

RG750

Digital Controller for Synchronous Machines



The digital Automatic Voltage Regulator (AVR) RG750 was specially designed to control the excitation of large synchronous machines (alternators & motors).

Thanks to its regulation principles & high performances, it allows the machines that are equipped with to ensure dynamic stability of the feeded networks.

The AVR RG750 belongs to the RG700 series grouping Technirel's digital regulators. They are dedicated to the control of synchronous machines.



Regulation purposes

The digital AVR RG750 acts on the rectifier bridge to control the excitation current of the alternator in order to:

- Maintain the voltage value at the stator terminals on the fixed point regardless of the load conditions of the network
- Maintain the power factor value of the machine according to the conditions requested for production or absorption of reactive power
- The RG750 AVR is a digital controller with override regulation facilities (open loop control operation)

Limitation purposes

The digital AVR RG750 takes into account 3 kinds of limitation that supersede the regulation purposes.

These limitations make the alternator operating inside its proper boundary defined by the PQ diagram.

However, the limits of this boundary can be trespassed in case of extreme operational conditions that require exceptional & short field forcing.

- Rotor & stator current limitations
They correspond to rotor & stator coils over heating conditions
- Reactive power absorption limitation
It corresponds to the practical static stability limits of the machine (internal angle limitation)

Over excitation purposes

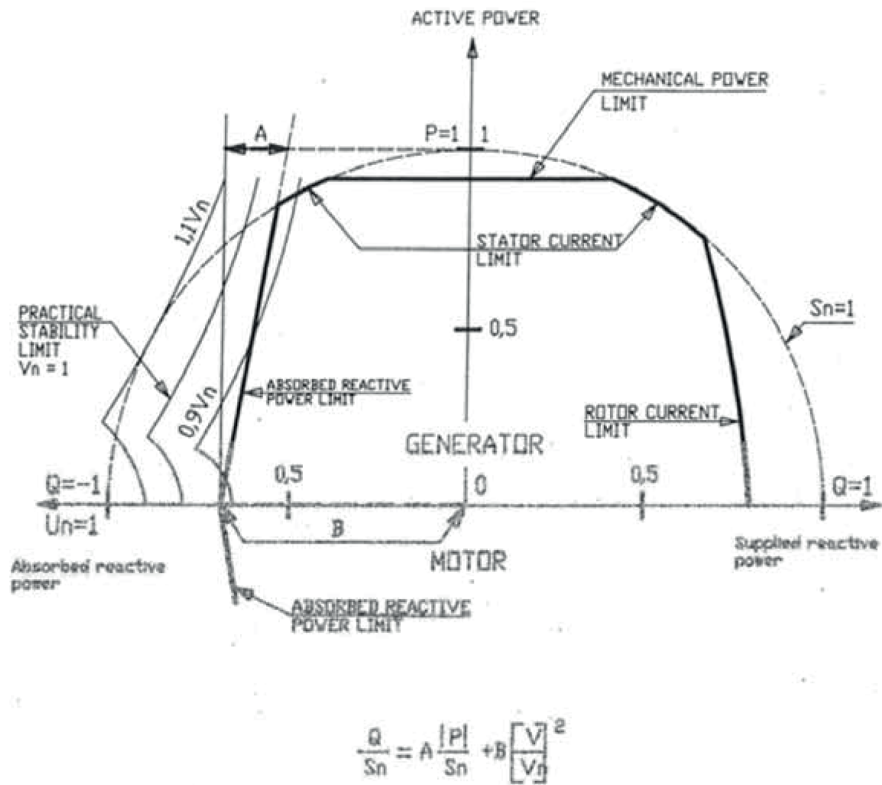
The digital AVR RG750 allows to set the field excitation current at several levels of over excitation.

- Thus, when the grid network suffers from important disturbances (short circuits), the RG750 AVR can cancel the permanent excitation ceiling that goes up from 1.2 Ifn normal value to 1.6 Ifn exceptional value for a 10 s maximum duration

OUR TRADEMARKS



Active power



ALTERNATOR P-Q DIAGRAM

P : (active power)
Q : (reactive power)

SC088A

Functions

Basically, the digital AVR RG750 ensures the following functions

• Regulation functions

- Field flashing up to 0.6 Un stator voltage
- Excitation current regulation
- Progressive stator voltage establishment when starting up (soft start)
- Stator voltage regulation
- Stator voltage & grid voltage matching before coupling
- Machine powerfactor control
- Under frequency operation control of U/F = Constant ratio
- Bumpless transfer from auto mode to manual mode (and inversely)
- Adjustable droop

• Limitations

- Stator current limitation
- Rotor current rotor limitation
- Reactive power absorption limitation

• Regulation & limitation functions activation

Regulation & limitations modes are activated by switching on external contacts or logic arrangement of these contacts.

