

# PEM3012 and PEM3112 Auxiliary Power Supply using remote shut down

This application note explains how to provide an optional Auxiliary power supply to the target device. As an example, this optional and additional circuit provides for a target device using the PEM3012 or PEM3112 module to be powered by 12V DC power supply such as a wall adapter.

Please refer to the circuit as shown in Fig 1 below.

Under default conditions, the target device draws power from the PEM module via the Schottky diode D1. (D1 to be chosen so as to have a forward voltage drop of maximum +0.5V). Resistor R1 is used to increase the output voltage at pin +VDC so that the voltage drop due to D1 gets compensated and provides desired +12V output to target device.

Whenever auxiliary supply is in an on-state and delivering 12V~13V DC, it biases the opto-coupler U1 through resistors R4 and R5 which pulls the RSD pin HIGH (through R2, R3 and C4). The RSD in HIGH state shuts down the output of the PEM module internally. The auxiliary supplies power to the target device via D2. The PEM module will continue to stay in an internally off state as long as RSD pin is HIGH.

The RSD will go to LOW state only when the auxiliary supply is removed or its voltage drops to zero. At this state the PEM module will resume supplying power to the target board via POE and via D1.

Capacitor C3 is required in order to reduce the change over time between the auxiliary supply and the POE supply. C3 should be placed as close as possible to the output. For an increased buffer and to provide for a longer change-over time, the capacitance of C3 can be increased. Capacitor C1 and C2 are used for loop stability and output ripple reduction.

Note: Since the RSD (remote shut down) pin is on the input side, use of an opto-isolator is required in order to maintain 1500V isolation with the auxiliary supply which is connected on the output side.

It is recommended that D1 and D2 are same and these can be of any type having Maximum forward voltage drop of 0.5V. Example: 1N5820.

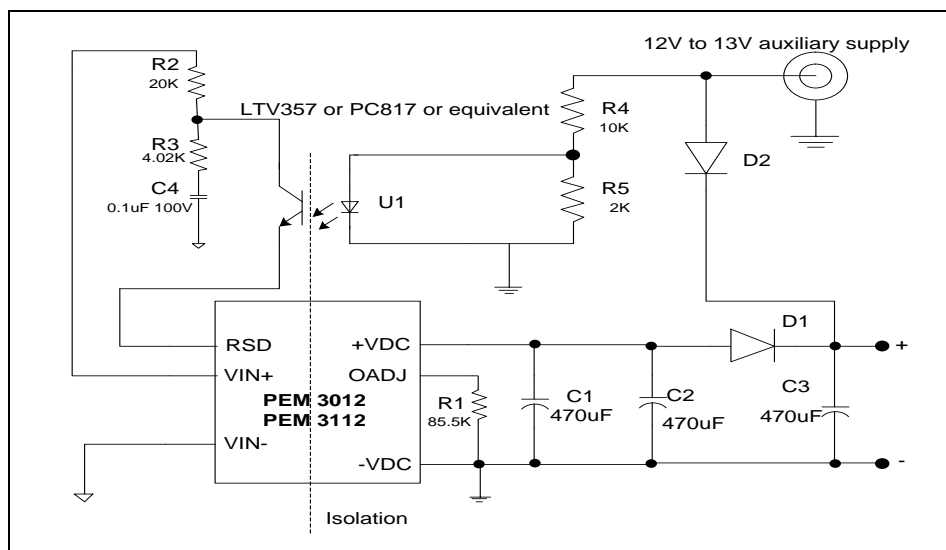


Figure 1: Auxiliary power supply having priority Over POE PEM3012/3112

Any Power over Ethernet (PoE) module will generate Electromagnetic Interference (EMI) both radiated and conducted, during its operation, but since it is just one component within your overall equipment/system, it is extremely difficult for Infomart® to comment on what exact methods and components will be required for meeting the EMI requirements of the EN55022 (CISPR22) or EN55024 or EN61000 test standards.

