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STANDARD CONTROL APPLICATION

(par. 0.1 = 2)

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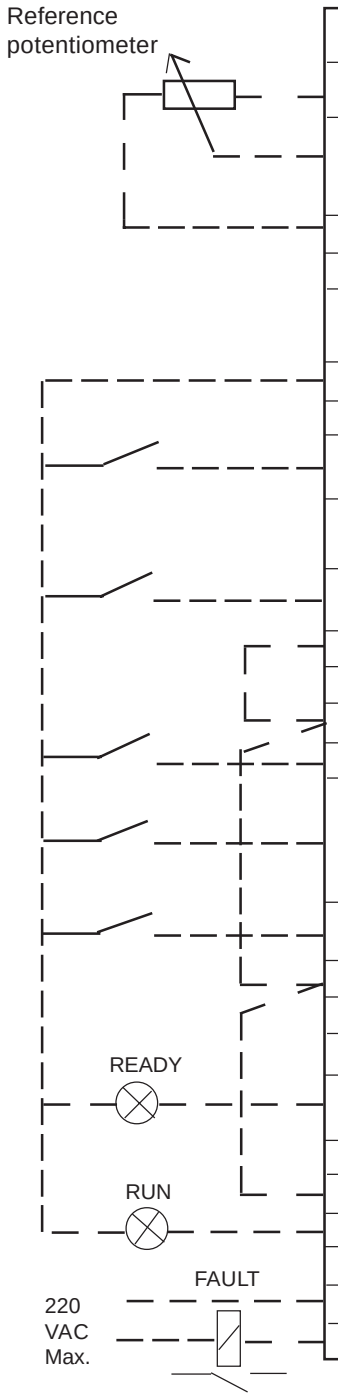
1 STANDARD APPLICATION

1.1 General

The Standard application has the same I/O signals and same Control logic as the Basic application. Digital input DIA3 and all outputs are programmable.

The Standard Application can be selected by setting the value of parameter 0**.** 1 to 2. Basic connections of inputs and outputs are shown in the figure 1.2-1. The control signal logic is shown in the figure 1.3-1. Programming of I/O terminals is explained in chapter 1.5.

1.2 Control I/O



Terminal		Signal	Description
1	$+10V_{ref}$	Reference output	Voltage for a potentiometer, etc.
2	$V_{in}+$	Analog input, voltage range 0—10 V DC	Frequency reference if activated if terminals 14 and 15 open and parameter 1.17 = 0 (default value)
3	GND	I/O ground	Ground for reference and controls
4	$I_{in}+$	Analog input, current range 0—20 mA	Frequency reference activated if terminals 14 and 15 closed, or open and parameter 1.17 = 1
5	$I_{in}-$		
6	+24V	Control voltage output	Voltage for switches, etc. max. 0.1 A
7	GND	I/O ground	Ground for reference and controls
8	DIA1	Start forward (Programmable)	Contact closed = start forward
9	DIA2	Start reverse (Programmable)	Contact closed = start reverse
10	DIA3	External fault input (Programmable)	Contact open = no fault Contact closed = fault
11	CMA	Common for DIA1—DIA3	Connect to GND or + 24V
12	+24V	Control voltage output	Voltage for switches, (same as #6)
13	GND	I/O ground	Ground for reference and controls
14	DIB4	Multi-step speed select 1	*DIB4* / *DIB5* / *Frequency ref.*
15	DIB5	Multi-step speed select 2	open / open / Ref. V_{in} (par.1.17=0) closed / open / Multi-step ref. 1 open / closed / Multi-step ref. 2 closed / closed / Ref. I_{in} (term. #4,5)
16	DIB6	Fault reset	Contact open = no action Contact closed = fault reset
17	CMB	Common for DIB4—DIB6	Connect to GND or + 24V
18	$I_{out}+$	Output frequency	Programmable (par. 3**.** 1)
19	$I_{out}-$	Analog output	Range 0—20 mA/R_L max. 500 Ω
20	DO1	Digital output READY	Programmable (par. 3**.** 6) Open collector, I≤50 mA, U≤48 VDC
21	RO1	Relay output 1 RUN	Programmable (par. 3**.** 7)
22	RO1		
23	RO1		
24	RO2	Relay output 2 FAULT	Programmable (par. 3**.** 8)
25	RO2		
26	RO2		

Figure 1.2-1 Default I/O configuration and connection example of the Standard Application.

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1.3 Control signal logic

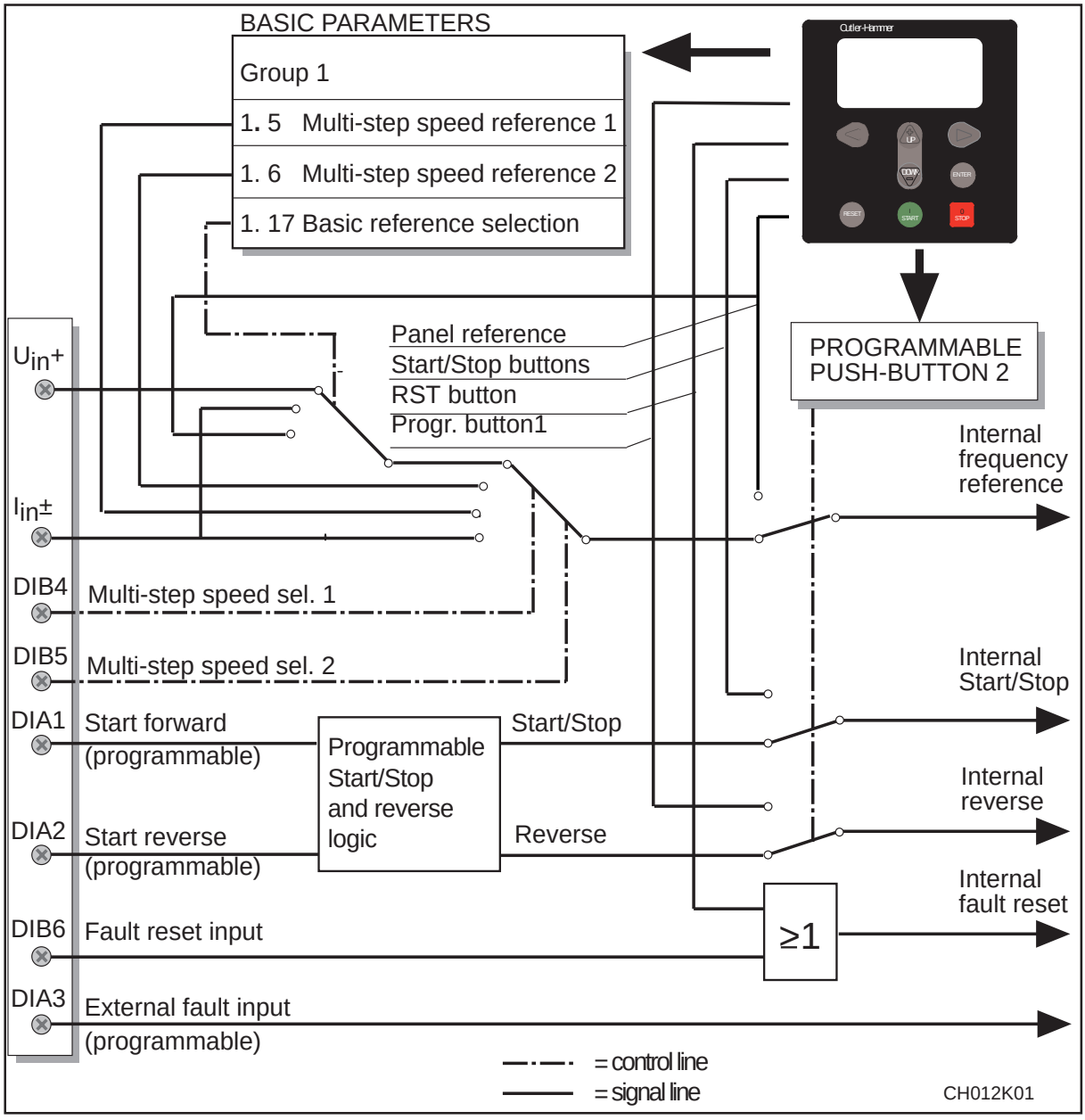

Figure 1.3-1 Control signal logic of the Standard Application.