• Manual mode

The digital AVR RG750 offers the possibility of manually controlling the excitation current by allowing the stator voltage adjustment over a span covering from 0 to 125 % of nominal voltage.

The RG750 AVR performs bumpless transfer from manual to auto mode & vice versa.

Manual mode is activated through external contacts selection & stator voltage is set by action on voltage rise or down contacts.

• Preset mode

This facility allows to start up the excitation of the system using a predetermined value.

The preset mode is activated by switching on an external contact. The preset value is adjusted from the PC terminal.

Displays

Regulation & limitation modes selections are displayed by LEDs illumination on the front face of the RG750.

- Yellow LEDs indicating regulation modes involved
- Red LEDs indicating limitation modes involved, microprocessors alarms and communication port activation
- Green LEDs indicating stabilized regulation condition

Settings

The settings of the internal set points, the scalling of the measurements, the selection of the PID parameters are performed through the communication port located on the front face by using the PC terminal.

Measurements

All measurements are filtered

- 5 voltage measurements through PTs with 100 / 110 V :
 - 3 stator voltage measurements (V1, V2, V3 / U12 - U23 - U31)
 - 1 grid voltage measurement
 - 1 voltage measurement for thyristors synchronisation
- 1 voltage measurement through a Hall effect probes
- 1 voltage measurement (Uf rotor / U excitation)
- 3 current measurements through CTs with 5 A secondary. 3 stator current measurements (I1, I2, I3)
- 1 excitation current measurement through an Hall effect probe (If rotor / Iex)

Remote settings

The RG750 Digital AVR allows remote adjustment of the following regulation set points:

- Stator voltage regulation set point
- Power factor regulation set point
- If rotor excitation current set point

These remote settings are retrieved in form of analog signals:

- Current :

± 5 mA	0 to 5 mA	1 to 5 mA
±10 mA	0 to 5 mA	2 to 10 mA
± 20 mA	0 to 5 mA	4 to 20 mA
- Voltage

± 5 V	0 to 5 V	1 to 5 V
±10 V	0 to 10 V	2 to 10 V
- Potentiometer 0 to 10 kΩ on 0 to 5 V

Logic control input signals

To activate regulation or limitation automatic functions the RG750 digital AVR retrieves 16 logic control signals galvanically insulated by the means of optocouplers.

Logic control output signals

Independently from the serial communication links, the RG750 digital AVR has the capacity of 5 logic signals output to deliver the following status informations:

- Current stator limitation function activated
- Current rotor limitation function activated
- Reactive power absorption
- AVR CPU Faulty (Watchdog)
- Field flashing sequence over

Description

The digital AVR RG750 uses 2 microprocessors 16 bits type 80C196KB-12 MHZ.

One microprocessor is in charge of:

- Communication management: serial ports 1 & 2
- Binary data input & output management

The other one is in charge of regulations & limitations functions as well as the control of the triggers.

The RG750 hardware is made of 7 PCBs fitted in a 19" wide rack 3 units high suitable for flush or projection mounting.

Safety

Each microprocessor has its own watchdog equipped with an alarm signalling contact hardwired on terminal.

All parameters used by the regulation are saved in EEPROM with a backup lifetime of 10 years.

Man-machine interface of ICE's configuration software

- Introduction of the operation software RG7x0:
 - Measurements display
 - Set points & PID parameters generation or modification
 - Alarms & signals display
 - Set points & parameters are protected by passwords
 - PQ diagram situation display

Communication

The RG750 digital AVR is basically devoted to control & communication.

Communication function uses 2 serial dedicated ports:

- Port n°1 is dedicated to the man/machine dialogue needed by commissioning operation.
- Port n°2 is dedicated to communication with supervisory system.
- Port n°1 characteristics:
 - Link type: RS232
 - Speed: 9,600 Bauds
 - Protocol: private TECHNIREL ICE SAS property
 - Plug in connexion: on the front panel, DB9 plug in type

Terminal suitable: PC / Windows XP.

