

## **Technical Description**

**VAREOTRON Rü 467 / 3**  
**VAREOTRON Rü 467 / 5**

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## 1.0 General

VAREOTRON - Type RÜ 467 control units are single-phase current regulators for one quadrant DC shunt wound motors. They can be operated with both separately excited field and permanent field motors.

The rotational speed can be regulated from either tacho-voltage feedback signal or through the internal measurement of the armature voltage with additional so-called IxR compensation. A run-up and run-down integrator is provided for smooth control of the unit, this enables the run-up and run-down times to be independently adjusted.

The other adjustment facilities provided in the control unit are:

$N_{min}$  - Minimum motor speed for zero speed reference

$N_{max}$  - Maximum motor speed for full speed reference

$I_{max}$  - Maximum Armature Current

PI - Regulation adjustment (response)

IxR - IxR compensation for armature voltage feedback

To prevent a thermal overload of the motor from continuous operation above the current limit, the motor is switched off as soon as the current limit is exceeded for longer than 3 minutes.

The output of the unit can be switched off remotely by opening contacts.

The rated range of these units is 540 W and 900 W.

All units have transient suppression to Class N.

## 2.0 Function

The unit is divided into a control section with the complete regulating electronics and a power section to drive the motor - see block schematic, diagram 1. The power section comprises a half-controlled bridge rectifier for the armature circuit and a non-controlled rectifier for the field excitation. The armature voltage can be infinitely varied by the half-controlled bridge rectifier. The set point for the armature voltage ie the rotational speed can be adjusted by means of a potentiometer or a signal voltage from 0...10 V DC - see diagram 2.

### **Please note that all terminals are at mains potential**

The selected set-point is reached following the run-up integrator (also on run-down), whereby the rate of rise (or fall) is controlled. This is connected to the speed control circuit.

Motor currents measured by a shunt-resistor are fed back to the regulator circuit and are limited by an adjustable amount. The rotational speed is decreased if the current limit is exceeded. Thermal overload of the motor windings can occur at the lower speed range because the heat-sink becomes less efficient. To prevent this the half controlled arms are switched off after the current limit has been exceeded for 3 minutes. Free wheeling of the half controlled arm is only achieved by switching the mains voltage ON and again for OFF.

## 2.1 Operating Methods

### 2.1.1 Armature voltage regulation with IxR Compensation

When there is no tacho-generator available for a feed-back signal, the unit can be controlled from the armature voltage. The IxR compensation provides compensation for rotational speed drops due to loading and constant voltage. The control accuracy achieved by this means is approximately +/-4 % of the rotational speed value.

### 2.1.2 Rotational speed control using a tachogenerator

Units with a tachogenerator for feedback control of the rotational speed can achieve a regulation accuracy of +/- 1 %. Tachogenerators with a DC output should be used. The maximum tacho voltage may not exceed 180 V DC. The current calibration is achieved with tachogenerators which have an output of 15 V/1000 rpm. Other tachogenerators can be adapted by resistor Rx1.

## 2.2 Free wheeling

Using the firing board, the power section of the unit can be switched off instantly eg during faulty operation of the machine mechanism. When the regulator is continuously switching this causes the firing board to switch the mains on and off and by doing this increases the unit safety.

## 2.3 Adjustment of the Current Limit on the Rated Motor Current

\* The unit current value is factory set \*

When operating a DC motor with a thyristor current regulator the adjustment of the maximum current must take into account the form factor F.

Should the motor be installed without an armature choke a form factor of approximately 1,4 should be considered.

The adjustment for the current limit value is calculated as follows: rated armature current as given on the motor rating plate divided by the form factor equals current limit. (Measured with a moving coil instrument in the armature conductor)

$$\frac{I_{\text{Armature}}}{F} = \text{Current Limit}$$

eg. For a current of 3 A from the rating plate

$$\frac{3 \text{ A}}{1,4} = 2,14 \text{ A}$$

The current limit should be set at 2,14 A.

By the use of a smoothing choke in the armature circuit the form factor is improved to 1.11.

3 A

1,11 = 2,70 A

The current limit should be set to 2,7 A.

Smoothing chokes can be used to:

1. Improve the control characteristics
2. Protect the motor against undue heating
3. Preserve the motor commutator

### 3.0 Adjustment Instructions

Connect equipment according to diagrams 2 or 3

Trimming potentiometers  $I_{max}$ ,  $N_{min}$ ,  $N_{max}$ ,  $t_{on}$ ,  $t_{off}$  should be set fully anti-clockwise, PI and IxR in the middle position.

