INSTRUCTION MANUAL

M-series COUPLING/DECOUPLING NETWORKS (CDN)

CDN-M125E, M225E, M325E, M425E, M525E

150 kHz to 230 MHz

Table of Contents

1.0 Introduction

This manual includes product specifications, safety precautions, product maintenance and warranty information. It also includes some basic guidance on properly configuring calibration , test setup, running test level calibrations and performing conducted immunity testing.

2. 0 Product Specifications

Models Covered:	CDN-M125E, M225E, M325E, M425E, M525E
Frequency Range:	150 kHz to 230 MHz
I/O rating for EUT/AE ports:	250 VAC, 350 VDC
Number of lines:	1 (M125E), 2 (M225E), 3 (M325E), 4 (M425E), 5 (M525E)
Max current rating:	25 Amp (AC), 17.5 Amp (DC)
Common mode impedance	
150 kHz - 26 MHz:	150Ω ± 20Ω
26 MHz - 80 MHz:	150Ω + 60Ω / – 45Ω
80 MHz - 230 MHz:	150Ω + 60Ω / – 60Ω
Maximum RF voltage input:	40 V max
Voltage division factor (RF to EUT port):	9.5 dB + 4/ - 1 dB
I/O connections:	4 mm banana socket with shrouded sheath
RF (Disturbance coupling) connector:	BNC (f) 50Ω
Dimensions L x W x H (inches / cm):	6 × 6 × 13 /15.2 × 15.2 × 33
Weight:	5 lbs / 2.3 kg (max weight all models)
Operating Temperature:	5° C to 40° C / 40° F to 104° F

This equipment is designed for indoor use only.

2.1 Other equipment available from Com-Power.

- ADA-515-2 - 150Ω to 50Ω adapter
- TEP-050 - 50Ω terminator
- ADA-M series - Shorting Adapters
- DCD-1000-100W - Dual Directional Coupler , 100 kHz – 1000 MHz
- DCU-300-100W - Uni Directional Coupler, 100 kHz – 300 MHz
- ATTN-X-100W- Attenuator, DC to 1 GHz
- ACS-250 -25W-25 Watt Power Amplifier, 150 kHz – 250 MHz
- ACS-250-50W- 50 Watt Power Amplifier, 150 kHz – 250 MHz
- ACS-250-100W-100 Watt Power Amplifier, 150 kHz – 250 MHz
- CSAT (Ver-XX) - Conducted Immunity Automated Test Software.

3. 0 Important Safety Precautions

The CDN must be securely fastened to the earth ground before making any connections to external power. **Proper grounding of the CDN is required in order to prevent high leakage currents from presenting a potential safety hazard for test personnel**. To help establish proper grounding, the bottom surface of the CDN is unpainted. In addition, the bottom plate has mounting holes for securely bolting the CDN to a ground plane. If proper grounding has been achieved, the resistance measured between the CDN bottom plate and the ground plane should be less than **10** milliohms.

Do not connect the power to the CDNs until all the test equipment and EUT are in place and electrically connected. Avoid having any exposed live wires or connections. You can use the following procedure.

1. Connect EUT power lines to CDN EUT port using the 4 mm safety socket.
2. Connect the Test Generator (signal generator, power amplifier, attenuators, etc) to the RF port of the CDN. The test generator output must remain disabled until all connections are made.
3. Connect accessory equipment (AE) port of the CDN to the power source using 4 mm safety socket connectors.

3.1 Maximum RF input

Do not exceed RF input level to the CDN. Excessive RF input will damage the CDN input and will not be covered under warranty. To avoid accidental damage to the power amplifier or CDN, disable the RF output of power amplifier before making any connections. Also make sure the signal generator output is set to its minimum level when the RF is turned on.

4.0 Warranty

Com-Power warrants to its Customers that the products it manufactures will be free from defects in materials and workmanship for a ***period of 3 years***. This warranty shall not apply to:

- Transport damages during shipment from your plant.
- Damages due to poor packaging.
- Products operated outside their specifications.
- Products Improperly maintained or modified.
- Consumable items such as fuses, power cords, cables, etc.
- Normal wear
- Calibration
- Products shipped outside the United States without the prior knowlege of Com-Power.

