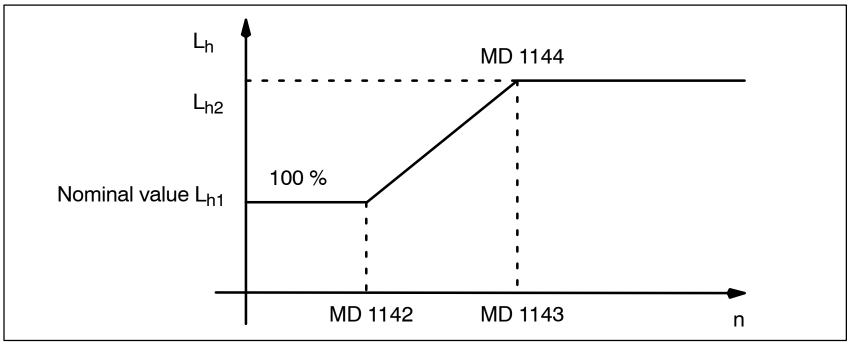


Fig. 2-2 L_h characteristic (magnetizing inductance)

Note

100% should be entered if the value is not known, so that the magnetizing reactance is constant over the complete speed range.

1145	STALL_TORQUE_REDUCTION				Cross reference: –
	Breakdown torque reduction factor			Relevant: MSD/FDD	Protection level: 2/4
Unit: %	Default: 100.0	Minimum: 5.0	Maximum: 1 000.0	Data type: FLOAT	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: FDD/MSD	Protection level: 2/4
Unit: rev/min	Default: 0.0 MSD: 1500.0	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) 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: /IADC/ Commissioning Manual 840D/810D/611D

1400	MOTOR_RATED_SPEED				Cross reference: –
	Nominal motor speed			Relevant: FDD/MSD	Protection level: 2/4
Unit: rev/min	Default: 0.0 MSD: 1450.0	Minimum: 0.0	Maximum: 100,000.0	Data type: FLOAT	Active: POWER ON

Enter the nominal 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.

1602	MOTOR_TEMP_WARN_LIMIT				Cross reference: –
	Motor temperature warning threshold			Relevant: FDD/MSD	Protection level: 2/4
Unit: °C	Default: 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 via the temperature sensor and evaluated on the drive side. A signal ("Motor temperature prewarning", IS DB31, ... DBX94.0) is output to the PLC when the warning limit is reached (see MD 1603 and MD 1607).

References: /FBA, DÜ1/ Monitoring Functions, Limits

2.1.2 Power section data

1106	INVERTER_CODE				Cross reference: –
Power section code number				Relevant: FDD/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 (the user does not have to enter anything) by entering the power section MLFB when the drive is started up, using the startup tool/HMI Advanced. 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	Current magnitude	PM	Comment
6	MSD	24/32/32 A	50 A	
7	MSD	30/40/51 A	80 A	
8	MSD	45/60/76 A	120 A	
9	MSD	60/80/102 A	160 A	
A	MSD	85/110/127 A	200 A	
B	MSD	120/150/193 A	300 A	
C	MSD	200/250/257 A	400 A	
D	MSD	45/60/76 A	108 A	
E	MSD	24/32/40 A	50 A	810D internal
11	FDD	3/6 A	8 A	
12	FDD	5/10 A	15 A	
13	FDD	6/12 A	15 A	810D internal
14	FDD	9/18 A	25 A	
15	FDD	9/18 A	25 A	810D internal
16	FDD	18/36 A	50 A	
17	FDD	28/56 A	80 A	
19	FDD	56/112 A	160 A	
1A	FDD	70/140 A	200 A	
1E	FDD	18/36 A	50 A	810D internal
28	FDD	140/210 A	400 A	SW 4.2 and higher

1107	INVERTER_MAX_CURRENT				Cross reference: –
	Transistor limit current, power section			Relevant: FDD/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 peak value. MD 1106: INVERTER_CODE is used to automatically parameterize the Siemens power sections for this machine data.

Example

Power section 50 A	FDD: 18/36 A MSD: 24/32/32 A
LT 50 A	MD 1107: INVERTER_MAX_CURRENT for MSD and FDD
FDD **18**/xxA	MD 1111: INVERTER_RATED_CURRENT
FDD 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 **must not be changed** by the user following automatic default selection.

1108	INVERTER_MAX_THERMAL_CURRENT				Cross reference: –
	Thermal limit current, power section			Relevant: FDD/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 is used to automatically parameterize 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 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.

1111	INVERTER_RATED_CURRENT				Cross reference: –
	Rated power section current			Relevant: FDD/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 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.

1119	SERIES_INDUCTANCE				Cross reference: –
	Series reactor inductance			Relevant: MSD/AM	Protection level: 2/4
Unit: mH	Default: 0.0	Minimum: 0.0	Maximum: 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	Designation	Drive
1000	CURRCTRL_CYCLE_TIME	Current controller cycle clock	FDD/MSD/SLM
1001	SPEEDCTRL_CYCLE_TIME	Speed controller clock cycle	FDD/MSD/SLM
1003	STS_CONFIG	Configuration STS	FDD/MSD/SLM
1015	PEMSD_MODE_ENABLE	Activate PE-MSD	FDD/SLM
1104	MOTOR_MAX_CURRENT	Max. motor current	FDD/SLM
1116	ARMATURE_INDUCTANCE	Armature inductance	FDD/SLM
1117	MOTOR_INERTIA	Motor moment of inertia	FDD/MSD/SLM
1118	MOTOR_STANDSTILL_CURRENT	Motor standstill current	FDD/SLM
1119	SERIES_INDUCTANCE	Inductance of the series reactor	MSD
1134	MOTOR_NOMINAL_FREQUENCY	Rated motor frequency	MSD
1138	ROTOR_COLD_RESISTANCE	Rotor resistance, cold	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	Speed at the start of field weakening	FDD/MSD/SLM
1146	MOTOR_MAX_ALLOWED_SPEED	Maximum motor speed	FDD/MSD/SLM
1172	PEMSD_VSA	FDD operation with field weakening	FDD/SLM
1400	MOTOR_RATED_SPEED	Rated motor speed	FDD/MSD/SLM

The following machine data are changed using the **Calculate controller data** softkey:

Table 2-4 Output machine data

MD No.	MD name	Designation	Drive
1120	CURRCTRL_GAIN[DRx]	P gain, current controller	FDD/MSD/SLM
1121	CURRCTRL_INTEGRATOR_TIME[DRx]	Integrator time of current controller	FDD/MSD/SLM
1147	SPEED_LIMIT[DRx]	Speed limitation	FDD/MSD/SLM
1150	FIELDCTRL_GAIN	Flux controller P gain	FDD/MSD/SLM
1151	FIELDCTRL_INTEGRATOR_TIME	Flux–controller reset time	FDD/MSD/SLM
1230	TORQUE_LIMIT_1	1st torque limit value	FDD/MSD/SLM
1235	POWER_LIMIT_1	1st power limit value	FDD/MSD/SLM
1401	MOTOR_MAX_SPEED	Speed for the max. useful motor speed	FDD/MSD/SLM
1405	MOTOR_SPEED_LIMIT	Monitoring speed, motor	FDD/MSD/SLM
1407	SPEEDCTRL_GAIN_1[0...7,DRx]	P gain of speed controller	FDD/MSD/SLM
1408	SPEEDCTRL_GAIN_2[0...7,DRx]	P gain, upper adaptation speed	FDD/MSD/SLM
1409	SPEEDCTRL_INTEGRATOR_TIME_1[0...7,DRx]	Integral time of speed controller	FDD/MSD/SLM
1410	SPEEDCTRL_INTEGRATOR_TIME_2[0...7,DRx]	Integral action time, upper adaptation speed	FDD/MSD/SLM
1411	SPEEDCTRL_ADAPT_SPEED_1	Lower adaptation speed	FDD/MSD/SLM
1412	SPEEDCTRL_ADAPT_SPEED_2	Upper adaptation speed	FDD/MSD/SLM
1413	SPEEDCTRL_ADAPT_ENABLE	Selection, speed controller adaptation	FDD/MSD/SLM

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:

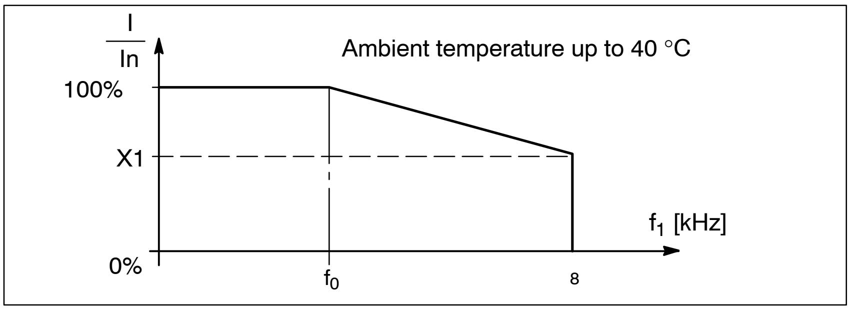


Fig. 2-3 Derating characteristic

If pulse frequency f1 (MD 1100) is greater than frequency f0 (FDD: 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:

- FDD (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
- FDD 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 FDD 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 (FDD 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 FDD or 3.2 kHz for MSD and PE–MSD. Otherwise, a derating factor of 100% is displayed in MD 1099.

SW 6.08.22 and higher:

When booting, the currently effective derating factor is calculated as a function of the pulse frequency (MD 1100), the ambient temperature (MD 1094), the installation altitude (MD 1095) and derating factor X1

It can be viewed in display data MD 1099.

The derating curves – ”pulse-frequency dependent”, ”temperature-dependent” and ”installation-altitude dependent” for the power unit are the basis for this automatic calculation.

Reader’s note

Derating curves, refer to

References: /PJU/ SIMODRIVE Configuration Manual Drive Converters
Chapter 4.4 Current reduction/derating

With this functionality, the following current reduction is obtained for the power unit:

$I_{max\ (MSD/FDD)}$ = MD 1108 (from the power unit list) • MD 1099

$I_{max\ (SLM)}$ = MD 1175 (from the power unit list) • MD 1099

$I_{S6\ (MSD)}$ = MD 1109 (from the power unit list) • MD 1099 • MD 1260

$I_{S6\ (SLM)}$ = MD 1176 (from the power unit list) • MD 1099 • MD 1260

I_{rated} = MD 1111 (from the power unit list) • MD 1099 • MD 1261

2.3.2 Machine data

The following machine data are available for i^2t derating:

1094	DERATING_AMB_AIR_TEMPERAT				Cross reference: –
	Derating, ambient temperature			Relevant: MSD/SLM/FDD	Protection level: 2/4
Unit: °C	Default: 40.0	Minimum: 30.0	Maximum: 55.0	Data type: UNS.WORD	Active: Power On

1095	DERATING_ABSOLUTE_ALTITUDE				Cross reference: –
	Derating, installation altitude			Relevant: MSD/SLM/FDD	Protection level: 2/4
Unit: m	Default: 1000.0	Minimum: 0.0	Maximum: 5000.0	Data type: FLOAT	Active: Power On

1098	INVERTER_MAX_CURR_DERAT				Cross reference: –
	PS derating limit current			Relevant: MSD/SLM/FDD	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			Relevant: MSD/SLM/FFD	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			Relevant: SLM/FDD	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/FDD	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/FDD	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/FDD	Protection level: 2/4
Unit: %	Default: 0.0	Minimum: 0.0	Maximum: 100.0	Data type: FLOAT	Active: POWER ON

1179	INVERTER_DERATING_ASYN				Cross reference: –
	Power section, derating ASYN			Relevant: FDD/MSD/SLM	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: –
	PS derating limit current			Relevant: FDD/MSD/SLM	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			Relevant: FDD/MSD/SLM	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 (hexadecimal)	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

Table 2-5 Power section data for MSD

MD 1106 (hexadecimal)	MD 1107	MD 1108	MD 1109	MD 1111	MD 1179
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

FDD

Table 2-6 Power section data for FDD

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^2t power section limitation (SW 6 and higher)

2.4.1 Description

Note

The function is taken from SIMODRIVE 611 universal.

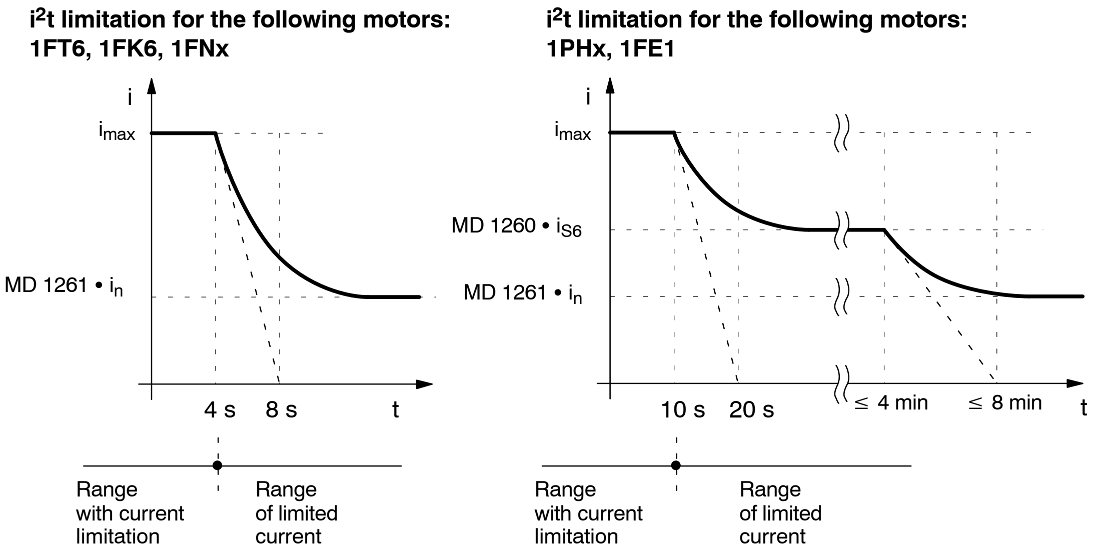
References: /FBU/ Function Manual, SIMODRIVE 611 universal

i^2t power section limitation

This limit protects the power module from continuous 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 limit is removed step–by–step if the power module is no longer being operated above the load limit.



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. 2-4 Behavior when operation is continued at the current limit

Output signals

The limit status is displayed via ZK3, bit 10.

ZK3 bit 10 = 1: Power section within i^2t limit

ZK3 bit 10 = 0: Power section within i^2t limit

2.4.2 Machine data

The following machine data are available for the "i^2t power section limitation" function:

Settable MD

These MDs are preset to protect the power section. It may be possible to protect the motor against continuous overload by reducing the parameter values.

1260	I2T_S6_REDUCTION				Cross reference: –
	i^2t limitation, limit current, power section S6			Relevant: FDD/MSD/SLM	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^2t limitation, rated current, power section S6			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: %	Default: 110.0 MSD: 100.0	Minimum: 25.0	Maximum: 110.0 MSD: 100.0	Data type: FLOAT	Active: Immediately

---

Note

The maximum value of MD 1261 is

- For 1FT6, 1FK□ and 1FN□ = 110%,
- For 1PH□ 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: –
	i^2t time in limit			Relevant: FDD/MSD/SLM	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: –
	i^2t current limitation factor			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: %	Default: 0.0	Minimum: 0.0	Maximum: 100.0	Data type: FLOAT	Active: Immediately

1264	LOAD_I2T				Cross reference: –
	i^2t current load factor			Relevant: FDD/MSD/SLM	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 limitation. 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	Machine statistic 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

Note

Terminology change:
Rotor position identification (RLI), corresponds to the pole position identification (PLI)!

Description

Converters with field–oriented closed–loop control specify the current for permanently–excited synchronous motors with respect to the magnetic flow in the motor. Rotor/pole position identification determines the absolute position of the rotor in the motor independently on power–up, based on the maximum magnetic flow.

Rotor/pole position identification is used for:

- Determining the rotor position (coarse synchronization and fine synchronization)
- Support during startup in determining the commutation angle offset

Rotor/pole position identification is possible using three techniques:

- Saturation–based technique (MD 1075 = 1)
- Motion–based technique (MD 10 75 = 3)
  (with drive SW 05.01.10, 06.03.09 and higher)
- Elasticity technique (MD 1075 = 6) (with drive SW 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 1523: ACT_SPEED_FILTER_TIME_RLI	X	X	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

Determining the rotor position

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 Section 2.5.5).

Fine synchronization

- with zero marks: MD 1011.13 = 0

  With fine synchronization (MD 1011.13 = 0), the commutation offset is transferred when passing the zero mark.

  Advantages:

  - Fine synchronization guarantees consistent force and torque utilization.
  - An increase in robustness thanks to renewed encoder monitoring (absolute information and internal pole position).

  Parameter P1016 must be appropriately set.

Notice

When replacing the motor/encoder, the commutation angle (MD 1016) must be re–determined.

- with pole position identification: P1011.13 = 1

  For MD 1011.13 = 1, fine synchronization is replaced by pole position identification. This makes MD 1016 ineffective.

Equivalent of the encoder adjustment

If rotor/pole position identification is used for coarse and fine synchronization, encoder adjustment may be omitted.

Configuration, actual value sensing motor encoder

In MD 1011, bit 12 (identify coarse position) is set to cause the RPI procedure to be initiated when the drive is switched on. If bit 13 is set (fine synchronization), rotor/pole position identification is executed independently of bit 12.

2.5.1 Supplementary conditions

- The techniques can only be started when the controller and pulses are enabled as current must flow through the motor.
- When using an absolute motor measuring system, rotor/pole position identification can only be used to determine the commutation angle offset (P1016).
- The technique can only be started with controller and pulse enable, as the motor must be conducting current.
- When the motor changeover function is activated (this enables star/delta changeover, MD 1013) with different techniques for the rotor/pole position identification (MD x075) when booting, ”Motor data set 1” must be selected. A motor changeover is not permissible during the rotor/pole position identification.

