

Customer and Technical Support

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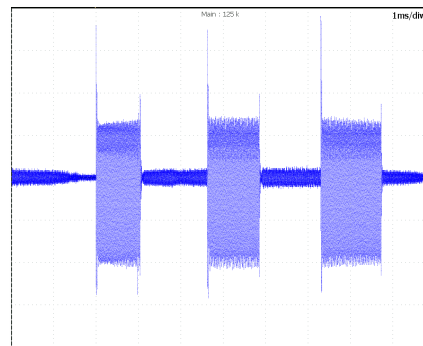
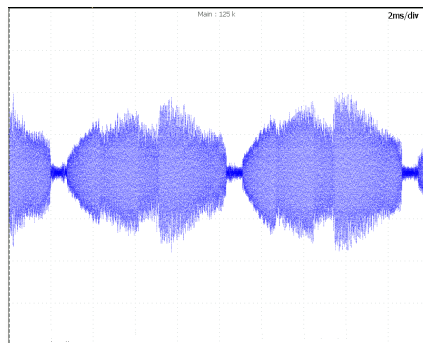
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Hand-Held EMI Power Line Adapter Model MSN12



User's Guide



Overview

Welcome to EMI Power Line Adapter! MSN12 EMI Adapter will help you to observe high frequency noise on power lines with the help of your spectrum analyzer or an oscilloscope and provide measure of success in managing electromagnetic interference in your facility. In addition to noise, EMI Adapter also allows measurements of signals used for communication over power lines (PLC) used for Smart Power, control of home appliances and signal transfer.

EMI Power Line Adapter galvanically isolates its output from 50/60Hz voltage on the mains while passing through high-frequency signals on power line which allows connection of conventional instrumentation such as oscilloscopes and spectrum analyzers for analysis.

Power lines often contain substantial amount of noise, or electromagnetic interference (EMI). This noise is generated by electrical and electronic equipment, such as switched power supplies, relays, solenoids, stepper and variable frequency motors and other equipment. This noise is typically concentrated in frequency range up to 30MHz and can reach several volts in magnitude.

EMI on power lines can disrupt normal operation of sensitive equipment, such as industrial robotics, metrology tools, scientific and medical equipment, etc. Strong noise "spikes" can damage electronic components. Proper EMI control in a facility can improve uptime and error-free operation of such equipment. See more details on noise reduction further in this Guide.

EMI Adapter has 50 Ohms BNC output, allowing its connection to many instruments. Please read cautionary note further in this document before connecting EMI Adapter to your instrument.

What is included with your EMI Adapter:

- EMI Adapter MSN12
- Test Leads
- BNC-BNC cable, 10' (~3m)
- BNC T-adapter
- BNC 50 Ohms terminator
- This User's Guide

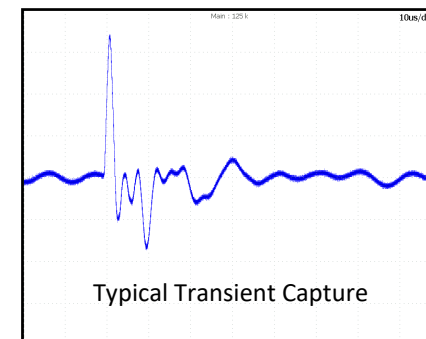
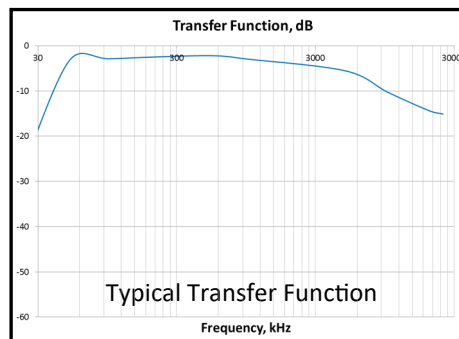
Optional accessories (ordered separately):

- BNC attenuator 20dB
- Spare BNC cable/T-connector/50 Ohms terminator pack

Specification

Max. Mains Supply Voltage
Frequency Response
Output Impedance
Connector
Internal Signal Limiter, Typ.
High-Voltage Indicator

380VAC RMS
30kHz...30MHz
50 Ohms
BNC
15V either polarity
LED



The Next Step

Noise on power lines is harmful to sensitive equipment and components and needs to be controlled. There are several methodologies to accomplish noise reduction, among them identifying most polluting noise sources in your environment and isolating them; rearranging power and grounding branches and using EMI filters, the latter being most effective both for noise reduction and cost since filtering of noise does not involve rewiring your facility. Please visit www.onfilter.com/Library for more technical information on the subject.

