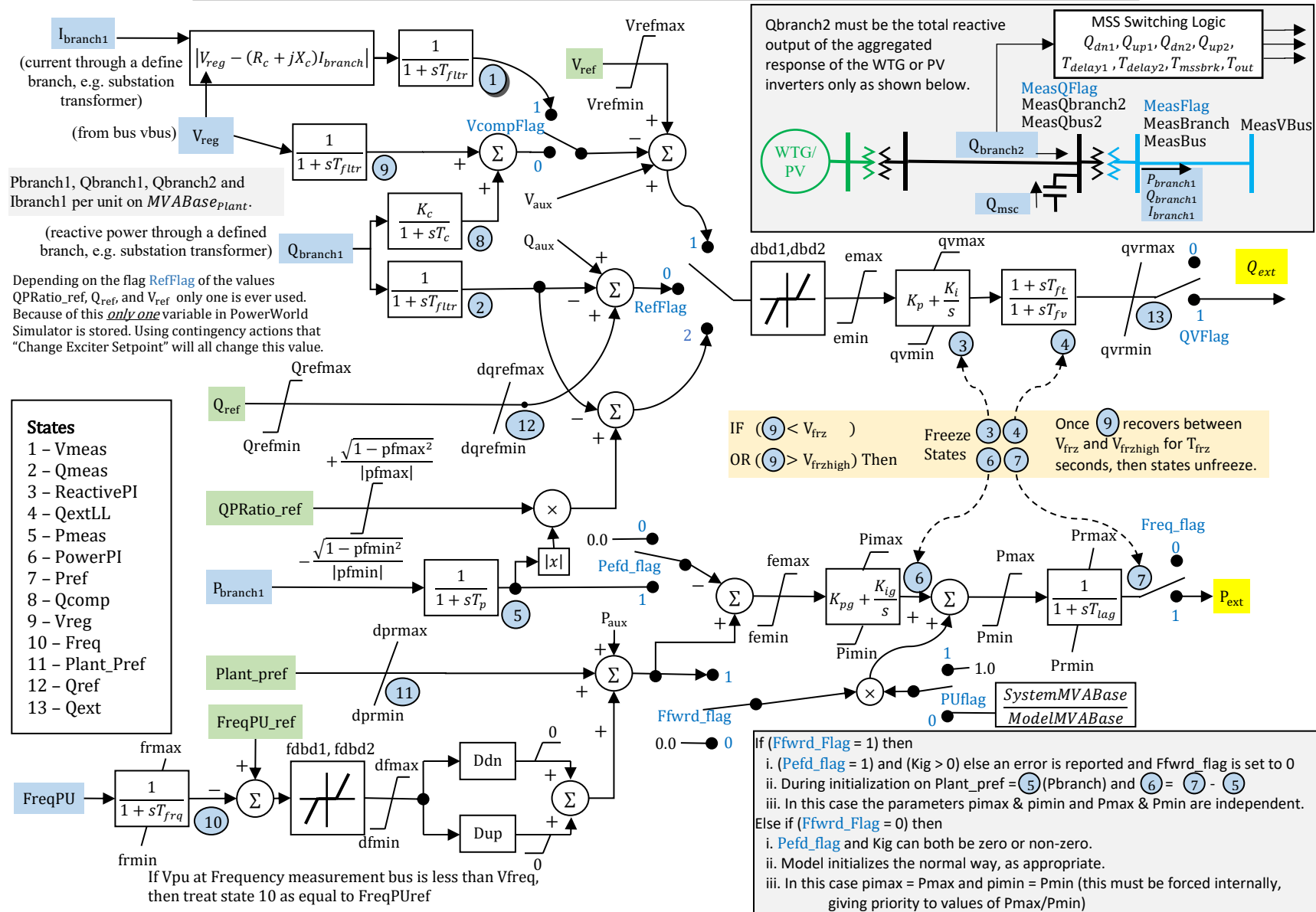


## Bus Controller REPC\_D

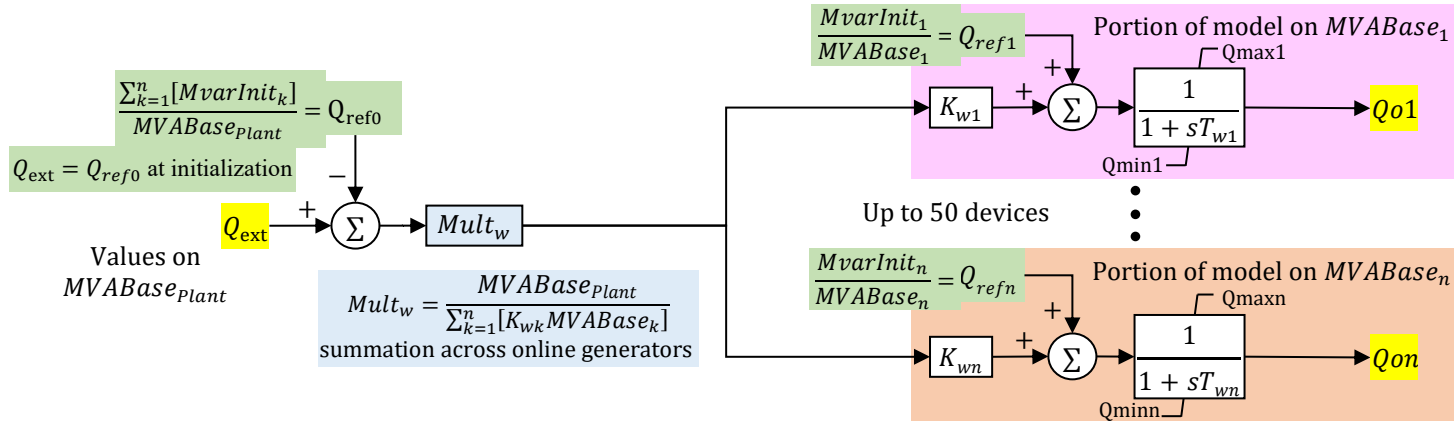
## Renewable Energy Plant Control Model REPC\_D



Each presently on-line generator will have the following.

- $MVABase_i$  : MVABase of on-line generator i
