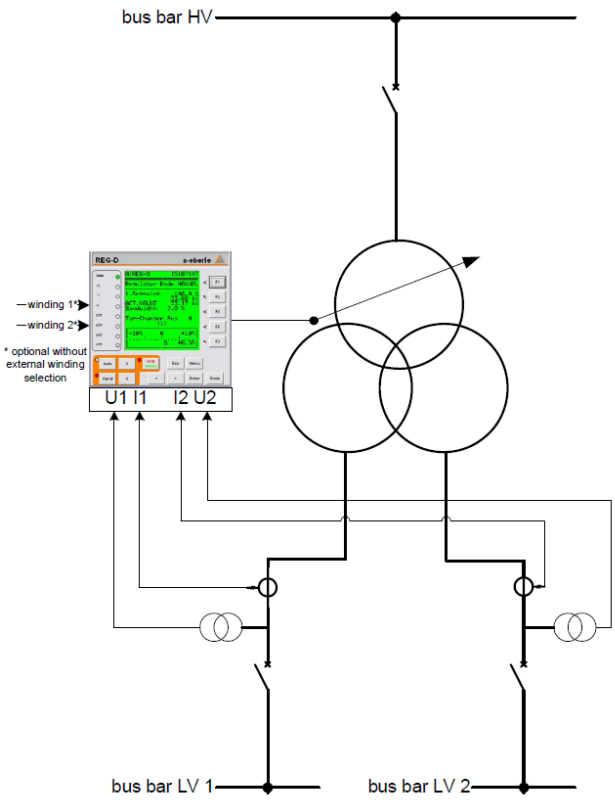
Introduction

The three winding feature is available on REG-D & REG-DA Voltage Regulators. It was originally designed to regulate and supervise three winding transformers. However, the design also allows it be used for other applications such as reverse power flow scenarios for two winding interconnecting transformers.

The main characteristics of the three winding feature are:

- two galvanic separated voltage and current inputs (M9 hardware feature)
- three winding transformers with different secondary voltage levels can be regulated (CT and VT ratio can be different on the two measurement inputs)
- display of both voltages in the transducer mode
- the voltage, current, cos(phi), apparent, active and reactive power can be seen on the transducer screen for the measurement input that is selected for regulation
- the voltage measurement input that is used for regulation can be selected via binary inputs, SCADA system or by an optional background program. One possibility for a background program is to change the regulation voltage based on the load of the windings. For example, regulation can be based on the most loaded winding
- the selection of the regulated voltage (measurement input 1 or 2) is indicated on the REG-D(A) screen, via SCADA and via relay.
- all parallel programs and the current influence settings of the REG-D(A) can be also used in three winding applications

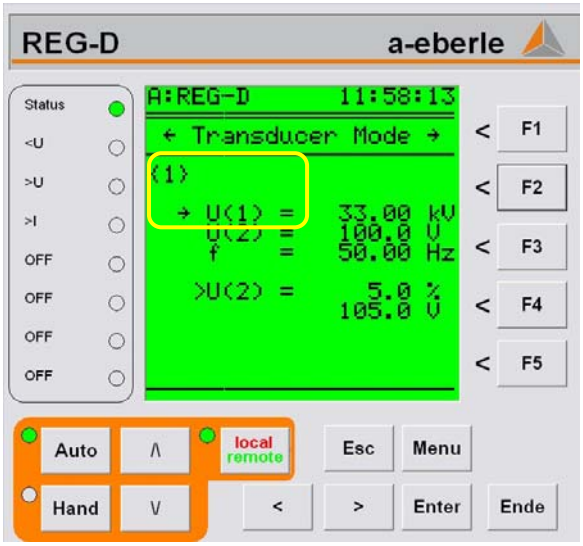
Regulation of a three winding transformer



A three winding transformer is a power transformer that has two secondary windings that normally feed different bus bars. The voltage on the secondary windings can be equal or different. Normally the transformer has only one OLTC on the primary side so that it is necessary to connect both secondary voltages to the regulator to allow selection of either one for regulation as appropriate.

If current measurement is available on the transformer or in the feeder bay the REG-D(A) can automatically select the regulation voltage dependent upon the load. A special background program is used and in general it's possible to set the regulation mode based on any user defined customer condition(s).

