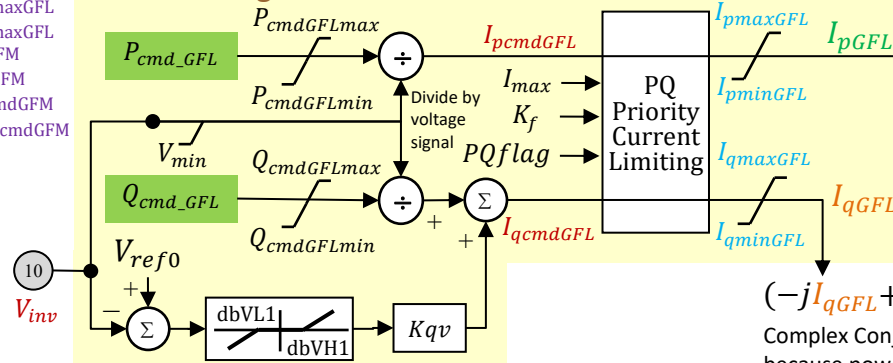


States:	Other Fields:
1 - DeltaVSM	1 - IpGFL
2 - EVSM	2 - IqGFL
3 - Damp	3 - IpcmdGFL
4 - Dwm	4 - IqcmdGFL
5 - IntE	5 - IpmxGFL
6 - Wmmes	6 - IqmxGFL
7 - PinvGFM	7 - PGFM
8 - wrefmeas	8 - IqGFM
9 - Vrefmeas	9 - PcmdGFM
10 - Vinv	10 - IqcmdGFM
11 - IqGFMmeas	

