



## **RECTIVAR<sup>®</sup> 4** série 44

Variateurs de vitesse  
réversibles pour moteurs  
à courant continu

Reversing  
variable speed controllers  
for d.c. motors

Guide d'exploitation  
User's manual



*GROUPE SCHNEIDER*

## ATTENTION

### NOTE

Le variateur comporte des dispositifs de sécurité qui peuvent, en cas de défauts, commander l'arrêt du variateur et par là-même, l'arrêt du moteur. Ce moteur peut lui-même subir un arrêt par blocage mécanique. Enfin, des variations de tension, et en particulier des coupures d'alimentation, peuvent également être à l'origine d'arrêts.

La disparition des causes d'arrêt risque de provoquer un redémarrage entraînant un danger pour certaines machines ou installations, en particulier pour celles qui doivent être conformes aux décrets du 15 Juillet 1980 relatifs à la sécurité.

Il importe donc que, dans ces cas-là, l'utilisateur se prémunisse contre ces possibilités de redémarrage notamment par l'emploi d'un détecteur de vitesse basse, provoquant, en cas d'arrêt non programmé du moteur, la coupure de l'alimentation du variateur.

La conception des équipements doit être conforme aux prescriptions de la norme NF C 15-100.

D'une façon générale toute intervention, tant sur la partie électrique que sur la partie mécanique de l'installation ou de la machine doit être précédée de la coupure de l'alimentation du variateur.

## CAUTION

### NOTE

The speed controller includes safety devices which can shut down the speed controller, and consequently the motor, in the event of a fault. The motor may itself be stopped by mechanical faults. Finally, voltage variations and, in particular, mains failures can result in stoppages.

Disappearance of the cause of a stoppage may cause restarting of the motor, which can be dangerous for certain machines or installations, particularly those which must conform to specific safety regulations.

Therefore, in such cases, the user should take appropriate steps to prevent restarting, by the use of an underspeed detector for example, which causes disconnection of the speed controller power supply in the event of a non-programmed motor stoppage.

The design of control systems must conform to the appropriate standards.

As a general rule, the power supply to the speed controller must always be switched off before carrying out any intervention on either the electrical or the mechanical parts of the machine or installation.

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# Presentation

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## RTV-44 Reversing 4 quadrants

### Characteristics

The RTV- 44 speed controllers are designed to control separately excited d.c. motors, or permanent magnet motors, from a single phase a.c. mains supply. Reversing, with fully controlled bridge, they operate in all four torque/speed quadrants. Total power/control isolation.

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Ratings :	6, 12, 24, 44A
Mains voltage	up to 415V (1) $\pm 10\%$ 50/60 Hz $\pm 2$ Hz (1) except 6A rating : U = 220/240V
Speed range	1 to 200 with tachogenerator 1 to 20 by U-RI feedback; the accuracy, however, depends on the motor

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### Composition

The RTV- 44 range comprises 4 ratings from 6 to 44A, with compact technology.

Inside a metal enclosure with protective cover are housed :

- for ratings from 6 to 12A :
  - . the control board
  - . the power board
- for ratings from 24 to 44A :
  - . the control board
  - . the power interface board
  - . the power section.

#### • Control board

This is common to the complete range of RTV-44 and has the following characteristics :



- 4 point clip-on fixing
- plug-in connectors for the external connections in the lower part of the board
- principal adjustments arranged within the same zone.

It comprises the following functions :

- proportional and integral speed regulation
- current regulation
- reversing logic
- 2 level current limitation
- pulse train gate circuit
- safety when switching on and off
- ramp with independent adjustment of acceleration and deceleration times
- LED and signalling relay.

#### • Power board (ratings 6 and 12A)

It comprises :

- the power bridge
- the power semi-conductor firing and protection circuits
- the isolated armature current reading circuit
- the excitation current rectifying diodes
- the excitation current rectification type selection link :
  - . half wave 
  - . full wave 

For the 12A rating, a link enables selection of the transformer tap corresponding to the mains voltage.



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# Presentation

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## Power interface board (24 and 44A ratings)

It comprises :

- the power semi-conductor firing and protection circuits
- the excitation current rectifying diodes
- the selection link for transformer supply voltage, depending on mains voltage
- the excitation current rectification type selection link :
  - . half wave 
  - . full wave 

## Dialogue by LED and relays

2 LEDs : 1 green and 1 yellow, visible from the front.  
2 relays.

Data supplied by the LEDs :

- ON : speed controller validated → green LED on.
- I A > : speed controller in current limit → yellow LED on.

Data supplied by the relays :

- Relay K1 :
  - speed controller validated → K1 energised, contact closed
- Relay K2 assignable via a 2 position link :
  - either speed controller outside current limit → K2 energised, contact closed
  - or speed not zero ( $N > 0,02$  rated N) → K2 energised, contact closed.

## Choice of motor

The motor should be designed and rated for supply by pulsed current, with speed and torque variation corresponding to the application.

Form factor = 1,6.

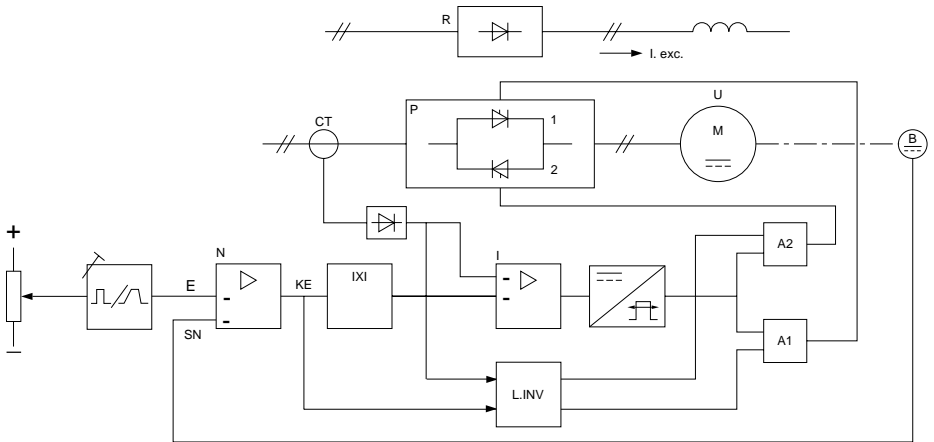
The motor must be separately excited or permanent magnet type. Do not use a series or compound excited motor.

Excitation voltage 0,45 or 0,86 times mains voltage, depending on whether the supply voltage is half or full wave rectified (choice via link F).

Recommended armature voltage  $\leq$  mains voltage x 0,68.

# General

## Functional block diagram



- P1 : single phase Graetz bridge
- P2 : single phase Graetz bridge
- CT : motor current measurement
- B : motor speed measurement
- R : field winding supply
- L.INV : reversing logic

# Selection guide

## Selecting the speed controller rating

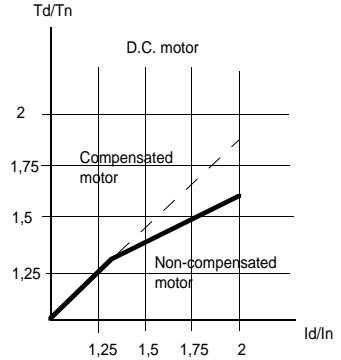
The table on page 7 enables the speed controller rating to be determined for :  
 - either continuous duty opération, with starting torque 1,2 times the rated motor torque,  
 - or an overcurrent of  $I_d/I_n = 1,5$  during 8s maximum (operating with 2 states limitation on overcurrent) with cyclic operation

If the required starting torque is greater than 1,2  $T_n$ , use the maximum current taken by the motor  $I_d$  determine the speed controller rating :

-  $I_d$  must be  $\leq$  maximum continuous current of the speed controller.

To determine the maximum motor current  $I_d$  depending on the starting torque, consult the machine curves or, if if these are not available, the curve on the left.

Exemple :  $T_d/T_n = 1,6$  non compensated motor. The curves give  $I_d/I_n = 2,1$  maximum speed controller  $\geq 2 I_n$  motor.

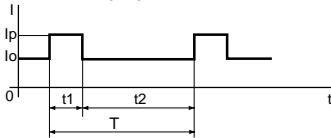


## Operating modes

### Continuous duty

The speed controller has a maximum continuous current ( $I_{max}$ ) which cannot be exceeded.

### Normal duty cycle



Operation can be defined by two current values :  $I_o$  and  $I_p$ .

- $I_o$  : continuous duty current
- $I_p$  : peak current.

For the Rectivar 4 series 44, the following time limits must be observed :  $t_2 \geq 7 t_1$ ,  $t_1 \leq 8s$ .

