EMC Auxiliary Device Application Guide 2017

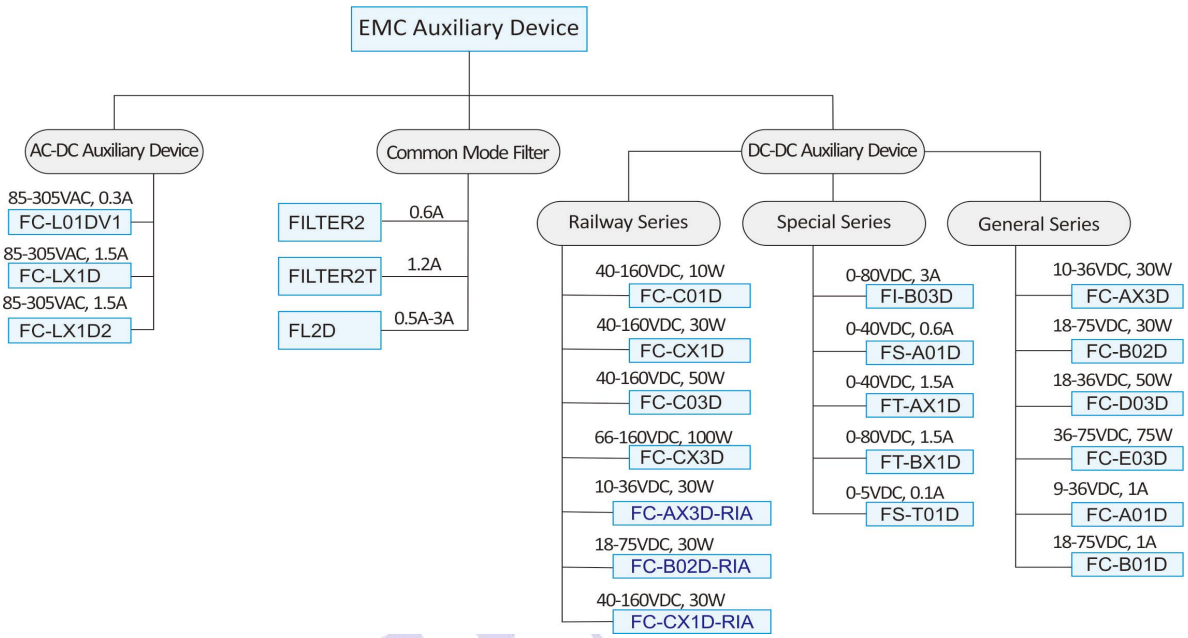
地址: 广州市萝岗区科学城科学大道科汇发展中心科汇一街5号 (510663)
No. 5, Kehui St. 1, Kehui development center, Science Ave.,
Guangzhou Science City, Luogang district, Guangzhou, P.R.China
Tel: (+86)20-38601850 Fax: (+86)20-38601272
Http://www.mornsun.cn www.mornsun-power.com

1. Selection Guide

1.1 Confirm EMC Auxiliary Device Specification

First, confirm the specification of EMC Auxiliary Devices, then select the product according to the requirements, shown as below Diagram.

Diagram 1-1: EMC Auxiliary Device Selection Diagram



Note: MORNSUN reserves the right to add new product into above selection diagram without notice.

Step 1, select EMC Auxiliary Device type.

EMC includes EMI and EMS. Different requirements need different EMC Auxiliary Devices. If EMI needed, filter type EMC Auxiliary Device is most recommended. If EMS needed, protection type EMC Auxiliary Device is most recommended. If both EMI and EMS are needed, EMC Auxiliary Device with the functions of EMI and EMS is the best recommendation.

Step 2, confirm the input power supply type.

To confirm the System voltage input source is AC or DC. AC/DC EMC Auxiliary Device is for AC, DC/DC EMC Auxiliary Device is for DC.

Step 3, confirm the input voltage range.