There are many methods of reducing EMI from utilizing proper PCB layout, metal chassis or EMI suppression plates, components, and filtering.

This application note attempts to describe some of the filtering techniques which can be used for EMI suppression. These techniques may be used in combination to achieve desired results. For the purposes of this application note, the PoweredEthernet™ PEM1312 is being used as a representative POE-PD module. The PEM modules do feature some built-in EMI filtration.

## **1a. EMI filtration using safety capacitor.**

Figure 1 (below) shows connections for EMI tuning by using a safety capacitor (C2) between the primary and secondary ground planes. It is important for the capacitor to maintain a safety isolation voltage. For example X2 or X1 safety capacitors can be used. For compact applications 2KV DC multi-layer ceramic capacitors can be used. The exact capacitance values will have to be tuned by the system designer.

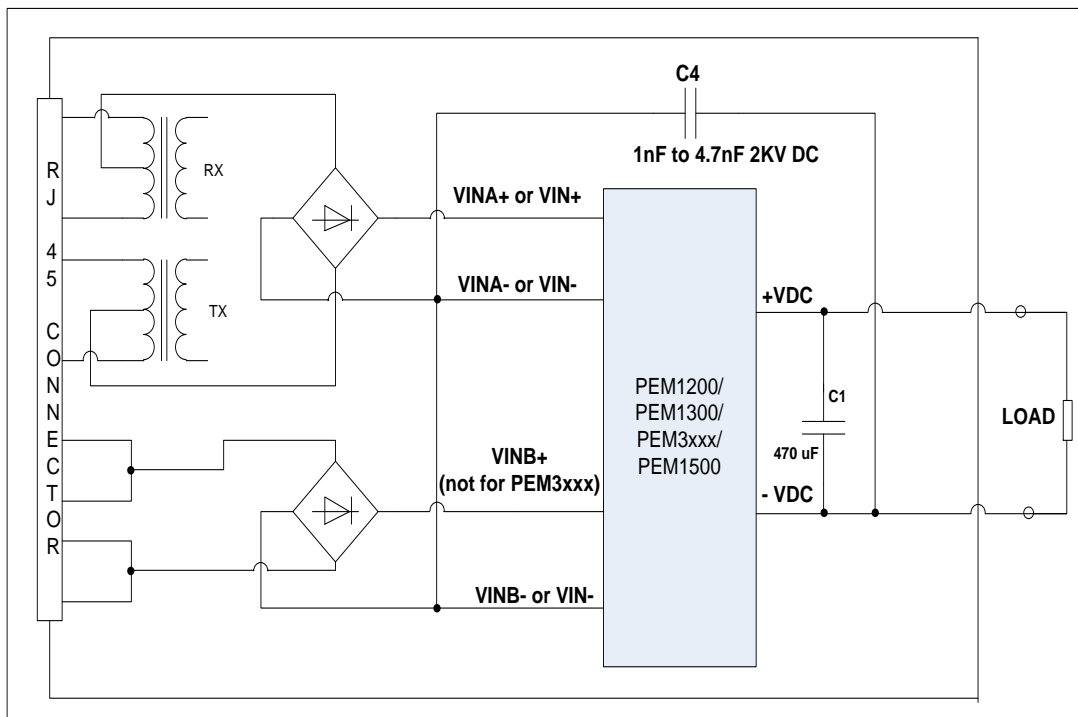


Figure 1. EMI filtration using safety capacitor

**1b. EMI filtration using EMI and EMO pins only for PEM3000 and PEM3100 series.**

Figure 2 (below) shows connections for EMI tuning by using EMI and EMO pins which are internally connected across the switching transformer. It is important for the capacitor to maintain a safety isolation voltage. For example X2 or X1 safety capacitors can be used. For compact applications 2KV DC multi-layer ceramic capacitors can be used. The exact capacitance values will have to be tuned by the system designer. Example: B32921C3104M-Metal poly film capacitor.

