Draft EG 201 147 V1.1.1 (1997-12)

ETSI Guide

Equipment Engineering (EE); Interworking between Direct Current/Isolated (DC/I) and Direct Current/Common (DC/C) electrical power systems

European Telecommunications Standards Institute

Reference

DEG/EE-02005 (amc00icq.PDF)

Keywords

earthing, power supply

ETSI Secretariat

Postal address

F-06921 Sophia Antipolis Cedex - FRANCE

Office address

650 Route des Lucioles - Sophia Antipolis
Valbonne - FRANCE
Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16
Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

X.400

c= fr; a=atlas; p=etsi; s=secretariat

Internet

secretariat@etsi.fr
http://www.etsi.fr

Contents

Foreword

This ETSI Guide (EG) has been produced by ETSI Technical Committee Environmental Engineering (EE), and is now submitted for the ETSI standards Membership Approval Procedure.

Introduction

ETS 300 253 [1] recognises the direct current/common (DC/C) and direct current /isolated (DC/I) electrical power systems usable in telecommunication equipments.

The aim of the present document is to show the effective interconnecting possibility of the two systems and to list some engineering precautions ensuring good interworking.

1 Scope

The present document describes and establishes simplified models of the different sections of the ground distribution network constituting the DC/I and the DC/C electrical power systems.

These models are interworked to identify the common impedance where DC power supply currents can circulate (interconnection between DC/C and DC/I, DC/C and DC/C, DC/I and DC/I).

These results allow the establishment of some basic engineering advice that should be applied to guarantee the good behaviour when interconnecting two systems. These precautions are given for functionality reasons:

- the noise immunity of the pre-existing system and of the links between the system and the MDF must be conserved;

and safety aspects:

- the screens of signal cables between the pre-existing system and the Main Distribution Frame (MDF), the conductors and the connections of the pre-existing system have to withstand additional currents.

2 References

References may be made to:

a) specific versions of publications (identified by date of publication, edition number, version number, etc.), in which case, subsequent revisions to the referenced document do not apply; or

b) all versions up to and including the identified version (identified by "up to and including" before the version identity); or

c) all versions subsequent to and including the identified version (identified by "onwards" following the version identity); or

d) publications without mention of a specific version, in which case the latest version applies.

A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] ETS 300 253 (1995): "Equipment Engineering (EE); Earthing and bonding of telecommunication equipment in telecommunication centres".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following definitions apply:

DC power return conductor: this is the name given to the 0V power supply conductor. It is also called "battery return".

DC/C system: System where the DC power return conductors are connected to the Common Bonding Network (CBN), ensuring simultaneously the supply and protection functions. the DC/C system is also called a "2 wire system".

DC/I system: System where the current return function and the grounding of the equipment are separated. The DC/I system is also called a "3 wire system".

3.2 Abbreviations

For the purposes of the present document, the following abbreviations, apply:

CBN	Common Bonding Network
DC/C	Direct Current/Common
DC/I	Direct Current/Isolated
MDF	Main Distribution Frame.
MESH-BN	Meshed Bonding Network
MET	Mains Earthing Terminal.
PWP	PoWer Plant.
RGT	Room Grounding Terminal.
SRPP	System Reference Potential Plan
SYST	System

4 Description of the DC/C and DC/I systems

4.1 Global view of the systems

In this study, the DC power supply current is supplied by a power plant whose positive polarity (0 V) is connected to the CBN. This is generally the case for telecom buildings.

The two systems (DC/C and DC/I) are made up of the following elements**:**

1) the PoWer Plant (PWP) installed outside the system;

2) the Grounding network System Reference Potential Plan (SRPP) integrating the system and which constitutes its reference plane;

3) the Telecom system (SYST) itself constituted by its items**:** racks, subracks, boxes, etc.;

4) the Main Distribution Frame (MDF) of the subscriber line and transmission circuit connection.

