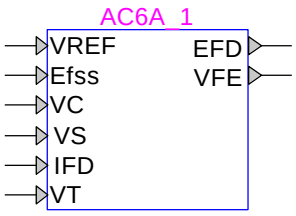
# Exciters and Governors: Exciter AC6A




**Exciter AC6A**



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## 1 Description

This device is an implementation of the IEEE type AC6A excitation system model. This device is implemented as described in [1]. Implementation details can be viewed by inspecting the subcircuit of this device.

## 1.1 Pins

This device has 8 pins:

| Pin name | Type | Description | Units |
|---|---|---|---|
| VREF | Input | Reference voltage of the stator terminal voltage | pu |
| Efss | Input | Steady-state field voltage at t = 0, for initialization | pu |
| VC | Input | Terminal voltage of synchronous machine, transducer output | pu |
| VS | Input | Power System Stabilizer signal | pu |
| IFD | Input | Field current | pu |
| VT | Input | Terminal voltage of synchronous machine | pu |
| EFD | Output | The field voltage signal | pu |
| VFE | Output | Signal proportional to exciter field current | pu |

## 1.2 Parameters

The default set of parameters can be found in [1].

### 1.2.1 Data tab

The parameters on the Data tab are:

1. **Gain $K_A$**: voltage regulator gain
2. **Time constant $T_A$**: voltage regulator time constant
3. **Time constant $T_K$**: voltage regulator lead time constant

4. **Maximum regulator output $V_{Amax}$**: maximum regulator voltage output
5. **Minimum regulator output $V_{Amin}$**: minimum regulator voltage output
6. **Maximum regulator output $V_{Rmax}$**: maximum regulator voltage output
7. **Minimum regulator output $V_{Rmin}$**: minimum regulator voltage output
8. **Time constant $T_B$**: time constant of the lead-lag compensator
9. **Time constant $T_C$**: time constant of the lead-lag compensator

### 1.2.2 Exciter tab

The exciter tab allows to input:

1. **Gain $K_E$**: exciter gain
2. **Time constant $T_E$**: exciter time constant
3. **Time constant $T_H$**: exciter field current limiter time constant
4. **Time constant $T_J$**: exciter field current limiter time constant
5. **Field current feedback limit $V_{HMAX}$**: exciter field current feedback limit
6. **Field current limit reference $V_{FELIM}$**: exciter field current limit reference
7. **Demagnetizing factor $K_D$**: demagnetizing factor
8. **Rectifier loading factor $K_C$**: rectifier loading factor
9. **Voltage $V_{E1}$**: The exciter voltage point which is near the exciter ceiling voltage
10. **Voltage $V_{E2}$**: The exciter voltage point which is near 75% of $V_{E1}$
11. **Saturation function output SE_$V_{E1}$**: The exciter saturation function value at $V_{E1}$
12. **Saturation function output SE_$V_{E2}$**: The exciter saturation function value at $V_{E2}$

The exciter saturation function is defined as

$$S_E = A_{EX} e^{B_{EX} E_{FD}} \tag{1}$$

which gives the approximation saturation for any $E_{FD}$ (exciter output voltage). According to [2] (see pages 562 and 563), the coefficients $A_{EX}$ and $B_{EX}$ can be found from:

$$A_{EX} = \frac{S_{V_{E2}}^4}{S_{V_{E1}}^3} \tag{2}$$

$$B_{EX} = \frac{4}{V_{E1}} \ln\left(\frac{S_{V_{E1}}}{S_{V_{E2}}}\right) \tag{3}$$

In the literature [2] $V_{E1} = V_{E_{max}}$ and $V_{E2} = V_{E_{0.75max}}$.

## 2 Initial conditions

The reference voltage VREF can be manually or automatically set by connecting or not connecting the input signal VREF, respectively. When VREF is not connected (the signal is zero), the reference voltage is internally found from the steady-state solution. When VREF is connected, its initial value must match the per unit steady-state voltage of the stator terminal voltage, since otherwise the generator voltage will not start at the actual steady-state.

## 3 References


[1] "IEEE Recommended Practice for Excitation System Models for Power System Models for Power System Stability Studies," IEEE Standard 421.5-2005.

[2] P. M. Anderson and A. A. Fouad, "Power system control and stability", second edition, IEEE Press, Wiley Interscience, 2003.