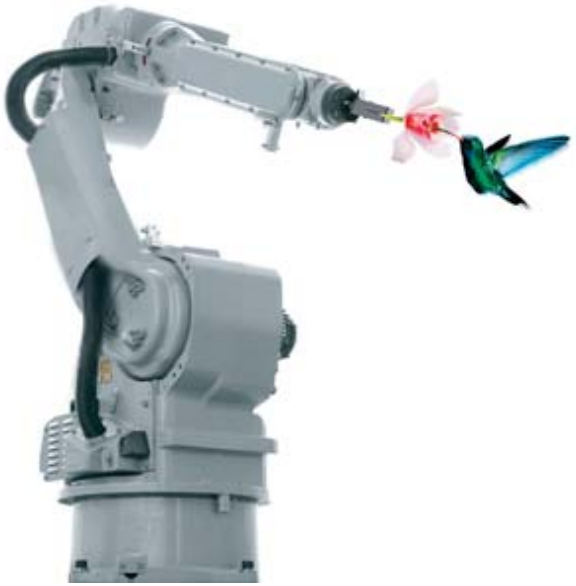
1000 Series Technical Training

Yaskawa Drives Department



Application Settings

Rev.: 04 (31.08.2010)

Overview and Contents

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How to use this Presentation ?

This presentation shows all property and parameters that can be found in any of the J1000, V1000, A1000 drives. To distinguish whether the property or parameter is available in all of the drives or only in A1000 for example, please note the „ticks“ in the grey bar:

In the example above the function or the parameter would be available in V1000 and A1000 but NOT in J1000.

Default settings (i.e. the standard setting from the factory) are underlined.

Availability in different control modes:

All Modes

V/f | V/f w/PG | OLV | CLV
OLV/PM | AOLV/PM | CLV/PM

V/f | V/f w/PG | OLV | CLV
OLV/PM | AOLV/PM | CLV/PM

A2: User Parameters

A2-01 to A2-32: User Parameter 1 to 32

J V A

All Modes

User can select 32 parameters and assign them to A2-01 through A2-32

- ➔ **User can also select parameters (b1-01 to o2-08) to appear for quick access**
- ➔ **Customer Parameter Protection**

How to set up?

1) **Set the access level to allow access to all parameters (A1-01 = 2)**

   Assign the parameter number to the User Parameters list by entering it into one of the A2-☐☐ parameters

2) **Selected inverter parameter range is b1-01 to o2-08**
3) **Enable User Parameter by setting A1-01=1**

- **If A1-01 is set to 1, the access level can be restricted so that users can only set and refer to the specific parameters saved as User Parameters**

A2-33: User Parameter Automatic Selection

J V A

All Modes

Save most recently viewed parameter to User Parameters (A2-17 to A2-32) for quick access

User Parameters can be accessed using the Setup Mode (digital operator)

0: Do not save list of recently viewed parameters

➔ **Manually select the parameters listed in the User Parameter group**

1: Save history of recently viewed parameters

A total of 16 parameters (b1-01 to o2-08) which are recently edited will be automatically saved to A2-17 through A2-32

- **Most recently parameter will be set to A2-17, the second most recently to A2-18**

Technical Training – Application Settings

b6: Dwell Function

b6-01 to b6-04: Dwell Reference at Start and Stop

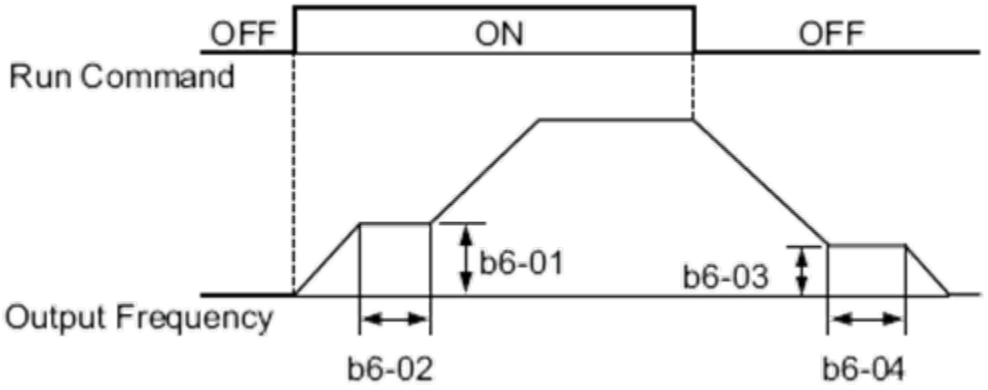
J V A

All Modes

- Temporarily hold of the output frequency
  - Prevent a heavy loaded (high inertias) motor from stalling during acceleration or deceleration
  - Reducing starting current
  - PM motor: Hold in acceleration allows rotor to align with the stator field of the motor

    ➔ Application: Centrifuge, Extruder

Note: Dwell Function requires b1-03=0 (ramp to stop)



b6: Dwell Function

b6-01 and b6-03: Dwell Reference at Start and Stop
b6-02 and b6-04: Dwell Time at Start and Stop

J V A

All Modes

Parameter	Name	Range	Default
b6-01	Dwell Reference at Start	0.0 to 400.0 Hz	0.0 Hz
b6-02	Dwell Time at Start	0.0 to 10.0 s	0.0 s
b6-03	Dwell Reference at Stop	0.0 to 400.0 Hz	0.0 Hz
b6-04	Dwell Time at Stop	0.0 to 10.0 s	0.0 s

Technical Training – Application Settings

b7: Droop Control

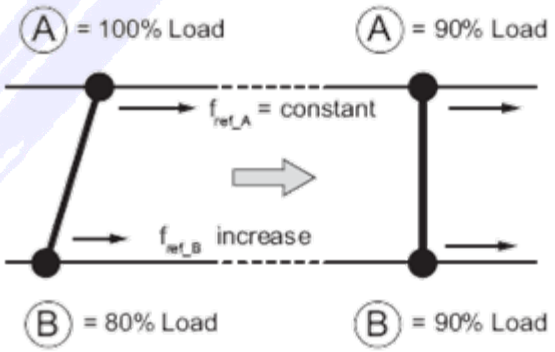
b7-01 to b7-03: Droop Control

J V A

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

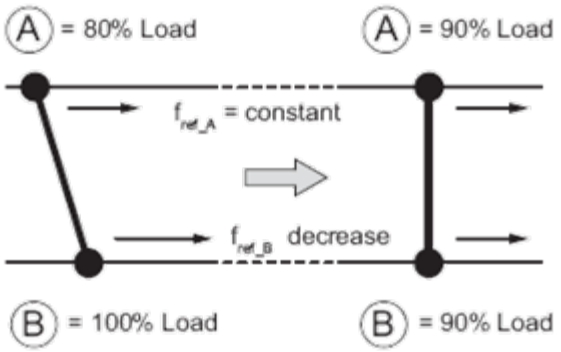
- **Droop control can automatically balance the load level between two motors which drive the same load and is mechanically coupled**
- **Droop Control must be activated in one of the two drives that control these motors**
- **The drive in which Droop control is activated will automatically reduce the speed if the torque reference rises and increase the speed if the torque reference falls again**
  - ➔ **Shifting the load from one motor to the other**
  - ➔ **Example application: Overhead crane**

Motor A runs faster than B, pulling more load



Droop Control increases the speed reference in drive B accomplishing load balance

Motor B runs faster than A, pulling more load



Droop Control decreases the speed reference in drive B accomplishing load balance

b7: Droop Control

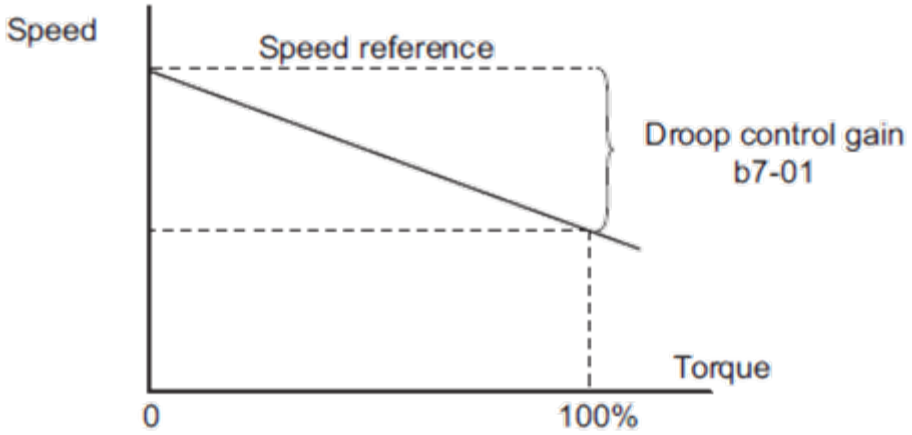
b7-01: Droop Control Gain

J V A

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

- Sets the amount of speed reduction when the torque reference is 100%
- Gain is set as a percentage of the maximum output frequency
- Setting of 0.0% disables the Droop control function

Parameter	Name	Range	Default
b7-01	Droop Control Gain	0.0 to 100.0%	0.0%



b7: Droop Control

b7-02: Droop Control Delay Time
b7-03: Droop Control Limit Selection

J V A

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

b7-02: Droop Control Delay Time

- Adjusts the responsiveness of Droop control:
  - Reduce the setting if the reaction time is too long
  - Increase it if hunting occurs

b7-03: Droop Control Limit Selection

- Enables or disables the droop control limit (1 = Enabled)

Parameter	Name	Range	Default
b7-02	Droop Control Delay Time	0.03 to 2.00 s	0.05 s
b7-03	Droop Control Limit Selection	0, 1	1

Technical Training – Application Settings

b9: Zero Servo

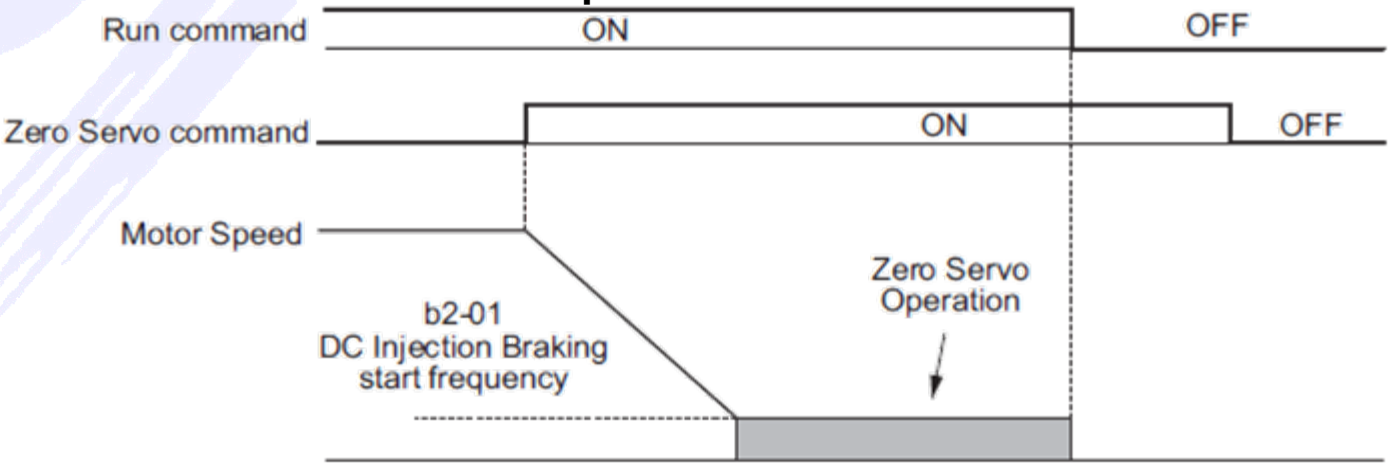
b9-01 to b9-02: Zero Servo

J V A

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

➔ **Applications:** Crane or positioning application (before mechanical brake is active or for positioning lock)

- Zero Servo function is a position loop to lock the motor at a certain position
- Zero Servo function must be activated using a digital input set for H1-☐☐ = 72
  - Inverter will decelerate when this input is closed
  - Once the motor speed falls below set level, inverter goes into the Zero Servo mode and holds the current position



b9: Zero Servo

b9-01: Zero Servo Gain

J V A

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

- Adjusts the responsiveness of the Zero Servo position loop
  - Increase the value if the response is too slow and the deviation from the zero position rises too high when load is applied
  - Decrease the value if vibrations occur during Zero Servo operation

Parameter	Name	Range	Default
b9-01	Zero Servo Gain	0 to 100	5

Note: Before adjusting the Zero Servo gain check ASR parameters (C5-☐☐) to avoid vibration or hunting when running with a zero speed reference

b9: Zero Servo

b9-02: Zero Servo Completion Width

J V A

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

- During Zero Servo a digital output (H2-☐☐ = 33) is switched as long as position is kept
- Position window can be adjusted in b9-02
- The value in b9-02 must be set to the allowable deviation in actual encoder pulses multiplied by four

Parameter	Name	Range	Default
b9-02	Zero Servo Completion Width	0 to 16383	10

b9: Zero Servo

b9-01 to b9-02: Zero Servo

J V A

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

- Deviation between the rotor position and the zero position is displayed in monitor U6-22 (displays pulses multiplied by 4)

Note:

1) Avoid using Zero Servo to lock 100% load for long periods
   - "oL2" fault ("Inverter Overload") can be triggered. Mind the "oL2" limitation below 6Hz !

   If such loads need to be held for long periods make sure the current is less than 50% of the drive rated current during Zero Servo or use a larger capacity drive

2) If the load rotates the motor when using CLV/PM a "dv4" (Inversion Prevention Detection) fault may occur.
   - To prevent increase the Zero Servo gain (b9-01) or increase the number of pulses set to F1-19 that are required to trigger dv4.

3) PG faults (PGo, PGoH, oS, dEv,dv1...) will stop Zero Servo function

Technical Training – Application Settings

C1: Acceleration and Deceleration Times

C1-01 to C1-08: Acceleration and Deceleration Times 1 to 4

All Modes

- Four different sets of acceleration and deceleration times can be set in the drive
- Acceleration and deceleration times can be selected by digital inputs (by motor selection) or can be switched automatically
- Acceleration and deceleration time corresponds to maximum output frequency (E1-04)

Parameter	Name	Range	Default
C1-01	Acceleration Time 1	0.0 to 6000.0 s	10.0 s
C1-02	Deceleration Time 1	0.0 to 6000.0 s	10.0 s
C1-03	Acceleration Time 2	0.0 to 6000.0 s	10.0 s
C1-04	Deceleration Time 2	0.0 to 6000.0 s	10.0 s
C1-05 1)	Acceleration Time 3 (Motor 2 Accel Time 1)	0.0 to 6000.0 s	10.0 s
C1-06 1)	Deceleration Time 3 (Motor 2 Decel Time 1)	0.0 to 6000.0 s	10.0 s
C1-07 1)	Acceleration Time 4 (Motor 2 Accel Time 2)	0.0 to 6000.0 s	10.0 s
C1-08 1)	Deceleration Time 4 (Motor 2 Decel Time 2)	0.0 to 6000.0 s	10.0 s

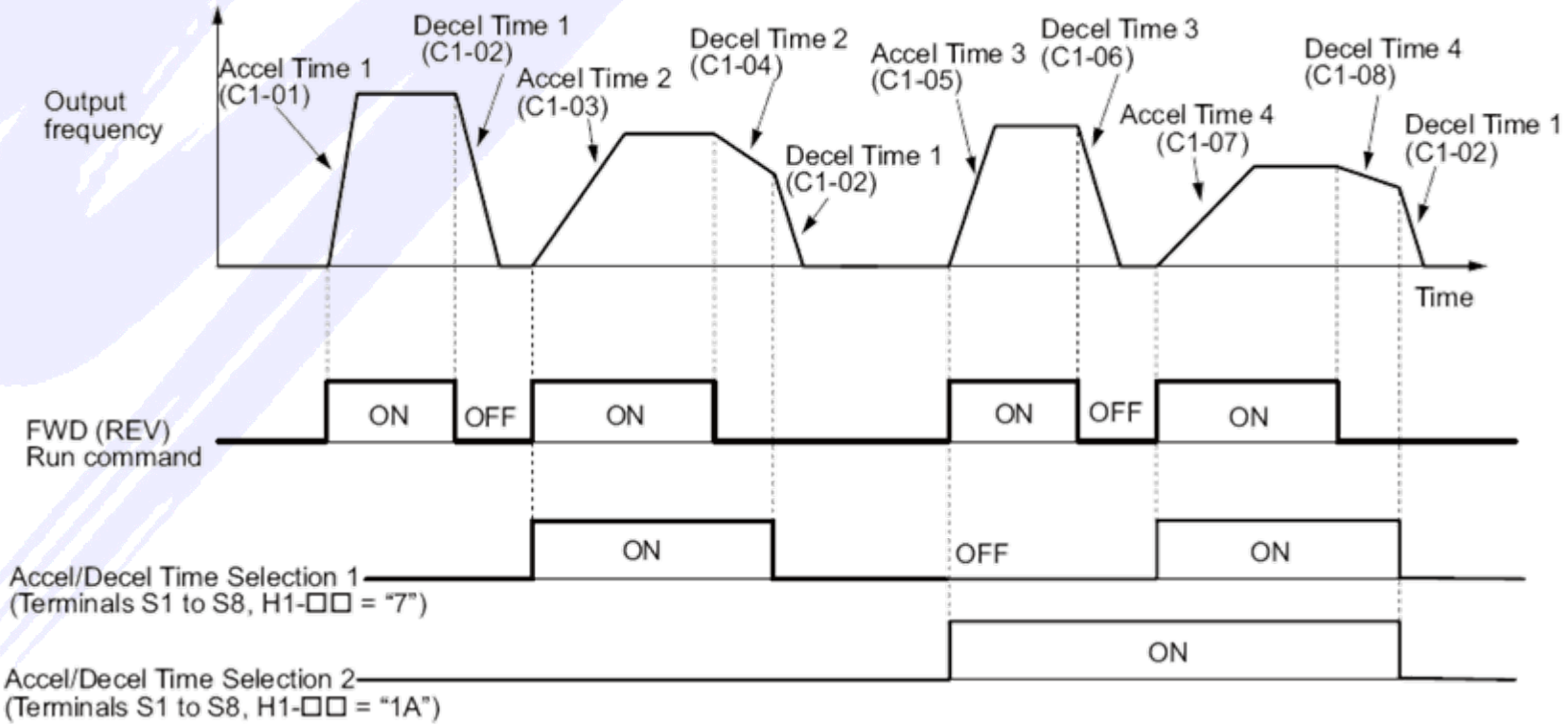
1) Not available for J1000

C1: Acceleration and Deceleration Times

C1-01 to C1-08: Acceleration and Deceleration Times 1 to 4

All Modes

- **Switching Acceleration and Deceleration times by Digital Input (H1-☐☐ = 7 and H1-☐☐ = 1A)**



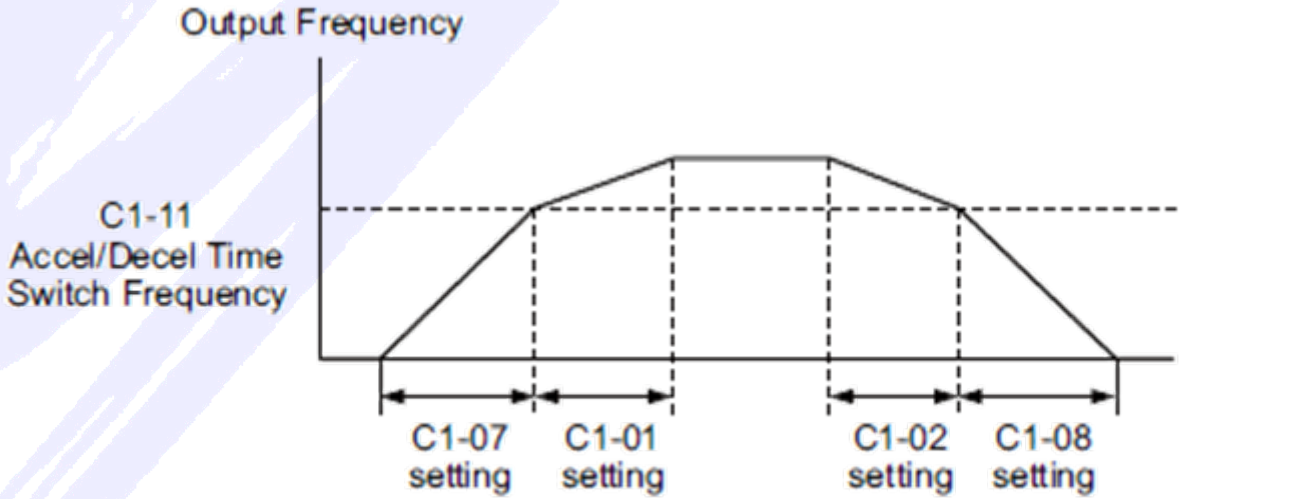
C1: Acceleration and Deceleration Times

C1-11: Acceleration/Deceleration Time Switching Frequency

J V A

All Modes

- **According to frequency level inverter switch automatically between different acceleration and deceleration times**



When the output frequency ≥ C1-11, drive uses Accel/Decel Time 1 (C1-01, -02)
When the output frequency < C1-11, drive uses Accel/Decel Time 2 (C1-07, -08)

Note: Acceleration and deceleration times selected by digital inputs have priority over the automatic switching by the frequency level set to C1-11

C1: Acceleration and Deceleration Times

C1-09: Fast Stop Time

J V A

All Modes

Parameter	Name	Range	Default
C1-09	Fast Stop Time	0.0 to 6000.0 s	10.0 s

- Fast Stop input H1-☐☐ = 15 (N.O.) or 17 (N.C.) triggers the Fast Stop operation (Edge triggered)
- Digital output H2-☐☐ = 4C is active during Fast Stop
- When Fast Stop was triggered inverter cannot be restarted until the deceleration is complete, the Fast Stop input is cleared and the Run command is cycled.