In addition, Com-Power shall not be obliged to provide service under this warranty to repair damage resulting from attempts to install, repair, service or modify the instrument by personnel other than Com-Power service representatives.

Under no circumstances does Com-Power recognize or assume liability for any loss, damage or expense arising, either directly or indirectly, from the use or handling of this product, or any inability to use this product seperately or in combination with any other equipment.

When requesting warranty services, it is recommended that the original packaging material be used for shipping. Damage due to improper packaging will void warranty.

In the case of repair or complaint, a label should be attached to the housing of the instrument which describes briefly the faults observed. Please include the name, telephone number and email address of the contact person. Please visit our website www.com-power.com and obtain an RMA number by selecting service and completing the online form.

4.1 Maintenance

This product contain no user serviceable parts inside. If the unit does not operate or needs calibration, please contact Com-Power Corporation. Do not instrument cover. Any modifications or repairs performed on the unit by someone other than an authorized factory trained technician will void warranty.

The exterior surface may be cleaned with mild detergent and then be wiped with a dry, clean, lint-free cloth. Use care to avoid liquids or other foreign objects entering the chassis.

5.0 CDN Requirements

5.1 Overview

Com-Power CDN-Mseries Coupling/Decoupling Networks are designed specifically for conducted immunity testing per IEC 61000-4-6.

The CDN-M series are for use on powerline up to 25 A (AC). These CDNs

- Provide a means of coupling RF common mode signals to the power supply lines.
- Provide the required common mode impedance between the power supply lines and ground necessary for proper performance of the testing. impedance to the equipment under test independent of the auxillary equipment common mode impedance.
- Minimize interference to the auxillary equipment via common mode decoupling of the disturbing signals.
- Provide uninterrupted path for the power to the EUT.

The Com-Power CDN M series fully comply with the requirement contained in the IEC 61000-4-6 and CISPR 16-1-2.

5.2 CDN Parameters

5.2.1 Common Mode Impedance

Common mode impedance is defined as the "ratio of common mode voltage and common mode current at a certain point". The common mode impedance requirements for a CDN must be met with CDN auxillary equipment input power terminals open or short circuited to ground.

5.2.2 Voltage Division Factor

Voltage division factor is the amount of voltage that is lost between the RF input terminal of the CDN and the EUT port and is measured through a 150Ω to 50Ω adapter (ADA-515-2) connected to the EUT port.

5.2.3 Coupling Factor

The CDN coupling factor is defined as the ratio given by the open circuit voltage (e.m.f) obtained at the EUT port of the coupling (and decoupling) device divided by the open circuit voltage obtained at the test generator.

5.3 Calibration Accessories

The following accessories are available for the CDN verification of the parameters above and for the level setting calibration described herein.

- Shorting adapters (Part# ADA-M1 / ADA-M2 / ADA-M3 / ADA-M4 / ADA-M5)
- Two 150Ω – 50Ω adapters (Part# ADA-515-2)
- 50Ω terminator (Part# TEP-050)

6.0 Calibrating the Test Levels and Running the Test

6.1 Test Levels

Table 1: Required test levels per IEC-61000-4-6

V_o Volts	V_o dBµV	V_o dBm	Umr(150) Volts	Umr(150) dBµV	Umr(150) dBm
1	120	13	0.167	104.5	-2.5
2	130	23	0.5	114	7
3	140	33	1.67	124.5	17.5

V_o = Open circuit voltage in 150Ω system
Umr= Voltage level measured at the output of the 150Ω to 50Ω adapter (ADA-515-2)

6.1.1 CDN Selection

The IEC-61000-4-6 requires that an appropriate coupling decoupling networks (CDN) with defined common mode impedance be used for coupling and/or decoupling purposes on any type of power or I/O interface for which a CDN is suitable and available. The M series CDN are only appropriate for power lines. Other types CDNs available from Com-Power Corporation are given below.