A technique based on saturation (MD 1075 = 1)

When using the saturation–based technique for rotor/pole position identification, the following supplementary conditions must be observed:

- This technique can be used for both braked and non–braked motors.
- The technique cannot be used for motors which are moving.
- The specified current level must be sufficient to produce a significant measuring signal.
- 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 FDD 06.03.09, 05.01.10):

- Due to differences in mechanical construction, the result of motionbased rotor/pole position identification must be checked once on initial startup. The deviation in measured rotor position should be < 10° electrical.
- The measuring system must be firmly mounted.
- The axis static friction must be low in comparison to the rated motor force or rated motor torque. An excessively high static friction can have a significant negative impact on the accuracy of rotor/pole position identification and, under certain circumstances, make it impossible to execute rotor/pole position identification with motion.
- The technique may only be used for horizontal axes which can freely move and which do not have a brake.
- There must be no external forces acting on the motor during rotor/pole position identification.
- If the supplementary conditions listed above are not met, in the case of linear motors, operation is only permitted in conjunction with Hall sensor boxes or with an absolute measuring system.
- When this technique is used, in a worst–case scenario movement in the range of ± 10 mm or ±5 degrees can occur.
- The axis to be identified must be placed in follow–up mode until identification has been completed, to suppress alarm 25040 (zero–speed monitoring).

Warning

When the motors are not braked, the motor rotates or moves as a result of the current impressed during the measurement. The magnitude of the motion depends on the magnitude of the current and the moment of inertia of the motor and load.

- 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 (MD 1705 = 3), it is possible to enter a time constant for actual–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 noise which is generated should be heard as a sequence of soft surges.

The following should be done if faults occur:

- 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. This test function can determine the difference between the determined rotor position angle and the rotor position angle used by the closed–loop control.

The following procedure should be applied 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.

Condition: High Performance controller with FDD software ≥ 06.07.07

Note

The axis must be securely braked.

2.5.2 Steps when commissioning the system

1. Step: Determine the pole position

   – Incremental measuring system (with zero mark)

   Set MD 1011.12 = 1
   Set MD 1011.13 = 0
   Perform an HW RESET
   Set MD 1017.0 = 1
   Switch on the pulse and servo enable signals
   Move the axis over the zero mark (e.g. enter low n_{set})
   —> The angular offset is automatically entered in MD 1016
   —> Alarm 300799
   (save to FEPROM and HW RESET required) is displayed
   Save to FEPROM and perform an HW RESET

   – Absolute measuring system (with CD track)

   Switch on with the controller and pulses disabled
   Set MD 1017.0 = 1
   Switch on the controller and pulse enable
   —> The angular offset is automatically entered in MD 1016
   —> Alarm 300799
   (save to FEPROM and HW RESET required) is displayed
   Save to FEPROM and perform an HW RESET

2. Step: Check the pole position

   To check the rotor/pole position identification, you can use a test function to determine the difference between the calculated rotor angle position and that actually used by the closed–loop control. Proceed as follows:

   – Start the test function several times and evaluate the difference
   Start Set MD 1736 (test rotor/pole position identification) to 1
   Difference MD 1737 (difference, rotor/pole position identification)

   = _ _ _ _ , _ _ _ _ , _ _ _ _ , _ _ _ _ , _ _ _ _

   – Is the spread of the measured values less than 2 degrees electrical?
   Yes: OK
   No: Increase MD 1019 (e.g. by 10%)
   and repeat the measurements

   If OK after having repeated the measurements, then the angular commutation offset can be re–determined:

   For an incremental measuring system:
   as for Point 2. (determining the angular commutation offset)

   For an absolute measuring system:
   Shut down the drive (POWER ON–RESET)
   Switch on the drive with the pulse or servo enable signals switched off
   Set MD 1017.0 to 1
   Switch on the pulse and servo enable signals
   —> The angular offset is automatically entered into MD 1016
   —> Alarm 300799
   (save to FEPROM and HW RESET required) is displayed
   Save to FEPROM and perform an HW RESET

2.5.3 Machine data

1011	**ACTUAL_VALUE_CONFIG**				**Cross reference:** –
	Configuration, actual–value sensing IM			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hex	Default: 0	Minimum: 0	Maximum: F1FF	Data type: UNS.WORD	Active: 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, If bit 13 is set (fine synchronization), rotor/pole position identification is executed independently of bit 12.

1016	**COMMUTATION_ANGLE_OFFSET**				**Cross reference:** –
	Commutation angle offset			Relevant: FDD/SLM	Protection level: 2/4
Unit: Degrees.	Default: 0.0	Minimum: –360.0	Maximum: 360.0	Data type: FLOAT	Active: POWER ON

1017	**STARTUP_ASSISTANCE**				**Cross reference:** –
	Assistance for startup			Relevant: FDD/SLM	Protection level: 2/4
Unit: –	Default: 0	Minimum: –1	Maximum: 1	Data type: WORD	Active: 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: FDD/SLM	Protection level: 2/4
Unit: %	Default: 50.0 SLM: 12.0	Minimum: 0.0	Maximum: 100.0	Data type: FLOAT	Effective: 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 MAX_MOVE_ROTORPOS_IDENT (SLM)				Cross reference: –
	ROT: Maximum rotation, rotor/pole position identification LIN: Maximum motion, rotor/pole position identification			Relevant: FDD/SLM	Protection level: 2/4
Unit: Degrees. SLM: mm	Default: 10.0 SLM: 5.0	Minimum: 0.0	Maximum: 90.0 SLM: 30.0	Data type: FLOAT	Active: Immediately

The rotor/pole position identification can cause a more or less large motion 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			Relevant: FDD/SLM	Protection level: 1/1
Unit: –	Default: 1	Minimum: 1	Maximum: 6	Data type: UNS.WORD	Active: Immediately

The technique is set in MD 1075.

Table 2-8 Coding in MD 1075

MD 1075 =	Process
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 setpoint rise time of RPI			Relevant: FDD/SLM	Protection level: 2/4
Unit: ms	Default: 500.0	Minimum: 0.0	Maximum: 10 000.0	Data type: FLOAT	Active: 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: –
	RPI wait time			Relevant: FDD/SLM	Protection level: 2/4
Unit: ms	Default: 20	Minimum: 0.0	Maximum: 10 000.0	Data type: FLOAT	Active: Immediately

The delay between two measurements during the RPI process (MD 1075 = 6).

1072	RLI_AMOUNT				Cross reference: –
	Number of RPI measurements			Relevant: FDD/SLM	Protection level: 2/4
Unit: –	Default: 12	Minimum: 6	Maximum: 60	Data type: UNS.WORD	Active: Immediately

1073	POSS_TURN_ROTORPOSS_IDENT POSS_MOVE_ROTORPOSS_IDENT (SLM)				Cross reference: –
	Permissible rotation of rotor position identification Permissible rotor position identification (SLM)			Relevant: FDD/SLM	Protection level: 2/4
Unit: Degr. SLM: mm	Default: 1.0 SLM: 0.1	Minimum: 0.0	Maximum: 90.0 SLM: 30.0	Data type: FLOAT	Active: Immediately

1076	FACTOR_INERTIA FACTOR_MASS (SLM)				Cross reference: –
	Load moment of inertia factor Load mass factor (SLM)			Relevant: FDD/SLM	Protection level: 1/1
Unit: kg m^2 SLM: kg	Default: 0.0	Minimum: –500.0	Maximum: 500.0 SLM: 10 000.0	Data type: FLOAT	Active: Immediately

Additional moment of inertia (FDD) 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: –
	Integrator time for RLI controller			Relevant: FDD/SLM	Protection level: 1/1
Unit: ms	Default: 3.7	Minimum: 0.0	Maximum: 500.0	Data type: FLOAT	Active: 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_ROTORPOS_ID				Cross reference: –
	Max. duration of rotor/pole position identification			Relevant: FDD/SLM	Protection level: 1/1
Unit: ms	Default: 800.0	Minimum: 100.0	Maximum: 1 000.0	Data type: FLOAT	Active: Immediately

The maximum time for one measurement is specified in MD 1078.

1523	ACT_SPEED_FILTER_TIME_RLI				Cross reference: –
	Time constant of speed actual value filter RPI Time constant of velocity actual value filter RPI (SLM)			Relevant: FDD/SLM	Protection level: 1/1
Unit: ms	Default: 0.0	Minimum: 0.0	Maximum: 500.0	Data type: FLOAT	Active: Immediately

Time constant of actual–speed–value filter during rotor position identification, technique 3. This MD is effective with SW 6.8.5 and higher.

1729	ACTUAL_ELECTRIC_ROTORPOS				Cross reference: –
	Current rotor position, electrical			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Degrees.	Default: 0.0	Minimum: –100 000.0	Maximum: 100 000.0	Data type: FLOAT	Active: Immediately

1734	DIAG_ROTORPOS_IDENT				Cross reference: –
	Current, rotor/pole position identification			Relevant: FDD/SLM	Protection level: 2/4
Unit: –	Default: 0	Minimum: –1018	Maximum: 6	Data type: WORD	Active: Immediately

Table 2-9 Coding in MD 1734

MD 1734 =	Description	Remedy	Process MD 1075 =
0	Function was not selected or is not yet completed		1
1, 2, 3, 6	Each function has been successfully completed		1, 3, 6
–1	Measurement has not provided a significant result	Increase current in MD 1019	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 (MD 1019)	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

Table 2-9 Coding in MD 1734

MD 1734 =	Description	Remedy	Process MD 1075 =
–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
–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: –
	Current, rotor/pole position identification			Relevant: FDD/SLM	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 3	Data type: UNS.WORD	Active: Immediately

Setting MD 1736 Bit 1 = 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 Bit 1 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.

MD 1736 Bit 23 starts an encoder plausibility monitoring (cannot be adjusted). If the encoder plausibility monitoring is activated, Bit 0 and Bit 23 are set (SW 6.7.4 and higher).

1737	DIFF_ROTORPOS_IDENT		840D only		Cross reference: –
	Difference, rotor/pole position identification			Relevant: FDD/MSD ROT/LIN	Protection level: 2/4
Unit: Degrees.	Default: 0.0	Minimum: –100 000.0	Maximum: 100 000.0	Data type: FLOAT	Active: 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.

2.5.4 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			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hex	Default: 0	Minimum: 0	Maximum: F1FF	Data type: UNS.WORD	Active: POWER ON

Bit 7: 1 Distance–coded measuring system available
0 No distance–coded measuring system available

1055	MARKER_DIST		840D only		Cross reference: –
	Reference–mark distance with a distance–coded measuring system			Relevant: FDD/SLM	Protection level: 2/4
Unit: Degrees. SLM: mm	Default: 20.0	Minimum: 0	Maximum: 90.0 SLM: 1 000.0	Data type: FLOAT	Active: POWER ON

Drive machine data 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			Relevant: FDD/LIM	Protection level: 2/4
Unit: Degrees. SLM: mm	Default: 0.02	Minimum: 0.0	Maximum: 45.0 SLM: 500.0	Data type: FLOAT	Active: POWER ON

Drive machine data 1056 corresponds to NC machine data MD 34310 ENC_REFP_MARKER_INC. MD 1056 is motor–side, MD 34310 is load–side.

Interrupts

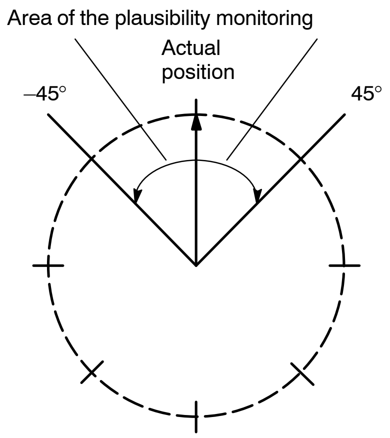
Errors discovered during fine synchronization are output with alarm signal 300507.

The following faults are detected:

- The calculated new rotor position differs more than 45 degrees compared 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).

2.5.5 Encoder plausibility check (SW 6.6.6 and higher)

To increase the ruggedness of the drive against incorrect encoder information, 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.



Note:

An offset by one of more pole pitches cannot be detected!

Fig. 2-5 Limits of plausibility monitoring (rotary axis example)

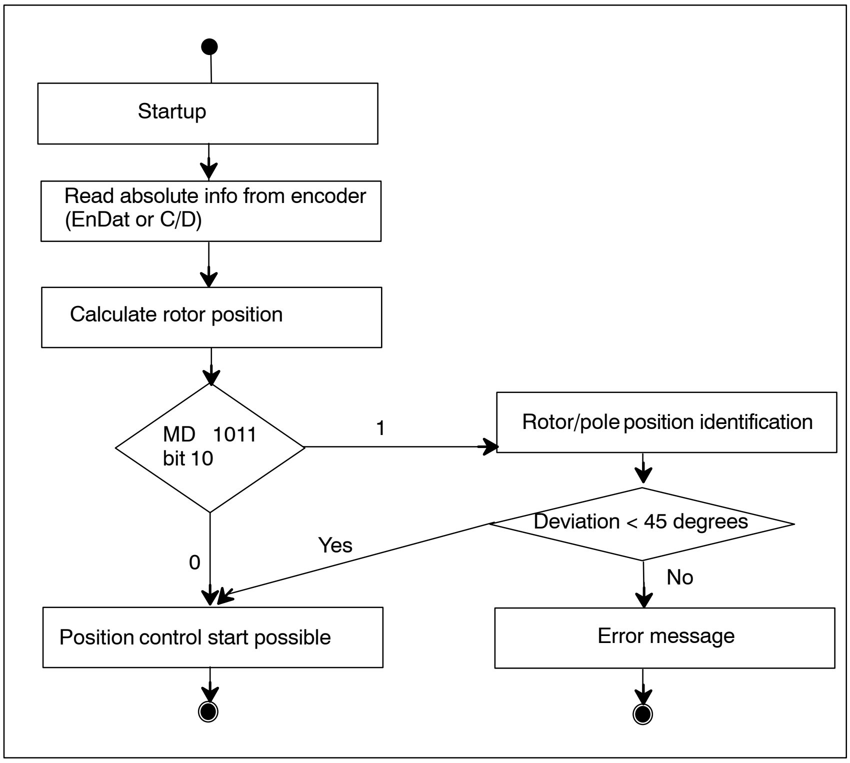


Fig. 2-6 Plausibility monitoring for absolute value encoder

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	ACTUAL_VALUE_CONFIG				Cross reference: –
	Configuration, actual–value sensing IM			Relevant: MSD/FDD/SLM	Protection level: 2/4
Unit: Hex	Default: 0	Minimum: 0	Maximum: F1FF	Data type: UNS.WORD	Active: Power on

MD 1011, bit 10 = 0
Plausibility monitoring is switched off

MD 1011, bit 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 3 (movement–based).
Noise can occur during techniques 1 (saturation–based) and 6 (elasticity–based).

Please observe the supplementary conditions in Section 2.5.1.

Alarm

300512	Plausibility monitoring responded
Explanation	• Ramp–up: 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, MD 1011[10]. • In operation: The acceleration/velocity direction is different to the torque/force direction. This monitoring can be set with MD 1645 and MD 1646.
Remedy	– This alarm can also occur when an axis is mechanically blocked. Check the cause of the fault analog to Alarm 300608 ”Speed controller at its end stop”. – Operation may only resume once the fault has been remedied, otherwise there is a risk of uncontrollable movement. • Ramp–up: – The deviation may be due to local contamination on the encoder or the encoder or encoder cable may not have been installed correctly. • In operation: – Increase the delay for the monitoring (MD 1645) for strongly oscillation load. – Caution: The value in MD 1645 influences the duration of the axis motion, triggered by positive feedback, until there is a fault response. – Check the encoder: Installation, contamination, fault of the absolute track, lost pulses, encoder cable.

2.5.6 Monitoring of the direction of the axis motion (SW 6.8.19 and higher)

Description

The ruggedness of the drive system with regard to encoder and pole position faults can be increased with this function.

It offers a solution for the following faults:

- Faulty absolute information from the encoder and thus false pole position information
- Demagnetized synchronous machine with faulty pole position identification

A check is carried out whether the acceleration/velocity of a machine always corresponds to the direction of the torque/force, referenced to all the torques/ forces existing in the system, In the process, oscillatory systems, external torques/forces and the energy storage in the system are taken into account.

If the speed controller is longer at its limit than the period parameterized in P1645 and the direction of acceleration/speed and torque/force differs, Alarm 300512 is reported.

Activating

Activating with parameter:

- MD 1645 Malorientation timer, direction monitoring

  Parameterization of the duration for which power controllers at the limit may have different directions during the acceleration/velocity and torque/force.
- MD 1646 Threshold deactivating of the direction monitoring

  Parameterization from which speed/velocity the direction monitoring is to be deactivate.

  If this limit is exceeded and no malorientation occurs, the monitoring is switched off. After ramp–up and deselection of the parking axis, the monitoring is activated again.

