B612

The PolarSys font

DESIGN & PRODUCTION
OF A DIGITAL FONT

AIRBUS

intactile® DESIGN

ENAC

Université de Toulouse

B612

The PolarSys font

DESIGN & PRODUCTION
OF A DIGITAL FONT

*"I have serious reason to believe
that the planet from which
the little prince came is the
asteroid known as B612."*

Antoine de Saint-Exupéry,
The Little Prince, 1943

Project members

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Thanks to Jonathan Favre

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Foreword

The Airbus team for HMI (EDYDN), as part of research cooperation between Airbus and DSNA, requested Jean-Luc VINOT of the IIP Division team of the DSNA/DTI R&D department and Sylvie ATHÈNES of the PRISSMH laboratory (University of Toulouse III) to conduct a research and assessment study for the design, evaluation and technical validation of a digital typeface designed for aeronautical interfaces.

In 2010, this request led to the identification and management of a joint research project: *Design, evaluation and validation of digital fonts used to display critical information on screens within the field of aeronautics.* The results of this research led Airbus to confer Intactile Design with the professional realization of a typeface based on concepts and criteria identified and validated in the design phase of the font. This realization forms part of the evaluation methodology developed in previous research.

Project Destination

For Airbus, the objective of the project is the provision of a software component: a digital typeface consisting of a set of variants (vector fonts) for the optimal display of textual information on screens of future Airbus programs. This font will be an integral part of all systems and devices of the aircraft: cockpit displays for CDS systems (avionics), OIS (information), OMS (maintenance), and cabin display screens for the FAP (control panel).

User Description

End users of the digital font, once integrated into the on-board HMI, are pilots of future Airbus aircraft (cockpit HMI), the cabin crew (FAP) and maintenance engineers (OMS, ground and in flight use).

The first or 'meta' users of this software component will be the designers of future systems and HMI developers of interactive systems (Airbus suppliers) who will implement the component within the HMI. Their specific functional needs and system constraints from systems, technical and software points of view were taken into account for this study.

The deliverable *B612*:
Design & production of a typeface

The first objective of this document is to explain the design process, and also the methods used to achieve the objectives of clarity and quality.

It also contains a complete catalogue of the font: all of its characteristics, its variants and its glyphs are laid out. The document comes with a digital file containing all the files relative to the *B612* font in TrueType format. To this effect, it is intended for users who will implement the font, and will allow them to best choose the variants and characters best suited to targeted activities.

Typographical glossary

❶ Ascender

Vertical part of some lower case characters projecting over the x-height [3].

❷ Crossbar

Oblique part of a character.

❸ X-height

Height of lowercase characters without ascender [1] or descender [4] – like the letter "x".

❹ Descender

Vertical part of some lower case characters projecting under the baseline [5].

❺ Baseline

Imaginary line on which letters are seen to sit.

Signs

⑥ ❼ ⑧ ❾ ᵇ ❾ ᵇ ⑩ ❾ ᵃ

❻ **Bowl**

Part of a character which
encloses a counter [7].

❼ **Counter**

Area of a character that is
entirely or partially enclosed.

❽ **Stem**

Vertical part of a character.

❾ **Letter-spacing**

Space between two letters
❶ [a], obtained by adding
together the minimal spacing
located on either side of
these two letters ❶ [b].

❿ **Width**

Width defined by a letter
and its spacing [9].

These definitions are taken from
Typographie, guide pratique – Seconde édition,
Damien Gautier, 2003, Éditions Pyramid.

B612 font design

The *Dossier de conception et de spécifications typo-graphiques* [*Design and typographical specifications document*] by J-L VINOT and S ATHÈNES determines the criteria for usability evaluation and design recommendations. These elements define the requirements of the software component requested by Airbus.

The design choices made are presented below, with regard to usability criteria and recommendations set out during the specification phase.

1. Efficient and easy reading

Ease and efficiency of reading are the first criteria to consider when designing a software component for the display of aeronautical information for critical interfaces. To meet the requirements of target activities, typeface design must ensure discrimination and identification of its characters.