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1.4 PARAMETERS, GROUP 1

1.4.1 Parameter table

Code	Parameter	Range	Step	Default	Custom	Description	Page
1. 1	Minimum frequency	0—f_{max}	1 Hz	0 Hz			1-5
1. 2	Maximum frequency	f_{min}-120/500 Hz	1 Hz	60 Hz		*)	1-5
1. 3	Acceleration time 1	0.1—3000.0 s	0.1 s	3,0 s		Time from f_{min} (1. 1) to f_{max} (1. 2)	1-5
1. 4	Deceleration time 1	0.1—3000.0 s	0.1 s	3.0 s		Time from f_{max} (1. 2) to f_{min} (1. 1)	1-5
1. 5	Multi-step speed reference 1	f_{min} —f_{max}	0.1 Hz	10.0 Hz			1-5
1. 6	Multi-step speed reference 2	f_{min} —f_{max}	0.1 Hz	60.0 Hz			1-5
1. 7	Current limit	0.1—2.5 x I_{nCX}	0.1 A	1.5 x I_{nCX}		Output current limit [A] of the unit	1-5
1. 8	V/Hz ratio selection STOP	0—2	1	0		0 = Linear 1 = Squared 2 = Programmable V/Hz ratio	1-5
1. 9	V/Hz optimization STOP	0 —1	1	0		0 = None 1 = Automatic torque boost	1-6
1. 10	Nominal voltage of the motor STOP	180—690 V	1 V	230 V 380 V 480 V 575 V		Voltage code 2 Voltage code 4 Voltage code 5 Voltage code 6	1-7
1. 11	Nominal frequency of the motor STOP	30—500 Hz	1 Hz	60 Hz		f_n from the nameplate of the motor	1-7
1. 12	Nominal speed of the motor STOP	1—20000 rpm	1 rpm	1720 rpm **)		n_n from the nameplate of the motor	1-7
1. 13	Nominal current of the motor STOP	2,5 x $I_{n\,CX}$	0,1 A	$I_{n\,CX}$		I_n from the nameplate of the motor	1-7
1. 14	Supply voltage STOP	208—240		230 V		Voltage code 2	1-7
		380—440		380 V		Voltage code 4	
		380—500		480 V		Voltage code 5	
		525—690		575 V		Voltage code 6	
1. 15	Parameter conceal	0—1	1	0		Visibility of the parameters: 0 = all parameter groups visible 1 = only group 1 is visible	1-7
1. 16	Parameter value lock	0—1	1	0		Disables parameter changes: 0 = changes enabled 1 = changes disabled	1-7
1. 17	Basic frequency reference selection STOP	0—2	1	0		0 = analog input U_n 1 = analog input I_n 2 = reference from the panel	1-7

Table 1.4-1 Group 1 basic parameters.

Note! STOP = Parameter value can be changed only when the drive is stopped.

*) If 1. 2 > motor synchr. speed, check suitability for motor and drive system.
Selecting 120 Hz/500 Hz range see page 1-5.
**) Default value for a four pole motor and a nominal size drive.

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1.4.2 Description of Group 1 parameters

1. 1, 1. 2 Minimum/maximum frequency

Defines the frequency limits of the drive.

The default maximum value for parameters 1**.** 1 and 1**.** 2 is 120 Hz. By setting the value of the parameter 1**.** 2 to 120 Hz when the drive is stopped (RUN indicator not lit) parameters 1**.** 1 and 1**.** 2 are changed to 500 Hz. At the same time the resolution of the display panel is changed from 0.01 Hz to 0.1 Hz. Changing the max. value from 500 Hz to 120 Hz in done by setting parameter 1**.** 2 to 119 Hz while the drive is stopped.

1. 3, 1. 4 Acceleration time1, deceleration time 1:

These limits correspond to the time required for the output frequency to accelerate from the set minimum frequency (par. 1**.** 1) to the set maximum frequency (par. 1**.** 2).

1. 5, 1. 6 Multi-step speed reference 1, Multi-step speed reference 2:

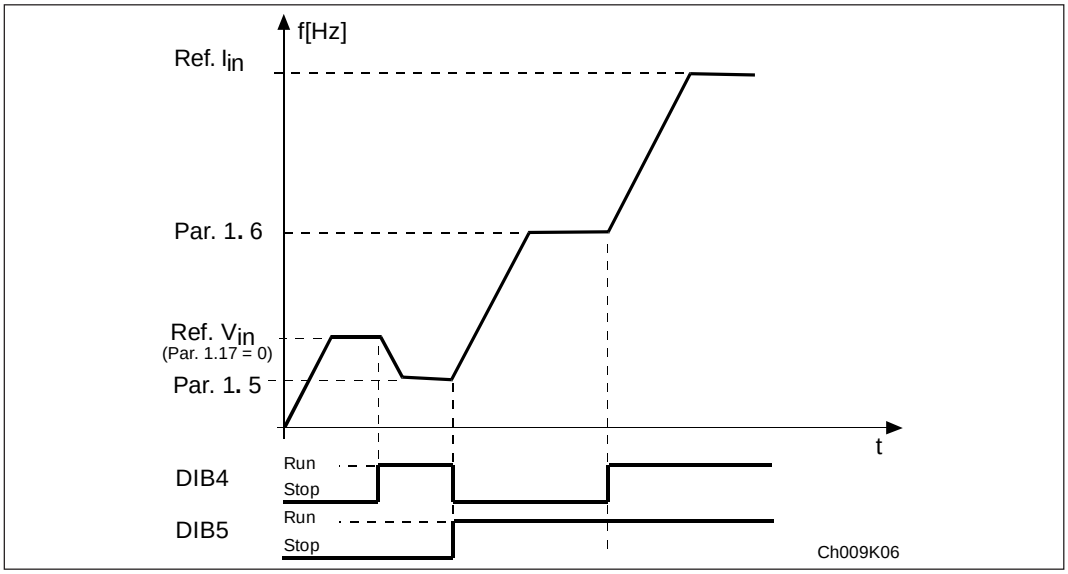

Figure 1.4-1 Example of Multi-step speed references.

Parameter values are automatically limited between minimum and maximum frequency (par 1**.** 1, 1**.** 2).

1. 7 Current limit

This parameter determines the maximum motor current that the SV9000 will provide short term.

1. 8 V/Hz ratio selection

Linear:
0 The voltage of the motor changes linearly with the frequency in the constant flux area from 0 Hz to the field weakening point (par. 6**.** 3) where a constant voltage (nominal value) is supplied to the motor. See figure 1.4-2.

A linear V/Hz ratio should be used in constant torque applications. **This default setting should be used if there is no special requirement for another setting.**

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Squared: The voltage of the motor changes following a squared curve form with the frequency in the area from 0 Hz to the field weakening point (par. 6. 3) where the nominal voltage is also supplied to the motor. See figure 1.4-2.

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The motor runs undermagnetized below the field weakening point and produces less torque and electromechanical noise. A squared V/Hz ratio can be used in applications where the torque demand of the load is proportional to the square of the speed, e.g. in centrifugal fans and pumps.

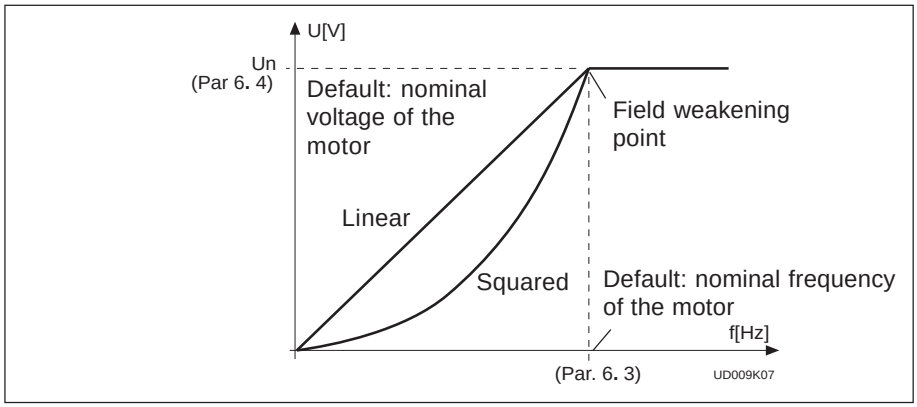

Figure 1.4-2 Linear and squared V/Hz curves.