Supplementary conditions

The direction monitoring is activated by default. It can be deactivated by setting MD 1646 = 0. This may be necessary for the following applications:

- External torque
- Oscillating system
- Vertical axis
- Axes coupled at HLA
- Master slave with bias
- Travel to fixed stop
- Extremely fast axis (reversing in 10 ms)

Machine data

1645	MALORIENTATION_TIME				Cross reference: –
	Malorientation timer			Relevant: FDD/SLM	Protection level: 2/4
Unit: ms	Default: 12.0	Minimum: 5.0	Maximum: 1000.0	Data type: FLOAT	Active: Immediately

1646	POS_FEEDBACK_THRESHOLD				Cross reference: –
	Deactivation threshold of the direction monitoring (deactivated at value 0)			Relevant: FDD/SLM	Protection level: 2/4
Unit: rpm SLM: m/min	Default: 20.0 0.2	Minimum: 0.0	Maximum: 100000.0	Data type: FLOAT	Active: Immediately

■

3 Supplementary Conditions

None

■

4 Data Descriptions (MD, SD)

See Chapter 2

■

5 Signal Descriptions

None

■

6 Example

None

■

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Data Fields, Lists

7

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	Rated motor current	FDD/MSD
1104	MOTOR_MAX_CURRENT	Max. motor current	FDD
1112	NUM_POLE_PAIRS[DRx]	Motor pole pair number	FDD
1113	TORQUE_CURRENT_RATIO[DRx]	Torque constant	FDD
1114	EMF_VOLTAGE[DRx]	Voltage constant	FDD
1115	ARMATURE_RESISTANCE[DRx]	Armature resistance	FDD
1116	ARMATURE_INDUCTANCE[DRx]	Armature inductance	FDD
1117	MOTOR_INERTIA[DRx]	Motor moment of inertia	FDD/MSD
1118	MOTOR_STANDSTILL_CURRENT[DRx]	Motor standstill current	FDD
1129	POWER_FACTOR_COS_PHI	cos φ power factor	MSD
1130	MOTOR_NOMINAL_POWER[DRx]	Rated motor output	MSD
1132	MOTOR_NOMINAL_VOLTAGE[DRx]	Rated motor voltage	MSD
1134	MOTOR_NOMINAL_FREQUENCY[DRx]	Rated 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 resistance, cold	MSD
1138	ROTOR_COLD_RESISTANCE[DRx]	Rotor resistance, cold	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]	Speed at the start of 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 (standstill) 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 temperature warning threshold	FDD/MSD

7.2 Power section data

Table 7-2 Machine data

No.	Identifier	Name	Drive
1106	INVERTER_CODE[DRx]	Power module 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)	Inductance of the series reactor	MSD/AM

7.3 Power section derating

Table 7-3 Machine data

No.	Identifier	Name	Drive
1098	INVERTER_MAX_CURR_DERAT	PS derating limit current	FDD/MSD/SLM
1099	INVERTER_DERATING_FACT	PS limit current derating factor	FDD/MSD/SLM
1175	INVERTER_THERM_CURR_ASYN	Limit current, power section ASYN	FDD/SLM
1176	INVERTER_MAX_S6_CURR_ASYN	Limit current, power section S6 ASYN	FDD/SLM
1177	INVERTER_RATED_CURR_ASYN	Nominal current, power section ASYN	FDD/SLM
1178	INVERTER_DERATING_SYN	Power section, derating SYN	FDD/SLM
1179	INVERTER_DERATING_ASYN	Power section, derating ASYN	FDD/MSD/SLM
2098	INVERTIER_MAX_CURR_DERAT_M2	PS derating limit current	FDD/MSD/SLM
2099	INVERTIER_DERATING_FACT_M2	PS limit current derating factor	FDD/MSD/SLM

7.4 i^2t power module limitation

Table 7-4 Machine data

No.	Identifier	Name	Drive
1260	I2T_S6_REDUCTION	i^2t limitation, limit current, power section S6	FDD/MSD/SLM
1261	I2T_NOMINAL_REDUCTION	^2t limitation, nominal current, power section S6	FDD/MSD/SLM
1262	DIAGNOSIS_I2T	i^2t time in limit	FDD/MSD/SLM
1263	LIMIT_I2T	i^2t current limitation factor	FDD/MSD/SLM
1264	LOAD_I2T	i^2t current load factor	FDD/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/SLM
1016	COMMUTATION_ANGLE_OFFSET	Commutation angle offset	FDD/SLM
1017	STARTUP_ASSISTANCE	Assistance for startup	FDD/SLM
1019	CURRENT_ROTORPOS_IDENT	Current, rotor/pole position identification	FDD/SLM
1020	MAX_TURN_ROTORPOS_IDENT (FDD) MAX_MOVE_ROTORPOS_IDENT (SLM)	Max. rotation, rotor/pole pos. identification Max. motion, rotor/pole pos. identification	FDD/ SLM
1055	MARKER_DIST	Reference marker distance	FDD/SLM
1056	MARKER_DIST_DIFF	Distance difference	FDD/SLM
1070	RLI_RAMP_TIME	Current setpoint rise time of RPI	FDD/SLM
1071	RLI_WAIT_TIME	Current setpoint rise time of RPI	FDD/SLM
1072	RLI_AMOUNT	Number of RPI measurements	FDD/SLM
1073	POSS_TURN_ROTORPOS_IDENT POSS_MOVE_ROTORPOS_IDENT (SLM)	Perm. rotation of rotor position identification Permissible rotor position identification	FDD/ SLM
1075	ALGORITHM_ROTORPOS_IDENT	Process of rotor/pole position identification	FDD/SLM
1076	FACTOR_INERTIA FACTOR_MASS (SLM)	Load moment of inertia factor Load mass factor	FDD/ SLM
1077	RLI_INTEGRATOR_TIME	Integrator time for RLI controller	FDD/SLM
1078	MAX_TIME_ROTORPOS_ID	Maximum time for rotor position ID	FDD/SLM
1523	ACT_SPEED_FILTER_TIME_RLI	Time constant Actual–speed–value filter, RPI	FDD/MSD
1729	ACTUAL_ELECTRIC_ROTORPOS	Current rotor position (electrical)	FDD/MSD/SLM
1734	DIAG_ROTORPOS_IDENT	Diagnostics, rotor/pole position identification	FDD/SLM
1736	TEST_ROTORPOS_IDENT	Test, rotor/pole position identification	FDD/SLM
1737	DIFF_ROTORPOS_IDENT	Difference, rotor/pole position identification	FDD/SLM

7.6 Monitoring of the direction of the axis motion

Table 7-6 Machine data

No.	Identifier	Name	Drive
1645	MALORIENTATION_TIME	Malorientation timer	FDD/SLM
1646	POS_FEEDBACK_THRESHOLD	Threshold malorientation monitoring	FDD/SLM

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

Current Control Loop (DS1)

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1 Product Brief

Current controller

The current controller parameters are set when the operator selects **Select motor** 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.

■

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Detailed Description 2

2.1 Current controller setting

1000	CURRCTRL_CYCLE_TIME				Cross reference: –
	Current controller cycle			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: 31.25 µs 810D/Perf.2 840D	Default: 5 4	Minimum: 2 1	Maximum: 5 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 • 31.25 µs = 156.25 µs).

Table 2-1 Current controller cycle clock

Control type and drive control	Axes used	Minimum current controller cycle settable	Default
810D	–	5 (156.25 µs)	5 (156.25 µs)
810D	< 4	4 (5 (125 µs)	5 (156.25 µs)
840D with 611 D Performance 1–axis control	1	2 (62.5 µs)	4 (125 µs)
840D with 611 D Performance 2–axis control	1	2 (62.5 µs)	4 (125 µs)
840D with 611 D Performance 2–axis 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 Performance 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 external closed–loop control module	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

The computation time in the current controller cycle level must not be exceeded, as this would cause the drive to shutdown (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				Cross reference: –
Computation deadtime of current control loop				Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: µs 810D 840D	Default: 32 110	Minimum: 0 0	Maximum: 124 124	Data type: WORD	Active: POWER ON

The computation deadtime is the time between the start of a current control 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: FDD/MSD/SLM	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:** –
	Integrator time of current controller			Relevant: FDD/MSD/SLM	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 integrator 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: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0.5	Minimum: 0.0	Maximum: 1.0	Data type: FLOAT	Active: Immediately

!

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 loop characteristics of the closed P–controlled current control loop.

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.

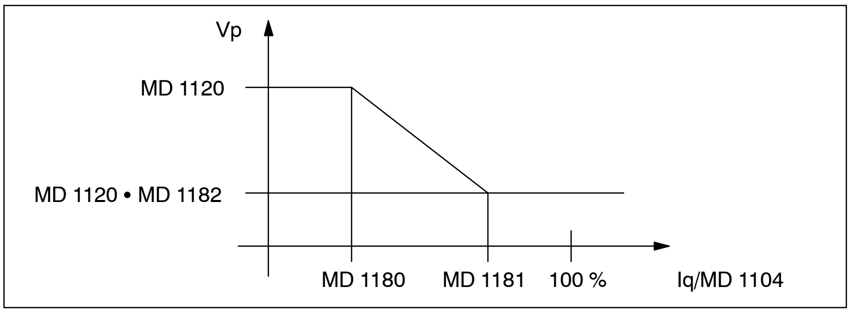

Fig. 2-1 Overview of limits

1122	MOTOR_LIMIT_CURRENT		840D only		Cross reference: –
	Motor limit current			Relevant: FDD/SLM	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: –
	Lower current limit adaptation			Relevant: FDD/SLM	Protection level: 2/4
Unit: %	Default: 0.0	Minimum: 0.0	Maximum: 100.0	Data type: FLOAT	Active: Immediately

1181	CURRCTRL_ADAPT_CURRENT_2		840D only		Cross reference: –
	Upper current limit adaptation			Relevant: FDD/SLM	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: FDD/SLM	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 up 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 (P gain current controller)

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: FDD/SLM	Protection level: 2/4
Unit: –	Default: 1	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
⇒ No overlay: IREG code is not recopied, as it is already stored in P–RAM

MD 1183=0: Current controller adaptation OFF
⇒ 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.

2.1.1 Current and speed controller cycle for CCU3

General

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 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 current and speed controller cycle 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)

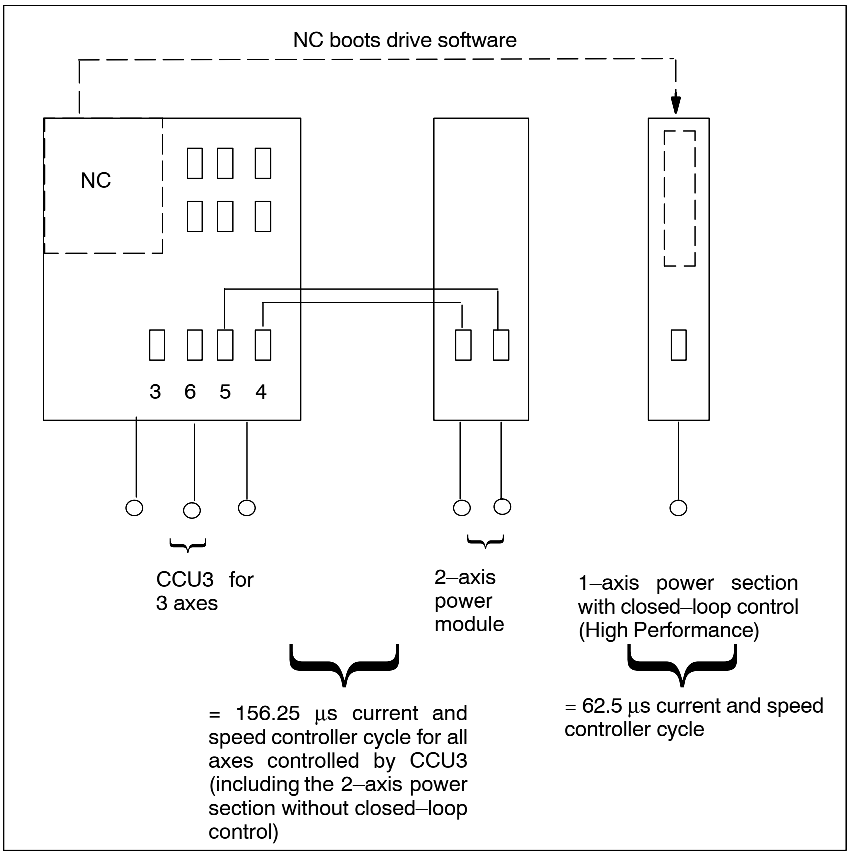

Fig. 2-2 Example

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 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 controller 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: FDD/MSD/SLM	Protection level: 2/4
Unit: Hex	Default: 0000	Minimum: 0000	Maximum: 3115	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	Function	Description
Bit 0	Speed–torque feedforward control	0 = Not active 1 = Active
Bit 1	unassigned	
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 controller active in n controller The integrator is stopped on one side if torque, current or voltage controllers are within limits. 1 = Integrator control not active in n controller The integrator is not stopped, but instead is limited to double the torque limit as an absolute value.
Bits 5 –7	unassigned	
Bit 8	ESR (Extended Stop and Retract): Follow NC setpoints	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.
Bits 9 –11	unassigned	
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 = Suppress mid–frequency error ("current detection of power section missing"). Module starts up without power section.
Bits 14 –15	unassigned	

!

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: FDD/MSD/SLM	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–pass filters are active as current–setpoint filters.

1425	SPEED_FFW_DELAY		840D only		Cross reference: –
	Balancing, computation deadtime, current control loop			Relevant: FDD/MSD/SLM	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 pre–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: –
	Flux controller P gain			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 integrator 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 integrator 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: rev/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: FDD/MSD	Protection level: 2/4
Unit: V	Default: 0	Minimum: 0	Maximum: 700	Data type: UNS.WORD	Active: Immediately

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/R module and transferred as analog signal to the 611 D 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 by default 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.

Calculation of the voltage drop due to reduced leakage inductance depending on operating frequency and current controller cycle (see Table 2-3):

$$U_{L\sigma 1} = \frac{i_k - i_{k-1}}{L_\sigma * T_{Samp}}$$ (original status) 1

$$U_{L\sigma 2} = \frac{i_k - i_{k-2}}{2 * L_\sigma * T_{Samp}}$$ 2

$$U_{L\sigma 4} = \frac{i_k - i_{k-4}}{4 * L_\sigma * T_{Samp}}$$ 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: FDD/MSD/SLM	Protection level: 2/4
Unit: Hex	Default: 0330	Minimum: 0000	Maximum: 07F0	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 clock	Switching frequency	Alternative frequency
125 μs	4000 Hz	3.2 kHz
156.25 μs	3200 Hz	2.56 kHz
187.5 μs	2660 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).

840D/611D:

1100	PWM_FRQUENCY			840D only	Cross reference: –
	Pulse–width–modulation frequency (PWM)			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 4 000.0 MSD: 3 200.0	Minimum: 2 000.0	Maximum: 8 000.0	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 (FDD/SLM ≙ 4000, MSD ≙ 3200) and is configured by the drive configuration during commissioning. 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: 2000, 2666, 3200, 4000, 5333, 6400, 8000 Hz.
- Operation without encoder: 4,000 and 8,000 Hz only (IM mode)

If possible, the synchronous switching frequencies should be selected (4000, 8000Hz). 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 Section 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	3200	312.5
FDD/SLM	4000	250.0
–	5333.3....	187.5
–	8000	125.0

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 Section 2.3.1).

2.5 Advanced Position Control (APC)

APC is a control function for damping mechanical vibrations in tool 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.

APC cannot be used in conjunction with the Safety Integrated 1–encoder concept.

Note

Exercise caution with axes carrying workpieces and axes with a changing mass.

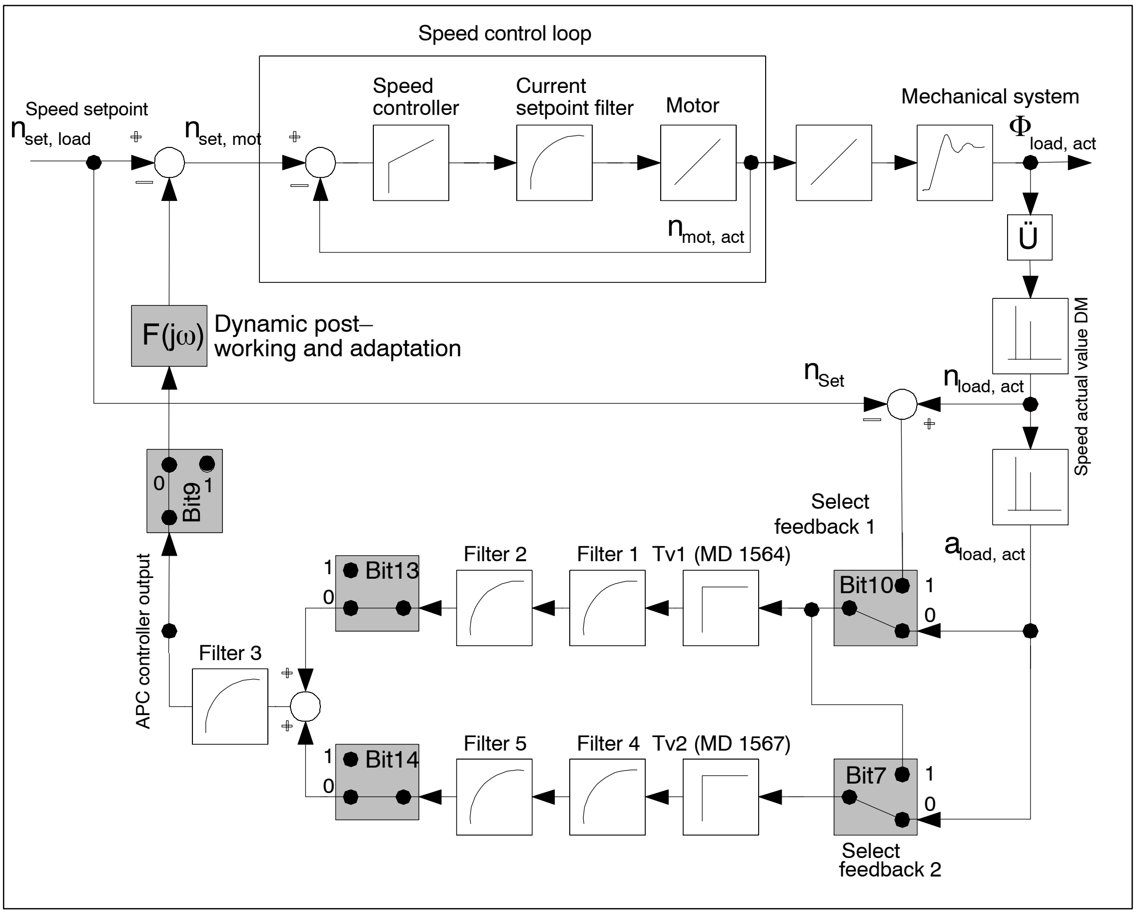

Fig. 2-3 Basic structure of block diagram

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: FDD/MSD/SLM	Protection level: 2/4
Unit: Hex	Default: 0000	Minimum: 0000	Maximum: 7FFF	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: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 1.0	Minimum: –100 0000.0	Maximum: 100 0000.0	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. If the direction of rotation is different, then this 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: 2048/500 = 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 the load side; factor: 2048/ 8192 • 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: 1024 pulses per motor revolution on the load side; factor: 2048/1024 = 2.0

1563	ACC_HIGH_PASS_TIME				Cross reference: –
	Smoothing time, high–pass filter or PT1 integration			Relevant: FDD/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: $\frac{s\ T_{sm}}{1+s\ T_{sm}}$. 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.

1564	LOAD_SPEEDCTRL_DIFF_TIME[n] 0...7 index of the parameter set				Cross reference: –
	Acceleration feedforward control (derivative action time of load speed controller), 1st cascade			Relevant: FDD/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[n] 0...7 index of the parameter set				Cross reference: –
load	Acceleration feedforward control (derivative action time of speed controller), 2nd cascade			Relevant: FDD/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: FDD/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 used for filters with a low blocking frequency. It is generally recommended that

Blocking frequency • Sampling time • Sub–sampling factor should be ≧ 1/160.