Identification

In order to ensure clear and rapid identification, the typeface design has respected basic shape characteristics to allow for good visual information on the graphic characteristics unique to each letter ❶. The variations in thickness of each mark [stems[8] – bars – crossbars[2]– bowls[6]] retain the natural contrast of each letter. Linear marks [with no thickness contrast], as that of the *CDS* font [actual cockpits], were excluded.

The general form of the characters – archetype – is also respected and highlighted as much as possible by the accentuation of the ascenders[1] and descenders[4] ❷.

In the same way we avoid making the bowls[6] rectangular: the legibility of the counterforms[7] is preserved, with a sufficient dimension for the bowls[6], crossbars[2] and internal angles.

Discrimination

The design of the typeface and the alphanumerical characters aims at maximising the distances between forms to allow for easy, clear identification of each character. The results of experiments done during previous phases on successive versions of the typeface have meant 'confusion matrices' could be created [cf. Experimental and Algorithmic evaluation in Laboratory: Final report [*Évaluation expérimentale et algorithmique en laboratoire : Rapport Final*] S ATHÈNES and J-L VINOT].

▸

Drawing   Vector font

❶ The shaded areas indicate accentuated and enlarged parts for each character.

❷ The ascenders[1] and descenders[4] are marked.

▸ These matrices have identified possible confusion between characters; for example, between H and N, B and 8, 5 and S, 0, O and Q, 1 and I, 2 and Z etc. The accentuation of differences in shape between the characters ❶ leads to less confusion.

Optical corrections for pixel display

When creating a typeface, certain characters must take into account optical distortions and corrections in the mark, in order to maintain visual consistency and good overall legibility of the text ❷.

The *B612* design has also incorporated a set of graphic 'corrections' in order to meet the specific requirements. Firstly, it was necessary to optimise it for LCD screen resolution of medium or low rendering. The image of the letter in pixels (glyph) is given using a rasterization of the vectorial path which alters the perception of the initial design: it is therefore necessary to control this adaptation as thoroughly as possible (cf. *Hinting*, page 20).

Moreover, activity analysis has highlighted possible impairment in reading context: variations of light and viewing angle, high cognitive load for the pilot etc.

So, *B612* has created a concept of increased legibility of shape for less ideal situations and associated methods of mark corrections, to optimise the final rendering of the text and on-screen reading, particularly with the use of incises and 'light-traps' ❸.

An incise is a small serif which interrupts the regularity of the vertical line: here it allows to accentuate the clarity of the leading stroke (top part) of the vertical stem[8] to avoid it being rounded off when antialiasing.

The principle of 'ink traps' has existed as long as typography has: it is a small indentation at the junction of letter strokes which 'traps' the ink on small characters, so that it doesn't block the junction and affect the legibility. In the case of *B612*, the 'light traps' accentuate the counterforms[7], particularly for the sharp angles. The indentations are always well distinguished, even at a small size, and the contrast between the different strokes of the character is reinforced.

❶ Enhancement of contrasting character shapes likely to be confused.

Incise Light trap

❸ Incises and 'light traps': focus on the principle, consequences on the display screen, examples characters concerned.
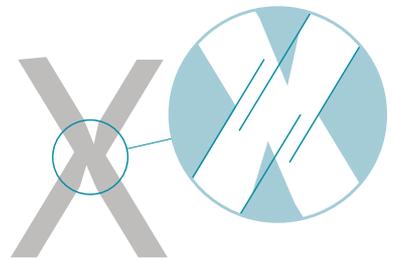
❷ The diagonals of the 'X'" and 'x', shifted in order to open the upper and lower cavity.

▸ **Managing the character width**[3]**: proportional or fixed?**

A proportional alignment of typeface is essential to ensure respect of form and coherence of spacing. That is why the width [10] of *B612* is 'variable': each character uses the space adapted to its form - the characters therefore have different widths (e.g. 'M' is much wider than 'i') ❹.

