

16.1 Introduction

SV-IS7 is a three-phase standard variable frequency drive (VFD). When applying single-phase power to a three-phase VFD, there are several constraints that need to be considered. Standard Pulse-Width-Modulated (PWM) VFDs use a 6-pulse diode rectifier. The 6-pulse rectification results in 360 Hz DC bus ripple when used with a three-phase 60 Hz supply. However, under single-phase use, the DC bus ripple becomes 120 Hz and the VFDs DC bus circuit is subject to higher stress in order to deliver equivalent power.

Additionally, input currents and harmonics increase beyond those encountered with three-phase input.

Input current distortion of 90% THD and greater can be expected under single-phase input, compared to approximately 40% with three-phase input as indicated in Figure 2.

Therefore, single-phase use requires the three-phase VFD power rating be reduced (derated) to avoid over stressing the rectifier and DC link components.

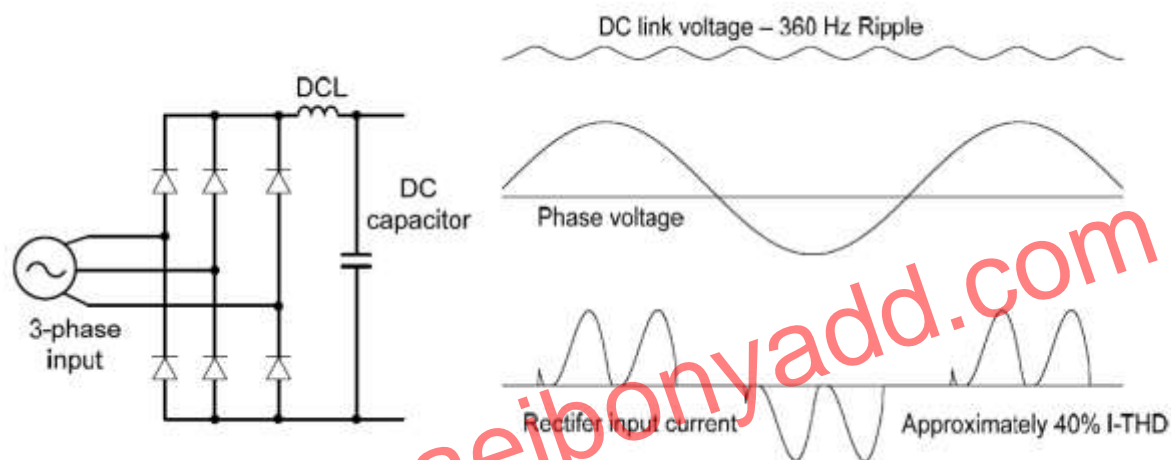


Figure-1 Typical Three-Phase Configuration

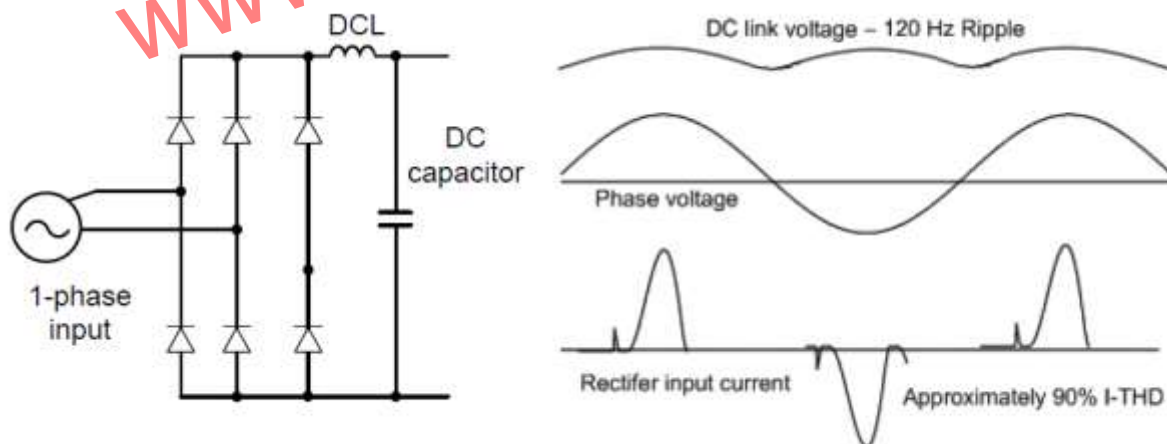


Figure-2 Typical Single-Phase Configuration

16.2 Power(HP), Input Current and Output Current

When using a three-phase VFD with single-phase input, derating the drive's output current and horsepower will be necessary because of the increase in DC bus ripple voltage and current.

In addition, the input current through the remaining two phases on the diode bridge converter will approximately double, creating another derating consideration for the VFD.

Input current harmonic distortion will increase beyond that with a three-phase supply making the overall input power factor low.

Input current distortion over 100% is likely under single-phase conditions without a Reactor.

Therefore, the Reactor is always required.

When using a motor that is selected by the three-phase drive rating criteria when using single-phase input, it may result in poor performance, premature drive failure.

The selected drive of single-phase current ratings must meet or exceed the motor current ratings as indicated in Table 1.

16.3 Input Frequency and Voltage Tolerance

The drive ratings in Table 1 are valid for 60Hz input only.

The AC supply voltage must be within the required voltage range of 240/480Vac +10% to -5% to maximize motor power production. Standard product with three-phase voltage input as an allowable range of +10% to -15%. Therefore, a stricter input voltage tolerance of +10 to -5% applies when using the drive with a single-phase supply. The average bus voltage with single-phase input is lower than the equivalent of a three-phase input.

Therefore, the maximum output voltage (motor voltage) will be lower with a single-phase input.

The minimum input voltage must be no less than 228Vac for 240 volt models and 456Vac for 480 volt models, to ensure motor voltage production of 207Vac and 415Vac, respectively.

Thus, if full motor torque must be developed near base speed (full power) it will be necessary to maintain a rigid incoming line voltage so that adequate motor voltage can be produced.

Operating a motor at reduced speed (reduced power), or using a motor with a base voltage that is lower than the incoming AC supply rating (ex. 208Vac motor with a 240Vac supply), will also minimize the effect of voltage deprivation.

(240VAC Input → 208V motor, 480VAC Input → 400V motor)

16.4 Wiring and Peripheral Device

It is important that input wiring and branch circuit protection be selected based on the drive's single-phase input current rating indicated in Table 1-2.

The single-phase input current after derating differs from the three-phase input indicated on the VFD nameplate.

Connect single-phase AC input wiring below Figure-3 (R(L1)-T(L3)).

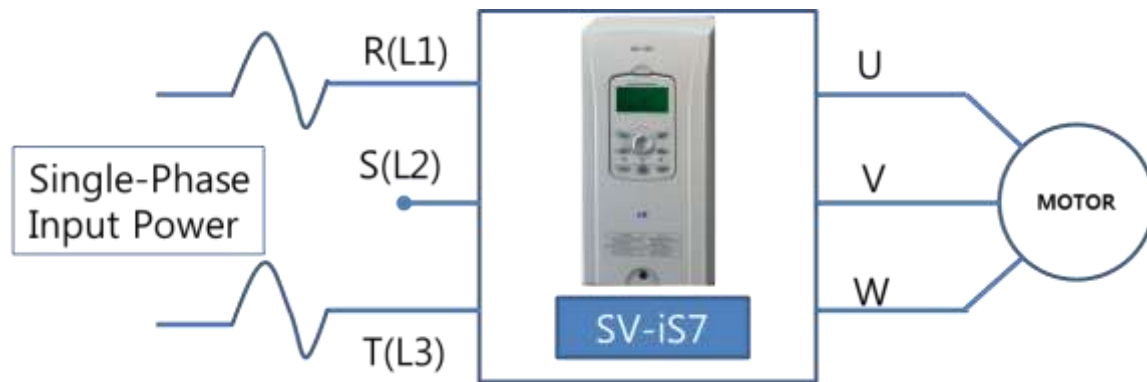


Figure-3 Terminal Wiring Diagram

| Single-Phase Rating (200V/60Hz) | | | | | | | | | | | | | | |
|---------------------------------|------|-----------------------------|--------|-----------|--------|----------------|-------|------|------|---------------|-------------|---------------|----------------------|---------|
| [kW] | [HP] | Single-Phase Current Rating | | | | Wire Selection | | FUSE | | DC Link Choke | | MCCB | Electronic Contactor | |
| | | Output Amp | | Input Amp | | AWG | | [A] | [V] | [mH] | [A] | LSIS(UL Type) | | |
| | | HD [A] | ND [A] | HD [A] | ND [A] | R,S,T | U,V,W | | | | | | | |
| 0.75kW | 1 | 2.6 | 4.1 | 4.3 | 6.8 | 14 | 14 | 10 | 500V | Built-in | UTE100/15A | MC-9b | | |
| 1.5kW | 2 | 4.0 | 6.0 | 6.9 | 10.6 | 14 | 14 | 15 | | | UTE100/15A | MC-12b | | |
| 2.2kW | 3 | 6.2 | 8.2 | 11.2 | 14.9 | 14 | 14 | 20 | | | UTE100/30A | MC-18b | | |
| 3.7kW | 5 | 8.1 | 12 | 14.9 | 21.3 | 12 | 12 | 32 | | | UTE100/30A | MC-32a | | |
| 5.5kW | 7.5 | 12 | 16 | 22.1 | 28.6 | 10 | 10 | 50 | | | UTS150/50A | MC-40a | | |
| 7.5kW | 10 | 16 | 23 | 28.6 | 41.2 | 8 | 8 | 63 | | | UTS150/60A | MC-50a | | |
| 11kW | 15 | 24 | 31 | 44.3 | 54.7 | 6 | 6 | 80 | | | UTS150/100A | MC-65a | | |
| 15kW | 20 | 31 | 38 | 55.9 | 69.7 | 4 | 4 | 100 | | | UTS150/125A | MC-100a | | |
| 18.5kW | 25 | 38 | 45 | 70.8 | 82.9 | 2 | 2 | 125 | | | UTS150/150A | MC-130a | | |
| 22kW | 30 | 45 | 64 | 85.3 | 116.1 | 1 | 1 | 160 | | | UTS250/175A | MC-150a | | |
| 30kW | 40 | 60 | 75 | 121.0 | 152.0 | 1/0 | 1/0 | 200 | | | 0.24 | 200 | UTS250/225A | MC-150a |
| 37kW | 50 | 75 | 93 | 154.0 | 190.0 | 2/0 | 2/0 | 250 | | | 0.2 | 240 | UTS400/300A | MC-225a |
| 45kW | 60 | 93 | 114 | 191.0 | 231.0 | 2/0 | 2/0 | 350 | | | 0.17 | 280 | UTS400/350A | MC-330a |
| 55kW | 75 | 114 | 149 | 233.0 | 302.0 | 3/0 | 3/0 | 400 | | | 0.12 | 360 | UTS600/500A | MC-400a |
| 75kW | 100 | 149 | 178 | 305.0 | 362.0 | 4/0 | 4/0 | 450 | | | 0.1 | 500 | UTS600/600A | MC-630a |

Table 1. Single Phase Rating(240V/60Hz)

Chapter 16 Single-Phase Rating

| Single-Phase Rating (400V/60Hz) | | | | | | | | | | | | | |
|---------------------------------|------|-----------------------------|--------|-----------|--------|----------------|-------|------|------|---------------|-------------|---------------|----------------------|
| [kW] | [HP] | Single-Phase Current Rating | | | | Wire Selection | | FUSE | | DC Link Choke | | MCCB | Electronic Contactor |
| | | Output Amp | | Input Amp | | AWG | | [A] | [V] | [mH] | [A] | LSIS(UL Type) | |
| | | HD [A] | ND [A] | HD [A] | ND [A] | R,S,T | U,V,W | | | | | | |
| 0.75kW | 1 | 1.4 | 2.2 | 2.2 | 3.7 | 14 | 14 | 10 | 500V | Built-in | UTE100/15A | MC-9b | |
| 1.5kW | 2 | 2.1 | 3.2 | 3.6 | 5.7 | 14 | 14 | 10 | | | UTE100/15A | MC-9b | |
| 2.2kW | 3 | 2.8 | 4.1 | 5.5 | 7.7 | 14 | 14 | 15 | | | UTE100/15A | MC-12b | |
| 3.7kW | 5 | 4.1 | 6.1 | 7.5 | 11.1 | 14 | 14 | 20 | | | UTE100/15A | MC-18b | |
| 5.5kW | 7.5 | 6.1 | 8.0 | 11.0 | 14.7 | 12 | 12 | 32 | | | UTE100/30A | MC-22b | |
| 7.5kW | 10 | 8.1 | 12 | 14.4 | 21.9 | 12 | 12 | 35 | | | UTE100/30A | MC-32a | |
| 11kW | 15 | 12 | 16 | 22.0 | 26.4 | 10 | 10 | 50 | | | UTS150/50A | MC-40a | |
| 15kW | 20 | 16 | 20 | 26.6 | 35.5 | 8 | 8 | 63 | | | UTS150/60A | MC-50a | |
| 18.5kW | 25 | 20 | 23 | 35.6 | 41.1 | 6 | 6 | 70 | | | UTS150/80A | MC-65a | |
| 22kW | 30 | 23 | 31 | 41.6 | 55.7 | 4 | 4 | 100 | | | UTS150/100A | MC-65a | |
| 30kW | 40 | 32 | 39 | 55.5 | 67.5 | 4 | 4 | 125 | | | UTS150/125A | MC-100a | |
| 37kW | 50 | 39 | 47 | 67.9 | 81.7 | 4 | 2 | 125 | | | UTS150/150A | MC-130a | |
| 45kW | 60 | 47 | 57 | 82.4 | 101.8 | 1 | 1 | 160 | | | UTS250/175A | MC-150a | |
| 55kW | 75 | 57 | 78 | 102.6 | 143.6 | 1/0 | 1/0 | 200 | | | UTS250/225A | MC-185a | |
| 75kW | 100 | 78 | 94 | 143.4 | 173.4 | 2/0 | 2/0 | 250 | | | UTS400/300A | MC-225a | |
| 90kW | 120 | 95 | 116 | 174.7 | 212.9 | 4/0 | 4/0 | 350 | | | UTS400/400A | MC-330a | |
| 110kW | 150 | 116 | 138 | 213.5 | 254.2 | 4/0 | 4/0 | 400 | | | UTS600/500A | MC-400a | |
| 132kW | 180 | 134 | 165 | 255.6 | 315.3 | 300 | 300 | 450 | | | UTS600/600A | MC-400a | |
| 160kW | 225 | 166 | 189 | 316.3 | 359.3 | 400 | 400 | 450 | | | UTS600/600A | MC-630a | |

Table 2. Single-Phase Rating(480V/60Hz)

16.5 Considerations When Using a Three-Phase Drive with Single-Phase Input

Depending on the increased DC ripple, sensorless mode may result in poor performance, If phase open trip occurs, cancel the input phase open protection bit setting. (PRT-05 : Phase Loss Chk)

When applying single-phase power to a three-phase VFD, you can not limit the current to exceed the single-phase rating. Therefore, motor capacity, motor overload trip and E-thermal function must be set to protect motor.

The Reactor is always required. Therefore, Please purchase a built-in DC reactor product.

IS7 200V 30 ~ 75kW, 400V 280 ~ 375kW capacity products does not have a built-in DC reactor.

The product does not have a built-in DC reactor, install an external AC reactor because it can not be equipped with a DC reactor.