This can easily be ensured using the sub–sampling factor. It is effective for filters 1, 2, 4 and 5. The 3rd filter is always processed 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[n] 0...7 index of the parameter set				Cross reference: –
	Type of acceleration filter			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hex	Default: 0000	Minimum: 0000	Maximum: 1B1F	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[n] 0...7 index of the parameter set				Cross reference: –
	Time constant, 1st acceleration filter			Relevant: FDD/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[n] 0...7 index of the parameter set				Cross reference: –
	Denominator natural frequency, 1st acceleration filter			Relevant: FDD/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[n] 0...7 index of the parameter set				Cross reference: –
	Denominator damping, 1st acceleration filter			Relevant: FDD/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[n] 0...7 index of the parameter set				Cross reference: –
	Numerator natural frequency, 1st acceleration filter			Relevant: FDD/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[n] 0...7 index of the parameter set				Cross reference: –
	Numerator damping, 1st acceleration filter			Relevant: FDD/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.

1576	ACC_FILTER_TIME2[n] 0...7 index of the parameter set				Cross reference: –
	Time constant, 2nd acceleration filter			Relevant: FDD/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[n] 0...7 index of the parameter set				Cross reference: –
	Denominator natural frequency, 2nd acceleration filter			Relevant: FDD/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[n] 0...7 index of the parameter set				Cross reference: –
	Denominator damping, 2nd acceleration filter			Relevant: FDD/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[n] 0...7 index of the parameter set				Cross reference: –
	Numerator natural frequency, 2nd acceleration filter			Relevant: FDD/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[n] 0...7 index of the parameter set				Cross reference: –
	Numerator damping, 2nd acceleration filter			Relevant: FDD/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[n] 0...7 index of the parameter set				Cross reference: –
	Denominator natural frequency, 3rd acceleration filter			Relevant: FDD/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[n] 0...7 index of the parameter set				Cross reference: –
	Denominator damping, 3rd acceleration filter			Relevant: FDD/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[n] 0...7 index of the parameter set				Cross reference: –
	Numerator natural frequency, 3rd acceleration filter			Relevant: FDD/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[n] 0...7 index of the parameter set				Cross reference: –
	Numerator damping, 3rd acceleration filter			Relevant: FDD/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[n] 0...7 index of the parameter set				Cross reference: –
	Time constant, 4th acceleration filter			Relevant: FDD/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.

1586	ACC_DENOM_FILTER_FREQU4[n] 0...7 index of the parameter set				Cross reference: –
	Denominator natural frequency, 4th acceleration filter			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 2000.0	Minimum: 2.0	Maximum: 8000.0	Data type: FLOAT	Active: Immediately

If PT2 or general bandstop is selected, the denominator natural frequency is set here.

1587	ACC_DENOM_FILTER_DAMP4[n] 0...7 index of the parameter set				Cross reference: –
	Denominator damping, 4th acceleration filter			Relevant: FDD/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[n] 0...7 index of the parameter set				Cross reference: –
	Numerator natural frequency, 4th acceleration filter			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 2000.0	Minimum: 2.0	Maximum: 8000.0	Data type: FLOAT	Active: Immediately

If general bandstop is selected, the numerator natural frequency is set here.

1589	ACC_NOM_FILTER_DAMP4[n] 0...7 index of the parameter set				Cross reference: –
	Numerator damping, 4th acceleration filter			Relevant: FDD/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[n] 0...7 index of the parameter set				Cross reference: –
	Time constant, 5th acceleration filter			Relevant: FDD/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[n] 0...7 index of the parameter set				Cross reference: –
	Denominator natural frequency, 5th acceleration filter			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 2000.0	Minimum: 2.0	Maximum: 8000.0	Data type: FLOAT	Active: Immediately

If PT2 or general bandstop is selected, the denominator natural frequency is set here.

1592	ACC_DENOM_FILTER_DAMP5[n] 0...7 index of the parameter set				Cross reference: –
	Denominator damping, 5th acceleration filter			Relevant: FDD/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[n] 0...7 index of the parameter set				Cross reference: –
	Numerator natural frequency, 5th acceleration filter			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Hz	Default: 2000.0	Minimum: 2.0	Maximum: 8000.0	Data type: FLOAT	Active: Immediately

If general bandstop is selected, the numerator natural frequency is set here.

1594	ACC_NOM_FILTER_DAMP5[n] 0...7 index of the parameter set				Cross reference: –
	Numerator damping, 5th acceleration filter			Relevant: FDD/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

Filters 1 and 2 or 4 and 5 can be disabled by selecting PT1 and setting the time constant to zero. Filter 3 cannot be configured as PT1 and therefore cannot be disabled.

Note

SimoCom U (the SIMODRIVE 611 universal startup program) can be used to display the filter frequency responses.

■

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3 Supplementary Conditions

None

■

4 Data Descriptions (MD, SD)

See Chapter 2

■

5 Signal Descriptions

None

■

6 Example

None

■

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7 Data Fields, Lists

7.1 Current controller setting

Table 7-1 Machine data

No.	Identifier	Name	Drive
1000	CURRCTRL_CYCLE_TIME[DRx]	Current controller cycle clock	FDD/MSD/SLM
1101	CTRLOUT_DELAY	Computation dead time of current control loop	FDD/MSD/SLM
1120	CURRCTRL_GAIN[DRx]	P gain, current controller	FDD/MSD/SLM
1121	CURRCTRL_INTEGRATOR_TIME[DRx]	Integrator time of current controller	FDD/MSD/SLM
1122	MOTOR_LIMIT_CURRENT	Motor limiting current	FDD/SLM
1124	CURRCTRL_REF_MODEL_DELAY[DRx]	Balancing, current reference model	FDD/MSD/SLM
1180	CURRCTRL_ADAPT_CURRENT_1	Adaptation of lower current limit (840D only)	FDD/SLM
1181	CURRCTRL_ADAPT_CURRENT_2	Adaptation of upper current limit (840D only)	FDD/SLM
1182	REDUCE_ARMATURE_ENABLE	Current controller adaptation factor (840D only)	FDD/SLM
1183	CURRCTRL_ADAPT_ENABLE	Current controller adaptation ON (840D only)	FDD/SLM

7.2 Torque feedforward control

Table 7-2 Machine data

No.	Identifier	Name	Drive
1004	CTRL_CONFIG	Configuration structure	FDD/MSD/SLM
1424	SPEED_FFW_FILTER_TIME	Balancing, speed feedforward control channel	FDD/MSD/SLM
1425	SPEED_FFW_DELAY	Balancing, computation deadtime, current control loop	FDD/MSD/SLM

7.3 Flux sensing and flux controller for MSD

Table 7-3 Machine data

No.	Identifier	Name	Drive
1150	FIELDCTRL_GAIN[DRx]	Flux controller P gain	MSD
1151	FIELDCTRL_INTEGRATOR_TIME[DRx]	Flux–controller reset time	MSD
1159	FLUX_MODEL_CORRECTION[DRx]	Flux–model correction	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 clock	FDD/MSD/SLM
1003	STS_CONFIG[DRx]	Configuration STS	FDD/MSD/SLM
1100	PWM_FREQUENCY	Frequency, pulse–width modulation	FDD/MSD/SLM

7.5 Advanced Position Control (APC)

Table 7-5 Machine data

No.	Identifier	Name	Drive
1560	ACC_MODE	Acceleration evaluation mode	FDD/MSD/SLM
1562	FACTOR_MM_DM	Ratio of motor to DM	FDD/MSD/SLM
1563	ACC_HIGH_PASS_TIME	Time cons. acc. high pass	FDD/MSD/SLM
1564	LOAD_SPEEDCTL_DIFF_TIME	Derivative–action time, load–speed controller	FDD/MSD/SLM
1567	LOAD_SPEEDCTL_DIFF_TIME2	Derivative action time, load velocity controller 2	FDD/MSD/SLM
1569	ACC_FIL_DOWNSCAN	Sub–sampling of acceleration filter	FDD/MSD/SLM
1570	ACC_FILTER_TYPE	Type of acceleration filter	FDD/MSD/SLM
1571	ACC_FILTER_TIME1	Time constant, acceleration filter 1	FDD/MSD/SLM
1572	ACC_DENOM_FILTER_FREQU1	Denominator natural frequency, acceleration filter 1	FDD/MSD/SLM
1573	ACC_DENOM_FILTER_DAMP1	Denominator damping, acceleration filter 1	FDD/MSD/SLM
1574	ACC_NOM_FILTER_FREQU1	Numerator natural frequency, acceleration filter 1	FDD/MSD/SLM
1575	ACC_NOM_FILTER_DAMP1	Numerator damping, acceleration filter 1	FDD/MSD/SLM
1576	ACC_FILTER_TIME2	Time constant, acceleration filter 2	FDD/MSD/SLM
1577	ACC_DENOM_FILTER_FREQU2	Denominator natural frequency, acceleration filter 2	FDD/MSD/SLM
1578	ACC_DENOM_FILTER_DAMP2	Denominator damping, acceleration filter 2	FDD/MSD/SLM
1579	ACC_NOM_FILTER_FREQU2	Numerator natural frequency, acceleration filter 2	FDD/MSD/SLM
1580	ACC_NOM_FILTER_DAMP2	Numerator damping, acceleration filter 2	FDD/MSD/SLM

Table 7-5 Machine data

No.	Identifier	Name	Drive
1581	ACC_DENOM_FILTER_FREQU3	Denominator natural frequency, acceleration filter 3	FDD/MSD/SLM
1582	ACC_DENOM_FILTER_DAMP3	Denominator damping, acceleration filter 3	FDD/MSD/SLM
1583	ACC_NOM_FILTER_FREQU3	Numerator natural frequency, acceleration filter 3	FDD/MSD/SLM
1584	ACC_NOM_FILTER_DAMP3	Numerator damping, acceleration filter 3	FDD/MSD/SLM
1585	ACC_FILTER_TIME4	Time constant, acceleration filter 4	FDD/MSD/SLM
1586	ACC_DENOM_FILTER_FREQU4	Denominator natural frequency, acceleration filter 4	FDD/MSD/SLM
1587	ACC_DENOM_FILTER_DAMP4	Denominator damping, acceleration filter 4	FDD/MSD/SLM
1588	ACC_NOM_FILTER_FREQU4	Numerator natural frequency, acceleration filter 4	FDD/MSD/SLM
1589	ACC_NOM_FILTER_DAMP4	Numerator damping, acceleration filter 4	FDD/MSD/SLM
1590	ACC_FILTER_TIME5	Time constant, acceleration filter 5	FDD/MSD/SLM
1591	ACC_DENOM_FILTER_FREQU5	Denominator natural frequency, acceleration filter 5	FDD/MSD/SLM
1592	ACC_DENOM_FILTER_DAMP5	Denominator damping, acceleration filter 5	FDD/MSD/SLM
1593	ACC_NOM_FILTER_FREQU5	Numerator natural frequency, acceleration filter 5	FDD/MSD/SLM
1594	ACC_NOM_FILTER_DAMP5	Numerator damping, acceleration filter 5	FDD/MSD/SLM

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

Monitoring Functions, Limits (DÜ1)

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Product Brief 1

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” message 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 FDD is calculated from the motor data. On MSDs, the default setting is 100%. Limiting is carried out via the speed controller output.

Power limitation

The power for FDDs 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 limitation

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 limitation

The speed setpoint is limited to the maximum value set in the machine data.

Actual speed limitation

If the actual speed value exceeds the limit setting by more than 4%, the torque is set to zero. Thus, further acceleration is not possible. 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.

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Detailed Description 2

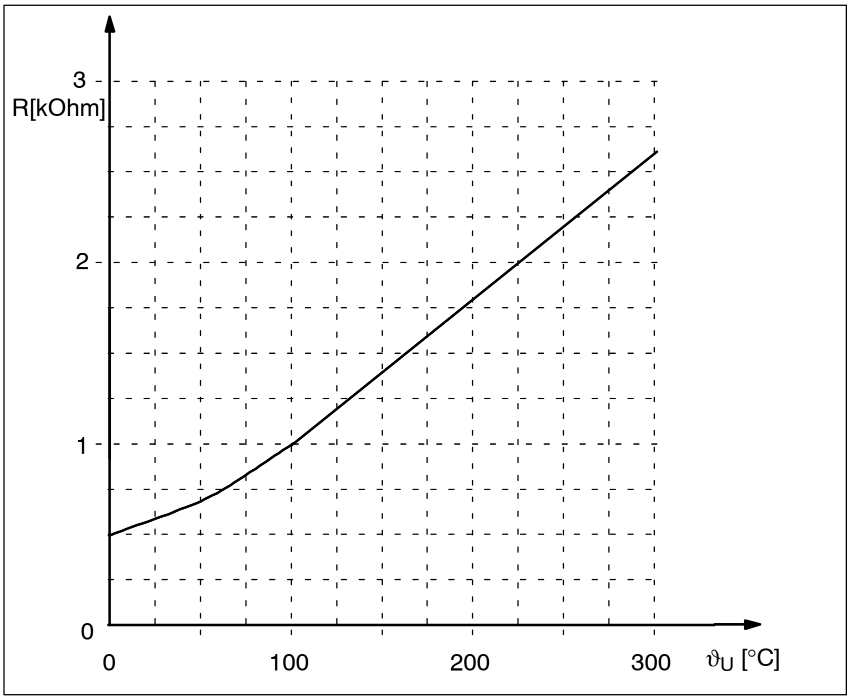
2.1 Motor temperature monitoring

2.1.1 General

1602	MOTOR_TEMP_WARN_LIMIT				Cross reference: –
	Motor temperature warning threshold			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: °C	Default: 120	Minimum: 0	Maximum: 200	Data type: UNS.WORD	Active: Immediately

Enter the thermal steady–state permissible 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/R module is energized, independent of MD 1601, bit 14: ALARM_MASK_RESET and signals the motor overtemperature condition.

Temperature sensor



Thermistor type	KTY 84
Resistance when cold (20°C)	approx. 580 Ohm
Resistance when hot (100°C)	approx. 1000 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: FDD/MSD/SLM	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 suppressed, 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: FDD/MSD/SLM	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 suppressed, 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: FDD/MSD/SLM	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.

2.1.2 Thermal motor model (from SW 6.08.13 and SW 5.01.34, for rotary motors only, not CCU3)

Description

This monitoring protects the motor from constant thermal overload so that the motor is not overloaded beyond the permissible temperature. It represents an expansion of the known temperature measurement (temperature sensors).

With the thermal motor model, a model temperature of the motor is calculated internally in accordance with the motor type, the measured motor current, the KTY motor temperature sensor, if present, and the shutdown temperature threshold. If the KTY motor temperature sensor is incorporated, the motor can no longer be overloaded when powered on in the warmed–up state. The calculated model temperature refers to the permissible shutdown temperature of the motor from MD 1607 (up to SW 6.08.25) and MD 1288 (from SW 6.08.26).

Note

The thermal motor model cannot be activated if MD 1268 = 0 (winding time constant).

To protect the motor, the power section must be selected so that for synchronous motors the stall current, and for induction motors the rated motor current >15% of the transistor limit current MD 1107.

The thermal motor model cannot be used together with the motor changeover!

Machine data

1265	ACTIVITY_THERM_MOT		840D only		Cross reference: –
	Configuration of thermal motor model			Relevant: FDD/MSD	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 3	Data type: UNS.WORD	Effective: Power On

Bit 0 = 0 Thermal motor model not activated
Bit 0 = 1 Thermal motor model activated (also MD 1268 > 0)
Bit 1 = 0 With KTY motor temperature sensor evaluation
Bit 1 = 1 Pure current monitoring
→ no evaluation of KTY motor temperature sensor

1266	LOAD_THERM_MOT		840D only		Cross reference: –
	Thermal motor load			Relevant: FDD/MSD	Protection level: 2/4
Unit: %	Default: 0	Minimum: 0	Maximum: 65 535	Data type: UNS.WORD	Active: Immediately

MD 1266 indicates the thermal load of the motor as a percentage. The calculation model refers to the maximum permissible motor temperature from MD 1288.
The value in MD 1288 is preassigned for the specific motor during startup. If this value is changed, the triggering of the thermal motor model also changes.

Note

If the thermal motor load is >100%, the motor temperature alarm 300613 ”Maximum permissible motor temperature exceeded” is output.

1267	LOAD_THERM_MOT_WARN_LIM				Cross reference: –
	Thermal motor load warning threshold			Relevant: FDD/MSD	Protection level: 2/4
Unit: %	Default: 80.0	Minimum: 0.0	Maximum: 100.0	Data type: UNS.WORD	Active: Immediately

Where a thermal motor load (MD 1266) is greater than what has been configured in the response threshold MD 1267, a signal is output to the PLC (”Motor temperature prewarning” IS, DB 31,...DBX94.0), as it is when MD 1602 is exceeded, and the time monitoring function (MD 1603) is started.

If the timer expires but the thermal motor load has still not dropped below the threshold, the drive generates a configurable alarm 300614 ”Axis %1, drive %2 motor temperature exceeded”.

Depending on the configured response (MD 1613, bit 14), the alarm shuts down the unit as follows::

- The pulse enable is immediately cancelled and the drive coasts down.
- 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.

1268	TAU_TIME				Cross reference: –
	Winding time constant			Relevant: FDD/MSD	Protection level: 2/4
Unit: s	Default: 0.0	Minimum: 0.0	Maximum: 5000.0	Data type: FLOAT	Active: POWER ON

MD 1268 = 0	Thermal motor model deactivated
MD 1268 > 0	Thermal motor model activated (basic requirement: MD 1265.0 = 1)

The default value is preassigned with the default value from the the internal motor table during startup.

1288	T_MOT_MAX_THERM				Cross reference: –
	Shutdown threshold, thermal motor model			Relevant: FDD/MSD	Protection level: 2/4
Unit: °C	Default: 180	Minimum: 0	Maximum: 220	Data type: UNS.WORD	Active: Immediately

From SW 6.08.26 and higher, MD 1288 defines the shutdown threshold of the thermal motor module (up to SW 6.08.25, MD 1607 applies).

When commissioning, the value in MD 1288 is pre–assigned depending on the specific motor.

Note

Also refer to MD 1265, MD 1266, MD 1268 and MD 1269.

2.2 DC link monitoring

1604	LINK_VOLTAGE_WARN_LIMIT				Cross reference: –
DC link undervoltage warning threshold				Relevant: FDD/MSD	Protection level: 2/4
Unit: V	Default: 200	Minimum: 0	Maximum: 680	Data type: UNS. WORD	Active: Immediately

MD 1604 is evaluated axially from SW 5.01.04 and higher.

