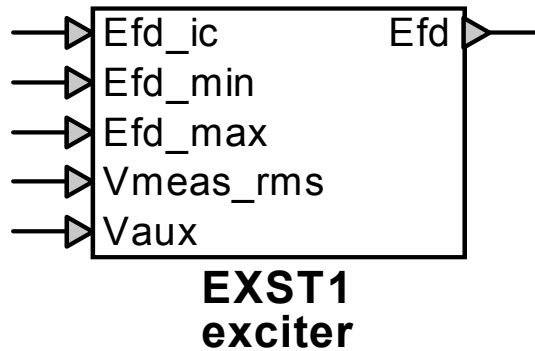


# Machine control : exciter EXST1



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## 1 Description

This device is an implementation of an IEEE Type ST1 excitation system similar to PSS/E's EXST1 exciter model. This version of the exciter interprets all input and output values in physical units. For a version with input and output in per-unit quantities, use the device "exciter EXST1 pu".

### 1.1 Pins

This device has six pins:

<i>pin</i>	<i>type</i>	<i>description</i>	<i>units</i>
Efd_ic	input pin	initial field voltage at t=0	V
Efd_min	input pin	minimum field voltage	V
Efd_max	input pin	maximum field voltage	V
Vmeas_rms	input pin	measured rms voltage	V
Vaux	input pin	auxiliary voltage order	V
Efd	output pin	field voltage	V

### 1.2 Parameters

The value of the following parameters must be defined:

<i>parameter</i>	<i>description</i>	<i>units</i>
Tr	time constant (lag) of voltage meter	s
Ta	time constant (lag) of regulator	s
Tc	time constant (lead) of transient filter	s

Tb	time constant (lag) of transient filter	s	
Tf	time constant (lag) of feedback	s	
Kf	gain of feedback		(includes base conversion)
Ka	gain of regulator		(includes base conversion)
Vimin	loop error low limit	pu(V_base)	
Vimax	loop error high limit	pu(V_base)	
V_base	terminal voltage base	V	
Efd_base	field voltage base	V	

### 1.3 Input

The input pins may be connected to any control signals.

The following inputs are available:

<i>input</i>	<i>description</i>	<i>units</i>
Efd_ic	initial field voltage at t=0	V
Efd_min	minimum field voltage	V
Efd_max	maximum field voltage	V
Vmeas_rms	measured rms voltage	V
Vaux	auxiliary voltage order	V

### 1.4 Output

The output value is the calculated field voltage, in physical units.

<i>output</i>	<i>description</i>	<i>units</i>
Efd	field voltage	V

### 1.5 Representation

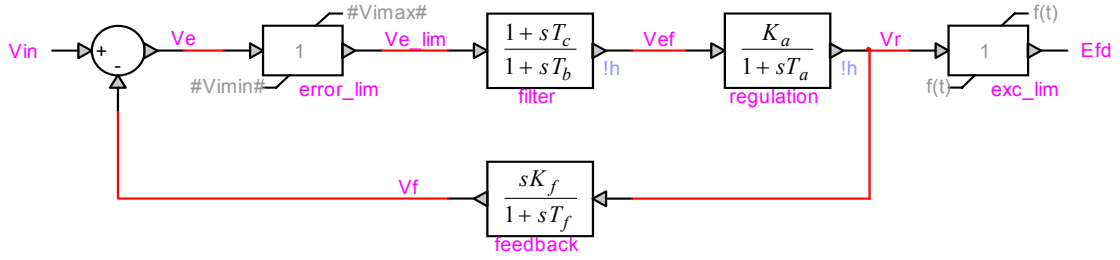
The implementation of the model can be inspected by opening the device's subcircuit.

The model uses a unit-conversion shell surrounding the per-unit version of this exciter.



The model is self-initializing at t=0.

The dynamic representation of the model is the following:



where

$$V_{in} = V_{ref} - V_{meas\_rms} + V_{aux} \quad (1)$$

with  $V_{meas\_rms}$  filtered by  $\frac{1}{1+sT_r}$

and with the value of  $V_{ref}$  calculated to produce  $E_{fd} = E_{fd\_ic}$  at  $t=0$ .

The internal signals are:

<i>signal</i>	<i>description</i>	<i>units</i>
Vin	control input	pu(V_base)
Ve	control error	pu(V_base)
Ve_lim	control error limited	pu(V_base)
Vef	control error filtered	pu(V_base)
Vr	regulator voltage	pu(Efd_base)
Vf	feedback	pu(V_base)