For  $I_o$  et  $I_p$ , the maximum values for the different ratings are as follows (in A) :

$I$ maximum continuous	6	12	24	44
$I_o$	4	8	16	29
$I_p$	9	18	36	66

### Special duty cycle

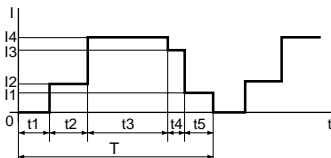
For a given known specific operating cycle,  $Imte$ , the equivalent mean thermal current must be calculated :

$$Imte = \sqrt{\frac{I_1^2 t_1 + I_2^2 t_2 + I_3^2 t_3 + \dots + I_n^2 t_n}{T}} \quad \text{avec } T = t_1 + t_2 + t_3 + \dots + t_n$$

Operating conditions are satisfied for :

- $Imte \leq 0,8 I$  maximum continuous of the speed controller,
- $I_p \text{ motor} \leq I_p \text{ speed controller}$ , defined in the table below.

Example of the  $Imte$  definition :



$$Imte = \sqrt{\frac{I_2^2 t_2 + I_3^2 t_3 + I_4^2 t_4 + I_5^2 t_5}{T}}$$

# Selection guide

## Speed controller-motor combination

The speed controller's reference, shown on the delivery note and on the rating plate located on the left hand side of the controller, must be quoted in any correspondence with our departments.

The values given correspond to an ambient air temperature of 40°C. For operation between 40°C and 60°C, apply a current derating factor of 1,2% for each additional degree C.

Single phase supply		Continuous current d.c. side		Motor Maximum motor power ( $\eta = 0,85$ )				Recommended	Excitation Rectifying			RECTIVAR (1)	Current	Reference	Weight	
Voltage line	current	Maximum continuous	Peak	standard		2 state		armature voltage	voltage		full wave	half wave	I ex.			
				limitation(2)	limitation(2)	Td/Tn = 1,2	Id/In = 1,5		voltage	voltage						
U rms	I rms	Im	Ip	In	P	Pn <sup>(4)</sup>	Pc <sup>(3)</sup>	UA	V	V	V	A				kg
220V 50/60 Hz	8	6	9	5	0,6	0,5	1,15	150	190	100	2			<b>RTV-44U60M</b>	3,600	
	16	12	18	10	1,25	1	2,3	150	190	100	2			<b>RTV-44D12Q</b>	3,600	
	32	24	36	20	2,55	2	4,6	150	190	100	2			<b>RTV-44D24Q</b>	6,000	
	58	44	66	36	4,6	3,7	8,4	150	190	100	2			<b>RTV-44D44Q</b>	6,000	
240V 50/60 Hz	8	6	9	5	0,65	0,55	1,2	160	205	110	2			<b>RTV-44U60M</b>	3,600	
	16	12	18	10	1,35	1,1	2,45	160	205	110	2			<b>RTV-44D12Q</b>	3,600	
	32	24	36	20	2,7	2,2	4,9	160	205	110	2			<b>RTV-44D24Q</b>	6,000	
	58	44	66	36	4,9	4	9	160	205	110	2			<b>RTV-44D44Q</b>	6,000	
380V 50/60 Hz	16	12	18	10	2,2	1,8	4	260	330	170	2			<b>RTV-44D12Q</b>	3,600	
	32	24	36	20	4,4	3,5	8	260	330	170	2			<b>RTV-44D24Q</b>	6,000	
	58	44	66	36	8	6,4	14,6	260	330	170	2			<b>RTV-44D44Q</b>	3,600	
415V 50/60 Hz	16	12	18	10	2,4	1,9	4,3	280	360	185	2			<b>RTV-44D12Q</b>	3,600	
	32	24	36	20	4,8	3,8	8,6	280	360	185	2			<b>RTV-44D24Q</b>	6,000	
	58	44	66	36	8,6	6,9	15,7	280	360	185	2			<b>RTV-44D44Q</b>	6,000	

Form factor = 1,6.

- Note :** (1) Products are delivered set to 380/415V.  
To use them at 220/240V, follow the instructions on page 52.  
The RTV-44U60M product is supplied for 220/240V exclusively.
- (2) See "adjustement of current limitation" on page 54.
- (3) Pp : peak power on overload (Id/In = 1,5).
- (4) Pn : rated power.



# Characteristics

Mains supply, voltage and frequency	220/240 V and 380/415 V $\pm$ 10 % (except 6A rating : 220/240only) 50/60 Hz $\pm$ 2 Hz
Recommended armature voltage depending on mains voltage	U armature $\leq$ U mains x 0,68
Excitation mains voltage	Maximum voltage : 415 V, and U excitation : 0,45 or 0,86 U mains (see table on page 37)
Maximum excitation current	2A
Armature current limitation	Current limitation adjustable by potentiometer from 0,4 to 1,5 times the max. continuous current
Speed range	
<ul style="list-style-type: none"> <li>• Control by back emf Accuracy :</li> <li>• Control by tachogenerato Accuracy with variations :</li> </ul>	1 to 20 (by U-RI feedback) Depends on motor characteristics 1 to 200
<ul style="list-style-type: none"> <li>- of resistive torque 0,2 Tn to Tn</li> <li>- of mains voltage <math>\pm</math> 10%</li> <li>- of ambient air temperature 20°C <math>\pm</math> 20°C</li> </ul>	<ul style="list-style-type: none"> <li>- 0,24 % of the set speed</li> <li>- 0,07 % of the maximum speed</li> <li><math>\pm</math> 0,22 % of the set speed</li> <li><math>\pm</math> 2,2 % of the set speed</li> <li><math>\pm</math> 0,1 % of the maximum speed</li> </ul>
Speed references	Galvanically isolated from power circuits
<ul style="list-style-type: none"> <li>• two voltage inputs :</li> <li>- by potentiometer</li> <li>- by analogue signal</li> </ul>	0 to $\pm$ 10 V (*) input impedance 39 k $\Omega$ 2,2 to 10 k $\Omega$ connected to the internal supply : 0 to $\pm$ 10 V 0 to $\pm$ 10 V, supplied by an external supply 0-20 mA and 4-20 mA with reversing by logic signal (optional) (*) The 2 inputs $\pm$ 10 V are summing; their sum must never exceed 10 V
Reversing	By speed reference polarity or by logic signal (optional)
Speed feedback	
<ul style="list-style-type: none"> <li>• by armature voltage</li> <li>• by tachogenerator</li> </ul>	Link H in position U. Use the galvanic isolation board 5 adjustment positions : 10 - 30 - 60 - 120 - 240 V
Acceleration and deceleration ramp	Independently adjustable acceleration and deceleration times : 0 to 20 s in two ranges. Possibility of increasing time up to 120 s, or of cancelling ramp
Output relays	For auxiliary contactor : 250 V $\sim$ , inrush 300 VA max., sealed 30 VA max. ; 30 V === 0,5 A max.
Electrical characteristics of contacts	Number of operations : 10 <sup>6</sup> Minimum switching capacity : 24 V/20 mA, a.c. and d.c.
Voltage and current available on the speed controller (cumulative current values).	+15 V (P15): 50 mA. -15 V (N15): 50 mA. For all the inputs, optional boards and external functions. +24 V (PL): 30 mA (80 mA if no load on the +15 V). +10V (P10): 5mA. -10 V (N10): 5mA.
Logic inputs	RUN: 10mA consumption at 24 V, 10 V minimum switching INR, ISI: 10mA consumption at 24 V, 7,5 V maximum switching.
Degree of protection	IP 00
Ambient air temperature	
<ul style="list-style-type: none"> <li>• for operation</li> <li>• for storage</li> </ul>	0°C to 40°C (operation possible up to 60° C by derating the current by 1,2 % per additional °C) - 25°C to + 70°C
Derating according to altitude	Current derating by 0,7 % for each 100 m above 1000 m
Vibrations and shocks	Tests carried out conforming to the recommendations of IEC publication 68-2-6/FC

# RECTIVAR terminal referencing

## Power bridge 24/44A

Marking	Function
AL1 AL2   —	Power bridge mains supply up to 415V 50/60Hz
—	
M2 - M1 +	Earth (ground)
	Motor armature

## Power interface board 24/44A

AL11 AL21	Mains voltage pick-off AL1-AL2
CL1 CL2	Control supply : 220/240V or 380/415V (see page 50)
FL1 FL2 F1 + F2 -	Single phase supply to the excitation bridge Positive output of the excitation bridge Negative output of the excitation bridge