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 supplied to the drive modules as 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: FDD/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: FDD/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 filter). The transition frequency f_0 of the PT_1 filter is determined by $f_0 = 1/(2\pi T_1)$.

Secondary 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 $|i_{RZ}| = + \mathrm{sqrt}\ (i_d^2 + i_q^2)$.
If the monitoring function is activated, alarm 300607, ”Current controller output limited” is output.

2.4 Limits

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: FDD/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: –
	Adaptation factor, servo limiting torque			Relevant: FDD/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: FDD/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 per cent (%) to ensure compatibility between SIMODRIVE digital (FDD/MSD), linear motors (FDD) 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 counterweight” and are thus mutually comparable.

References: /FB/, K3 ”Electronic Counterweight”
/FBHLA/, Description of Functions ”HLA Module”

1230	**TORQUE_LIMIT_1[n] 0...7 index of parameter set**				**Cross reference:** –
	1st torque limit value			Relevant: FDD/MSD/SLM	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 (FDD) or rated motor torque (MSD) of the motor.

- **FDD:** 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 minimum torque, power and breakdown torque limiting is always effective (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:

$$\text{FDD: MD 1230} = \frac{\text{MD 1104}}{\text{MD 1118}} \text{ x } 100\%$$

As the current limit (MSD – MD 1238, FDD – 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 also 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 output and current limits must also be increased.

!

Important

If the motor is overloaded for a longer period of time, this can result in an impermissible temperature rise (the drive is shut down as a result of a motor overtemperature condition); the motor can also be destroyed.

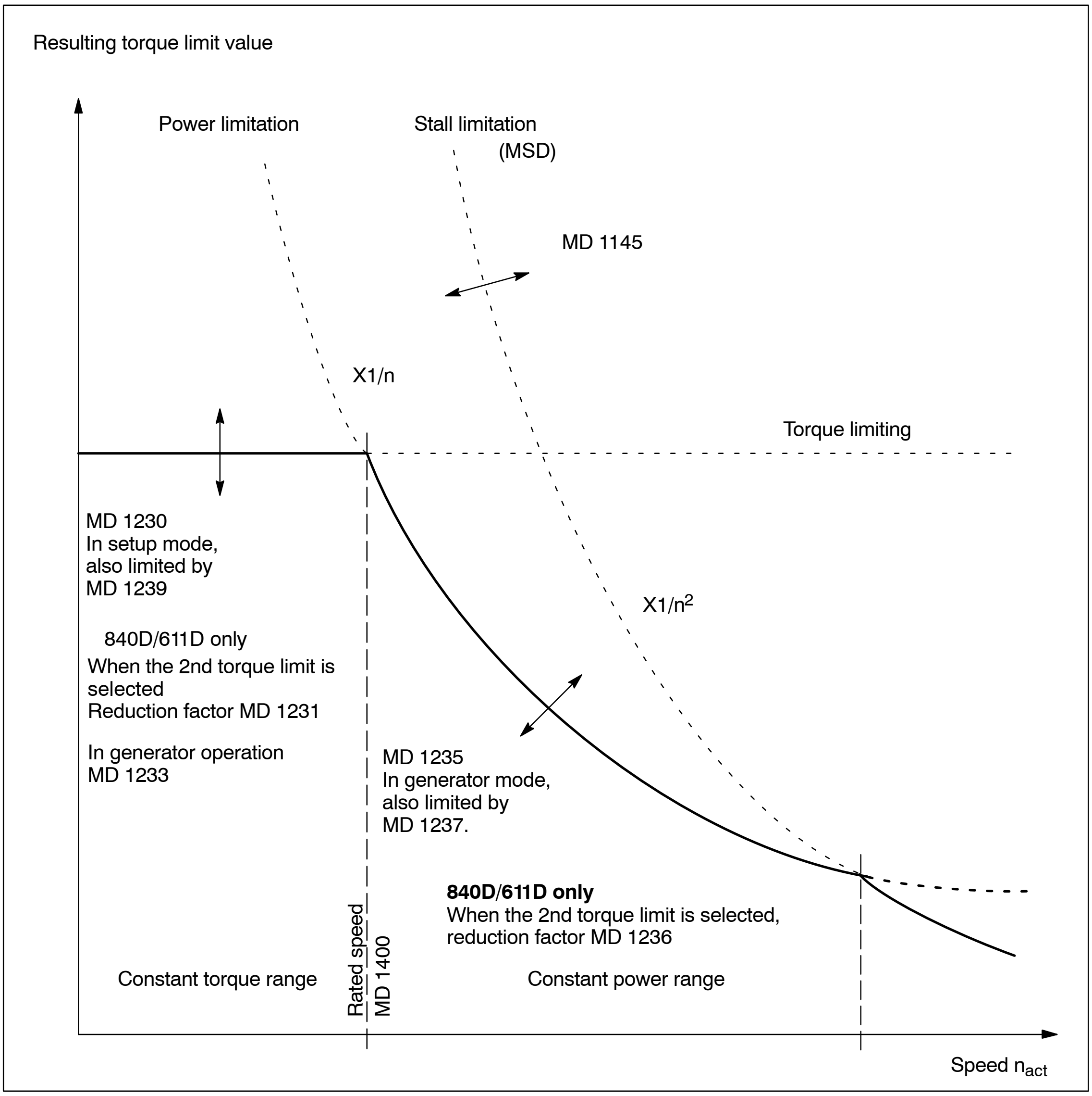


Fig. 2-1 Torque limiting

1231	TORQUE_LIMIT_2		840D only		Cross reference: –
	2nd torque limit			Relevant: FDD/MSD	Protection level: 2/4
Unit: %	Default: 100.0	Minimum: 5.0	Maximum: 100.0	Data type: FLOAT	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: FDD/MSD	Protection level: 2/4
Unit: rev/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: FDD/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 (regenerative 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: FDD/MSD	Protection level: 2/4
Unit: rev/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.

1239	TORQUE_LIMIT_FOR_SETUP				Cross reference: –
	Torque limit, setup mode			Relevant: FDD/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 (FDD) 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.

References: /FB/, K3 ”Electronic Counterweight”

2.4.2 Power limitation

1235	POWER_LIMIT_1[n]0...7 index of parameter set				Cross reference: –
	1st power limit			Relevant: FDD/MSD/SLM	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 (FDD) respective to the rated motor output
(MSD – MD 1130: MOTOR_NOMINAL_POWER).

Motor power [kW] (FDD) = 1 / 9549 • (MD 1118 • MD 1113) • 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 ($P = 2\pi \bullet M \bullet n/60$; where P = const. $\Rightarrow M \sim 1/n$).
The minimum torque, power and breakdown torque limiting is always effective (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:

$$\text{FDD : MD 1235} = \frac{\text{MD 1104}}{\text{MD 1118}} \text{ x } 100\%$$

For main spindle drives, the following is especially valid: If the speed at the start of field weakening is greater than the rated speed, then the ramp–up times can already be shorted and the power yield increased if only the power limit is increased (with the same current limit). 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, this can result in an impermissible temperature rise (the drive is shutdown as a result of a motor overtemperature condition); the motor can also be destroyed. Corresponding machine data are MD 1104, MD 1145 and MD 1231 to MD 1239.

1236	POWER_LIMIT_2			840D only	Cross reference –
	2nd power limit			Relevant: FDD/MSD/SLM	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: –
	Maximum regenerative power			Relevant: FDD/MSD/SLM	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 limitation

With FDD/SLM

1104	**MOTOR_MAX_CURRENT**				**Cross reference:** –
	Max. motor current			Relevant: FDD/SLM	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: FDD/SLM	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, which are too high, then the monitoring is triggered with MD 1605/MD1606.

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.

For MSD

1103	MOTOR_NOMINAL_CURRENT				Cross reference: –
	Rated motor current			Relevant: FDD/MSD/SLM	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: %	Default: 150.0	Minimum: 0.0	Maximum: 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, this can result in an impermissible temperature rise (the drive is shut down as a result of a motor overtemperature condition); the motor can also be destroyed.

2.5 Torque–setpoint monitoring

1605	SPEEDCTRL_LIMIT_TIME				Cross reference: –
	Timer, speed controller at its limit			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: ms	Default: 200.0	Minimum: 20.0	Maximum: 10 000.0	Data type: FLOAT	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, regenerative braking may be canceled 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: FDD/MSD/SLM	Protection level: 2/4
Unit: rev/min	Default: 8 000.0 MSD: 30.0 SLM: 500.0	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 (FDD ≙ 8000, MSD ≙ 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: FDD/MSD/SLM	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/velocity setpoint limitation

1405	MOTOR_SPEED_LIMIT[n] 0...7 index of parameter set				Cross reference: –
	Motor monitoring speed Motor monitoring velocity (SLM)			Relevant: FDD/MSD/SLM	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

SW 4.2 and higher:
For MSD/IM 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 · (lower of MD 1146, MD 1147)
N_{max2} = MD 1401 · MD 1405

N_{setmax} = minimum from N_{max1}, N_{max2}

1420	MOTOR_MAX_SPEED_SETUP				Cross reference: –
	Max. motor speed setup mode Max. motor velocity setup mode			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: rev/min	Default: 30.0 SLM: 2.0	Minimum: 0.0	Maximum: 100,000.0	Data type: FLOAT	Active: Immediately

For setup mode (terminal 112), the absolute speed/velocity setpoint is limited to the specified value.

2.7 Actual speed/velocity limitation

The actual speed limit is calculated as follows:

FDD:

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 > MD 1605).

1147	SPEED_LIMIT				Cross reference: –
	Speed limitation Velocity limitation (SLM)			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: rev/min	Default: 7,000.0 MSD: 8 000.0 SLM: 120.0	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:

- **FDD,** the value MD 1400: MOTOR_RATED_SPEED • 110% and
- **MSD,** the value MD 1146: MOTOR_MAX_ALLOWED_SPEED

1146	MOTOR_MAX_ALLOWED_SPEED				Cross reference: –
	Maximum motor speed Maximum motor velocity			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: rev/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.

2.8 Motor ground fault test (SW 6.8.19 and higher)

This functionality enables detection of a ground fault, i.e., a conductive connection between one of the motor phases and ground. The motor test takes place when the closed–loop control ramps up and can also be initiated during operation upon request.

Note

During the motor ground fault test, the machine cannot be used for production.

Description

Monitoring can be activated using MD 1166 bit 0 (automatic motor ground fault test after ramp–up) or bit 1 (initiated during operation). Likewise, the motor ground fault test can be started using interface signal ”Ground fault test” DB 31, ... DBX20.6.

If the current exceeds the value configured in MD 1167 ”Response threshold for ground fault test” during the ground fault test, the error message 300513 ”Ground fault detected” is output and the cause is stored in diagnostic machine data MD 1169.

Because the motor is energized for the ground fault test, the function can be started with the first servo and pulse enables, at the earliest.

If the pulse enable has been canceled by the NC, PLC or an alarm during the ground fault test, the test waits for the next pulse enable and repeats the whole procedure.

Figure 2-2 shows the process and the error response:

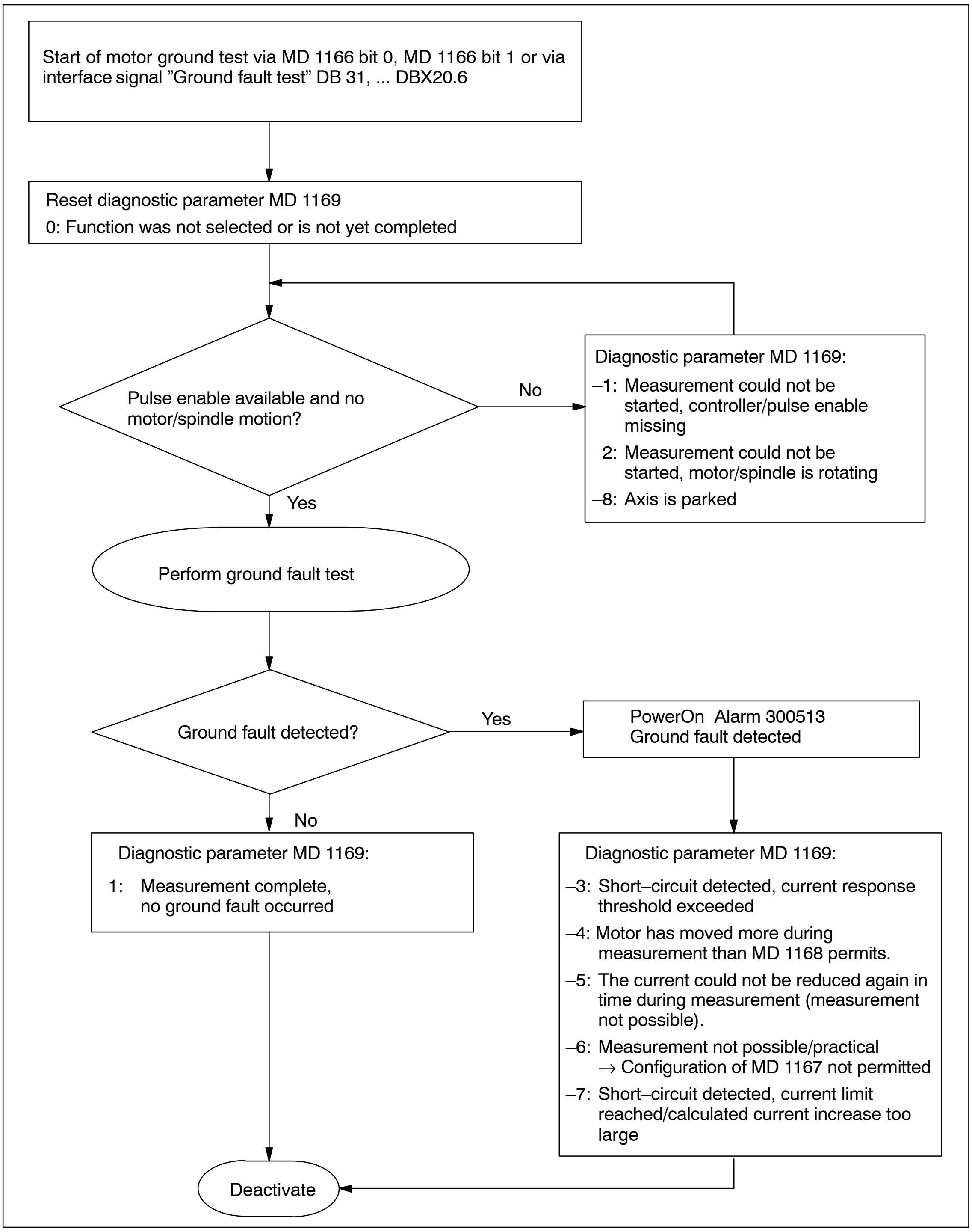


Fig. 2-2 Evaluations of diagnostic parameter MD 1169

Supplementary conditions

The ground fault test cannot be performed on a motor that is currently moving. For this reason, the motor must be at a standstill prior to starting the test (speed actual value ≤ MD 1403 ”Shutdown speed, pulse suppression”).

If the brake control is activated (MD 1060 ”Activate brake control”), the actual speed value must be ≤ MD 1062 ”Close speed / motor velocity holding brake”.

During ramp–up after Power On, the automatic ground fault test (MD 1166 Bit 0 = 1) can only be performed for motor 1.
If a ground fault test is to be performed for motors 2 to 4 from the motor data set switchover, this must be performed explicitly via MD 1166 Bit 1 = 1 or IS ”Ground fault test” DB 31, ... DBX20.6.

A ground fault test for suspended axes is possible, in principle, but the axis must be clamped mechanically with the holding brake.

Machine data

1166	MOTDIAG_GROUND_PROTECTION				Cross reference: –
	Activate ground fault test			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 3	Data type: UNS.WORD	Active: Immediately

Bit 0 = 0 Automatic ground fault test switched off after ramp–up.

Bit 0 = 1 Automatic ground fault test switched on after ramp–up.

Bit 1 = 1 Start : Activate motor ground fault test during operation via edge $0 \rightarrow 1$.
After the ground fault test has been carried out, the bit will be reset automatically.

Note

The ground fault test has no protective function (in the sense of VDE guidelines).

1167	CURRENT_GROUND_IDENT				Cross reference: –
	Response threshold of ground fault test			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: %	Default: 4.0	Minimum: 2.0	Maximum: 100.0	Data type: UNS.WORD	Active: Immediately

Response threshold for ground fault test in relation to transistor limit current, power section (MD 1107).

Note

If the threshold exceeds the rated motor current, MD 1103, it is not possible or practical to carry out a measurement using this power section/motor combination.

–6 is entered in MD 1169.

Remedy: Reduce threshold or adjust power section/motor configuration.

1168	MAX_TURN_MOTORIDENT MAX_MOVE_MOTORIDENT (SLM)				Cross reference: –
	Enter the rotation permitted during the ground fault test Enter the motion permitted during the ground fault test (SLM)			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: Degr. SLM: mm	Default: 10, SLM 5	Minimum: 0	Maximum: 30, SLM: 10	Data type: FLOAT	Active: Immediately

The motion monitoring can be deactivated with an input value of 0.

1169	DIAG_MOTORIDENT				Cross reference: –
	Diagnostics, motor			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0	Minimum: –7	Maximum: 1	Data type: UNS.WORD	Active: Immediately

A positive value means that no ground fault has been detected. Otherwise:

0: Function was not selected or is not yet complete.
1: Measurement complete, no ground fault occurred.
–1: Measurement could not be started, controller/pulse enable missing.
–2: Measurement could not be started, motor/spindle is rotating.
–3: Short–circuit detected, current response threshold exceeded.
–4: Motor has moved more during measurement than MD 1168 permits.
–5: The current could not be reduced in time during measurement (measurement not possible).
–6: Measurement not possible/practical → Configuration of MD 1167 not permitted.
–7: Short–circuit detected, current limit reached/calculated current increase too large.
–8: Parking axis selected.

Alarm message

300513	Ground fault detected
Cause	Measured phase currents are greater than those configured in MD 1167, or the motor movement during the ground fault test was greater than that configured in MD 1168.
Explanation	• You can find detailed information in the diagnostic machine data MD 1169: MOTORIDENT. • The firmware has detected a ground fault. • Ground fault in the power lines or in the motor. During ground fault detection, at least one phase current exceeds the threshold MD 1167: CURRENT_GROUND_IDENT. • The motor has moved more during the test than the value configured in threshold MD 1168.
Remedy	Check the connection of the power lines and the motor. • MD 1167: Increase CURRENT_GROUND_IDENT or • MD 1168: MAX_TURN_MOTORIDENT/ MAX_MOVE_MOTORIDENT (SLM)
DRIVE Ready and 611D Ready are cancelled.	