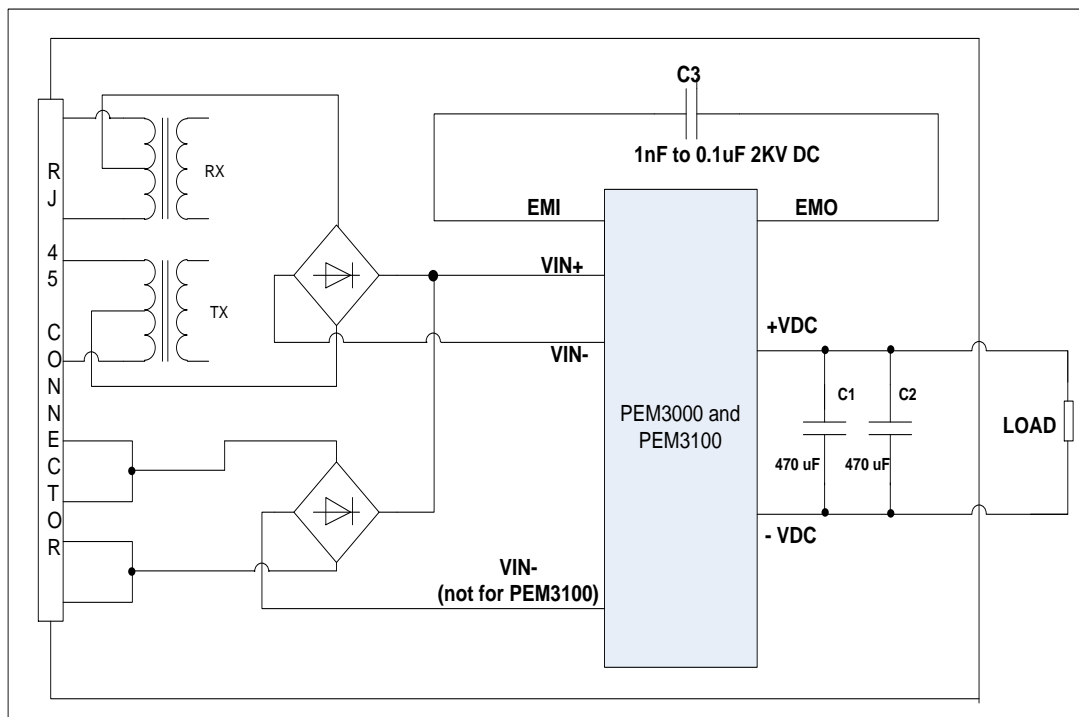


Figure 2. EMI filtration using EMI and EMO pins only for PEM3000 and PEM3100 series

**2. Input chip bead filter**

EMI, especially conducted emission can be reduced by using chip bead filter connected in series on each of the POE input lines.

An example is shown in Figure 3 (below) using MURATA part number BLM15AX221SN1. The bead features nominal impedance 220R at 100MHz, DC resistance of 180mΩ and current capacity of 580mA. Please check the latest manufacturer datasheet for correct ratings. Chip bead filters of various impedance can be used to tune and suppress the EMI.

For increased suppression, multiple chip bead filters can be used in series on each PoE input line.