Select the EMC Auxiliary Device based on the system input voltage range. The input voltage range of AC/DC EMC Auxiliary Device is 85-305VAC. The input voltage range of DC/DC Auxiliary Device is 4:1(40-160VDC). The conventional series have two kinds of input range of 2:1(18-36VDC) and 4:1(9-36VDC, 18-75VDC). The special series has three kinds of input range of 0-50VDC, 0-40VDC and 0-80VDC.

Step 4, confirm the operating current or power.

EMC Auxiliary Device includes active filter and passive filter. The operating voltage and the system

地址: 广州市萝岗区科学城科学大道科汇发展中心科汇一街5号 (510663)
No. 5, Kehui St. 1, Kehui development center, Science Ave.,
Guangzhou Science City, Luogang district, Guangzhou, P.R.China
Tel: (+86)20-38601850 Fax: (+86)20-38601272
Http://www.mornsun.cn www.mornsun-power.com

power should be considered for the active filter selection. In Diagram 1-1, the active filter selection is based on the voltage and power, while the passive filter selection is based on the voltage and current. AC/DC EMC Auxiliary Device only has passive filter. Therefore, the product selection should be based on voltage and current, while the system input voltage range can't be over the maximum operating voltage of Auxiliary Device and the current can't be over the maximum operating voltage of it. DC/DC EMC Auxiliary Device includes active filter and active filter, the product selection should be based on the filter type to select the power or current.

Note: The active filter is a filter that used an active components(like switching tube), while the passive filter is a filter that used a passive components(like capacitor, inductance).

1.2 AC/DC EMC Auxiliary Device selection

Different AC/DC EMC Auxiliary Devices support different AC/DC series power supply to improve the EMC performance of Power supply. Below is the selection diagram for AC/DC EMC Auxiliary Device supporting AC/DC series power supply.

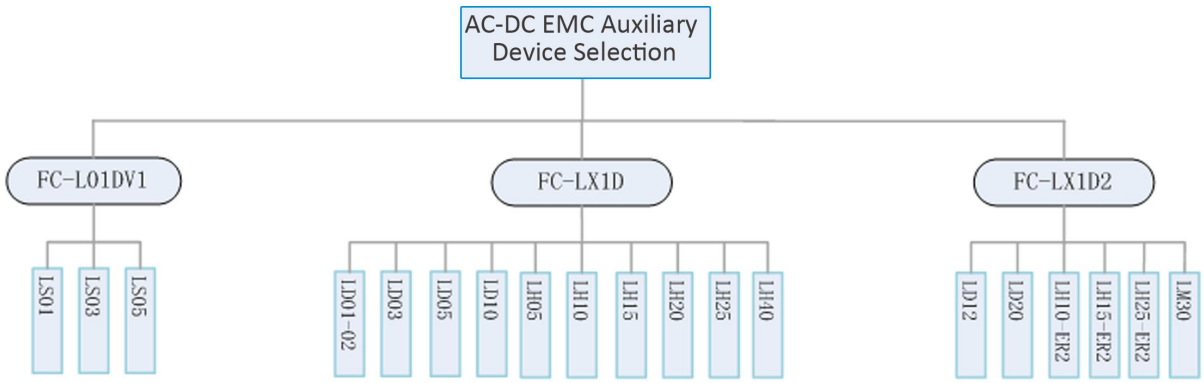


Diagram 1-2: AC/DC EMC Auxiliary Device Selection Diagram

AC/DC power supplies supported with EMC Auxiliary Device have different EMC specification. Below table is the EMC performance of them.