2.9 Vdc_min controller (SW 6.8.20 and higher)

With the Vdc_min controller function, the DC link voltage can be kept above a certain voltage threshold ”Lower Vdc_min threshold” (MD 1285) by changing the torque limit, in order to minimize or reduce the power taken from the DC link by the motor.

Note

The Vdc_min controller can only be used with regulated I/R modules.

Plant–specific configuration of MD 1285 ”Lower Vdc_min threshold” and MD 1286 ”Vdc_min controller Kp” is essential!

Description

With the Vdc_min control, it is possible to react to undervoltage in the DC link and therefore avoid an overload of the incoming supply.

The Vdc_min controller influences the torque limits when there is an overload of the DC link. It only intervenes when the DC link voltage approaches the ”Lower Vdc_min threshold” (MD 1285) and the Vdc_min controller is activated via MD 1284.Bit = 1.

When the DC link voltage rises above the threshold value MD 1285 again, the Vdc_min controller disables the torque limiting depending on MD 1286 (”Vdc_min controller Kp”).

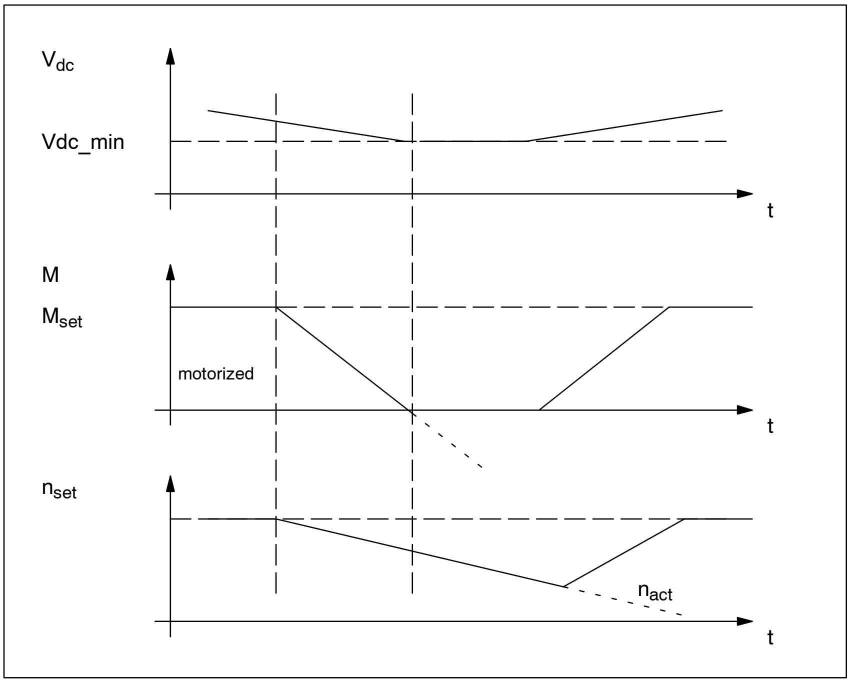


Fig. 2-3 Vdc_min control structure and display of the torque limiting

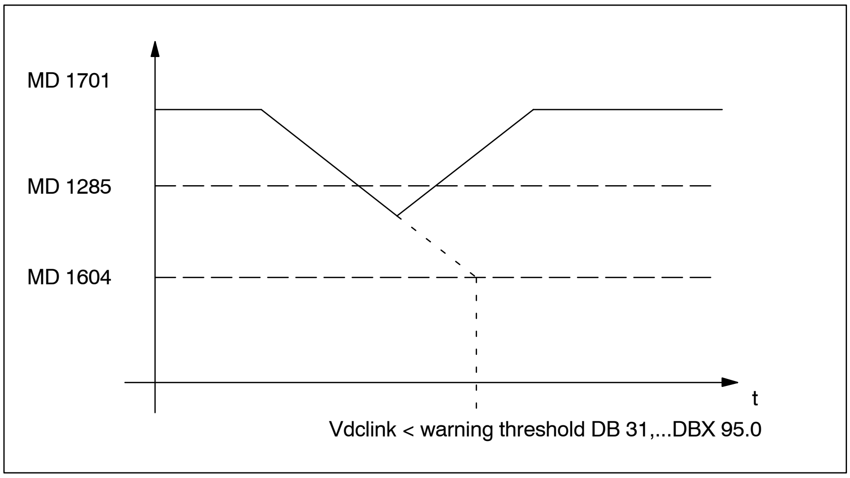


Fig. 2-4 Configuration recommendation for Vdc_min controller

Supplementary conditions

- The drives may not be able to maintain their set speed or the acceleration phases are extended (not recommended for feed axes → also Alarm 25050 ”Contour monitoring”).
- Cannot be used for V/f operation
- Not possible with unregulated infeeds
- Vdc_min controller only active when speed greater than 60 rpm

Machine data

1284	VDC_MIN_CONTROLLER				Cross reference: –
	Vdc_min controller active			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 0	Minimum: 0	Maximum: 1	Data type: UNS.WORD	Active: Immediately

Bit 0 = 0 Vdc_min controller not activated
Bit 0 = 1 Vdc_min controller activated

1285	VDC_THRESHOLD_MIN				Cross reference: –
	Lower Vdc–min threshold			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: V	Default: 550	Minimum: 0	Maximum: 800	Data type: UNS.WORD	Active: Immediately

Setting of the lower threshold for the DC link voltage as setpoint limit for the Vdc_min controller.

Note

MD 1285 is only active when the Vdc_min controller has been activated with MD 1284 = 1.

The following applies when the lower DC link voltage threshold is reached (MD 1285):

The VDC–min controller limits the power drawn from DC link in order to keep the DC link voltage above the minimum DC link voltage during acceleration.

1286	VDC_MIN_CONTROLLER_KP				Cross reference: –
	Vdc_min controller Kp			Relevant: FDD/MSD/SLM	Protection level: 2/4
Unit: –	Default: 1.0	Minimum: 0	Maximum: 10.0	Data type: UNS.WORD	Active: Immediately

Setting of the proportional gain Kp for the Vdc_min controller (controller for the DC link voltage).

The proportional gain Kp must be entered plant–specifically.

Proposed setting for the proportional gain Kp:
MD 1286 = 0.5 · DC link capacitance [mF].

It is assumed that the power modules are also electrically connected to the DC link.

Note

MD 1286 is only active when the Vdc_min controller has been activated with MD 1284 = 1.

1287	VDC_MIN_COUNTER				Cross reference: –
	Vdc–min counter			Relevant: FDD/MSD/SLM	Protection level: Read–only
Unit: –	Default: 0	Minimum: 0	Maximum: 8388607	Data type: UNS.WORD	Active: Immediately

The value of the machine data is incremented each time the Vdc_min controller starts to limit the torque.

Note

MD 1287 is only active when the Vdc_min controller has been activated with MD 1284 = 1. After POWER ON, the count value is set to the last saved value.

■

3 Supplementary Conditions

None

■

4 Data Descriptions (MD, SD)

See Chapter 2

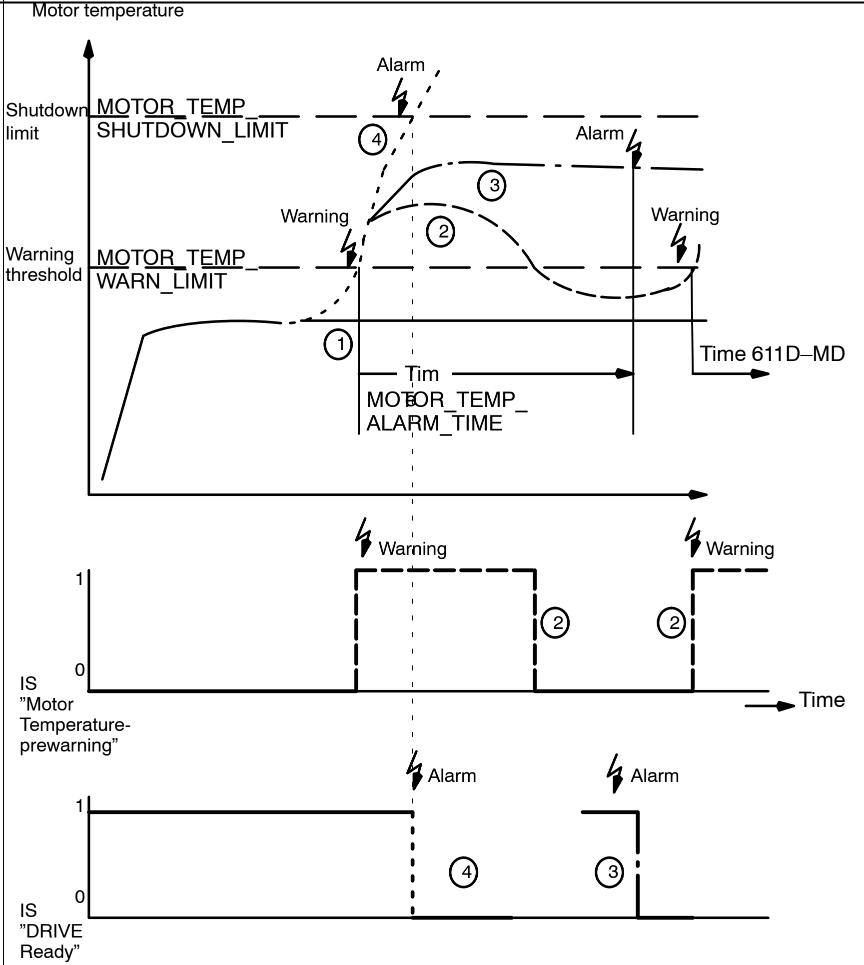
■

Space for your notes

Signal Descriptions 5

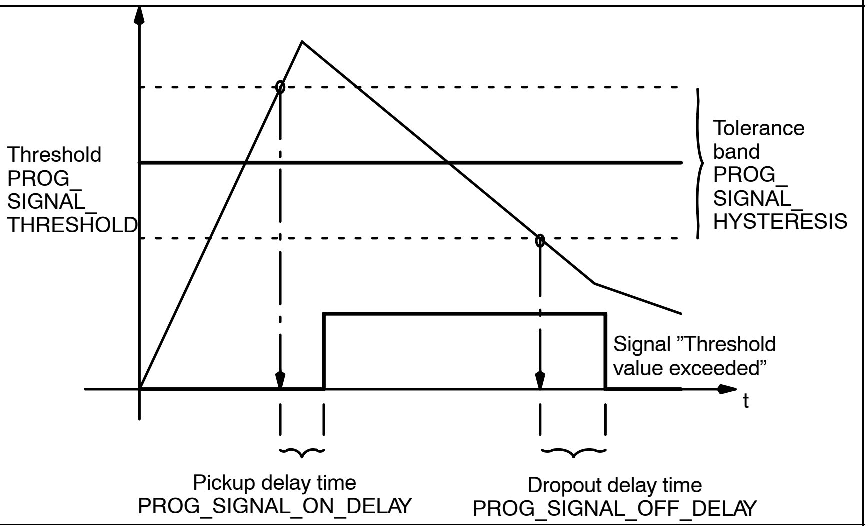
DB 31, ... **DBX92.6** Data block	**Ground fault test** Signal(s) to axis/spindle (drive → PLC)	
Edge evaluation: No	Signal(s) updated: Cyclic	Signal(s) valid from SW: 6.8
Signal state 1 or signal transition 0 ——> 1	An acknowledgement is sent from the drive (611D) to the PLC that the ground fault test for the axis/spindle has been successfully completed.	
Signal state 0 or signal transition 1 ——> 0	Reset status The ”Ground fault test in progress” IS is automatically cancelled after approx. 500 ms have elapsed on the 0 signal.	
Corresponding to...	”Ground fault test” IS (DB31,...DBX20.6)	
Special cases, errors,...	The ground fault test has been successfully carried out if there are no alarms pending other than 300513 ”Ground fault detected” (method of evaluation: no alarm with processing stop present; DB21,...DB36.7).	

DB 31, ... **DBX94.0** Data block	**Motor temperature pre–warning** Signal(s) from axis/spindle (drive → PLC)	
Edge evaluation: No	Signal(s) updated: Cyclic	Signal(s) valid from SW: 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 $\boxed{2}$). If the motor temperature remains at this level, the drive will be regeneratively braked once a specified time set in MD 1603: MOTOR_TEMP_ALARM_TIME (timer motor temperature alarm; default value 240 s) has expired and the pulses suppressed (see Figure 5-1 $\boxed{3}$). Alarm 300614 is then output and the ”DRIVE ready” IS is canceled. **Note:** With MSD, regenerative braking does not occur after the time specified in MD 1603. Here, the drive coasts to a standstill (MD 1613 bit 13 = 1, bit 14 = 1). 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 $\boxed{4}$). An alarm is 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 $\boxed{2}$). 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 operating area Diagnosis. The display corresponds to MD 1702: MOTOR_TEMPERATURE (motor temperature).	

DB 31, ... **DBX94.0** Data block	**Motor temperature pre–warning** Signal(s) from axis/spindle (drive → PLC)
Figure 51	
Application example(s)	As soon as ”Motor temperature prewarning” has been signaled, the PLC can, for example, initiate controlled shutdown of the drives.
Corresponding to	”DRIVE–Ready” IS (DB31, ..., DBX93.5) MD 1602: MOTOR_TEMP_WARN_LIMIT MD 1603: MOTOR_TEMP_ALARM_TIME MD 1607: MOTOR_TEMP_SHUTDOWN_LIMIT
Additional references	/DA/, ”Diagnostics Manual” /IAD/, SINUMERIK 840D Installation and StartUp Guide, Section SIMODRIVE 611D or /IAG/, SINUMERIK 810D Commissioning Manual

DB 31, ... **DBX94.1** Data block	**Heatsink temperature prewarning** Signal(s) from axis/spindle (drive → PLC)	
Edge evaluation: No	Signal(s) updated: Cyclic	Signal(s) valid from SW: 1.1
Signal state 1 or signal transition 0 ——> 1	The drive module sends the warning ”heatsink temperature pre–warning” 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.	
Signal state 0 or signal transition 1 ——> 0	The drive module heatsink temperature pre–warning has not responded.	
Application example(s)	As soon as ”heatsink temperature warning” has been signaled, the PLC can, for example, initiate controlled shutdown of the drives.	
Additional references	/DA/, ”Diagnostics Manual”	

DB 31, ... **DBX94.7** Data block	**Variable signaling function** Signal(s) from axis/spindle (drive → PLC)	
Edge evaluation: No	Signal(s) updated: Cyclic	Signal(s) valid from SW: 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 ’Threshold exceeded’ signal can be also be combined with an ON delay and OFF delay time (see Fig. 58). 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 the PLC that the threshold value of the variable being monitored has not been exceeded or that the conditions defined in the above 611DMD are not fulfilled. If the variable signaling function is disabled (PROG_SIGNAL_FLAGS), signal state ”0” is output to the PLC.	

DB 31, ... **DBX94.7** Data block	**Variable signaling function** Signal(s) from axis/spindle (drive → PLC)
Fig. 52	
Application example(s)	With the variable signal function the machine tool manufacturer 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 signal function” is to be set to 1 when the motor torque exceeds 50% of the nominal torque.
Corresponding 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 Commissioning Manual

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 from SW: 1.1
Signal state 1 or signal transition 0 ——> 1	The drive signals to the PLC that the DC link voltage U_{DC} link 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 to be greater than 400 V, depending on the application case. If the DC link voltage drops below 280 V, the unit is powered–down by the hardware.	
Signal state 0 or signal transition 1 ——> 0	The DC link voltage U_{DClink} is greater than the DC link undervoltage warning threshold.	
Application example(s)	If a warning signal is given, measures can be taken by the PLC user program, for example, to stop machining (e.g. start tool retraction) or to buffer the DC link voltage.	
Corresponding 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 Commissioning Manual	

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Example 6

None

Data Fields, Lists 7

7.1 Motor temperature monitoring

Table 7-1 Machine data

No.	Identifier	Name	Drive
1265	ACTIVITY_THERM_MOT	Configuration of thermal motor model	FDD/MSD
1266	LOAD_THERM_MOT	Thermal motor load	FDD/MSD
1267	LOAD_THERM_MOT_WARN_LIM	Thermal motor load warning threshold	FDD/MSD
1268	TAU_TIME	Winding time constant	FDD/MSD
1288	T_MOT_MAX_THERM	Shutdown threshold, thermal motor model	FDD/MSD
1602	MOTOR_TEMP_WARN_LIMIT[DRx]	Motor temperature warning threshold	FDD/MSD/SLM
1603	MOTOR_TEMP_ALARM_TIME[DRx]	Timer, motor temperature alarm	FDD/MSD/SLM
1607	MOTOR_TEMP_SHUTDOWN_LIMIT[DRx]	Shutdown limit, motor temperature	FDD/MSD/SLM
1608	MOTOR_FIXED_TEMPERATURE[DRx]	Fixed temperature	FDD/MSD/SLM

7.2 DC link monitoring

Table 7-2 Machine data

No.	Identifier	Name	Drive
1604	LINK_VOLTAGE_WARN_LIMIT[DRx]	DC link under voltage warning threshold	FDD/MSD/SLM
1630	LINK_VOLTAGE_MON_THRESHOLD	Response threshold, only DC link monitoring	FDD/MSD/SLM

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/SLM

7.4 Limits

7.4.1 Torque–setpoint limitation

Table 7-4 Machine data

No.	Identifier	Name	Drive
1145	STALL_TORQUE_REDUCTION[DRx]	Stall (standstill) torque reduction factor	FDD/MSD/SLM
1190	TORQUE_LIMIT_FROM_NC	Evaluation, torque limit value	FDD/MSD/SLM
1191	TORQUE_LIMIT_ADAPT_SERVO	Adaptation factor, servo limiting torque	FDD/MSD/SLM
1192	TORQUE_LIMIT_WEIGHT	Weight torque	FDD/MSD/SLM
1230	TORQUE_LIMIT_1[0...7,DRx]	1st torque limit value	FDD/MSD/SLM
1231	TORQUE_LIMIT_2[0...7,DRx]	2nd torque limit value	FDD/MSD/SLM
1232	TORQUE_LIMIT_SWITCH_SPEED	Switch speed from Md1 to Md2	FDD/MSD/SLM
1233	TORQUE_LIMIT_GENERATOR[0...7,DRx]	Regenerative limiting	FDD/MSD/SLM
1234	TORQUE_LIMIT_SWITCH_HYST	Hysteresis, MD 1232	FDD/MSD/SLM
1239	TORQUE_LIMIT_FOR_SETUP[DRx]	Torque limit for setup mode	FDD/MSD/SLM

