Digital DRIVE for Brushless motors
SMD Series

Asynchronous mode Quick Start guide

SMD-Asynchronous Quick Start Guide-2012-EN

Asynchronous Quick Start Guide

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II. Introduction

An asynchronous motor can be controlled in two ways:
- Scalar (called V/F)
- Vector

SMD only use the scalar mode

II.1 Scalar mode

This is to control the motor in frequency (50Hz = nominal speed of the motor, 25Hz = half of the nominal speed), but also to vary the voltage so as to keep the V / F ratio constant. In this way, the flow in the motor is constant. The motor current (= torque) is directly proportional to the flux. So, the torque remains constant over the entire speed range and therefore even at low or zero speed. This then produces heating in the motor.
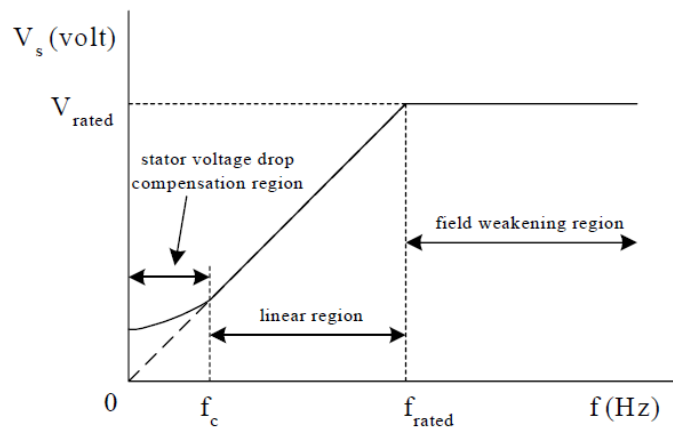
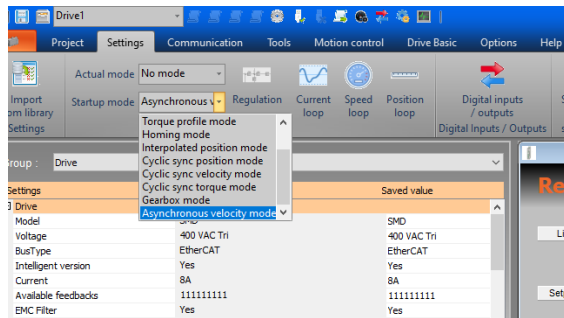# III. Drive Studio using
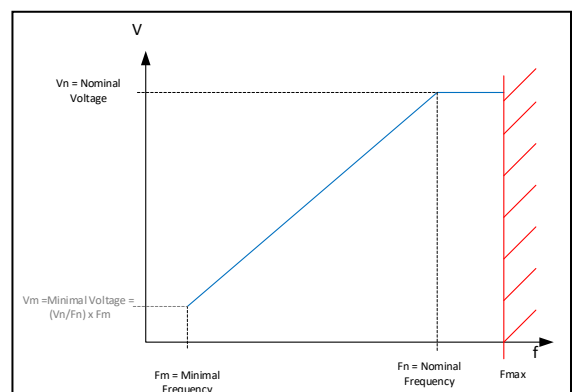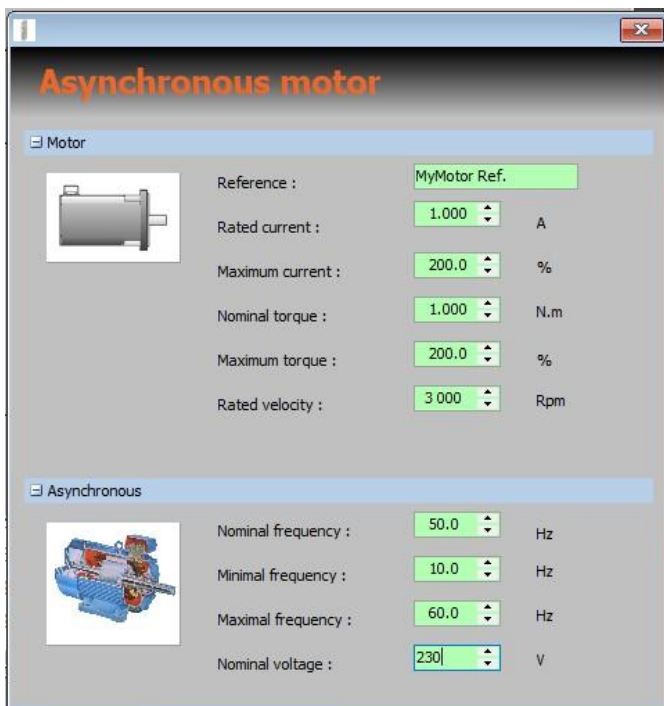
Note: No control of the asynchronous motor via DriveStudio is possible. Will only be used for setting and viewing the speed in progress.