Table 1-1: Specification of AC/DC power supplies supported with EMC Auxiliary Device

AC/DC Series	Filter P/N	EMI	EFT	Surge
LS01		Class B	±4KV	±1KV/±2KV
LS03	FC-L01DV1	Class B	±4KV	±1KV/±2KV
LS05		Class B	±4KV	±1KV/±2KV
LD01-03		--	±2KV	±1KV/±2KV
LD05	FC-LX1D	--	±4KV	±2KV/±4KV
LD10		--	±4KV	±2KV/±4KV

地址: 广州市萝岗区科学城科学大道科汇发展中心科汇一街5号 (510663)
No. 5, Kehui St. 1, Kehui development center, Science Ave.,
Guangzhou Science City, Luogang district, Guangzhou, P.R.China
Tel: (+86)20-38601850 Fax: (+86)20-38601272
Http://www.mornsun.cn www.mornsun-power.com

LH05/10/15/20/25/40	FC-LX1D2	--	±4KV	±2KV/±4KV
LD12		--	--	±4KV/±6KV
LD20		--	--	±4KV/±6KV
LH10/15/25-ER2		--	--	±4KV/±6KV
LM30		--	--	±4KV/±6KV

1.3 Selection of DC/DC EMC Auxiliary Device to Support General Railway DC/DC converters

General DC/DC Railway power supply has its own EMC Auxiliary Device to improve its EMC performance, meeting the Railway industry EN50155 standard requirements. Below Diagram is the most recommendation to select the right filter.

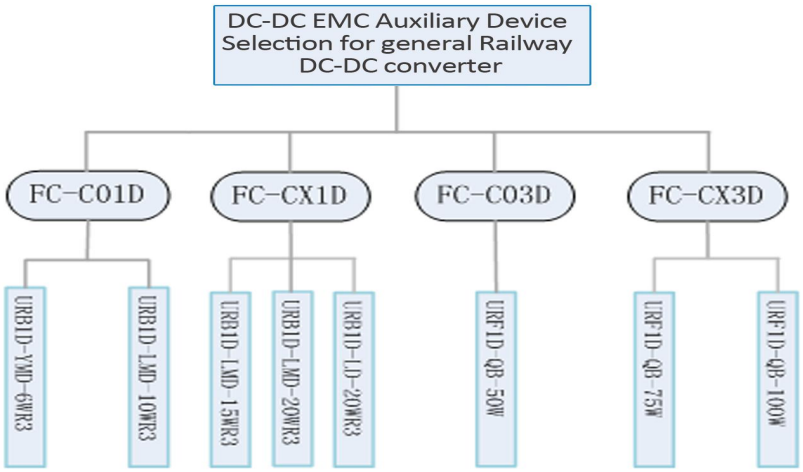


Diagram 1-3: Selection Diagram of DC/DC EMC Auxiliary Device to support Railway DC/DC Converter

1.4 Other EMC Auxiliary Device Supporting Selection

1.4.1 DC/DC EMC Auxiliary Device for Railway RIA series

MORNSUN DC/DC EMC Auxiliary Device meets British Railway RIA12 standards. They also meet 3.5 times input voltage requirement and 20ms test requirement. So, the input voltage range of DC/DC converter should be within the input voltage range of Auxiliary Device and the power of it should be lower than the maximum output power of the Auxiliary Device during selection.

1.4.2 General DC/DC EMC Auxiliary Device Series

For general DC/DC EMC Auxiliary Device series, the power selection should be based on the input voltage and power of Auxiliary Device. The input voltage should be within the input voltage range of Auxiliary Device and the power should be lower than the maximum output power of it.

1.4.3 Dedicated DC/DC EMC Auxiliary Device Series

This EMC Auxiliary Device series is designed for special EMC projects. In design, it is necessary to

地址: 广州市萝岗区科学城科学大道科汇发展中心科汇一街5号 (510663)
No. 5, Kehui St. 1, Kehui development center, Science Ave.,
Guangzhou Science City, Luogang district, Guangzhou, P.R.China
Tel: (+86)20-38601850 Fax: (+86)20-38601272
Http://www.mornsun.cn www.mornsun-power.com

select the corresponding Auxiliary Device according to required EMC performance. In Auxiliary Device selection, the input voltage and current should be lower than the specification of itself.