7.4.2 Power limitation

Table 7-5 Machine data

No.	Identifier	Name	Drive
1235	POWER_LIMIT_1[0...7,DRx]	1st power limit	FDD/MSD/SLM
1236	POWER_LIMIT_2[0...7,DRx]	2nd power limit	FDD/MSD/SLM
1237	POWER_LIMIT_GENERATOR[DRx]	Maximum regenerative power	FDD/MSD/SLM

7.4.3 Current limitation

Table 7-6 Machine data

No.	Identifier	Name	Drive
1103	MOTOR_NOMINAL_CURRENT[DRx]	Rated motor current	FDD/MSD
1104	MOTOR_MAX_CURRENT[DRx]	Max. motor current	FDD/SLM
1105	MOTOR_MAX_CURRENT_REDUCTION[DRx]	Reduced maximum motor current	FDD/SLM
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 stage, n controller at its limit	FDD/MSD
1606	SPEEDCTRL_LIMIT_THRESHOLD[DRx]	Threshold, speed controller at its limit	FDD/MSD
1728	DESIRED_TORQUE	Torque setpoint	FDD/MSD/SLM

7.6 Speed/velocity setpoint limitation

Table 7-8 Machine data

No.	Identifier	Name	Drive
1405	MOTOR_SPEED_LIMIT[0...7,DRx]	Motor monitoring speed Motor monitoring velocity	FDD/MSD SLM
1420	MOTOR_MAX_SPEED_SETUP[DRx]	Max. motor speed setup mode Max. motor velocity setup mode	FDD/MSD SLM

7.7 Actual speed/velocity limitation

Table 7-9 Machine data

No.	Identifier	Name	Drive
1146	MOTOR_MAX_ALLOWED_SPEED[DRx]	Max. motor speed Max. motor velocity	FDD/MSD SLM
1147	SPEED_LIMIT[DRx]	Speed limitation Velocity limitation	FDD/MSD SLM

7.8 Motor ground fault test

Table 7-10 Machine data

No.	Identifier	Name	Drive
1166	MOTDIAG_GROUND_PROTECTION	Ground fault detection active	FDD/MSD/SLM
1167	CURRENT_GROUND_IDENT	Response threshold for ground fault detection	FDD/MSD/SLM
1168	MAX_TURN_MOTORIDENT MAX_MOVE_MOTORIDENT	Maximum rotation for ground fault detection Maximum movement for ground fault detection	FDD/MSD SLM
1169	DIAG_MOTORIDENT	Diagnostics, motor	FDD/MSD/SLM

7.9 Vdc_min controller

Table 7-11 Machine data

No.	Identifier	Name	Drive
1284	VDC_MIN_CONTROLLER	Vdc_min controller active	FDD/MSD/SLM
1285	VDC_THRESHOLD_MIN	Lower Vdc_min threshold	FDD/MSD/SLM
1286	VDC_MIN_CONTROLLER_KP	Vdc_min controller Kp	FDD/MSD/SLM
1287	VDC_MIN_COUNTER	Vdc_min counter	FDD/MSD/SLM

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Abbreviations

A

AC	Adaptive control
ACKNLG	Acknowledge from printer
ADF	Autofeed printer
ARM	Asynchronous rotating motor
ASCII	American Standard Code for Information Interchange
ASUB	Asynchronous subprogram (see also Interrupt routine)
AuxF	Auxiliary function
BA	Operating mode
BAG	Mode groups
Base 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	Binary files
BOT	Boot files for SIMODRIVE 611D
BP	Basic program
BUSY	Busy from printer
CAM	Reference cam
CC	Compile cycle
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.
CPA	Compiler projecting data
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	Cutter radius compensation
DAC	Digital–to–analog converter
DATA	Printer data bit x (x is index from 0 to 7)
DB	Data block in the PLC
DBB	Data block byte 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
DOE	Data transmission equipment
DPR	DUAL–port RAM
DRF	Differential resolver function: Differential function for handwheel signaling
DRY	Dry run feedrate
DSB	Decoding single block
DSR	Data set ready

DSR Data send ready: Signals that data is ready to be sent from the serial data interfaces

DTE Data terminal equipment

DTR Data terminal ready

EIA code Special punched tape code: Number of holes per character always odd

EMC Electronic compatibility

EMK Electromotive force

ENC Encoder (actual–value sensor)

EnDat Encoder–data–interface: Bidirectional synchronous–serial interface

Note:
The abbreviation EnDat refers to the descriptions provided in the FBA for EnDat 2.1 encoders from Heidenhain.
EnDat 2.2 encoders with incremental interface are supported in the EnDat 2.1 mode (SW 06.08.14 and higher).

EPROM Erasable programmable read–only memory

ERROR Error from printer

FC Function call, function block on the PLC

FDD Feed drive

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

FST Feed stop

GEO Geometry

GIA Gear interpolation data

GND Signal ground

GUD Global user data

GWPS Grinding wheel peripheral speed

HEX Hexadecimal number

HMI	Human machine interface: Operating functions of SINUMERIK for operation, programming, and simulation. MMC means the same as HMI.
HW limit switch	Hardware limit switch
I/RF	Infeed/regenerative feedback unit of SIMODRIVE 611(D)
ICA	Interpolative compensation
IF	Pulse enable of the drive module
IK (GD)	Implicit communication (global data)
INC	Increment
INI	Initializing data
INIT	Initialize printer
Interpolation point	A position of the base axis and the corresponding compensation value of the compensation axis.
IPO	Interpolator
IS	Interface signal
ISO code	Special punched tape code, number of holes per character always even
JOG	Jogging: Setup mode
KD	Coordinate rotation
K_V	Servo gain factor
K_{UE}	Transmission ratio
LEC	Leadscrew error compensation
LEDs	Light–emitting–diode display
LF	Line feed
LR	Position controller
LUD	Local user data
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.
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.
NV	Zero offset
OB	Organization block on the PLC
OP	Operator panel
OPI	Operator panel interface: Interface for connection to the operator panel
OPT	Options
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
PE	Paper error
PG	Programming device
PLC	Programmable logic controller
PM	Power section
PMS1	Position measuring system 1
PMS2	Position measuring system 2
PRAL	Process alarm

PRT	Program test
PTP	Point to point
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: RTS, control signal of serial data interfaces
RXD	Receive data
SBL	Single block
SD	Setting data
SIDA	SIMODRIVE double–axis ASIC
SKP	Skip block
SLCT	Select from printer
SLM	Synchronous linear motor
SLS	Setting data active: Memory area for setting data on the NCK
SM	Stepper motor
SPF	Subprogram file
SRM	Synchronous rotating motor
STROBE	Data strobe to printer
SW limit switch	Software limit switch
SYF	System files
SYNACT	Synchronized action

TEA	Testing data active: Refers to machine data
TLC	Tool length compensation
TNRC	Tool nose radius compensation
TO	Tool offset
TOA	Tool offset active: Memory area for tool offsets
TXD	Transmit data
UFR	User frame: Zero 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	Workpiece directory
WZ	Tool
Xy	Connector designation (y is index)
450	Type of modern interface controller
550	Type of modern interface controller
75188	Driver module for serial interface

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Space for your 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 manufacturer.

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 programs.

C

C axis Axis, around which the tool spindle describes a controlled rotational and positioning 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 interpolation The →tool is required to travel in a circle between defined points on the contour at a specified feed while machining the workpiece.

COM Component of the NC control for the implementation and coordination of communication.

Command channel The PLC program can transfer or invoke NC functions (e.g. S–external, transformation) via the command channel.

Compensation memory Data range in the control, in which the tool offset data are stored.

Continuous–path mode The purpose of continuous–path mode is to prevent excessive deceleration of 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 work 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: →work offset, →rotation, →scaling, →mirroring.

G

Gantry axes

Gantry axes comprise at least one pair of 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 measuring system
Measuring 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 operator 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 programming 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 operator and programmer and can be controlled accordingly in the same way as a normal NC axis.

Leadscrew error compensation Compensation for the mechanical inaccuracies of a ball screw participating in 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 values 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 interpolation The tool travels along a straight line to the destination point while machining the workpiece.

M

Machine axes Axes, which exist physically on the machine tool.

Machine control panel An operator panel on a →machine tool with operating elements such as keys, rotary switches, etc., and simple indicators such as LEDs. It is used to control the machine tool directly via the PLC.

Machine coordinate system System of coordinates based on the axes of the →machine tool.

Machine zero A fixed point on the machine tool, which can be referenced by all (derived) measuring systems.

Macro techniques Grouping of a set of instructions under a single identifier. The identifier represents 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 programs, 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 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 machine 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

Operating mode An operating concept on a SINUMERIK control. The following modes have been defined: →JOG, →MDA, →AUTOMATIC.

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

Part program

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 feedrate

Path feed acts on →path axes. It represents the geometrical sum of the feeds on the participating geometry axes.

PLC

Programmable logic controller: 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

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.

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.

Rotary axis Rotary axes rotate a workpiece or tool to a defined angular position.

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".

R parameters Arithmetic parameter, for which the programmer of the part program can assign or request values as required.

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.

Soft key
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 assignable 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 position 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.

Synchronous 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 cutting tools, mills, drills, laser beams, etc.

Tool nose radius compensation
Contour programming assumes that the tool is pointed. Since this is not actually the case in practice, the curvature radius of the tool used must be communicated 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 work 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 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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Space for your notes

List of Drive Machine Data

C

The following table lists all the machine data described in this publication in ascending order with cross reference to the corresponding manual.

MD No.	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	/DG1/ + /DM1/
1017	STARTUP_ASSISTANCE	/DG1/ + /DM1/
1019	CURRENT_ROTORPOS_IDENT	/DL1/ + /DM1/
1020	MAX_TURN_ROTORPOS_IDENT/ MAX_MOVE_ROTORPOS_IDENT (FDD, SLM)	/DL1/ + /DM1/
1021	ENC_ABS_TURNS_MOTOR	/DG1/
1022	ENC_ABS_RESOL_MOTOR	/DG1/
1023	ENC_ABS_DIAGNOSIS_MOTOR	/DG1/
1024	DIVISION_LIN_SCALE	/DL1/
1025	SERIAL_NO_ENCODER	/DG1/
1027	ENC_CONFIG	/DG1/
1028	NO_TRANSMISSION_BITS	/DG1/
1030	ACTUAL_VALUE_CONFIG_DIRECT	/DG!/
1031	ENC_ABS_TURNS_DIRECT	/DG1/
1032	ENC_ABS_RESOL_DIRECT	/DG1/
1033	ENC_ABS_DIAGNOSIS_DIRECT	/DG1/
1034	DIVISION_LIN_SCALE_DM	/DL1/
1037	ENC_CONFIG_DIRECT	/DG1/

1038	SERIAL_NO_ENCODER_DM	/DG1/
1041	NO_TRANSMISSION_BITS_DM	/DG1/
1049	EMF_BRAKE_ENABLE	/DE1/
1055	MARKER_DIST	/DG1/ + /DM1/
1056	MARKER_DIST_DIFF	/DG1/ + /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/
	POSS_MOVE_ROTORPOS_IDENT	/DM1/
1074	ROTORPOS_OFFSET	/DM1/ +/DE1/
1075	ALGORITHM_ROTORPOS_IDENT	/DM1/
1076	FACTOR_INERTIA (SRM)/FACTOR_MASS (SLM)	/DM1/
1077	RLI_INTEGRATOR_TIME	/DM1/
1078	MAX_TIME_ROTORPOS_ID	/DM1/
1096	RED_TORQUE_LIMIT_GS_ACTIV	/DE1/
1097	RED_TORQUE_LIMIT_GENSTOP	/DE1/
1098	INVERTER_MAX_CURR_DERAT	/DE1/ + /DM1/
1099	INVERTER_DERATING_FACT	/DE1/ + /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/
	FORCE_CURRENT_RATIO (FDD/SLM)	/DL1/
1114	EMF_VOLTAGE	/DM1/ + /DL1/
1115	ARMATURE_RESISTANCE	/DM1/ + /DL1/
1116	ARMATURE_INDUCTANCE	/DM1/

1117	MOTOR_INERTIA (FDD, MSD)	/DM1/
	MOTOR_MASS (FDD, SLM)	/DL1/
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_RESISTANCE	/DM1/
1138	ROTOR_COLD_RESISTANCE	/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	/DL1/ + /DÜ1/
1148	ACTUAL_STALL_POWER_SPEED	/DD1/
1149	RELUCT_TORQUE_RATIO	/DE1/
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/
1164	LINK_VOLTAGE_SPEED_SETUP	/DE1/
1165	DYN_MANAG_ENABLE	/DE1/
1166	MOTDIAG_GROUND_PROTECTION	/DÜ1/
1167	CURRENT_GROUND_IDENT	/DÜ1/
1168	MAX_TURN_MOTORIDENT	/DÜ1/
	MAX_MOVE_MOTORIDENT (SLM)	/DÜ1/
1169	DIAG_MOTORIDENT	/DÜ1/

1170	**POLE_PAIR_PITCH**	/DL1/
1172	**PEMSD_VSA**	/DE1/
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/
1182	**REDUCE_ARMATURE_INDUCTANCE**	/DS1/
1183	**CURRCTRL_ADAPT_ENABLE**	/DS1/
1185	**STARTUP_FACT_CURRCTRL**	/DS1/
1190	**TORQUE_LIMIT_FROM_NC**	/DÜ1/
1191	**TORQUE_LIMIT_ADAPT_SERVO**	/DÜ1/
1192	**TORQUE_LIMIT_WEIGHT (FDD/MSD)**	/DÜ1/
	FORCE_LIMIT_WEIGHT (FDD/SLM)	/DL1/
1193	**BALANCE_BY_STOP_C**	/DL1/
1200	**NUM_CURRENT_FILTERS** [n] 0...7 index of parameter set	/DD2/
1201	**CURRENT_FILTER_CONFIG** [n] 0...7 index of parameter set	/DD2/
1202	**CURRENT_FILTER_1_FREQUENCY** [n] 0...7 index of parameter set	/DD2/
1203	**CURRENT_FILTER_1_DAMPING** [n] 0...7 index of parameter set	/DD2/
1204	**CURRENT_FILTER_2_FREQUENCY** [n] 0...7 index of parameter set	/DD2/
1205	**CURRENT_FILTER_2_DAMPING** [n] 0...7 index of parameter set	/DD2/
1206	**CURRENT_FILTER_3_FREQUENCY** [n] 0...7 index of parameter set	/DD2/
1207	**CURRENT_FILTER_3_DAMPING** [n] 0...7 index of parameter set	/DD2/
1208	**CURRENT_FILTER_4_FREQUENCY** [n] 0...7 of parameter set	/DD2/
1209	**CURRENT_FILTER_4_DAMPING** [n] 0...7 index of parameter set	/DD2/
1210	**CURRENT_FILTER_1_SUPPR_FREQ** [n] 0...7 index of parameter set	/DD2/
1211	**CURRENT_FILTER_1_BANDWIDTH** [n] 0...7 index of parameter set	/DD2/
1212	**CURRENT_FILTER_1_BW_NUM** [n] 0...7 index of parameter set	/DD2/
1213	**CURRENT_FILTER_2_SUPPR_FREQ** [n] 0...7 index of parameter set	/DD2/
1214	**CURRENT_FILTER_2_BANDWIDTH** [n] 0...7 index of parameter set	/DD2/
1215	**CURRENT_FILTER_2_BW_NUM** [n] 0...7 index of parameter set	/DD2/
1216	**CURRENT_FILTER_3_SUPPR_FREQ** [n] 0...7 index of parameter set	/DD2/
1217	**CURRENT_FILTER_3_BANDWIDTH** [n] 0...7 index of parameter set	/DD2/
1218	**CURRENT_FILTER_3_BW_NUM** [n] 0...7 index of parameter set	/DD2/
1219	**CURRENT_FILTER_4_SUPPR_FREQ** [n] 0...7 index of parameter set	/DD2/
1220	**CURRENT_FILTER_4_BANDWIDTH** [n] 0...7 index of parameter set	/DD2/
1221	**CURRENT_FILTER_4_BW_NUM** [n] 0...7 index of parameter set	/DD2/
1222	**CURRENT_FILTER_1_BS_FREQ** [n] 0...7 index of parameter set	/DD2/
1223	**CURRENT_FILTER_2_BS_FREQ** [n] 0...7 index of parameter set	/DD2/
1224	**CURRENT_FILTER_3_BS_FREQ** [n] 0...7 index of parameter set	/DD2/
1225	**CURRENT_FILTER_4_BS_FREQ** [n] 0...7 index of parameter set	/DD2/

