



SURGE PROTECTION FOR NETWORK & COMMS APPLICATIONS

Zone Barrier



ZoneBarrier

Protects network and communications applications against induced surges and transients

- **Modular, expandable protection for one to an unlimited number of ports**
- **Wall, DIN rail or 19" rack mountable**
- **Wide range of connector types available**
- **Three stage protection**
- **Category 6 universal model available**
- **10 year product warranty**



The ZoneBarrier Series is a uniquely modular data and signal line protection system for 24V, 4-20mA current loop and Industrial Ethernet applications. By providing an effective barrier between uncontrolled transient environments and your valuable electronic systems the ZoneBarrier Series protects you from costly system down time and equipment failure.

The sophisticated hybrid circuitry employed by the ZoneBarrier Series protects your equipment without impeding normal operation. ZoneBarrier protection components comprise a combination of high energy Gas Discharge Tubes with ultra fast diodes and Silicon Avalanche Diodes. This combination of high quality surge protection components gives the ZoneBarrier Series its characteristic low let-through voltage and high, 10kA, surge current capacity which provides excellent protection. ZoneBarrier devices have RJ45, terminal strip or pluggable terminal strip connectors.

Designed for multi-loop or single control loop applications the ZoneBarrier Series offers a flexible surge protection solution that is capable of growing with your requirements. A ZoneBarrier module can be used as a stand-alone device or as a building block in a surge protection solution as simple or as complex as your requirements, now and in the future.

The small foot print of ZoneBarrier modules allows a single module to be conveniently located near to the equipment it is protecting. Where multiple modules are required, ZoneBarrier units can be mounted on standard DIN rail. A DIN rail kit is also available for 19" rack applications which can hold up to 32 modules, providing protection of an impressive 64 10/100Base-T lines while occupying less than 5.2 inches (or a 3U space).

All widely used network systems

can be protected by the ZoneBarrier Series. ZoneBarrier modules are available for 10/100Base-T, 1,000Base-T, 10Base-2, RS232, RS422, RS423 and others with a range of connector types to suit all common network applications.

Additional protection circuitry should be provided for other parts of the network or other systems which may be interconnected e.g. incoming AC power, telephone wiring, fire and security systems etc. ZoneBarrier modules are available to meet these requirements, contact your local supplier for details.

Network & Comms Protection

Specification

All figures typical at 77°F (25°C) unless otherwise stated

Maximum load current

0.5 Amps

Ambient temperature limits

-40°F to +185°F (working)
-40°C to +85°C (working)

Humidity

95% RH (non-condensing)

Casing

Molded plastic

Weight

2.8 oz (0.08Kg)

Dimensions

See figure 1

EMC compliance

BS EN 60950: 1992
BS EN 61000-6-2: 1999
IEC 61000-4-5 and CCITT K17

Installation

All ZoneBarrier modules are installed in-line and are identified with "Protected" and "Unprotected" for fail-safe installation.

DIN rail mounting (figure 2)

ZoneBarrier modules can be mounted on any standard T-section DIN rail or on the optional 19" DIN rail assembly. To attach the ZoneBarrier module to the DIN rail, simply locate the DIN rail foot of the module over on edge of the DIN rail and then securely push the ZoneBarrier onto the DIN rail. Note the DIN rail must be properly grounded.

Stand-alone installation (figure 3)

To install a ZoneBarrier module as a stand-alone protector, attach an ground lead to the supplied ring terminal and secure this with the self tapping screw provided to the base of the unit. Using screws (or bolts) mount the module on any flat surface.

To order specify -

Model number as per specification table above

Mounting options

- DR21605** 5" DIN rail for up to 4 ZoneBarriers
- DR21649** 17.5" DIN rail for up to 16 ZoneBarriers
- DR24500** 19" DIN rail (with mounting brackets) for up to 32 ZoneBarriers

Model	Type	Maximum surge current (kA)	Wires	Working voltage (V)	Let-through voltage (V)	Bandwidth (MHz)	Connectors
ZB24509	RS232	3	4 + Shield	15	27	0.5	Terminal Strip
ZB24510	RS232	3	5	15	27	0.5	Terminal Strip
ZB24511	RS232	3	8	18	27	0.5	RJ45
ZB24512	RS232	3	6	18	27	0.5	MMJ
ZB24513	RS422	10	4 + Shield	8	15	0.5	Terminal Strip
ZB24516	RS423	3	4 + Shield	6	12	3	Terminal Strip
ZB24517	RS423	3	6	6	12	0.5	MMJ
ZB24518	RS485	10	2	5	10	50	Terminal Strip
ZB24523	AS400	10	2	8	15	70	TwinAx
ZB24528	RS422	10	4 + Shield	8	15	50	Terminal Strip
ZB24532	10Base-T	10	4	4	5	130	RJ45
ZB24534	10Base-2	10	Coax	8	30	150	BNC
ZB24537	ArcNet	10	Coax	8	30	70	BNC
ZB24540	100Base-T*	1	8	5	10	155	RJ45
ZB24550	100Base-T*	1	2 x 4	5	10	155	2 x RJ45
ZB24551	100Base-T*	1	8	5	10	155	RJ45/110
ZB24563	1000Base-T+	1	8	5	10	250	RJ45