III.1 Motor configuration

The mode must be placed to "Asynchronous mode". By setting the Startup mode to "Asynchronous", the SMD will directly start to the mode of operation Asynchronous.

Configure the motor characteristics:

III.2 Asyncrhonous configuration

Different modes are offered to control the motor:

Motion : Asynchronous		
Command Mode	Stop	Stop
Stop Mode	Deceleration ramp	Deceleration ramp
Velocity input	Analog input	Analog input
Preselection table 1 (Hz)	50.0	50.0
Preselection table 2 (Hz)	50.0	50.0
Preselection table 3 (Hz)	50.0	50.0
Preselection table 4 (Hz)	50.0	50.0
Preselection table 5 (Hz)	50.0	50.0
Preselection table 6 (Hz)	50.0	50.0
Preselection table 7 (Hz)	50.0	50.0
Acceleration time (s)	5.0	5.0
Deceleration time (s)	5.0	5.0

Command Mode:
- On/Off + Direction: Use Inputs E1/E2 with respective function On-Off / Direction
- Forward / Reverse: Use Inputs E1/E2 with respective function On-forward / On-reverse
- Stop: No move
- On Forward: Set motor On and turn into forward sense (to be used with communication link)
- On Reverse: Set motor On and turn into reverse sense (to be used with communication link)

Stop Mode: Configure the manners to stop the motor when Off request is done.
- Deceleration ramp: execute a deceleration ramp configured by the parameter "Deceleration time"
- Free wheel: Switch off the power on the motor and let it into free wheel.
- E3 input: selection is done by E3 input. Low level corresponds to Deceleration ramp, High level to Free wheel.

Velocity input: Select the input use to set the wanted velocity. Used in combination of input {E6, E5, E4}.
If Inputs E6, E5, E4 are set to 0:
- Analog input: The input voltage {0...10V} indicate the wanted velocity {0...Fmax}. The analog input can be configured to set an offset and a gain (refer to Analog input configuration parameters).
- Target velocity 0x60FF (0.1%): Used with communication link, the object 0x60FF is used as reference frequency with step of 0.1% of FMax.
- Target velocity 0x60FF (0.1Hz): Used with communication link, the object 0x60FF is used as reference frequency with step of 0.1Hz.

Else the binary number given by E6 to E4, allow to select the preselected value with the parameters "Preselection table n" with n the number given by E6, E5 and E4.

IV. SMD implementation

The SMD has the following parameters in order to be able to operate any asynchronous motor:

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Asynchronous operating parameters 0x2709
- Command mode:
  - Discrete input (E1, E2): On/Off + Direction
  - Discrete input (E1, E2): Forward + Reverse
  - Stop
  - ON Run Forward (At the start, if in this value, force to "Stop")
  - ON Reverse (At the start, if in this value, force to "Stop"

- Stop mode:
  - Deceleration ramp
  - Freewheel
  - E3 (0 = Ramp, 1 = Freewheel)

- Setpoint source {when E4, E5, E6 = 0, 0, 0}
  - Analog input 0
  - …
  - Analogue input n
  - Communication bus in 0.1% (TargetVelocity object 0x60FF)
  - Communication bus in 0.1Hz (TargetVelocity object 0x60FF)

Note : (0V, 0% = Fmin, 10V, 100% = FMax)

- Pre-selection speed table {when E4, E5, E6 <> 0, 0, 0}
  - Preset speed 1 [10.0Hz… 400.0Hz]
  - …
  - Preset speed 7 [10.0Hz ... 400.0Hz]

- Acceleration time (time to go from 0 to VNominal). Unit in 0.1s

- Deceleration time (time to go from VNominal to 0). Unit in 0.1s

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Asynchronous motor parameters 0x2113

- Nominal current (Same as "Rated current Object 0x6075)
- Nominal Speed (Same as MotorParameter 0x2112.9)
- Nominal Frequency [10.0Hz..400.0Hz]
- Minimum Frequency [0.0Hz..FNom [
- Maximum Frequency [FNom..400.0Hz]
- Nominal Voltage [100.0V..480.0V]

