Selecting an appropriate surge protective device

Recently we have had several inquiries as to whether, or not, a particular ZeroDT field device protector was an appropriate choice for protection of devices against overvoltage transients. Some of the reasoning behind the question about the proper application included the power specifications for the device they were trying to protect. In one case the ultrasonic flow meter specified that the power be 12 – 28.8 V DC, and in another case the power for the transmitter was specified to be 4.5 – 16 V DC. The comments included:

- "How can the ZeroDT 24-1 or 24-2 be used for this application as its MCOV (Maximum Continuous Operating Voltage) is specified at 36 V DC, and the device specifies a maximum of 28.8 V DC?"
- "How can the ZeroDT 12-1 or 12-2 be used for this application as its MCOV (Maximum Continuous Operating Voltage) is specified at 18 V DC, and the device specifies a maximum of 16 V DC?"

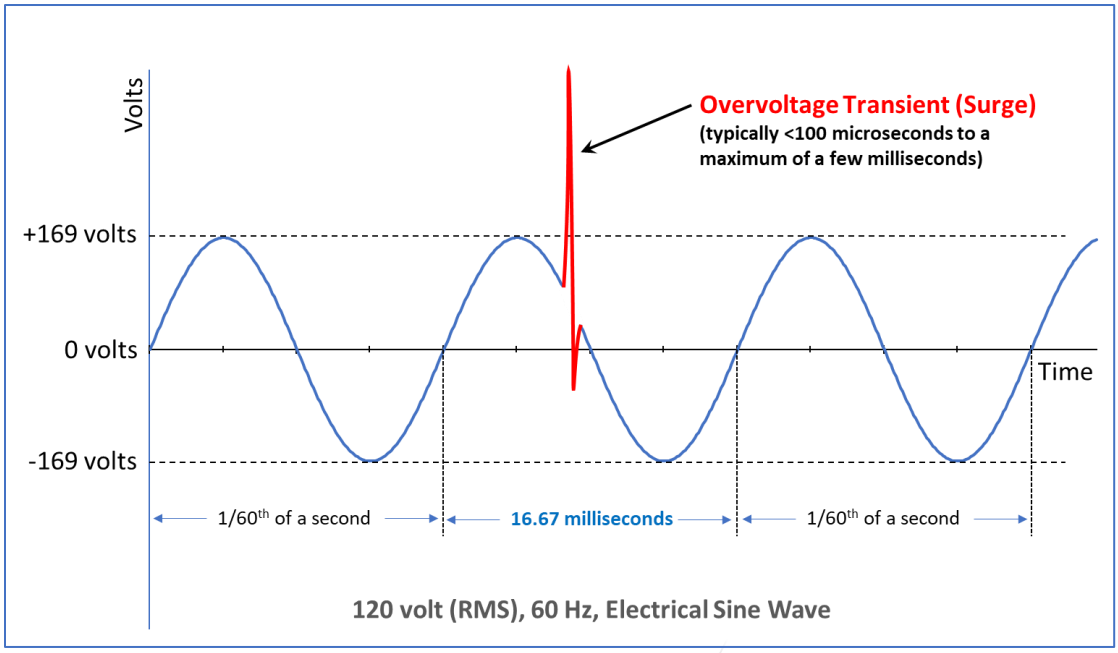
First, I want to congratulate the person for reading the transmitter's specifications and trying to ensure that they were choosing the correct protective device, but I then want to discuss with the person the meanings behind the specifications for the electrical power and the operation and specifications of the protective devices.

The electrical power specifications for a device are the set of power parameters that they device is specified to work correctly under. For example, the specifications of its readings are warranted to be correct when the device has the appropriate input power, but if the power is outside of the specified power range the readings may not meet the accuracies specified. There are other reasons a transmitter (or other device) manufacturer may specify a particular power range, but it is usually not that unit will be damaged if power fluctuates slightly outside of that range. So yes, we want to have a power supply that is designed to provide the correct power for the device, and it should have appropriate 'regulation' to keep the power in that range as much as possible with changes in load and variations in its inputs.

