Appendix V — Standards[1]

1.0 Introduction

This appendix reviews the standards and standards committees that are relevant to the Power Control User Interface Standard. As the documents and committees continuously evolve, this is necessarily a snapshot, as of the end of 2002. This topic was first addressed early in the development process for the User Interface Standard (Nordman, 2000a).

The existing relevant standards and committees fall into several categories: graphical symbols, energy consumption and safety, indicators, ergonomics and usability, accessibility, and terminology. The majority of the relevant standards and committees are international. The national committees cited here are all based in the United States. An increasing number of standards are defined by industry consortia rather than through traditional standards organizations.

The topics covered by the user interface standard do not fall cleanly into the existing work areas of any single existing standards committee. This is because existing committees and standards cover only a single interface element in isolation, or provide only vague, general principles for user interface design. In contrast, the Power Control User Interface Standard presents a specific and coherent system of all of the elements with clear correspondences among them.

The user interface standard as proposed requires creating a new standard graphical symbol for "sleep" — ☾ —and changing the definition of the "standby" symbol — ⏻ — to mean primarily "power" while retaining its meaning that the *off* condition is not a zero-power *off*.

1.1 International Standards Bodies

The two international standards organizations most relevant to the user interface standard are the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC). The ISO and IEC also have a joint body — Joint Technical Committee 1 (JTC1) on Information Technology. Each of these entities has an extensive tree of technical committees, subcommittees, and working groups. In some cases, there are joint working groups created to coordinate topics that span more than one committee, along with extensive networks of individual liaisons between committees.

1.2 U.S. National Standards Bodies

ANSI, the American National Standards Institute, coordinates most U.S. standards efforts, and often serves as a conduit for relations with international committees. For example, for JTC1, the U.S. JTC 1 TAG reports to JTC 1 through ANSI. The U.S. National Committee of the IEC operates under the auspices of ANSI. A national committee that corresponds to an international committee is called a "TAG" (Technical Advisory Group).

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[1] This appendix provides detailed background information about the development of the Power Control User Interface Standard. For the full report and more about the Standard, see http://eetd.LBL.gov/Controls

2.0 Standards and Standards Committees

2.1 Graphical Symbols

The most important symbol standard for power control is IEC 60417: Graphical Symbols For Use On Equipment (IEC, 1998). IEC 60417 was originally published in 1973 and updated frequently since, including in 1997. More recently (the latter part of 2002), it has been converted to an electronic database format so that it can be updated continuously.

IEC 60417 defines over 600 symbols, the great majority of which have nothing to do with energy use or power control. A modest number have something to do with office equipment and consumer electronics, such as those for audio or video controls. The key power control symbols,  ,  ,  , and  , all reside in IEC 60417, as do their variants for "part of equipment" and "remote station". The core power symbols were all present in the first edition of IEC 417 (as it was previously called), in 1973.

IEC 60417 is the responsibility of TC 3/SC 3C — Graphical Symbols For Use On Equipment, which is a subcommittee of TC 3: Documentation and Graphical Symbols. The United States is not a member of TC 3 or SC 3C[2]. In fact, no country in the western hemisphere is a member of SC 3C.

A second collection of graphical symbols is ISO 7000: Graphical Symbols For Use On Equipment (ISO, 1989). ISO 7000 covers a similarly wide range of symbols as IEC 60417, though the IEC symbols are more oriented towards electrical, electronic, and medical equipment, and the ISO symbols include many designed for industrial equipment (e.g. handling cloth). The fact that symbols reside in one standard or the other is not always obvious, such as that most of those related to copiers are in the ISO standard[3]. The two symbols from ISO 7000 that are commonly found on power controls are Ready —  — and Electric Energy —  . Symbols for "manual control", "remote control", and "battery charging" are in ISO 7000, but are generally not found on office equipment or consumer electronics.

Responsibility for ISO 7000 lies with TC 145: Graphical Symbols, and specifically TC 145/SC 3 Graphical Symbols For Use On Equipment. The U.S. is a member of SC 3, and in fact holds the chair. However TC 145/SC 3 serves a registration and coordination function and generally does not originate symbols itself.

The symbols relevant to office equipment from IEC 60417 and ISO 7000 are collected into a third document, ISO/IEC 13251: Information Technology — Collective Standard — Graphical Symbols For Office Equipment (ISO / IEC 2000). As this is a joint document, it was prepared by a JTC1 committee, SC 35: User Interfaces (WG 3: Graphical symbols).

IEC 80416-1: Basic Principles For Graphical Symbols For Use On Equipment — Part 1 Creation of graphical symbols (IEC, 2000) provides guidance on creating graphical symbols. IEC 80416-1 contains a pattern (a set of grid lines) upon which symbol originals are to be designed, and specific instructions for how to do this (another document of this type is ISO 3461: General Principles For The Creation Of Graphical Symbols). A second part of this standard, IEC 80416-3 Basic principles for graphical symbols for use on equipment — Part 3: Guidelines for the application of graphical symbols (IEC 2002), specifies how symbol originals can be adapted for use on products.