1.4.4 Common Mode Filter

To select the corresponding Common Mode Filter based on the input current, the input current should be lower than the specification of Common Mode Filter. According to the frequency points of excessive noise, select the corresponding impedance Common Mode Filter. Below is an example of impedance characteristic curve for Common Mode Filter. For specifications, please refer to datasheet.

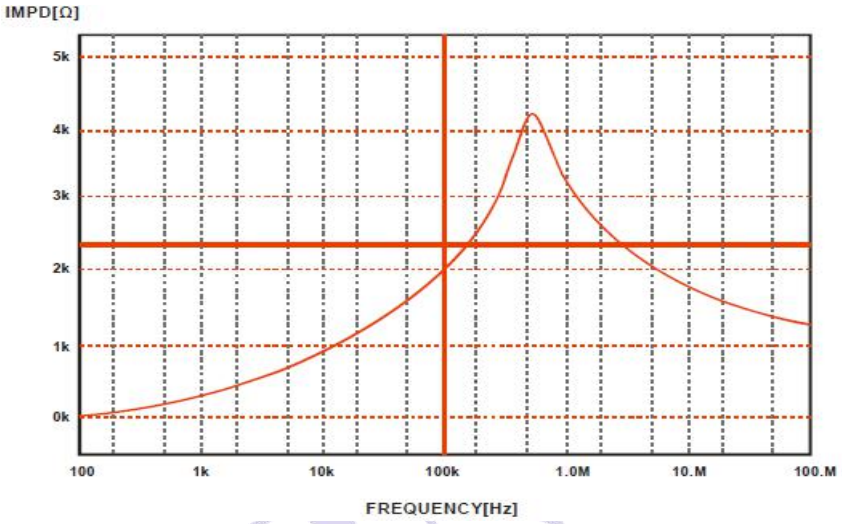


Diagram 1-4: Impedance Characteristic Curve for Common Mode Filter

Note: Any question on above selection, please contact our technical person.

2. EMC Auxiliary Device Test

In addition to the appropriate EMC Auxiliary Device, the electrical performance applied to the actual unit circuit is also important. Rigorous test should be made before using. The following is a brief introduction to general test methods of the EMC Auxiliary Device.

2.1 The Input and Output Connection Diagram

Below Diagram is used to confirm whether the selected EMC Auxiliary Device is good or bad.

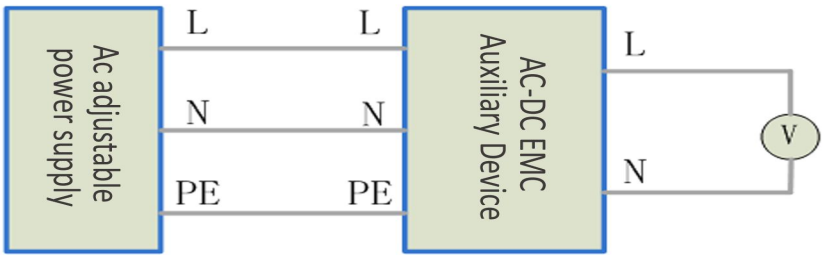


Diagram 2-1: The input and output connection diagram for AC/DC EMC Auxiliary Device

地址: 广州市萝岗区科学城科学大道科汇发展中心科汇一街5号 (510663)
No. 5, Kehui St. 1, Kehui development center, Science Ave.,
Guangzhou Science City, Luogang district, Guangzhou, P.R.China
Tel: (+86)20-38601850 Fax: (+86)20-38601272
Http://www.mornsun.cn www.mornsun-power.com