## Power board 6/12A

M2 - M1 +	Motor armature
AL1 AL2	Power bridge mains supply up to 415V 50/60 Hz (except 6A : 220V/240V)
AL11 AL21	Mains voltage pick-off AL1-AL2
CL1 CL2	Control supply : 220/240V or 380/415V (see page 48)
FL1 FL2 F1 + F2 -	Single phase supply to the excitation bridge Positive output of the excitation bridge Negative output of the excitation bridge

## Control board

RNA RNB	Speed sensor input
AT (1)	Assignable terminal, second reference input (39 kΩ)
0V	
E1	Speed reference input 0 to ± 10V (39 kΩ)
SP	Speed signal [0±8 V for the maximum set speed (3 mA max)]
IRT	Increase of ramp time by external voltage (page 45)
SAO	Speed loop output. I output ≤ 3mA
CAI	Speed loop input (68 kΩ)
ECL	Current limitation input 0/-10 V
DCC	Current signal. I output ≤ 3 mA (1,5V for set I, average value)
RUN	Validation of the controller (gate circuits, loops, ramp)
PL	Logic input supply (24 V), RUN, option1 and option 2
INR	Validation of the ramp by 0V
ISI	Inhibition of the speed amplifier integration by 0V
P10	Reference potentiometer supply + 10V ± 0,2V (5 mA)
0V	
N10	Potentiometer supply -10 V ±0,2 V (5 mA)
P15	Supply +15 V ±0,6 V. I max. = 50 mA
N15	Supply -15 V ±0,6 V. I max. = 50 mA
K1A (2)	Voltage free contact of relay K1 (interlock) closed when the controller is validated
K1B	
K2A (2)	Voltage free contact of relay K2 with function configurable by link :
K2B	

- a) Current limitation. Closed when the controller is outside limitation
- b) Speed not zero. Closed when the speed is higher than 0,02 times the rated speed

(1) Second speed input connected either to the ramp, or to the speed amplifier.

(2) Maximum characteristics of contacts :

- voltage 250V ~, inrush 300 VA max., sealed 30 VA maxi ; 30V d.c. : 0,5 A maxi
- number of operations : 10<sup>6</sup>, minimum switching capacity : 24 V/20 mA a.c. or d.c.

# Installation

## Preliminary checks

Remove the Rectivar from its packaging and check that it has not been damaged during transport. Make sure that the reference on the speed controller label is the same as that on the delivery note, corresponding to the order form.

## Mounting precautions

Mount the speed controller in the vertical position, so that the air circulates from the bottom to the top of the heat sink fins.

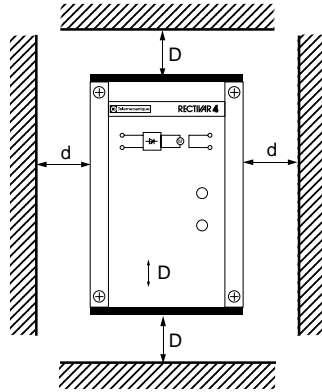
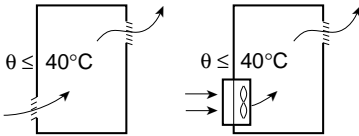
Do not install near heat radiating elements.

## Mounting in a general purpose metal enclosure

IP23 degree of protection.

In order to ensure adequate air flow inside the controller :

- leave sufficient space around the unit :
  - .  $d \geq 50$  mm,
  - .  $D \geq 100$  mm,
- provide ventilation louvres,
- make sure that the ventilation is adequate; if not, fit a cooling fan with filter.



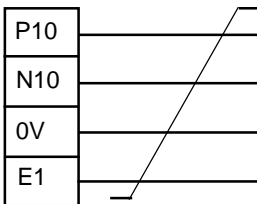
## Wiring precautions

To carry out the external wiring, remove the cover and use a suitable screwdriver. Apart from the special earth terminal marked  $\text{PE}$ , no other conductors connected to terminal blocks should be connected to earth or to the protective earth of the installation.

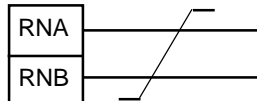
**The external speed setting and feedback circuits (when using a tachogenerator) must be wired using twisted pairs (pitch  $\leq 5$  cm).**

As far as possible, separate the control wires from the power cables. The signals to the following terminals must be connected as described above.

Control board terminals



Control board terminals



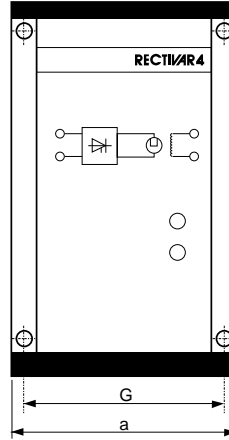
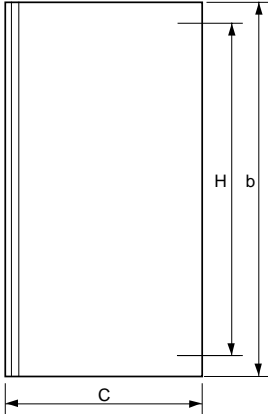
The other signals accessible at the customer terminal block (except K1A-K1B, and K2A-K2B), must be cabled using twisted pairs (pitch  $\leq 5$  cm) and screened (with the screening connected to the controller earth). The maximum length of the interconnection is 5 m. For greater distances, use an interface circuit.

Group mounting of two or more speed controllers : where necessary, fit line inductances. Where necessary, fit interference suppression circuits on the sequence contactors.

# Installation

## Dimensions

### Rectivar

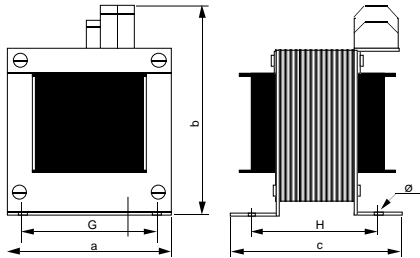


Fixings: 4 x  $\varnothing$  6,5

Reference	Overall			Fixings	
	a	b	c	H	G
RTV-44U60M	159	264	130	230	120
RTV-44D12Q	159	264	130	230	120
RTV-44D24Q	162	264	177	230	120
RTV-44D44Q	162	264	177	230	120

### Line inductances

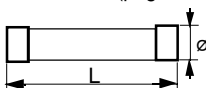
Association with controllers (see pages 43 and 62)



Référence	Overall			Fixings			Weight (kg)
	a	b	c	G	H	$\varnothing$	
VZ1-L008 U860	60	105	90	50	44	4	0,400
VZ1-L016 U860	60	105	105	50	60	4	0,750
VZ1-L032 U800	96	135	115	80	68	5,5	1,850
VZ1-L060 U400	108	145	130	90	82	5,5	3,100

### Fuses

Association with controllers (pages 43 and 61)



Reference	L	$\varnothing$
DF2-CF02001	38	10
DF2-CF02501	38	10
DF3-FF04001	51	14
DF3-FF10001	58	22