- Port n°2 characteristics

Link type:

- RS232
- Current loop 0 - 20 mA

Speed: 300 to 19,200 Bauds

Protocol: Modbus / Jbus slave

Connexion: on rear terminal (screw connexion)

RG7x0 software: Operation window

The screenshot displays the 'RG750 settings software' window. At the top, the status is 'RG750 status: Not connected'. Below this, there are sections for 'Status (I/O)', 'If field regulation', and 'Settings'. The 'Settings' section includes a table for 'If field regulation' with parameters like 'Internal Ifo', 'PG1 FCR', 'IT1 FCR', 'DT1 FCR', 'Lower ext If', and 'High ext If'. A 'Measures' table on the right lists various electrical parameters such as V, I, Φ, F, Cos Φ, Sin Φ, S, P, Q, Vnet, Fnet, Φcoup, If, α, Psi, Vsyn, Fsyn, Efpot, Uc, Ifc, Sequence, and JBUS. The bottom of the window features a 'Commissioning' bar with several function buttons: (F12) Connection, (F5) Send all, (F3) Send, (F11) Bar Chart, (F2) Screenshot, (F5) Receive all, (F4) Receive, (F9) Scanning, (F10) Write E2PROM, and (F8) PQ diagram.

Uc	V	Measures
1.2 Un		V
		I
		Φ
1.1 Un		F
		Cos Φ
		Sin Φ
1 Un		S
		P
		Q
0.9 Un		Vnet
		Fnet
		Φcoup
0.8 Un		If
		α
		Psi
		Vsyn
		Fsyn
		Efpot
		Uc
		Ifc
		Sequence
		JBUS

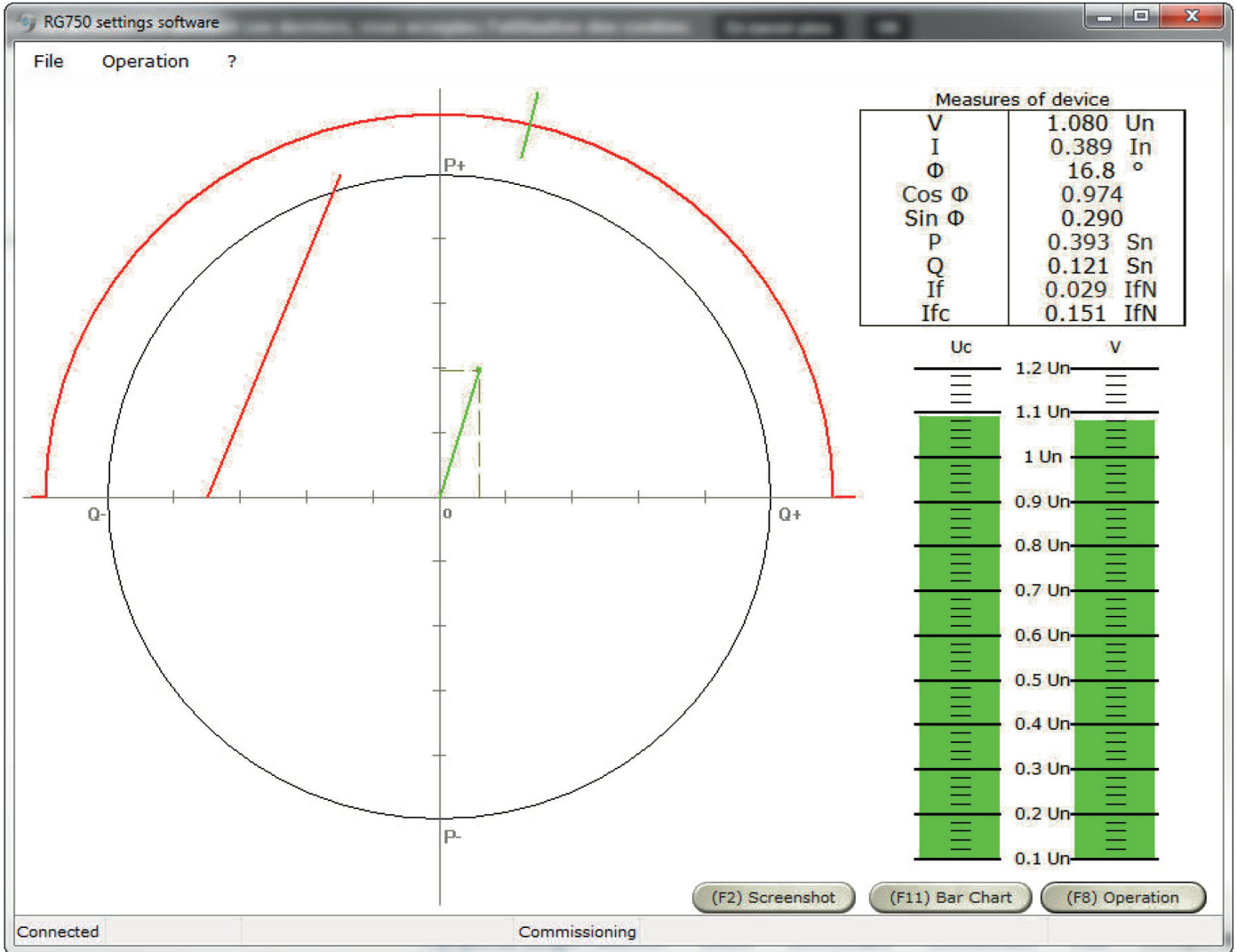
If field regulation	
Internal Ifo	1 IfN
PG1 FCR	2.3
IT1 FCR	0.7 s
DT1 FCR	0.75 s
Lower ext If	0 IfN
High ext If	1.2 IfN