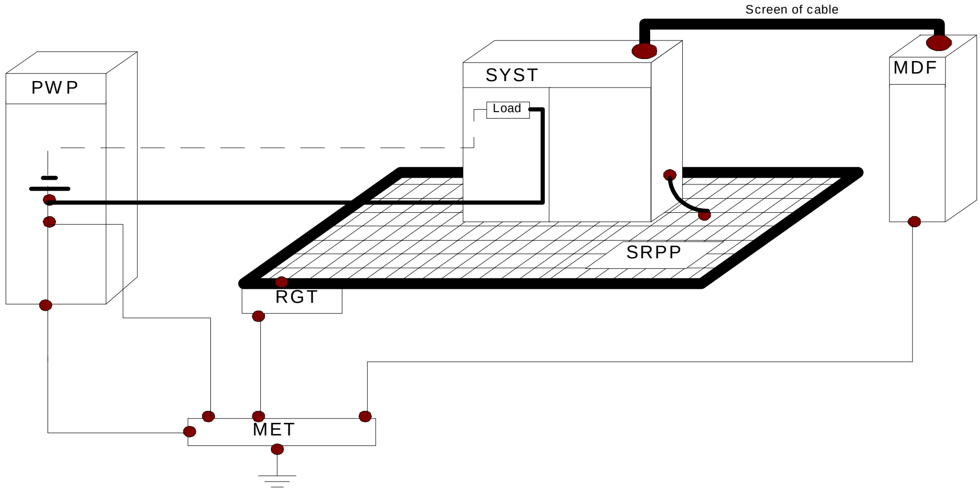

Figure 1: Entities constituting a DC/I system

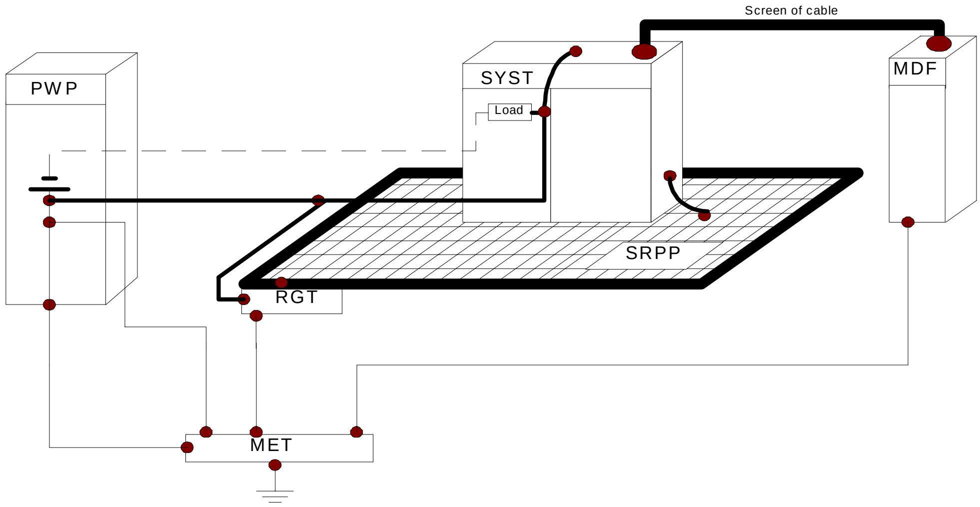

Figure 2:Entities constituting a DC/C system

4.2 Identification of the connections

The paths which form the CBN are identified in the following figure. They have been divided in 4 groups**:**