# Connections

Reversing with regenerative braking

Supply : 220/240V or 380/415V, 50/60 Hz

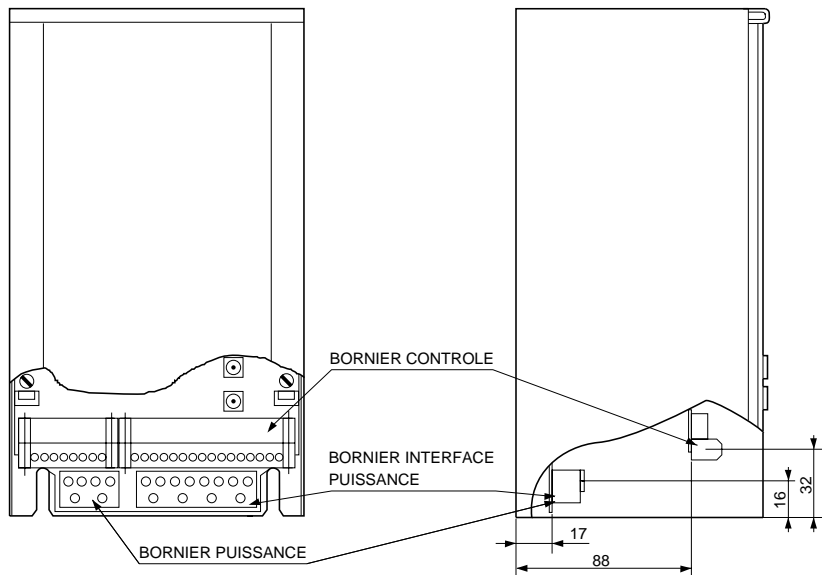
6 to 44A speed controllers

Nomenclature of the required equipment

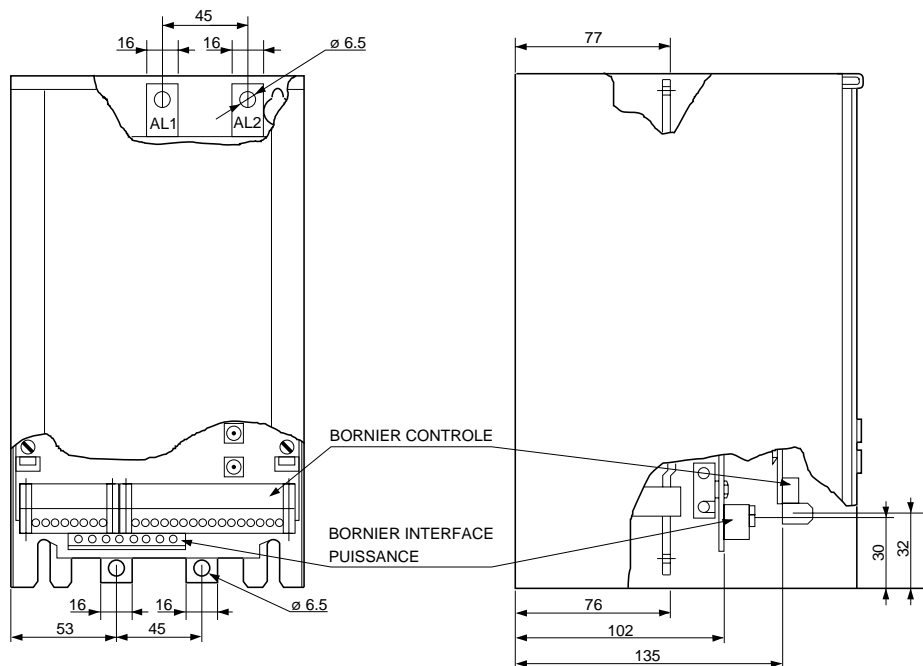
Item	Description	Voltage	Voltage	Reference	Reference	Reference	Reference
		Mains	Armature	Maximum power with Td/Tn = 1,2			
		220/240V	150/160V	0,65 kW	1,3 kW	2,7 kW	4,8 kW
M	Motor	380/415V	260/280V	–	2,4 kW	4,8 kW	8,5 kW
A1	Speed controller			RTV-44U60M	RTV-44D12Q	RTV-44D24Q	RTV-44D44Q
F1	Thermal overload relay (1) + terminal block			LR2-D13** LA7-D1064	LR2-D13** LA7-D1064	LR2-D**** LA7-D****	LR2-D**** LA7-D****
KA1	Control relay Timer			CA2-DN40M7 LA3-DR0	CA2-DN40M7 LA3-DR0	CA2-DN40M7 LA3-DR0	CA2-DN40M7 LA3-DR0
KM1	Line contactor			LC1-D0910M7	LC1-D1210M7	LC1-D2510M7	LC1-D5011M•
L1	Line inductance			VZ1-L008U860	VZ1-L016U860	VZ1-L032U800	VZ1-L060U400
LAD	Smoothing choke if required			-Essential for motor with flat rotor. -Strongly recommended for torque motor. (Consult our local sales service)			
Q1	Isolator + 2 power fuses			LS1-D2531A65 DF2-CF02001	LS1-D2531A65 DF2-CF02501	GK1-EK DF3-EF04001	DK1-GB2 DF3-FF10001
Q2	Circuit breaker + contact block			GV1-M07 GV1-A01	GV1-M07 GV1-A01	GV1-M07 GV1-A01	GV1-M07 GV1-A01
Q3	Circuit breaker			GV1-M05	GV1-M05	GV1-M05	GV1-M07
Q4	Circuit breaker			GB2-CB05	GB2-CB05	GB2-CB05	GB2-CB06
R	Potentiometer			SZ1-RV1202	SZ1-RV1202	SZ1-RV1202	SZ1-RV1202
S1-S2 -S3 H	Control  Signalling			Au choix, éléments XB2-M ou XB2-B ou boîtes complètes			
T3	Transformer (secondary 220V)			100 VA	100 VA	100 VA	250 VA

(1) To be suitably rated for the motor, taking the form factor into account.

## RECTIVAR 6/12A



## RECTIVAR 24/44A



# Connections

## Function of the speed reference inputs

### Speed reference

The circuit enables two voltage references to be used varying between 0V and  $\pm 10V$ .

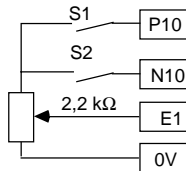
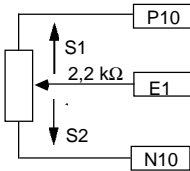
The first is applied to the ramp function input, via terminal E1.

The second must be applied to the AT terminal. A two position link enables the reference to be directed to :

- either the ramp function
- or the speed amplifier.

**Warning :** the sum of the voltages applied SIMULTANEOUSLY to the two inputs must never exceed +10V or -10V.

The direction command is given by the reference polarity.



### Ramp

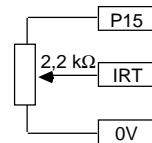
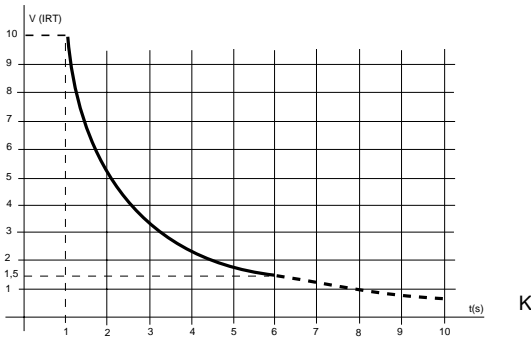
Acceleration time (ACC) and deceleration time (DEC) can be adjusted independently. They can be adjusted in 2 ways :

*internally*

- by a switch with 2 positions, defining 2 ranges : 0 to 1s and 0,5 to 20s.
- by a potentiometer which enables time adjustment within each range

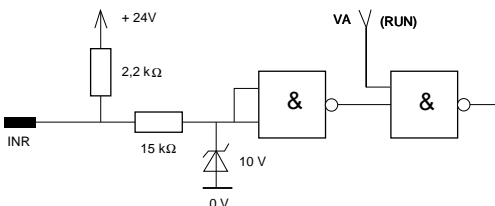
*externally*

the ramp time can be modified using the IRT input, connecting the two 2,2 kΩ potentiometers and two diodes as shown in the diagram on the left, or by using a programmable controller analogue output.



The operating range is from 1,5 to 10V. Reducing this voltage enables the times, which can be adjusted using the ACC and DEC potentiometers, to be increased by a factor varying from 1 to 6.

When the INR input is connected to 0V, the speed ramp is validated. To reset the ramp to zero, the INR-0V link must be opened.



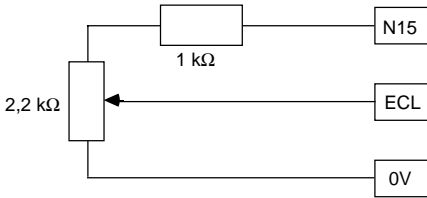


# Connections

## Function of the speed reference inputs

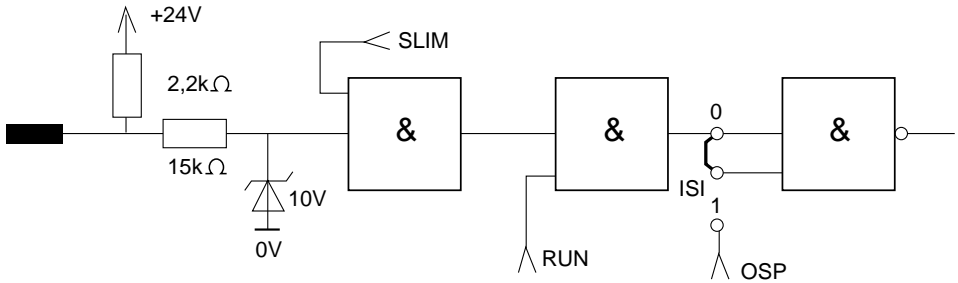
### External current limitation

It is possible to modify the speed controller's current limitation externally (decrease of current value only)

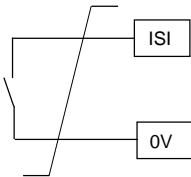


$I = 0$  for ECL = - 10V  
 $I = I_{lim}$  for ECL = 0V  
 0 to 100 % adjustment of the current limitation

### Integration short-circuit

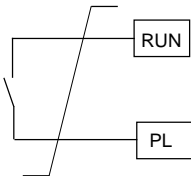


In order to cancel the integral term of the speed loop, link terminal ISI to zero by connecting terminal ISI to the 0V terminal on the control board.