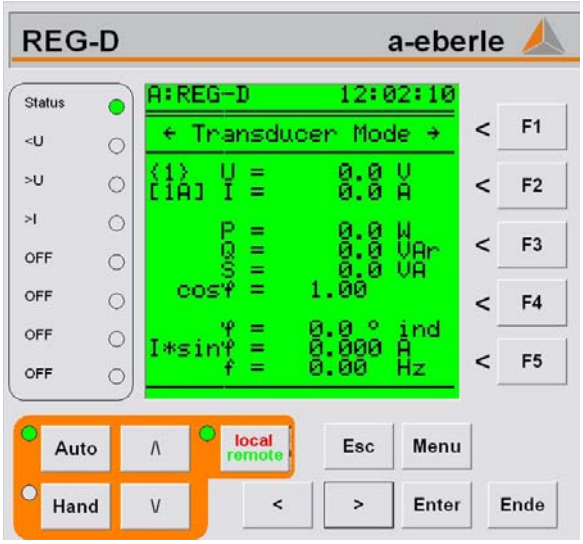
The voltage that is used for regulation is indicated in the regulator screen. The default is a {1} for voltage input 1 and a {2} for voltage input 2. However, in setup this indication can be changed to a user definable 3 character string, e.g. 33k.



In the transducer mode you can see both voltages, the frequency and the supervision limit for the unregulated voltage.

Supervision of the non regulated voltage can be activated if desired. This will block regulation if the other winding voltage exceeds upper or lower limits.

The regulated voltage is again indicated in the left upper corner (with user defined label if set) and an arrow in front of the appropriate measured voltage.



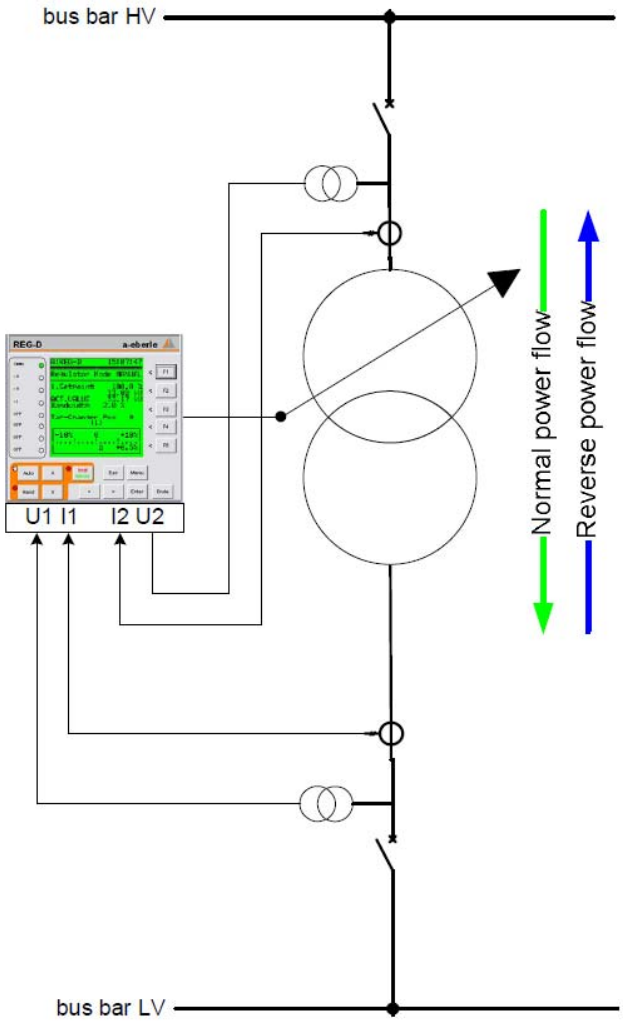
On the second transducer screen you can find the current, phase angle and the power of the regulated measurement input.

Other applications

The three winding feature can also be used for other applications. The following shows the flexibility of the REG-D(A) voltage regulator for **Regulation of a coupling transformer between two networks**

In this case the power flow direction can change so that it's necessary to change the voltage which is regulated from one side to the other. In normal operation the power flow is from the HV side to the LV side so the LV side needs to be selected as the regulated voltage. When the power flow changes to reverse power flow, the HV side should be selected as the regulated voltage.

To achieve this, the VT's and CT's of the LV and the HV side are connected to the regulator. The REG-D(A) calculates the power flow direction from the measurement values, and automatically determines which site to regulate. The REG-D(A) also changes the tap command direction in order to achieve a voltage change in the right direction.



For further information on the three winding feature please contact HV Power (info@hvpowerautomation.com)