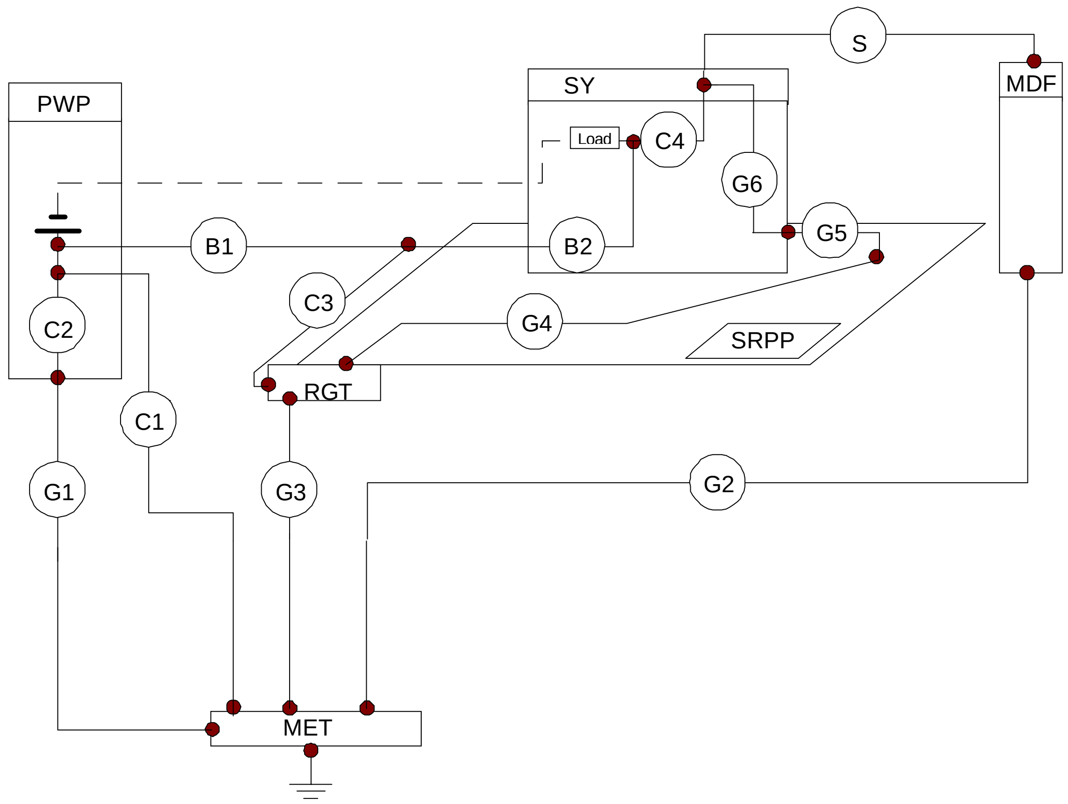

figure 3: Power supply and ground connections in a system

NOTE: In the installation, other possible paths exist, created by cable trays, building steel etc., but are not taken into account because their impedances are neither perfectly controlled nor guaranteed over time, except by making selecting measurement. It would be difficult or even uncertain to assess their contribution to the circulation of current.

4.3 Definition of the connections

4.3.1 Ground connections (G connections)

G1: Power Plant to Main Earthing Terminal: (The equivalent impedance is called RG 1)

- Represents the link from the power source and the MET. It is constituted:
  - either directly by a single conductor; or
  - by means of a ring conductor set up in the PWP room.

-G2: Main Distribution Frame to the Main Earthing Terminal: (The equivalent impedance is called RG 2)

- Represents the link between the metallic frame constituting the MDF and the MET. It is composed of:
  - either directly by only one conductor; or
  - by means of a ring conductor set up at the MDF room.

G3: Room Grounding Terminal to Main Earthing Terminal: (The equivalent impedance is called RG 3)

- Link between the ground interface Room Grounding Terminal (RGT) of the system room and the MET. It is made up of:
  - either directly by a single conductor; or
  - by the intermediary of the CBN and reinforcement conductors.

NOTE: For small installations, RGT and MET can be merged. In this case: RG 3= 0.

G4: Room Ground Terminal to SRPP: (The equivalent impedance is called RG 4)

- Represents the proper impedance of the bonding network on which the system is installed. This impedance includes the system room ring conductor.