Program-mable V/Hz curve The V/Hz curve can be programmed with three different points. The parameters for programming are explained in chapter 1.5.2. A programmable V/Hz curve can be used if the standard settings do not satisfy the needs of the application. See figure 1.4-3.

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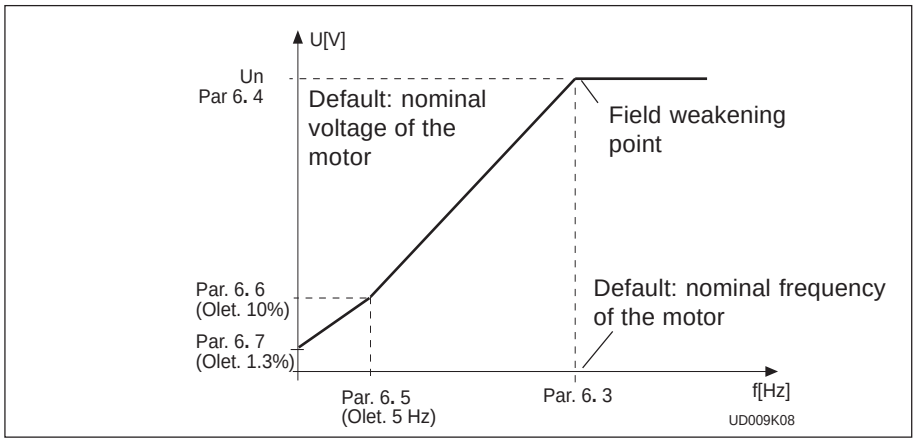

Figure 1.4-3 Programmable V/Hz curve.

1. 9 V/Hz optimization

Automatic torque boost The voltage to the motor changes automatically which allows the motor to produce enough torque to start and run at low frequencies. The voltage increase depends on the motor type and horsepower. Automatic torque boost can be used in applications where starting torque due to starting friction is high, e.g. in conveyors.

NOTE! *In high torque - low speed applications - it is likely that the motor will overheat.*

If the motor has to run for a prolonged time under these conditions, special attention must be paid to cooling the motor. Use external cooling for the motor if the operating temperature rise is too high.

1. 10 Nominal voltage of the motor

Find this value from the nameplate of the motor.
This parameter sets the Voltage at the field weakening point, parameter 6**.** 4, to 100% x U_{nmotor}.

Note! If the nominal motor voltage is lower than the supply voltage, check that the insulation level of the motor is adequate.

1. 11 Nominal frequency of the motor

Find this value f_n from the nameplate of the motor.
This parameter sets the field weakening point, parameter 6**.** 3, to the same value.

1. 12 Nominal speed of the motor

Find this value n_n from the nameplate of the motor.

1. 13 Nominal current of the motor

Find the value I_n from the nameplate of the motor.
The internal motor protection function uses this value as a reference value.

1. 14 Supply voltage

Set parameter value according to the nominal voltage of the supply.
Values are predefined for voltage codes 2, 4, 5, and 6. See table 1.4-1.

1. 15 Parameter conceal

Defines which parameter groups are available:

0 = all groups are visible
1 = only group 1 is visible

1. 16 Parameter value lock

Permits access for changing the parameter values:

0 = parameter value changes enabled
1 = parameter value changes disabled

1. 17 Basic frequency reference selection

0 Analog voltage reference from terminals 2—3, e.g. a potentiometer
1 Analog current reference from terminals 4—5, e.g. a transducer.
2 Panel reference is the reference set from the Reference Page (REF), see chapter 7.5.

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1.5 SPECIAL PARAMETERS, GROUPS 2—8

1.5.1 Parameter tables

Group 2, Input signal parameters

Code	Parameter	Range	Step	Default	Custom	Description		Page
						DIA1	DIA2	
2. 1	Start/Stop logic selection (STOP)	0—3	1	0		0 = Start forward 1 = Start/Stop 2 = Start/Stop 3 = Start pulse	Start reverse Reverse Run enable Stop pulse	1-12
2. 2	DIA3 function (terminal 10) (STOP)	0—5	1	1		0 = Not used 1 = Ext. fault, closing contact 2 = External fault, opening contact 3 = Run enable 4 = Acc./dec. time selection 5 = Reverse (if par. 2. 1 = 3)		1-13
2. 3	Reference offset for current input	0—1	1	0		0 = 0—20 mA 1 = 4—20 mA		1-13
2. 4	Reference scaling, minimum value	0—par. 2.5	1 Hz	0 Hz		Selects the frequency that corresponds to the minimum reference signal		1-13
2. 5	Reference scaling, maximum value	0—f_{max}	1 Hz	0 Hz		Selects the frequency that corresponds to the maximum reference signal 0 = Scaling off >0 = Maximum frequency value		1-13
2. 6	Reference invert	0—1	1	0		0 = No inversion 1 = Reference inverted		1-14
2. 7	Reference filter time	0,00 —10,00s	0,01s	0,10s		0 = No filtering		1-14

Group 3, Output and supervision parameters

Code	Parameter	Range	Step	Default	Custom	Description	Page
3. 1	Analog output function (STOP)	0—7	1	1		0 = Not used Scale 100% 1 = O/P frequency (0—f_{max}) 2 = Motor speed (0—max. speed) 3 = O/P current (0—2.0xI_{nCX}) 4 = Motor torque (0—2xT_{nMot}) 5 = Motor power (0—2xP_{nMot}) 6 = Motor voltage (0—100%xU_{nMot}) 7 = DC-link volt. (0—1000 V)	1-15
3. 2	Analog output filter time	0.00—10.00 s	0.01s	1.00 s		0 = no filtering	1-15
3. 3	Analog output inversion	0—1	1	0		0 = Not inverted 1 = Inverted	1-15
3. 4	Analog output minimum	0—1	1	0		0 = 0 mA 1 = 4 mA	1-15
3. 5	Analog output scale	10—1000%	1%	100%			1-15

Note (STOP) = Parameter value can be changed only when the drive is stopped.

(Continues)

Group 3, Output and supervision parameters

Code	Parameter	Range	Step	Default	Custom	Description	Page
3. 6	Digital output function (STOP)	0—14	1	1		0 = Not used 1 = Ready 2 = Run 3 = Fault 4 = Fault inverted 5 = SV9000 overheat warning 6 = External fault or warning 7 = Reference fault or warning 8 = Warning 9 = Reversed 10 = Multi-step speed selected 11 = At speed 12 = Motor regulator activated 13 = Output frequency limit superv. 14 = Control from I/O-terminal	1-16
3. 7	Relay output 1 function (STOP)	0—14	1	2		As parameter 3. 6	1-16
3. 8	Relay output 2 function (STOP)	0—14	1	3		As parameter 3. 6	1-16
3. 9	Output freq. limit supervision function	0—2	1	0		0 = No 1 = Low limit 2 = High limit	1-16
3. 10	Output freq. limit supervision value	0.0—f_{max} (par. 1. 2)	0.1 Hz	0.0 Hz			1-16
3. 11	I/O-expander option board analog output function	0—7	1	3		As parameter 3. 1	1-15
3. 12	I/O-expander option board analog output scale	10—1000%	1%	100%		As parameter 3. 5	1-15

Group 4, Drive control parameters

Code	Parameter	Range	Step	Default	Custom	Description	Page
4. 1	Acc./Dec. ramp 1 shape	0.0—10.0 s	0.1 s	0.0 s		0 = Linear >0 = S-curve acc./dec. time	1-17
4. 2	Acc./Dec. ramp 2 shape	0.0—10.0 s	0.1 s	0.0 s		0 = Linear >0 = S-curve acc./dec. time	1-17
4. 3	Acceleration time 2	0.1—3000.0 s	0.1 s	10.0 s			1-17
4. 4	Deceleration time 2	0.1—3000.0 s	0.1 s	10.0 s			1-17
4. 5	Brake chopper (STOP)	0—2	1	0		0 = Brake chopper not in use 1 = Brake chopper in use 2 = External brake chopper	1-17
4. 6	Start function	0—1	1	0		0 = Ramp 1 = Flying start	1-17
4. 7	Stop function	0—1	1	0		0 = Coasting 1 = Ramp	1-18
4. 8	DC-braking current	0.15—1.5 x I_{nCX} (A)	0.1 A	0.5 x I_{nCX}			1-18
4. 9	DC-braking time at Stop	0.00—250.00 s	0.01 s	0.00 s		0 = DC-brake is off	1-18

Note! (STOP) = Parameter value can be changed only when the drive is stopped.