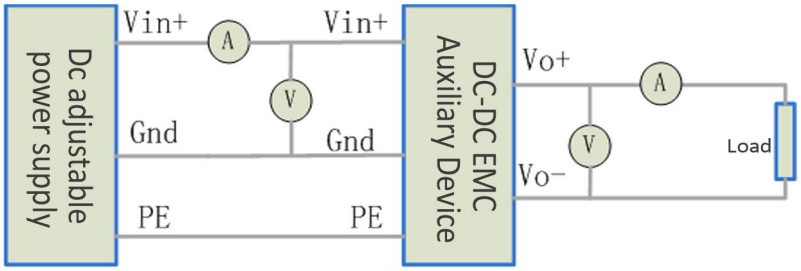


Diagram 2-2: The input and output connection diagram for DC/DC EMC Auxiliary Device

Note: According to the connection diagram and the input-output characteristics, that EMC Auxiliary Device is good or not can be determined. AC/DC EMC Auxiliary Device is a passive filter and the output voltage varies with the input voltage; DC/DC EMC Auxiliary Device contains active filter and passive filter. The output voltage of the active filter is about 1V lower than the output voltage(voltage drop-out of switch tube), while the output voltage of the passive filter varies with the input voltage.

2.2 Basic Performance Tests

Conduct performance test and judgment after connecting EMC Auxiliary Device and then confirm whether the performance parameters meet standards. Here is mainly for DC/DC active EMC Auxiliary Device.

2.2.1 Efficiency

Nominal input voltage V_{in}, full load I_{out}, measured output voltage recorded as V_{out}, input current recorded as I_{in}	Efficiency $\eta = \frac{Iout \times Vout}{Iin \times Vin} \times 100\%$

For example, EMC Auxiliary Device FC-CX3D, $V_{in} = 110V$, tested output voltage at full load $V_{out} = 109V$, output current $I_{out} = 916mA$, input current $I_{in} = 911mA$, $\eta = \frac{0.916 \times 109}{0.911 \times 110} \times 100\% = 99.63\%$.

Note 1: Efficiency test is mainly for DC/DC active EMC Auxiliary Device. The passive filter does not need efficiency test.

Note 2: When doing DC/DC active Auxiliary Device test, start at no load then test at full load. If electronic load connected. The test range of electronic load should be more than the maximum input voltage of the EMC Auxiliary Device.

2.2.2 The clamping characteristics

DC/DC EMC Auxiliary Device contains active filter and passive filter. The active filter has the input over voltage clamping function, and should be at no load when testing the input over-voltage clamping

地址: 广州市萝岗区科学城科学大道科汇发展中心科汇一街5号 (510663)
No. 5, Kehui St. 1, Kehui development center, Science Ave.,
Guangzhou Science City, Luogang district, Guangzhou, P.R.China
Tel: (+86)20-38601850 Fax: (+86)20-38601272
Http://www.mornsun.cn www.mornsun-power.com

characteristics, the test voltage should be lower than the maximum input limiting voltage required by the EMC Auxiliary Device datasheet, otherwise, the product has the risk of damage.

2.2.3 Leakage Current

For EMC Auxiliary Device, leakage current is mainly the current of the input terminal to the protection ground. When doing the leakage current test, set the limiting value of leakage current as EMC Auxiliary Device datasheet and respectively test withstand voltages of the input terminal L and N. The leakage current should be no more than the set value.

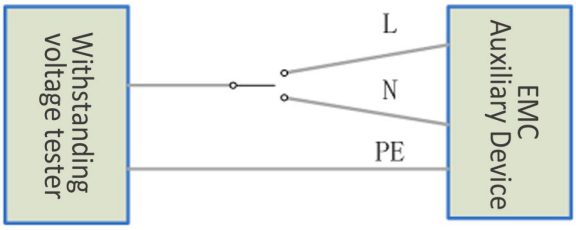


Diagram 2-3: Example of Withstanding Voltage Test

3. Application Notes

3.1 EMC Auxiliary Device Protection Principle

A principle is “protecting before filtering” for EMC Auxiliary Device. In diagram 3-1, the left diagram breaks the principle but the right one shows the right connection.