However, *B612* also exists in a fixed width version, called *B612 Mono* ❺. All the characters have been designed with exactly the same width – as with other monospaced typefaces (e.g. *Courier*, *Monaco* etc). Although less legible for text, this version could be used in cases of high technological display constraints. It can be used in specific cases where the vertical alignment of the letters is important (e.g. a column of callsigns).

It is important to note that, given the technical context of its use and the frequency of use of checklists in the cockpit, an equal width has been used for figures ❻, whether it be for the proportional or monospaced version.

Spacing

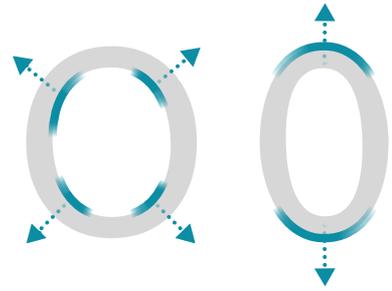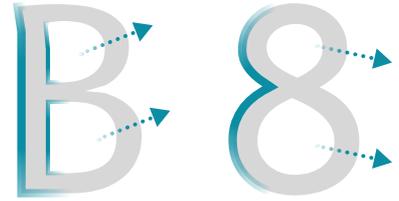Studies on information gathering in the cockpit show that visual time available is sometimes extremely brief and this highlights difficulties linked with the density of the information, especially during periods of high cognitive demand. The design must therefore be quickly legible and make reading as comfortable as possible.

The specification of the spacing between letters and words (character spacing) and between lines provides a hierarchical structure of these elements and avoids errors in the visual scanning of the text. The shape of certain characters means that the visual space between each character can seem different and can lead to difficulty in reading a word ❼.

Metrics kerning, or kerning between character pairs, is incorporated into the typeface to assure good letter spacing ❽. This ratio serves to balance the visual isolation of a character and the coherence necessary to enable efficient reading of the word.

B612 benefits from a complete kerning on all characters. The space between all pairs of letters has been adjusted in each case. In the example of the space between the 'V' and the 'e' has been reduced and the space between the 'r' and the 't' has been increased.

Character template

The character template (width [10], x-height [3]) must be compatible with a fairly high density of information. The fixed-width of characters is therefore quite narrow to conform to the display density required ❾.

The visual height (viewing angle) of the characters displayed (rendering) should however be no less than a 15 degree arc to ensure good text legibility. This corresponds approximately to a 16 point font for a 72 dpi screen. This limitation should be taken into account when using the font. ▸

❹ *B612* is a variable-width font: each glyph can have a different width.

❺ *B612* mono is a fixed-width font: all the glyphs have exactly the same width.
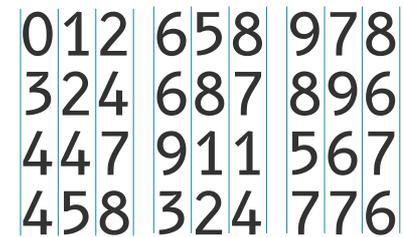
❻ The figures always have the same width

❼ Without kerning: the spacing between the 'V' and the 'e' and between the 'r' and the 't' are not harmonious.

❽ With kerning: the 'e' has been brought closer to the 'V' and the 'r' has been moved further from the 't'.

Extended   Normal   **B612**   Cond.   Ultra cond.

❾ The proportions of *B612* puts it into the class of 'condensed' typefaces.

▸ 2. Information structure

To meet the activity requirements, the typeface must favour a highly structured composition of the textual information displayed in IHM aeroplanes. This graphic structure not only improves the reading process but also the visual search for information or its prioritization in terms of the activity.Composition et alignements

The factors that contribute to a good visual composition of the information are principally exterior to the typeface design. They come into play at the implementation stage, with the exact positioning or choice of text alignment in HMI. The execution requires adequate layout which does not affect the legibility.

Good visual composition of the interface can actually be helped by the very letter stucture and visual adherence to the alignment. The drawing of the *B612* characters favours visual alignment and takes optical corrections into account ❶.

