



Figure 5: We examine the impact of the EMA warm-up epoch on the IEEE 39-Bus system. By default, we use a smoothing factor of  $\alpha = 0.99$  and apply a 10-epoch warm-up period.

Table 4: Effects of the weight  $\lambda$  on the equation loss  $\mathcal{L}_{equ}$ . We set  $\lambda$  as 0.1 by default.

$\lambda$	0.0	0.05	0.10	0.15	0.20	0.25
PQ <sub>Vm</sub>	0.00099400	0.00083139	0.00078161	0.00118891	<b>0.00075882</b>	0.00111757
PQ <sub>Va</sub>	0.01137573	0.00768562	0.00608600	0.00752592	<b>0.00590381</b>	0.00866294
PV <sub>Va</sub>	0.01234842	0.00835177	<b>0.00609802</b>	0.00805090	0.00646078	0.00960786

## A MORE EXPERIMENTS.

Table 5: Power flow estimation on IEEE 1354pegase.

	PQ <sub>Vm</sub>	PQ <sub>Va</sub>	PV <sub>Va</sub>
PowerflowNet [21] with 2k-ep	0.00082930	0.02937557	0.02814063
Senseflow with 100-ep	0.00196035	0.03509841	0.03051907
Senseflow with 500-ep	<b>0.00013276</b>	<b>0.00077648</b>	<b>0.00071715</b>

Table 4 shows that without incorporating the equation loss (i.e.,  $\lambda = 0$ ), the RMSE for phase angle predictions of PV and PQ nodes is at its worst, around 0.01. Based on our findings, we select a default value of 0.1 for  $\lambda$ , as it yields improved accuracy for both types of phase angle predictions and maintains a reasonable balance between equation loss and ground-truth loss, which differ by approximately 10-fold.

Figure 5 illustrates the effect of the self-ensembling mechanism on phase angle predictions. Without self-ensembling, the RMSE is approximately 0.008 while incorporating Selter reduces the RMSE to around 0.006. We set the momentum parameter to be 0.99 due to its stable performance across different warm-up epochs, and its corresponding best warm-up period of 10 epochs as the default.

We also establish a new benchmark of IEEE 1354-Bus, containing 40W training samples and 10W test samples, with 50% parameter perturbation and distinct topology for testing. We adopt the exact same model as we used for IEEE 300-Bus, but differently we train the model for 500 epochs. As shown in Table 5, our senseflow can obtain high-accuracy power flow estimations.