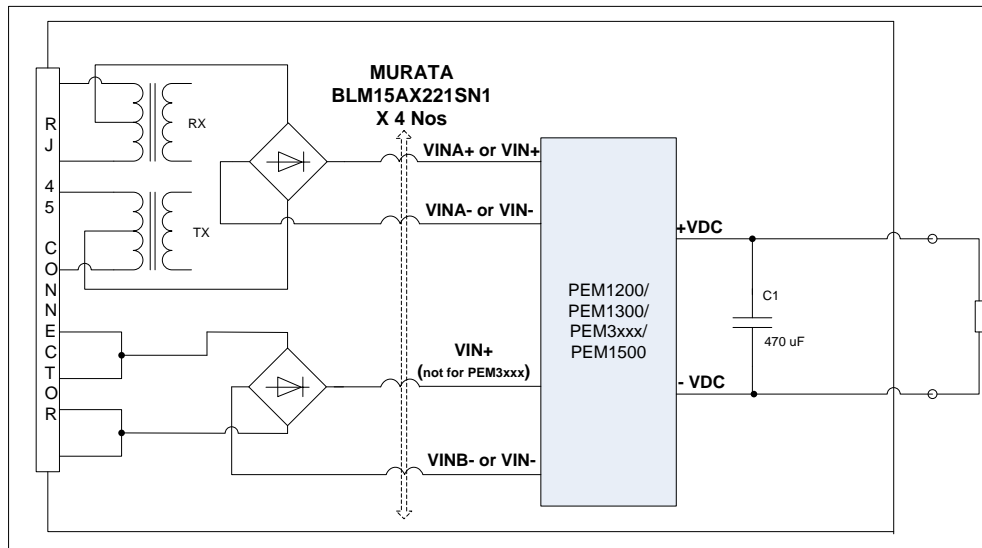


Figure 3. Chip bead filter

### 3. Common mode filters

This method uses Common mode filters to reduce the EMI. The connection diagram shown in Figure 4 (below). It is recommended that the input common mode filters be placed after the SMAJ58A TVS diode protection.

Input side filters L1 and L2 should be rated for 100VDC and at least 450mA current for IEEE 802.3af modules such as the PEM1200 and PEM1300 series and for at least 750mA current for IEEE802.3at applications such as the PEM3000 and PEM3100 series modules.

The output side filter (L3) should have a current rating which will be able to withstand a short-circuit between the POE PD module and the host board.

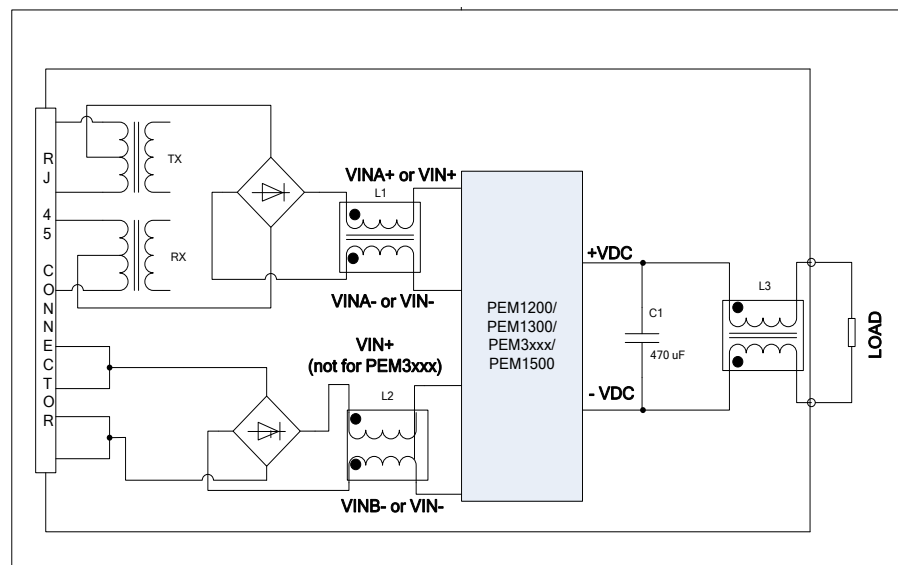


Figure 4. Common mode filters

## 4. Ground planes filtration

A very effective method of EMI suppression is with the use of ground planes. In addition to the primary and secondary ground planes of the PoE PD module, Figure 5 below introduces the concept of “Data Ground or F Ground” which uses the grounding provided by use of a metal jacket RJ-45 connector and STP Cat-5 or Cat-6 cabling.

EMI filtering can be achieved by using high voltage capacitors and RC networks as depicted in the schematic (Figure 5) below.