Model	Specifications
CDN-C50E	50 Ohm coax cable, 150 kHz - 230 MHz
CDN-C75E	75 Ohm coax cable, 150 kHz - 230 MHz
CDN-S1	Shielded cable with 1 conductor,150 kHz - 80 MHz
CDN-S2	Shielded cable with 2 conductors,150 kHz - 80 MHz
CDN-S4	Shielded cable with 4 conductors,150 kHz - 80 MHz
CDN-S9	Shielded cable with 9 conductors,150 kHz - 80 MHz
CDN-S15	Shielded cable with 15 conductors,150 kHz - 80 MHz
CDN-S25	Shielded cable with 25 conductors,150 kHz - 80 MHz
CDN-AF2E	Unshielded cable with 2 conductors,150 kHz - 230 MHz
CDN-AF4E	Unshielded cable with 4 conductors,150 kHz - 230 MHz
CDN-AF8E	Unshielded cable with 8 conductors,150 kHz - 230 MHz
CDN-T2E	Unshielded cable with 2 balanced conductor pairs,150 kHz -230 MHz
CDN-T4E	Unshielded cable with 4 balanced conductor pair s, 150 kHz - 230 MHz
CDN-T8E	Unshielded cable with 8 balanced conductor pairs,150 kHz - 230 MHz
CDN-T8SE	Shielded cable with 8 balanced conductor pairs,150 kHz - 230 MHz
CDN-USB-AE	USB CDNs with Type A connector
CDN-USB-BE	USB CDNs with Type B connector

6.2 Test Level Calibration

Before you begin testing with the CDN you will need to establish a calibrated drive levels corresponding to your desired test levels. During drive level calibration the RF signal level being injected to the CDN is adjusted incrementally until the voltage level measured at the 150Ω to 50Ω adapter connected to the EUT port is approximately equal to the Umr (150) value given in table 1, and thes signal generator output, or forward power delivered to the CDN is recorded. This process is then repeated at each frequency starting at 150 kHz with step sizes no greater than 1% of the preceding frequency value up to 80 or 230 MHz. This equates to 633 discrete test frequency points up to 80 MHz and 739 points up to 230 MHz. Record the signal generator output at each frequency. Typical test level calibration setup is shown in figure 1 below.

6.2.1 Automating the calibration and running test using CSAT.

The entire calibration and process described above can be performed manually, but it is very time consuming and tedius process. This process can be can be automated using the CSAT software available from Com-Power. Please call Com-Power for more information.