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Group 5, Prohibit frequency parameters

Code	Parameter	Range	Step	Default	Custom	Description	Page
5. 1	Prohibit frequency range low limit	f_{min}—f_{max} par. 5. 2	0.1 Hz	0.0 Hz			1-19
5. 2	Prohibit frequency range high limit	f_{min}—f_{max} (1. 1) (1. 2)	0.1 Hz	0.0 Hz		0 = no prohibit frequency range (max limit = par. 1. 2)	1-19

Group 6, Motor control parameters

Code	Parameter	Range	Step	Default	Customer	Description	Page
6. 1	Motor control mode (STOP)	0—1	1	0		0 = Frequency control 1 = Speed control	1-20
6. 2	Switching frequency	1.0—16.0 kHz	0.1	10/3.6 kHz		Dependant on Hp rating	1-20
6. 3	Field weakening point (STOP)	30—500 Hz	1 Hz	Param. 1. 11			1-20
6. 4	Voltage at field weakening point (STOP)	15 —200% x U_{nmot}	1%	100%			1-20
6. 5	V/Hz curve mid point frequency (STOP)	0.0—f_{max}	0.1 Hz	0.0 Hz			1-20
6. 6	V/Hz curve mid point voltage (STOP)	0.00—100.00% x U_{nmot}	0.01%	0.00%			1-20
6. 7	Output voltage at zero frequency (STOP)	0.00—100.0% x U_{nmot}	0.01%	0.00%			1-20
6. 8	Overvoltage controller	0—1	1	1		0 = Controller is off 1 = Controller is on	1-20
6. 9	Undervoltage controller	0—1	1	1		0 = Controller is off 1 = Controller is on	1-20

Note! (STOP) = Parameter value can be changed only when the drive is stopped.

Group 7, Protections

Code	Parameter	Range	Step	Default	Custom	Description	Page
7. 1	Response to reference fault	0—3	1	0		0 = No action 1 = Warning 2 = Fault, stop according par. 4.7 3 = Fault, always coasting stop	1-21
7. 2	Response to external fault	0—3	1	2		0 = No action 1 = Warning 2 = Fault, stop according par. 4.7 3 = Fault, always coasting stop	1-21
7. 3	Phase supervision of the motor	0—2	2	2		0 = No action 2 = Fault	1-21
7. 4	Ground fault protection	0—2	2	2		0 = No action 2 = Fault	1-21
7. 5	Motor thermal protection	0—2	1	2		0 = No action 1 = Warning 2 = Fault	1-22
7. 6	Stall protection	0—2	1	1		0 = No action 1 = Warning 2 = Fault	1-22

Group 8, Autorestart parameters

Code	Parameter	Range	Step	Default	Custom	Description	Page
8. 1	Automatic restart: number of tries	0—10	1	0		0 = no action	1-23
8. 2	Automatic restart: multi-attempt max. trial time	1—6000 s	1 s	30 s			1-23
8. 3	Automatic restart: start function	0—1	1	0		0 = Ramp 1 = Flying start	1-24

Table 1.5-1 Special parameters, Groups 2—8.

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1.5.2 Description of Group 2—8 parameters

2. 1 Start/Stop logic selection

0 DIA1: closed contact = start forward
DIA2: closed contact = start reverse,
See figure 1.5-1.

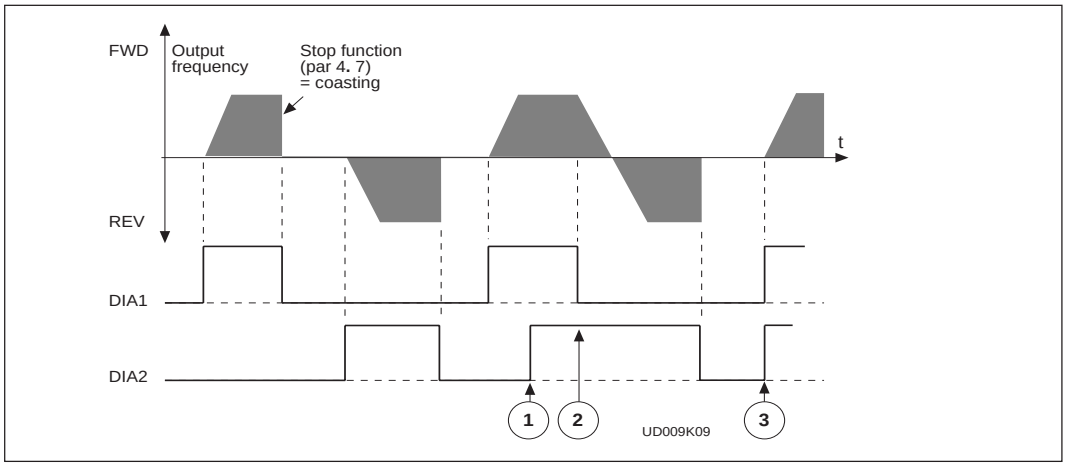

Figure 1.5-1 Start forward/Start reverse.

(1) The first selected direction has the highest priority

(2) When DIA1 contact opens, the direction of rotation starts to change

(3) If Start forward (DIA1) and Start reverse (DIA2) signals are active simultaneously, the Start forward signal (DIA1) has priority.

1 DIA1: closed contact = start open contact = stop
DIA2: closed contact = reverse open contact = forward
See figure 1.5-2.

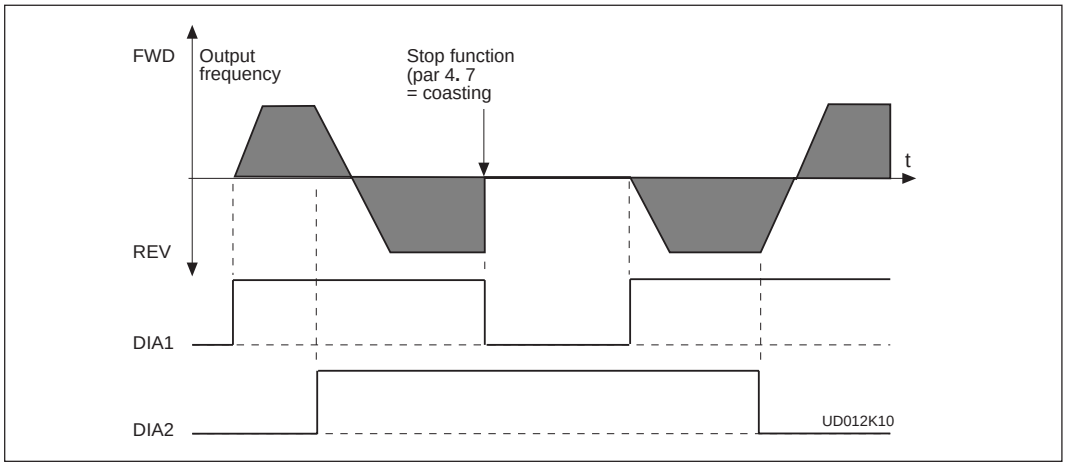

Figure 1.5-2 Start, Stop, reverse.

2: DIA1: closed contact = start open contact = stop
DIA2: closed contact = start enabled open contact = start disabled

3: 3-wire connection (pulse control):

DIA1: closed contact = start pulse
DIA2: closed contact = stop pulse
(DIA3 can be programmed for reverse command)
See figure 1.5-3.

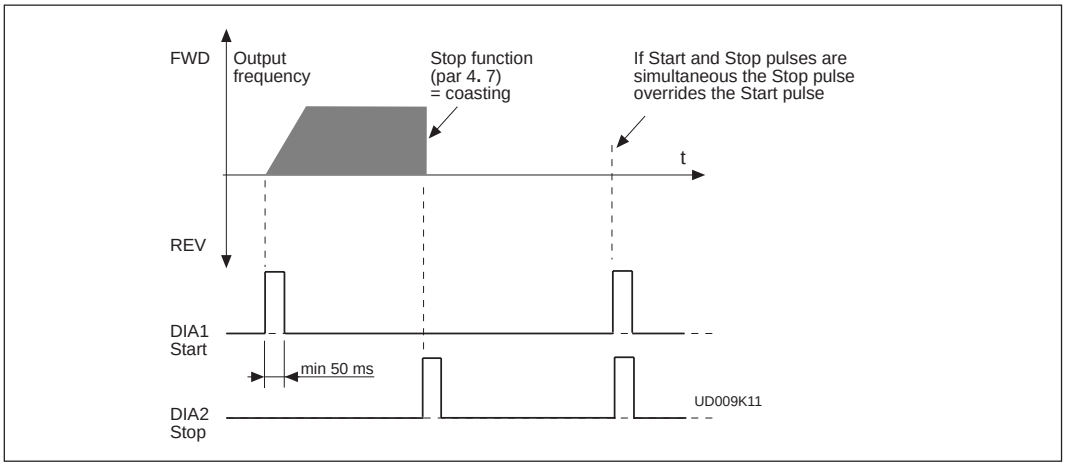

Figure 1.5-3 Start pulse/Stop pulse.