G5: System to SRPP: (The equivalent impedance is called RG 5)

- Represents the connection of an element or group of elements of a system to the room bonding network.

G6: Between 2 points of the system: (The equivalent impedance is called RG 6)

- Represents the ground impedance of the system. This is the impedance between the connecting point of the DC return conductor to the frame and the connecting point of the frame to the SRPP.

NOTE: The value of this impedance depends both on the density of the bonding of the metallic parts and on the internal reference planes of the systems.

4.3.2 DC Power supply return links (B connection).

B1: Power source and the entry point of the system: (The equivalent impedance is called RB 1)

- Is the DC power return section placed between the power source and the entry point of the system.

B2: The entry-point of the system room and the system: (The equivalent impedance is called RB 2)

- Is the DC power return section placed between the power source and the entry point of the system.

NOTE 1**:** For DC/C distribution, the voltage drop along each DC power return conductor should be less than 1 V at maximum load current. One concern of this requirement is to avoid electrochemical corrosion in metallic structures by stray currents (see subclause 6.1 of ETS 300 253 [1])

NOTE 2**:** For DC/I distribution, the voltage drop in DC power return conductors is calculated to ensure that at the maximum load current the supply voltage at the power interface to the equipment is within its specified limits.

4.3.3 DC return conductor connections (C connections)

C1: DC return conductors and CBN at MET: (The equivalent impedance is called RC 1)

- Represents the link between the DC return conductor and the MET.

C2: DC return conductors and CBN at power source level: (The equivalent impedance is called RC 2)

- Represents the link between the DC return conductor and the frame of the power source.

C3: DC return conductors and CBN at the SRPP of the system: (The equivalent impedance is called RC 3)

- Represents the link between the DC return conductor and the RGT at the entry point of the system.

C4: DC return conductors and CBN in the system (SYST): (The equivalent impedance is called RC 4)

- Represents the link between the DC return conductor and the frame of the system.

NOTE**:** For DC/I distribution , the connections C1, C3 and C4 do not exist. The impedances RC1, RC3 and RC4 are considered to be infinite.

4.3.4 Signal screen connections (S connections)

S: Between the System and MDF: (The equivalent impedance is called RS)

- Represents the screens of signal cables which are at least bonded at each end to the metallic structure of the system and the MDF (according to subclause 5.5 of ETS 300 253 [1]).

5 Modelling of the systems

5.1 DC/C power supply model

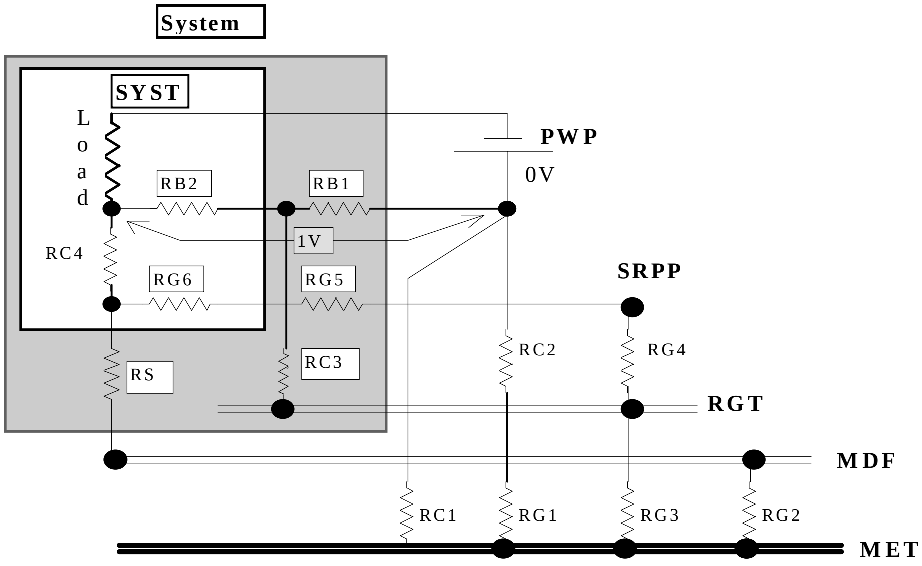

Figure 4: Electrical diagram for DC/C power supply principle

5.2 DC/I power supply model

The main characteristic of this distribution is the fact that the DC power supply current is confined to a single loop.