#### 3.1 Adjustment of the Current Limit

Adjust the set point to the middle position. Connect a moving coil instrument into the armature circuit to measure the current. Lock the armature or disconnect the field.

Switch on the unit and turn  $I_{max}$  clockwise until the required rated current is reached

\*\*\* Remember the Form Factor \*\*\*.

Switch off unit and reconnect the field.

#### 3.2 Adjustment of the Minimum Speed

Adjust the set point to zero. Using the trimmer  $N_{min}$  adjust to the desired minimum speed. (Clockwise increases speed).

#### 3.3 Adjustment of the maximum speed

Adjust the set point to maximum. Using the trimmer  $N_{max}$  adjust to the desired maximum speed.

\*\*\* Not greater than 180 V armature voltage \*\*\*  
(Clockwise increases speed).

#### 3.4 Adjustment of the IxR Compensation

\*\*\* IxR Compensation is only used when there is no Tacho-Generator \*\*\*

The IxR Compensation can only be adjusted relative to the dynamic conditions of the unit. The trimmer IxR should be adjusted so that at low speed there is little speed variance between rated load and free running. If it does vary then the IxR compensation has been adjusted too much. (Clockwise adjustment increases the influence of the IxR Compensation).

### 3.5 Sensitivity of speed regulator

The trimmer PI (regulator amplifier) is used for adjusting the control characteristics for the drive conditions (Response, adjustment time). This can only provide for realistic conditions, which are affected by heavy masses and friction.

### 3.6 Adjustment of the set point integrator

Trimmers  $t_{on}$  and  $t_{off}$  are used for setting the time ramp when the speed changes. Clockwise adjustment of  $T_{on}$  increases the acceleration rate of the motor and similarly  $T_{off}$  increases the deceleration rate.

## 4.0 Technical Data

VAREOTRON Rü 467-	3 A	5 A
Supply Voltage	U 230 V +/- 10% 50/60 Hz	230 V +/- 10% 50/60 Hz
Output Power $P_{el}$	540 W	900 W
Field Voltage $U_F$	200 V, DC	200 V, DC
Armature Voltage $U_A$	0 - 180 V, DC	0 - 180 V, DC
Armature Current $I_A$	3 A	5 A
Field Current $I_F$	0,8 A	0,8 A
Set point pot	10 kR	10 kR
Set point Voltage	0 - 10 V, DC	0 - 10 V, DC
Operating Temp.	0 - 45 °C	0 - 45 °C
Dimensions	160x100x35 185x110x35	160x100x50 185x110x50

## 5.0 Ordering Codes

VAREOTRON	Rü 467K/3 A	3 A Armature Current, with Terminal Connections
	Rü 467D/3 A	3 A Armature Current with 32 pin Socket Connector Type D DIN 41612
	Rü 467E/3 A	3 A Armature Current with 48 pin Socket Connector Type E DIN 41612
VAREOTRON	Rü 467K/5 A	5 A Armature Current, with Terminal Connections
	Rü 467D/5 A	5 A Armature Current with 32 pin Socket Connector Type D DIN 41612
	Rü 467E/5 A	5 A Armature Current with 48 pin Socket Connector Type E DIN 41612