The primary or secondary ground planes of the POE-PD (pins 2 and 4, or on PEM13xx and PEM12xx) can also be connected to the metal jacket of the RJ45 connector (data ground) but the system designer must use a X2 safety or 2KV DC capacitors of 1nf to 4.7nf between each of the ground planes to maintain isolation and safety.

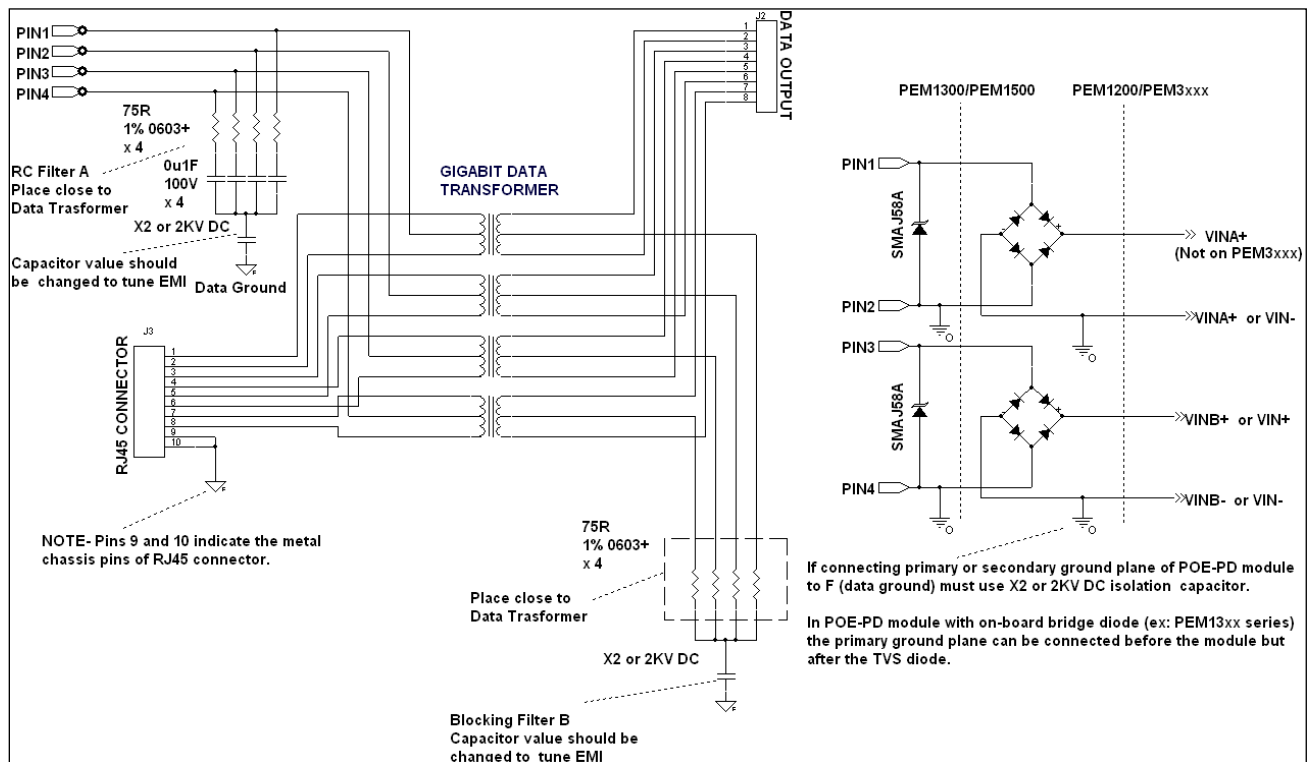


Figure 5– Ground planes filtration

In case the system designer is using 10BaseT or 100BaseT Ethernet, it is strongly recommended the RC Filter A on the POE connections to the module are still used. i.e. 2 x RC from the data transformer and 2 x RC from the spare pair. The Blocking Filter B, will be reduced to 2xResistors.