It is also possible to cancel the integral term for  $N \leq 0,02$  times rated N by setting the ISI link in the 1 position, if the link is in position 0 the term can only be cancelled by terminal ISI on the customer connector.

### Validation



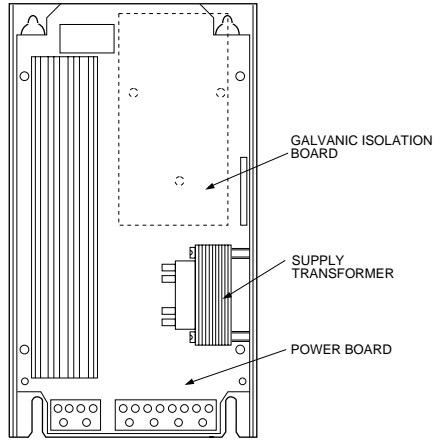
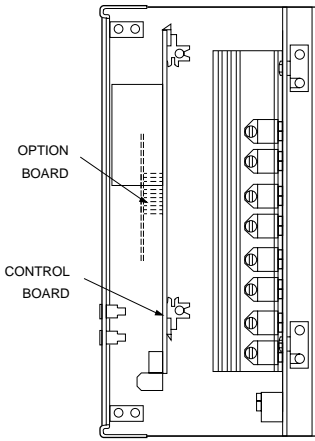
The speed controller is validated via the RUN command input.  
 When this input is connected to the PL input, the speed controller is validated.

When this link is no longer closed, the speed loop, current loop, firing gate and ramp functions are locked :

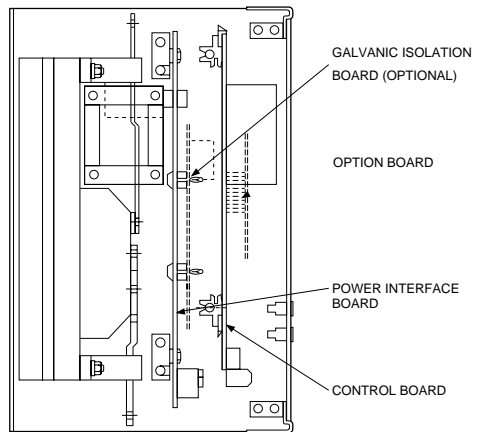
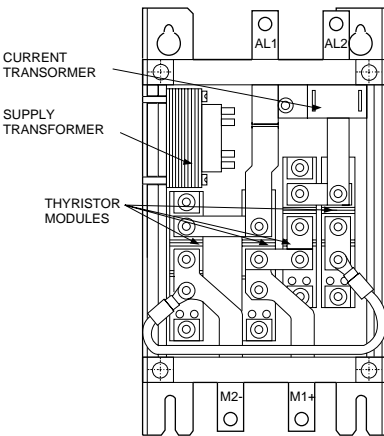


When the control supply (CL1-CL2) is connected on the incoming side of the line contactor KM1, the closure of the contact on RUN must never precede the closure of the line contactor (risk of damage). When the controller is switched on, the RUN contact must always open 0,2 seconds minimum before the line contactor (risk of damage).

