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Multiple-Octet Coded Character Set

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For some years gradual progress has been made in adding to ISO 10646, Universal Character Set (UCS), certain electrotechnical characters shown in Registered Set #181, and derived from the IEC 617 standard and the IEC Publication 1289, from their Sub-Committee 3B.

While most of the IEC characters already existed in UCS, the others required have been recently added in Amendment 18.

Whereas the IEC Registered Set provides their characters as a coherent set, often grouped together like-with-like, the equivalent characters are scattered widely amongst the very large repertoire of UCS. It will be quite difficult for users to identify these.

This paper therefore provides the necessary guidance for identifying them in UCS. It takes the form of a 'mapping table', or table of preferred equivalences. It is emphasised that it is only a suggestion, and does not carry any status other than being for information. In fact, ISO does not specify any mapping tables between UCS and other coded character sets; however the Unicode Consortium have issued some of those.

Like very many of the symbol characters in UCS, that standard does not specify how they shall be used nor what is their precise significance, which may vary from one application to another. This flexibility contrasts with the more specific usages in the IEC publications, and is sufficient to accommodate those.

The following table provides the suggested mappings between the characters of the IEC publications, as coded in Registered Set #181, and the UCS coded characters.

For the IEC characters, their coding is shown in column/row decimal notation. For the UCS characters, their coding is shown in hexadecimal notation.











Where the IEC names and the UCS names are identical, the latter are noted as Ditto. This high-lights the other names where they are different; otherwise, such differences would be likely to be a source of confusion to users.

Because UCS has very many symbols, some differ only slightly from each other in appearance, or even have to be distinguished only by their names. Therefore to assist the user to avoid ambiguous mapping the alternative characters that should not be used are noted here.

In some cases the glyph shown in ISO 10646 is not identical to that shown in the IEC publications. A note is added in each case. It needs to be appreciated that WG2 is reluctant to add a character whose glyph differs only slightly from a character already in the standard.

It is also to be noted that the IEC experts, in choosing the names for characters, seem to have made a real attempt to harmonize with the practices of UCS, within the context of their particular requirements.

The Table of Equivalences

NBSP	2/0	NO-BREAK SPACE	=	00A0	Ditto
	2/1	POSTPONED OUTPUT SYMBOL	=	2510	BOX DRAWINGS LIGHT DOWN AND LEFT NOT 00AC. NOT 2309. NOT 230D. NOT FE41.
					Note for 2/1. Admittedly the IEC glyph is positioned differently within the character area from the box-drawing character 2510 suggested here. However, WG2 was reluctant to add another character when there are already four others with similarly shaped glyphs.
	2/2	MONOSTABLE SYMBOL	=	238D	Ditto
	2/3	HYSTERESIS SYMBOL	=	238E	Ditto
					Note for 2/3. The IEC glyph has rather more marked lines at the top-right and the bottom-left than the ISO glyph in Amendment 18. Perhaps that glyph could be modified in the next printing of ISO 10646.
	2/4	OPEN-CIRCUIT-OUTPUT SYMBOL	=	25C7	WHITE DIAMOND NOT 22C4. NOT 25CA. NOT 2662.
	2/5	OPEN-CIRCUIT-OUTPUT H-TYPE SYMBOL	=	238F	Ditto
	2/6	OPEN-CIRCUIT-OUTPUT L-TYPE SYMBOL	=	2390	Ditto NOT 235A.
	2/7	PASSIVE-PULL-DOWN OUTPUT SYMBOL	=	2391	Ditto
	2/8	PASSIVE-PULL-UP OUTPUT SYMBOL	=	2392	Ditto
©	2/9	COPYRIGHT SYMBOL	=	00A9	Ditto
	2/10	LESS-THAN OR EQUAL TO	=	2264	Ditto
					Note for 2/10. Registered Set #181 adds a note emphasising that the glyph shall be as drawn here and 'not with an alternative shape. For font design see ISO 3098'. It has always been an understanding in WG2 that the forms \leq and \leq should be regarded as equivalent in UCS.
	2/11	MUCH LESS-THAN	=	226A	Ditto