Note: To short deceleration can trigger an Overvoltage fault

- Motor coast to stop. To avoid “ov” fault (Overvoltage) adjust Fast Stop time

C1: Acceleration and Deceleration Times

C1-10: Accel/Decel Time Setting Units

J V A

All Modes

Parameter	Name	Range	Default
C1-10	Accel/Decel Time Setting Units	0 or 1	1

0: 0.01 s units

- Acceleration and deceleration times are set in 0.01 s units. Setting range will be 0.00 to 600.00 s

1: 0.1 s units

- Acceleration and deceleration times are set in 0.1 s units. Setting range will be 0.0 to 6000.0 s.

Technical Training – Application Settings

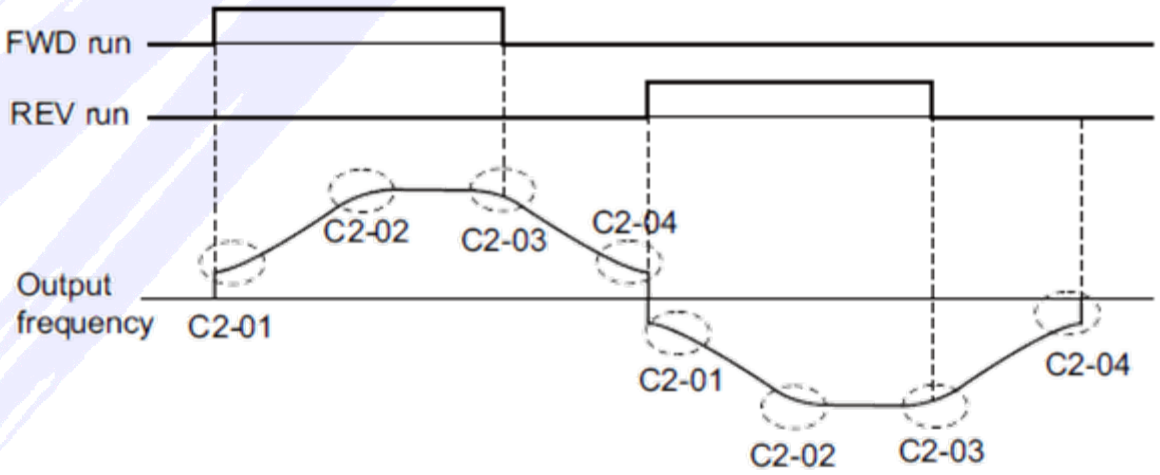
C2: S-Curve Characteristics

C2-01 to C2-04: S-Curve Characteristics

All Modes

- **Use S-curve characteristics to smooth acceleration and deceleration**

  ➔ **Application: Lift, conveyor belt, high inertia load**



Note: If "STO" fault (Step Out) occurs when starting a PM motor increasing parameter C2-01 can help

C2: S-Curve Characteristics

C2-01 to C2-04: S-Curve Characteristics

All Modes

Parameter	Name	Range	Default
C2-01	S-Curve Characteristic at Accel Start	0.00 to 10.00 s	0.20 s*
C2-02	S-Curve Characteristic at Accel End		0.20 s
C2-03	S-Curve Characteristic at Decel Start		0.20 s
C2-04	S-Curve Characteristic at Decel End		0.00 s

*) 1 sec when A1-02=5 (OLV/PM)

- Setting the S-curve will increase the acceleration and deceleration times.
  - Actual acceleration time = acceleration time setting + (C2-01 + C2-02) / 2
  - Actual deceleration time = deceleration time setting + (C2-03 + C2-04) / 2

Technical Training – Application Settings

d1: Reference Settings

d1-01 to d1-17: Frequency Reference 1 to 17

All Modes

- 17 different frequency references can be preset
- Frequency reference is limited by the maximum output frequency (E1-04)
- Frequency reference value that has to be used can be set by using a combination of the multifunction digital input signals (H1-☐☐ = 3, 4, 5, and 32)

Parameter	Name	Range	Default
d1-01 to d1-16 [1)]	Frequency Reference 1 to 16	0.00 to 400.00 Hz	0.00 Hz
d1-17	Jog Frequency Reference	0.00 to 400.00 Hz	6.00 Hz

1) J1000 only d1-01 to d1-08

d1: Reference Settings

d1-01 to d1-17: Frequency Reference 1 to 17

All Modes

- The multi-speed references 1, 2, and 3 can be provided by analogue inputs
  - When an analogue input is set to “Auxiliary frequency 1” (H3-02, H3-06, or H3-10 = 2), then the analogue input will be used as the Multi-Step Speed 2 instead of the value set to parameter d1-02
  - If no analogue inputs are set for “Auxiliary frequency 1”, then d1-02 becomes the reference for Multi-Step Speed 2
  - When an analogue input is set to “Auxiliary frequency 2” (H3-02, H3-06, or H3-10 = 3), then d1-03 becomes the reference for Multi-Step Speed 3

d1: Reference Settings

d1-01 to d1-17: Frequency Reference 1 to 17

All Modes

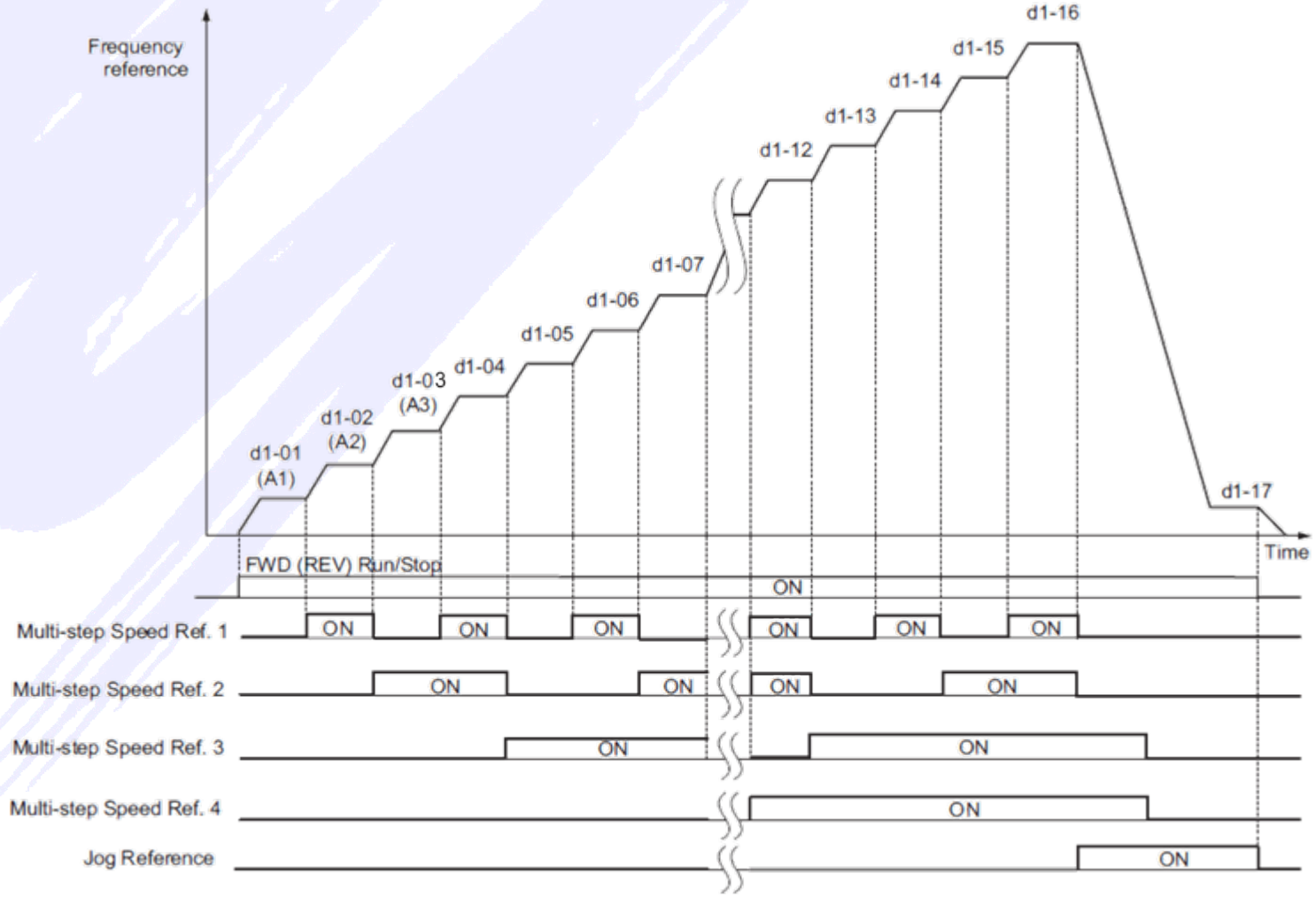
Reference	Multi-Step Speed H1-□□=3	Multi-Step Speed 2 H1-□□=4	Multi-Step Speed 3 H1-□□=5	Multi-Step Speed 4 H1-□□=32	Jog Reference H1-□□=6
Frequency Reference 1 (set in b1-01)	OFF	OFF	OFF	OFF	OFF
Frequency Reference 2 (d1-02 or input terminal A1, A2, A3)	ON	OFF	OFF	OFF	OFF
Frequency Reference 3 (d1-03 or input terminal A1, A2, A3)	OFF	ON	OFF	OFF	OFF
Frequency Reference 4 (d1-04)	ON	ON	OFF	OFF	OFF
Frequency Reference 5 (d1-05)	OFF	OFF	ON	OFF	OFF
Frequency Reference 6 (d1-06)	ON	OFF	ON	OFF	OFF
Frequency Reference 7 (d1-07)	OFF	ON	ON	OFF	OFF
Frequency Reference 8 (d1-08)	ON	ON	ON	OFF	OFF
Frequency Reference 9 (d1-09)	OFF	OFF	OFF	ON	OFF
Frequency Reference 10 (d1-10)	ON	OFF	OFF	ON	OFF
Frequency Reference 11 (d1-11)	OFF	ON	OFF	ON	OFF
Frequency Reference 12 (d1-12)	ON	ON	OFF	ON	OFF
Frequency Reference 13 (d1-13)	OFF	OFF	ON	ON	OFF
Frequency Reference 14 (d1-14)	ON	OFF	ON	ON	OFF
Frequency Reference 15 (d1-15)	OFF	ON	ON	ON	OFF
Frequency Reference 16 (d1-16)	ON	ON	ON	ON	OFF
Jog Frequency Reference (d1-17)	–	–	–	–	ON

Note: Jog Frequency Reference overrides all other frequency reference

d1: Reference Settings

d1-01 to d1-17: Frequency Reference 1 to 17

All Modes



Technical Training – Application Settings

d2: Frequency Upper/Lower Limits

d2-01 to d2-02: Frequency Reference Upper and Lower Limit

All Modes

- Using upper or lower frequency limits user can avoid e.g. equipment damage due to wrong setting of frequency reference
  - ➔ Applications: Pump, Compressor, Fan

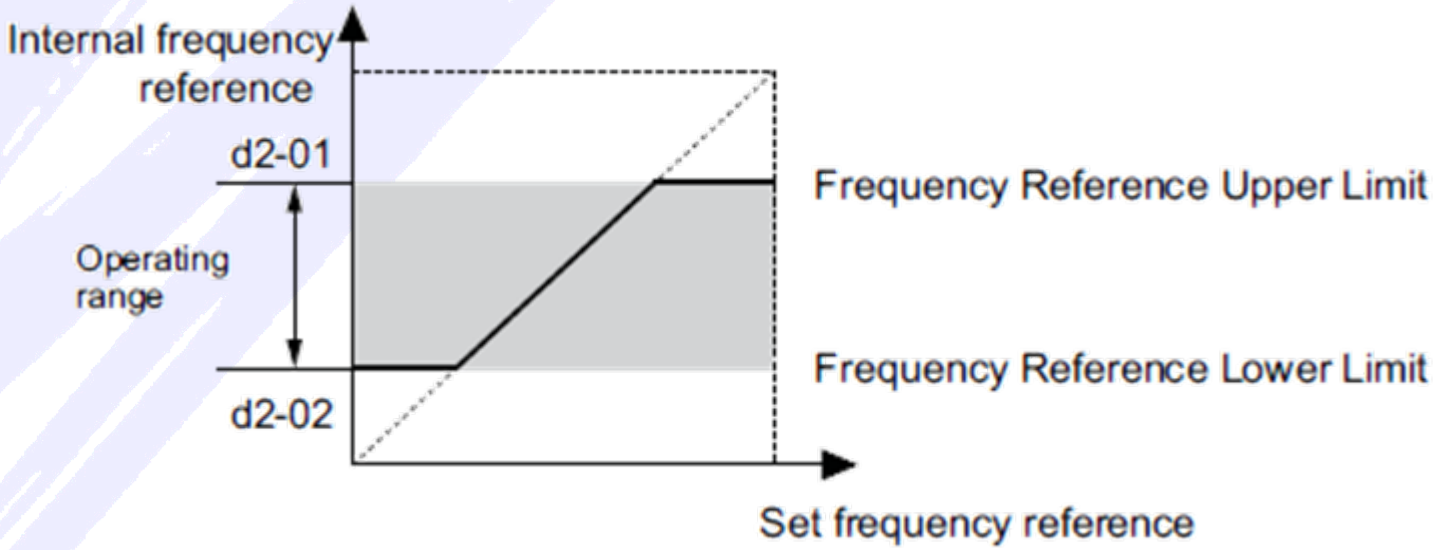
Parameter	Name	Range	Default
d2-01	Frequency Reference Upper Limit	0.0 to 110.0%	100.0%
d2-02	Frequency Reference Lower Limit	0.0 to 110.0%	0.0%

- Even if the frequency reference is set to a higher value, the drive internal frequency reference will not exceed this value
- If a lower reference than this value is entered, the drive will run at the limit set to d2-02
- If the drive is started with a lower reference than d2-02, it will accelerate up to d2-02

d2: Frequency Upper/Lower Limits

d2-01 to d2-02: Frequency Reference Upper and Lower Limit

All Modes



Note: Set the upper and lower frequency reference as a percentage of the Maximum Output Frequency (E1-04). This limit applies to all frequency references.

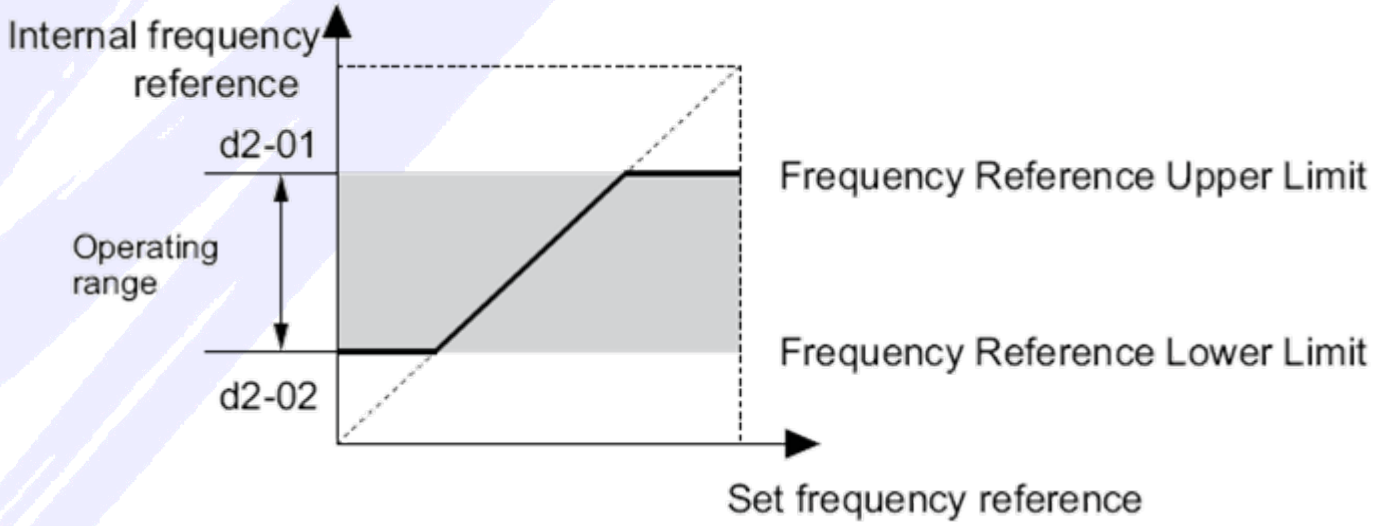
d2: Frequency Upper/Lower Limits

Functions of Analogue Inputs
Output frequency Lower Limit, Setting H3- ☐☐ = 9

J V A

All Modes

This setting allows an analogue input to adjust the Output Frequency Lower Limit.



