DISTRIBUTION
Voltage Regulating Control

TARTN20D

The **V**oltage **R**egulating **C**ontrol "**TARTN20D**" allows regulation of the medium-voltage supply (M.V.) provided by a H.V. / M.V. transformer or by two parallel transformers.

The **TARTN20D** monitors the voltage and current of H.V. network and initiates the on-load tap-chargers of the power transformer in order to raise or lower the voltage.

The **TARTN20D** can operate according to two modes:
- direct regulation by measuring output voltage of the transformer,
- by reactive compoundage regulation.

The direct regulation operates by comparison between transformer output voltage and the setting voltage Vc (± α value).

The reactive compounding takes into account of the complex load impedance of the network: $Z = R + jX$, in order to calculate a compensated output voltage.

The setting of **TARTN20D** can be done:
- directly on the front face, by using the 16 keys of the keypad, the screen display and the signalling LEDs,
- with a laptop connected to the front RS232 port.

Functionalities
- compounding,
- voltage compensation,
- voltage monitoring.

The TARTN20D allows
- greater flexibility of settings:
  - choice of all compounding categories (active, reactive, additive & subtraction of reactive),
  - choice of time delays (definite or dependent time) for the first tap changing,
  - choice of taps failure on under voltage or by external command,
  - 2 settings of voltages available (1 for summer & 1 for winter).
- friendly MMI by PC under WINDOWS® or by local keypad/screen,
- auto-test of all electronic cards,
- choice of wiring connection (front or rear connections),
- High immunity level EMC (IEC 801.4 class 4,...).

Protection & Control

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DIGITAL VOLTAGE REGULATING CONTROL

Control functions

- **Un** is the secondary rated voltage of transformer (e.g.: 20 kV)
- **Vc** is the setting voltage value (e.g.: 98% of Un)
- **α** is the sensitization threshold value (e.g.: 2% of Un)
- **β** is the abnormal voltage threshold value (e.g.: 3% of Un)
- **Um** is the output voltage of the transformer

- if $Vc - \alpha < Um < Vc + \alpha$, no operation
- if $Um > Vc + \alpha$, TARTN20D initiates the command "**low**" to the tap changer
- if $Um < Vc - \alpha$, TARTN20D initiates the command "**raise**" to the tap changer
- if $Um < Vc - \beta$ or $Um > Vc + \beta$, there is abnormal condition (**Um** is too low or too high)
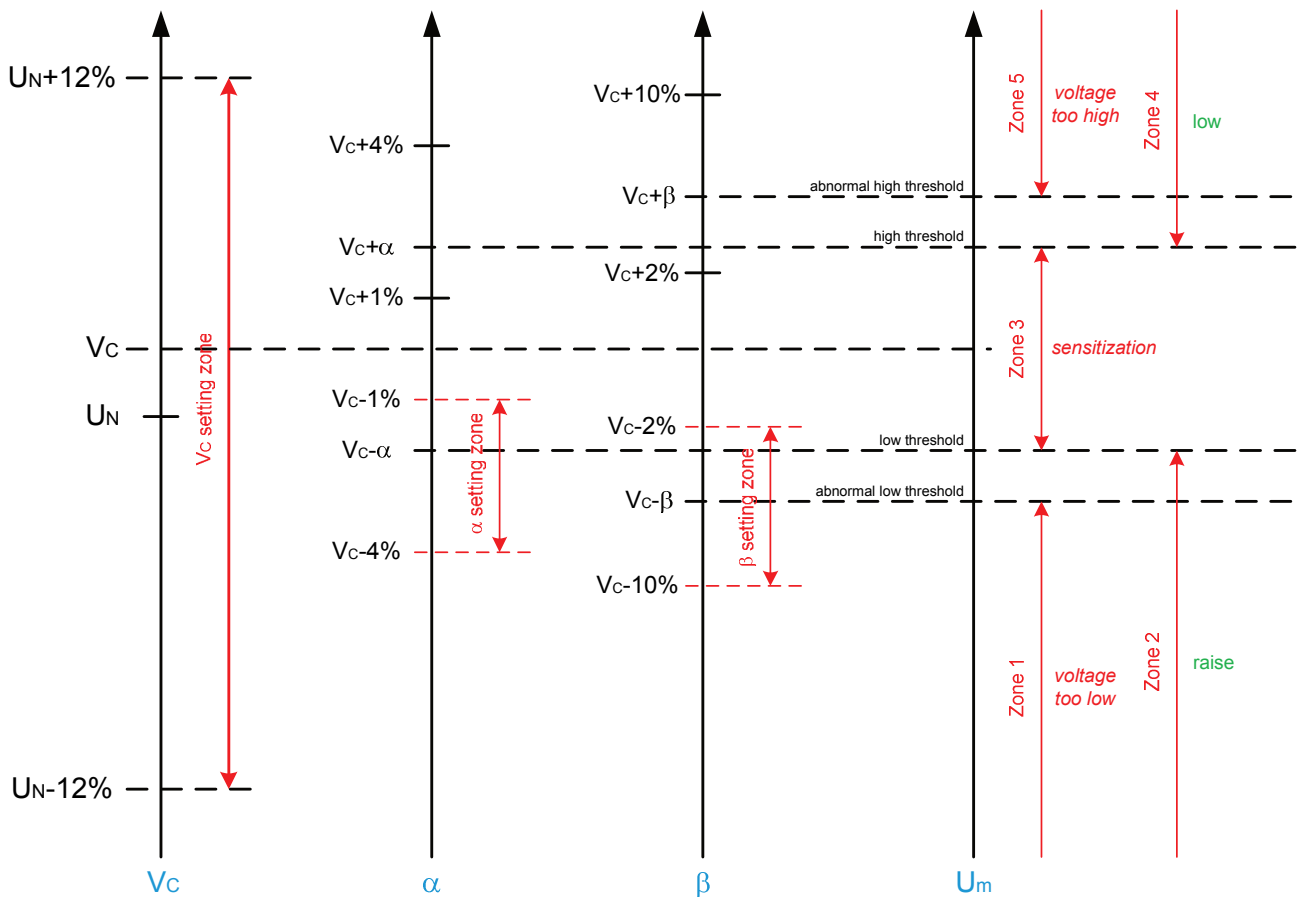
Time delay for the first tap changing

