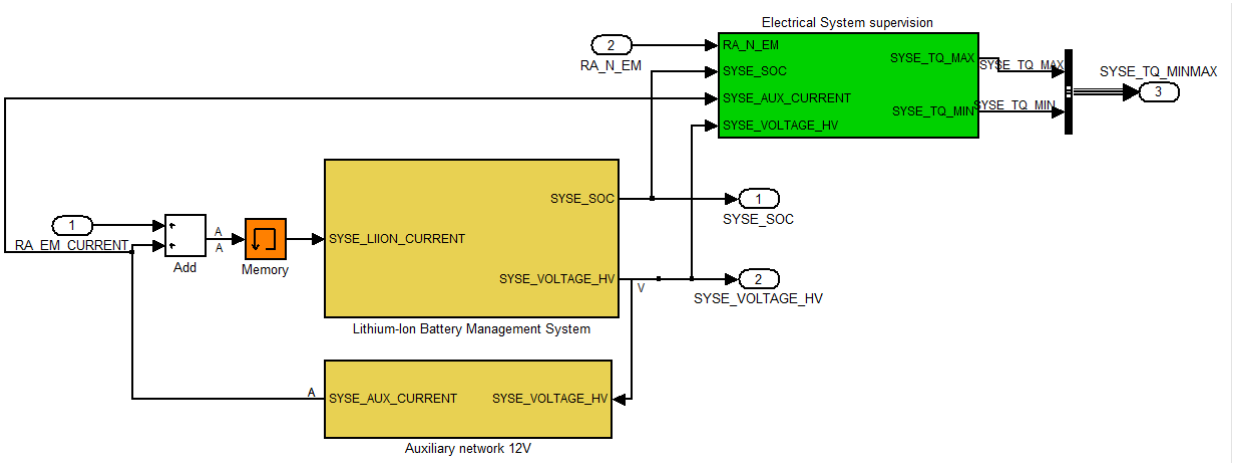
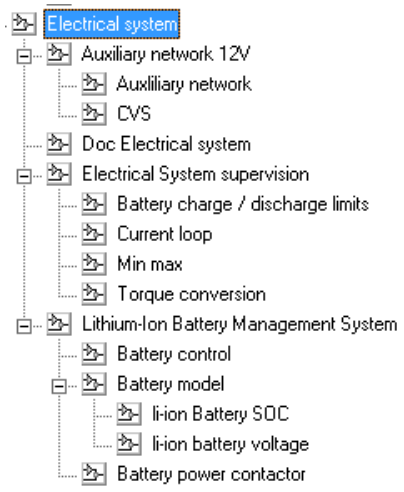
Electrical system model

1 System description

Model of the electrical system. It includes the batteries and the network associated. The auxiliary network (servitude, 12V) is considered as a constant load.

2 System organization





3 Signals and parameters

Inputs

Name	Description	Note
RA_EM_CURRENT	Electrical machine requested current	-
RA_N_EM	Electrical machine shaft speed	In RPM

Outputs

Name	Description	Note	Destination
SYSE_SOC	Li-Ion battery state of charge	-	Command
SYSE_VOLTAGE_HV	Voltage on the HV network	-	Command, Rear axle
SYSE_TQ_MINMAX	Minimum and maximum torque for the electrical system	Normalized torque “to wheel”, two signal: - SYSE_TQ_MIN - SYSE_TQ_MAX	Command

Parameters

Native

Name	Type	Unit	Description	Source	Linked to
syse_aux_current	var	A	Current on the servitude network	Continental	
syse_aux_voltage	var	V	Voltage on the servitude network	Continental	
syse_bat_nominal_capacity_as	var	As	Li-ion nominal capacity in As	Continental	
syse_cdl	var	F	Polarisation capacity	Continental	
syse_dcdc_efficiency	vector	-	DC-DC converter efficiency	Continental	syse_dcdc_in_power
syse_dcdc_in_power	vector	W	DC-DC converter efficiency input vector	Continental	syse_dcdc_efficiency
syse_electrical_machine_torque_vs_power_speed_nneg	table	Nm	Electrical machine torque	Continental	ra_electrical_machine_speed; syse_em_in_power
syse_electrical_machine_torque_vs_power_speed_npos	table	Nm	Electrical machine torque	Continental	ra_electrical_machine_speed; syse_em_in_power
syse_em_in_power	vector	W	Elatrical machine torque vs power input vector	Continental	syse_electrical_machine_torque_vs_power_speed_npos; syse_electrical_machine_torque_vs_power_speed_nneg; ra_electrical_machine_speed
syse_max_charge_current	vector	A	Maximum charge current	Continental	syse_soc_current_limits
syse_max_discharge_current	vector	A	Maximum discharge current	Continental	syse_soc_current_limits
syse_nb_cell	var	-	Number of cell in the battery	Continental	