┘	2/12	NOT SYMBOL	= 00AC Ditto NOT 231D. NOT FE41.
SHY	2/13	SOFT HYPHEN	= 00AD Ditto
®	2/14	REGISTERED SIGN	= 00AE Ditto
°	3/0	DEGREE SIGN	= 00B0 Ditto
±	3/1	PLUS-MINUS SIGN	= 00B1 Ditto
÷	3/2	DIVISION SIGN	= 00F7 Ditto
∞	3/3	INFINITY	= 221E Ditto
∫	3/4	INTEGRAL	= 222B Ditto
...	3/5	HORIZONTAL ELLIPSIS	= 2026 Ditto NOT 22EF,
≠	3/6	NOT EQUAL TO	= 2260 Ditto
•	3/7	MIDDLE DOT	= 22C5 DOT OPERATOR
		Note for 3/7. The IEC glyph is different from any in UCS. That has the punctuation character 00B7 MIDDLE DOT, the pictorial character 2219 BULLET DOT, and the mathematical character 22C5 DOT OPERATOR. Despite the name of 00B7 being the same as the IEC name, it is suggested it will be more appropriate to map to the mathematical character 22C5.	
≈	3/8	APPROXIMATELY EQUAL TO	= 2248 ALMOST EQUAL TO
≡	3/9	IDENTICAL TO	= 2261 Ditto
≥	3/10	GREATER-THAN OR EQUAL TO	= 2265 Ditto
		Note for 3/10. Same as note for 2/10.	
≫	3/11	MUCH GREATER-THAN	= 226B Ditto
™	3/12	TRADE MARK SYMBOL	= 2122 TRADE MARK SIGN
⌒	3/13	CENTRE LINE SYMBOL	= 2104 Ditto
		Note for 3/13. The IEC glyph is very different from the UCS glyph. However, since the IEC form is more commonly used in many countries, consideration might be given to amending the glyph in the next printing of ISO 10646.	
	3/14	DIRECT-CURRENT SYMBOL FORM ONE	= 2014 EM DASH NOT 2212.
≡	3/15	DIRECT-CURRENT SYMBOL FORM TWO	= 2393 Ditto
‰	4/0	PER MILLE SIGN	= 2030 Ditto
†	4/1	SHIFTING-INPUT SYMBOL RIGHT-TO-LEFT OR BOTTOM-TO-TOP	= 2190 LEFTWARDS ARROW

- Γ 4/3 CAPITAL LETTER SYMBOL GAMMA = 0393 GREEK CAPITAL LETTER GAMMA
- Δ 4/4 CAPITAL LETTER SYMBOL DELTA = 25B3 WHITE UP-POINTING TRIANGLE
 NOT 0394. NOT 2206. NOT 25B5.
- Note for 4/4. Despite the IEC name including the Greek name DELTA, it is considered preferable to relate this character to the following three characters and map it to 25B3 in Table 46 of ISO 10646. This maintains all four characters as a set.
- \triangleleft 4/5 AMPLIFICATION SYMBOL RIGHT-TO-LEFT
 = 25C1 WHITE LEFT-POINTING TRIANGLE
 NOT 25C3. NOT 25C5.
- ∇ 4/6 THREE-STATE OUTPUT SYMBOL
 = 25BD WHITE DOWN-POINTING TRIANGLE
 NOT 25BF.
- \trianglerightarrow 4/7 AMPLIFICATION SYMBOL LEFT-TO-RIGHT
 = 25B7 WHITE RIGHT-POINTING TRIANGLE
 NOT 25B9. NOT 25BB.
- Θ 4/8 CAPITAL LETTER SYMBOL THETA = 0398 GREEK CAPITAL LETTER THETA
- \cap 4/9 ANALOGUE SYMBOL = 2229 INTERSECTION
 NOT 22C2.
- \circ 4/10 SOFTWARE FUNCTION SYMBOL = 2394 Ditto
- Λ 4/11 CAPITAL LETTER SYMBOL LAMBDA = 039B GREEK CAPITAL LETTER LAMDA
- Ξ 4/14 CAPITAL LETTER SYMBOL XI = 039E GREEK CAPITAL LETTER XI
- Π 5/0 CAPITAL LETTER SYMBOL PI = 03A0 GREEK CAPITAL LETTER PI
- \rightarrow 5/1 SHIFTING INPUT SYMBOL LEFT-TO-RIGHT OR TOP-TO-BOTTOM
 = 2192 RIGHTWARDS ARROW
 NOT 2799. NOT 279B. NOT 279D. NOT 279E.
- Σ 5/3 CAPITAL LETTER SYMBOL SIGMA = 03A3 GREEK CAPITAL LETTER SIGMA
- Υ 5/5 CAPITAL LETTER SYMBOL UPSILON = 03A5 GREEK CAPITAL LETTER UPSILON
- Note for 5/5. The ISO 10646 1993 version standard was printed with the wrong glyph at 03A5, with curved arms. The Unicode version 2.0 standard has the correct straight arms. The IEC publications use the glyph with straight arms.
- Φ 5/6 CAPITAL LETTER SYMBOL PHI = 03A6 GREEK CAPITAL LETTER PHI
- \times 5/7 MULTIPLICATION SIGN = 00D7 Ditto
- Ψ 5/8 CAPITAL LETTER SYMBOL PSI = 03A8 GREEK CAPITAL LETTER PSI