# 6.0 Diagrams

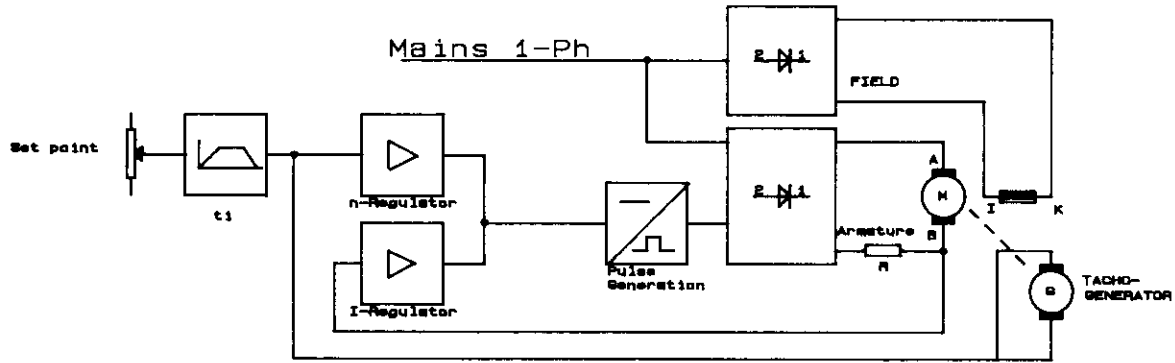
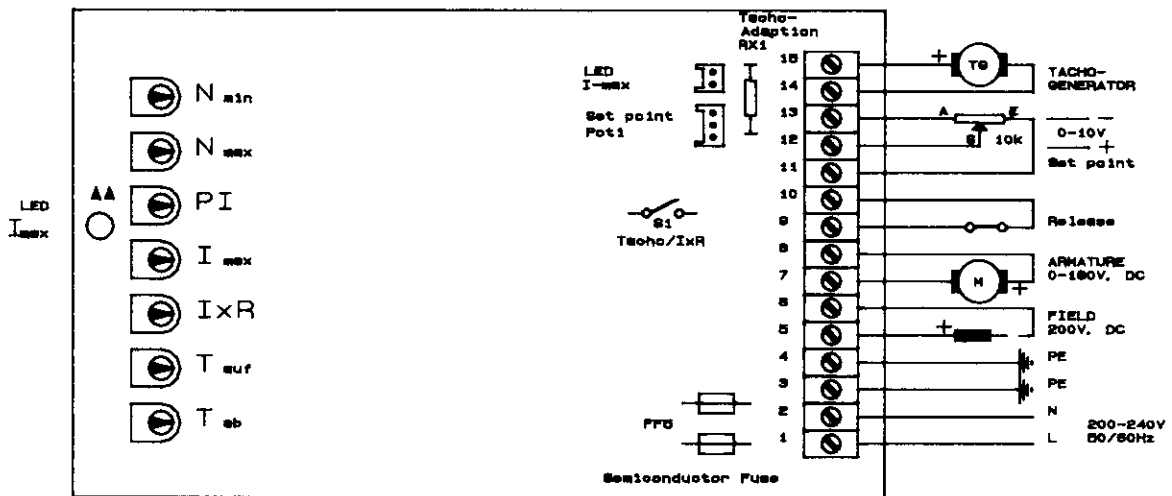
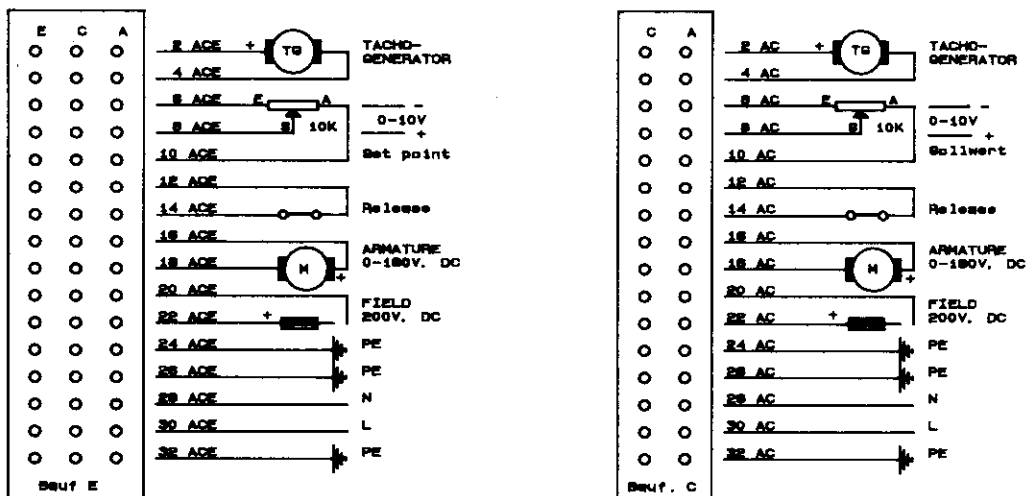


Fig. 1 Block Schematic



\*\*\* Please Note that all terminals are at mains potential \*\*\*

Fig. 2 Connection diagram for Terminals and potentiometer positions



\*\*\* Please Note that all terminals are at mains potential \*\*\*

Fig. 3 Wiring diagram for connectors type DIN 41612