Either Frequency Reference Lower Limit (d2-02) or the analogue value is used, whichever value is lower.

d2: Frequency Upper/Lower Limits

d2-03: Master Speed Reference Lower Limit

J V A

All Modes

- **Sets the lower limit for frequency references entered from the analogue input terminals (A1, A2, or A3) as a percentage of the maximum output frequency**

Parameter	Name	Range	Default
d2-03	Master Speed Reference Lower Limit	0.0 to 110.0%	0.0%

Technical Training – Application Settings

d3: Jump Frequency

d3-01 to d3-03: Jump Frequency 1 to 3

All Modes

Parameter	Name	Range	Default
d3-01	Jump Frequency 1	0.0 to 400.0 Hz	0.0 Hz
d3-02	Jump Frequency 2	0.0 to 400.0 Hz	0.0 Hz
d3-03	Jump Frequency 3 (not available for J1000)	0.0 to 400.0 Hz	0.0 Hz
d3-04	Jump Frequency Width	0.0 to 20.0 Hz	1.0 Hz

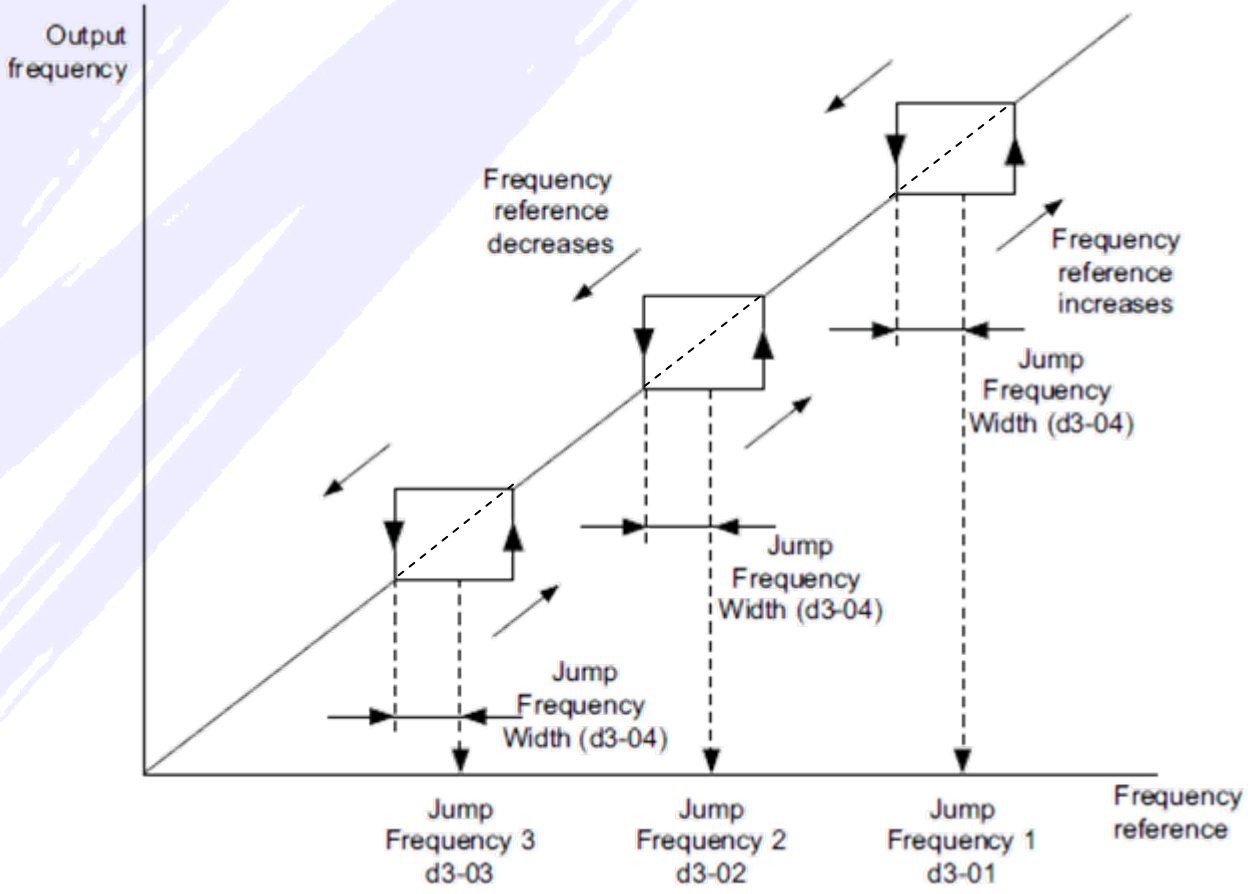
- The Jump Frequency function allows the prohibition of certain output frequencies to avoid possible resonant vibration of motor or driven machinery
  - Inverter will not allow continuous operation in Jump Frequency range
  - Inverter accelerates and decelerates the motor through the prohibited frequency ranges

In AOLV/PM and CLV/PM control modes, the setting units are expressed in percent of Maximum Output Frequency (E1-04)

d3: Jump Frequency

d3-01 to d3-03: Jump Frequency 1 to 3

All Modes



Technical Training – Application Settings

d4: Frequency Reference Hold and Up/Down 2 Function

Up/Down function

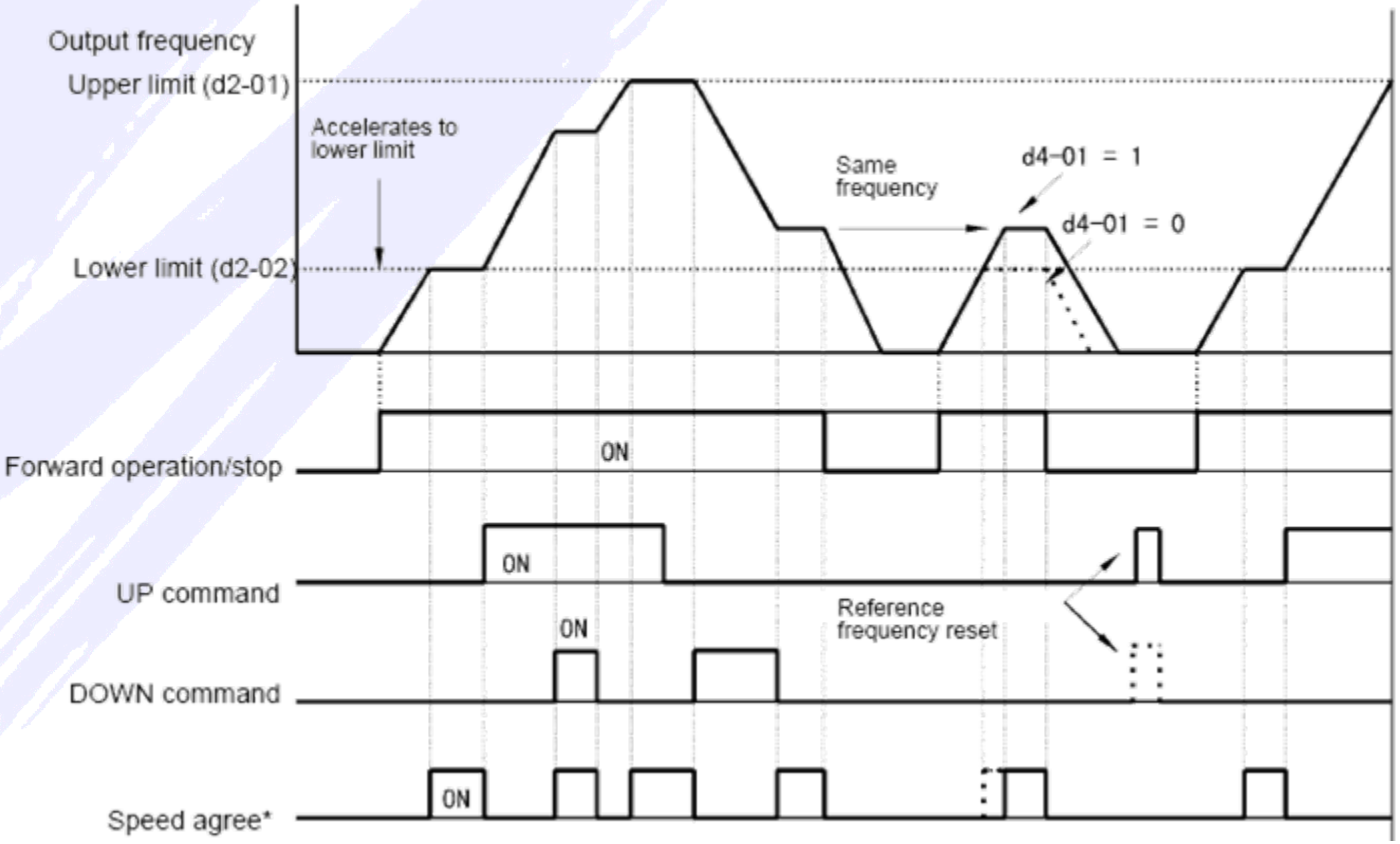
All Modes

- Up/Down function like in F7
- Set H1-☐☐ = 10/11 for Up/Down command
- When the Up input is TRUE, the output will increase by a rate based on the programmed time.
- When the Down input is TRUE, the output will decrease by a rate based on the programmed time.
- If the Up and Down inputs are either both TRUE or both FALSE, the output value will not change.
- The Up/Down function has priority over the frequency references from the digital operator, the analog inputs and the pulse input.

d4: Frequency Reference Hold and Up/Down 2 Function

d4-01: Frequency Reference Hold Function Selection

Up/Down function like in F7



Frequency Reference hold with accel/decel hold function

d4: Frequency Reference Hold and Up/Down 2 Function

Up/Down 2 Function

All Modes

If d4-01 = 1

Parameter d4-01 determines whether the frequency reference or the frequency bias (Up/Down 2) value is saved when the Stop command is entered or the power supply is shut down

If d4-03 = 0Hz

Bias value will be increased/decreased using accel/decel time set in d4-04

If d4-03 > 0Hz

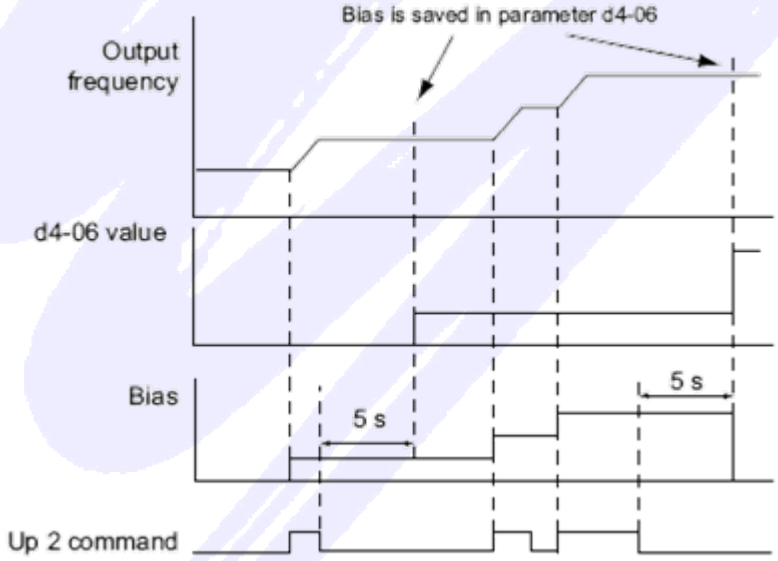
Bias is increased/decreased in steps for the value set in d4-03

Bias value will be increased/decreased using accel/decel time set in d4-04

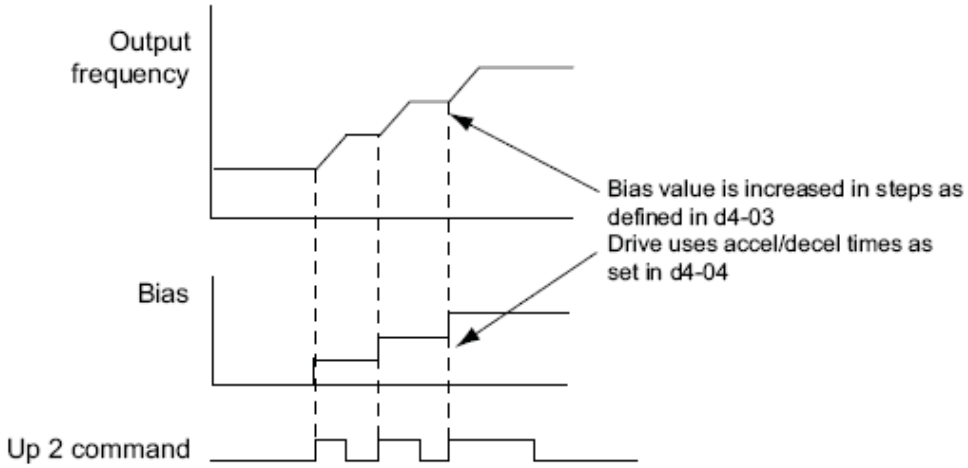
Bias value and frequency reference constant for 5s:
Bias is added to frequency reference and hold/reset afterwards

d4: Frequency Reference Hold and Up/Down 2 Function

d4-01: Frequency Reference Hold Function Selection



Up/Down 2 with other frequency references then digital operator and d4-01 = 1



Up/Down 2 Bias when d4-03 > 0.0Hz

Technical Training – Application Settings

d7: Offset Frequency

d7-01 to d7-03: Offset Frequency 1 to 3

J V A

All Modes

Parameter	Name	Range	Default
d7-01	Offset Frequency 1	-100.0 to 100.0%	0%
d7-02	Offset Frequency 2	-100.0 to 100.0%	0%
d7-03	Offset Frequency 3	-100.0 to 100.0%	0%

➔ **Application: Flying Knife**

- **Offset values will be added to the frequency reference**
- **Offset values selected by digital inputs (H1-☐☐ = 44, 45, 46)**
- **100% = E1-04**

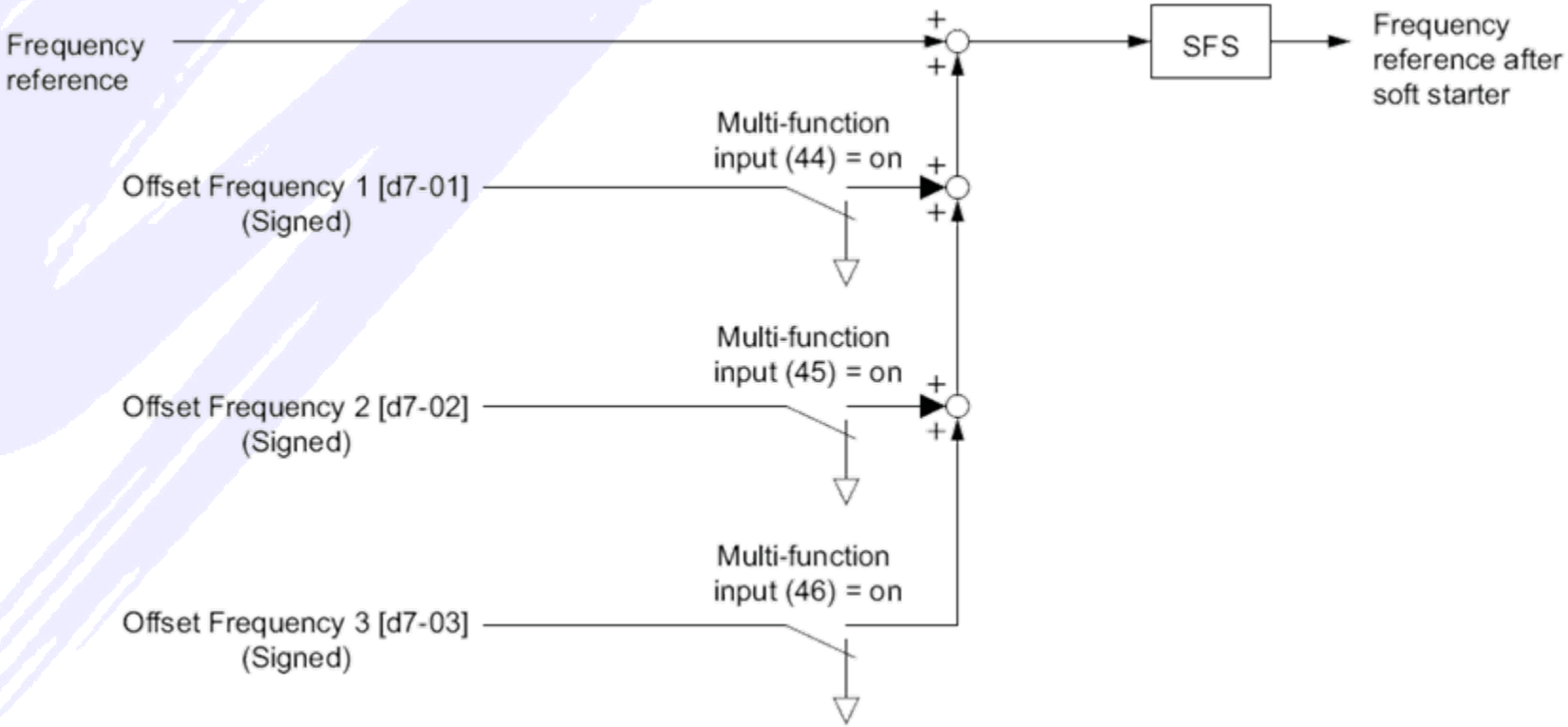
Note: This function can be used to replace the "Trim Control" function (H1-☐☐ = 1C, 1D) of earlier Yaskawa drives.

d7: Offset Frequency

d7-01 to d7-03: Offset Frequency 1 to 3

J V A

All Modes



Technical Training – Application Settings

High Slip Braking

J V A

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

High Slip Braking (V/f)

- High Slip Braking works in V/f Control only
  - Producing a high slip / increases motor slip

- Stops the motor by reducing the output frequency in large steps
  - Regenerative energy created from decelerating the load is dissipated in the rotor
  - Motor temperature increases therefore High Slip Braking should not be used for frequently stopping the motor
  - Max. deceleration time is 2 min. with Duty cycle of 5% or less

High Slip Braking

J V A

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

- Deceleration time will be ignored during High Slip Braking
- Use Overexcitation Deceleration 1 (L3-04 = 4) or a dynamic braking option if the motor has to be stopped in a defined time
- Braking time varies based on the load inertia and motor characteristics
- High Slip Braking and KEB Ride-Thru cannot be used simultaneously
  - oPE03 (Multi-Function Input Selection Error) will occur if enable at same time
- High Slip Braking must be triggered by a digital input set to H1-☐☐ = 68