2. 2 DIA3 function

1: External fault, closing contact = Fault is shown and motor is stopped when the contact is closed.

2: External fault, opening contact = Fault is shown and motor is stopped when the contact is open.

3: Run enable contact open = Start of the motor disabled
contact closed = Start of the motor enabled

4: Acc. / Dec time select. contact open = Acceleration/Deceleration time 1 selected
contact closed = Acceleration/Deceleration time 2 selected

5: Reverse contact open = Forward
contact closed = Reverse
Can be used for reversing if parameter 2. 1 has value 3

2.3 Reference offset for current input

0: No offset

1: Offset 4 mA, provides supervision of zero level signal. The response to reference fault can be programmed with the parameter 7. 1.

2.4, 2.5 Reference scaling, minimum value/maximum value

Setting value limits: 0 ≤ par. 2. 4 ≤ par. 2. 5 ≤ par. 1. 2.
If parameter 2. 5 = 0 scaling is set off. See figures 1.5-4 and 1.5-5.

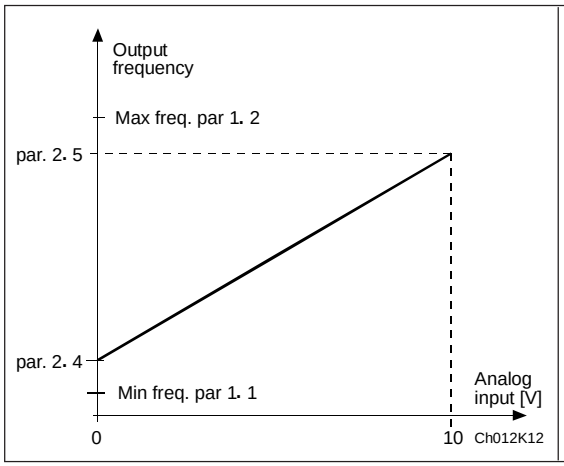

Figure 1.5-4 Reference scaling.

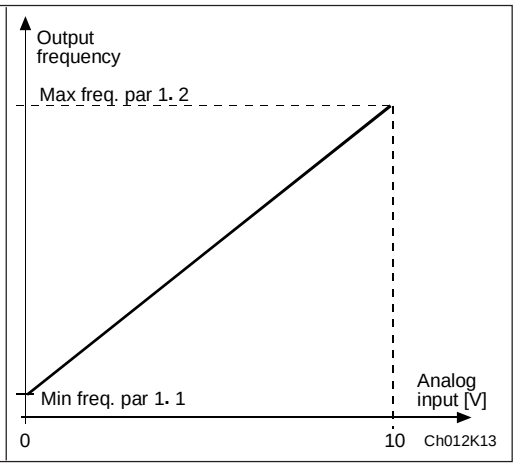

Figure 1.5-5 Reference scaling, parameter 2. 5 = 0.

2.6 Reference invert

Inverts reference signal:

max. ref. signal = min.set freq.
min. ref. signal = max. set freq.

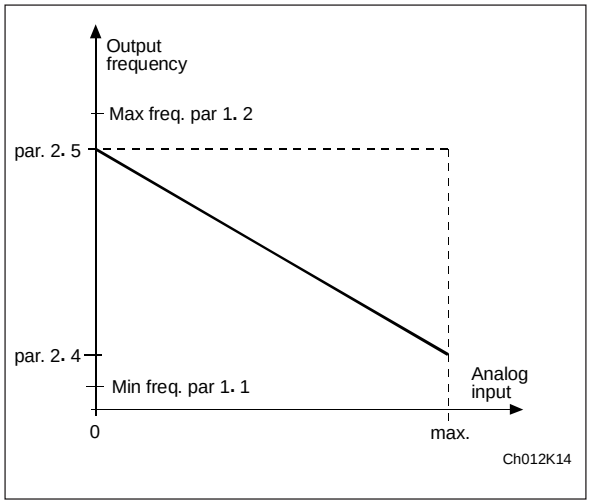

Figure 1.5-6 Reference invert.

2.7 Reference filter time

Filters out disturbances from the incoming reference signal. A long filtering time makes regulation response slower. See figure 1.5-7.

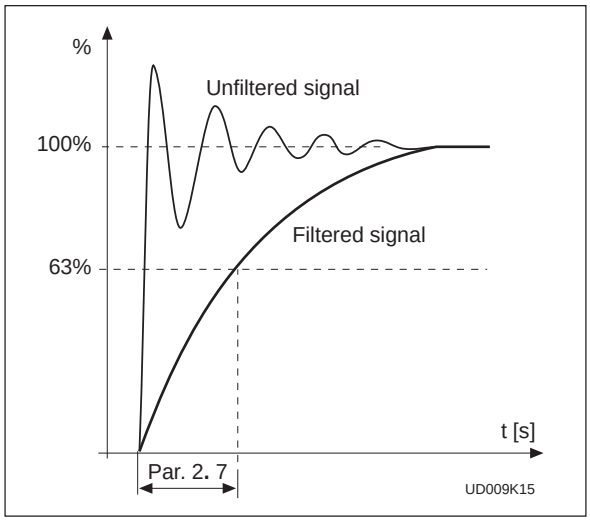

Figure 1.5-7 Reference filtering.

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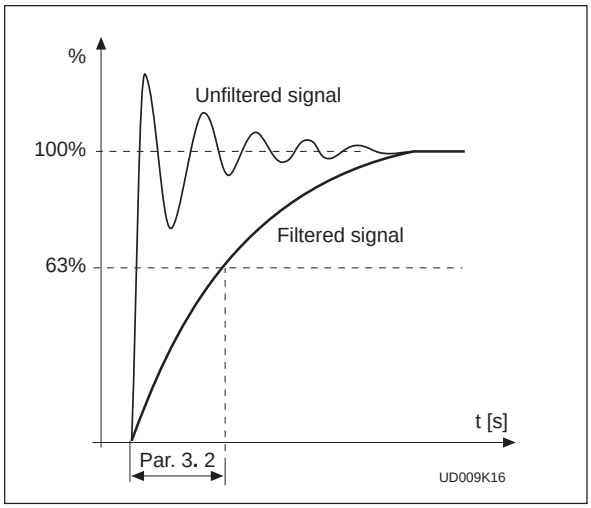
3. 1 Analog output function

See table "Group 3, output and supervision parameters" on the page 1-8.



3. 2 Analog output filter time

Filters the analog output signal. See figure 1.5-8.

Figure 1.5-8 Analog output filtering.

3.3 Analog output invert

Inverts analog output signal:
max. output signal = minimum set value
min. output signal = maximum set value

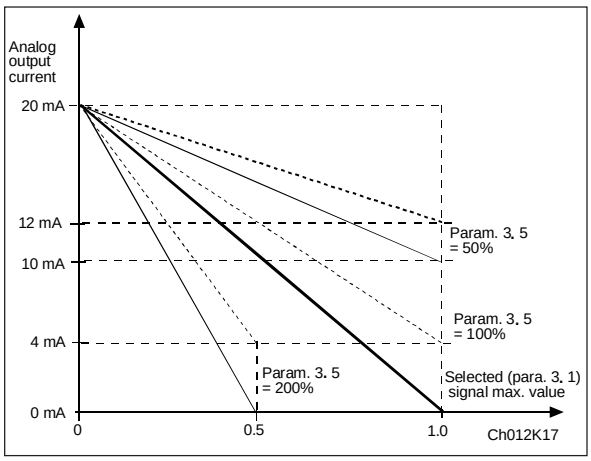


Figure 1.5-9 Analog output invert.