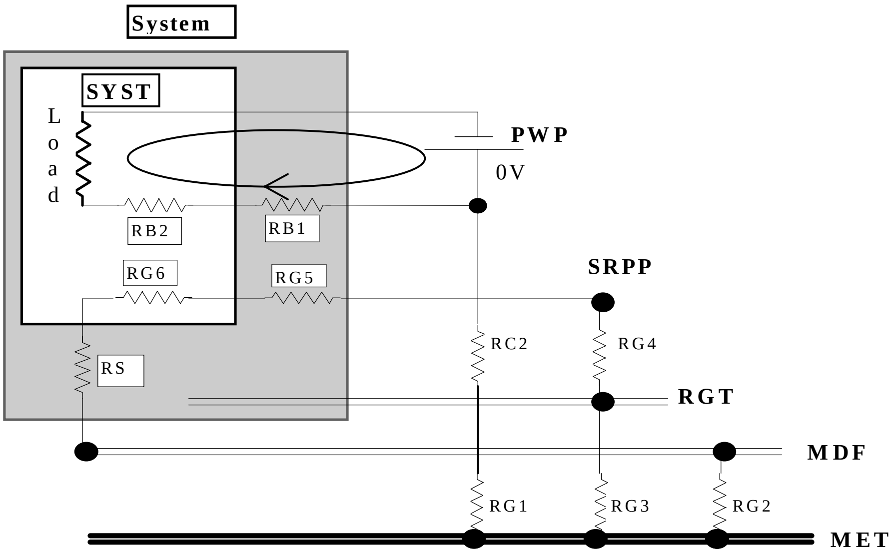

Figure 5: Electrical diagram for DC/I power supply principle

6 Interworking between 2 systems

In all the following subclauses, a new system (System B) is considered to be connected to a pre-existing one (System A).They are installed in the same CBN and exchanging signals through a common MDF. For each configuration, the currents circulating through the CBN are analysed. Engineering precautions resulting from this analysis are listed for each configuration.

NOTE: For simplification reasons, the impedances RC 1, RC 2 and RG 1 (PWP grounds) have been replaced by the equivalent impedance RE 1.