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[2] The U.S. is a member of SC 3D on Data Sets For Libraries, but that is not relevant to the User Interface Standard.

[3] One possible explanation is that as copiers were originally more mechanical than electrical.

Examples of application guidance for symbols are that line thickness can be changed, that outlined spaces can be filled in, and that color should be avoided unless where necessary.

The crescent moon symbol proposed in the User Interface Standard was designed in accordance with IEC 80416-1.

With several different committees working in essentially the same territory, coordination is vital, and so there is a Joint Working Group (JWG 11) combining members of IEC SC 3C and ISO TC 145.

SC 3C operates under Annex J of IEC Supplement to ISO/IEC Directives (Ed. 4: 2001). Annex J specifies the method to specify a new graphical symbol. A proposal can come from SC 3C itself (in the process of maintaining IEC 60417), from a technical committee, or from a "national committee … with technical committee liaison". A new symbol is part of 60417, not a new standard, so does not require "new work item" paperwork.

Normally, proposals for a committee originate in a member country's TAG, but as the U.S. is not part of SC 3C, that is not possible. There are related committees such as for medical products (TC 62), appliances (TC 59), and audio / video / multimedia equipment (TC 100).

2.1.1 Other Symbol Standards/Committees

IEC 11581 Icon Symbols and Functions is for those symbols used on displays. None of the existing symbols are specific to power status or management. Some general symbols such as a clock symbol are likely to be needed for future power control panels.

ISO 9186, Graphical Symbols — Test methods for judged comprehensibility and for comprehension (ISO 2001a) specifies procedures to be used in advance of establishing international standard symbols. Some of the principles can be extended to the other interface elements. This standard is further addressed in Appendix VII on Testing.

IEC 61592: Household Electrical Appliances – Guidelines for consumer panel testing does not mention power controls specifically, but supports the idea of improved user interfaces. The panels of people to test devices are to be diverse on many criteria, and topics to address include "aspects that can be evaluated" as "legibility, visibility and comprehensibility of indications" and "simplicity of use of control panel and programming". IEC 61592 references other publications: ISO/IEC 37 (1995) and ISO/IEC Guide 37, both entitled Instructions for use of products of consumer interest and ISO/IEC Guide 71, Guidelines for standards developers to address the needs of older persons and persons with disabilities.

For the U.S., ANSI Z535 specifies safety signs, symbols, and colors but contains no power symbols. Several Underwriters Laboratories (UL) standards replicate the brief symbol specifications of the IEC safety standards. We believe that there is no U.S. national standard that addresses power controls[4], and this was confirmed by an authoritative source (Peckham, 2002).

[4] The exception is the safety standards that refer in passing to the basic power control symbols.

2.2 Energy Consumption and Safety

IEC TC 108 on Safety Of Electronic Equipment Within The Field Of Audio/Video, Information Technology And Communication Technology is primarily concerned with safety issues. It is presently addressing energy consumption through a draft standard IEC 62018 on Power Consumption of Information Technology Equipment: Measurement Methods. TC 108 was created out of the merger of two previous committees: TC 74 on IT Equipment and TC 92 on Audio/Video Equipment.

The energy work of TC 108 has not addressed user interface issues, though power modes are specified for technical measurement purposes: two "energy saving modes" and a "full-on mode". TC 108 is responsible for IEC 60950, Information technology equipment — Safety: Part 1: General requirements which in passing notes that ⏀ is for a mains disconnect and ⏻ is for controls that do not accomplish a mains disconnect. TC 108 is not concerned with the user interface beyond this narrow issue.

IEC TC 59 on Performance of household electrical appliances is creating a standard IEC 62301 on "Measurement of Standby Power" (IEC, 2002a). While IEC 62301 was designed initially for appliances, it was crafted so as to applicable to a much wider range of devices. The "standby mode" is the long-term stable mode in which the device consumes the minimum power of all such modes while still being connected to mains power. As such, this could be an *on*, *sleep*, or *off* mode, depending on the device and its design. For example, a telephone answering machine might have its normal *on* mode as the standby mode; a television may be effectively in a *sleep* mode in its minimum power mode (still being able to be turned on by a remote control); and computer monitors are in their *off* mode while in "standby". As such, "standby" is a power level and not a specific operating or power mode.

Safety issues inevitably cross paths with power controls. In general, the concern for safety and power is how to label switches to communicate the way to completely disconnect power in an emergency. As such, ○ and ⏀ are safety symbols since they imply a mains disconnect, but the ⏻ symbol is not. Safety during servicing of devices is of lower concern, since one can simply unplug a device before opening the chassis.