syse_rdl	var	Ω	Polarization resistance	Continental	
syse_rser	var	Ω	Serial resistance of a cell	Continental	
syse_soc_current_limits	vector	V	SOC	Continental	syse_max_charge_current; syse_max_discharge_current
syse_soc_initial	var	-	Initial value of the SOC	Continental	
syse_soc_ocv	vector	-	Open circuit voltage input vector	Continental	syse_vocv
syse_vocv	vector	V	Open circuit voltage vs SOC	Continental	syse_soc_ocv

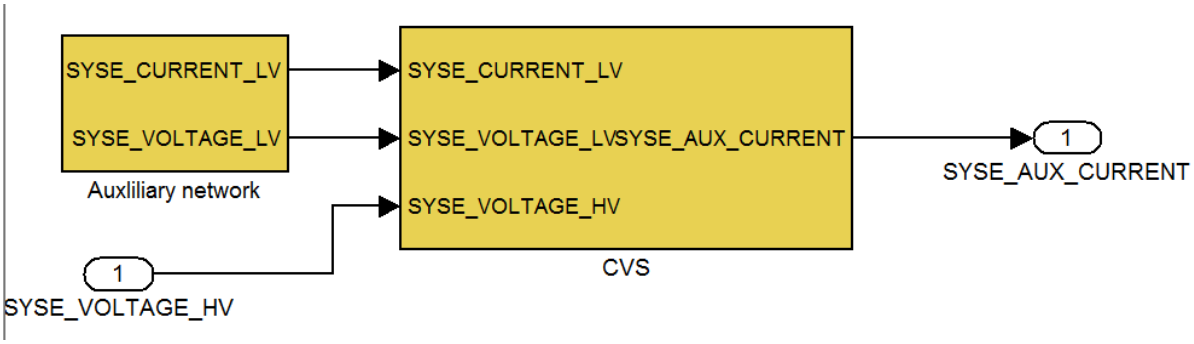
Inherited

Name	Type	Unit	Description
ra_differential_ratio	var	-	Rear axle differential reduction ratio
ra_electrical_machine_speed	vector	RPM	rendement de la machine électrique
ra_transmission_efficiency	var	-	Rear axle differential efficiency

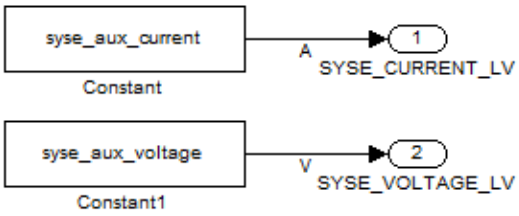
4 Subsystems description

Auxiliary network 12V:

Describe the auxiliary network and the DC/DC converter. The power consumption of the auxiliary network is seen as a current loss.

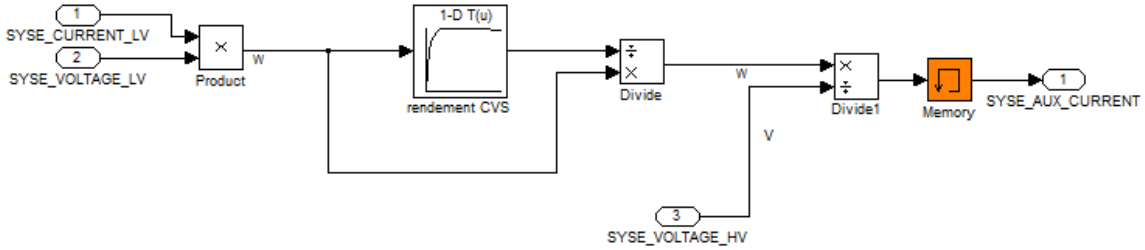


Auxiliary network:

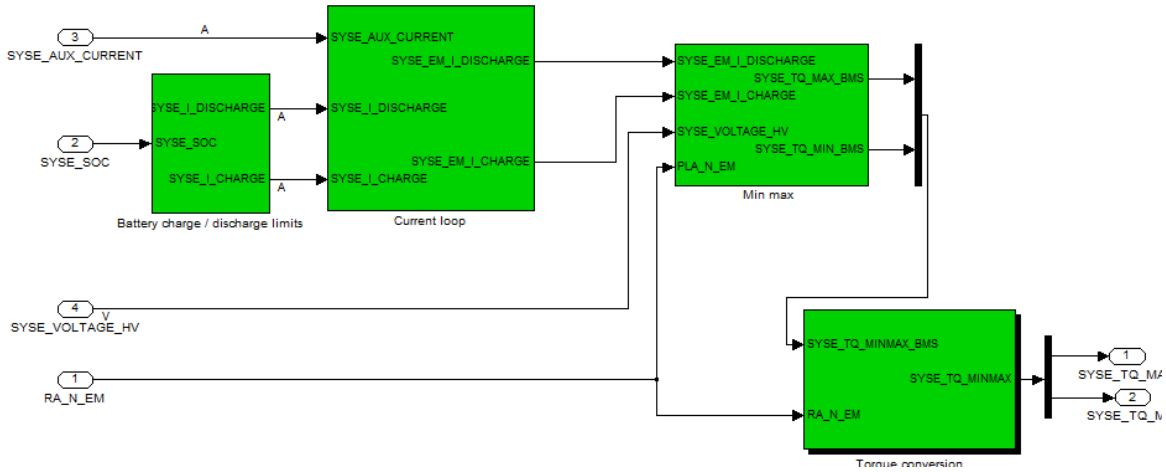


CVS

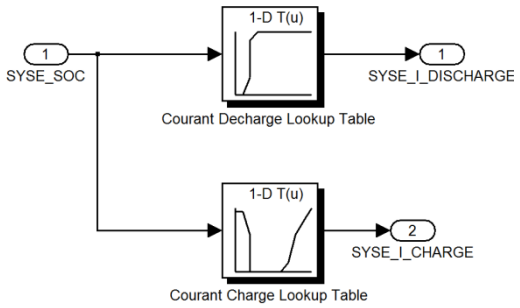
Converter DC/DC between the servitude and the power network.



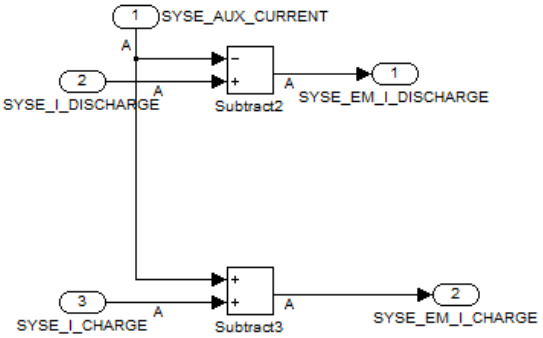
Electrical system supervision :