## RTV-44U60M / RTV-44D12Q

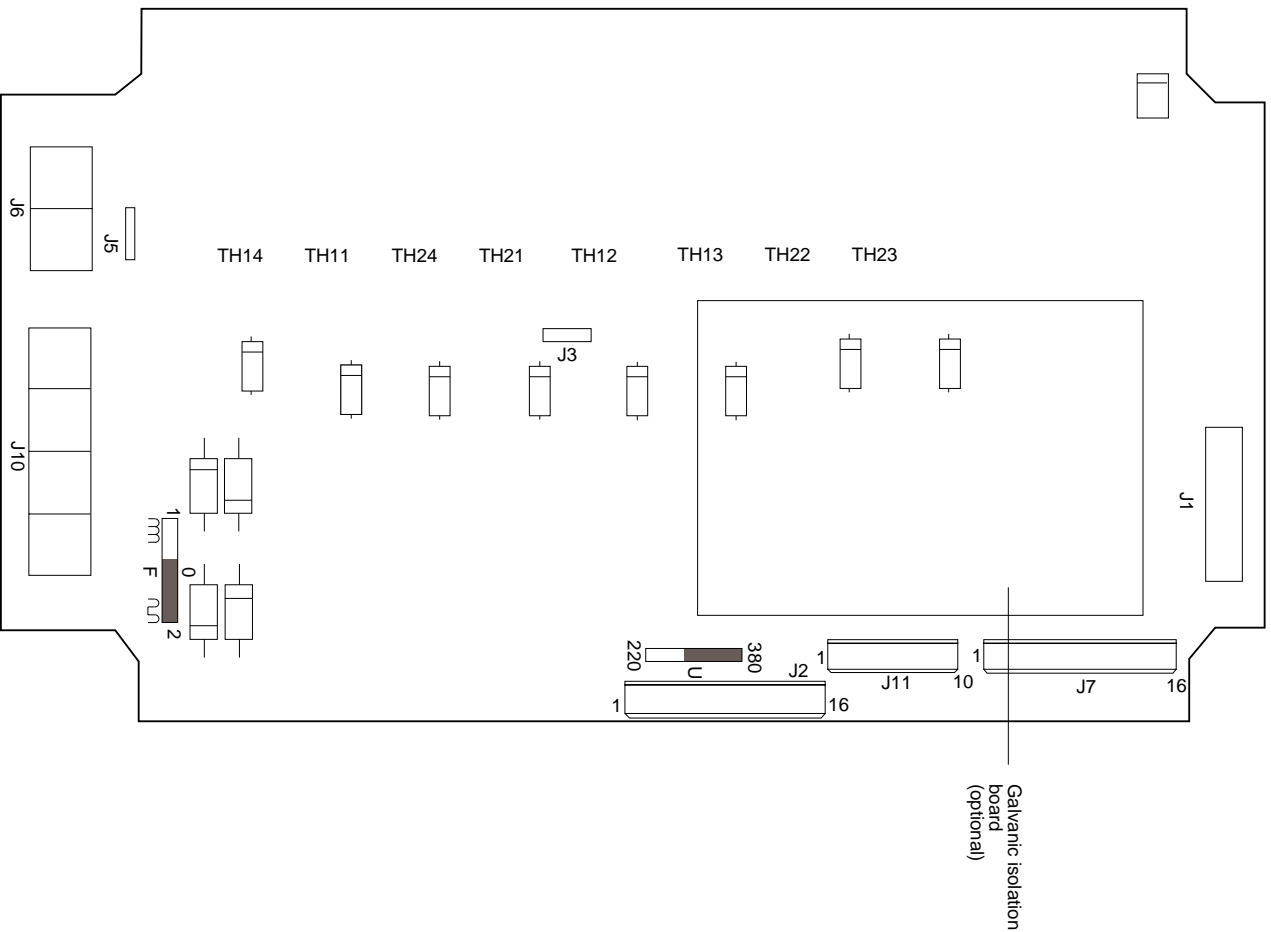


## RTV-44D24Q / RTV-44D44Q



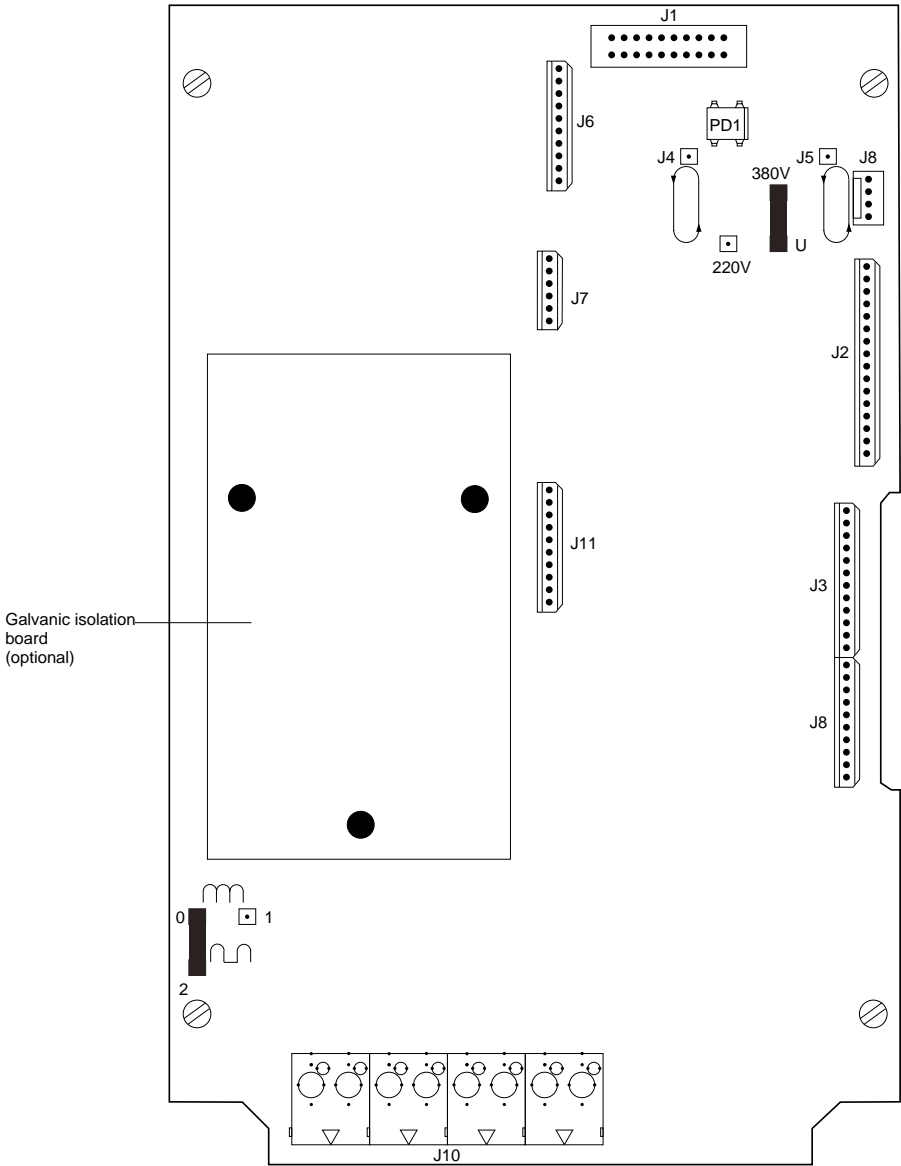
# Layouts

## 6/12A power board



# Layouts

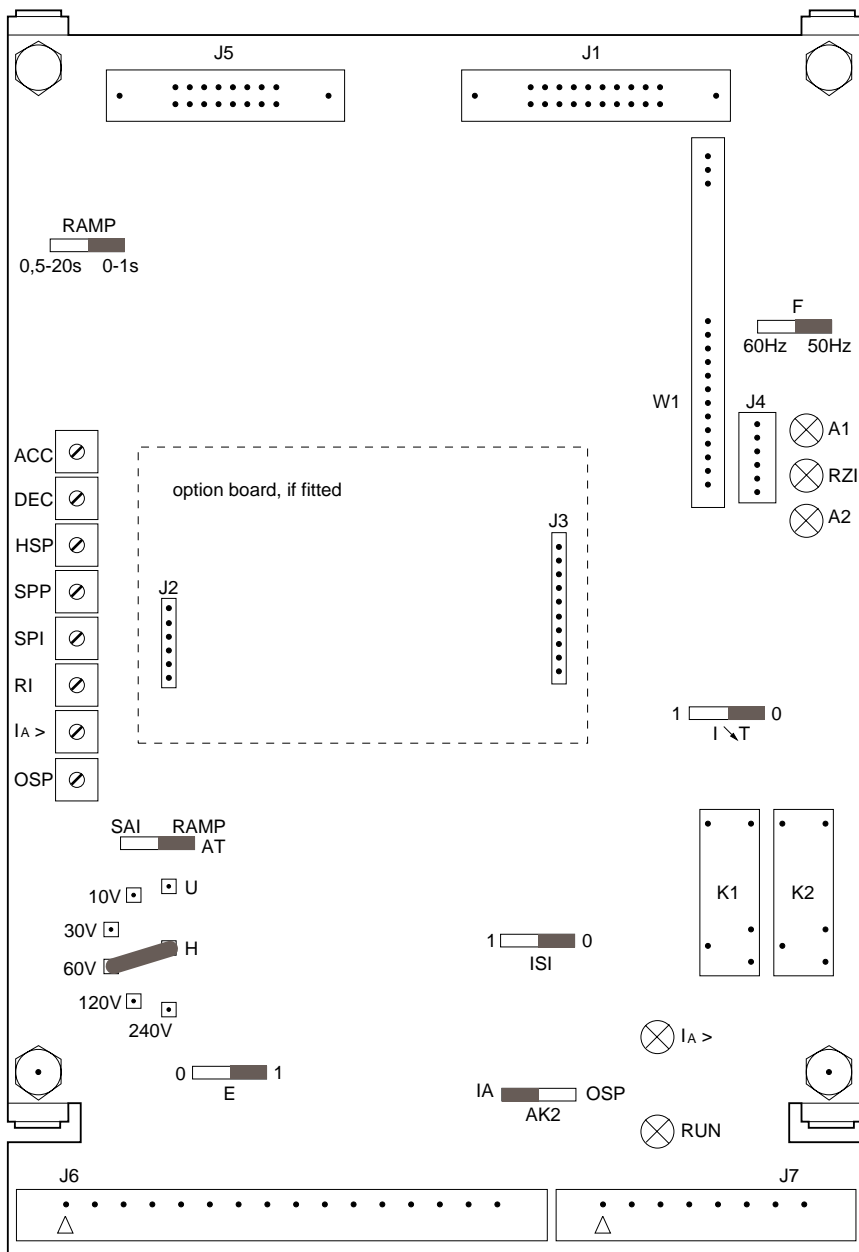
## 24/44A power interface board



# Layouts

## Control board (common to all the speed controllers)

### Clip-in board



# Layout

---

Links

Potentiometers

LEDs

## Control board

### Links

- F : 50 or 60 Hz  
E : separates the speed amplifier (w) from the current amplifier (open in position 0)  
AT : enables the reference applied to terminal AT to be directed, either to the ramp (position RAMP) or to the speed amplifier (position SA1)  
RAMP : operation of the reference ramp : 0 - 1 s or 0,5 - 20 s.
- ISI : cancellation of the integral gain : 0 : standard. 1 : for  $N \leq 2\%$   
N : selection of the type of limitation  
0 : standard  
1 : with 2 states
- H : selection of level of speed image voltage feedback  
AK2 : assignment of relay K2 : - IA : closed outside current limitation  
- OSP : closed when speed  $\geq 2\%$

### Potentiometers

- ACC : adjustment of acceleration time  
DEC : adjustment of deceleration time  
HSP : adjustment of maximum speed (high speed)
- RI : adjustment of RI compensation (U – RI operation)  
IA > : adjustment of limitation current  
SPP : proportional speed adjustment  
SPI : integral speed adjustment  
OSP : adjustment of the speed amplifier offset, factory preset

### LEDs

- RUN : (green LED) validated state of the speed controller  
I A > : (yellow LED) operating in current limitation  
A1 : (green LED) bridge 1 validated  
A2 : (green LED) bridge 2 validated  
RZI : (yellow LED) current loop reset

### Electromagnetic relay

- K1 : relay indicating validation state  
K2 : assignable relay

## Power board

### Links

- F : excitation voltage selection  
U : control transformer supply voltage selection, except 6A rating, supplied for 220V only.

# Initial setting up

## Preliminary checks

OUR PRODUCTS ARE PRESET FOR TACHOGENERATOR FEEDBACK

### With the supply disconnected

Check the rating plates and the labels on the equipment to ensure that the speed controller, the motor and the mains supply are compatible.

Make sure that the wiring corresponds to the circuit diagram.

Check that all terminals are tight, and that the speed controller connectors are fully plugged in and latched. When a voltage speed reference is being used, check the connections of the speed reference potentiometer and measure its resistance using a multimeter :

- suggested value : 2200  $\Omega$  (terminals 0V, P10, N10)

- recommended value : 2,2 k $\Omega$   $\leq$  R  $\leq$  10 k $\Omega$

- power : P  $\geq$  3W.

When the AT additional input is being used, check that :

max. U ref. = V (E1) + V (AT) =  $\pm$ 10 V.

Check the position of the links. Make sure that they are in the positions shown on pages 48 to 51.



The control board must be turned round in order to check the links on the power board.

### Adaptation to the mains supply

Ratings 12, 24 and 44 A are dual-voltage products. They are delivered suitable for 380/415 V.