Ω	5/9	CAPITAL LETTER SYMBOL OMEGA	= 03A9 GREEK CAPITAL LETTER OMEGA NOT 2126.
□	5/10	SQUARE SIGN	= 25A1 WHITE SQUARE NOT 2610.
∅	5/11	DIAMETER SIGN	= 2300 Ditto
∠	5/12	ANGLE	= 2220 Ditto
~	5/13	ALTERNATING-CURRENT SYMBOL LOW-FREQUENCY RANGE	= 223C TILDE OPERATOR
Note for 5/13 and 5/14 and 5/15. The IEC glyphs for this and the following two characters are drawn much more emphatically than those suggested in UCS.			
~	5/14	ALTERNATING-CURRENT SYMBOL MEDIUM-FREQUENCY RANGE	= 2248 ALMOST EQUAL TO
~	5/15	ALTERNATING-CURRENT SYMBOL HIGH-FREQUENCY RANGE	= 224B TRIPLE TILDE
α	6/1	SMALL LETTER SYMBOL ALPHA	= 03B1 GREEK SMALL LETTER ALPHA NOT 237A.
β	6/2	SMALL LETTER SYMBOL BETA	= 03B2 GREEK SMALL LETTER BETA NOT 03D0.
γ	6/3	SMALL LETTER SYMBOL GAMMA	= 03B3 GREEK SMALL LETTER GAMMA
δ	6/4	SMALL LETTER SYMBOL DELTA	= 03B4 GREEK SMALL LETTER DELTA
ε	6/5	SMALL LETTER SYMBOL EPSILON FORM ONE	= 220A SMALL ELEMENT OF
Note for 6/5. Registered Set #181 emphasises that the glyph for this character shall be drawn as in ISO 3098 -- see note for 2/1 above. This also applies to 6/8, 7/0, 7/1, 7/3, 7/6, 7/10, 7/11 and 7/12.			
ζ	6/6	SMALL LETTER SYMBOL ZETA	= 03B6 GREEK SMALL LETTER ZETA
η	6/7	SMALL LETTER SYMBOL ETA	= 03B7 GREEK SMALL LETTER ETA
θ	6/8	SMALL LETTER SYMBOL THETA FORM TWO	= 03B8 GREEK SMALL LETTER THETA NOT 03D1.
ι	6/9	SMALL LETTER SYMBOL IOTA	= 03B9 GREEK SMALL LETTER IOTA
κ	6/10	SMALL LETTER SYMBOL KAPPA	= 03F0 GREEK KAPPA SYMBOL NOT 03BA.
λ	6/11	SMALL LETTER SYMBOL LAMBDA	= 03BB GREEK SMALL LETTER LAMDA

μ	6/12	SMALL LETTER SYMBOL MU	= 03BC	GREEK SMALL LETTER MU NOT 00B5.
ν	6/13	SMALL LETTER SYMBOL NU	= 03BD	GREEK SMALL LETTER NU
ξ	6/14	SMALL LETTER SYMBOL XI	= 03BE	GREEK SMALL LETTER XI
π	7/0	SMALL LETTER SYMBOL PI	= 03C0	GREEK SMALL LETTER PI
ρ	7/1	SMALL LETTER SYMBOL RHO	= 03F1	GREEK RHO SYMBOL NOT 03C1. NOT 2374.
σ	7/3	SMALL LETTER SYMBOL SIGMA	= 03C3	GREEK SMALL LETTER SIGMA
τ	7/4	SMALL LETTER SYMBOL TAU	= 03C4	GREEK SMALL LETTER TAU
υ	7/5	SMALL LETTER SYMBOL UPSILON	= 03C5	GREEK SMALL LETTER UPSILON
ϕ	7/6	GREEK SMALL LETTER PHI FORM TWO	= 03C6	GREEK SMALL LETTER PHI
		Note for 7/6. The IEC glyph is drawn slightly differently from that in ISO 10646.		
χ	7/7	SMALL LETTER SYMBOL CHI	= 03C7	GREEK SMALL LETTER CHI
ψ	7/8	SMALL LETTER SYMBOL PSI	= 03C8	GREEK SMALL LETTER PSI
ω	7/9	SMALL LETTER SYMBOL OMEGA	= 03C9	GREEK SMALL LETTER OMEGA NOT 2375.
θ	7/10	SMALL LETTER SYMBOL THETA FORM ONE	= 03D1	GREEK THETA SYMBOL
φ	7/11	SMALL LETTER SYMBOL PHI FORM ONE	= 03D5	GREEK PHI SYMBOL
ϵ	7/12	SMALL LETTER SYMBOL EPSILON FORM ONE	= 03B5	GREEK SMALL LETTER EPSILON

Note for Greek letter symbols. Registered Set #181 shows for all these that they are used in IEC 27 Parts 1 to 4, ISO 31 Parts 0 to 13, IEC 617 Parts 1 to 13, and IEC 1082 Parts 1 to 13.