

Appendix 3 Regenerative Resistance

Selecting Regenerative Braking Resistance

When Servo motor is operated with a Regenerative mode, the energy comes into the axis of Servo drive. This is called a regenerative energy.

Whereas Regenerative energy is charged and absorbed into the smoothing condenser of Servo drive inside, but if it exceeds the energy that can be charged, it consumes the regenerative energy with a regenerative braking resistance.

(1) The operating servo motor conditions with regenerative mode ;

- 1 High speed operation and short deceleration time
- 2 Repeat Accel/Deceleration very frequently
- 3 When the load inertia is much bigger than motor inertia
- 4 When operated at the Upper and below axis
- 5 In the case of minus load that rotate the servo motor at load axis

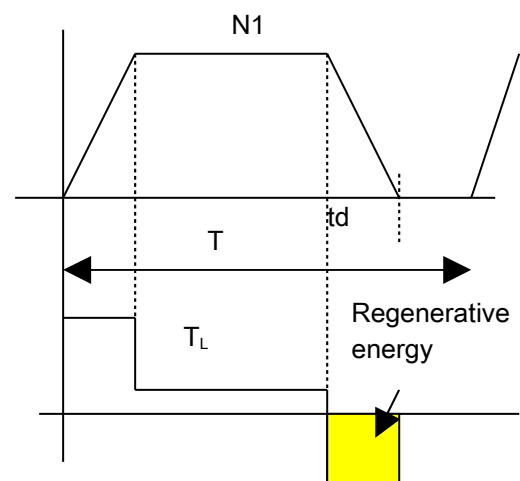
But, Because the regenerative capacity that is installed in the servo drive is a short time rated of deceleration stop range, the continuous operation by minus load is impossible.

(2) On the Regenerative mode operation, the regenerative energy of motor should be less than the energy that can be absorbed in the servo drive for proper operation.

(Motor rotating energy – Motor loss – Deceleration load friction) < (Condenser absorbing energy + Regenerative resistance consuming energy)

- Motor rotating energy = $(J_M + J_L) * (N1^2) / 182$
- Motor loss = Approx. 3~5% of rated capacity
- Decel. Load friction energy = $(\pi/60) * N1 * T_L * t_d$
- Condenser absorbing energy = $1/2 * C * (V1^2 - V2^2)$

But, J : [kgm²], N : [r/min], T_L [Nm], C[F]
and V1 :385[V], V2 :310[V].



Regenerative Resistance Need[W]

= (Motor rotating energy – Motor loss – Decel. Load friction energy – Condenser absorbing energy)/(0.2*T)

APD-VS[Standard Type] Manual

But, Using rate of regenerative resistance is about 20%.

When the result of this value exceeds the regenerative resistance[W], users are requested to install the regenerative resistance that is higher than the calculated value[W].

3) Absorbing way of regenerative energy when over voltage alarm occurred.

- 1 Reduce the load inertia or reduce the operating speed in order to reduce the Motor rotating energy.
- 2 Increase the decel. Time to make the deceleration load friction energy bigger.
- 3 Change the standard regenerative resistance to option regenerative braking resistance (Chapter 7 Product Specification).

(4) APD-VS Regenerative capacity (10[%]ED : Standard)

Model No.	Regenerative IGBT	Inside Absorbing energy[J]	Standard Regenerative Braking resistance	Standard Regenerative energy (10[%]ED)	Option Regenerative Braking resistance	Option Regenerative energy (10[%]ED)
VSR5	-	8.6	-	-	-	-
VS01	-	8.6	-	-	-	-
VS02	20[A]	8.6	50[W]50[Ω]	296	140[W]40[Ω]	370
VS04	20[A]	17.2	50[W]50[Ω]	296	140[W]40[Ω]	370
VS05	20[A]	20.3	140[W]40[Ω]	370	300[W]23[Ω]	644
VS10	20[A]	30.5	140[W]40[Ω]	370	300[W]23[Ω]	644
VS15	30[A]	43.8	300[W]23[Ω]	644	1200[W]15[Ω]	988
VS20	50[A]	58.4	300[W]23[Ω]	644	1200[W]15[Ω]	988
VS35	50[A]	73	600[W]11.5[Ω]	1289	1800[W]10[Ω]	1482
VS50	50[A]	87.6	600[W]11.5[Ω]	1289	1800[W]10[Ω]	1482
VS75	50[A]	116.8	600[W]11.5[Ω]	1289	1800[W]10[Ω]	1482
VS110	75[A]	175.1	Option(주4)	-	2400[W]7.5[Ω]	1976

(Note1) Regenerative consuming energy = $(V^2/R) * ([\%]ED/100)$

(Note2) APD-VSR5~01 Type does not include regenerative circuit and regenerative resistance.

(Note3) For APD-VS02~04 Type, standard regenerative resistance(50[W], 50[Ω]) is installed inside and the terminal between B2~B3 is not connected.

If the regenerative capacity is quite big due to the frequent accel/deceleration, users

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are requested to remove the short pin(B2-B3) and install the outside option regenerative resistance at (B1-B2).

(Note4) For APD-VS110 Type, users need to purchase the regenerative resistance separately as an option item when need it.