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Analog Input n Parameters 0x2403
- Offset in 1st (integer in steps of 0.001V: {-10000 .. + 10000} = {-10,000V .. + 10,000V}
- Gain in 2nd (integer in steps of 0.1: {1 ... 10000} = {0.01 .. 100.00}
- Tau filtering (integer in ms)

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To adapt to the DS402 standard, a new operating mode is created: Velocity Asynchronous Mode. (Refer to the MC guide)
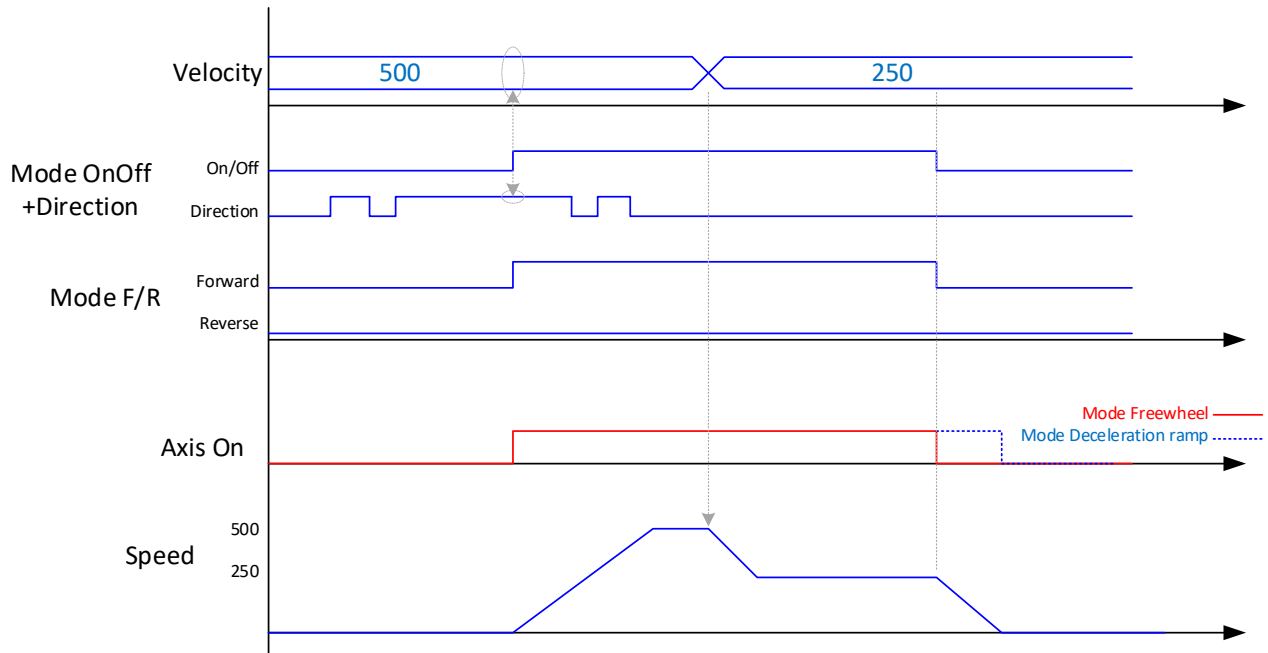
- If the speed reference source changes during a movement, the new speed will be taken into account
- The direction of rotation is only taken into account when torque On.
- The speed instructions are not limited to writing (preselection table, etc.). On the other hand, when it is executed, the actual instruction applied will be limited to {FMin..FMax}
- **No control of the asynchronous motor via DriveStudio is possible. Will only be used for setting and viewing the speed in progress.**
- If fault, it must be acknowledged as in VALIDATION mode: When "Axis Off" is requested. (Via input E1 / E2 or COM bus depending on command mode)

IV.1   Specific dictionary object detail

IV.1.1 *0x2709: Asynchronous velocity mode*

Allowing to drive the Asynchronous specific mode:

Attribute	Value
Index	0x2709
Name	Asynchronous Velocity Mode
Object Code	Record
Data Type	parameters
Category	Mandatory