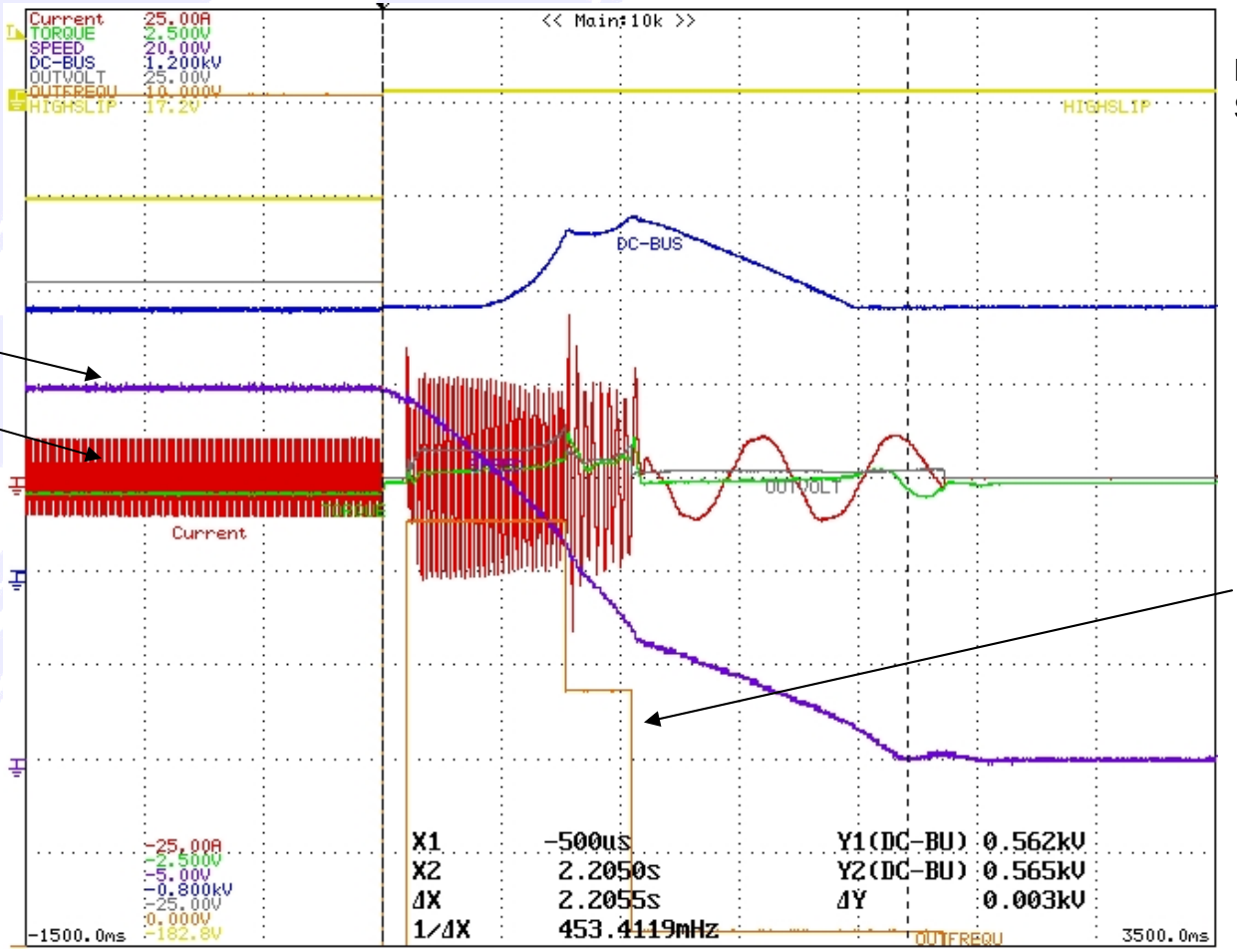
Note: When HSB command is active, it is not possible to restart the drive until the motor has stopped completely and the Run command is cycled

n3: High Slip Braking (HSB) and Overexcitation Braking

High Slip Braking

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

High Slip Braking from 100Hz to 0Hz



Motor Speed

Output Current

Digital Input:
Start High Slip Braking

DC Bus

Frequency Referencs

n3: High Slip Braking (HSB) and Overexcitation Braking

n3-01: High Slip Braking Deceleration Frequency Width
n3-02: High Slip Braking Current Limit

J V A

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

Parameter	Name	Range	Default
n3-01	High Slip Braking Deceleration Frequency Width	1 to 20%	5%
n3-02	High Slip Braking Current Limit	100 to 200%	Determined by C6-01 and L8-38

- n3-01 sets step width for frequency reduction during High Slip Braking
  - Increase n3-01 if DC bus overvoltage (ov) occurs during High Slip Braking
- n3-02 sets the maximum output current during High Slip Braking stop as a percentage E2-01
  - Lower limit if motor current is too high during High Slip Braking
  - High current can damage the motor due to overheat
  - Reducing current limit increases the deceleration time
  - Lower limit if overvoltage occurs during High Slip Braking
  - The default setting is 150% in HD mode and 120% in ND

n3: High Slip Braking (HSB) and Overexcitation Braking

n3-03: High Slip Braking Dwell Time at Stop
n3-04: High Slip Braking Overload Time

J V A

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

Parameter	Name	Range	Default
n3-03	High Slip Braking Dwell Time at Stop	0.0 to 10.0 s	1.0 s
n3-04	High Slip Braking Overload Time	30 to 1200 s	40 s

- At the end of High Slip Braking the output frequency is kept at the minimum output frequency (E1-09) time set in n3-03
  - Increase time (n3-03) if the inertia is very high and the motor is still coasting after High Slip Braking is complete
- n3-04 sets time for High Slip Braking Over Load (“oL7”) during High Slip Braking when output frequency does not change during High Slip Braking stop
  - Caused by the load rotating the motor or by excessive load inertia
  - To protect the motor from overheat (caused by high current), inverter trips with “oL7” fault when such conditions occur longer than the time set in n3-04

Technical Training – Application Settings

Overexcitation Deceleration

V/f | V/f w/PG | OLV | CLV
OLV/PM | AOLV/PM | CLV/PM

- Overexcitation deceleration increases the flux during deceleration
  - Shorter deceleration time compared to standard deceleration without using of a braking resistor possible
  - Enabled by setting L3-04 = 4 or 5

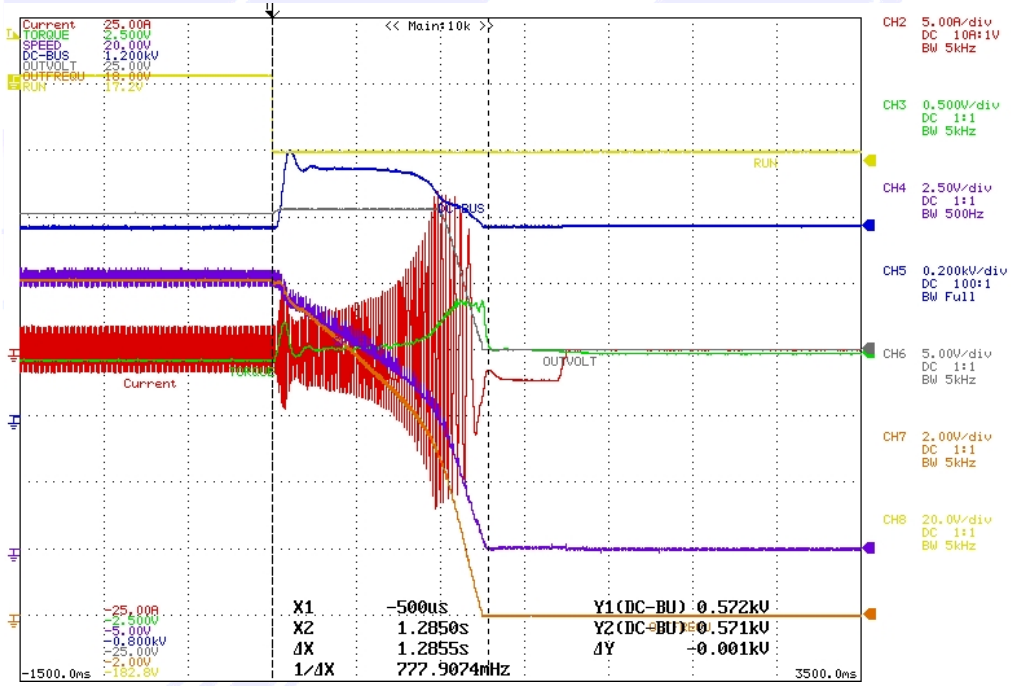
Note: Overexcitation deceleration can not be used with PM motors.
Only used at stop command.

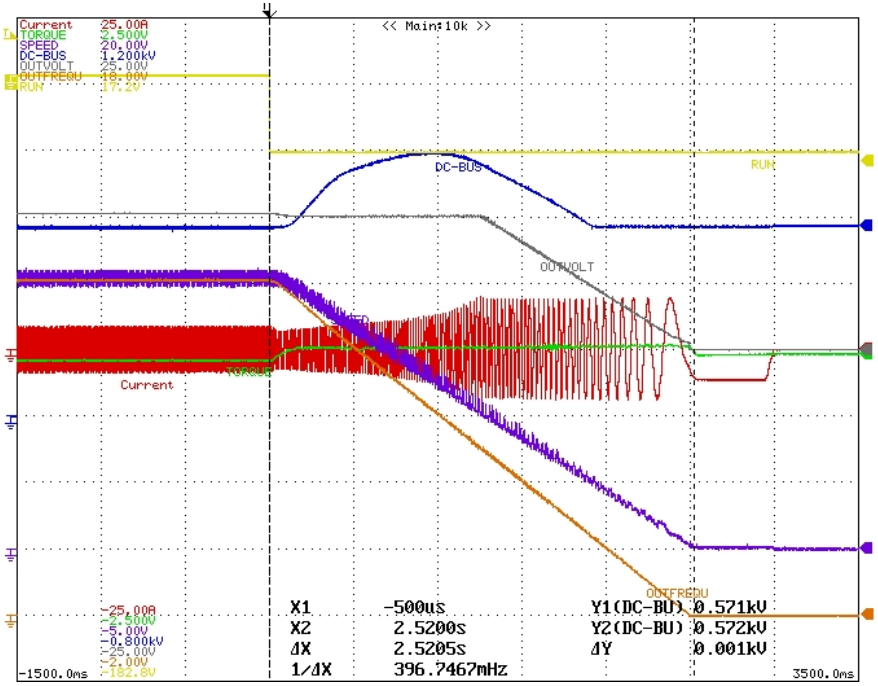
n3: High Slip Braking (HSB) and Overexcitation Braking

Overexcitation Deceleration

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

Stopping from 100Hz





Overexcitation Braking

Deceleration time: 1.286 sec from

Standard Stopping

Deceleration time: 2.521 sec

n3: High Slip Braking (HSB) and Overexcitation Braking

Overexcitation Deceleration

V/f | V/f w/PG | OLV | CLV
OLV/PM | AOLV/PM | CLV/PM

- Frequently use of overexcitation deceleration causes motor temperature increase
  - Regenerative energy dissipated as heat in the motor windings

Note: Make sure the motor temperature does not exceed the maximum allowable value or consider using a braking resistor option instead

- The drive decelerates at the active deceleration time
  - Overvoltage (ov) fault can occur
  - Stall prevention is not active

- Active Run command has priority about overexcitation deceleration

n3: High Slip Braking (HSB) and Overexcitation Braking

n3-13: Overexcitation Deceleration Gain

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

Parameter	Name	Range	Default
n3-13	Overexcitation Deceleration Gain	1.00 to 1.40	1.10

- Multiplies a gain to the V/f pattern output value during Overexcitation Deceleration
  - Increase the gain to improve the braking power of Overexcitation Deceleration
  - Decrease n3-13 if overcurrent (“oC”), motor overload (“oL1”) or inverter overload (“oL2”) occurs

- Inverter returns to normal V/f value after:
  - Motor stopped
  - Accelerating to the frequency reference

n3: High Slip Braking (HSB) and Overexcitation Braking

n3-14: High Frequency Injection during Overexcitation Deceleration

J V A

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

- Injecting high frequency into the motor increases motor losses
  - ➔ Shortens deceleration time

Note: Injecting high frequency can increase audible noise from the motor and might not be desirable in environments where motor noise is a concern

0: Disable High Frequency Injection During Overexcitation Deceleration

1: Enable High Frequency Injection During Overexcitation Deceleration

n3: High Slip Braking (HSB) and Overexcitation Braking

n3-21: High Slip Suppression Current Level

J V A

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

Parameter	Name	Range	Default
n3-21	High Slip Suppression Current Level	0 to 150%	100%

- Automatic reduction of overexcitation gain when motor current exceeds the limit set in n3-21 during Overexcitation Deceleration
- n3-21 is set as a percentage of the drive rated current

Note: n3-21 should be set to a relatively low value to optimize deceleration. If “oC” (Overcurrent), “oL1” (Motor overload) or “oL2” (Inverter Overload) occurs during Overexcitation Deceleration reduce the High Slip Suppression Current level

n3: High Slip Braking (HSB) and Overexcitation Braking

n3-23: Overexcitation Operation Selection

J V A

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

- **Limits the Overexcitation Deceleration operation selected in parameter L3-04 to forward only or reverse only**

0: Overexcitation Operation as Selected in L3-04 in Forward and Reverse Direction

1: Overexcitation Operation as Selected in L3-04 in Forward Direction Only

2: Overexcitation Operation as Selected in L3-04 in Reverse Direction Only

Technical Training – Application Settings

b3: Speed Search

J V A

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

Speed Search function allows the drive to detect the speed of a rotating motor shaft that is driven by external forces

Application: Fan rotating by windmill effect, motor driven by load inertia, motor coast to stop, power loss

- **Motor operation can be directly started from the speed detected without needing to stop the machine before**
- **Two types of Speed Search (Speed Estimation and Current Detection) can be selected by parameter b3-24**

Note: For PM motors, only parameter b3-01 is needed to enable Speed Search
J1000: No Speed Search tuning for J1000. Speed search function can be only activated by Digital Input H1-☐☐=61/62

Activating of Speed Search

J V A

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

Setting	Description	b3-24 = 0	b3-24 = 1
61	External Search Command 1	Closed: Activate Current Detection Speed Search from the maximum output frequency (E1-04)	Activate Speed Estimation Speed Search
62	External Search Command 2	Closed: Activate Current Detection Speed Search from the frequency reference.	

1. Automatically activate Speed Search with every Run command (b3-01=1)
   ➔ External Speed Search commands are ignored

2. Activate Speed Search using the digital input terminals
   - Digital Input H1-☐☐ must always be set together with the Run command
   - Run command must be entered after the Speed Search command
   - Digital output H2-☐☐ = 3D is active during Speed Search

Activating of Speed Search

J V A

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

3. After automatic fault restart

- **When number of maximum fault restarts in parameter L5-01 ≠ 0, the drive will automatically perform Speed Search as specified by b3-24**

4. After momentary power loss

- **Power Loss Ride-Thru function must be enabled (L2-01 = 1 or 2)**

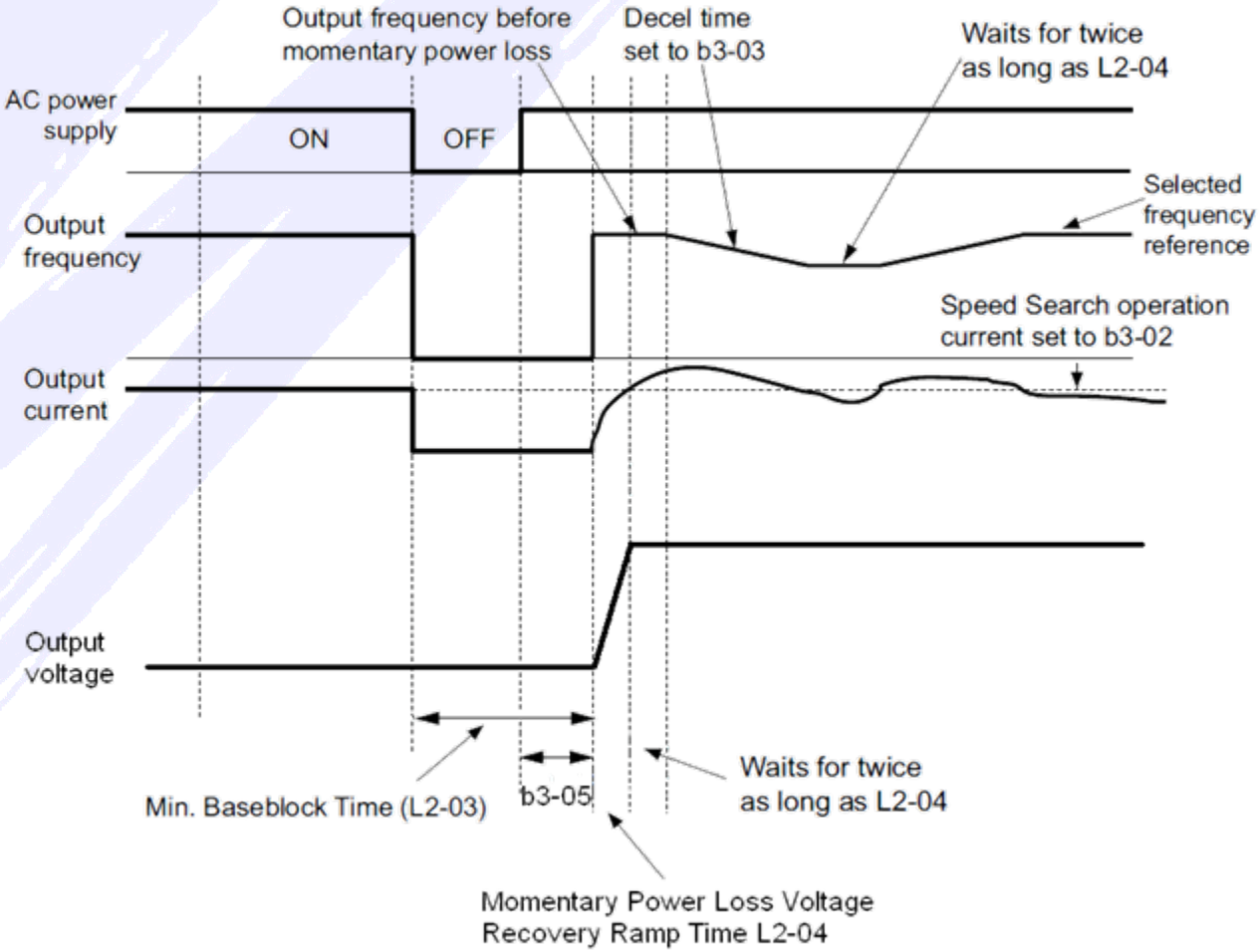
5. After external Baseblock is released

- **Inverter starts Speed Search if Run command is active and output frequency is above the minimum frequency when the Baseblock command (H1-☐☐ = 8 or 9) is released**

