POWER AUTOMATION TECHNOLOGIES

REG-D & REG-DA voltage regulators:

DNP Scaling of Voltage, Current, Power Factor & Power

Voltage:
With REG-D/DA connected to an 11 kV (L-L) network, via VT with 110V (L-L) secondary's, the setting **Knu** should be 100. (i.e. 11000/110)

Note that regulator voltage input can be connected L-L, or L-N and the appropriate setting choice must be chosen in the "CT/VT mounting" selection setup. This selection does not influence the above **Knu** ratio.

In the default "HV Power map" Index Point **0**, is the **Knu** ratio, and has a default scaling factor of "1", therefore in the above example a DNP master will read this point as "100"

In the default "HV Power map" Index Point **3**, is the **Measured (secondary) Voltage**. With a 110 V secondary voltage applied, and with default scale setting "1", a DNP master device will read "110". If you want this Index Point to read "11000" then DNP scaling should be changed to "100".

Current:
REG-D and REG-DA voltage regulators can connect to 1 A or 5 A CT secondary's.

- With the REG-DA, the correct 1 A or 5 A selection must be made within the setting.
- With the REG-D, the correct 1 A or 5 A selection must be made within the setting, and a jumper must also be appropriately set within the device (if the factory ordered setting is to be changed)

  The REG-D manual shows 2 x 2 pin jumper boards. For REG-D's ordered with M1 order code (balanced load), only one board exists, for REG-D's ordered with M2 (unbalanced load) two jumper boards need changing.

  Some REG-D's are supplied with 4 pin jumper boards. Contact HV Power for information of setting these jumpers.

The setting **Kni** is obtained from the CT primary rating, divided by the secondary rating.
e.g. with 600/5 A CT, **Kni** = 120
e.g. with 600/1 A CT, **Kni** = 600

In the default "HV Power map" Index Point **1**, is a "**Kni"** ratio, which has a default scaling factor of "1". Note however, that this **Kni** is not the setting **Kni**, but the equivalent Kni for a 1A secondary (from this point of the document referred to as "Kni at 1A"). If you look at this Index Point in the DNP map, using both above "setting Kni's" in turn, you will find the "Kni at 1A" value to be "600" for both setups. This is due to the DNP mapping values be based on 1A normalised values.

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In the default "HV Power map" Index Point **4**, is the **Measured (secondary) Current**. Note that as discussed above REG-D/DA DNP output for current is normalised to 1 A (before scaling). That is:

- With inputs and settings correctly set for 1 A input, a full scale 1 A secondary current input would result in DNP output of "1" (with DNP scaling set to 1)
- With inputs and settings correctly set for 5 A input, a full scale **5** A secondary current input would result in DNP output of "**1**" (with DNP scaling set to 1)

To output primary current values via DNP use:

DNP Scaling factor = secondary CT value x "setting Kni"

e.g. with 600/5 A CT, a scaling factor of "600" (5 x 120) would be required to get the correct primary value via DNP map.
e.g. with 600/1 A CT, a scaling factor of "600" (1 x 600) would be required to get the correct primary value via DNP map.

Power Factor

In the default "HV Power map" Index Point 99, is Power factor, and has a default scaling factor of "100". Therefore:

- If PF="1" , then DNP = "100"
- If PF="0.98" , then DNP = "98"

Power (Real or Active Power [P], Reactive Power [Q], Apparent Power [S])

Using Apparent Power (S) as an example:

- With inputs and settings correctly set for 1 A input, a full scale 1 A secondary current input, and secondary 110 V input* would result in DNP output of "110" (VA) at the Apparent Power index point 7 (with DNP scaling set to 1)
- With inputs and settings correctly set for 5 A input, a full scale 5 A secondary current input, and secondary 110 V input* would result in DNP output of "110" (VA) at the Apparent Power index point 7 (with DNP scaling set to 1).

*110 V if input is set for L-L values, or 63.5 V if input is set for L-N connection.

Using our earlier example values, the transformer primary Apparent Power value at full rated current would be:

= 600 A x 11,000 V x √3
= 11,431,534 VA
= 11,431 kVA
= 11.431 MVA

To fit within the usable DNP range of 1-65536 with the best resolution, it would be best to set DNP scaling to output a primary value in kVA, being 11431 (kVA).

Therefore DNP scaling factor would be = **transformer primary rating (in desired units)/non scaled DNP value**
= 11431/110
= 103.923

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The same scaling factors for real power would be recommended. This scaling could also be used for reactive power, but given reactive power is likely to be in the range of 0 - 1,143 kVAr, a factor x10 greater (1039.23) could be applied to give a higher resolution output, with appropriate correction of the decimal place location at the SCADA end.

Alternative recommendation to obtain useful scaling to primary values:

Scaling factor to get primary value (in kW/kVAr/kVA) = (Knu * "Kni @ 1A" * √3)/1000

For example with above 600/5 CT, the scaling factor = (100 * 600 * 1.732)/1000
= 103.923

For example with above 600/1 CT, the scaling factor = (100 * 600 * 1.732)/1000
= 103.923

Reactive Current

Reactive Current value (Index Point 10) is also normalised to a pu value in the DNP map. The same scaling factor as used for Current, should be used for Reactive Current to obtain the primary value.

General

Scaling factors can be non-integer values up to 8 characters in length (including the decimal point) i.e.: 0.000001 to 99999999. Negative values are not allowed.

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