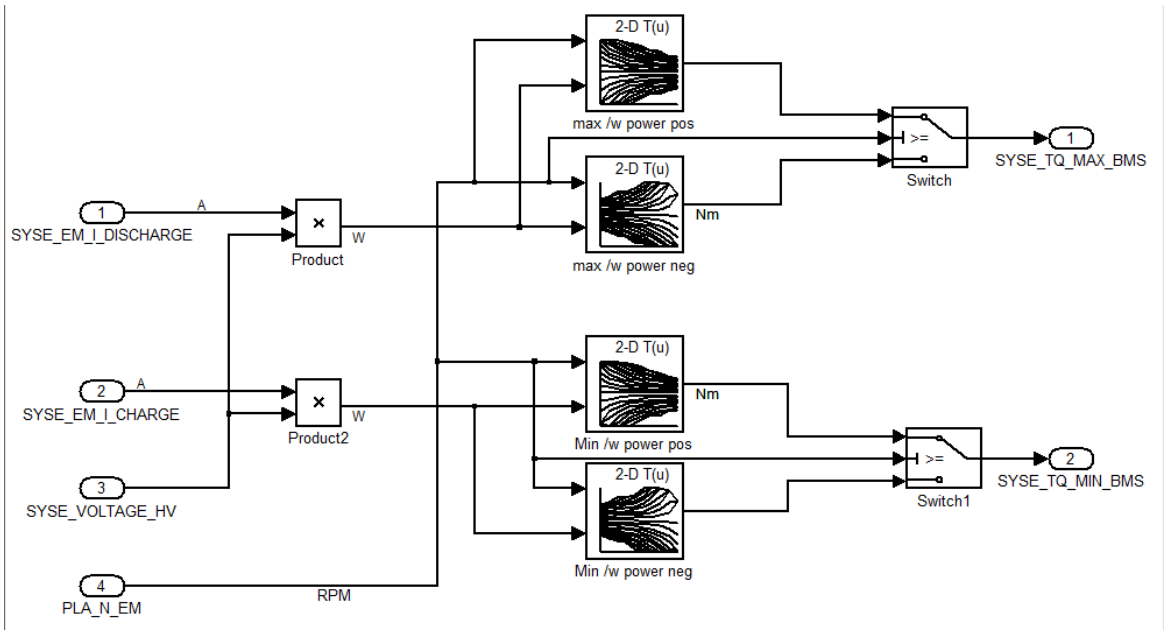
Discharge limits



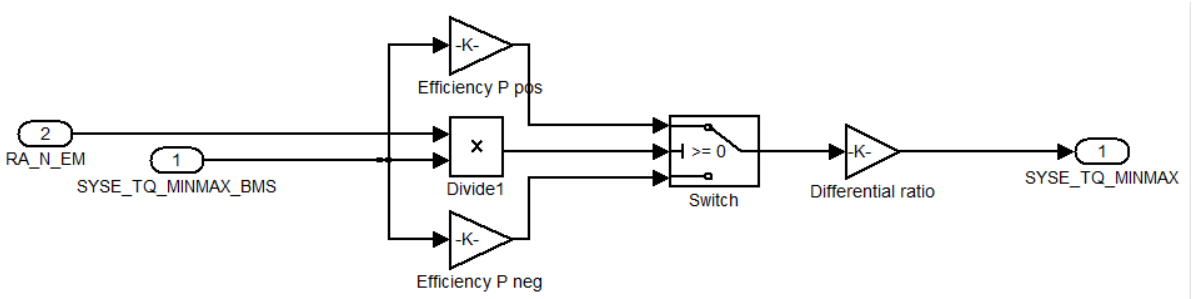
Current loop



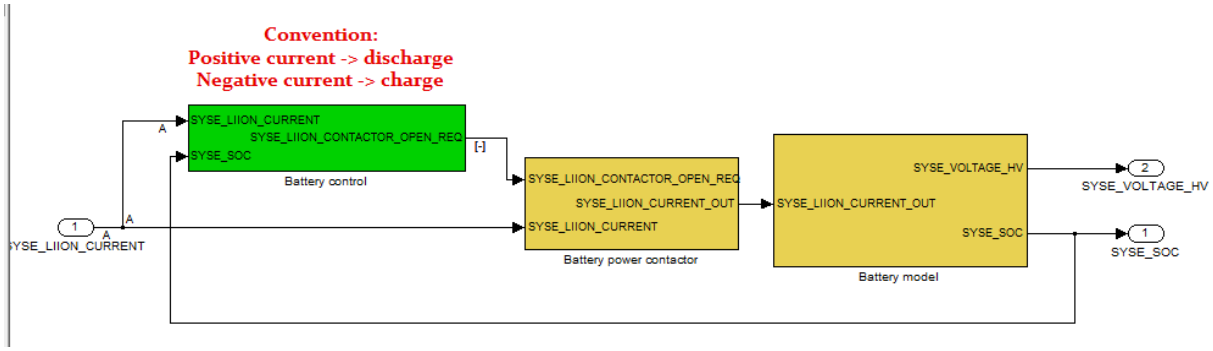
Min max:



Torque conversion

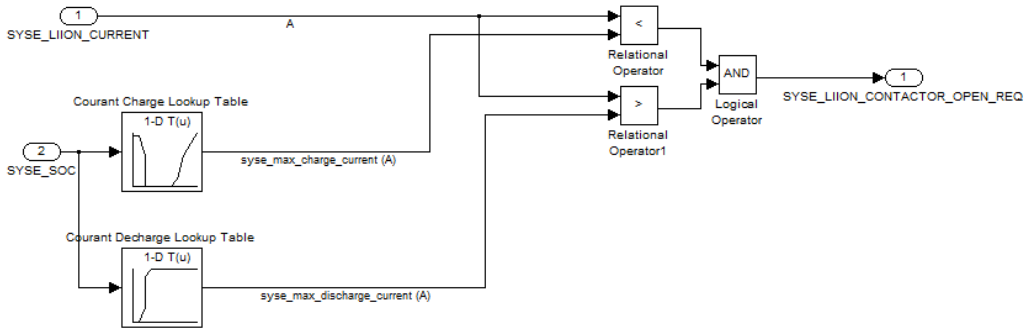


Lithium-Ion battery Management System

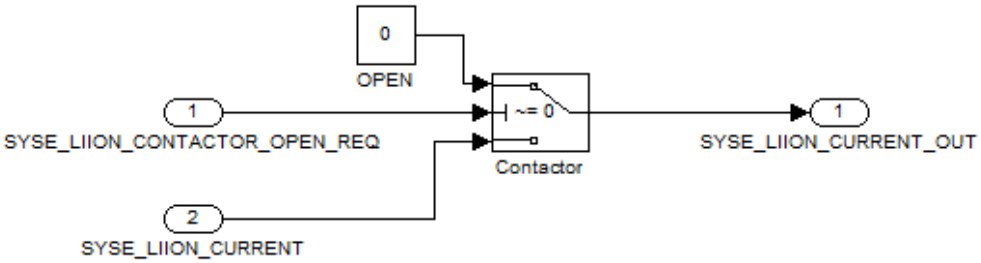


Battery control

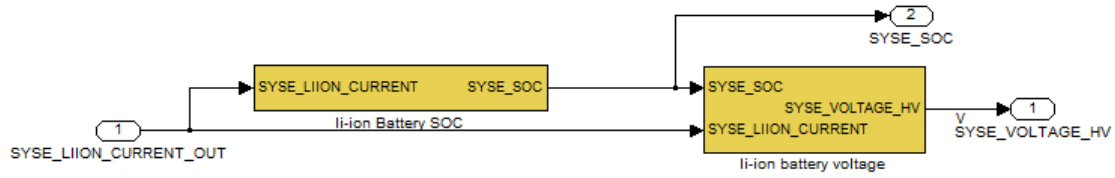
Battery safety system



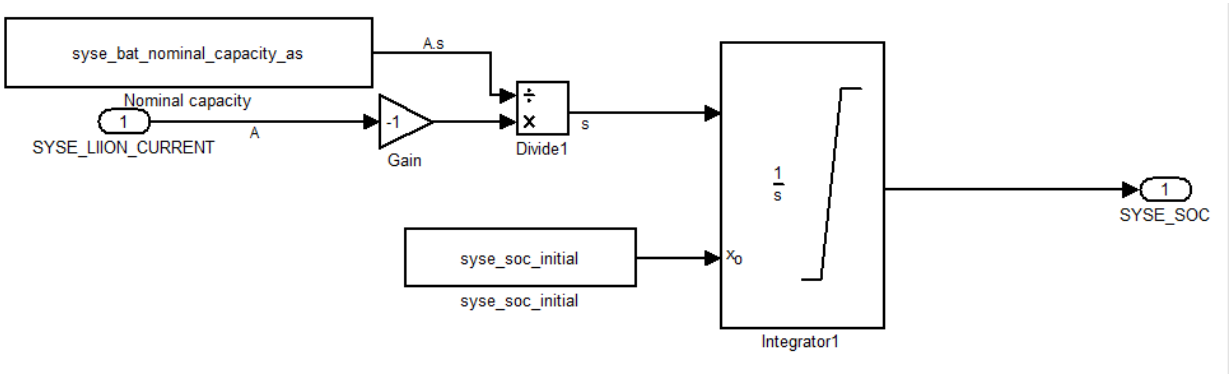
Battery power contactor



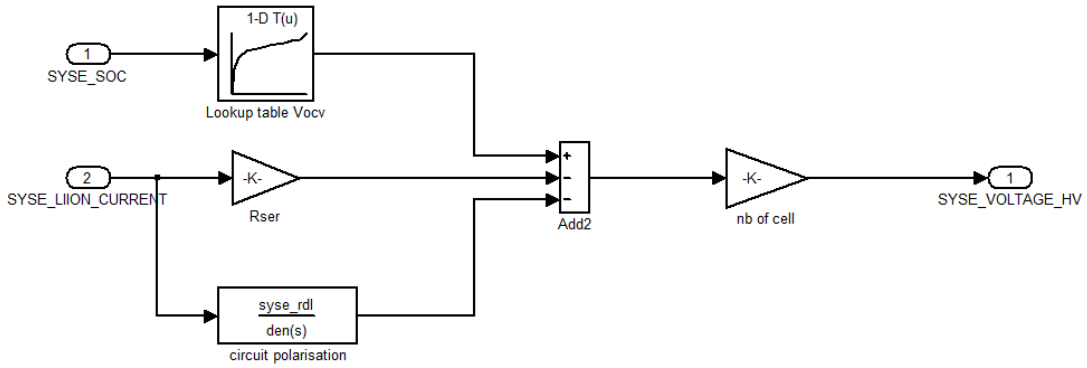
Battery model



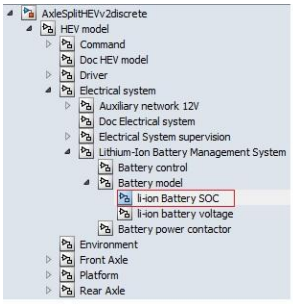