Current Detection

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

Speed Search after Power Loss

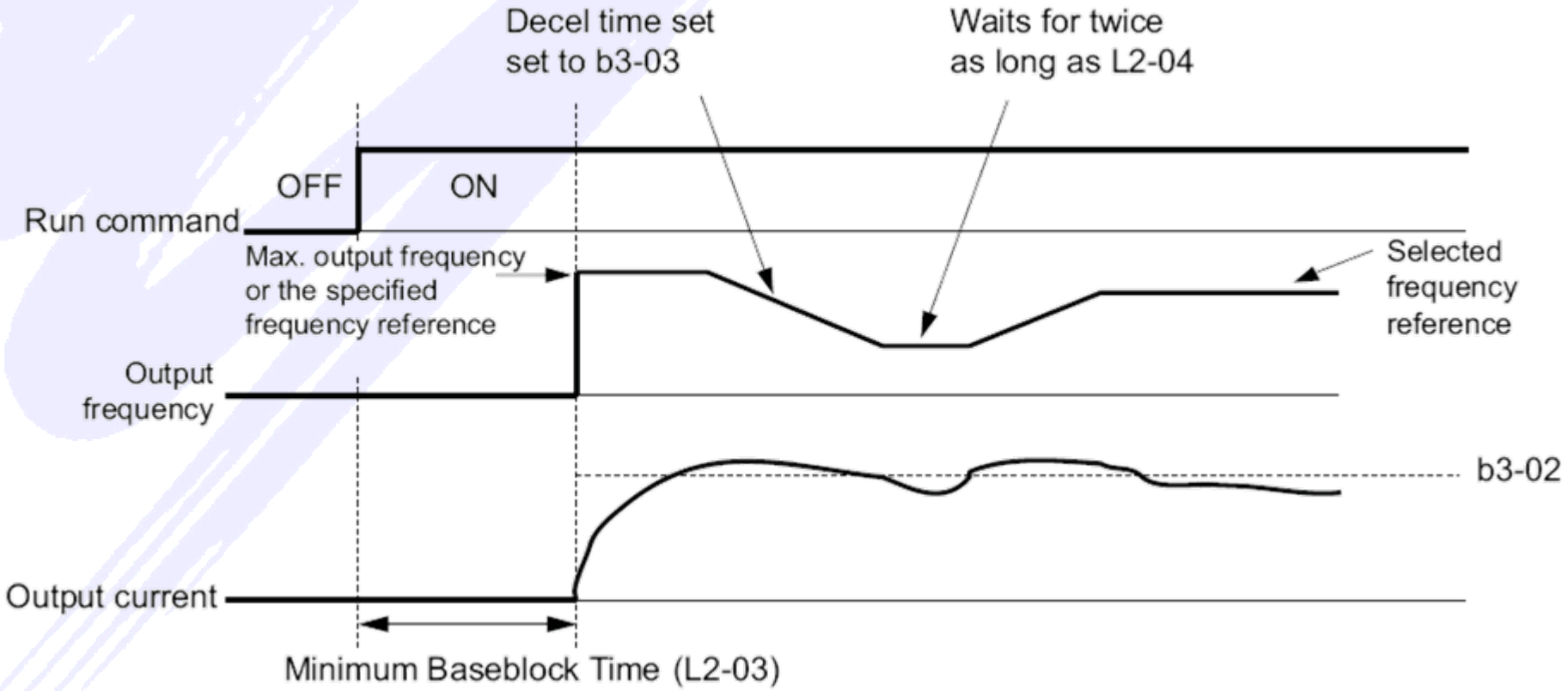


Current Detection Speed Search at Start or Speed Search

J V A

Command by Digital Input

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

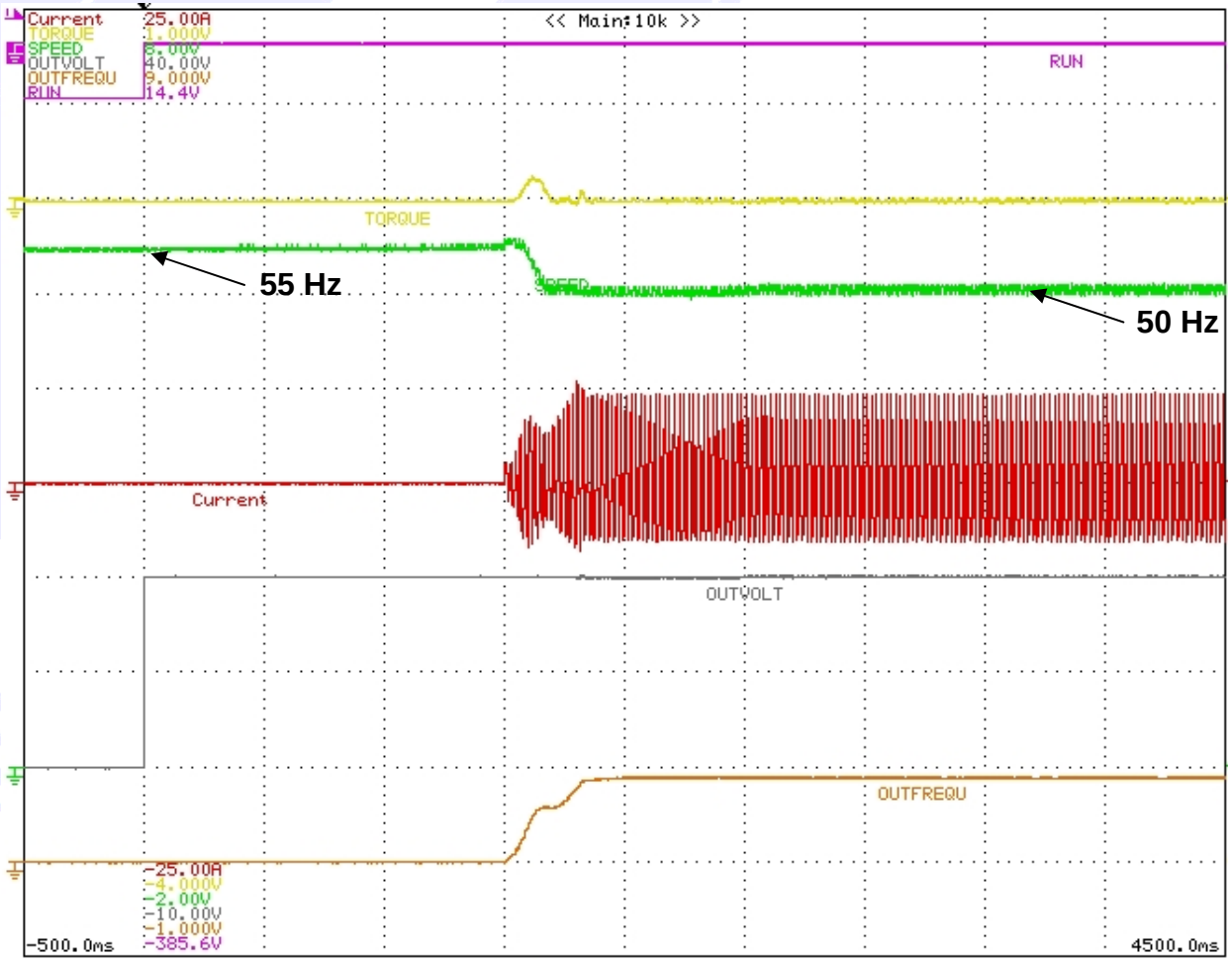


Current Detection

Motor coasting at 55 Hz forward direction

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

Frequency reference is 50Hz forward direction



Run Command

Torque

Motor Speed

Output Current

Output Voltage

Output Frequency

Speed Estimation Type Speed Search

J V A

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

Speed Estimation is executed in two steps:

- **Step 1: Speed Estimation through Back EMF Voltage**
- **Step 2: Current Injection**

Speed Estimation should not be used if:

- **Motor is one or more frame sizes smaller than the drive**
- **At motor speed above 200 Hz**
- **When using a single drive to operate more than one motor**

Speed Estimation Type Speed Search

J V A

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

Speed Estimation through Back EMF Voltage

- Back EMF Voltage Estimation is used by Speed Search after short baseblock
  - After power loss where the drive's CPU kept running and the Run command was kept active
- Inverter estimates the motor speed by analyzing the back EMF voltage
  - Outputs the estimated frequency and increases the voltage using the time constant set in parameter L2-04
- If there is not enough residual voltage in the motor windings to perform the calculations then the drive will automatically proceed to Current Injection

Speed Estimation Type Speed Search

J V A

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

Speed Estimation through Current Feedback

Speed Estimation through Current Feedback is performed when not enough residual voltage remaining in the motor:

- **E.g. after longer power losses**
- **When Speed Search is applied with the Run command (b3-01=1)**
- **When External search command is used**

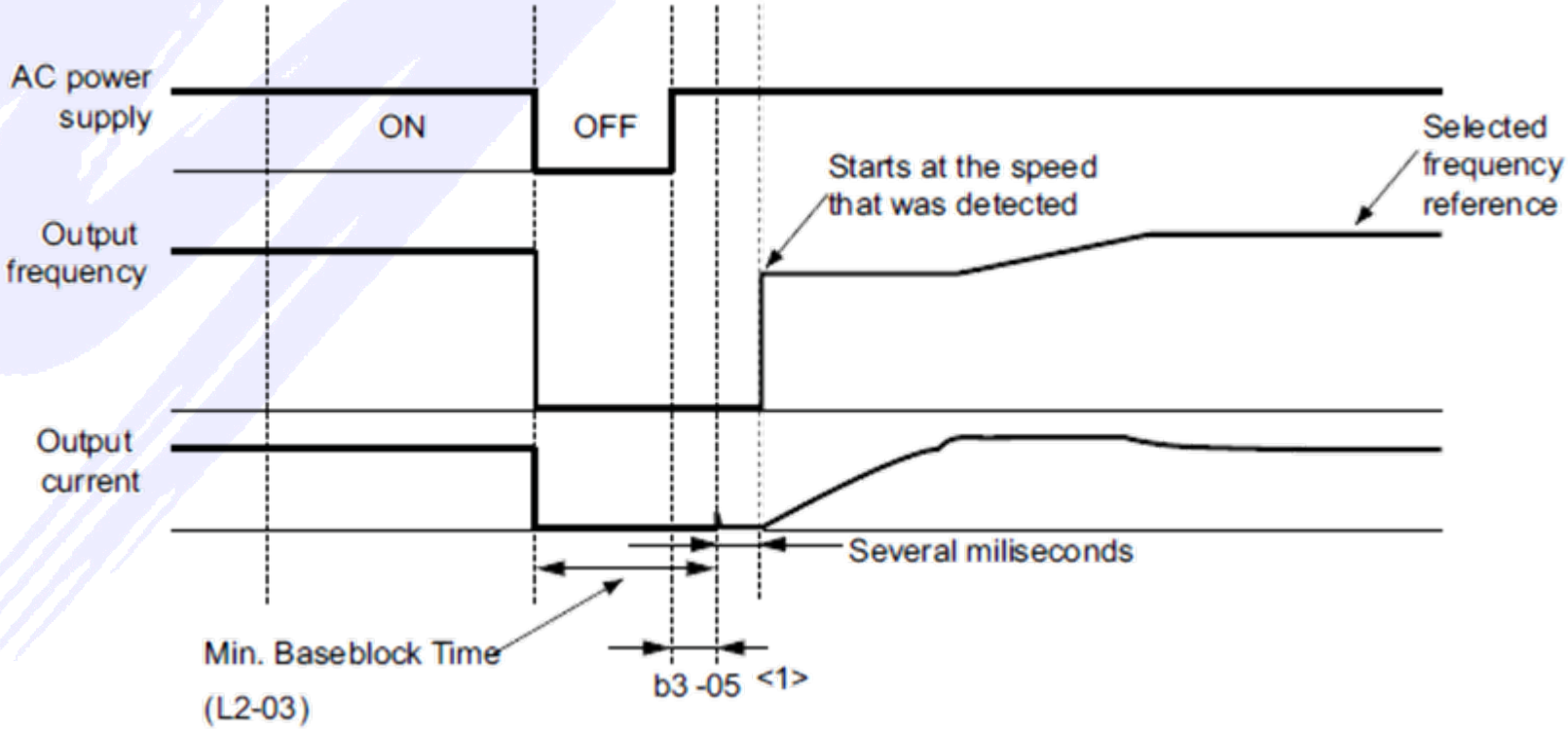
Speed Estimation Type Speed Search

J V A

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

Speed Search after BaseBlock

(Speed Estimation through Back EMF Voltage)

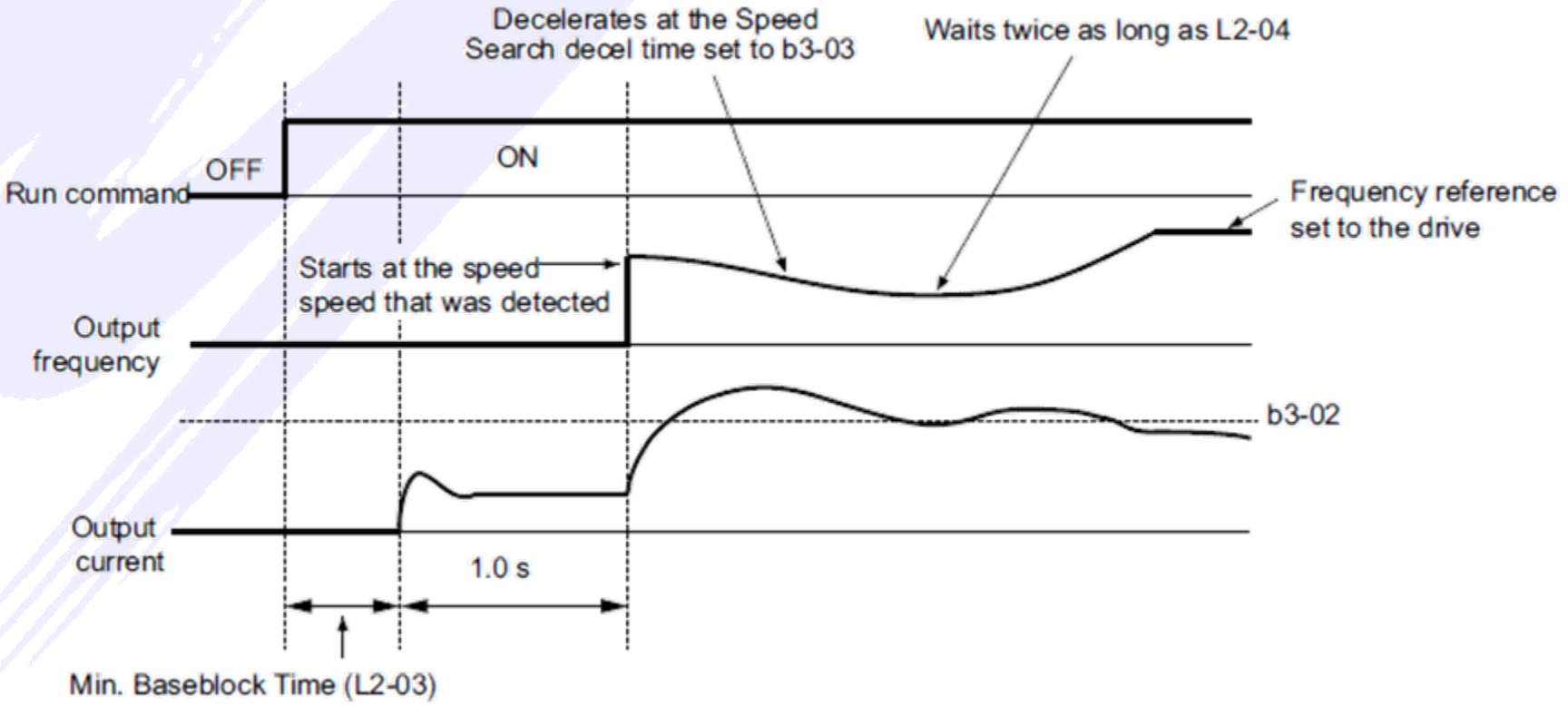


Speed Estimation Type Speed Search

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

Speed Search at Start

(Speed Estimation through Current Feedback)

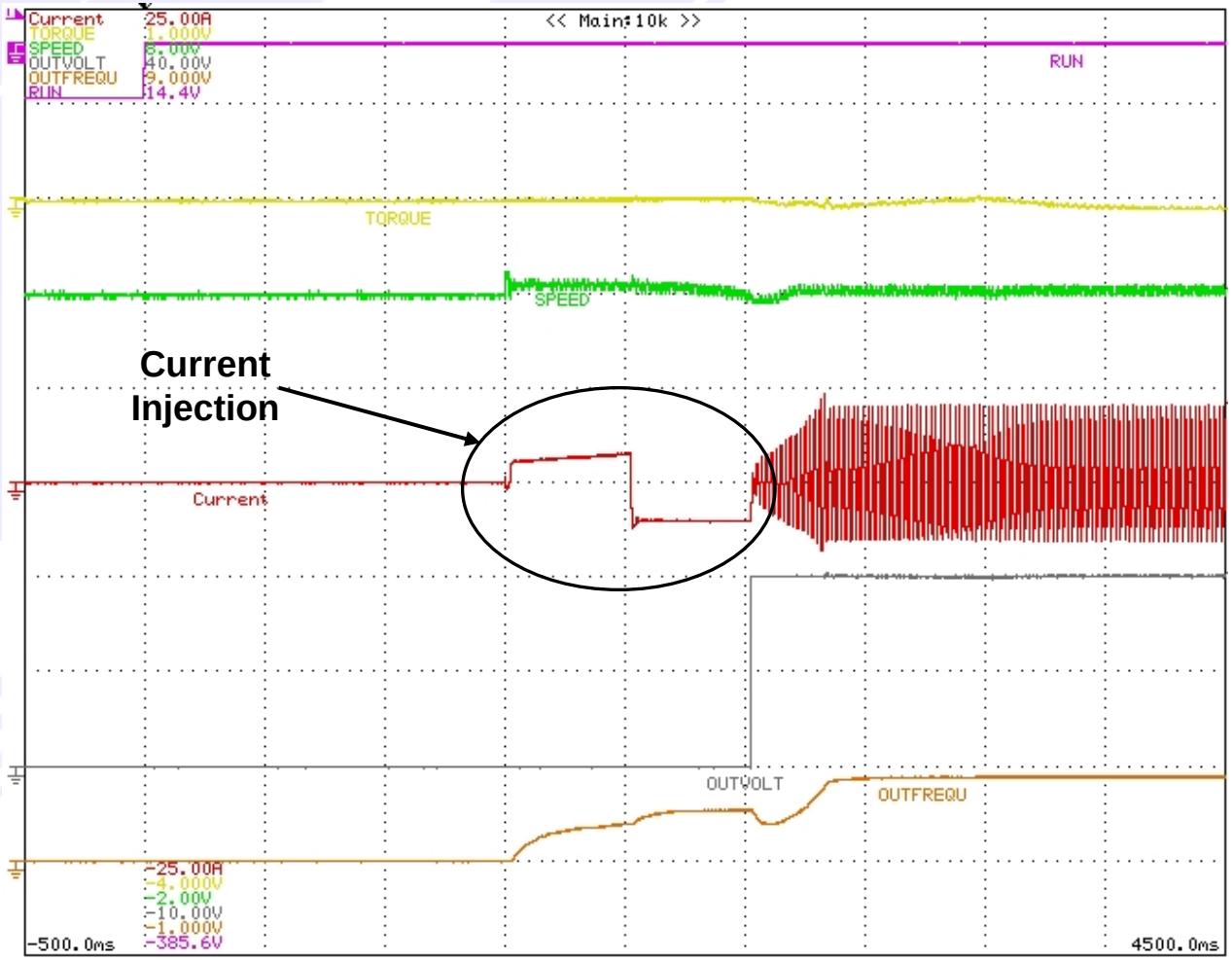


Speed Estimation through Current Feedback

Motor coasting at 50 Hz forward direction

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

Frequency reference is 50Hz forward direction



Run Command

Torque

Motor Speed = 50 Hz

Output Current

Output Voltage

Output Frequency

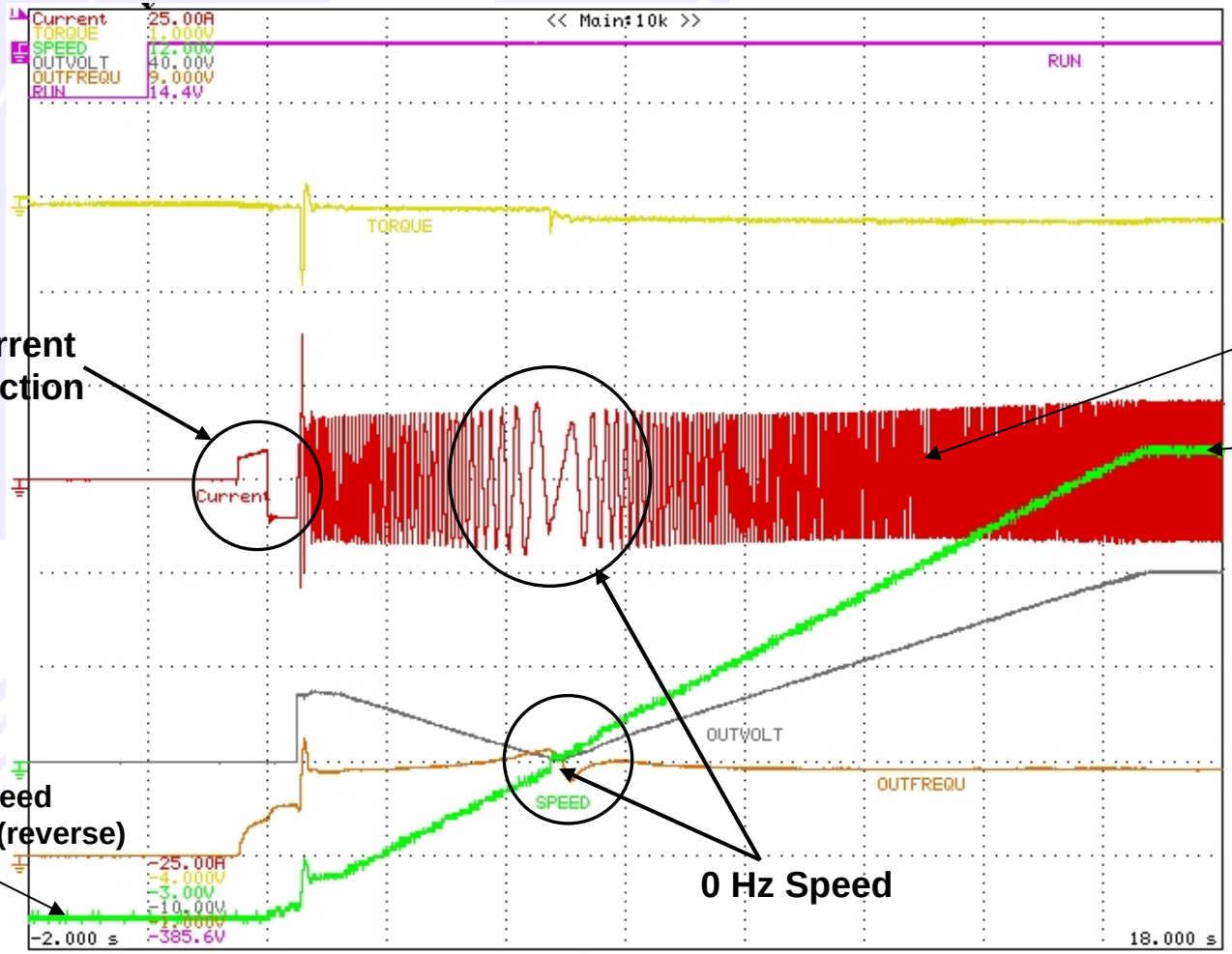
b3: Speed Search

Speed Estimation Type Speed Search

Motor coasting at 30 Hz reverse direction

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

Frequency reference is 50Hz forward direction



Run Command

Torque

Current Injection

Output Current

Motor Speed ➔ 50 Hz (forward)

