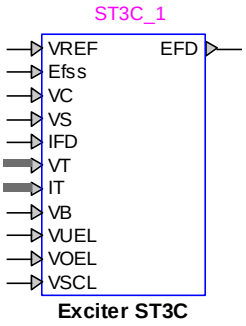
Exciters and Governors: Exciter ST3C



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1 Description

This device is an implementation of an IEEE type ST3C 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 12 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, bundle	Terminal voltage (phasor) of synchronous machine (magnitude and phase)	pu
IT	Input, bundle	Current (phasor) of synchronous machine (magnitude and phase)	pu
VB	Input	Available exciter voltage	pu
VUEL	Input	Under Excitation Limiter signal	pu
VOEL	Input	Over Excitation Limiter signal	pu
VSCL	Input	Stator Current Limiter signal	pu
EFD	Output	The field voltage signal	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_{PR}**: voltage regulator proportional gain
2. **Gain K_{IR}**: voltage regulator integral gain
3. **Maximum regulator output V_{PImax}**: Maximum regulator voltage output
4. **Minimum regulator output V_{PImin}**: Minimum regulator voltage output
5. **Gain K_A**: voltage regulator gain
6. **Time constant T_A**: thyristor bridge firing control time constant
7. **Time constant T_B**: lead-lag time constant
8. **Time constant T_C**: lead-lag time constant
9. **Maximum regulator output V_{Rmax}**: maximum regulator voltage output
10. **Minimum regulator output V_{Rmin}**: minimum regulator voltage output
11. **Maximum regulator input V_{Imax}**: maximum regulator voltage input
12. **Minimum regulator input V_{Imin}**: minimum regulator voltage input
13. **Gain K_M**: forward gain of inner loop field regulator
14. **Time constant T_M**: forward time constant of inner loop field regulator
15. **Maximum field current output V_{Mmax}**: maximum output of field current regulator
16. **Minimum field current output V_{Mmin}**: minimum output of field current regulator
17. **Gain K_G**: feedback gain of field current regulator
18. **Voltage V_{Gmax}**: maximum field current feedback voltage
19. **Rectifier loading factor K_C**: rectifier loading factor proportional to commutating reactance
20. **Gain K_P**: potential circuit (voltage) gain coefficient
21. **Phase angle $Theta_P$**: potential circuit phase angle (degrees)
22. **Gain K_I**: compound circuit (current) gain coefficient
23. **Reactance X_L**: Reactance associated with potential source
24. **Field voltage V_{Bmax}**: maximum available exciter voltage
25. **Excitation Type option**: see explanations below.
26. **Under Excitation Limiter option**: see explanations below.
27. **Over Excitation Limiter option**: see explanations below.
28. **Stator Current Limiter option**: see explanations below.

There are two possible selections for the Excitation Type option:

1. Excitation system is self-excited: VT and IT inputs must be connected.
2. Excitation system comes from a separate source: VB input must be connected

There are two possible selections for the Under Excitation Limiter option:

1. VUEL is not available or added to the reference voltage
2. VUEL is connected to the high value gate (HV Gate)

There are two possible selections for the Over Excitation Limiter option:

1. VOEL is not available or added to the reference voltage
2. VOEL is connected to the low value gate (LV Gate)

There are three possible selections for the Stator Current Limiter option:

1. SCL is not available or added to the reference voltage
2. SCL is connected to the high value gate (HV Gate)
3. SCL is connected to the low value gate (LV Gate)

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 421.5-2016.