OnFILTER manufactures a line of advanced EMI filters for suppression of noise on power lines and ground in actual installations. Please consider OnFILTER' CleanSweep® power line and ground line EMI filters to manage EMI in your facility.



Safety Precautions

EMI Adapter is designed to work with high voltage (up to ~380VAC) circuits. Observe caution when working with high voltage.

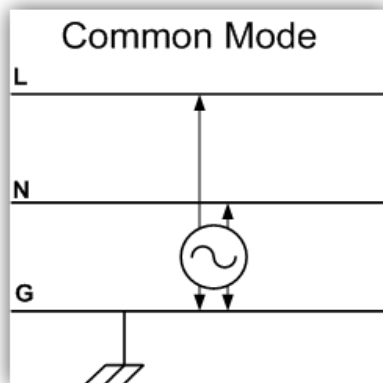
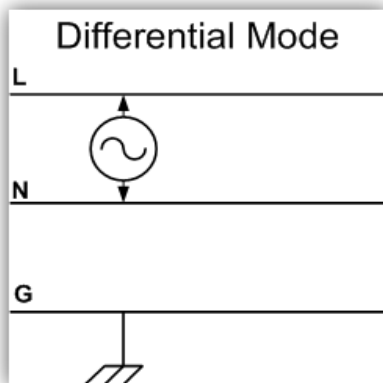
- Avoid working alone.
- Do not use the EMI Adapter if it is damaged, or it's safety is impaired.
- Inspect the test leads for damaged insulation or exposed metal. Check test lead continuity.
- Damaged leads should be replaced.
- Use only the accessories provided by the manufacturer.
- Disconnect the live test lead before disconnecting the common test lead.
- Follow all safety procedures for equipment being tested.
- High Voltage LED is only an indicator, not a measurement device. High voltage may be present even if LED is not lit.

WARNING

To avoid electrical shock, use caution when working with voltages above 30VAC. Such voltage poses a shock hazard

Common Mode and Differential Noise

Noise on power lines can be common-mode and differential (also called "normal") mode. Both need to be analyzed.



Differential signal exists between wires carrying power, such as Live and Neutral. Mains voltage of 50/60Hz itself is a differential signal. Communication over power lines also utilizes differential mode signals. As seen, signal of differential mode can be either "good" or "bad."

Common mode signals are never good news. This type of signal is typically generated when power cable passes nearby strong emission source or due to leakage in a power transformer.

Brief Tour of your EMI Adapter

Please refer to the rest of this User's Guide for a detailed explanation of each control, indicator and connection.

EMI Adapter MSN12 has no battery and there are no serviceable or replaceable parts inside.



Banana jacks for test leads

Indicator of high AC Voltage. LED is lit only when AC voltage is present

BNC output connector

Connections

CAUTION

High-frequency and transient signals on power lines can reach significant magnitude. MSN12 EMI Adapter limits peak amplitude of such signals to no more than 15V. This may exceed maximum allowed signal amplitude for 50 Ohms input in some instruments. In order to avoid damage to your instruments by such signals:

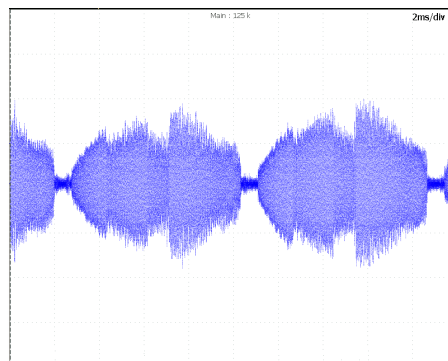
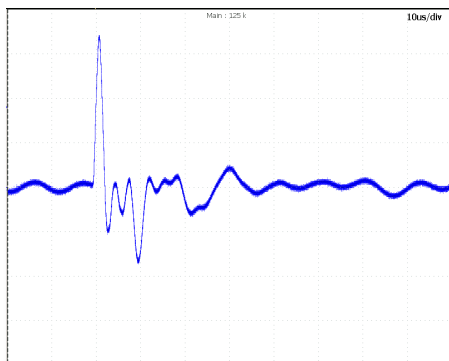
- Always read instructions to your instruments
- For instruments that allow 50 Ohms or 1 MOhm input selection, always choose 1 MOhm input and use supplied adapters as shown in this User's Guide to maintain 50 Ohms impedance
- For instruments that have only 50 Ohms input always use optional attenuator (at least 20dB) in line with the 50 Ohms input.

Signals on power lines are typically concentrated in the frequency range below 30MHz with most of strongest signals below 1...2 MHz. This is caused by distributed inductance and capacitance of long wires which suppress signals of higher frequencies. This should help you in setting your oscilloscope and spectrum analyzer for the best results.

An oscilloscope is the best tool to observe and characterize transient signals that spectrum analyzer can easily miss. For the best results the following minimum requirements for an oscilloscope are recommended:

- Type - digital storage
- Bandwidth - 100 MHz min.
- Sample rate - 500 MS/sec (Megasamples per Second) min.

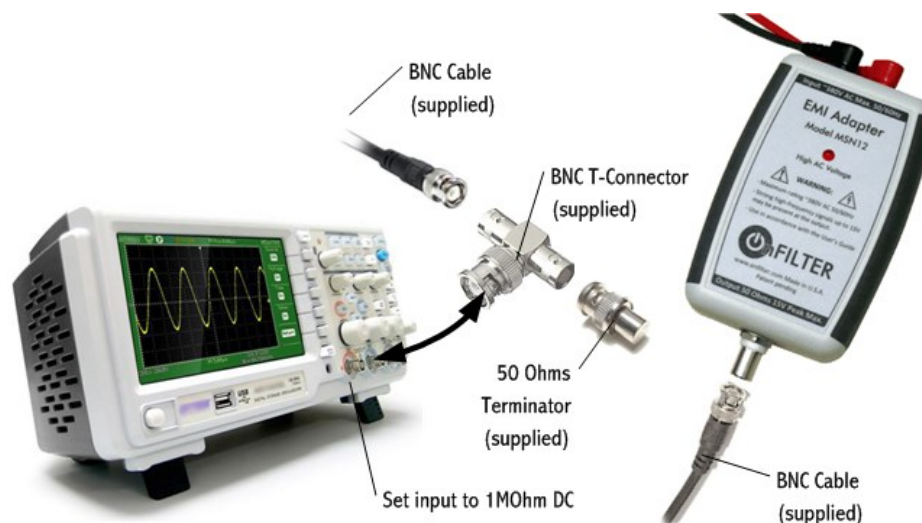
Below are some of typical waveforms you may see with your oscilloscope. It is helpful to change the time base of your scope to zoom on the sharpest transients and zoom out to see the pattern of noise as illustrated in the images below.



Spectrum analyzer is a good tool to understand the frequency content of continuous signals on power lines. Almost any spectrum analyzers would work. Make sure to set the bandwidth resolution of your spectrum analyzer low enough to be able to adequately present signals at low end of the spectrum.

Connecting to an Oscilloscope with 1MOhm Input

Most oscilloscopes offer selection between 1MOhm and 50 Ohms input. 50 Ohms input has much lower maximum signal level limit than 1MOhm input. Set such oscilloscope input to DC, 1MOhm. Connect EMI Adapter to an oscilloscope as shown below.



Connecting to an Oscilloscope or a Spectrum Analyzer with 50 Ohms Input

Spectrum analyzers normally have only 50 Ohms input. Some high-speed oscilloscopes also use only 50 Ohms input as well. Unless your 50 Ohms instrument can safely withstand 15V peak signals, we recommend to use optional in-line BNC attenuator as shown below. This way the maximum signal will not exceed 1.5V.