Entry description

Attribute	Value		
Sub-Index	0x00		
Description	Highest sub-index supported		
Entry Cateory	Mandatory		
Access	c		
PDO Mapping	None		
Value Range	0x0C		
Default Value	0x0C		
Sub-Index	0x01		Control Mode
Description	Control Mode		0: TOR input. {E1, E2} = {M/A, Direction}
Entry Cateory	Mandatory		1: TOR input. {E1, E2} = {ClockWise, AntiClockWise}
Access	rw-NV		2: Stopped
PDO Mapping	None		3: ON ClockWise (At startup time, if into this value, return to Stopped (2))
Value Range	Unsigned16		4: ON AntiClockWise (At startup time, if into this value, return to Stopped (2))
Default Value	2		
Sub-Index	0x02		Stop Mode
Description	Stop Mode		0: Deceleration rampe
Entry Cateory	Mandatory		1: Freewheel
Access	rw-NV		2: According Input TOR E3. 0 = Deceleration Rampe, 1 = Freewheel
PDO Mapping	None		
Value Range	Unsigned16		
Default Value	0		
Sub-Index	0x03		Velocity input
Description	Velocity Input		Indicate the Source velocity when Input TOR {E4, E5, E6} = {0,0,0}
Entry Cateory	Mandatory		0x00: Analog Input 0 : 0V => 0% = FMin. 10V => 100% = FMax
Access	rw-NV		0x10: By communiation bus object 0x60FF TargetVelocity. Unit is in 0,1%
PDO Mapping	None		0x11: By communiation bus object 0x60FF TargetVelocity. Unit is in 0,1Hz
Value Range	Unsigned16		
Default Value	0		
Sub-Index	0x04		Preselection velocity Table Value 1
Description	Preselection velocity Table Value 1		
Entry Cateory	Mandatory		
Access	rw-NV		Applied velocity (in 0.1HZ) when Input TOR {E4, E5, E6} = {0,0,1}
PDO Mapping	None		
Value Range	Unsigned16		
Default Value	100		
Sub-Index	0x05		Preselection velocity Table Value 2
Description	Preselection velocity Table Value 1		
Entry Cateory	Mandatory		
Access	rw-NV		Applied velocity (in 0.1HZ) when Input TOR {E4, E5, E6} = {0,1,0}
PDO Mapping	None		
Value Range	Unsigned16		
Default Value	100		
Sub-Index	0x06		Preselection velocity Table Value 3
Description	Preselection velocity Table Value 1		
Entry Cateory	Mandatory		
Access	rw-NV		Applied velocity (in 0.1HZ) when Input TOR {E4, E5, E6} = {0,1,1}
PDO Mapping	None		
Value Range	Unsigned16		
Default Value	100		
Sub-Index	0x07		Preselection velocity Table Value 4
Description	Preselection velocity Table Value 1		
Entry Cateory	Mandatory		
Access	rw-NV		Applied velocity (in 0.1HZ) when Input TOR {E4, E5, E6} = {1,0,0}
PDO Mapping	None		
Value Range	Unsigned16		
Default Value	100		
Sub-Index	0x08		Preselection velocity Table Value 5
Description	Preselection velocity Table Value 1		
Entry Cateory	Mandatory		
Access	rw-NV		Applied velocity (in 0.1HZ) when Input TOR {E4, E5, E6} = {1,0,1}
PDO Mapping	None		
Value Range	Unsigned16		
Default Value	100		

Sub-Index	0x09
Description	Preselection velocity Table Value 1
Entry Cateory	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Unsigned16
Default Value	100

Preselection velocity Table Value 6

Applied velocity (in 0.1HZ) when Input TOR {E4, E5, E6} = {1,1,0}

Sub-Index	0x0A
Description	Preselection velocity Table Value 1
Entry Cateory	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Unsigned16
Default Value	100

Preselection velocity Table Value 7

Applied velocity (in 0.1HZ) when Input TOR {E4, E5, E6} = {1,1,1}

Sub-Index	0x0B
Description	Acceleration time
Entry Cateory	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Unsigned16
Default Value	5000

Acceleration time

Allow to configure the acceleration rampe. Value is the time given in 1/10s to pass from 0 to Nominal Speed.

Sub-Index	0x0C
Description	Deceleration time
Entry Cateory	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Unsigned16
Default Value	5000

Deceleration time

Allow to configure the deceleration rampe. Value is the time given in 1/10s to pass from Nominal Speed to 0.