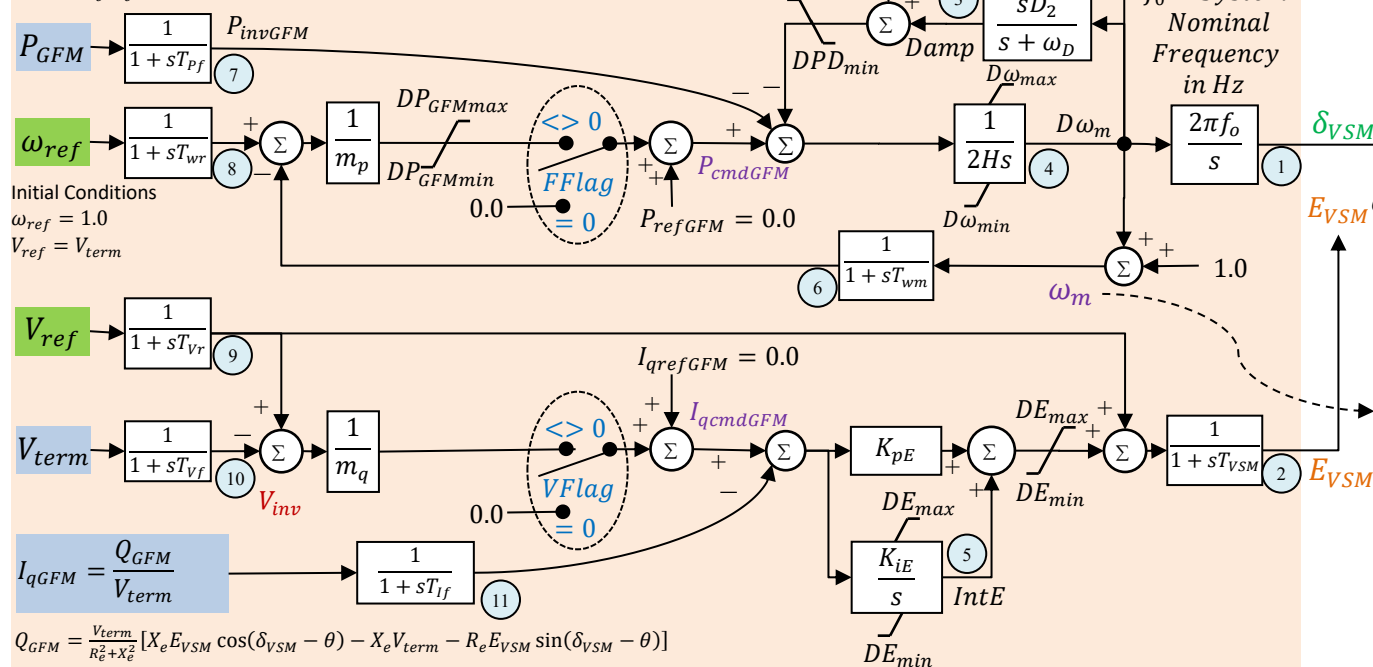
Grid Following Control



$PQflag < 0$	$PQflag = 0$
$I_{pmaxGFL} = +K_F I_{max}$ If $I_{pcmdGFL}^2 > I_{max}^2$ Then $I_{qmaxGFL} = 0$ Else $I_{qmaxGFL} = \sqrt{I_{max}^2 - I_{pcmdGFL}^2}$ $I_{pminGFL} = -I_{pmaxGFL}$ $I_{qminGFL} = -I_{qmaxGFL}$	$I_{qmaxGFL} = +K_F I_{max}$ If $I_{qcmdGFL}^2 > I_{max}^2$ Then $I_{pmaxGFL} = 0$ Else $I_{pmaxGFL} = \sqrt{I_{max}^2 - I_{qcmdGFL}^2}$ $I_{pminGFL} = -I_{pmaxGFL}$ $I_{qminGFL} = -I_{qmaxGFL}$

$$\begin{aligned} I_{rGFL} &= I_{pGFL} \cos(\theta) + I_{qGFL} \sin(\theta) \\ I_{iGFL} &= I_{pGFL} \sin(\theta) - I_{qGFL} \cos(\theta) \end{aligned}$$

$(-jI_{qGFL} + I_{pGFL})$ —
Complex Conjugate current
because power $S = VI^*$

$$P_{GFM} = \frac{V_{term}}{R_e^2 + X_e^2} [R_e E_{VSM} \cos(\delta_{VSM} - \theta) - R_e V_{term} + X_e E_{VSM} \sin(\delta_{VSM} - \theta)]$$


δ_{VSM} reported as generator Rotor Angle No Shift
 ➔ ω_m reported as generator Speed

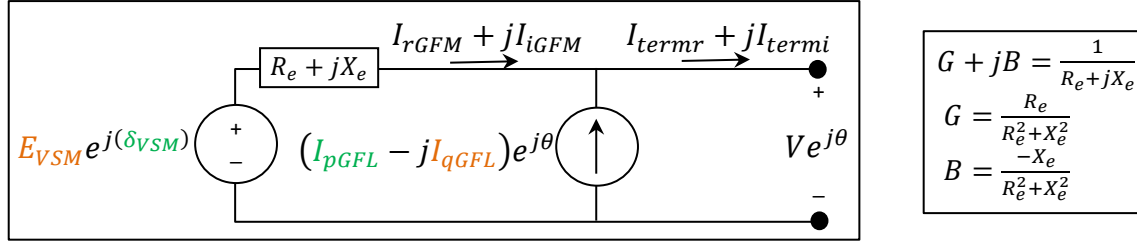
Special Handling is done in the network boundary equations to enforce the I_{max} limit on the total current.

See next page for details.

Network Boundary Equations Explanation

The network boundary equations for REGFM_C1 a simultaneous combination voltage source such as REGFM_A1 and current source such as REGC_A.

Model States: E_{VSM} , δ_{VSM} , I_{pGFL} , I_{qGFL} , Model Parameters: R_e , X_e , and I_{max} .



When the current limit is not active, the currents from the GFM portion and GFL portion of the network interface are calculated as.

$$I_{rGFM} = G E_{VSM} \cos(\delta_{VSM}) - B E_{VSM} \sin(\delta_{VSM}) - [G V_{term} \cos(\theta) - B V_{term} \sin(\theta)]$$

$$I_{iGFM} = B E_{VSM} \cos(\delta_{VSM}) + G E_{VSM} \sin(\delta_{VSM}) - [B V_{term} \cos(\theta) + G V_{term} \sin(\theta)]$$

$$I_{rGFL} = I_{pGFL} \cos(\theta) + I_{qGFL} \sin(\theta)$$

$$I_{iGFL} = I_{pGFL} \sin(\theta) - I_{qGFL} \cos(\theta)$$

$$I_{termr} = I_{rGFM} + I_{rGFL}$$

$$I_{termi} = I_{iGFM} + I_{iGFL}$$

During the network algebraic solution, if the terminal current exceeds the maximum current limit (I_{max}), then the algebraic network equations transitions to current equations that have a total current of I_{max} , but the component currents maintain the same ratio as the models desired currents. By assuming they maintain the same ratio, the assumption is that power factor is maintained.

If $\sqrt{I_{termr}^2 + I_{termi}^2} \leq I_{max}$, then the model terminal currents used are $(I_{usedr} + jI_{usedi}) = (I_{termr} + jI_{termi})$

If $\sqrt{I_{termr}^2 + I_{termi}^2} > I_{max}$, then the model terminal currents used transition to scaled desired currents as follows.

$$I_{usedr} = I_{termr} \frac{I_{max}}{\sqrt{I_{termr}^2 + I_{termi}^2}}$$

$$I_{usedi} = I_{termi} \frac{I_{max}}{\sqrt{I_{termr}^2 + I_{termi}^2}}$$

When the current limit is being enforced the model injects this current at the network.