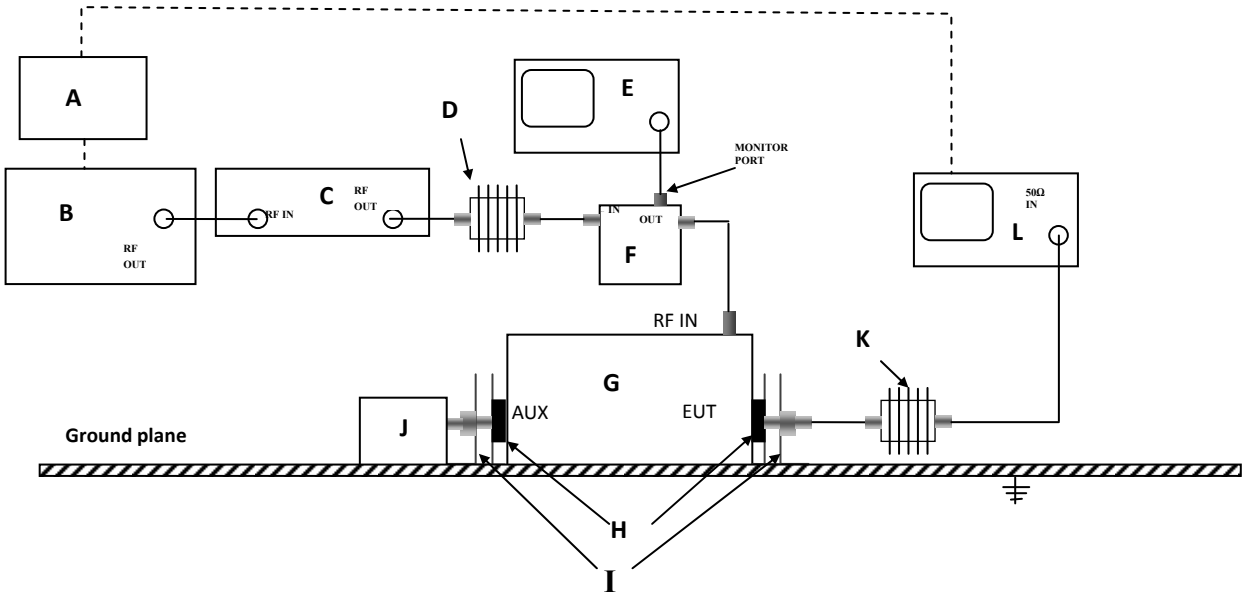

Figure 1: Typical Test level calibration setup

A	Optional PC Running CSAT Software	**G**	CDN-M125E/M225E/M325E/M425E/M525E
B	Signal Generator	**H**	Shorting adapters – ADA-M1, M2, M3, M4, M5
C	Power Amplifier (ASC-series)	**I**	ADA-515-2 – 150Ω to 50Ω adapters
D	6 dB Power Attenuator	**J**	TEP-050 – 50Ω terminator
E	Optional Power meter	**K**	Power Attenuator (ATTN-30-100W)
F	Optional Directional Coupler (DCU or DCD series)	**L**	Spectrum analyzer / Power Meter

6.3 Running the Test

Please read safety precautions in this manual before proceeding. The diagram below is the typical test setup for making conducting immunity testing using the CDN. The signal generator output levels recorded during the test level calibration are now used to perform the testing. During the test however, the signal generator output is usually modulated. Refer to the applicable product family standard, product environment standard for your product (whichever is applicable) to determine the modulation type and other specific test requirement appropriate for your product. Also refer to IEC 61000-4-6 for general details such as test setup and test procedures. These details are beyond the scope of this manual.

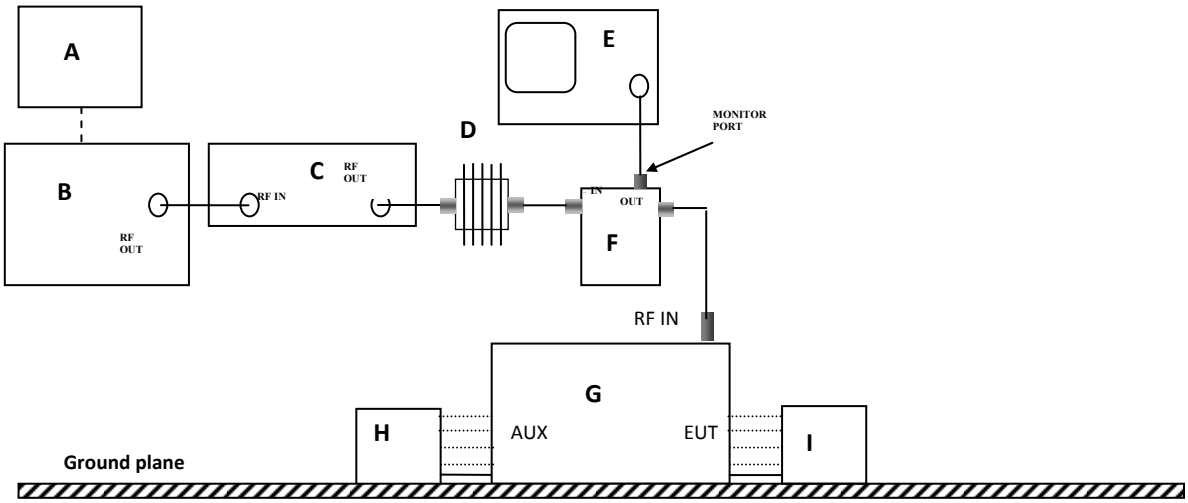

Figure 2: Typical Test Setup

A	Optional PC Running CSAT Software	**F**	Optional Directional Coupler (DCU or DCD series)
B	Signal Generator	**G**	CDN- M125E/M225E/M325E/M425E/M525E
C	Power Amplifier (ASC-series)	**H**	Power Supply
D	6 dB Power Attenuator	**I**	Equipment under test
E	Optional Power meter		