Field Current Regulation Set point, in per unit, ex.= 0.95 Ifn

From 0 to 1.6

Commissioning

RG7x0 software: PQ representation window



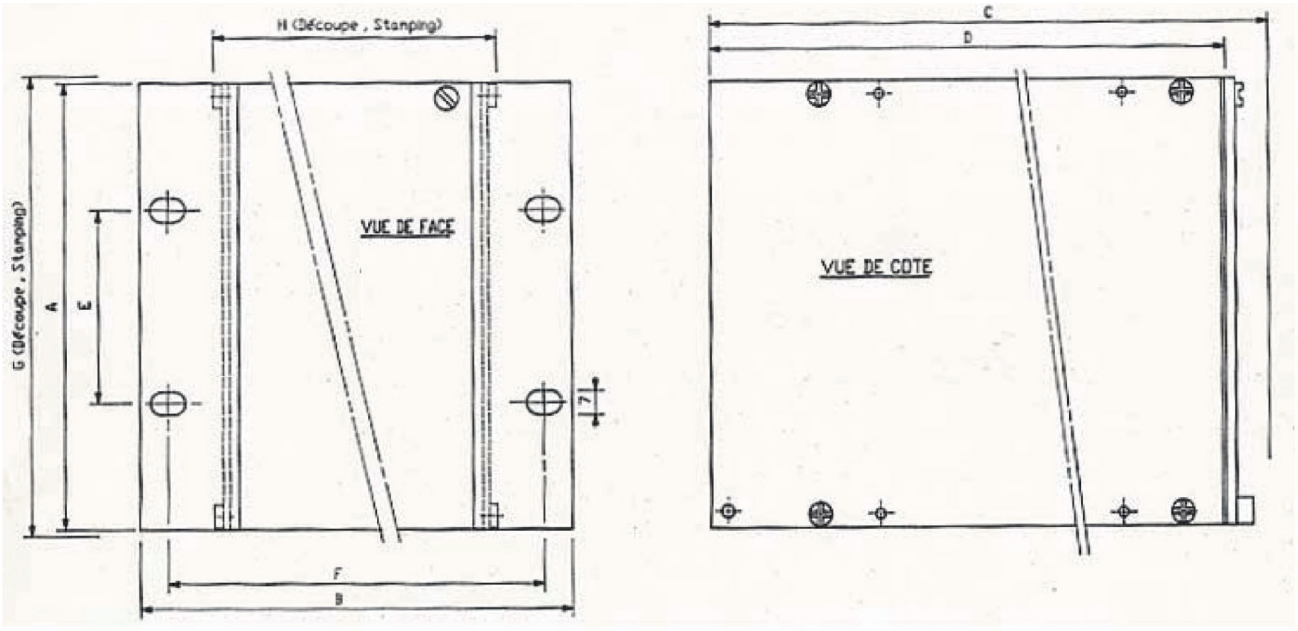
Electrical characteristics

- Auxiliary supply:
 - Galvanically isolated
 - 48 - 110 - 127 Vdc
 - Power consumption: 30 W maxi
 - Measurement input characteristics:
 - Input current: 5 A - 50 / 60 Hz
 - Consumption per input: 10 VA
 - Isolated
 - Voltage input: 100 / 110 V - 50 / 60 Hz
 - Consumption : 10 VA
 - Isolated
 - Set point input:
 - 3 ranges available: current (mA), voltage (mV), potentiometer (k Ω)
 - Control input characteristics:
 - Dry contacts free of voltage, galvanically insulated.
- Contacts output characteristics: dry contacts free of voltage.
- Breaking rate dc current:
30 V / 8 A - 100 V / 0.5 A - 30 V / 0.3 A