Now we add in the whole subject of overvoltage transients or surges to the mix. First, what do we mean by a transient or surge? These are very short duration events that can be caused by a number of things including:

- Utility Grid Switching
- Turning Motors Off / On
- Switching of large electrical currents (such as fuse blows or breakers opening)
- Accidents or human error
- Lightning discharges up to 1½ to 2 miles away
- ? ? ?

As I stated these events have very short durations. Typically, they last less than 100 µs (100 millionths of a second). The longest may last few milliseconds (a few thousandths of a second). To give you an idea of this duration, our AC power is a sine wave at 60 Hertz or 60 cycles per second, and each cycle lasts 16.17 milliseconds, so we are talking about voltage events that are much, much shorter than a single cycle of the AC power waveform (1/60th of a second or 16.67 ms).



Although these transients/surges have very short durations, they can have very high voltages. They are commonly in the range of 500 --900 Volts but can easily be several thousands of Volts and generate surge currents that are thousands of Amps (again these are of very short duration).

Getting back to our power input specifications for our transmitters that we want to protect. We said that we want a power supply/system that has 'regulation' to try and minimize the 'swells' and 'sags' overvoltage and undervoltage, but won't it take care of the transients as well? Unfortunately, the answer is that it will NOT take care of the transients/surges as they occur to fast (and are too great of magnitude) for the power supply's regulation to compensate for them. Because of this (and the fact that these events can damage the equipment) we need to apply overvoltage transient / surge protection.

Is it the job, or function, of the transient or surge protector to keep the voltage in the specified range? No, that is the objective of the design of the power supply system and its 'regulation'. The function of the SPD (Surge Protective Device) is to provide an alternate path for the damaging energy of the overvoltage transients or surges so that it does not go thru the device we are trying to protect and cause damage.

What is an appropriate MCOV (Maximum Continuous Operating Voltage) for a SPD? The MCOV is a voltage that the SPD can be operated at continuously and it (the SPD) will not have an impact on the communications or signal of the device it is protecting (it is essentially invisible). A general rule of thumb is that we want a protective device to have a MCOV that is at least 25% higher than any voltage we would expect to normally see on the system (and preferably less than about 50% higher).

> For a 12 Volt nominal system, battery charging voltages are typically around 14.1 V DC so we would want to choose a SPD that has a MCOV in the range of 17.6 to 21.1 V DC. The ZeroDT 12-1 and 12-2 have a specified MCOV of 18 V DC.
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> For a 24 Volt nominal system, battery charging voltages are typically around 28.8 V DC so we would want to choose a SPD that has a MCOV in the range of 36 to 43 V DC. The ZeroDT 24-1 and 24-2 have a specified MCOV of 36 V DC.

So, if we close the loop and again look at the original inquiries of whether a ZeroDT field device protector is an appropriate choice for protection of devices against over voltage transients. For the devices in question:

- In the case of the ultrasonic flow meter with a specified electrical power of 12 – 28.8 V DC, the ZeroDT 24-1 and 24-2 have the appropriate specification and are well suited to provide the protection for these devices.
- In the case of the transmitter with a specified electrical power of 4.5 – 16 V DC the ZeroDT 12-1 and 12-2 have the appropriate specification and are well suited to provide the protection for these devices.

Hopefully, this can help you understand why we have chosen to design the ZeroDT field device protection units with the specifications that they have. Remember ZeroDT devices all utilize non-degrading SASD (Silicon Avalanche Suppression Diode) technology, so that you get the same level of protection 5 years down the road as you do on the day you install it. There is no suppression technology that responds faster than SASDs, giving your device the protection to keep it operating and preventing Down Time.

If you have any further questions, or want to discuss the issue further, please feel free to contact me.:

Regards,

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