Output Voltage

Output Frequency

Motor Speed ➔ 30 Hz (reverse)

0 Hz Speed

Speed Estimation Type Speed Search

J V A

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

Note:

- **In case of problem to detect the real motor speed increase b3-05**
  ➔ avoid residual voltage effects which can influence the result of current injection

- **Speed Estimation may have trouble finding the actual speed if the motor cable is very long**
  - **Current Detection should be used in such situations**

- **Use Current Detection instead of Speed Estimation when operating motors smaller than 1.5 kW**
  - **Speed Estimation can stop smaller motors**
  - **Speed Estimation might not be able to detect the speed or rotation direction**

Speed Estimation Type Speed Search

J V A

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

Note:

- **For PM Motor no Speed Search below 20% of E1-04 (max. Speed)**
- **B2-☐☐ activate automatically DC Injection Braking**
  - **similar like Short Circuit Braking**
  - **can be helpful instead of Speed Search when**
    ➔ using OLV/PM and AOLV/PM along with a fairly long motor cable
    ➔ Speed Search of a motor coasting faster than 200 Hz in OLV/PM and AOLV/PM
- **Set digital input H1-☐☐ = 7C (N.O.) or 7D (N.C.) for Short Circuit Braking**
- **Set digital output H2-☐☐ = 4B for Short Circuit Braking is active**

b3: Speed Search

b3-01: Speed Search Selection at Start
b3-02: Speed Search Deactivation Current

J V A

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

Parameter	Name	Range	Default
b3-01	Speed Search Selection at Start	0 to 1	Determined by A1-02
b3-02	Speed Search Deactivation Current	0 to 200%	V/f control = 120% Vector control = 100%

b3-01

0: Disabled

Note: If external Speed Search 1 or 2 is active, the drive will start operating with Speed Search

1: Enabled: Speed Search is performed whenever the Run command is entered

b3-02

Sets the operating current for Speed Search as a percentage of the drive rated current. If the drive has trouble restarting, lowering this value
Note: not available for PM control mode

b3-03: Speed Search Deceleration Time
b3-04: V/f Gain During Speed Search

J V A

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

Parameter	Name	Range	Default
b3-03	Speed Search Deceleration Time	0.1 to 10.0 s	2.0 s

- b3-03 sets output frequency reduction ramp
  - From maximum frequency (E1-04) to minimum frequency (E1-09)

Parameter	Name	Range	Default
b3-04	V/f Gain During Speed Search	10 to 100%	Determined by o2-04

- Voltage calculated from the V/f pattern is multiplied with parameter b3-04
  - Changing b3-04 can be helpful to reduce the output current during Speed Search
  - Only in V/f control
  - Only A1000

b3-05: Speed Search Delay Time
b3-06: Output Current 1 During Speed Search

J V A

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

Parameter	Name	Range	Default
b3-05	Speed Search Delay Time	0.0 to 100.0 s	0.2 s

- Give output contactor (between the drive and the motor) enough time to close completely before Speed Search can be performed

Parameter	Name	Range	Default
b3-06	Output Current 1 during Speed Search	0.0 to 2.0	Determined by o2-04

- Sets the current injected to the motor at the beginning of Speed Estimation Speed Search as a factor of the motor rated current set in E2-01 (E4-01 for motor 2)
  - If motor speed is relatively slow when the drive starts Speed Search after a long period of baseblock increase the setting value
  - Output current during Speed Search is automatically limited by the drive rated current

b3-10: Speed Search Detection Compensation Gain
b3-14: Bi-Directional Speed Search Selection

J V A

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

Parameter	Name	Range	Default
b3-10	Speed Search Detection Compensation Gain	1.00 to 1.20	1.05

- Increased only if an overvoltage fault occurs when the drive restarts the motor

Parameter	Name	Range	Default
b3-14	Bi-Directional Speed Search Selection	0 or 1	Determined by A1-02

0: Disabled
- Inverter search rotated motor speed in frequency reference direction

1: Enabled
- Inverter detects motor rotation direction in forward and reverse direction

b3-17: Speed Search Restart Current Level

J V A

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

Parameter	Name	Range	Default
b3-17	Speed Search Restart Current Level	0 to 200%	150%

Note: Starting Speed Search a large current can flow into the drive if there is a large difference between estimated frequency and the actual motor speed

Sets current level at which Speed Estimation is restarted:

- Avoiding overcurrent and overvoltage problems
- Set as a percentage of the drive rated current

b3-18: Speed Search Restart Detection Time
b3-19: Number of Speed Search Restarts

J V A

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

Parameter	Name	Range	Default
b3-18	Speed Search Restart Detection Time	0.00 to 1.00 s	0.10 s

- Sets the time that the current must be greater than the level set in b3-17 before Speed Search can be restarted

  Note: Not available for PM motor

Parameter	Name	Range	Default
b3-19	Number of Speed Search Restarts	0 to 10	3

- If the number of restart attempts exceeds the value set to b3-19, the “Ser” (Too Many Speed Search Restarts) fault will occur and the drive will stop
- Digital output set to H2-☐☐ = 1E closes once then the inverter performed a restart after a fault has occurred

b3-24: Speed Search Method Selection
b3-25: Speed Search Wait Time

J V A

V/f | V/f w/PG | OLV | CLV | OLV/PM | AOLV/PM | CLV/PM

Parameter	Name	Range	Default
b3-24	Speed Search Method Selection	0 or 1	0

0: Current Detection Speed Search
1: Speed Estimation Speed Search
Note: Not available for PM motor

Parameter	Name	Range	Default
b3-25	Speed Search Wait Time	0.0 to 30.0 s	0.5 s

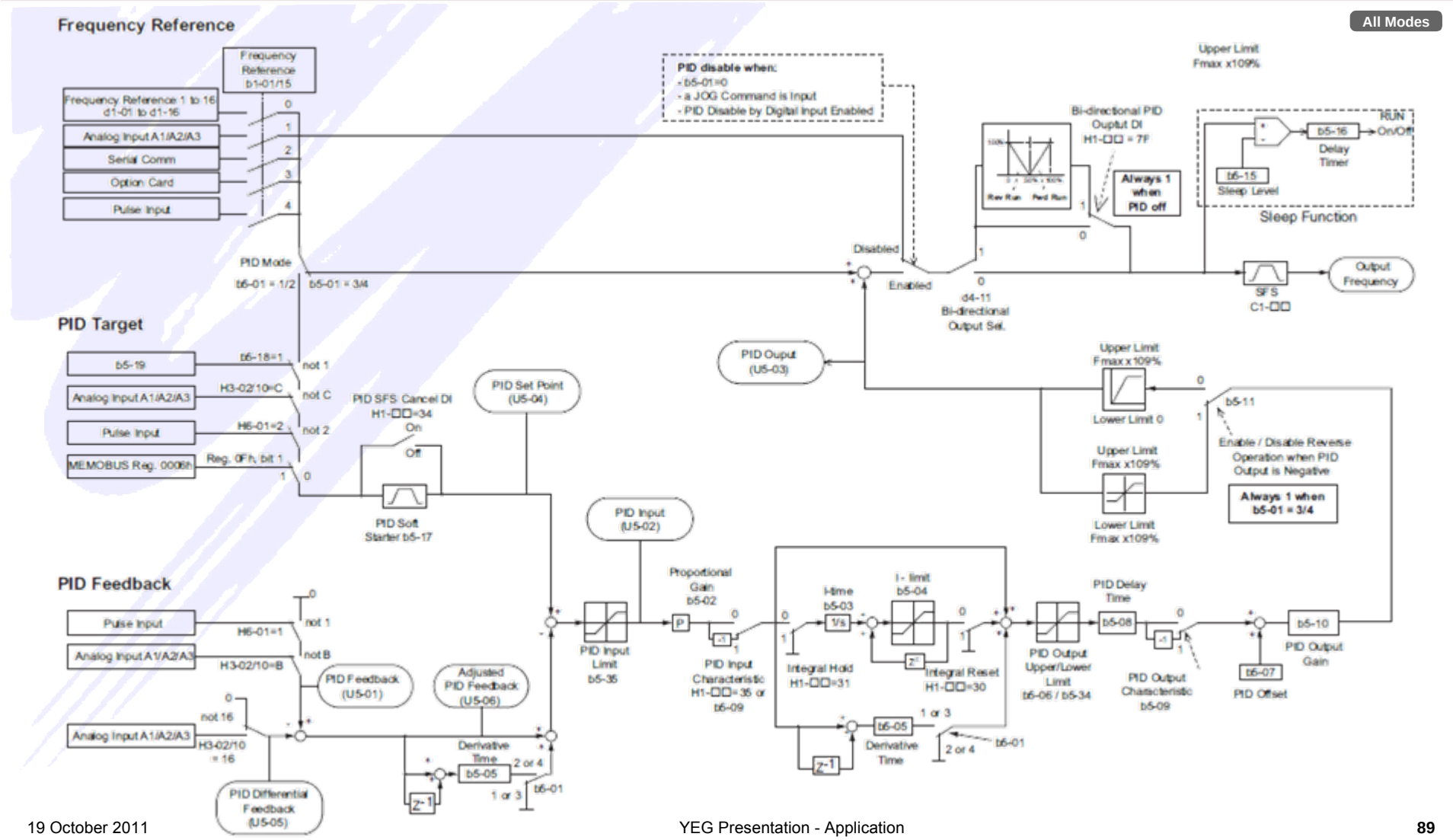
Sets the wait time between Speed Search restarts

- **Increase the wait time if problems occur with overcurrent or overvoltage**
- **Increase the wait time if "Ser" (Too Many Speed Search Restarts) fault occurs**

Technical Training – Application Settings

b5: PID Control

PID Controller

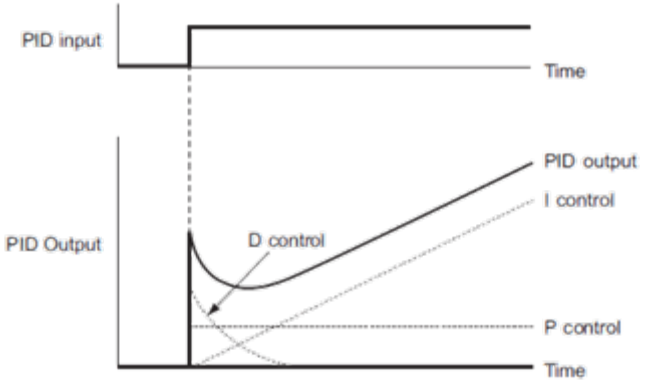


PID Control

J V A

All Modes

- Inverter has a built in PID controller (Proportional + Integral + Derivative)
- The difference between the target and the feedback value (deviation) is fed into the PID controller



- The PID controller adjusts inverter output frequency in order to minimize the deviation

Applications: Speed Control, Pressure Control, Fluid Control, Temperature Control

Note:

DWEZ PID Controller can be used same time

b5-01: PID Function Setting

J V A

All Modes

0: PID disabled

1: Output frequency = PID output 1
- PID output builds the frequency reference. The PID input is D controlled

2: Output frequency = PID output 2
- PID output builds the frequency reference. The PID feedback is D controlled

3: Output frequency = frequency reference + PID output 1
- PID output is added to the frequency reference. The PID input is D controlled

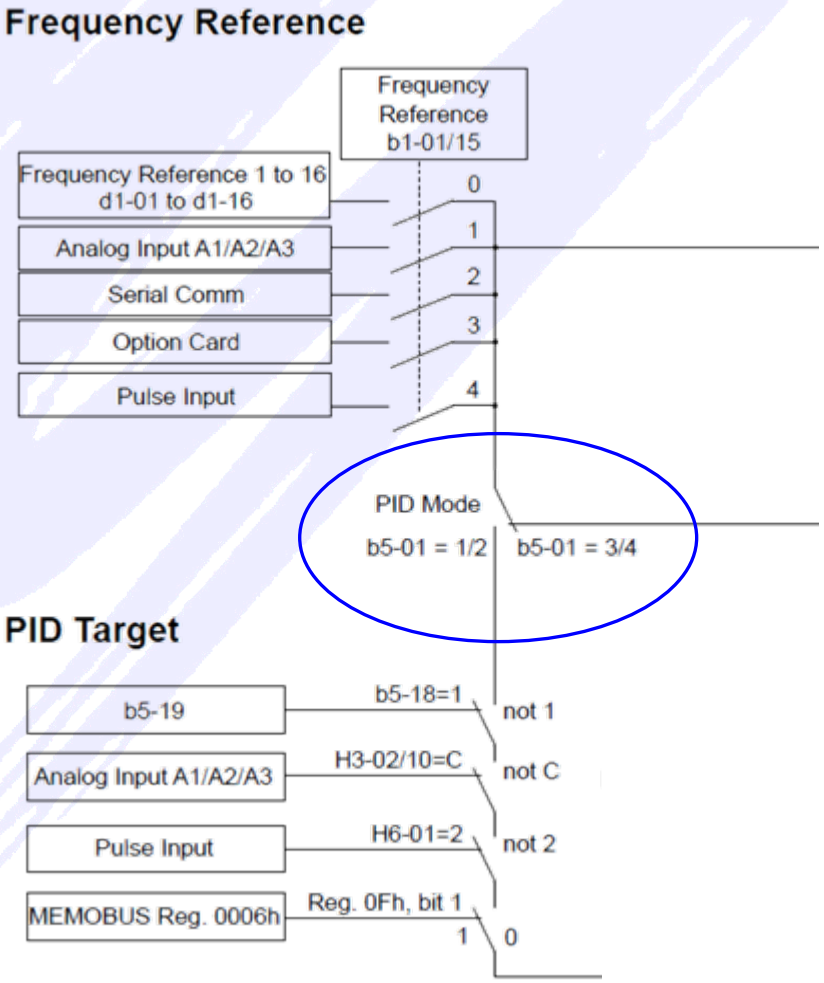
4: Output frequency = frequency reference + PID output 2
- PID output is added to the frequency reference. The PID feedback is D controlled

Note: To disable PID controller by digital input set H1-☐☐ = 19

b5: PID Control

b5-01: PID Function Setting

All Modes



PID Mode 3/4

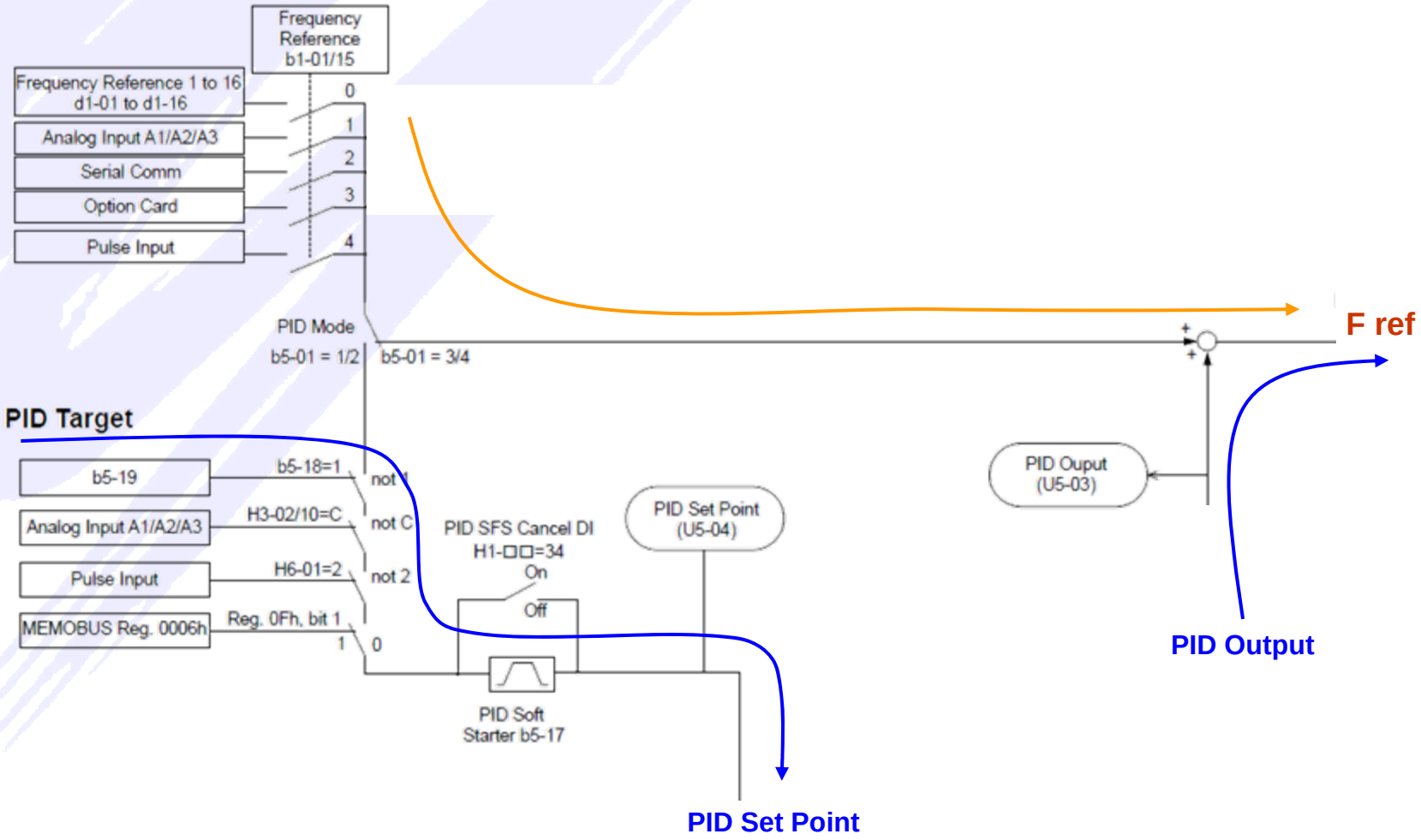
➔ **Winder: Line Speed + PID output for dancer control**

b5: PID Control

b5-19: PID Setpoint Value

J V A

All Modes



b5-18: PID Setpoint Selection
b5-19: PID Setpoint Value

J V A

All Modes

Parameter	Name	Range	Default
b5-18	PID Setpoint Selection	0 or 1	0
b5-19	PID Setpoint Value	0.00 to 100.00%	0.00%

b5-18:

0: Disabled

➔ **Parameter b5-19 is not used as the PID setpoint**

1: Enabled

➔ **Parameter b5-19 is used as PID setpoint**

PID Setpoint Input Methods

J V A

All Modes

The PID setpoint input depends on the PID function setting in parameter b5-01

PID Setpoint Source	Setting
Analogue Input A1	Set H3-02 = C
Analogue Input A2	Set H3-10 = C
Analogue Input A3 1)	Set H3-06 = C
MEMOBUS/Modbus Register 0006H	Set bit 1 in register 000FH to 1 and input the setpoint to register 0006H
Pulse Input RP	Set H6-01 = 2
Parameter b5-19	Set parameter b5-18 = 1 and input the PID setpoint to b5-19

Note: A duplicate allocation of the PID setpoint input will result in an “oPE” (Operator Programming Error) alarm.
1) Analogue input A3 only available for A1000

b5-20: PID Setpoint Scaling

J V A

All Modes

0: Hz (Setpoint and PID monitors are displayed with a resolution of 0.01 Hz)

1: % (Setpoint and PID monitors are displayed with a resolution of 0.01%)

2: r/min (Setpoint and PID monitors are displayed with a resolution of 1 r/min)

3: User Defined

- Parameters b5-38 and b5-39 determine the units and resolution used to display the setpoint in b5-19, and PID monitors U1-01 and U1-04

b5-38: PID Setpoint User Display
b5-39: PID Setpoint Display Digits

J V A

All Modes

Parameter	Name	Range	Default
b5-38	PID Setpoint User Display	1 to 60000	Determined by b5-20
b5-39	PID Setpoint User Digits	0 to 3	Determined by b5-20

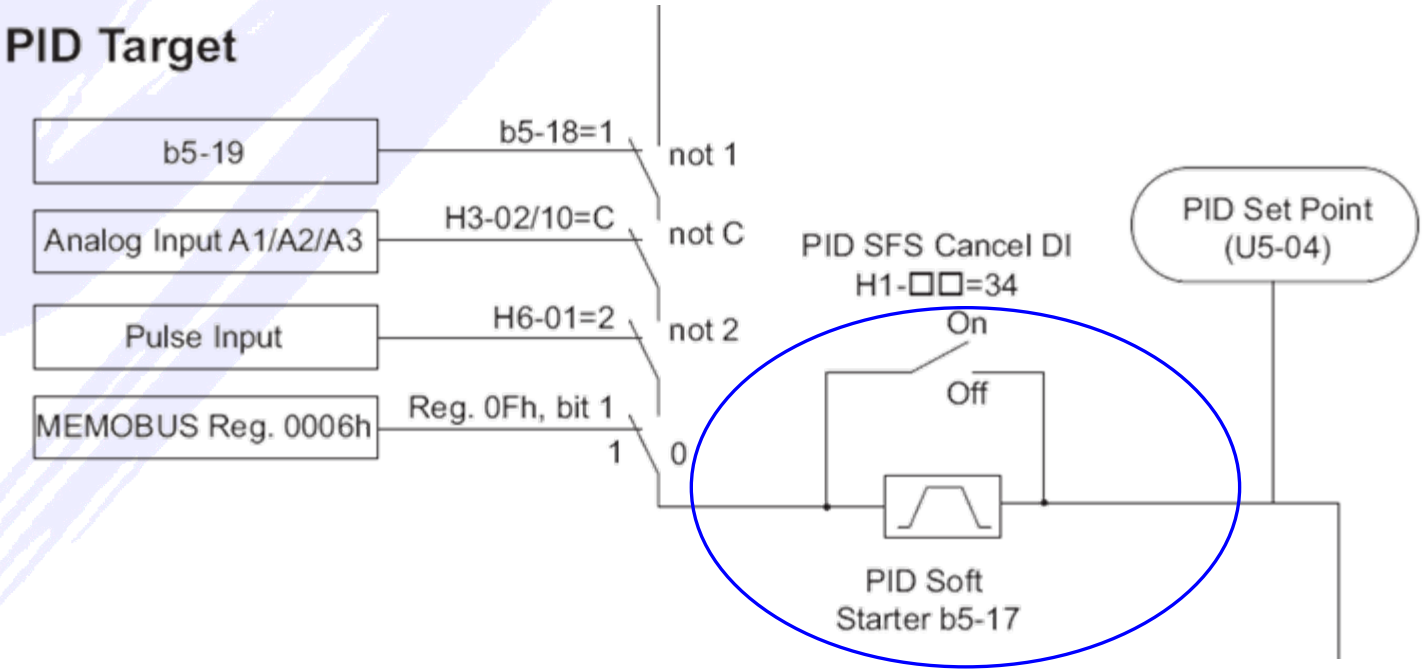
- If b5-20=3, then b5-38 and b5-39 are set as user-defined display for PID setpoint (b5-19) and PID feedback monitors (U5-01, U5-04)
- b5-38 determines the display value when maximum frequency is output
- b5-39 determines the number of digits:
  - 0: No decimal places
  - 1: One decimal place
  - 2: Two decimal places
  - 3: Three decimal places

b5-17: PID Accel/Decel Time

J V A

All Modes

- **The PID acceleration/deceleration time can be disabled using a digital input programmed for “PID SFS cancel” (H1-☐☐ = 34)**



b5-17: PID Accel/Decel Time

J V A

All Modes

Parameter	Name	Range	Default
b5-17	PID Accel/Decel Time	0.0 to 6000.0 s	0.0 s

- PID acceleration/deceleration time is applied on the PID setpoint value

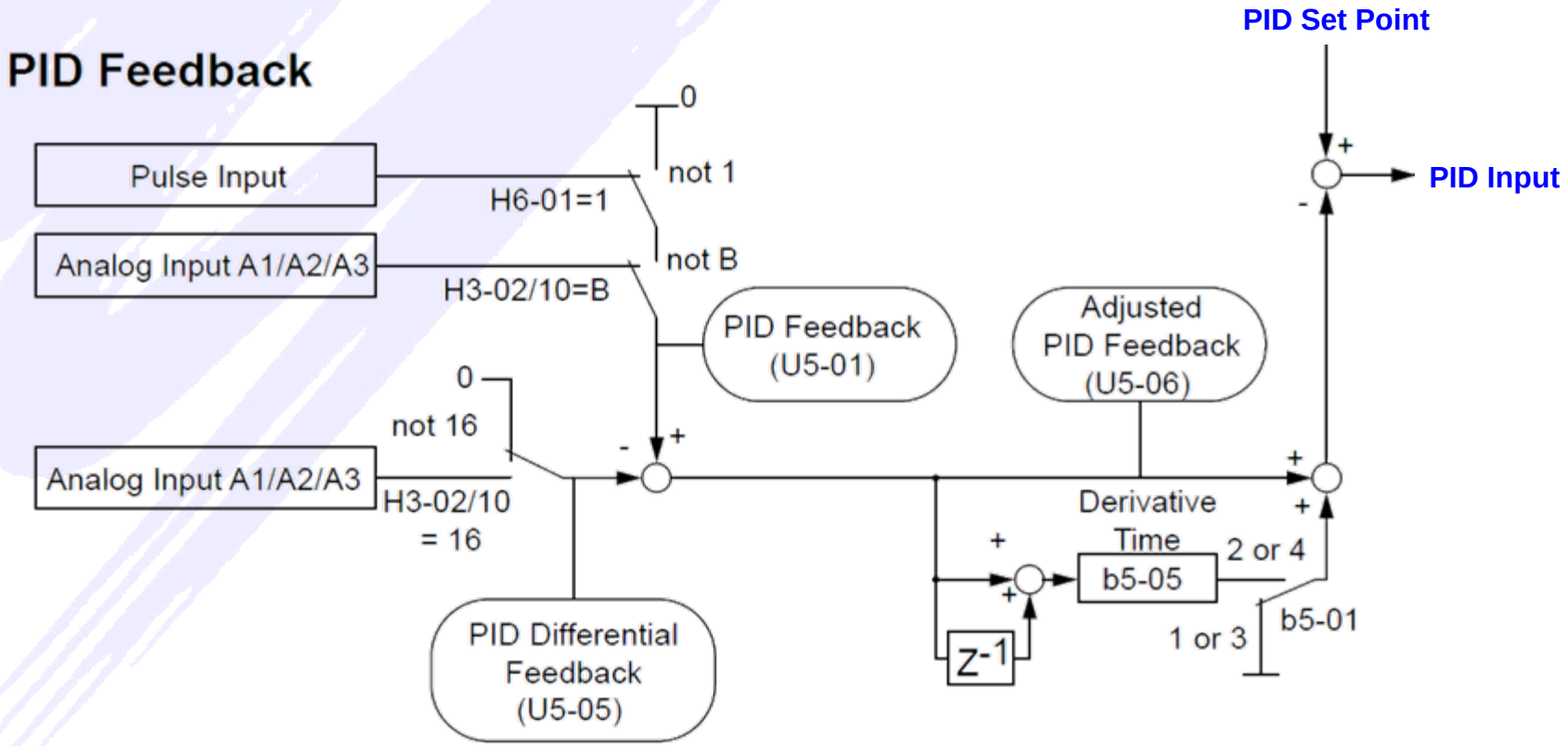
Note: Acceleration times C1-☐☐ are applied after the PID output and can cause following problems when PID setpoint (target) changes quickly:

- Reduce responsiveness of the system
- Can cause hunting or overshoot and undershoot when the setpoint changes quickly
- Using PID acceleration/deceleration time instead helps to avoid such problems

PID Feedback Input Methods

J V A

All Modes



PID Feedback Input Methods

J V A

All Modes

Normal PID Feedback

- One feedback signal can be input for normal PID control

PID Setpoint Source	Setting
Analogue Input A1	Set H3-02 = B
Analogue Input A2	Set H3-10 = B
Analogue Input A3 1)	Set H3-06 = B
Pulse Input RP	Set H6-01 = 1

Note: A duplicate allocation of the PID setpoint input will result in an “oPE” (Operator Programming Error) alarm.
1) Analogue input A3 only available for A1000

PID Feedback Input Methods

J V A

All Modes

Differential Feedback

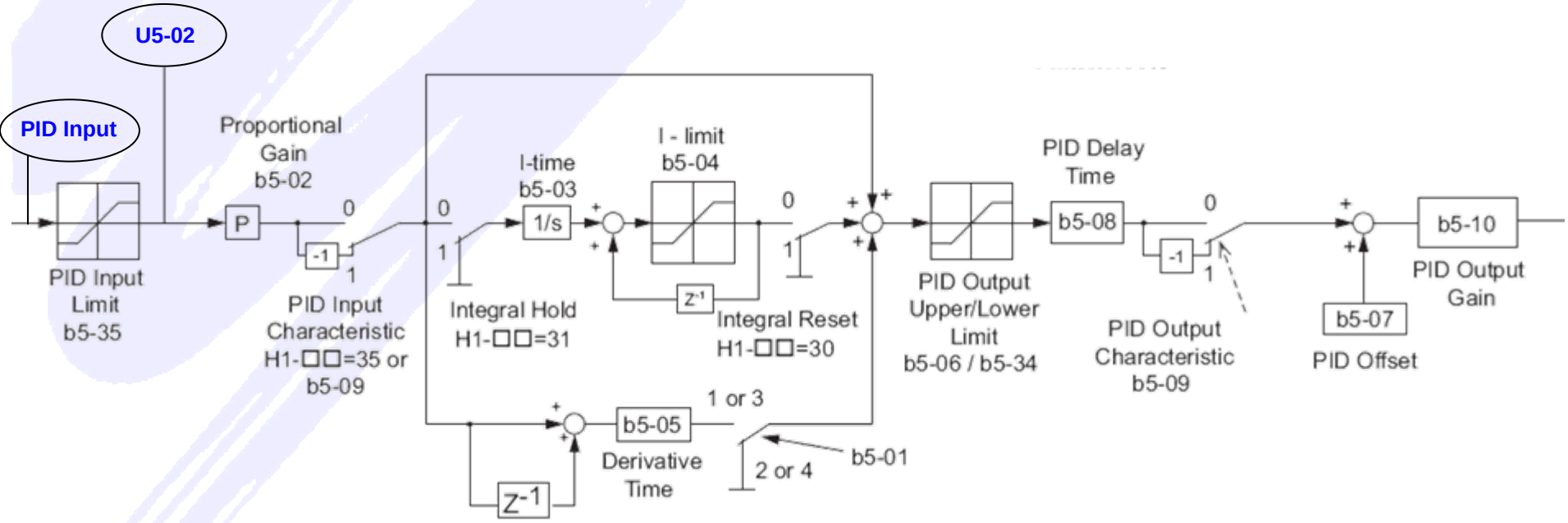
- Two feedback signals can be input for controlling a differential process value
  - ➔ For controlling a pressure, flow, difference
  - ▪ Differential feedback function is automatically enabled when a differential feedback input is assigned

PID Setpoint Source	Setting
Analogue Input A1	Set H3-02 = 16
Analogue Input A2	Set H3-10 = 16
Analogue Input A3 1)	Set H3-06 = 16

Note: A duplicate allocation of the PID setpoint input will result in an “oPE” (Operator Programming Error) alarm
1) Analogue input A3 only available for A1000

PID Controller

All Modes



b5-35: PID Input Limit
b5-02: Proportional Gain Setting (P)

J V A

All Modes

Parameter	Name	Range	Default
b5-35	PID Input Limit	0 to 1000.0%	1000.0%

- Set PID input as a percentage of the maximum output frequency (E1-04)
- Parameter b5-35 acts as a bipolar limit

Parameter	Name	Range	Default
b5-02	Proportional Gain Setting (P)	0.00 to 25.00	1.00

b5-03: Integral Time Setting (I)
b5-04: Integral Limit Setting

J V A

All Modes

Parameter	Name	Range	Default
b5-03	Integral Time Setting (I)	0.0 to 360.0 s	1.0 s
b5-04	Integral Limit Setting	0.0 to 100.0%	100.0%

b5-03:

- To disable proportional gain or integral time set parameter to 0
- To lock the PID integral component set H1-☐☐ = 31

b5-04:

Sets the maximum possible output (in percentage of E1-04) from the integral block

- To suppress big overshoot due to slow responding of control process
- To reset the PID integral component to 0 set H1-☐☐ = 30

b5-05: Derivative Time (D)
b5-09: PID Output Level Selection

J V A

All Modes

Parameter	Name	Range	Default
b5-05	Derivative Time (D)	0.00 to 10.00 s	0.00 s

b5-05:

To disable Derivative Time set parameter to 0

b5-09:

0: Normal Output

- **positive PID input causes an increase in the PID output (direct acting)**

1: Reverse Output

- **Positive PID input causes a decrease in the PID output (reverse acting)**
- **To invert the PID input signal set H1-☐☐ = 35**

b5-34: PID Output Lower Limit
b5-06: PID Output Limit

J V A

All Modes

Parameter	Name	Range	Default
b5-06	PID Output Limit	0.0 to 100.0%	100.0%

- b5-06 sets the maximum possible output in percentage of max. output frequency (E1-04) from PID controller

Parameter	Name	Range	Default
b5-34	PID Output Lower Limit	-100.0 to 100.0%	0.00%

- Lower limit is disabled when set to 0.00%
- Set limit as a percentage of the maximum output frequency (E1-04)

b5-07: PID Offset Adjustment
b5-08: PID Primary Delay Time Constant

J V A

All Modes

Parameter	Name	Range	Default
b5-07	PID Offset Adjustment	-100.0 to 100.0%	0.0%

- b5-07 set as percentage of E1-04

Parameter	Name	Range	Default
b5-08	PID Primary Delay Time Constant	0.00 to 10.00 s	0.00 s

➔ Helpful to suppress oscillation

- Increase than the cycle of the resonant frequency (increasing this time constant may reduce the responsiveness of the drive)

b5-10: PID Output Gain Setting
b5-11: PID Output Reverse Selection

J V A

All Modes

Parameter	Name	Range	Default
b5-10	PID Output Gain Setting	0.00 to 25.00	1.00

b5-10:

- To disable proportional gain set parameter to 0

b5-11:

Determines if a negative PID output can reverses the direction of drive operation or not.