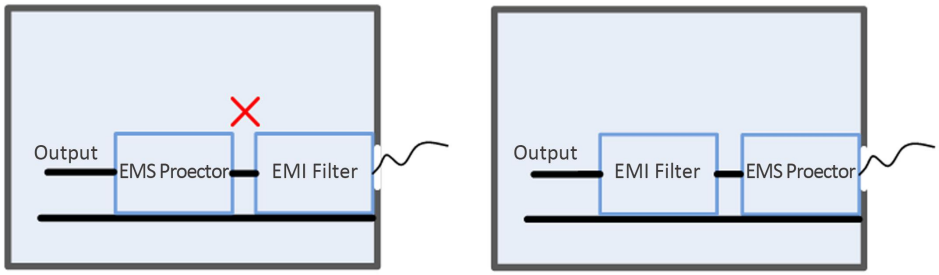
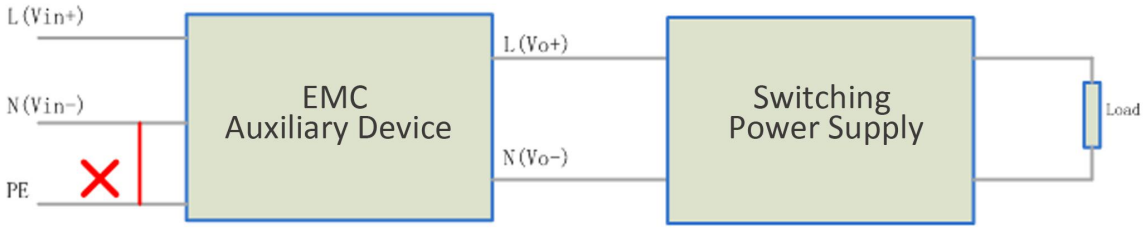


Diagram 3-1: EMC Auxiliary Device Protection Principle

3.2 Unsupported Applications

EMC Auxiliary Device has three function pins, L(Vin+), N(Vin-)and PE. To ensure the protection filter effect of the Auxiliary Device, the PE pin can not be shorted to input.



地址: 广州市萝岗区科学城科学大道科汇发展中心科汇一街5号 (510663)
No. 5, Kehui St. 1, Kehui development center, Science Ave.,
Guangzhou Science City, Luogang district, Guangzhou, P.R.China
Tel: (+86)20-38601850 Fax: (+86)20-38601272
Http://www.mornsun.cn www.mornsun-power.com

Diagram 3-2: Non-supported application 1

EMC Auxiliary Device has three function pins, L(Vin+), N(Vin-) and PE. Output has two pins, L(Vo+) and N(Vo-). To ensure the protection filter effect of EMC Auxiliary Device and not damage the Auxiliary Device, the PE pin can not be shorted to output (all pins).

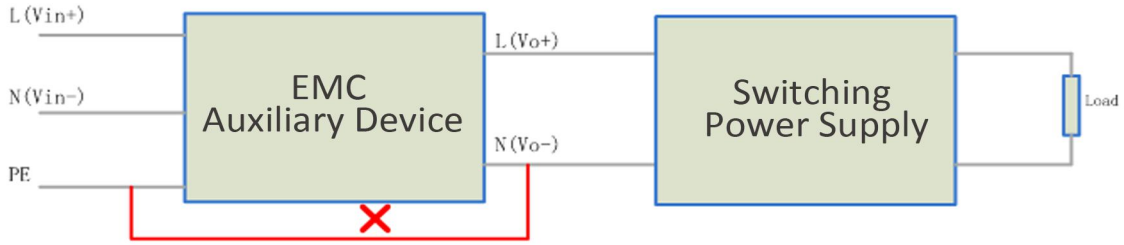


Diagram 3-3: Unsupported application 2

Diagram 3-4 is not recommended. If it is a must, please contact our technical person.