*Suitable for Cat.5 application, 100Base-T, 100VG, 10Base-T
+Suitable for Cat. 6 application

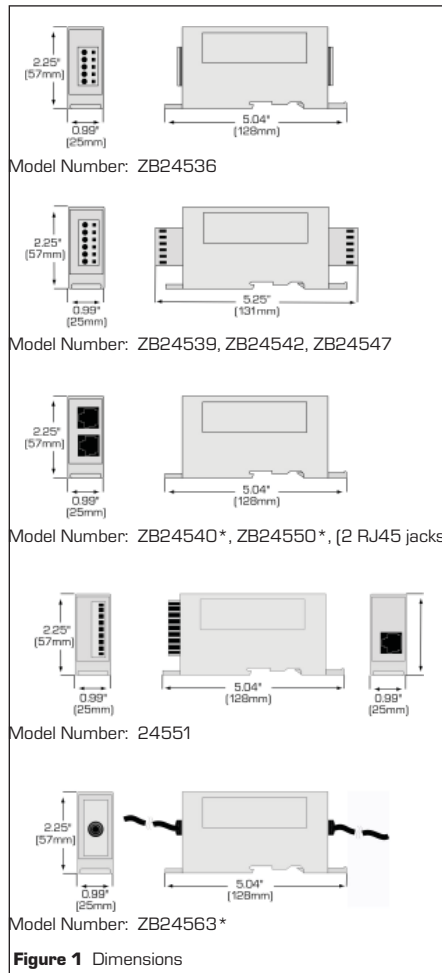


Figure 1 Dimensions

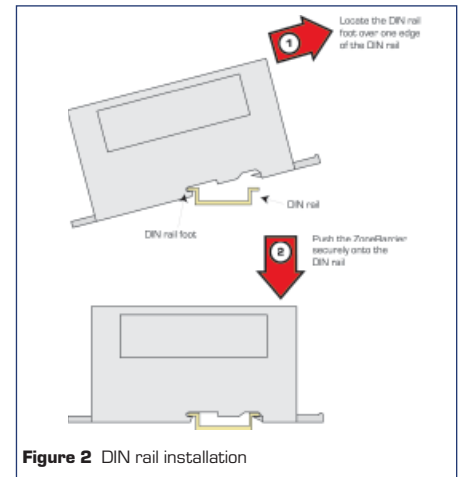


Figure 2 DIN rail installation

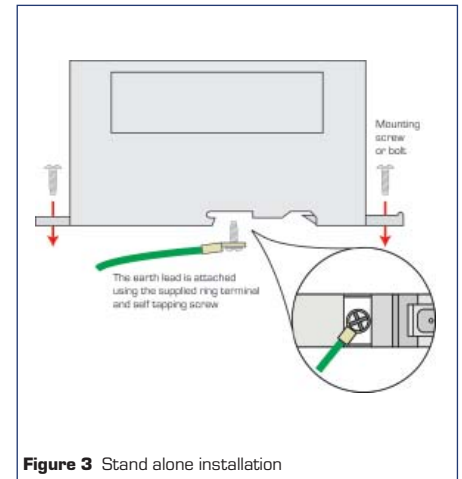


Figure 3 Stand alone installation

Approvals

For more information please contact your local MTL sales office:

- The Americas:** +1 800 835 7075
- UK:** +44 (0)1582 723633
- Singapore:** +65 6 487 7887
- The Netherlands:** +31 (0)481 450250
- Italy:** +39 (0)2 6180 2011
- Australia:** +61 (0)8 9455 2994
- India:** +91 (0)44 450 1660

Local sales office information is also available on our web site at:
www.mtl surge.com/support/distribution/index.htm

Country	Standard/Authority	Approved for	Product
United States & Canada	UL 497B Listed UL Certified Cat.5	Networks	ZB24525, ZB24540, ZB24563