- $MWInit_i$  : MW output in the initial condition for online generator i
- $MvarInit_i$  : Mvar output in the initial condition for online generator i

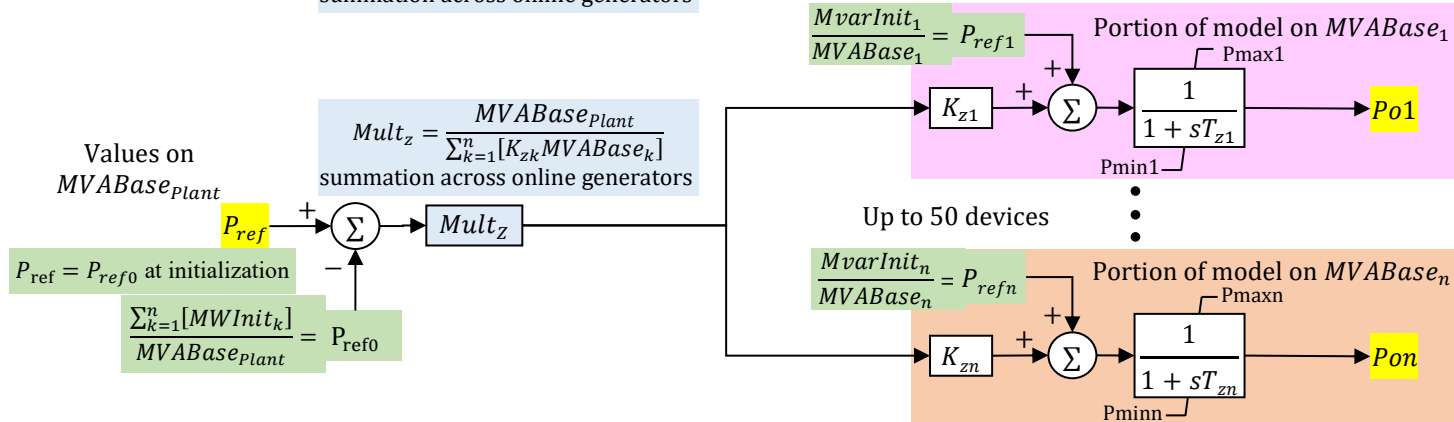
The model then initializes as shown in the green highlights in the following block diagram



