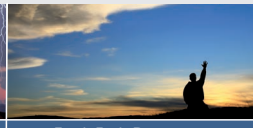
Applications


Grid Dynamics


Power Quality


Voltage Regulation


Earth Fault Detection

REGSys

Three Winding Transformer and Reverse Power Flow

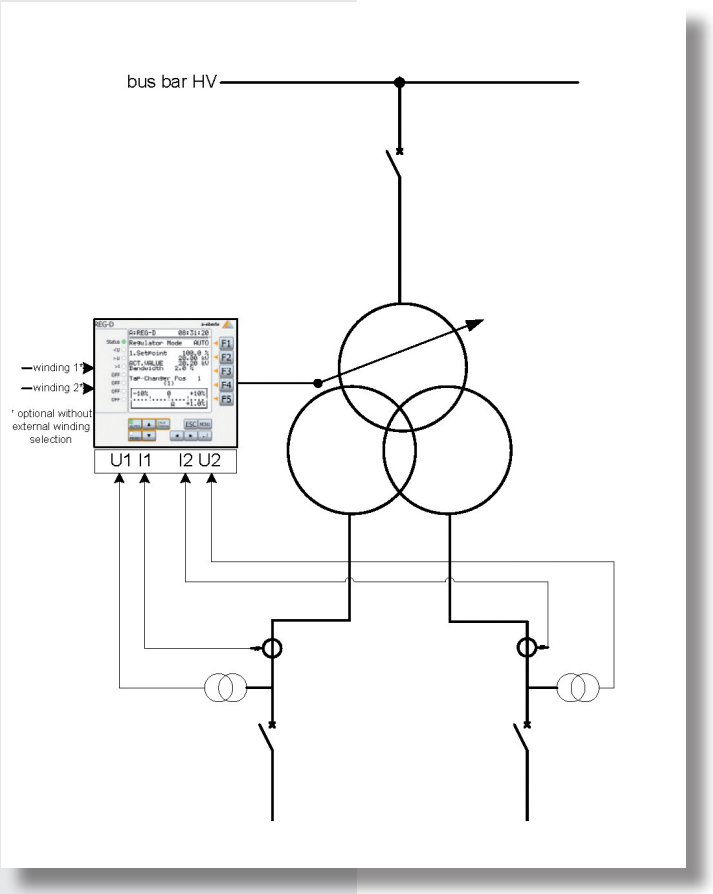
The *Three Winding firmware* feature is available on voltage regulators REG-D and REG-DA. It was originally designed to regulate and supervise three winding transformers. In the meantime it can also be used to fulfill other applications like reverse power flow - and blocking scenarios, or other applications in general which need a second voltage (U1, U2) and second current input (I1, I2). In these cases the firmware feature is mostly combined with background programming (special tool A. Eberle) to realize customer-specific requirements.

The main characteristics of the *Three Winding firmware* feature are:

- two galvanically separated voltage – (U1, U2) and current inputs (I1, I2) (hardware feature M9)
- equal or different voltage transformer settings (VT`s) for the two measurement inputs (U1, U2), what means three winding transformer with different secondary voltage levels can be regulated easily (CT ratio on the two measurement inputs (I1, I2) can be different either)
- display of both secondary voltages in the standard transducer mode
- voltage, current, cos ϕ, apparent-, active- and reactive power can be displayed in the transducer mode for the measurement input that is selected for the regulation (U1, I1 or U2, I2) at the moment
- voltage that is used for regulation can be selected via binary input, by SCADA-system or by background programming. One possibility for a background program is the change of the regulation voltage depending on the load of the two windings. This means, the winding with the bigger load will be regulated and the other one will be supervised (standard solution in case of three winding transformers if the currents are available).
- selection of the regulated voltage (measurement input U1 or U2) is indicated on the REG-D(A) LC-Display and can be signalled via SCADA and via relay
- all parallel programs and the current influence algorithms (ZIC or LDC) of the REG-D(A) can also be used in three winding applications
- in case of measuring only voltages (U1, U2) the regulation side can be defined too, and can be changed depending on voltage limits which need to be set.

Regulation of a *Three Winding Transformer*

Three winding transformers are special power transformers that have two windings on the secondary side and normally feed two different bus bars. The voltage levels on the secondary side of the power transformer can be equal or different. In most cases these transformers have only one OLTC (onload tap-changer) on the primary side, although types of two tap-changers on the secondary side exist, so that it is normally necessary to connect both secondary voltages with the measurement inputs (U1, U2) of the voltage regulator REG-D(A) and to select one of the voltages depending on the busbar situation for the regulation.

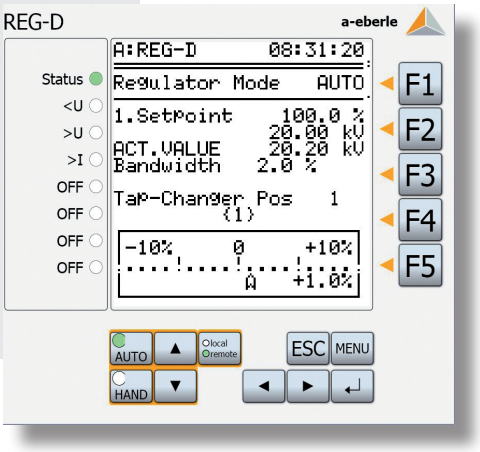


If REG-D is equipped with PAN-D voltage supervision unit (19"-technology), both voltages are also connected to the PAN-D to supervise the regulated voltage additionally. The change between the measurement inputs (U1, U2) is done in the same way as on the REG-D. With a so called background program – flexible tool to create customer specific solutions either - it is possible that the PAN-D can supervise both voltages at the same time.