6.1 Interconnection between DC/C and DC/I models

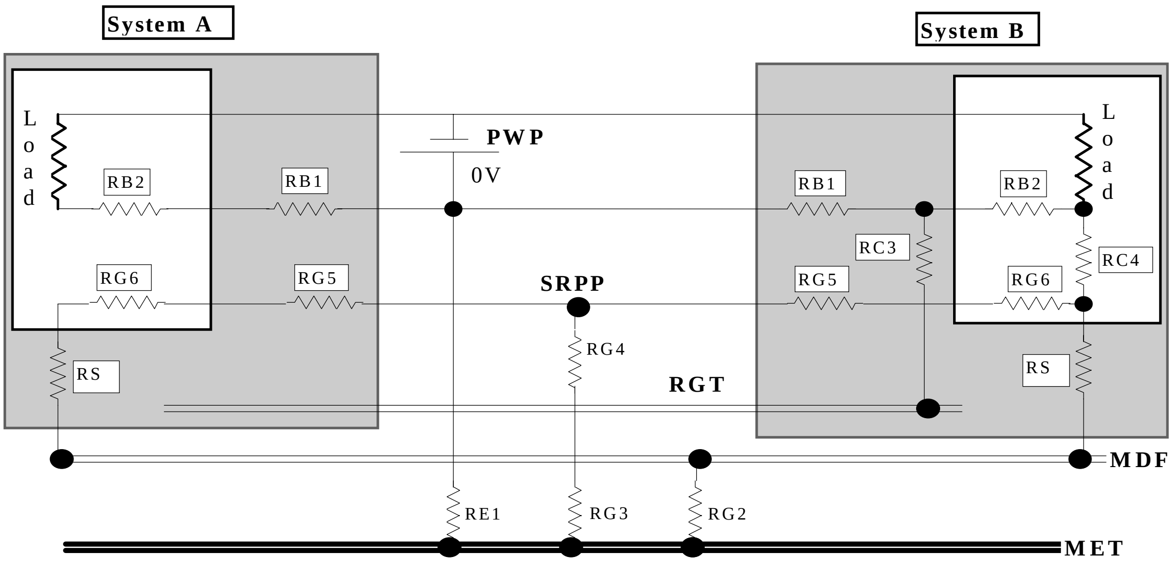

Figure 6: DC/I and DC/C interconnection

This diagram shows that a part of the current consumed by System B(DC/C system) can pass through the common impedance of the two systems RG 2, RG 3 and RE 1 and through the impedances RG 5, RG 6 and RS of system A (DC/I system).

Engineering precautions:

It is recommended to verify the following points before interconnection:

- the grounding conductors and connections of system A have been dimensioned to withstand the additional currents due to the introduction of the system B;
- the voltages generated by additional current inside the bounding network of system A (RG6) do not reduce its noise immunity (reduction of the immunity of the asymmetrical links which are referenced to the ground of system A);
- the signal cables between system A and MDF will neither suffer from excessive current heating, nor be subject to voltage drop (additional current through RS) which could create transmission faults in the case of asymmetrical links (for example: coaxial cables).

NOTE: All these precautions will also have to be applied to the DC/I system in case of connection with a pre-existing DC/C one.