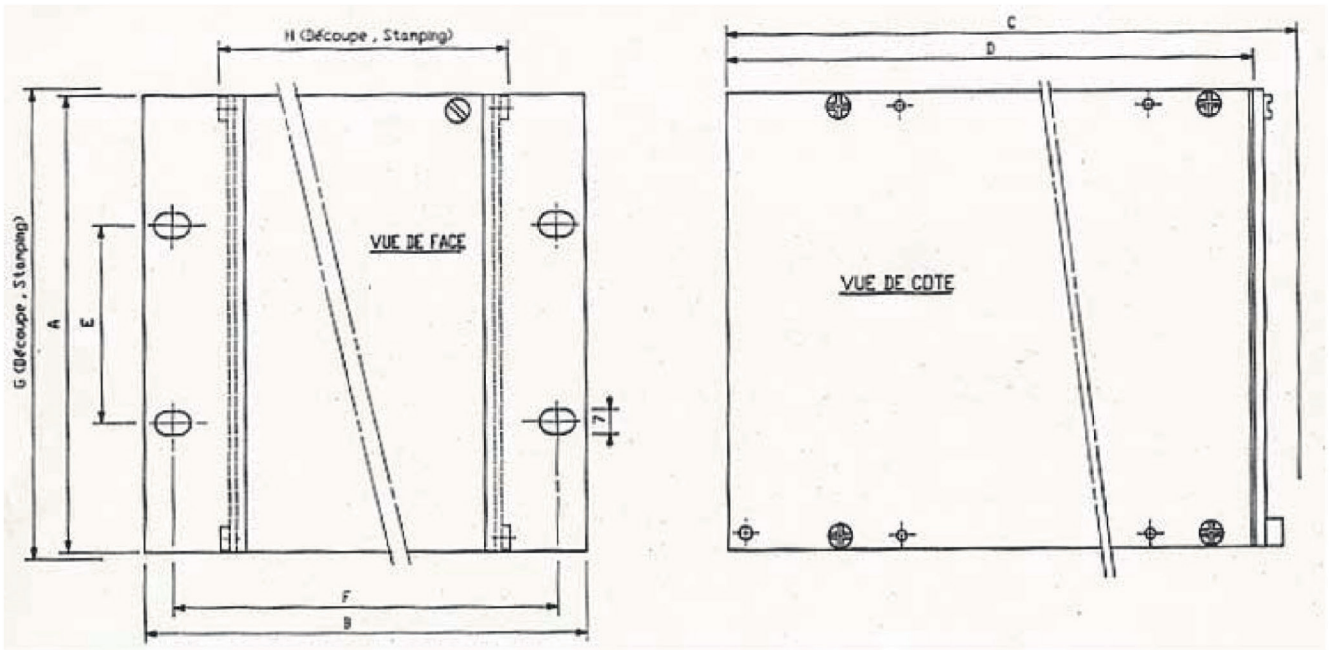
- Breaking rate ac current:
W
- Performances :
Regulation accuracy: $\pm 1\%$.
- Environmental conditions:
 - Operating temperature: 0°C to + 50°C
 - Storage temperature: - 20°C to + 70°C
 - Relative humidity: 0 to 92% non condensing
- Compliance and standards:
 - The RG750 was developed to comply to EDF CPC June 1972 & revision D421 PR / AG & DF 312 April 1981
- Cases

Dimension (mm)	Projecting mouting	Flush mouting
A	190	132,5
B	493	483,0
C	238	255,0
D	178	225,5
E	14	57,1
F	465	466,0
G	-	133,0
H	7	443,5

Flush mounting



Projecting mounting



- Weight: 10 kg
- Wiring: by 107 positions screw terminal.

The specifications and drawings given are subject to change and are not binding unless confirmed by our specialist.