- for the first tap changing, the operator has a choice between a time delay **TA1** (definite or inverse time),
- inverse time allows to accelerate the starting of the regulation (time being shorter when difference Um-Vc is high)
- characteristics of the inverse time curve can be changed

TA1 with inverse time
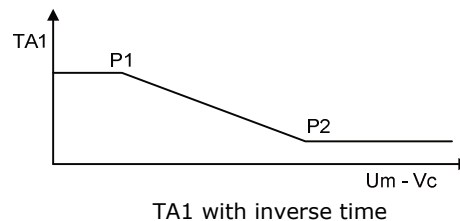
COMPOUNDING FUNCTION

Active or Reactive Compounding

Our compounding modules allow the voltage compensation in order to take account of the line impedance.

Fed by the 3 current phases, they provide a compensated voltage, or a compounding image of the network load [(R + jX).I] from the ouput voltage of the transformer "**Um**". It allows the AVR to regulate the voltage, not at the secondary of the transformer but to a fictive point of the network, with:
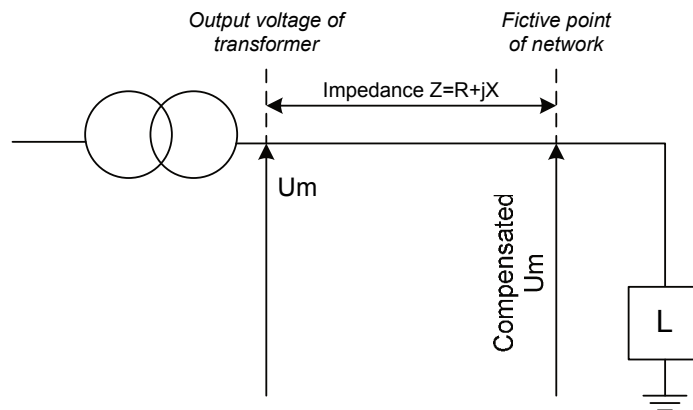
   Um compensated : Um - (R + jX).I
   R : line resistance
   X : line reactance
   I : current by phase

This compounding voltage is proportional to the current of the line but also to the impedance between the transformer and the fictive point (R + jX).