Li-ion battery SOC

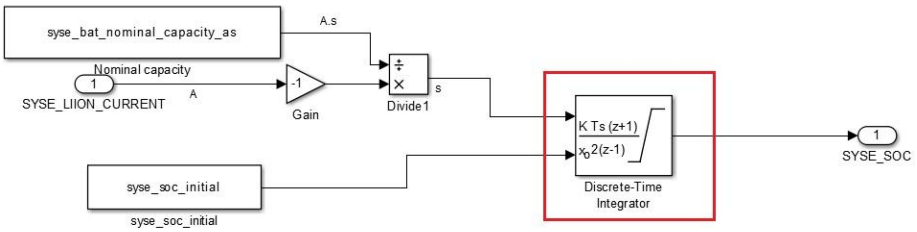


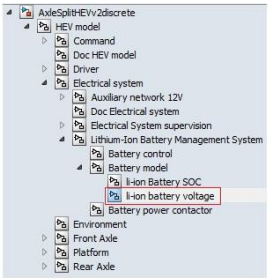
Li-ion battery voltage

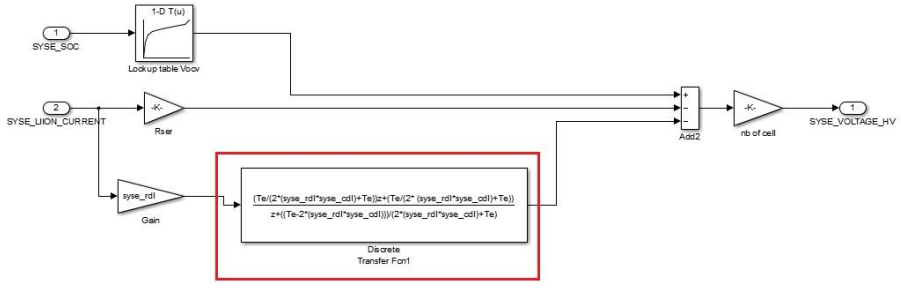


5 Discrete Model









Same inputs, outputs and parameters. The only changes are in the red squares.
See part 5 (“Discrete model”) of the document “HEV model” to know how are made the discrete blocs.