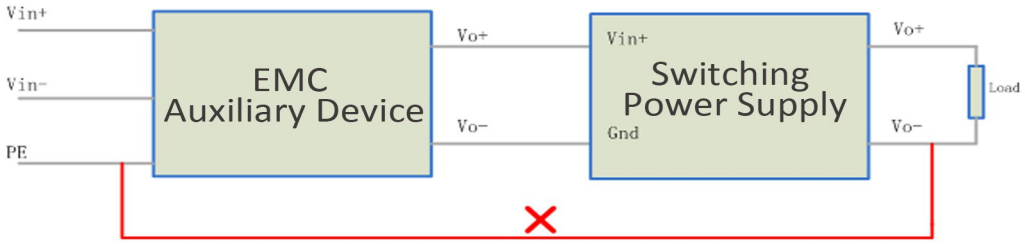


Diagram 3-4: Unsupported application 3

3.3 Installation of EMC Auxiliary Device

Improper installation may reduce its ability to suppress the interference signal even it is a good filter or filter circuit. Diagram 3-5 is a wrong installation and Diagram 3-6 is a right one. In Diagram 3-5, the EMI signal at one end of filter will escape the filter’ s limitation on it (the filter has no effect on the interfering signal) and is directly coupled to the other end of the filter without attenuation of the filter, while Diagram 3-6 doesn’t has such problem.

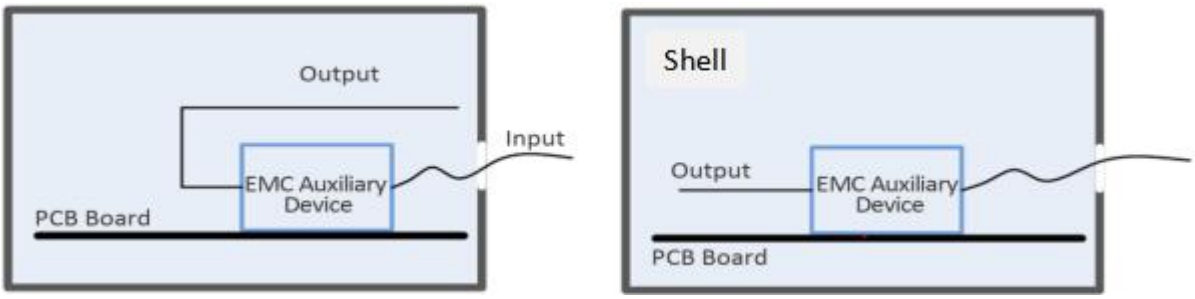


Diagram 3-5: Abnormal installation

地址: 广州市萝岗区科学城科学大道科汇发展中心科汇一街5号 (510663)
No. 5, Kehui St. 1, Kehui development center, Science Ave.,
Guangzhou Science City, Luogang district, Guangzhou, P.R.China
Tel: (+86)20-38601850 Fax: (+86)20-38601272
Http://www.mornsun.cn www.mornsun-power.com

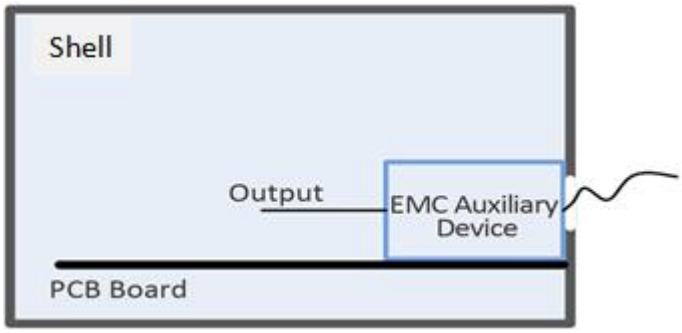


Diagram 3-6: Normal installation

3.4 Filter Ground

The ground wire should be shorten as much as possible to ensure the safety and reliability of the filter except that it must be installed at the rack or case of the equipment. The collimation of the filter should be consistent with the grounding point of the equipment case. In 3-7 left Diagram, the grounding point is too long which can influence the grounding effect. The 3-7 right Diagram is the correct connection.

