



On Your Mark is a monthly column written by Geoffrey Peckham, President of Clarion Safety Systems and chair of both the ANSI Z535 Committee and the U.S. Technical Advisory Group to ISO Technical Committee 145- Graphical Symbols. Over the past two decades he has played a pivotal role in the harmonization of U.S. and international standards dealing with safety signs, colors, formats and symbols.

The Grounding Symbols

BY GEOFFREY PECKHAM

With the various markings available to identify ground terminals, how do you know which specific symbol should be used? The international standards are the right place to go for guidance, and this column will outline these best practices for use of earthing (grounding) symbols and markings.

THE GROUNDING SYMBOLS

Identifying the ground terminal is critical to ensuring the products you design can be properly used and serviced in a safe manner. The actual symbols used to indicate ground terminals are found in IEC 60417 *Graphical symbols for use on equipment*, (Figure 1).

Here are the precise IEC definitions for each symbol:

No. 5017 Earth (ground): To identify an earth (ground) terminal in cases where neither the symbol 5018 nor 5019 is explicitly stated.

No. 5018 Noiseless (clean) earth (ground): To identify a noiseless (clean) earth (ground) terminal, e.g. of a specially designed earthing (grounding) system to avoid causing malfunction of the equipment.

No. 5019 Protective earth (ground): To identify any terminal which is intended

for connection to an external conductor for protection against electrical shock in case of a fault, or the terminal of a protective earth (ground) electrode.

No. 5020 Frame or chassis: To identify a frame or chassis terminal.

APPLYING THE SYMBOLS

When it comes to knowing where to apply these ground symbols, you'll want to reference *IEC 60204 Safety of machinery - Electrical equipment of*

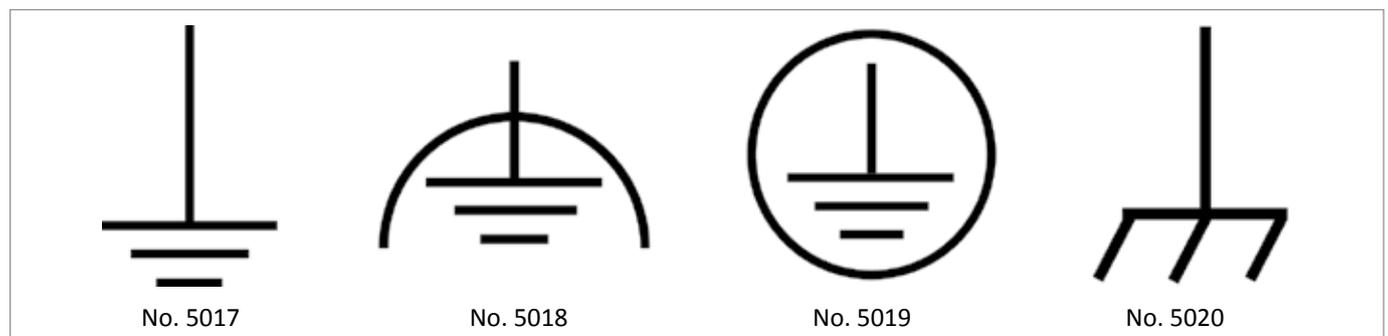
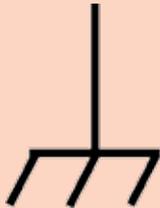


Figure 1: IEC 60417 ground symbols.

4.4.2 Electromagnetic compatibility (EMC)

To enhance the immunity of the equipment against conducted and radiated RF disturbance, measures include:

- connection of sensitive electrical circuits to the chassis. Such terminations should be marked or labeled with the symbol IEC 60417-5020:



- connection of sensitive electrical equipment or circuits directly to the PE circuit or to a functional earthing conductor (FE) (see Figure 2), to minimize common mode disturbance. This latter terminal should be marked or labeled with the symbol IEC 60417-5018:



8.2.6 Protective conductor connecting points

The protective conductor connecting points shall have no other function and are not intended, for example, to attach or connect appliances or parts. Each protective conductor connecting point shall be marked or labeled as such using the symbol IEC 60417-5019 or with the letters PE, the graphical symbol being preferred, or by use of the bicolour combination GREEN-AND-YELLOW, or by any combination of these.

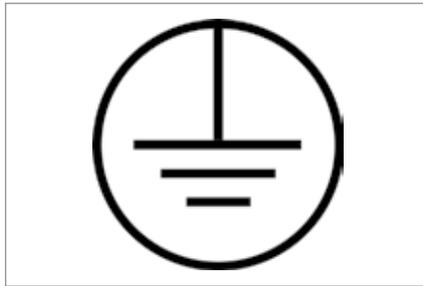
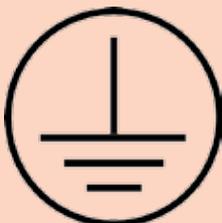


Figure 2: The incorrect drawing of IEC 5019 as shown in the NFPA 70-2011 National Electrical Code.

*machines – Part 1, 2005.*¹ This standard says the following about ground symbols (excerpts from Sections 4.4.2 and 8.2.6). (Shown at right, in Table 1.)

Notice the preference for the use of the 5019 symbol in the last quotation over the use of the letters “PE”. I believe this was done so a completely symbolic language for identifying components is maintained in preference to using letters that don’t translate well in other languages. ISO and IEC are creating a global language for safety and identification, and the use of words or letters as symbols can serve to undermine this goal.

From a U.S. perspective, you might think to look at the *NFPA 70-2011 National Electrical Code* for guidance on this subject. Don’t. This code’s advice on using ground symbols is useless because they show an illustration of a symbol drawn incorrectly (see Figure 2 - note how the vertical bar touches the circle). The NFPA 70 code indicates that this is an “informational note figure” and that it is “one example of a symbol used to identify the termination point for an equipment grounding conductor”. These words leave you to wonder about the other symbols

NOTE

1. The IEC version of this standard is nearly identical to the European version, EN 60204. For those engineers that build machinery, note that in November 2011 the European Commission acknowledged that 60204 is “harmonised” with Machinery Directive 2006/42/EC. This means that you can use 60204 to fulfill the requirements for electrical safety to meet the intent of the Machinery Directive, an important aspect for obtaining the CE mark.

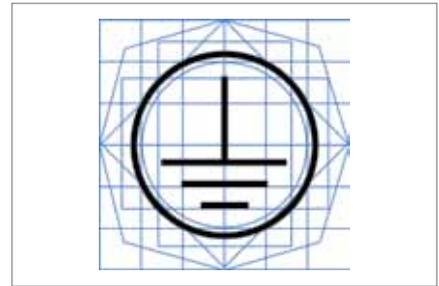


Figure 3: IEC 5019 drawn on the ISO/IEC function/control symbol drawing template.

that might exist and where and how you might best use them. Clearly, IEC 60204 is more useful on this topic.

THE SCIENCE BEHIND DESIGN AND LEGIBILITY

One last point should be made here. Whether it’s a safety symbol or a function/control symbol, there’s a science to creating icons that communicate. ISO and IEC have developed a carefully defined set of rules for drawing various types of symbols. The ISO and IEC committees in charge of function/control symbols use a carefully constructed template (Figure 3) and line width guidelines to ensure that their standardized symbols are drawn with common design principles and consistent visual weight to ensure legibility and readability.

Next issue’s topic will focus on the use of safety symbols to communicate how users must read and understand your product’s manuals before using or servicing your product.

For more information about safety signs and symbols, visit www.clarionsafety.com. 

Table 1