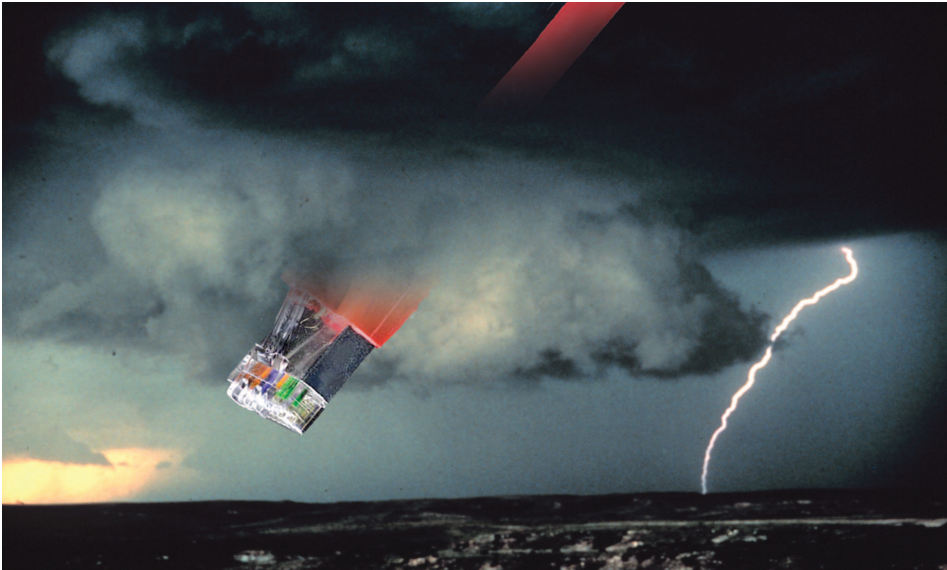


PHOTO: NOAA PHOTO LIBRARY/CLEVER STUFF FRANK OGDEN

As Ethernet moves out of the office and begins to take root in the process automation environment, questions relating to the medium's susceptibility to electrical interference are a legitimate concern. In this overview, Anthony Bird highlights the circumstances in which users should – or should not – be worried. His guide describes what to do, when to do it and where it should be done.

Protect against the network surge

Industrial Ethernet is an attractive proposition for industrial process plant users requiring rapid transfer of digital information within a standards-based network environment. However, the question of immunity of industrial control systems to electrical interference need to be addressed. To appreciate Industrial Ethernet's vulnerabilities and the appropriate countermeasures, it is helpful to understand the mechanisms by which interference and potentially damaging surges gain entry to network components.

The mechanisms by which interference can find its way into where it shouldn't be on an electronic system can be complex, but for the purposes of this article we will concentrate on the three primary coupling mechanisms: inductive, capacitive and resistive. Inductive coupling occurs when an interfering electromagnetic field generates unwanted voltages and currents in a sensitive part of the system. In capacitive coupling one part of the affected circuit becomes one plate of a capacitor while the second 'plate' could be an adjacent object, wire, etc, rapidly charged to a high voltage by some external event such as a lightning strike. This consequently produces a voltage on the affected circuit through electrostatic induction. Resistive coupling, as the name implies, directly generates voltages when an interfering current passes through a shared impedance element. This element could be part of the actual system, or some other circuit element associated with the system such as ground impedance (ground loops).

In-built protection

Industrial Ethernet has some inherent defences against resistive, capacitive and inductive coupling. Figure 1 shows a simplified Ethernet connection.

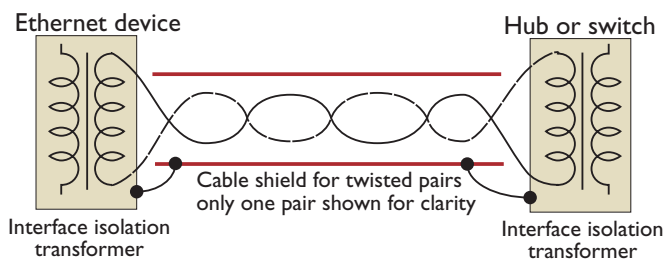


Figure 1: Simplified representation of Industrial Ethernet

So how does Industrial Ethernet handle inductive coupling? As the drawing indicates, each pair of wires is twisted together. This twisting serves two purposes. Firstly it minimises the loop area between the wires. In an electromagnetic field the voltage induced into the pair is proportional to the loop area. Secondly and more importantly the twisting of the wires presents the interfering field with a line of alternating loops. Such that the interfering voltage developed in two adjacent twists is largely of opposite polarity, effectively cancelling each other out. Twisting also assists with emission problems (for the same reasons) and helps to reduce crosstalk. As a side note, this explains the importance of careful dressing of the wires when adding a RJ connector, untwisting too much wire creates loops which will reduce the performance of the cable and make the system more vulnerable to interference.