7.0 Typical Performance Data

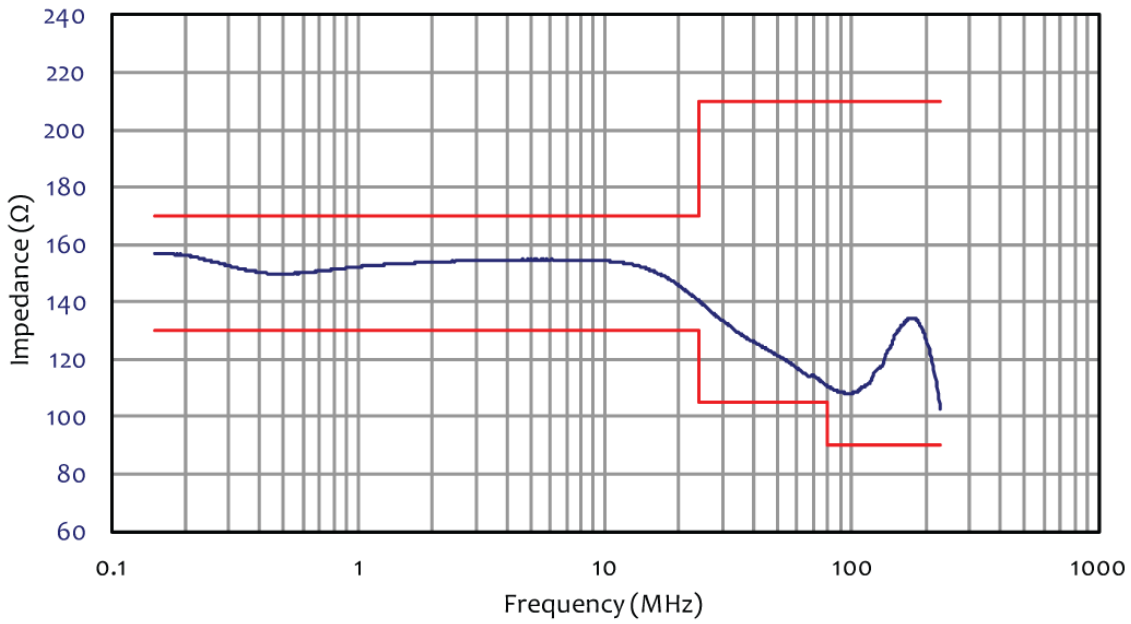

Figure 3 - Impedance compared to CISPR 16-1-2 edition 1.2 & IEC 61000-4-6 requirements.

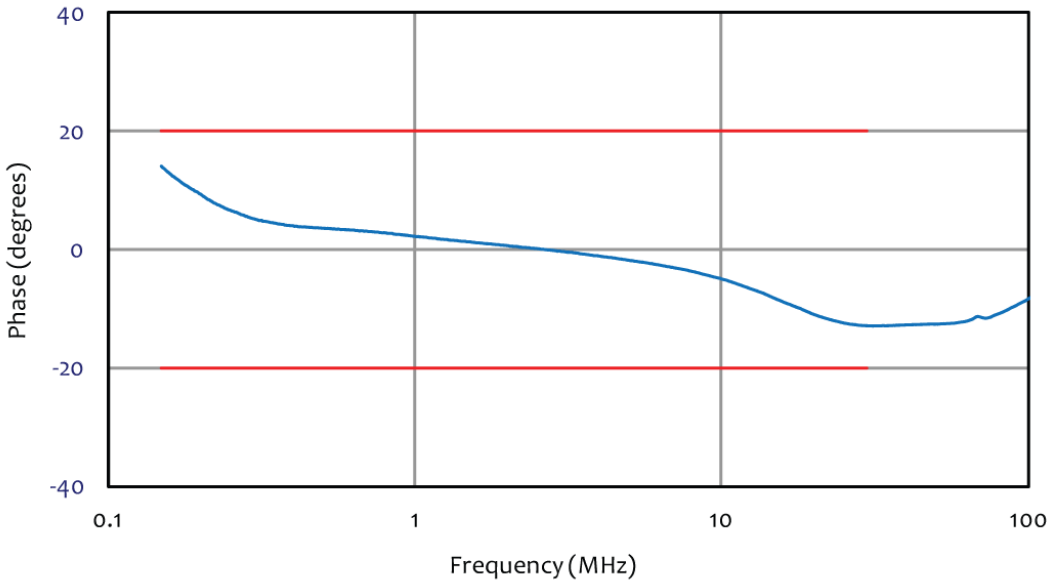

Figure 4 - Phase compared to CISPR 16-1-2 edition 1.2 requirements.