UL 6500, Audio/Video and Musical Instrument Apparatus for Household, Commercial, and Similar General Use is the UL version of IEC 60065, Audio, video and similar electronic apparatus — Safety requirements. UL 6500 states that "graphical symbols shall be in accordance with IEC 60417 and ISO 7000 as appropriate".

UL 60950, Safety of Information Technology Equipment is the U.S. version of IEC 60950, Information technology equipment — Safety: Part 1: General requirements. IEC 60950 states that "symbols shall conform with ISO 7000 and IEC 60417-1 where appropriate symbols exist". The use of colors is to be in accordance with IEC 60073 when safety is involved. When safety is **not** involved, any color can be used (including red) for "functional controls or indicators". The I, ○, ⏀, and ⏻ symbols are specifically mentioned, with the latter only clarified to its meaning as "A 'stand-by' condition". IEC 60950 also mentions indicators, stating that "where safety is involved, … indicators shall comply with IEC 60073" but that otherwise they need not. This is indirect evidence that manufacturers of consumer electronics do not see power indicators for those devices as having safety implications since so many are red.

2.3 Indicators

The key indicator standard is IEC 60073: Basic and safety principles for man-machine interface, marking and identification — Coding principles for indication devices and actuators (IEC 1996). It includes specifications for color assignments, audio indications, and flashing rates.

The User Interface Standard is consistent with IEC 60073, but it would be helpful for IEC 60073 to refer specifically to power indicators.

2.4 Ergonomics/Usability

IEC 447: Man-machine interface (MMI) — Actuating principles (IEC, 1993) provides many basic principles for user interface design. It notes that devices have both "normal" and "error" conditions that need to be considered. A power switch or button is an "actuator". A "stop" action is to have priority over "start". While this makes sense for mechanical devices for which being able to stop is a safety issue, for IT equipment, the more likely risk is data loss from accidental use of stop, so that the priority action should probably be the reverse. Effects of actuators are of three types: increasing, decreasing, and other. It seems clear that for power controls, the application of this is for "higher" power states to be caused by an increasing actuator, and lower states by decreasing actuators. Increasing is to be to the right, up, clockwise, and "away from the operator" (with one exception). The standard specifies basic principles for visual, audible, and tactile indications, but none of these have obvious implications for power controls.

ISO 9241-1, Ergonomic requirements for office work with visual display terminals (VDTs) — Part 1: General introduction and ISO 9241-10, Ergonomic requirements for office work with visual display terminals (VDTs) — Part 10: Dialogue principles provide general guidance on principles for designing interaction scenarios with software systems, though many of the principles can also apply to hardware. These do not mention power controls specifically, and the content that does apply is consistent with and reiterates the design principles discussed in Appendix II, the Literature Review.

A U.S. military standard (MIL-STD-1472F) on Human Engineering makes reference to indicator lights, LEDs, and controls, but makes only minor references to power indicators and controls specifically. A display that is *off* can signal that fact by being entirely off and not generally require an active indicator. Volume and power controls are not to be combined generally. Color associations are standard, such as that red is for an error, yellow for a "marginal condition" or "caution" or "unexpected delay"; and green is for "ready". Flashing is only to be used with red for an emergency condition. Some of these specifications are derived from aviation standards.

2.5 Accessibility

There are many committees, national and international, that address issues of accessibility for the disabled in one respect or another. Most of these don't have power controls within their purview or scope of interest. One exception is INCITS V2 on "Information Technology Access Interfaces". This committee is creating a protocol for communicating between electronic devices and "access devices" that are brought to the electronic device by people with disabilities. These access devices can deliver a user interface in the form best suited to the individual, be it graphic,

auditory, or tactile. The protocol describes the interface abstractly and does not need to know the details of the access device. The protocol is in development, but using power controls as an example is presently under consideration. INCITS (www.incits.org) is sponsored by ITI.

2.6 Terminology

The area of terminology is generally used in standards circles to include only terms used for technical purposes, not those terms used by ordinary people. As such, the topic is only marginally related to the User Interface Standard, though it is advantageous for internal and user terminology to be consistent. The committees responsible for terminology are ISO TC 37: Terminology (principles and coordination), and IEC TC 1: Terminology. The latter includes in its charter to "determine the equivalence of the terms used in the different languages", and the translation of technical terms to other languages may be helpful to the translation of terms for general use.

The IEEE Dictionary (1996) defines terms peripherally related to power controls. In the dictionary, a "state" is a "condition" and a "mode" is "an operating condition … of the system". Power terms included are all internal terminology that would not rise to the level of the user interface. Terms such as "on", "off", "sleep", "low-power" and the key colors are not defined.

3.0 References

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