3. 4 Analog output minimum

Defines the signal minimum to be either 0 mA or 4 mA. See figure 1.5-10.

3. 5 Analog output scale

Scaling factor for analog output. See figure 1.5-10.

Signal	Max. value of the signal
Output frequency	Max. frequency (p. 1. 2)
Motor speed	Max. speed (n_nxf_{max}/f_n)
Output current	2 x I_{nFC}
Motor torque	2 x T_{nMot}
Motor power	2 x P_{nMot}
Motor voltage	100% x U_{nMot}
DC-link volt.	1000 V

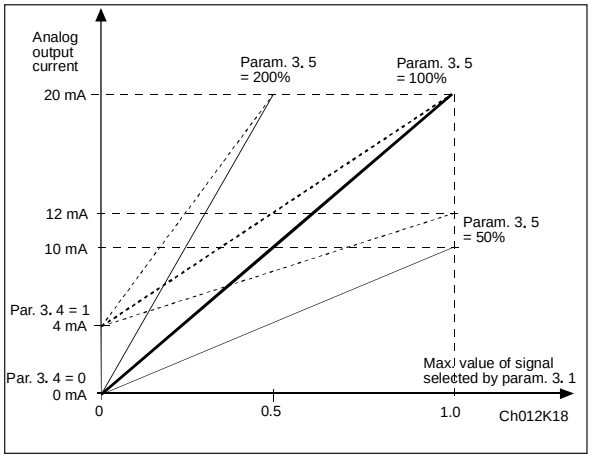


Figure 1.5-10 Analog output scale.

3. 6 Digital output function
3. 7 Relay output 1 function
3. 8 Relay output 2 function

Setting value	Signal content
0 = Not used	Out of operation
	Digital output DO1 sinks current and programmable relay (RO1, RO2) is activated when:
1 = Ready	The drive is ready to operate
2 = Run	The drive operates
3 = Fault	A fault trip has occurred
4 = Fault inverted	A fault trip has not occurred
5 = SV9000 overheat warning	The heat-sink temperature exceeds +70°C
6 = External fault or warning	Fault or warning depending on parameter 7. 2
7 = Reference fault or warning	Fault or warning depending on parameter 7. 1 - if analog reference is 4—20 mA and signal is <4mA
8 = Warning	Always if a warning exists
9 = Reversed	The reverse command has been selected
10= Multi-step speed selected	A multi-step speed has been selected
11 = At speed	The output frequency has reached the set reference
12= Motor regulator activated	Overvoltage or overcurrent regulator was activated
13= Output frequency supervision	The output frequency goes outside of the set supervision low limit/ high limit (par. 3. 9 and 3. 10)
14= Control from I/O terminals	Ext. control mode selected with progr. push-button #2

Table 1.5-2 Output signals via DO1 and output relays RO1 and RO2.

3. 9 Output frequency limit supervision function

0 = No supervision
1 = Low limit supervision
2 = High limit supervision

If the output frequency goes under/over the set limit (3. 10) this function generates a warning message via the digital output DO1 and via a relay output RO1 or RO2 depending on the settings of the parameters 3. 6—3. 8.

3. 10 Output frequency limit supervision value

The frequency value to be supervised by the parameter 3. 9.
See figure 1.5-11.

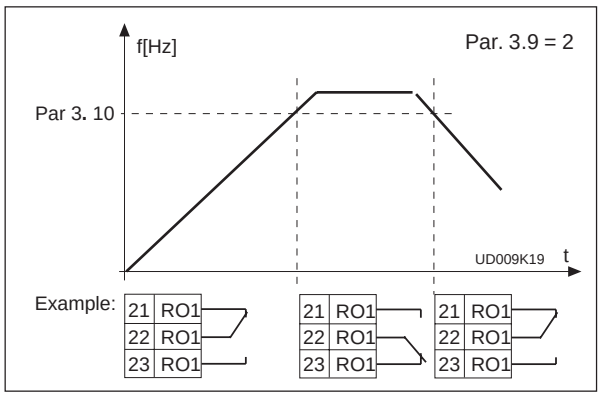


Figure 1.5-11 Output frequency supervision.

4. 1 Acc/Dec ramp 1 shape
4. 2 Acc/Dec ramp 2 shape

The acceleration and deceleration ramp shape can be programmed with these parameters.

Setting value 0 gives a linear ramp shape which causes acceleration and deceleration to act immediately to the changes in the reference signal with a time constant set by the parameter 1**.** 3/ 1**.** 4 (4**.** 3/ 4**.** 4).

Setting value 0.1—10 seconds for 4**.** 1 (4**.** 2) causes an S-shape ramp. Param. 1**.** 3/ 1**.** 4 (4**.** 3/ 4**.** 4) determine the time constant of acceleration/deceleration in the middle of the curve. See figure 1.5-12.

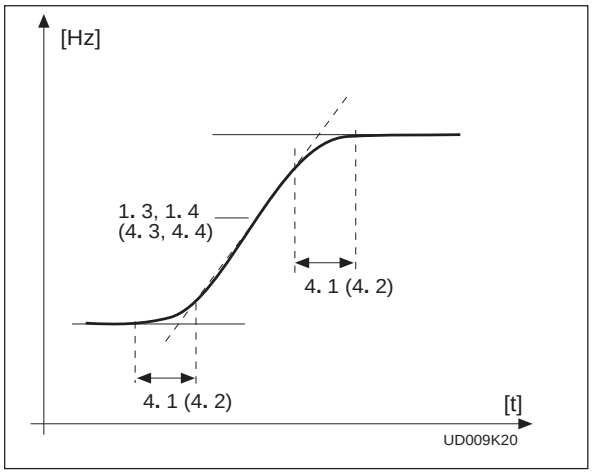


Figure 1.5-12 S-shaped acceleration/deceleration.

4. 3 Acceleration time 2

4. 4 Deceleration time 2

These values correspond to the time required for the output frequency to accelerate from the set minimum frequency (par. 1**.** 1) to the set maximum frequency (par. 1**.** 2). With this parameter it is possibile to set two different acceleration/ deceleration times for one application. The active set can be selected with the programmable signal DIA3. See parameter 2**.** 2.

4. 5 Brake chopper

0 = No brake chopper
1 = Brake chopper and brake resistor installed
2 = External brake chopper

When the drive is decelerating the motor, the energy stored in the inertia of the motor and the load is fed into the external brake resistor. This enables the drive to decelerate the load with the torque equal to that of acceleration, if the brake resistor is selected correctly. See separate Brake resistor installation manual.

4. 6 Start function

Ramp:

0 The drive starts from 0 Hz and accelerates to the set reference frequency within the set acceleration time. (Load inertia or starting friction may cause prolonged acceleration times).

1

Flying start:

1 The drive is able to start into running motor by applying a small torque to motor and searching for frequency corresponding to the speed the motor is running. Searching starts from the maximum frequency towards the actual frequency until the the correct value is detected. The output frequency will then accelerate/decelerate to the set reference value at a rate determined by the acceleration/deceleration ramp parameters.

Use this mode if the motor may be coasting when the start command is given. With the flying start it is possible to ride through short utility voltage interruptions.

4. 7 Stop function

Coasting:

0 The motor coasts to an uncontrolled stop with the SV9000 off, after the Stop command is issued.

Ramp:

1 After the Stop command is issued, the speed of the motor is decelerated based on the deceleration ramp time parameter.
If the regenerated energy is high, it may be necessary to use an external braking resistor for faster deceleration.

4. 8 DC braking current

Defines the current injected into the motor during the DC braking.

4. 9 DC braking time at stop

Defines if braking is ON or OFF and the braking duration time of the DC-brake when the motor is stopping. The function of the DC-brake depends on the stop function, parameter 4**.** 7. See figure 1.5-13.

0 DC-brake is not used

>0 DC-brake is in use dependant upon the setup of the stop function, (param. 4**.** 7). The time is set by the value of parameter 4**.** 9:

Stop-function = 0 (coasting):

After the stop command, the motor will coast to a stop with the SV9000 off.

With DC-injection, the motor can be electrically stopped in the shortest possible time, without using an optional external braking resistor.

The braking time is scaled according to the frequency when the DC-braking starts. If the frequency is ≥nominal frequency of the motor (par. 1.11), setting value of parameter 4.9 determines the braking time. When the frequency is ≤10% of the nominal, the braking time is 10% of the set value of parameter 4.9. See figure 1.5-13.