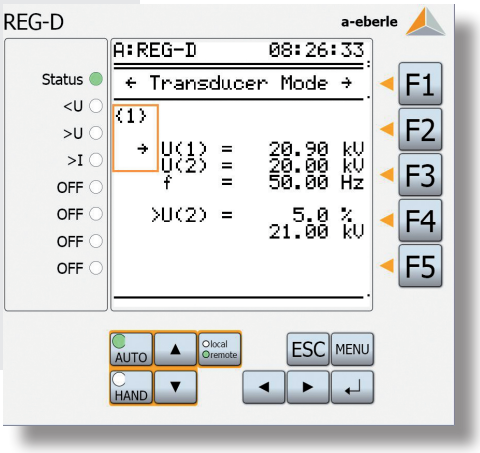
The voltage that is used for the regulation and supervision can be selected via binary input, via SCADA-system or by background program. It is possible to monitor the unregulated voltage in parallel to make sure that it stays within a certain defined range. If current measurement is available on the transformer or at the feeder bay the REG-D(A) can automatically select the regulation voltage in dependence on the load.

Therefore a different background programme is used, which is available as a standard. In general it is possible to realize the voltage selection on any costumer specific requirement.

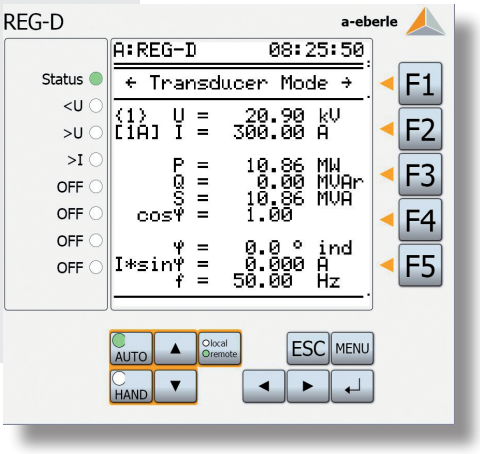
The voltage which is used for regulation is indicated on the voltage regulator LC-Display.
As standard you will see {1} for voltage input-1 (VT 1) and {2} for voltage input-2 (VT 2).
This indication – {1} or {2} - can be changed to a free definable, application-specific three character string.



In the transducer mode you can see both secondary voltages, the frequency and the limit for the unregulated voltage, which is monitored. The supervision of the unregulated voltage can be activated and deactivated by changing the feature *3winding*. The regulated voltage will be indicated in the left upper corner with the above marked label and an arrow in front of the measured voltage values.



On the second transducer screen you can find regulated voltage, current, phase angle and active, reactive and apparent power of the regulated measurement inputs. To have this screen available you need to activate the feature *3winding with phase measurement* (with measurement input swap).



other applications

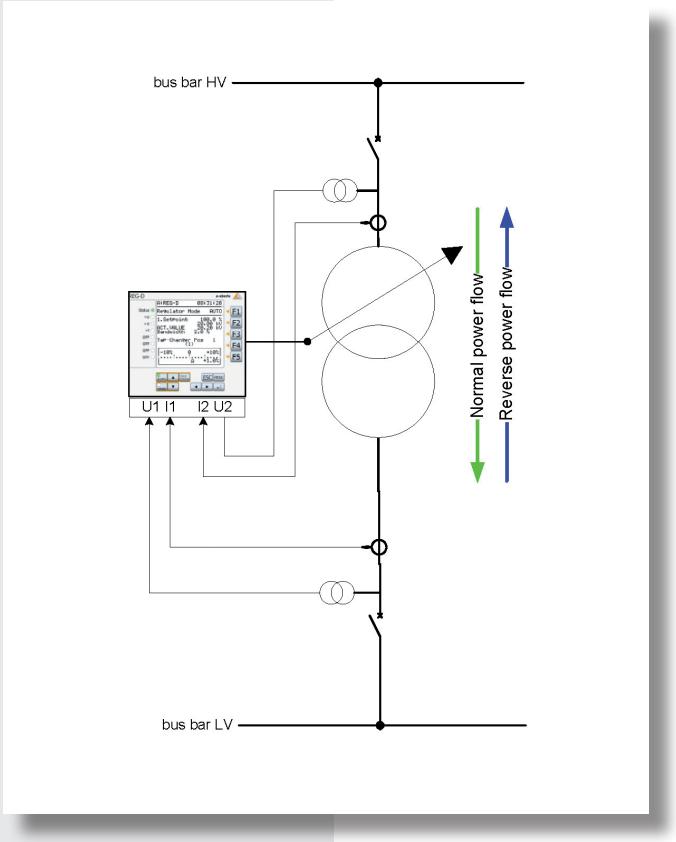
As mentioned before the three winding feature can also be used for other applications example:

Regulation of a coupling transformer between two grids

In this case power flow direction can change so that it is necessary to change also the regulated voltage. In normal operation the power flow is from the HV-side to the LV-side and the LV-side is used for measuring the regulated voltage. That`s the typical application of voltage regulation.

When the power flow direction changes to reverse power flow then the HV-side will be regulated. Therefore the VT's and the CT's of the LV- and the HV-side are connected to the voltage regulator REG-D(A). The regulated voltage will be determined automatically by the power flow direction that the REG-D(A) calculates out of the measurement values.

When the HV-side is regulated the REG-D(A) also changes the tap-command direction in order to achieve a voltage change into the right direction.



A. Eberle GmbH & Co. KG
Frankenstraße 160
D-90461 Nürnberg
Fon +49(0)911 628108-0
Fax +49(0)911 628108-99
www.a-eberle.de
info@a-eberle.de