To use them with a 220 / 240 V mains, modify the position of link U on the power board.

Also check that the position of link F on the power board corresponds to the excitation voltage.

Mains voltage 50 / 60 Hz	Excitation voltage according to link F	
		
220 V	100 V	190 V
240 V	110 V	205 V
380 V	170 V	330 V
415 V	185 V	360 V

**NOTE** : the 6A rating (RTV-44U60M) is only supplied for 220 / 240V.

# Initial setting up

---

## Preliminary checks

**Mounting of the options** (For further detail, refer to the documentation supplied with each option).

### **Operation with isolated U±RI**

Galvanic isolation board : reference VW2-RZD2071.

The board is not supplied with the controller. If required, mount this option onto the power board using the 3 rapid fixing insulating separators, then connect connecting ribbon n° 5 to the power board J7 connector and connecting ribbon n° 6 to the J11 connector on the power board. Set the H link on the control board in position U. Check the position of the galvanic isolation link according to the armature voltage (see notice for the board)

**NOTE** : connection ribbons and separators are supplied with the board.

### **VW2-DF308L current reduction board**

The board is not supplied with the controller.

Mount on connectors J2 and J3 on the control board without any other wiring.

### **VW2-RZD309 variable gain board**

Also includes current reduction function.

The board is not supplied with the controller.

Mount on connectors J2 and J3 on the control board without any other wiring.

**Adaptation modules** (see documentation supplied with each module).

- Adaptation of the VW3-RZE101 speed reference (current input, direction via logic signals...) .
- Excitation presence control. See RM2-JA\*\*\* relay



# Initial setting up

## Static adjustments

### Equipment required

- A multimeter, preferably 20000 ohms/volt.
- A two channel oscilloscope, if required.

The apparatus must be isolated from the mains supply. Do not connect the oscilloscope to another earth of the installation.

- A moving scale ammeter, if required, with shunt if necessary.
- Initial setting up and control unit if necessary (page 61).

## Static adjustments

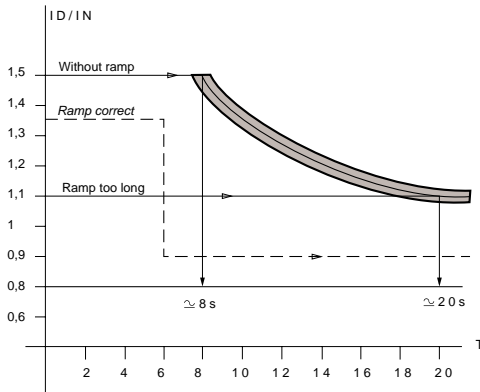
### Maximum motor current

This controller has 2 possible operating modes :

- Link I  $\blacktriangledown$  T at 0 : called "standard" use, does not authorise any overload; the current is adjustable to a value  $\leq$  max. continuous controller current.
- Link I  $\blacktriangledown$  T link in 1: called "2 state limitation" utilisation, which authorises, as for the motor, temporary overloads.

In this case, it is possible to exceed the set current value by up to 1,5 times, during a certain time period, automatically followed by a reduction to 0,8 times the set value.

The time of overload operation depends on the overload value. For 50 % (1,5 times the set value) the time is around 8 seconds. See the curve below.



NOTE : 1 - the set value corresponds to 1,5V on terminal DCC (page 39), i.e. 2,3V for the overload value  
2 - caution, in the event of a driving load, check that the 2 state current is adequate for braking.

### Adjustment

(carry out without the 2 state function. If required, take into account the ratio  $I_L = 1,5$  set I).

#### • Mains supply disconnected

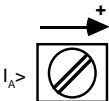
- Open the Q2 circuit breaker (for motors with permanent excitation, mechanically block the motor shaft, if it is possible to do so).

- On the control board, position the I  $\blacktriangledown$  T at 0 ( $I$  max. = constant) and check that the ACC and DEC potentiometers are in the fully anti-clockwise position (ramp at minimum) and the RAMP link in position 0.

- Connect an ammeter (position C) to the motor armature.

#### • Switch on the speed controller

- Set maximum speed using the reference potentiometer : the motor should not rotate.
- Turn potentiometer  $I_A >$  clockwise in order to obtain the required limitation value, taking  $T_d/T_n$  into account (see safety precautions on the next page).



Adaptation modules (see documentation supplied with each module).

# Initial setting up

## Dynamic adjustments

- *Safety measures*



- Do not stay in current limitation too long, as the motor and the commutator segments may overheat.
- Never exceed I maximum shown on the speed controller rating plate.
- Remember to derate the speed controller by 1,2 % for each °C, for ambient temperatures between 40 and 60 °C.

- **Example :**

Take an RTV-44D24Q operating in an ambient temperature of 55 °C.

Derating is equal to  $1,2 \times (55-40) = 18 \%$  giving a derated operating current of :  $24 \times \frac{(100-18)}{100} = 20 \text{ A}$

For a motor operating with Td/Tn of 1,2 and  $\eta = 0,85$ , the maximum power available at the motor shaft becomes :

$$\frac{I_{\max} \times U_{\text{armature}} \times \eta}{T_d / T_n} = \frac{20 \times 280 \times 0,85}{1,2} = 3900 \text{ W}$$

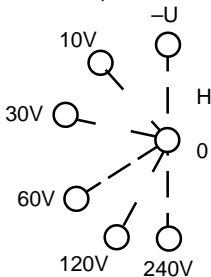
**Note :** for motors which cannot be blocked mechanically, the limitation will be adjusted with the motor running during the dynamic tests.

The adjustment having been made :

- Switch off the supply.
- Reclose Q2 or release the motor shaft.
- Disconnect the ammeter.
- Reset the speed reference potentiometer to zero..

### Adjustment of speed data feedback

Adaptation of voltage feedback is carried out using link H, as shown in the table below (with the galvanic isolation option board, essential if  $U \pm RI$  feedback).



Mode Feedback	Link H		Armature voltage
	Position	Voltage	
T.G.	0 - 10 V	0 - 10 V	
	0 - 30 V	10 - 30 V	
	0 - 60 V	30 - 60 V	
	0 - 120 V	60 - 120 V	
	0 - 240 V	120 - 240 V	
Isolated $U \pm RI$	0 - U	0 - 10 V	150 to 280 V

## Dynamic adjustments

### Adjustment of rated speed

Adjusted by HSP potentiometer, as follows :

– Switch off the speed controller.

– Set a low reference value :

– If the motor runs away :

*for T.G. feedback*

- switch off,
- check the continuity of the 2 tacho feedback wires,
- if not, reverse the 2 wires.

*for  $U \pm RI$*

- check the galvanic isolation board connections and the position of its link

– If the motor rotates the wrong way :

- switch off
- then reverse :
  - either the field winding,
  - or the armature (for motors with permanent magnets),
- switch the supply back on.

– If the motor is rotating slowly, but in the right direction :

- set the maximum reference
- adjust the rated speed, using (HSP)
- switch off.



# Initial setting up

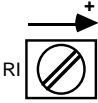
## Dynamic adjustments

### Special applications

#### Compensation for RI drop (only with U±RI coupling)

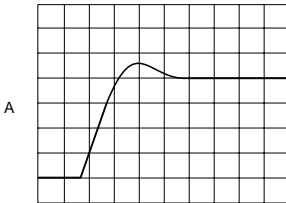
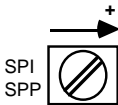
- Check whether the speed drops according to motor load.
- Correct the drop by turning P10 in the clockwise direction, to raise the compensation, until the speed remains perceptibly the same, whatever the motor load, from no-load operating, to operation at rated torque.
- Check that the compensation is operating satisfactorily throughout the speed range, and make sure that it does not exceed the level above which oscillations can occur; if this should happen, reduce the compensations until the oscillations are eliminated.

**Note :** having adjusted the RI drop, it may be necessary to reset the high speed value.

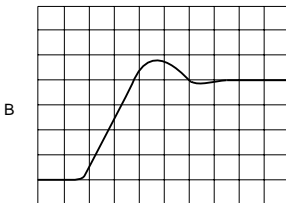


### Speed loop adjustments

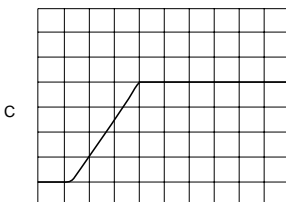
- set a reference of 100 %
- validate the product using RUN
- SPP and SPI are factory preset at the minimum (potentiometers against the stop in the anti-clock wise direction)
- adjust SPI so that the stability limit is reached, then set SPP at the stability limit as well
- for a display of the speed increase, connect an oscilloscope between 0V (terminal 31) and Sp (terminal 6)



SPI minimum  
SPP minimum



SPI adjusted  
SPP minimum



SPI adjusted  
SPP adjusted

# Initial setting up

---

## Dynamic adjustments

### Ramp time

The speed controller is delivered as standard with the ramp function in position 0 - 1 s.



Acceleration and deceleration ramp times are individually adjustable, using the control board's ACC and DEC potentiometers.

The adjustment range for these potentiometers is from 0 s (fully anti-clockwise position) to 20 s (fully clockwise position) in 2 ranges : 0 - 1 s and 0,5 - 20 s (RAMP link).

### Option boards

For current reduction or variable gain, refer to the instructions supplied with the boards.

## Maintenance

### Systematic checks

A loose contact, or faulty connection can result in faulty operation.

- Check the voltage at the terminals (see terminals on page 39)
- Ensure that the PL-RUN link is properly connected (speed controller unlocking).
- Ensure that the 0V-INR link is properly connected (ramp unlocking).

### Problems covered in the fault finding tables

- The motor is not rotating smoothly.
- Poor regulation: drop in speed as the load increases.
- Instability.
- Motor runs away.
- Speed adjustment not operating.
- Blown fuses.
- The motor is not rotating.

For each operation, the use of a measuring, or test device is recommended.

- (A) moving scale ammeter.
- (V) voltmeter or multimeter.
- ( $\Omega$ ) ohmmeter or "test lamp".

Use of the SD2MT2001 test unit, enabling display of the speed controller's internal signals, facilitates fault-finding and diagnostic.

# Maintenance

## Fault-finding table

Before any intervention on the RTV-44, check all the peripherals.

Faults observed	Check on the speed controller	
	control board	power section
The motor does not rotate	<ul style="list-style-type: none"> <li>– The current limitation adjustment (A)</li> <li>– Unlocking : when testing the OV-RUN and OV-INR interconnections, the LED must be on</li> <li>– Reference 0-10 V on terminal 0V et E1 (V)</li> </ul>	<ul style="list-style-type: none"> <li>– Mains supply voltage</li> <li>– Isolator fuses</li> </ul>
The motor does not rotate smoothly	<ul style="list-style-type: none"> <li>– SPP and SPI gain ajustement</li> </ul>	<ul style="list-style-type: none"> <li>– The power bridge (Ω)</li> </ul>
The motor runs away	–	<ul style="list-style-type: none"> <li>– Position of link F</li> <li>– The power bridge (Ω)</li> </ul>
Instability	<ul style="list-style-type: none"> <li>– SPP et SPI gain</li> <li>– Position of link H</li> </ul>	–
Poor regulation, speed drops as the load increases	<ul style="list-style-type: none"> <li>– Current limitation ajustement (set too low) LED I &gt; (yellow) goes on</li> </ul>	–
Speed regulation impossible	<ul style="list-style-type: none"> <li>– 0-10 V reference at terminal 0V and E1</li> </ul>	<ul style="list-style-type: none"> <li>– The power bridge (Ω)</li> </ul>
Fuses blown	–	<ul style="list-style-type: none"> <li>– The wiring(short circuit or earth fault)</li> <li>– The power bridge (Ω)</li> </ul>

# Maintenance

## Fault-finding table

Check the speed feed back by tachogenerator.		Check by $U \pm RI$	Check on the motor	Check on the other items
-	-	-	The excitation current and voltage on terminals F1+ et F2- 	-The wiring and connections
-	- RI drop compensation	- Motor and tachogenerator brush wear	- That the motor is not blocked mechanically - Brush wear	- That there is no earth fault
- The position of the link H from 0-10V to 0-240V - The TG feedback to terminals RNA et RNB	- The position of the link H to H0-HU - The voltage feedback	- The excitation voltage - The excitation current	- The wiring	- The wiring
- The TG-motor coupling	- RI drop compensation	- That the motor is not of the compound type	- That the cause is not mechanical	- That the cause is not mechanical
-	- RI drop compensation	-The value of rated armature voltage 150 V  for 220 V 260 V  for 380 V	-	-
-	-	-	-	-
-	-	- The wiring(short-circuit or earthfault)	- The fuse rating (see pages 41) - the contro circuit wiring (see page 39)	- The fuse rating (see pages 41) - the contro circuit wiring (see page 39)

# Maintenance

## Power bridge check

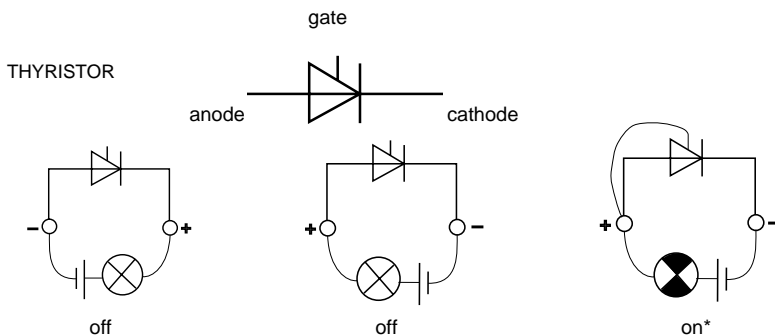
With the speed controller switched off, disconnect AL1, AL2, M1 and M2 and test the bridge as shown below, bearing in mind that 2 cases can arise:

- 1 - Thyristor open circuit : check each thyristor.
- 2 - Thyristor in short-circuit : as the bridge is fully controlled, one of the bridges must be removed before it is possible to determine whether a thyristor from bridge A or bridge B is involved.

In the event of a fault, disconnect the components' cathodes and :

- Test the power wiring.
- Test each component : result (see below).
- Replace the faulty part(s) (1).

(1) Note : for the 6 / 12 A ratings replace the power board.



(\*) Note : the lamp goes on when the gate and the anode are connected, and stays on when the gate is disconnected.

## Excitation circuit check

- The circuit is located on the power board.
- Remove the control board.
- Disconnect F1 and F2.
- Test the following four bridge diodes : D1 - D2 - D3 - D4.
- In the event of a fault, replace the power board.

# Spare parts and accessories

Description	For RECTIVAR	Characteristics	Reference	Weight (kg)
Fuses	RTV-44U60M	A060URB020T13	<b>DF2-CF02001</b>	0,010
	RTV-44D12Q	A060URB025T13	<b>DF2-CF02501</b>	0,010
	RTV-44D24Q	6,621CPURGB145140	<b>DF3-EF04001</b>	0,020
	RTV-44D44Q	6,621CPURD2258100	<b>DF3-FF10001</b>	0,045
Line (1) inductances	RTV-44U60M	860 $\mu$ H 8 A	<b>VZ1-L008 U860</b>	0,400
	RTV-44D12Q	860 $\mu$ H 16 A	<b>VZ1-L016 U860</b>	0,750
	RTV-44D24Q	800 $\mu$ H 32 A	<b>VZ1-L032 U800</b>	1,850
	RTV-44D44Q	400 $\mu$ H 60 A	<b>VZ1-L060 U400</b>	3,100
Thyristors (2)	RTV-44D24Q	26 A - 1200 V 1000 V/ $\mu$ s	<b>VZ3-TM2026M12</b>	0,150
	RTV-44D44Q	55 A - 1200 V 1000 V/ $\mu$ s	<b>VZ3-TM2055M12</b>	0,180
Control board	all ratings		<b>VX4-RDE101</b>	0,340
Power board	RTV-44U60M	6 A	<b>VX5-RDE101</b>	1,130
	RTV-44D12Q	12 A	<b>VX5-RDE102</b>	1,130
Power interface board	RTV-44D24Q, D44Q	24/44 A	<b>VX5-RDE103</b>	0,470
Variable gain option board	all ratings		<b>VW2-RZD309</b>	0,100
Current reduction option board	all ratings		<b>VW2-DF308L</b>	0,080
Excitation presence module	all ratings		<b>see RM2-JA***</b>	0,250
Speed reference adaptation module	all ratings		<b>VW3-RZE101</b>	0,220
Galvanic isolation board	all ratings		<b>VW2-RZD2071</b>	0,240
Reference potentiometer	all ratings	2,2 k $\Omega$ 3 W	<b>SZ1-RV1202</b>	0,060
Control unit	all ratings external sequence	For setting up without	<b>VW3RDE105</b>	0,900

(1) Mounting of two or more speed controllers together.

(2) These characteristics are given purely as a guide, and are not the only ones to be considered when selecting a component.



# Internal control wiring

## Speed controllers