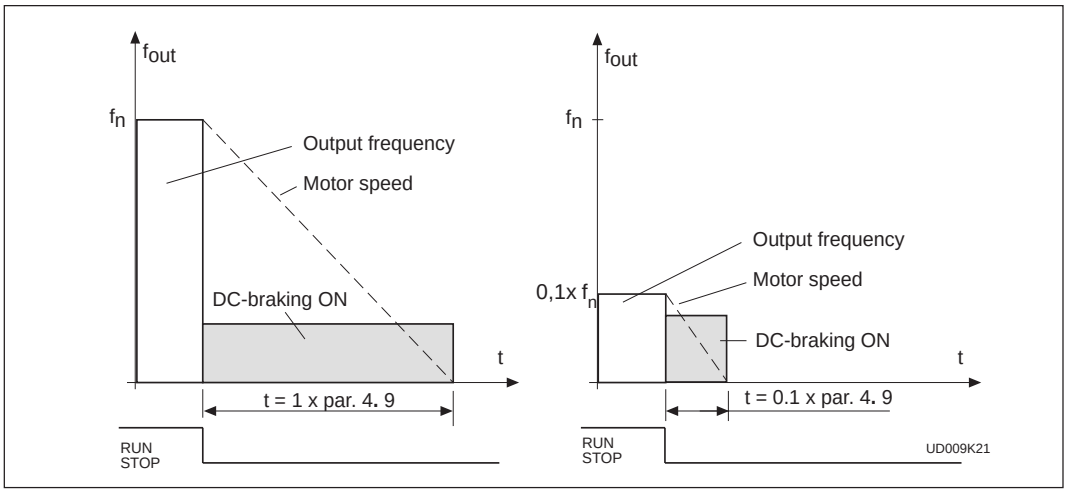


Figure 1.5-13 DC-braking time when stop = coasting.

Stop-function = 1 (ramp):

After a stop command, the speed of the motor is reduced based on the deceleration ramp parameter, if no regeneration occurs due to load inertia, to a speed defined with parameter 4. 10 where the DC-braking starts.

The braking time is defined by par. 4. 9.
If high inertia exists it is recommended to use an external braking resistor for faster deceleration.

See figure 1.5-14.

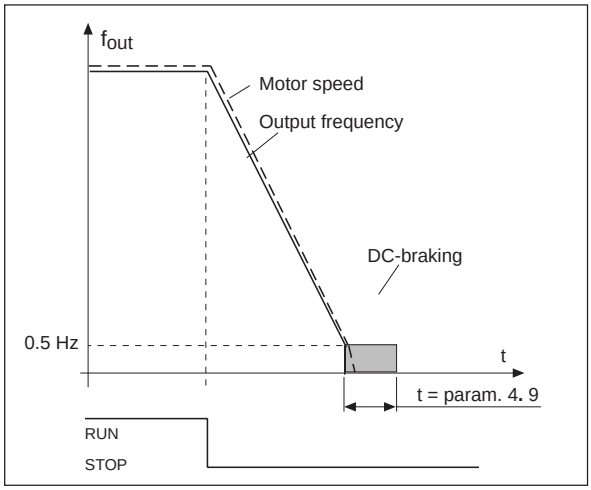


Figure 1.5-14 DC-braking time when stop function = ramp.

5. 1 Prohibit frequency area Low
5. 2 limit/High limit

In some systems it may be necessary to avoid certain frequencies because of mechanical resonance problems.

With these parameters it is possible to set limits for one "skip frequency" region between 0 Hz and 120 Hz/500 Hz. Accuracy of the setting is 0.1 Hz.
See figure 1.5-15.

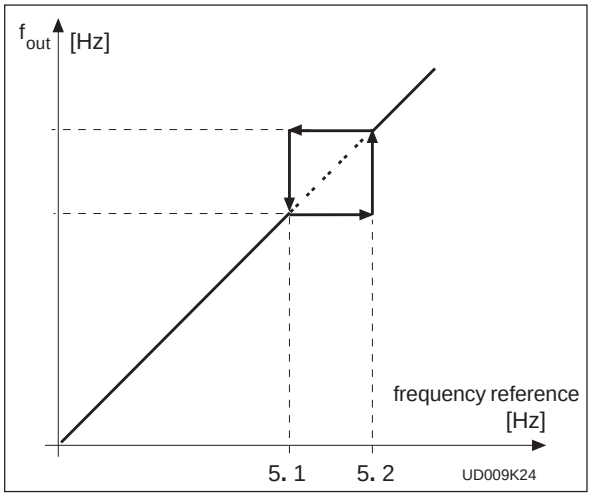


Figure 1.5-15 Example of prohibit frequency area setting.

1

6. 1 Motor control mode

0 = Frequency control:	The I/O terminal and panel references are frequency references and the drive controls the output frequency (output freq. resolution 0.01 Hz)
1 = Speed control:	The I/O terminal and panel references are speed references and the drive controls the motor speed (regulation accuracy ± 0.5%).

6. 2 Switching frequency

Motor noise can be minimized by using a high switching frequency. Increasing the switching frequency reduces the capacity of the SV9000.

Before changing the frequency from the factory default 10 kHz (3.6 kHz ≥40 Hp) check the drive derating from the curves shown in the figures 5.2-2 and 5.2-3 in chapter 5.2 of the User's Manual.

6. 3 Field weakening point

6. 4 Voltage at the field weakening point

The field weakening point is the output frequency where the output voltage reaches the set maximum value (param. 6**.** 4). Above that frequency output voltage remains constant at the set maximum value. Below that frequency output voltage depends on the setting of the V/Hz curve parameters 1**.** 8, 1**.** 9, 6**.** 5, 6**.** 6 and 6**.** 7. See figure 1.5-16.

When the parameters 1**.** 10 and 1**.** 11, nominal voltage and nominal frequency of the motor, are set, parameters 6**.** 3 and 6**.** 4 are also set automatically to the corresponding values. If you need different values for the field weakening point and the maximum output voltage, change these parameters after setting parameters 1**.** 10 and 1**.** 11.

6. 5 V/Hz curve, middle point frequency

If the programmable V/Hz curve has been selected with parameter 1**.** 8, this parameter defines the middle frequency point of the curve. See figure 1.5-16.

6. 6 V/Hz curve, middle point voltage

If the programmable V/Hz curve has been selected with parameter 1**.** 8, this parameter defines the middle voltage point of the curve. See figure 1.5-16.

6. 7 Output voltage at zero frequency

If the programmable V/Hz curve has been selected with parameter 1**.** 8, this parameter defines the zero frequency voltage of the curve. See figure 1.5-16.

6. 8 Overvoltage controller

6. 9 Undervoltage controller

These parameters allow the over/undervoltage controllers to be switched out of operation. This may be useful, for example, if the utility supply voltage varies more than -15%—+10% and the application will not tolerate this over/undervoltage. The regulator controls output frequency according to the supply fluctuations.

Over/undervoltage trips may occur when controllers are switched out of operation.

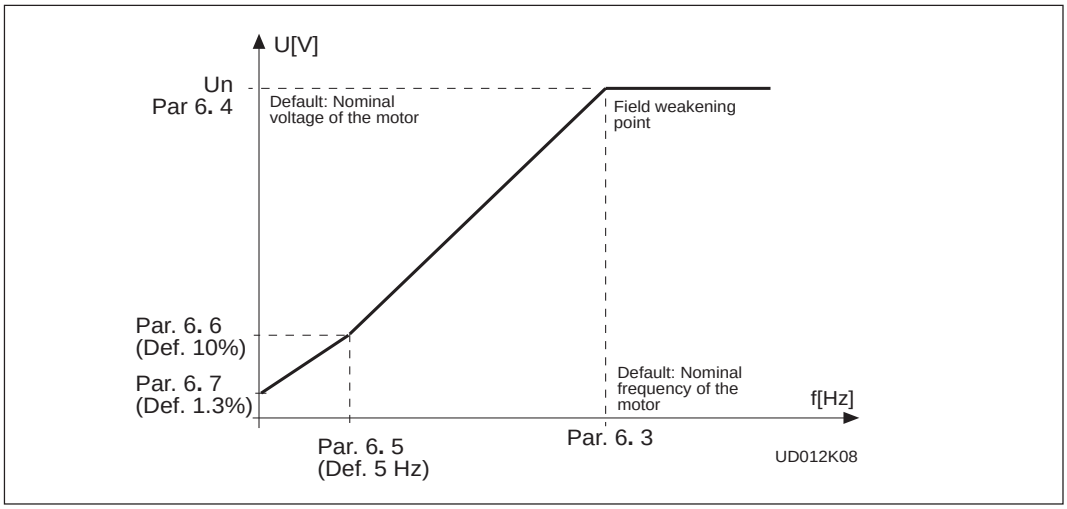


Figure 1.5-16 Programmable V/Hz curve.

