Application Note: Powering Inverters from a DC Supply

Please refer also to the Inverter Instruction Manual

AN091802-1

Hitachi America, Ltd.

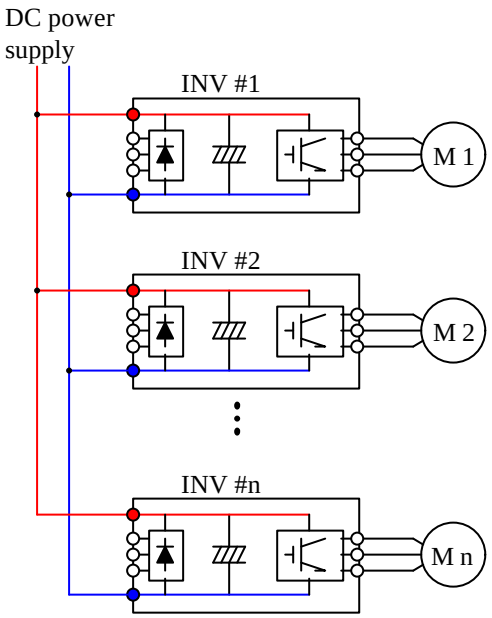
Powering Inverters from DC

It is possible to power inverters from a DC Power source, or to connect the DC Bus of multiple inverters together to achieve energy savings, since inverters in power driving mode can use power from those that are in regeneration mode.

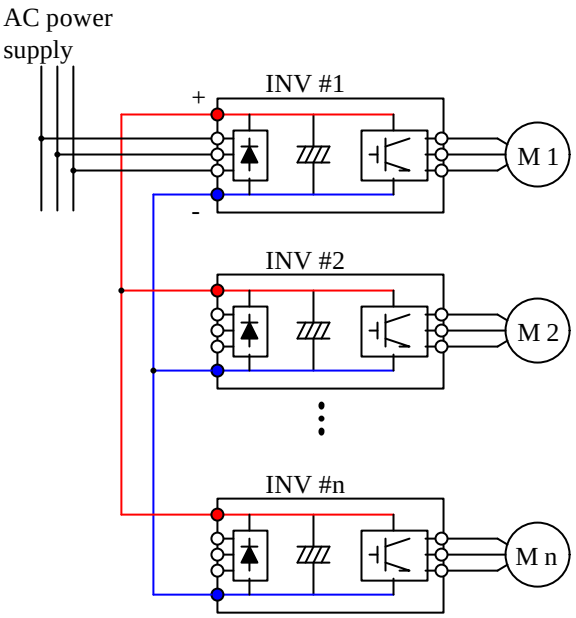
[1] Connection method

There are several ways for DC bus connection of the inverters. (Examples of 3-phase 200V or 400V class inverter.)

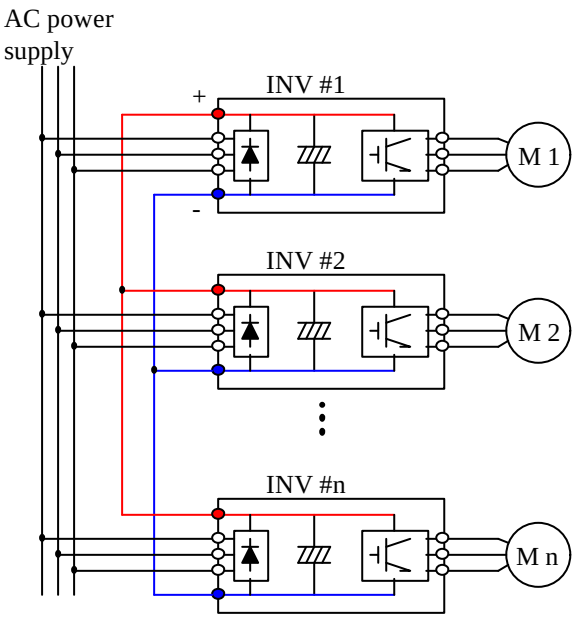
Case 1 : Connected in parallel to a common DC bus



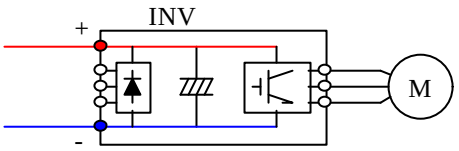
Case 2 : Connected in parallel to an A-fed inverter



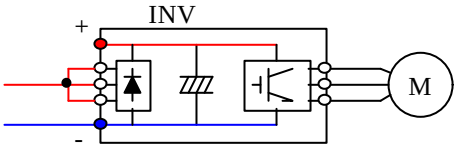
Case 3 : AC & DC Connected together



DC supply connection methods



❶ Connecting to + and - terminal



❷ Connecting to AC inputs and - terminal

➢ Advantage and disadvantages of each connection method.

Item	Contents	Advantage	Disadvantage
❶	Connecting to + & - terminal	• No concern for the rectifier bridge diodes.	• There will be no inrush current limiting.
❷	Connecting to AC inputs and - terminal	• Integrated inrush current limiting circuit is used.	• Rectifier bridge diodes of the main inverter may need to be up-sized.

[2] DC voltage to be supplied

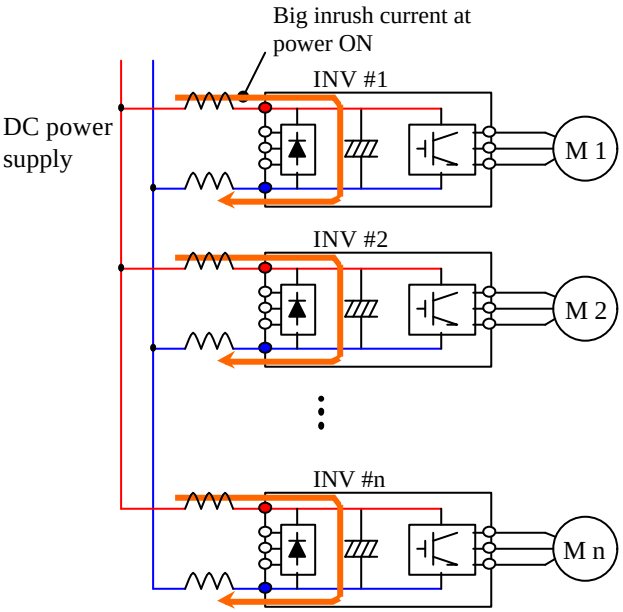
Supplied DC voltage should be between the UV voltage and the OV voltage (or BRD ON level) of the inverter.

Model name		UV level	BRD ON level	OV level (regen.)	OV level (source)
J100	200V class	140Vac ~ 160Vac	(V-SET) +137.5V	390Vdc ± 15Vdc	
	400V class	280Vac ~ 320Vac	(V-SET) +275V	780Vdc ± 30Vdc	
J300	200V class	140Vac ~ 160Vac	(AVR set) +138V	369Vdc ~ 404Vdc	
	400V class	280Vac ~ 320Vac	(AVR set) +276V	756Vdc ~ 827Vdc	
L100	200V class	190Vdc ± 10Vdc	-	395Vdc ± 20Vdc	Aprx. 365Vdc for 100s
	400V class	395Vdc ± 20Vdc		790Vdc ± 40Vdc	Aprx. 730Vdc for 100s
SJ100	200V class	Same as L100	370Vdc +4%,-3%	Same as L100	Same as L100
	400V class		740Vdc +4%,-3%		
L300P	200V class	200Vdc ± 10Vdc	-	395Vdc ± 10Vdc	Aprx. 380Vdc for 60s
	400V class	400Vdc ± 20Vdc		790Vdc ± 20Vdc	Aprx. 760Vdc for 60s
SJ300	200V class	Same as L300P	Adjustable by [b096]	Same as L300P	Same as L300P
	400V class				

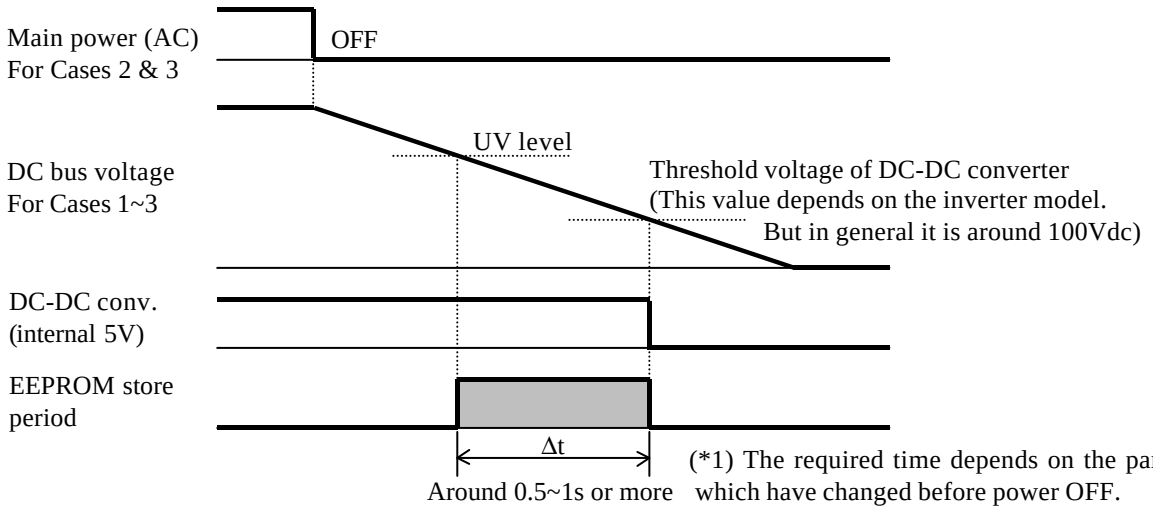
- If it is higher, inverter may trip with OV or BRD error.
- If it is lower, inverter may trip with UV.

[3] Cautions

Case 1 : Connected parallel to a common DC net

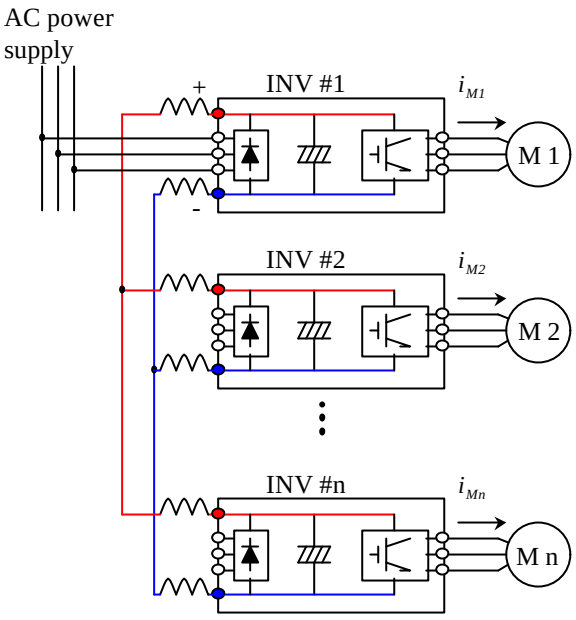


- Take preventive measures to limit inrush current at power ON, since the integrated inrush current limiting circuit is not used.
  → Otherwise there will be a unexpected UV at net side or damage to the inverter caused by ΔV=di/dt.
- Use DC chokes for each inverter to avoid interaction due to surge and/or harmonics.
  → Otherwise there may be an unexpected failure of the inverter or other attached equipment.
- Take preventive measures to ensure sufficient time between UV level and dead voltage of the DC/DC converter (*1) at power OFF. This is to allow ample time for EEPROM to store the existing data at power OFF. (Δt ; see below)
  → Otherwise there is a possibility of an EEPROM error at the next power ON.



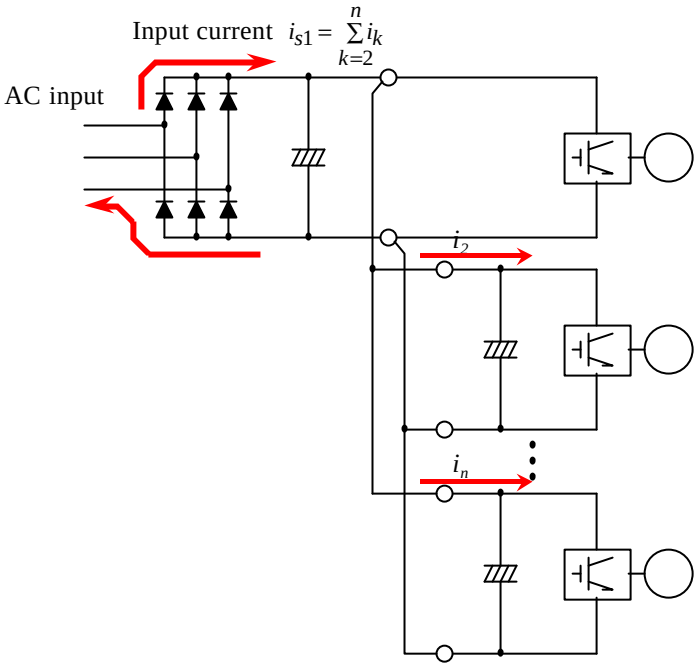
(*1) The required time depends on the parameters which have changed before power OFF.

Case 2 : DC Bus connected n parallel to a single AC-fed inverter



- **<u>Pay attention to the selection of the main inverter (#1) because all the input current flows through the rectifier bridge of this inverter. (*2)</u>**
- Need sufficient time for EEPROM to store the data. (Refer to Case 1)
- Use DC choke. (Refer to Case 1)

<Selection of the main inverter kW>



(*2) Capacity of the main inverter

Rated current of the main inverter should be higher than;

- Total rated current of the inverters
  and
- Possible highest total motor current

[Example of 4 inverters in parallel]

- INV#1~#4=SJ300-040HFx (8.6A rated)
- $i_{M1(max)} = i_{M2(max)} = i_{M3(max)} = i_{M4(max)} = 9.0Arms$

In this case, the total motor current <u>under the possible worst case</u> is higher than that of the inverters.

Total inverter rated current $= i_1 + i_2 + i_3 + i_4 = 8.6 * 4 = 32.2$ Arms

Total motor current under possible worst case $= i_{M1(max)} + i_{M2(max)} + i_{M3(max)} + i_{M4(max)} = 36Arms$

→ Main inverter must therefore be SJ300-185HFx (38A) or larger. SJ300-220HFx is suggested to provide additional safety margin.