A typical example of resistive coupling occurs during a distant lightning strike, power fault or switching event. Here, when surge current flows through ground impedance, a transient voltage can be developed between different areas of the plant. Any Ethernet cabling run between these two areas will be exposed to this difference in ground voltage. Fortunately Industrial Ethernet has a built-in defence mechanism. As fig 1 shows, each pair is transformer isolated at either end. This isolation serves to protect the network from differences in ground potential.

Finally the shield or screen normally present on Industrial Ethernet cable mitigates capacitive coupling and, to an extent, the effects of inductive coupling.

Not a cause for concern then?

It's clear that Industrial Ethernet has built in defences against certain levels of interference. Mandatory European Standards, such as the immunity standard EN 61000, require manufacturers to subject their products to varying levels of interference. For example EN 61000-4-5 describes a surge test. A manufacturer claiming approval to EN 61000-4-5 level 3 is in effect stating that their hardware will function in the presence of a 2kV surge with a 1.2/50µs waveform. A brief survey shows that most manufacturers of Industrial Ethernet hardware have a level 3 approval on the EN 61000-4-5 surge test.

This analysis assumes that a lightning pulse of magnitude 100kA, with a rise time of 10µs strikes the top of the vertical vessel, flows down this structure and then disperses partly to ground and partly through the well bonded structure of the plant. The portion of

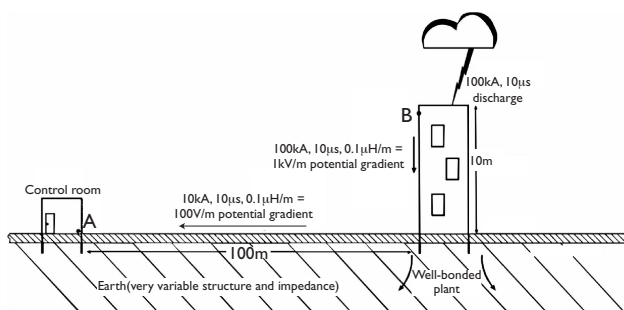


Figure 2 shows diagrammatically a simple well-bonded plant with one prominent vessel

current flowing towards the control room is one tenth of the whole strike or 10kA. Using simple arithmetic and the typical impedance of a plant structure (0.1µH/m) we can calculate the voltage across the horizontal plant at 100V/m and across the vertical vessel of 1kV/m.

The 10m high vessel would see 10kV voltage difference between top and bottom, and the 100m cable run from the vessel to the control room would likewise see a 10kV voltage occur across this length.

This explanation hopefully shows how a well-bonded plant can develop substantial voltages across its structure when hit by a lightning strike. Now is the time to worry! 10kV or more would exceed the defences inherent in Industrial Ethernet. Loss of plant availability and significant physical damage would be a likely consequence.

Clearly not all Industrial Ethernet applications will be exposed to 10kV+ surge voltages; it is unreasonable to expect hardware manufacturers to build in immunity to these levels. The solution is relatively simple; add quality surge protection to cable runs likely to encounter such high levels of surge activity.

Going for extra protection

Again this is remarkably easy. Hardware with a level 3 rating to standard EN61000-4-5, will withstand a 2kV pulse with no ill effects. Referring again to Fig. 2, a horizontal cable run across a well bonded plant of 20m or less should never need surge protection! A cable run of 40m could see a surge voltage of 4kV; surge protection would be advised here for critical applications. Horizontal cable runs of 50m or more should be surge protected. The surge protection must be applied at both ends of the Industrial Ethernet run.

If Ethernet is used to connect to equipment on a vertical vessel or tower, more care is required. A lightning strike here will have to channel 100% of the current flow down through the tower structure. Voltage gradients produced across the tower can be 1kV per meter, ten times greater than that across the horizontal plant runs. Thus 2m runs up a free standing vessel or tower are fine without protection while 4m involves some risk. More than 5m is very risky indeed. Again surge protection must be deployed at both ends of the Ethernet run.

Industrial Ethernet is well suited to the levels of interference typically encountered in an industrial environment. However, as a rule of thumb, care is required when run lengths exceed 50m in the horizontal plane and 5m vertically induced since interference currents can reach destructive levels. The solution to the problem is to add quality surge protection devices to cable runs beyond the lengths indicated.

Surge protection should always be deployed as part of a systematic approach which includes surge protection of AC power to critical equipment. There is one caveat however. Choose your surge protection carefully. Poorly designed protection components will lead to deterioration in the Ethernet signal giving rise to attenuation and increased levels of crosstalk and subsequent packet loss.

The installation of quality surge protection, from a reputable supplier along the guidelines in this article will result in a plant with less chance of breakdown.

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For more information circle 36