- $P_{ref0}$  and  $Q_{ref0}$  are NOT updated when units open or close.
- $Mult_z$ ,  $Mult_w$  are updated during the simulation whenever generators connected to this model are opened or closed.
- If the user sets  $MVABase_{plant} > 0$  then this value is used and not changed during the simulation.  
If the user sets  $MVABase_{plant} \leq 0$  then the value will be calculated as the summation of all online generators which are used by this REPC\_D model and this calculation will also be updated during the simulation as generators are opened or closed

$$MVABase_{plant} = \sum_{k=1}^n [MVABase_k]$$

summation across online generators



### Calculation of Multz and Multw to make parameters consistent

To make sense at a new steady state, MW requests should match each other, therefore following equality must be met.

$$(P_{ref})MVABase_{plant} = \sum_{k=1}^n [(Po_k)MVABase_k]$$

At a new steady state, we ignore the  $T_{zk}$  and  $T_{wk}$  time-constants so we have

$$(P_{ref0} + DeltaP)MVABase_{plant} = \sum_{k=1}^n [(P_{refk} + Mult_z K_{zk} DeltaP)MVABase_k]$$

Substitute terms from earlier.

$$\left( \frac{\sum_{k=1}^n [MWInit_k]}{MVABase_{plant}} + DeltaP \right) MVABase_{plant} = \sum_{k=1}^n \left[ \left( \frac{MWInit_k}{MVABase_k} + Mult_z K_{zk} DeltaP \right) MVABase_k \right]$$

Multiply by terms on each side

$$\sum_{k=1}^n [MWInit_k] + DeltaP * MVABase_{plant} = \sum_{k=1}^n [MWInit_k + Mult_z K_{zk} MVABase_k DeltaP]$$

Split up the summation on the right side.

$$\sum_{k=1}^n [MWInit_k] + DeltaP * MVABase_{plant} = \sum_{k=1}^n [MWInit_k] + \sum_{k=1}^n [Mult_z K_{zk} MVABase_k DeltaP]$$

Cancel like terms. Also pull-out terms that are not a function of summation index k

$$DeltaP * MVABase_{plant} = DeltaP * Mult_z \sum_{k=1}^n [K_{zk} MVABase_k]$$

Cancel out the  $DeltaP$  terms and solve for  $Mult_z$  and we have a requirement the following is met.

$$Mult_z = \frac{MVABase_{plant}}{\sum_{k=1}^n [K_{zk} MVABase_k]}$$

### Added in November 11, 2025 patch to Simulator 24

The REPC\_D model was created to send reactive power reference signals to downstream generators. If the electrical control models REEC\_\* for generators in the plant are configured to expect voltage reference signals then the REPC\_D model as described above will not work. Using Kw\* factors to divide up a voltage signal does not make any sense. To accommodate the use of this model with a plant controller sending voltage reference signals, a user can enter negative values for Kw1, Kw2, etc... for all downstream generators in this model. If all active Kw\* values are negative, PowerWorld will interpret this as an indication that all downstream generators are expecting a voltage reference signal. If this model is configured for use with 3 generators, the user needs only to enter Kw1, Kw2, and Kw3 as negative values. When PowerWorld sees all negative Kw\* values, the initialization of the multiplexor will change to the following:

- All Kw\* treated as 1.0
- Multw treated as 1.0
- Qref\* set equal to the downstream voltage reference Vo\*
- Qref0 set equal to the average of the downstream voltage reference signals at initialization