Note: When the PID function is used to trim the frequency reference (b5-01 = 3 or 4), this parameter has no effect and the PID output will not be limited (same as b5-11=1)

0: Reverse Disabled

- Negative PID output will be limited to 0 and the drive output will be stopped

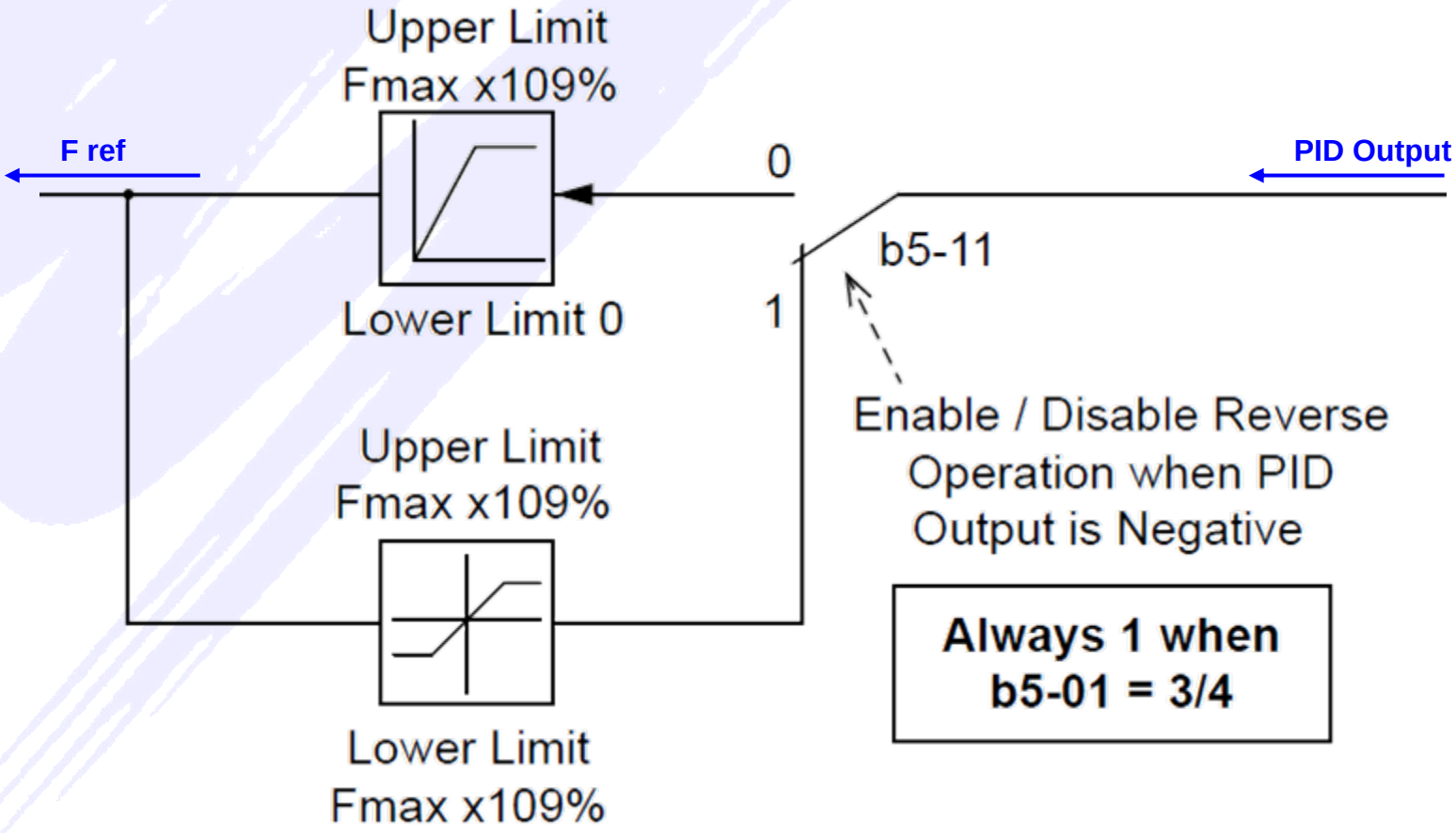
1: Reverse Enabled

- Negative PID output will cause the drive to run in the opposite direction

b5-11: PID Output Reverse Selection

J V A

All Modes



d4-11: Bi-Directional Output Selection

J V A

All Modes

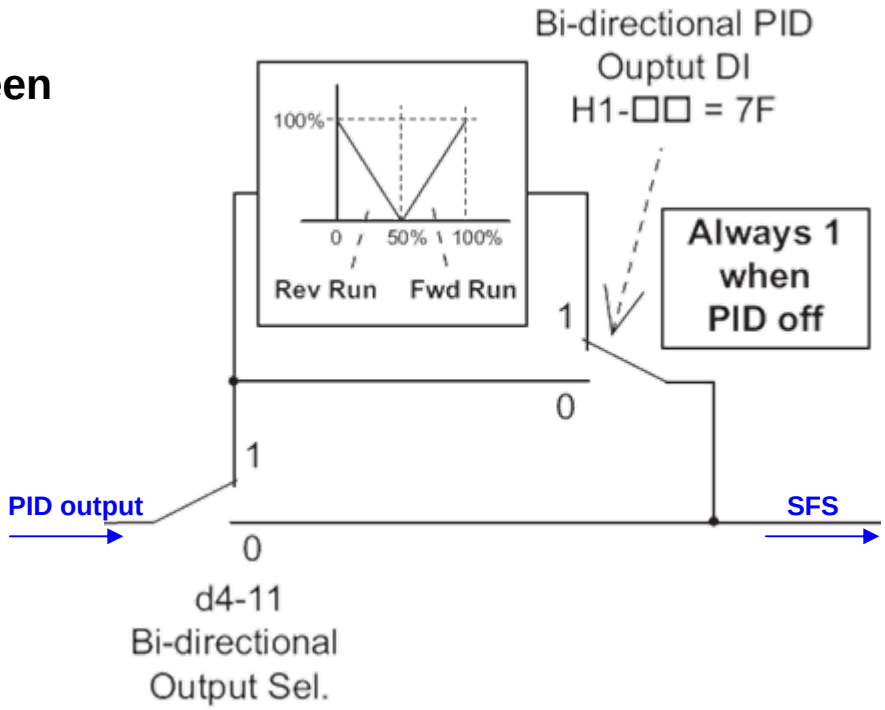
- Enables or disables the conversion of frequency reference or PID output value into bidirectional internal frequency reference
- To enable Bi-directional output by digital input set H1-☐☐ = 7F

0: Disabled

- Operation in the selected direction between 0 to 100% frequency reference or PID output

1: Enabled

- Operation in reverse direction when frequency reference or PID output <50%, else operation in the selected direction



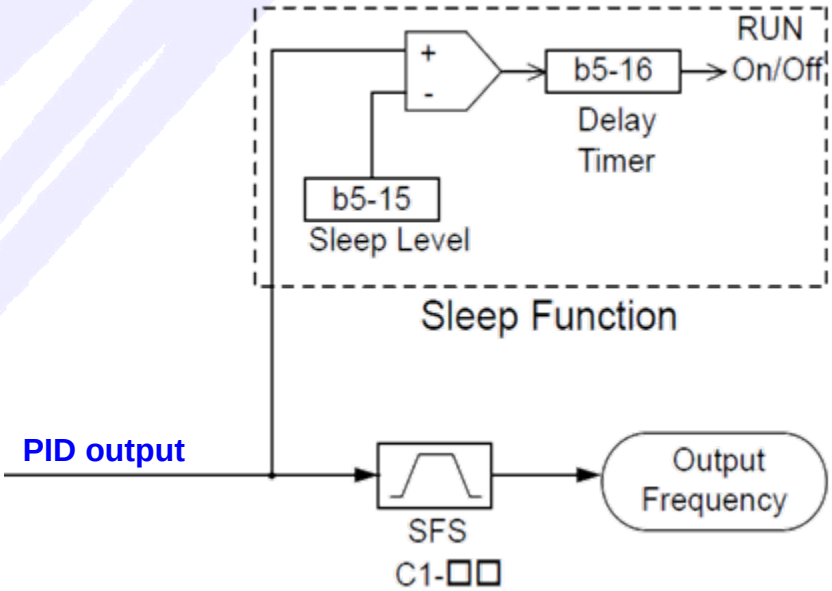
b5: PID Control

PID Sleep function

J V A

All Modes

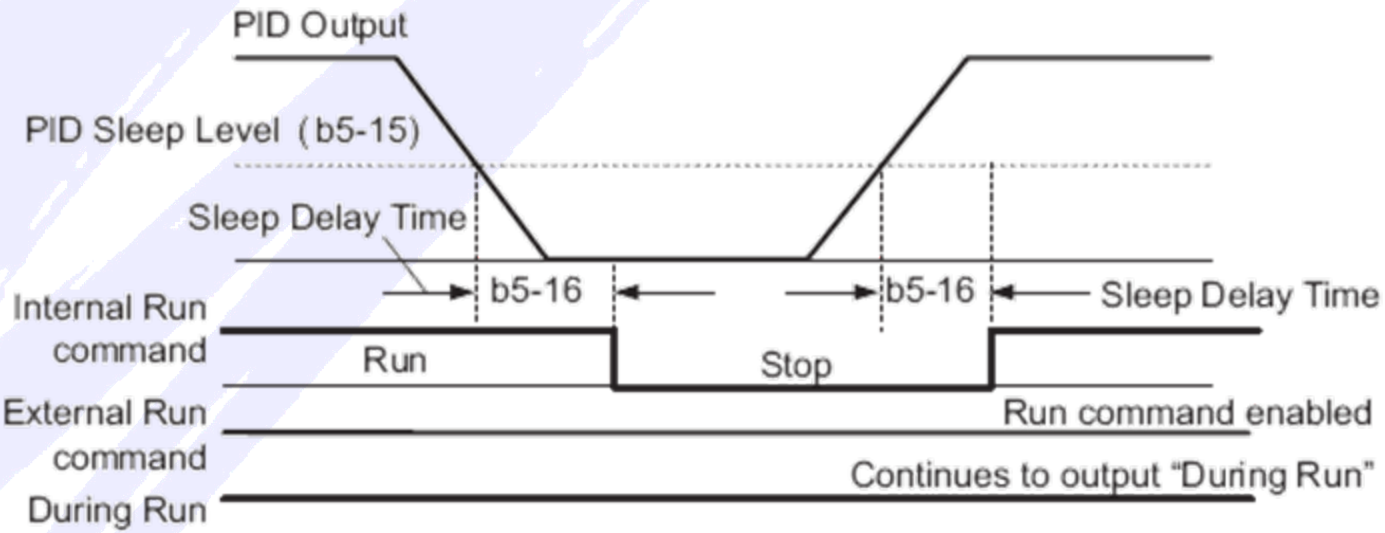
- PID Sleep function stops the drive when the PID output or the frequency reference falls below the PID Sleep operation level for a certain time
- Inverter will resume operating once the PID output or frequency reference rises above the PID Sleep operation level for the specified time



b5: PID Control

PID Sleep function

All Modes



- **Note: PID Sleep function is always active, even if PID control is disabled**
  PID Sleep function stops the motor according to the stopping method in b1-03

b5-15: PID Sleep Function Start Level
b5-16: PID Sleep Delay Time

J V A

All Modes

Parameter	Name	Range	Default
b5-15	PID Sleep Function Start Level	0.0 to 400.0 Hz	0.0 Hz
b5-16	PID Sleep Delay Time	0.0 to 25.5 s	0.0 s

b5-15:

- Inverter starts Sleep function when the PID output or frequency reference is smaller than b5-15 for time set b5-16
- Inverter restart operation when the PID output or frequency reference is above b5-15 for longer than the time set in b5-16

b5-16:

- Delay time to activate or deactivate the PID Sleep function

PID Feedback Loss Detection

J V A

All Modes

Why use? ➔ **PID feedback loss detection is enabled to prevent critical machine conditions (e.g. acceleration to max. frequency) caused by a feedback loss**

Feedback Low Detection

- **PID feedback loss detected when the feedback falls below a certain level for longer than the specified time**
- **This function is set up using parameters b5-12 to b5-14**

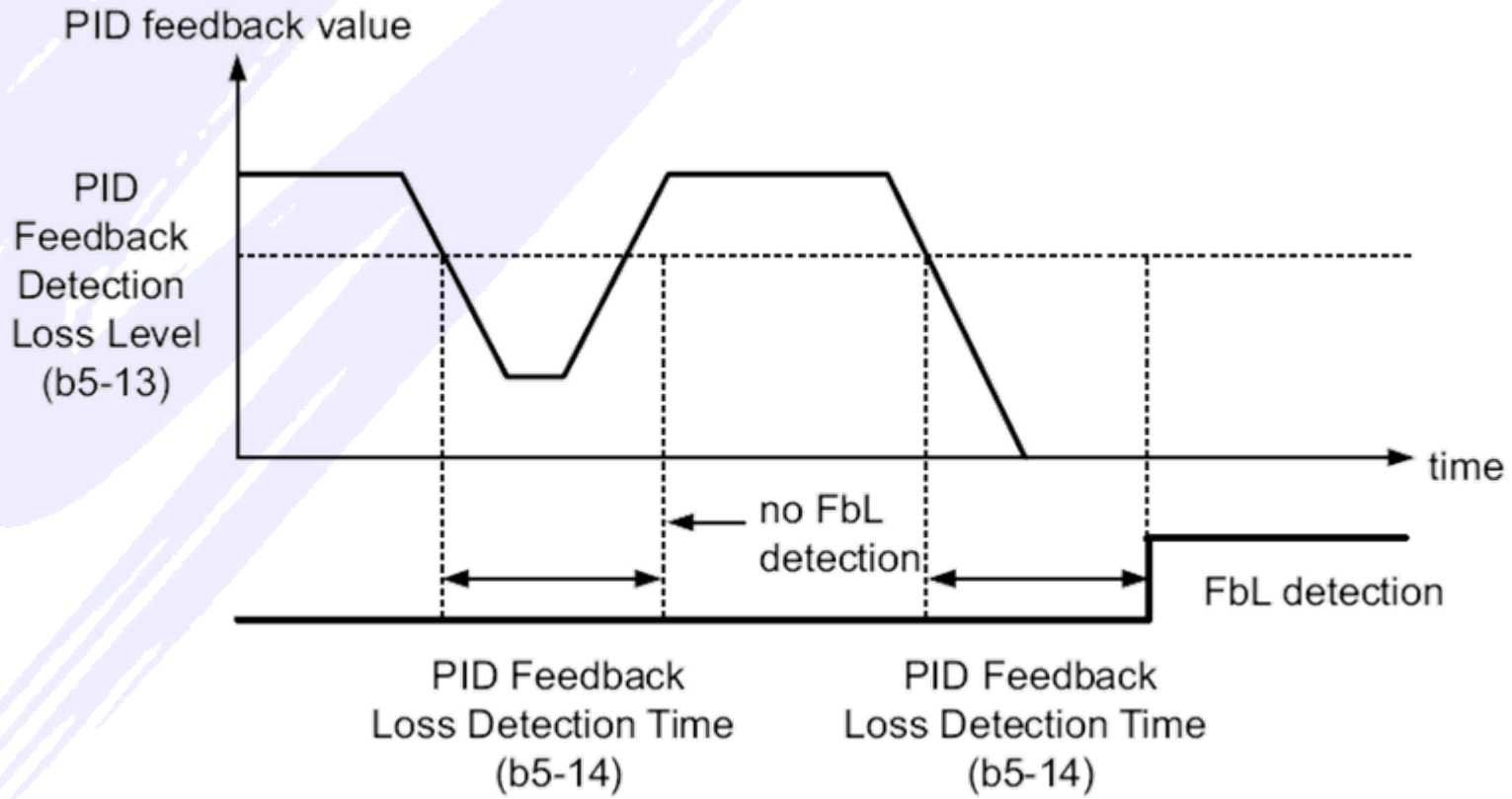
Feedback High Detection

- **PID feedback loss detected when the feedback rises beyond a certain level for longer than the specified time**
- **This function is set up using parameters b5-12, b5-36, and b5-37**

PID Feedback Loss Detection

J V A

All Modes



b5-12: PID Feedback Loss Detection Selection

J V A

All Modes

0: Digital Output Only

- **A digital output set for "PID feedback low" (H2-☐☐ = 3E) will be triggered if the PID feedback value is below the detection level set to b5-13 for the time set to b5-14**
- **A digital output set for "PID feedback high" (H2-☐☐ = 3F) will be triggered if the PID feedback value is above the detection level set to b5-36 for longer than times set to b5-37**
- **No fault and no alarm is displayed on the digital operator. The drive will continue operation**
- **When feedback value leaves the loss detection range, the output is reset**

b5-12: PID Feedback Loss Detection Selection

J V A

All Modes

1: Feedback Loss Alarm

- **If PID feedback value falls below the level set to b5-13 for time set to b5-14, “FBL” (Feedback Low) alarm will be displayed and a digital output set for “PID feedback low” (H2-☐☐ = 3E) will be triggered**
- **If PID feedback value exceeds the level set to b5-36 for longer than the time set to b5-37, a “FBH - Feedback High” alarm will be displayed and a digital output set for “PID feedback high” (H2-☐☐ = 3F) will be triggered**
- **Both events trigger an alarm output (H2-☐☐ = 10) and the drive will continue operation**
- **When PID feedback value leaves the loss detection range the alarm and outputs are reset**

b5-12: PID Feedback Loss Detection Selection

J V A

All Modes

2: Feedback Loss Fault

- If the PID feedback value falls below the level set to b5-13 for time set to b5-14, “FbL” (Feedback Low) fault will be displayed
- If the PID feedback value exceeds the level set to b5-36 for longer than the time set to b5-37, a “FbH” (Feedback High) fault will be displayed
- Both events trigger a fault output (H2-☐☐ = E) and cause the drive to stop the motor

3: Digital output only, even if PID is disabled by digital input

- Same as b5-12 = 0
- Detection is still active even if PID is disabled by a digital input (H1-☐☐ = 19)

b5-12: PID Feedback Loss Detection Selection

J V A

All Modes

4: Feedback loss alarm, even if PID is disabled by digital input (H1-☐☐ = 19)

- **Same as b5-12 = 1**
- **Detection is still active even if PID is disabled by a digital input**

5: Feedback loss fault, even if PID is disabled by digital input (H1-☐☐ = 19)

- **Same as b5-12 = 2**
- **Detection is still active even if PID is disabled by a digital input**

b5-13: PID Feedback Low Detection Level
b5-14: PID Feedback Low Detection Time

J V A

All Modes

Parameter	Name	Range	Default
b5-13	PID Feedback Low Detection Level	0 to 100%	0%

- The PID feedback has to fall below this level for longer time then b5-14 before feedback loss is detected

Parameter	Name	Range	Default
b5-14	PID Feedback Low Detection Time	0.0 to 25.5 s	1.0 s

- Sets the time that PID feedback has to fall below b5-13 before feedback loss is detected

b5-36: PID Feedback High Detection Level
b5-37: PID Feedback High Detection Time

J V A

All Modes

Parameter	Name	Range	Default
b5-36	PID Feedback High Detection Level	0 to 100%	0%

- The PID feedback has to exceed this level for longer time then b5-37 before feedback loss is detected

Parameter	Name	Range	Default
b5-37	PID Feedback High Detection Time	0.0 to 25.5 s	1.0 s

- Set the time that PID feedback has to exceed b5-36 before feedback loss is detected

b5-40: Frequency Reference Monitor Content During PID

J V A

All Modes

0: Frequency Reference after PID

- Monitor U1-01 displays frequency reference increased or reduced for the PID output (Softstarter/SFS Input)

1: Frequency Reference

- Monitor U1-01 displays the frequency reference value

Technical Training – Application Settings

U5: PID Monitors

U5-01 to U5-06: PID Monitors

J V A

All Modes

Parameter	Name	Discription	Analogue Output Level	Unit
U5-01	PID Feedback	Displays the PID feedback value	10 V: 100%	0.01% 1)
U5-02	PID Input	Displays the amount of PID input (deviation between PID setpoint and feedback)	10 V: 100%	0.01%
U5-03	PID Output	Displays PID control output	10 V: 100%	0.01%
U5-04	PID Setpoint	Displays the PID setpoint	10 V: 100%	0.01%
U5-05	PID Differential Feedback	Displays the 2nd PID feedback value if differential feedback is used (H3-☐☐ = 16)	10 V: 100%	0.01%
U5-06	PID Adjusted Feedback	Displays the difference of both feedback values if differential feedback (U5-01 - U5-05) is used. If differential feedback is not used, then U5-01 and U5-06 will be the same	10 V: 100%	0.01%

1) Unit depends on b5-20

Technical Training – Application Settings

q: DriveWorksEZ Parameters
r: DriveWorksEZ Connection Parameters

q1-01 to q6-07: DriveWorksEZ Parameters
r1-01 to r1-40: DriveWorksEZ Connection Parameters

J V A

All Modes

These parameters are reserved for use with DriveWorksEZ

- **q-Parameters can be edit using inverter operator**
- **r-Parameters can not be edit**
- **q-Parameter and r-Parameter can not be edit or copy by DriveWizardPlus or Copy Unit**

Note: Refer to the DriveWorksEZ manual for more information
For DriveWorksEZ Pro license DriveWorksEZ training is necessary

Technical Training – Application Settings

U8-01 to U8-13: DriveWorksEZ Monitors

J V A

All Modes

Parameter	Name	Discription	Analogue Output Level	Unit
U8-01 to U8-10	DriveWorksEZ Custom Monitor 1 to 10	DriveWorksEZ Custom Monitor 1 to 10	10 V: 100%	0.01%
U5-02	DriveWorksEZ Version Control Monitor 1 to 3	DriveWorksEZ Version Control Monitor 1 to 3	No signal output available	–

Technical Training – Application Settings