7. 1 Response to the reference fault

0 = No response
1 = Warning
2 = Fault, stop mode after fault detection according to parameter 4.7
3 = Fault, always coasting stop mode after fault detection

A warning or a fault action and message is generated if the 4—20 mA refer ence signal is used and the signal falls below 4 mA.
The information can also be programmed via digital output DO1 and via relay outputs RO1 and RO2.

7. 2 Response to external fault

0 = No response
1 = Warning
2 = Fault, stop mode after fault detection according to parameter 4.7
3 = Fault, always coasting stop mode after fault detection

A warning or a fault action and message is generated from the external fault signal in the digital input DIA3.
The information can also be programmed into digital output DO1 and into relay outputs RO1 and RO2.

7. 3 Phase supervision of the motor

0 = No action
2 = Fault

Phase supervision of the motor ensures that the motor phases have approximately equal current.

7. 4 Ground fault protection

0 = No action
2 = Fault

Ground fault protection ensures that the sum of motor phase currents is zero. The standard overcurrent protection is always present and protects the drive from ground faults with high current levels

1

7. 5 Motor thermal protection

Operation:
0 = Not in use
1 = Warning
2 = Trip function

Motor thermal protection protects the motor from overheating. In the Standard application the Motor thermal protection uses fixed settings. In the other applications it is possible to set more parameters for thermal protection. Tripping or warning will give a display indication with the same message code. If tripping is selected the drive will stop and activate the fault stage.

Deactivating the protection, setting parameter to 0, will reset the initial thermal stage of the motor to 0%.

The SV9000 drive is capable of providing higher than nominal current to the motor. If the load requires this high current there is a risk that motor will be thermally overloaded. This is true especially at low frequencies. With low frequencies the cooling effect of the motor fan is reduced and the capacity of the motor is reduced. Motor thermal protection is based on a calculated model and it uses the output current of the drive to determine the load on the motor.

The thermal current I_T specifies the load current above which the motor is overloaded. See figure 1.5-17. If the motor current is over the curve the motor temperature is increasing.

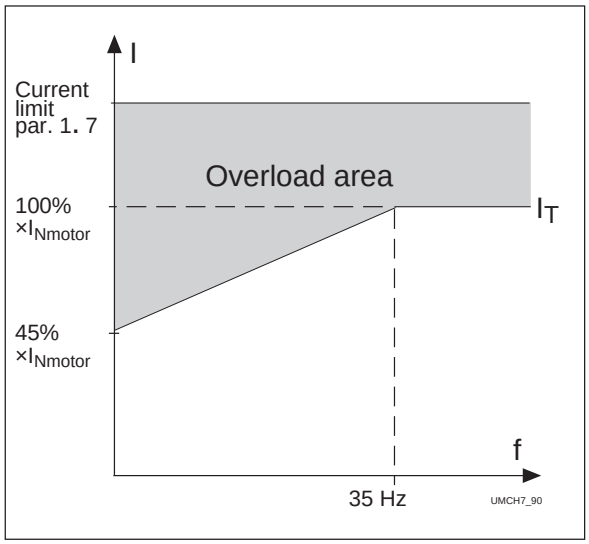


Figure 1.5-17 Motor thermal current I_T curve.

CAUTION! *The calculated model does not protect the motor if the cooling of the motor is reduced either by blocking the airflow or due to dust or dirt.*

7. 6 Stall protection

Operation:
0 = Not in use
1 = Warning
2 = Trip function

Motor Stall protection provides a warning or fault based on short time overload of the motor e.g. stalled shaft. The reaction time of the stall protection is shorter than with the motor thermal protection. The stall state is defined with Stall Current and Stall Frequency. In the Standard application they both have fixed values. See figure 1.5-18. If the current is higher than the set limit and output frequency is lower than the set limit the stall state is true. If the stall state lasts longer than 15 s the stall warning is given on the display panel. In the other applications it is possible to set more parameters for the Stall protection function. Tripping and warning will give a display indication with the same message code. If tripping is set on, the drive will stop and activate the fault stage.

Deactivating stall protection, by setting parameter to 0, will reset the stall time counter to zero.

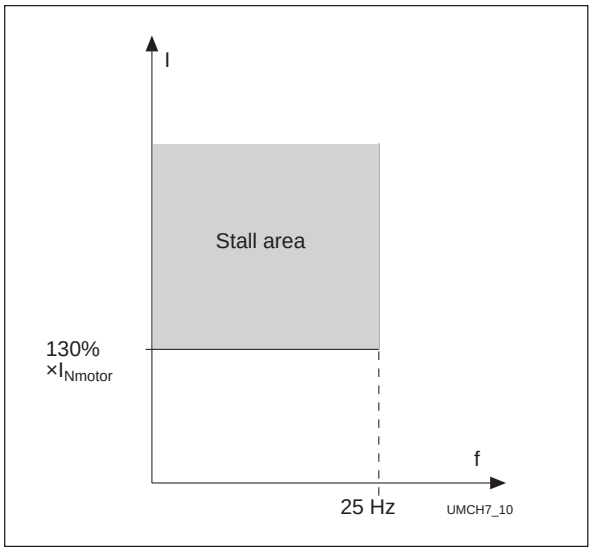


Figure 1.5-18 Stall state.

8. 1 Automatic restart: number of tries
8. 2 Automatic restart: trial time

The Automatic restart function will restart the drive after the following faults:

- overcurrent
- overvoltage
- undervoltage
- over/under temperature of the drive
- reference fault

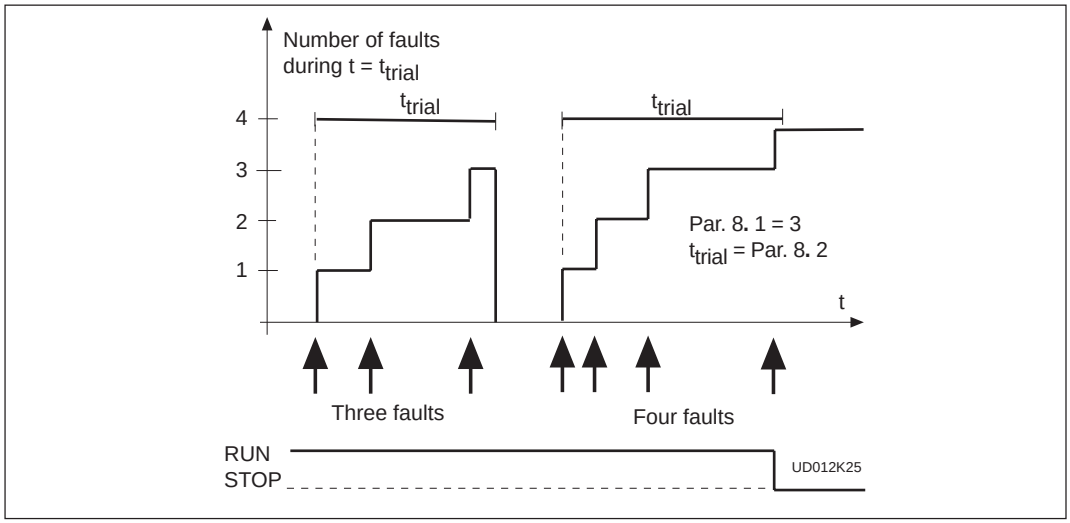


Figure 1.5-19 Automatic restart.

Parameter 8**.** 1 determines how many automatic restarts can be made during the trial time set by the parameter 8**.** 2.

The count time starts from the first autorestart. If the number of restarts does not exceed the value of the parameter 8.1 during the trial time, the count is cleared after the trial time has elapsed. The next fault starts the counting again.

1

8. 3 Automatic restart, start function

The parameter defines the start mode:

0 = Start with ramp

1 = Flying start, see parameter 4**.** 6.

Remarks: