

# How to set up a single phase input device from a three phase input for your 230V three phase input circuit

## Introduction

This application notes has been designed to aid in the wiring changes and protection requirements when converting a three phase input to a single phase input for your 230V system. The PowerXL DE1 variable speed starter is available in 230V and 460V, however the supply voltage for the 230V version is single phase in only. It is still a three phase output device to control the three phase motors. This application note will describe the wiring configuration changes and the changes in the protection requirements.

## Important considerations

If the DE1 is installed on one leg of a three phase system, the unfiltered harmonics generated from this device could cause issues with other equipment within the facility. With three phase operation of a non-linear load, the tripling harmonics cancel; likewise, with two phase operation of a non-linear load, the even harmonics cancel. However, there is no cancelation effect with single phase operation which can lead to significant even order and tripling harmonics. This is more of a concern where the amps drawn from the single phase drive constitute a significant portion of the total current drawn on that particular leg of the three phase system. If harmonics are not properly addressed, they can affect other components on the system and fines can be levied against the facility by the utility.

## Power wiring recommendations

Connections must come from a 480 Y transformer on the supply side using one of the phases and the neutral wire. The other 2 phases can be tapped off or not pulled to this section of the panel. In the case where a 230V Delta transformer is used on the supply side using two phases are used. The additional phase tapped off. (see page 17 of DE1 manual for DE1 Supply requirements.)

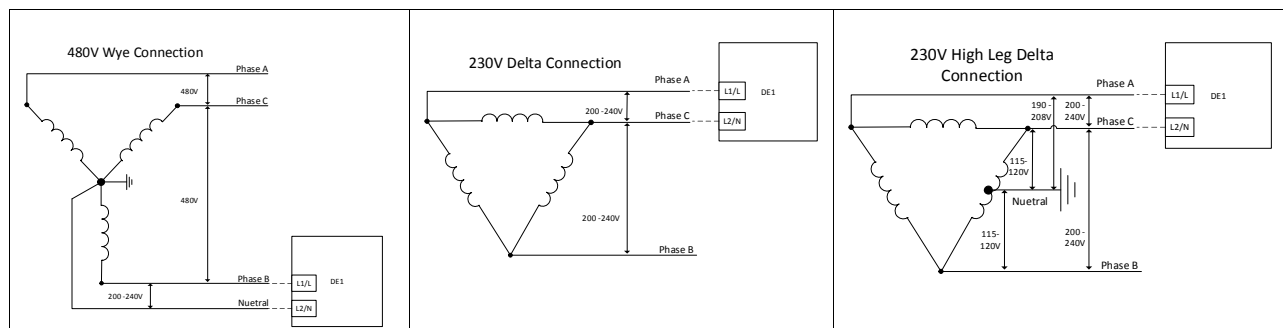


Figure 1. From left to right: 480V wye connection, 230V delta connection, 230V high leg delta connection

For FS1 drives, the single phase in must be connected to L1/L and the neutral line in the case of a Wye transformer must be connected to L2/L as per Figure 2 below. In the case of a Delta transformer L1 is connected to phase A and L2/N to phase B. On the left in the figure below, the L3 terminal and the RFI filter connection terminal are sealed off and not used. Below is shown the connection method for a single phase DE1.

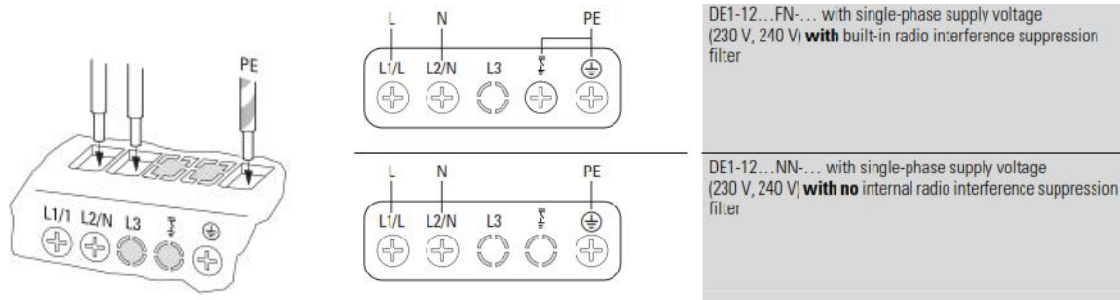


Figure 2. Incoming DE1 wiring configuration

Designation	Function	Notes
L1/L	Mains connection: <ul style="list-style-type: none"> <li>Phase L1 in DE1-34... devices</li> <li>Phase L in DE1-12... devices</li> </ul>	Mains nominal voltages : DE1-34... : 400 V/480 V (phase-phase) DE1-12... : 230 V/240 V (phase-neutral conductor)
L2/N	Mains connection: <ul style="list-style-type: none"> <li>Phase L2 in DE1-34... devices</li> <li>Neutral conductor N in DE1-12... devices</li> </ul>	Mains nominal voltages : DE1-34... : 400 V/480 V (phase-phase) DE1-12... : 230 V/240 V (neutral conductor-phase)
L3	Mains connection: <ul style="list-style-type: none"> <li>Phase L3 in DE1-34... devices</li> </ul>	Mains rated voltages: DE1-34... : 400 V/480 V (phase-phase)
	Ground connection (PE) for the internal RFI filter	Only for devices with an internal radio interference suppression filter (DE1-...FN-...). Link to PE terminal used only in combination with the EMC jumper on the motor side.
	PE, ground connection on mains side	Internal connection to the motor-side PE connection
U	Motor connection phase 1	Motor rated voltages : DE1-34... : 400 V/460 V DE1-12... : 230 V
V	Motor connection phase 2	
W	Motor connection phase 3	
	Ground connection (PE) for the DC link's internal filter (star capacitor)	Only for devices with an internal radio interference suppression filter (DE1-...FN-...). Link to PE connection used only in combination with the EMC jumper on the mains side
	PE, ground connection on motor side	Internal connection to the mains-side PE connection

Table 1. DE1 terminal designation

One final point to mention on proper wiring is that the DE1 must be connected to the power supply system's protective earth directly at the location of installation (system earthing). This protective earth must not pass through any other devices. All additional wiring practices should be followed as they would be for a three phase, standard drive.

## Upstream protection recommendations

The same considerations are taken when sizing an upstream protection device as would be looked at with three phase load systems. Breakers and fuses are recommended to be sized at least 125% larger than the current of the downstream drive.

A single phase input device requires a two pole protection device. For a single phase input device, the input current is typically higher compared to a three phase input device input current. This means that the protection device needs to take the increased current into consideration. The output current matches to what the nameplate current it on the DE1.

Sizing example:

230V single phase input, 2hp  
 DE1-127D0NN-N20N  
 Input current = 17.4A  
 $125\% \times 17.4A = 21.75A$   
 25A minimum protection required

230V three phase input, 2hp  
 DC1 Equivalent  
 Input current = 7.3A  
 $125\% \times 7.3A = 9.125A$   
 10A minimum protection required

Part number	HP	Input current (A)	Recommended minimum protection current rating (A)
DE1-121D4NN-N20N	0.33	3.6	5
DE1-122D3NN-N20N	0.5	6.2	10
DE1-122D7NN-N20N	0.75	7.3	10
DE1-124D3NN-N20N	1	11.3	15
DE1-127D0NN-N20N	2	17.4	25
DE1-129D6NN-N20N	3	23.2	30

Table 2. DE1 input current data