Tap changer failure

The « Tap Changer Failure » module allows, if commands are available:
   • to decrease the tap changer until a determinate tap
      or
   • to block all tap change commands if tap is lower or higher than the determinated tap.
The unblocking operates during the out of service of the function.
This command is available locally or remotely.

Common functions

Abnormal voltage "High" & "Low"
If the difference between the voltage Um and the seeting voltage Vc becomes higher than a limited value (β), TARTN20D generates an "abnormal voltage" alarm after a time delay T2 or during the feeding of the transformer, or an "abnormal voltage" time delay T3, if the network is already fed.

Tap changer failure
If a "lower" or "raise" command is sent or remains during a time greater or egal to T1, TARTN20D operates an alarm "Tap changer failure".

Control voltage failure
"Lower" and "raise" commands are mutually locked-out by output relays. Both commands cannot be sent simultaneously.

Also if both commands appear together (control voltage failure), or if the interlock position for "C.B. close" is failing, a "Control voltage failure" alarm is operated.

TARTN20D failure (WD)
If internal auxiliary supplies are lost, an alarm « TARTN20D » is activated.

Undervoltage function

In order to avoid an overvoltage when the voltage is back, it's possible to force the tap changer to be in the lower tap position in case of lost of voltage.

Tap change position boosting after voltage back

When the voltage is back, a time delay **TA3** of 1 min is initiated.
During this time-delay, it's possible to accelerate the commands of the tap changer by changing the long time delay **TA1** about the first tap changing by another time delay **TA2** (10 s).

CHARACTERISTICS

Auxiliary supply
- Auxiliary supply   48 or 125V$_{DC}$
- Accuracy   -20% to +10%
- Power   rated   24W
            maximum   32W

Analogue Inputs
- Rated Current   5A (50 Hz)
                          $I \leq 20$ In
          overload limit $I = 2$ In (permanently)
                          $I = 20$ In (5s)
          burden at In   1 VA maximum by phase (active or reactive on 10%)
- Rated Voltage   100/√3 or 100 V$_{AC}$
                          $U \leq 1,2$ Un
          overload limit $U = 1,5$ Un (permanently)
                          $U = 1,9$ Un (5s)
          burden at Un   0,3 VA
- Frequency   within accurancy $47 \leq F \leq 52$ Hz
             out of accurancy $46 \leq F \leq 54$ Hz

Setting
- 1 or 2 setting voltage values **Vc**   -12 to +12% Un (step of 1%)
- Sensitization threshold α   1 to 4% Vc (step of 0,25%)
- Abnormal voltage threshold **β**   2 to 10% Vc (step of 1%)
- Setting modification by remote control   0,95 Vc
- Compounding   *active*   0 to 10% (step of 1%)
                    positive reactive (Q+)   0 to 20% (step of 1%)
                    negative reactive (Q-)   0 to 10% (step of 0,5%)
- Tap management
             Number of taps managed   40 maximum
             Tap position on under voltage   1 to 40
             Tap position on external command   1 to 40

Time delay setting
- TA1 (1st tap change) with definite time   10 to 60s (step of 1s)
- TA1 (1st tap change) with inverse time   setting can be changed
- TA2 (tap by tap)   1 to 60s (step of 1s)
- T5 (under voltage validation before tap changer failure)   3 to 60s (step of 3s)

Time delay fixed
- Time delay for UVR   2s
- T1 (tap changer failure)   120s
- T2 (abnormal voltage when voltage back)   2s
- T3 (abnormal voltage if network is already fed)   60s
- Control voltage failure   4s

Accuracy
- Resetting percentage for H/L thresholds   high threshold, abnormal high threshold: 99,8%
                                             low threshold, abnormal low threshold: 100,2%
- Voltage detection   threshold 0,73 Un
                                  Resetting percentage: 96%
- Thresholds α & **β**   ± 0,25%
- Time delay   ± 5%
- Display of measured values   ± 5%

Installation
- Rear connection   19" cabinet installation

Dimensions
- W x H x D (mm)   440 x 266 x 350