1230	**TORQUE_LIMIT_1** [n] 0...7 index of parameter set	/DÜ1/
	FORCE_LIMIT_1[n] (FDD/SLM)	/DL1/
1231	**TORQUE_LIMIT_2**	/DÜ1/
	FORCE_LIMIT_2 (FDD/SLM)	/DL1/
1232	**TORQUE_LIMIT_SWITCH_SPEED**	/DÜ1/
	FORCE_LIMIT_SWITCH_SPEED (FDD/SLM)	/DL1/
1233	**TORQUE_LIMIT_GENERATOR** [n] 0...7 index of parameter set	/DÜ1/
	LIMIT_GENERATOR (FDD/SLM)	/DL1/
1234	**TORQUE_LIMIT_SWITCH_HYST**	/DÜ1/
	FORCE_LIMIT_SWITCH_HYST (FDD/SLM)	/DL1/
1235	**POWER_LIMIT_1** [n] 0...7 index of parameter set	/DÜ1/
1236	**POWER_LIMIT_2**	/DÜ1/
1237	**POWER_LIMIT_GENERATOR**	/DÜ1/
1238	**CURRENT_LIMIT**	/DÜ1/
1239	**TORQUE_LIMIT_FOR_SETUP**	/DÜ1/
	FORCE_LIMIT_FOR_SETUP (FDD/SLM)	/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**	/DB1/
1252	**TORQUE_FILTER_FREQUENCY**	/DB1/
	FORCE_FILTER_FREQUENCY (FDD/SLM)	/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/
1265	**ACTIVITY_THERM_MOT**	/DÜ1/
1266	**LOAD_THERM_MOT**	/DÜ1/
1267	**LOAD_THERM_MOT_WARN_LIM**	/DÜ1/
1268	**TAU_TIME**	/DÜ1/
1272	**CURRENT_FILTER_5_FREQUENCY** [n] 0...7 index of parameter set	/DD2/
1273	**CURRENT_FILTER_5_DAMPING** [n] 0...7 index of parameter set	/DD2/
1274	**CURRENT_FILTER_5_SUPPR_FREQ** [n] 0...7 index of parameter set	/DD2/
1275	**CURRENT_FILTER_5_BANDWIDTH** [n] 0...7 index of parameter set	/DD2/
1276	**CURRENT_FILTER_5_BW_NUM** [n] 0...7 index of parameter set	/DD2/
1277	**CURRENT_FILTER_5_BS_FREQ** [n] 0...7 index of parameter set	/DD2/
1278	**CURRENT_FILTER_6_FREQUENCY** [n] 0...7 index of parameter set	/DD2/
1279	**CURRENT_FILTER_6_DAMPING** [n] 0...7 index of parameter set	/DD2/
1280	**CURRENT_FILTER_6_SUPPR_FREQ** [n] 0...7 index of parameter set	/DD2/
1281	**CURRENT_FILTER_6_BANDWIDTH** [n] 0...7 index of parameter set	/DD2/

1282	**CURRENT_FILTER_6_BW_NUM** [n] 0...7 index of parameter set	/DD2/
1283	**CURRENT_FILTER_6_BS_FREQ** [n] 0...7 index of parameter set	/DD2/
1284	**VDC_MIN_CONTROLLER**	/DÜ1/
1285	**VDC_THRESHOLD_MIN**	/DÜ1/
1286	**VDC_MIN_CONTROLLER_KP**	/DÜ1/
1287	**VDC_MIN_COUNTER**	/DÜ1/
1288	**T_MOT_MAX_THERM**	/DÜ1/
1300	**SAFETY_CYCLE_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_POINT_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/
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/
1349	**SAFE_SLIP_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/
1355	**SAFE_STOP_SWITCH_TIME_F**	/FBSI/
1356	**SAFE_PULSE_DISABLE_DELAY**	/FBSI/
1357	**SAFE_PULSE_DIS_CHECK_TIME**	/FBSI/
1358	**SAFE_ACC_TEST_TIMEOUT**	/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/

1370	**SAFE_TEST_MODE**	/FBSI/
1371	**SAFE_TEST_STATE**	/FBSI/
1380	**SAFE_PULSE_DIS_TIME_FAIL**	/FBSI/
1390	**SAFE_FIRMWARE_VERSION**	/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**	/DL1/ + /DM1/
1401	**MOTOR_MAX_SPEED** [n] 0...7 index of parameter set	/DD1/ + /DL1/
1403	**PULSE_SUPPRESSION_SPEED**	/DB1/ + /DL1/
1404	**PULSE_SUPPRESSION_DELAY**	/DB1/
1405	**MOTOR_SPEED_LIMIT** [n] 0...7 index of parameter set	/DL1/ + /DÜ1/
1406	**SPEEDCTRL_TYPE**	/DD2/
1407	**SPEEDCTRL_GAIN_1** [n] 0...7 index of parameter set	/DD2/ + /DL1/
1408	**SPEEDCTRL_GAIN_2** [n] 0...7 index of parameter set	/DD2/ + /DL1/
1409	**SPEEDCTRL_INTEGRATOR_TIME_1** [n] 0...7 index of parameter set	/DD2/ + /DL1/
1410	**SPEEDCTRL_INTEGRATOR_TIME_2** [n] 0...7 index of parameter set	/DD2/ + /DL1/
1411	**SPEEDCTRL_ADAPT_SPEED_1**	/DD2/ + /DL1/
1412	**SPEEDCTRL_ADAPT_SPEED_2**	/DD2/ + /DL1/
1413	**SPEEDCTRL_ADAPT_ENABLE**	/DD2/ + /DL1/
1414	**SPEEDCTRL_REF_MODEL_FREQ** [n] 0...7 index of parameter set	/DL1/
1415	**SPEEDCTRL_REF_MODEL_DAMPING** [n] 0...7 index of parameter set	/DL1/
1416	**SPEEDCTRL_REF_MODEL_DELAY**	/DL1/
1417	**SPEED_THRESHOLD_X** [n] 0...7 index of parameter set	/DB1/ + /DL1/
1418	**SPEED_THRESHOLD_MIN** [n] 0...7 index of parameter set	/DB1/ + /DL1/
1420	**MOTOR_MAX_SPEED_SETUP**	/DÜ1/ + /DL1/
1421	**SPEEDCTRL_INTEGRATOR_FEEDBK** [n] 0...7 index of parameter set	/DD2/
1424	**SPEED_FFW_FILTER_TIME**	/DL1/ + /DS1/
1425	**SPEED_FFW_DELAY**	/DS1/
1426	**SPEED_DES_EQ_ACT_TOL** [n] 0...7 index of parameter set	/DB1/ + /DL1/
1427	**SPEED_DES_EQ_ACT_DELAY**	/DB1/ + /DL1/
1428	**TORQUE_THRESHOLD_X** [n] 0...7 index of parameter set	/DB1/
	FORCE_THRESHOLD_X [n] 0...7 index of parameter set	/DL1/
1429	**TORQUE_THRESHOLD_X_DELAY**	/DB1/ + /DL1/
1451	**SPEEDCTRL_GAIN_1_AM** [n] 0...7 index of parameter set	/DE1/
1453	**SPEEDCTRL_INTEGR_TIME_1_AM** [n] 0...7 index of parameter set	/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/
1472	**CURRENT_FILTER_7_FREQUENCY** [n] 0...7 index of parameter set	/DD2/
1473	**CURRENT_FILTER_7_DAMPING** [n] 0...7 index of parameter set	/DD2/
1474	**CURRENT_FILTER_7_SUPPR_FREQ** [n] 0...7 index of parameter set	/DD2/
1475	**CURRENT_FILTER_7_BANDWIDTH** [n] 0...7 index of parameter set	/DD2/
1476	**CURRENT_FILTER_7_BW_NUM** [n] 0...7 index of parameter set	/DD2/
1477	**CURRENT_FILTER_7_BS_FREQ** [n] 0...7 index of parameter set	/DD2/
1478	**CURRENT_FILTER_8_FREQUENCY** [n] 0...7 index of parameter set	/DD2/
1479	**CURRENT_FILTER_8_DAMPING** [n] 0...7 index of parameter set	/DD2/
1480	**CURRENT_FILTER_8_SUPPR_FREQ** [n] 0...7 index of parameter set	/DD2/
1481	**CURRENT_FILTER_8_BANDWIDTH** [n] 0...7 index of parameter set	/DD2/
1482	**CURRENT_FILTER_8_BW_NUM** [n] 0...7 index of parameter set	/DD2/
1483	**CURRENT_FILTER_8_BS_FREQ** [n] 0...7 index of parameter set	/DD2/
1484	**CURRENT_FILTER_9_FREQUENCY** [n] 0...7 index of parameter set	/DD2/
1485	**CURRENT_FILTER_9_DAMPING** [n] 0...7 index of parameter set	/DD2/
1486	**CURRENT_FILTER_9_SUPPR_FREQ** [n] 0...7 index of parameter set	/DD2/
1487	**CURRENT_FILTER_9_BANDWIDTH** [n] 0...7 index of parameter set	/DD2/
1488	**CURRENT_FILTER_9_BW_NUM** [n] 0...7 index of parameter set	/DD2/
1489	**CURRENT_FILTER_9_BS_FREQ** [n] 0...7 index of parameter set	/DD2/
1490	**CURRENT_FILTER_10_FREQUENCY** [n] 0...7 index of parameter set	/DD2/
1491	**CURRENT_FILTER_10_DAMPING** [n] 0...7 index of parameter set	/DD2/
1492	**CURRENT_FILTER_10_SUPPR_FREQ** [n] 0...7 index of parameter set	/DD2/
1493	**CURRENT_FILTER_10_BANDWIDTH** [n] 0...7 index of parameter set	/DD2/
1494	**CURRENT_FILTER_10_BW_NUM** [n] 0...7 index of parameter set	/DD2/
1495	**CURRENT_FILTER_10_BS_FREQ** [n] 0...7 index of parameter set	/DD2/

MD No.	MD identifier	Cross reference:
1500	**NUM_SPEED_FILTERS** [n] 0...7 index of parameter set	/DD2/ + /DL1/
1501	**SPEED_FILTER_TYPE** [n] 0...7 index of parameter set	/DD2/ + /DL1/
1502	**SPEED_FILTER_1_TIME** [n] 0...7 index of parameter set	/DD2/ + /DL1/
1503	**SPEED_FILTER_2_TIME** [n] 0...7 index of parameter set	/DD2/ + /DL1/
1506	**SPEED_FILTER_1_FREQUENCY** [n] 0...7 index of parameter set	/DD2/ + /DL1/
1507	**SPEED_FILTER_1_DAMPING** [n] 0...7 index of parameter set	/DD2/ + /DL1/
1508	**SPEED_FILTER_2_FREQUENCY** [n] 0...7 index of parameter set	/DD2/ + /DL1/
1509	**SPEED_FILTER_2_DAMPING** [n] 0...7 index of parameter set	/DD2/ + /DL1/
1514	**SPEED_FILTER_1_SUPPR_FREQ** [n] 0...7 index of parameter set	/DD2/ + /DL1/
1515	**SPEED_FILTER_1_BANDWIDTH** [n] 0...7 index of parameter set	/DD2/ + /DL1/
1516	**SPEED_FILTER_1_BW_NUMERATOR** [n] 0...7 index of parameter set	/DD2/ + /DL1/
1517	**SPEED_FILTER_2_SUPPR_FREQ** [n] 0...7 index of parameter set	/DD2/ + /DL1/
1518	**SPEED_FILTER_2_BANDWIDTH** [n] 0...7 index of parameter set	/DD2/ + /DL1/
1519	**SPEED_FILTER_2_BW_NUMERATOR** [n] 0...7 index of parameter set	/DD2/ + /DL1/

MD No.	MD identifier	Cross reference:
1520	**SPEED_FILTER_1_BS_FREQ** [n] 0...7 index of parameter set	/DD2/ + /DL1/
1521	**SPEED_FILTER_2_BS_FREQ** [n] 0...7 index of parameter set	/DD2/ + /DL1/
1522	**ACT_SPEED_FILTER_TIME**	/DD2/
1523	**ACT_SPEED_FILTER_TIME_RLI**	/DM1/
1560	**ACC_MODE**	/DS1/
1561	**ACC_SENS_RESOL**	/DS1/
1563	**ACC_HIGH_PASS_TIME**	/DS1/
1564	**LOAD_SPEEDCTL_DIFF_TIME** [n] 0...7 index of parameter set	/DS1/
1565	**LOAD_SPEEDCTL_GAIN** [n] 0...7 index of parameter set	/DS1/
1566	**LOAD_SPEEDCTL_LIMIT** [n] 0...7 index of parameter set	/DS1/
1567	**LOAD_SPEEDCTL_DIFF_TIME2** [n] 0...7 index of parameter set	/DS1/
1569	**ACC_FIL_DOWNSCAN**	/DS1/
1570	**ACC_FILTER_TYPE** [n] 0...7 index of parameter set	/DS1/
1571	**ACC_FILTER_TIME1** [n] 0...7 index of parameter set	/DS1/
1572	**ACC_DENOM_FILTER_FREQU1** [n] 0...7 index of parameter set	/DS1/
1573	**ACC_DENOM_FILTER_DAMP1** [n] 0...7 index of parameter set	/DS1/
1574	**ACC_NOM_FILTER_FREQU1** [n] 0...7 index of parameter set	/DS1/
1575	**ACC_NOM_FILTER_DAMP1** [n] 0...7 index of parameter set	/DS1/
1576	**ACC_FILTER_TIME2** [n] 0...7 index of parameter set	/DS1/
1577	**ACC_DENOM_FILTER_FREQU2** [n] 0...7 index of parameter set	/DS1/
1578	**ACC_DENOM_FILTER_DAMP2** [n] 0...7 index of parameter set	/DS1/
1579	**ACC_NOM_FILTER_FREQU2** [n] 0...7 index of parameter set	/DS1/
1580	**ACC_NOM_FILTER_DAMP2** [n] 0...7 index of parameter set	/DS1/
1581	**ACC_DENOM_FILTER_FREQU3** [n] 0...7 index of parameter set	/DS1/
1582	**ACC_DENOM_FILTER_DAMP3** [n] 0...7 index of parameter set	/DS1/
1583	**ACC_NOM_FILTER_FREQU3** [n] 0...7 index of parameter set	/DS1/
1584	**ACC_NOM_FILTER_DAMP3** [n] 0...7 index of parameter set	/DS1/
1585	**ACC_FILTER_TIME4** [n] 0...7 index of parameter set	/DS1/
1586	**ACC_DENOM_FILTER_FREQ4** [n] 0...7 index of parameter set	/DS1/
1587	**ACC_DENOM_FILTER_DAMP4** [n] 0...7 index of parameter set	/DS1/
1588	**ACC_NOM_FILTER_FREQ4** [n] 0...7 index of parameter set	/DS1/
1589	**ACC_NOM_FILTER_DAMP4** [n] 0...7 index of parameter set	/DS1/
1590	**ACC_FILTER_TIME5** [n] 0...7 index of parameter set	/DS1/
1591	**ACC_DENOM_FILTER_FREQ5** [n] 0...7 index of parameter set	/DS1/
1592	**ACC_DENOM_FILTER_DAMP5** [n] 0...7 index of parameter set	/DS1/
1593	**ACC_NOM_FILTER_FREQ5** [n] 0...7 index of parameter set	/DS1/
1594	**ACC_NOM_FILTER_DAMP5** [n] 0...7 index of parameter set	/DS1/

MD No.	MD identifier	Cross reference:
1600	ALARM_MASK_POWER_ON	/DB1/
1601	ALARM_MASK_RESET	/DB1/
1602	MOTOR_TEMP_WARN_LIMIT	/DÜ1/ + /DM1/
1603	MOTOR_TEMP_ALARM_TIME	/DÜ1/
1604	LINK_VOLTAGE_WARN_LIMIT	/DÜ1/
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/
1645	MALORIENTATION_TIME	/DM1/
1646	POS_FEEDBACK_THRESHOLD	/DM1/
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/

MD No.	MD identifier	Cross reference:
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	/DD2/

MD No.	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 (FDD, MSD)	/DD1/
	FORCE_LSB (FDD, SLM)	/DL1/
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 (FDD, MSD)	/DD1/
	MAX_FORCE_FROM_NC (FDD, SLM)	/DL1/
1728	DESIRED_TORQUE	/DÜ1/
1729	ACTUAL_ELECTRIC_ROTORPOS	/DM1/
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/

MD No.	MD identifier	Cross reference:
1791	**ENC_TYPE_DIRECT**	/DG1/
1796	**HW_VERSION**	/DD1/
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 C-1 Drive machine data, MSD, of the 2nd motor

MD No.	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

Table C-1 Drive machine data, MSD, of the 2nd motor

MD No.	Title
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
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

Table C-1 Drive machine data, MSD, of the 2nd motor

MD No.	Title
2711	SPEED_LSB_M2
2712	ROTOR_FLUX_LSB_M2
2713	TORQUE_LSB_M2
2714	ROTOR_POS_LSB_M2
2725	MAX_TORQUE_FROM_NC_M2

■

SIMODRIVE 611 digital Drive Functions

D

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 D-1 Function differences for SIMODRIVE 611 digital

Function	High Standard		High Performance	CCU3	Cross reference
	1–axis	2–axis (FDD only)	1–axis or 2–axis	(6–axis/810D)	
Safety Integrated with internal pulse suppression via drive bus	Yes	Yes	Yes	No	/DB1/
Encoder limit frequency of motor measuring system	200 kHz	200 kHz	350 kHz (420 kHz[1])	200 kHz	/DB1/
Encoder limit frequency for motor measuring system with Safety	200 kHz	200 kHz	350 kHz (420 kHz[1])	—	/DB1/
Encoder limit frequency, direct measuring system	200 kHz	200 kHz	350 kHz (420 kHz[1])	200 kHz	/DB1/
Encoder limit frequency for direct measuring system with Safety	200 kHz	200 kHz	300 kHz (420 kHz[1])	—	/DB1/
Motor data sets, expansion from 2 to 4 MSD	Yes	—	Yes	Yes	/DE1/
Actual–speed–value filter, analog 611 universal	Yes	Yes	Yes	Yes	/DD2/
i^2t power module limitation	Yes	Yes	Yes	Yes	/DM1/
Minimum current controller cycle	125 µs	125 µs	62.5 µs	Default 156.5 µs (minimum 125 µs)	/DS1/
Minimum speed controller cycle	125 µs	500 µs	62.5 µs	Default 312 µs (minimum 125 µs)	/DS1/
Minimum position controller cycle	2 ms	4 ms	0.5 ms	1.5 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	0.8 ms	1.4 ms	

Table D-1 Function differences for SIMODRIVE 611 digital, continued

Function	High Standard		High Performance	CCU3	Cross reference
	1axis	**2–axis (FDD only)**	**1–axis or 2–axis**	**(6–axis/810D)**	
Rated frequency of closed speed control loop	550 Hz	160 Hz	1 kHz	550 Hz at 125 µs; 300 Hz at 312 µs	
Max. motor speed (4–pole)	18000 rpm	18000 rpm	42000 rpm	18000 rpm	/DÜ1/
Max. electrical fundamental frequency for motor	600 Hz	600 Hz	1400 Hz	600 Hz	
Smooth running	0.2 µm	1.5 µm	0.1 µm	1.5 µm	
Pulse multiplication factor	128	128	2048	128	

1) The following supplementary conditions/restrictions 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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Space for your notes

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Suggestions

Corrections

For Publication/Manual:

SIMODRIVE 611 digital
SINUMERIK 840D/810D
Drive Functions
Function Manual

Manufacturer/Service Documentation

Function Manual

Order No.: 6SN1 197–0AA80–2BP0
Edition: 06/2009

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