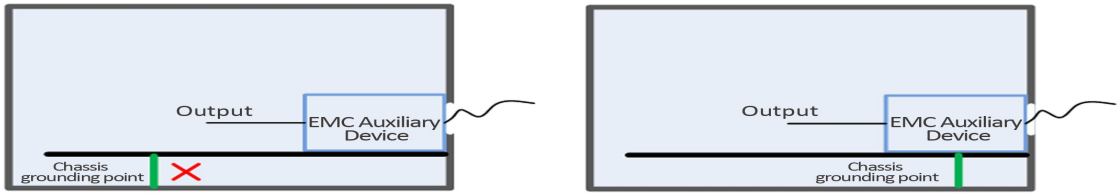


Diagram 3-7: EMC Auxiliary Device Ground Mode

3.5 Operating Under Over-current and Over-power

EMC Auxiliary Device contains active filter and passive filter. The design of active filter should be no more than the maximum output power of EMC Auxiliary Device because it uses active components(switch tube). While the input current of passive filter in design should be no more than the maximum operating temperature of EMC Auxiliary Device because the passive filter is consist of passive components, such as Difference Mode Choke, Common Mode Choke.

3.6 Input Reverse Polarity Protection

DC/DC active EMC Auxiliary Device has its input reverse polarity protection, which can protect back-end load if the input power supply is reverse connected, such as DC/DC switch power supply.

地址: 广州市萝岗区科学城科学大道科汇发展中心科汇一街5号 (510663)
No. 5, Kehui St. 1, Kehui development center, Science Ave.,
Guangzhou Science City, Luogang district, Guangzhou, P.R.China
Tel: (+86)20-38601850 Fax: (+86)20-38601272
Http://www.mornsun.cn www.mornsun-power.com

3.7 Peripheral Circuit

Peripheral recommended circuit is required to meet the corresponding EMC indicators in design. In below Diagram 3-8, capacitor C0, CY1 and CY2 are required to meet the EMC indicators except the DC-DC EMC Auxiliary Device.

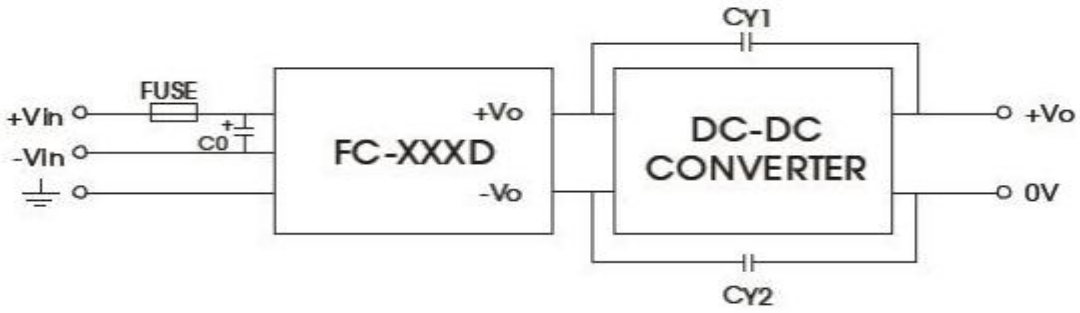


Diagram 3-8： DC-DC Auxiliary Device Peripheral Circuit

地址: 广州市萝岗区科学城科学大道科汇发展中心科汇一街5号 (510663)
No. 5, Kehui St. 1, Kehui development center, Science Ave.,
Guangzhou Science City, Luogang district, Guangzhou, P.R.China
Tel: (+86)20-38601850 Fax: (+86)20-38601272
Http://www.mornsun.cn www.mornsun-power.com