PMSM VDQ Section (Archived)

> The PMSM VDQ machine model and its associated **Hardware Configurations** have been archived. If starting a new project, consider using the **Dual PMSM BLDC Machine Model** instead.

The PMSM VDQ Machine model implements a three-phase permanent magnet synchronous machine with a resolver, encoder, and hall effect sensor.

PMSM VDQ Configuration Page

In the **System Explorer** window configuration tree, expand the **Power Electronics Add-On** custom device and select **Circuit Model >> PMSM VDQ** to display this page. Use this page to configure the PMSM VDQ machine model.

This page includes the following components:

Name	Specifies the name of the machine model.
Description	Specifies a description for the machine model.
Motor Configuration	
Motor Type	Choose from one of the following types. The motor configuration parameters automatically populate depending on the selected **Motor Type**. • Constant Parameter • Variable Parameter

	Symbol	Units	Default	Description
Inertia		kgm^2	1	Moment of inertia of the electric motor. This value must be equal to or greater than 0.
Friction Coefficient			0	Friction coefficient of the electric motor. This value must be equal to or greater than 0.

	Symbol	Units	Default	Description
Coil Base Temperature	$T_{c\text{-}base}$	Kelvin	200	Base temperature of the motor coil. This value must be equal to or greater than 0.
Coil Temperature Coefficient	k_c	1/Kelvin	0	Coefficient for temperature correction of the motor resistance. The material of the coil determines this value.
Magnet Base Temperature	$T_{m\text{-}base}$	Kelvin	200	Base temperature of the motor magnet. This value must be equal to or greater than 0.
Magnet Temperature Coefficient	k_m	1/Kelvin	0	Coefficient for temperature correction of the magnet flux. The material of the magnet determines this value.

Use the Input Mapping Configuration to route signals to the **Voltage Phase A**, **Voltage Phase B**, and **Voltage Phase C** inputs of the machine model. Available routing options may vary depending on the selected **Hardware Configuration**.

Group	Specifies the group that will be routed to the input voltages of the machine. The available routing options are defined by the selected Hardware Configuration, however it is typical to see the following options by default: • **Measurements** - eHS circuit model measurements
Element	Specifies the index of the measurement in the group that has been selected as the input voltage of the machine.

PMSM VDQ Section Channels

This section includes the following custom device channels:

Channel Name	Type	Units	Default Value	Description

Enable	Input		0	Set this channel to one of the following values: • **0** - Disables the machine model. • **1** - Enables the machine model.
Load Torque	Input	Newton Meters	0Nm	Torque externally applied to the shaft of the machine. This parameter is used only if **Force Speed** is disabled (0).
Force Speed	Input		0	Set this channel to one of the following values: • **0** - Disables Forced Speed mode. The **Force Speed Setpoint** parameter is ignored in this case. • **1** - Enables Forced Speed mode. The **Mechanical Model Parameters** and **Load Torque** are ignored in this case.
Force Speed Setpoint	Input	Radians per second	0rad/s	Forces the speed of the machine to the defined value. This parameter is used only if **Force Speed** is enabled (1).
Coil Temperature	Input	Kelvin	0K	Temperature of the motor coil. If this value is greater than 0, **Temperature Correction** is performed for the resistance and magnet flux.
Magnet Temperature	Input	Kelvin	0K	Temperature of the motor magnet. If this value is greater than 0, **Temperature Correction** is performed for the resistance and magnet flux.
BackEMF Gain	Input		0	
Current Phase A	Output	Amperes	0A	Phase A current of the electric motor.
Current Phase B	Output	Amperes	0A	Phase B current of the electric motor.
Current Phase C	Output	Amperes	0A	Phase C current of the electric motor.
Direct Stator Current	Output	Amperes	0A	Direct current of the electric motor. The value of dq current corresponds to the value of ABC current in the flux, torque (d, q) rotating reference frame.
Quadratic Stator Current	Output	Amperes	0A	Quadratic current of the electric motor. The value of dq current corresponds to the value of ABC current in the flux, torque (d, q) rotating reference frame.
Electromagnetic Torque	Output	Newton Meters	0Nm	Electromagnetic torque that the electric motor generates while it is running.
Speed	Output	Radians per second	0rad/s	Rotor speed of the electric motor.
Position	Output	Radians	0rad	Rotor position of the electric motor.
BackEMFa	Output	Volts	0V	
BackEMFb	Output	Volts	0V	
BackEMFc	Output	Volts	0V	

Motor Type: Constant Parameter

For a full description of the PMSM Constant Parameter model and its parameters, please see the National Instruments Help pages at the links below:

- PMSM Constant Parameter Model VI
- Constant Parameter Model for PMSM Simulation
- Temperature Correction
- Motor Speed and Rotor Position VI (Mechanical Model)

Motor Configuration				
	Symbol	**Units**	**Default**	**Description**
Direct Inductance	L_d	Henries	0.024H	Inductance along the d or direct axis.
Quadrature Inductance	L_q	Henries	0.028H	Inductance along the q or quadrature axis.
Loop Time	T_s	Seconds	1E-6s	Describes the timestep of the machine model.
Pole Pairs	PP		3	Number of machine pole pairs.
Flux Linkage		Webers	0.1Wb	Flux linkage between the rotor and stator. This value must be greater than 0.
Resistance	R	Ohms	1.2	Resistance in the electric motor. This value must be greater than 0.

Motor Type: Variable Parameter

For a full description of the PMSM Variable Parameter model and its parameters, please see the National Instruments Help pages at the links below:

- PMSM Variable Parameter Model VI
- Constant Parameter Model for PMSM Simulation
- Temperature Correction
- Motor Speed and Rotor Position VI (Mechanical Model)

Motor Configuration				
	Symbol	**Units**	**Default**	**Description**
Model File				Path to the model file on disk. The model file contains tables describing the d inductance, q inductance, and flux as a function of **Direct Current** and **Quadratic Current**. Additional formatting information and templates can be found here: • Template CSV file for PMSM VDQ Model • Inductance and Flux Table Description • JSON File Structure
Table Size			100	Specifies the size of the L_d, L_q, and Flux tables in the **Model File**.
Loop Time	T_s	Seconds	1E-6s	Timestep of the machine model.
Delimiter			,	Specifies the type of text delimiter in the **Model File**.
Resistance	R	Ohms	1.2	Resistance in the electric motor. This value must be greater than 0.