6.2 Interconnection between 2 DC/C models

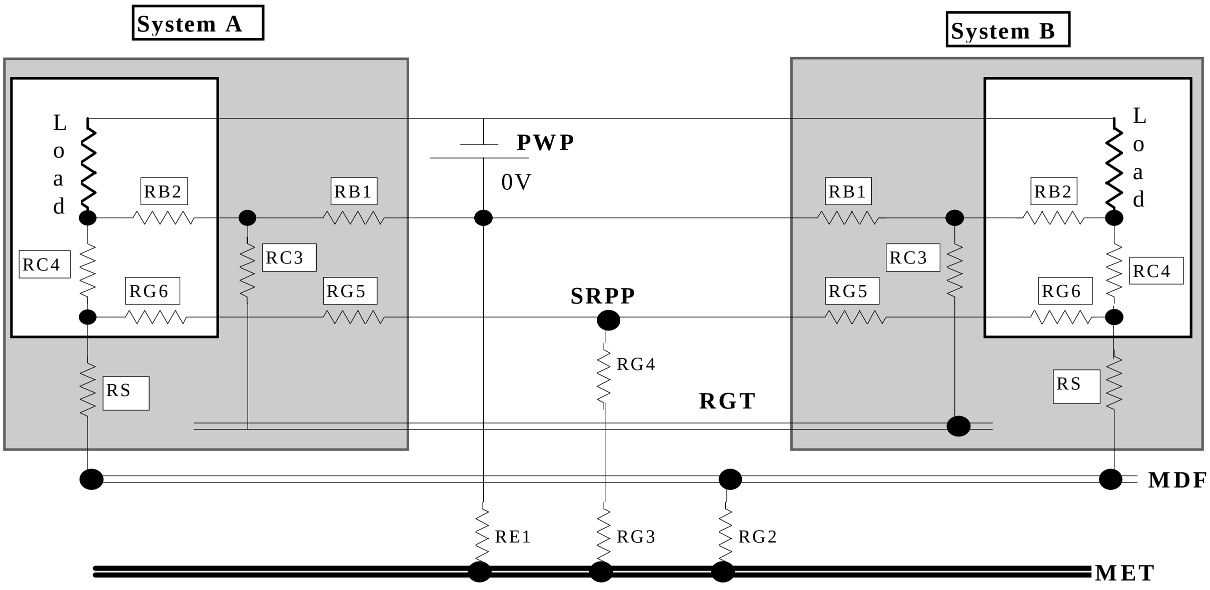

Figure 7: 2 DC/C interconnection

In this configuration, the total DC power supply current is split up into all ground connections of the 2 DC/C systems, and will modify the initial share of DC return current of system A.

Engineering precautions:

It is recommended to verify the following points before interconnection:

- the conductors and the connections of the 2 systems (A and B) have been dimensioned to withstand the additional currents coming from the other system (B and A);
- the voltages generated by additional current inside the bonding network of the 2 systems (RG6) do not reduce their noise immunity (reduction of the immunity of the asymmetrical links which are referenced to ground);
- the signal cables between the 2 systems (A and B) and MDF will neither suffer from excessive current heating, nor be subject to voltage drop (additional current through RS) which could create transmission faults in the case of asymmetrical links (for example: coaxial cables).

6.3 Interconnection between 2 DC/I models

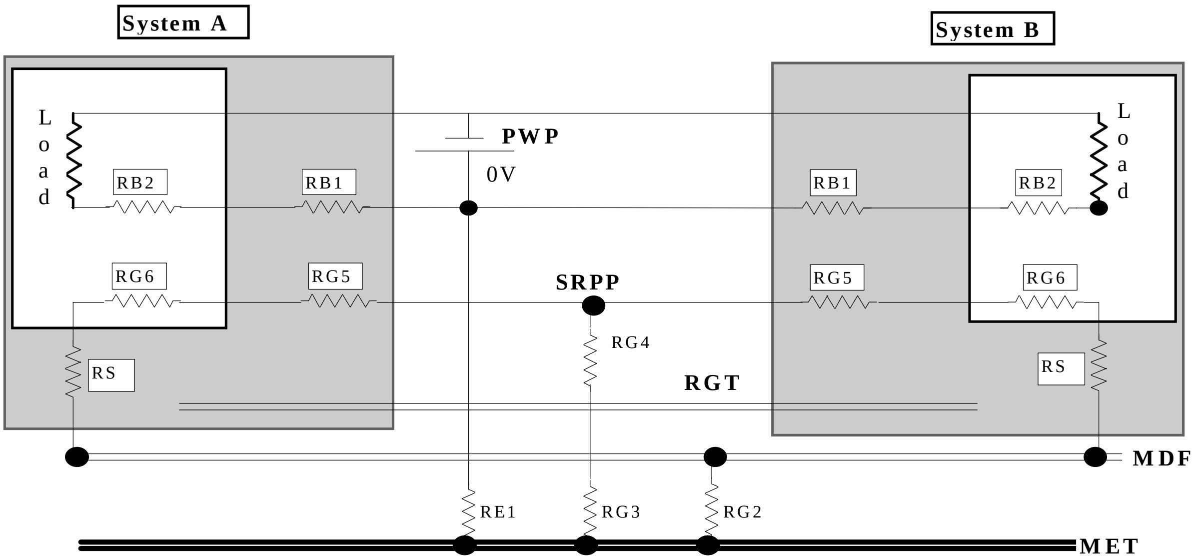

Figure 8: 2 DC/I interconnection

As there is no common path between grounding and power distribution, there is no mutual influence between the 2 systems.

Engineering precautions:

- none.

History

Document history		
V1.1.1	December 1997	Membership Approval Procedure MV 9807: 1997-12-16 to 1998-02-13