IV.1.2 *0x2113 – Asynchronous Motor Parameters*

Object description	
Attribute	**Value**
Index	0x2113
Name	Asynchronous Motor Parameters
Object Code	Record
Data Type	Motor Parameters
Category	Mandatory

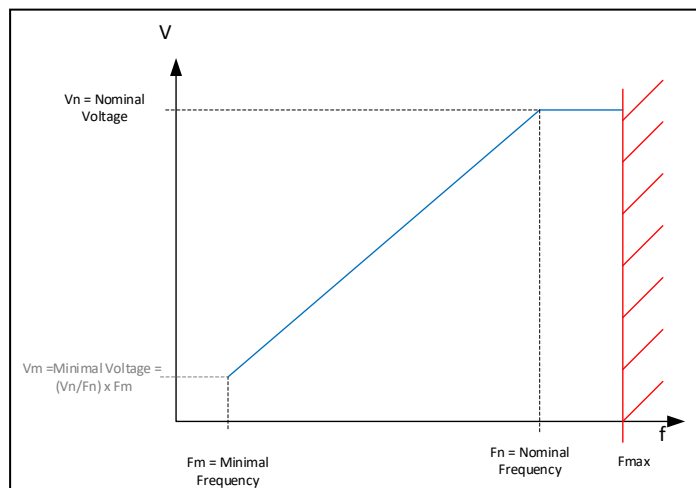| Entry description	
Attribute	**Value**
Sub-Index	0x00
Description	Highest sub-index supported
Entry Cateory	Mandatory
Access	c
PDO Mapping	Tx
Value Range	0x04
Default Value	0x04
Sub-Index	0x01
Description	Nominal Frequency
Entry Cateory	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Unsigned16
Default Value	500
Sub-Index	0x02
Description	Minimal Frequency
Entry Cateory	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Unsigned16
Default Value	100
Sub-Index	0x03
Description	Maximal Frequency
Entry Cateory	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Unsigned16
Default Value	600
Sub-Index	0x04
Description	Nominal Voltage
Entry Cateory	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Unsigned16
Default Value	2300

Nominal Frequency
 Indicate the nominal use frequency of the motor.
Unit is is 1/10 Hz : [10.0Hz..400.0Hz]

Minimal Frequency
 Indicate the minimal use frequency of the motor.
Unit is is 1/10 Hz : [10.0Hz... Nominal Frequency]

Maximal Frequency
 Indicate the maximal use frequency of the motor.
Unit is is 1/10 Hz : [Nominal Frequency..400.0Hz]

Nominal Voltage
 Indicate the nominal use voltage of the motor.
Unit is is 1/10 V : [100.0V..480.0V]

IV.1.3 *0x2403 – Analog Inputs*

To configure and get the analog input. (Only on a specific version of SMD)

Object description

Attribute	Value
Index	0x2403
Name	Analog inputs
Object Code	Record
Data Type	Input value
Category	Mandatory

Entry description

Attribute	Value
Sub-Index	0x00
Description	Highest sub-index supported
Entry Cateory	Mandatory
Access	c
PDO Mapping	Tx
Value Range	0x03
Default Value	0x03

Attribute	Value
Sub-Index	0x01
Description	Analog Input
Entry Cateory	Mandatory
Access	ro
PDO Mapping	Tx
Value Range	Real
Default Value	0x0000

Analog value:
Return the current analog value in volt (Only if option available)
[0.0 .. 10.5V]

Attribute	Value
Sub-Index	0x02
Description	Filter Tau
Entry Cateory	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	unsigned16
Default Value	50

Filter Tau
Define the time constant of the filter in miliseconds

Attribute	Value
Sub-Index	0x03
Description	Filtered Analog Value
Entry Cateory	Mandatory
Access	ro
PDO Mapping	None
Value Range	Real
Default Value	0x0000

Filtered Analog Value:
return the same as object 0x2403.01 but with a filter.

Attribute	Value
Sub-Index	0x04
Description	Offset
Entry Cateory	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	signed16
Default Value	0

Offset:
Apply an offset value on the returned analog value
[-10000 ... +10000] = [-10.000V ... +10.000V]

Attribute	Value
Sub-Index	0x05
Description	Gain
Entry Cateory	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	unsigned16
Default Value	10

Gain:
AFTER Offset applied Multiply input by thus amplification
[1 ... 10000] = [0.01 ... 100.00]

Read AnalogValue = (Analog Input + Offset) x Gain

Revision	Edited by	Date	Modification
R2112	AG (SERAD)	24/03/2021	Organization modifications
R2109	AG (SERAD)	03/03/2021	Add details
R2012	AG (SERAD)	16/03/2020	First edition