Hinting

Among other things *B612* has complete hinting on all characters. The hinting instructions, integrated into the characters, serve to calculate the rasterization of the character: it contributes to the layout for low and medium resolution, taking into consideration optical corrections and ensures correct alignment ❷. [cf. Hinting page 20].

Emphasis

The need to highlight information within the interface and the visual structure of information requires the creation of varied thicknesses. As well as the standard 'Regular' form, there is 'Bold', 'Italic' and 'Bold Italic'. [cf. Variants page 16].

3. User satisfaction

Ultimately, the *B612* typeface must give practical satisfaction to different users, but must also be esthetic – for users as well as those commissioning the study [Marketing].

Reading comfort

For the satisfaction of the operator legibility is important. In a critical context this comfort has a positive outcome on reducing visual fatigue and cognitive load.

The *B612* typeface facilitates reading comfort by having found a contrast of shape which balances visual characterization of letters with regularity of its components. Particular attention was given to the uniformity of the type face, whether being used for isolated terms, reading information on a map, capital letters [common in cockpit applications], waypoint lists or in long texts.

Style

The style of the font must be coherent with the activity and the requirements of the aeronautical sector: functional, ensuring reading precision and the technical nature of the activity. ▸
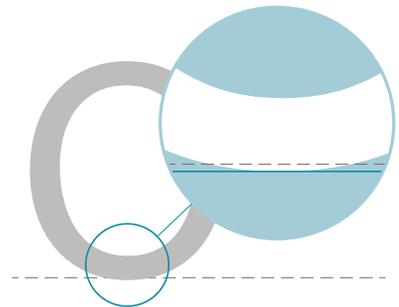
❶ The base of the 'O', exceeds the base line [same for 'b', 'c', 'G', 'Q', etc]

❷ Before the hinting phase, character alignment for low resolution is not uniform. The 'a', 'u' and 'l' go above their alignment baselines, whereas the 'i' and 'e' go below.

After the character hinting work, all the letters are aligned on their respective base lines.

▸ The style must correspond to the user experience of the operators and demands a certain similarity with existing typeface, but must also represent the technological innovation of a new range of aircraft: the typeface must represent the qualities associated with the aviation sector and high technological products; for example, the aspects of modernity and efficiency. The typeface currently used in cockpit interfaces, CDS, suggests a certain rigor and technical nature due to a very geometric design ❸.

In this sense, in order to express a certain technical aspect, the *B612* typeface is based on a linear design: the linear font is characterized by the absence of serif and tends towards a functional sober aspect. The thickness appears constant and the characters are designed using rigourous and geometric principles – as in typefaces such as Helvetica or DIN.

An over-strict application of such a system of graphic rules can weaken character identification: as described in Identification [page 7], and natural characterisics [thick strokes, thin strokes, variations, contrasts] allow for better discrimination. *B612* has been optimised following a more calligraphic approach.

B612 attempts therefore to preserve the readable qualities of humanistic fonts like réales and incises, but also the technical functional image of sans serif or bitmap ❹.

Safety

The typeface will be used on critical interactive systems. The experimental assessment of this safety criteria therefore needs to verify the use of digital font in a laboratory or semi-operational context taking into account the risks in impaired conditions – high cognitive load, stress – where the user's resources are diminished. The objective of these experiments was to help with design and validate the design choice. The results are detailed in the report *Experimental assessment of typeface in Laboratory* by S Athènes. [Évaluation Experimentale de la Police de Caractère en Laboratoire de S Athènes].

Initial experiments

A first draft of *B612*, called *B612 V0*, along with a specifications sheet, was created during an initial experimental phase before the work described in this document was done.

This first phase began with extensive analysis, using 3 method types: user observations in an operational context [simulator and real flight], an expert analysis of the existing and technical constraints, and 2 state of the art methods – on perception of visual information for reading and on typographical resources. The results of these analyses led to being able to define a design approach guided by theory and validated step by step with experiments.

As soon as the first prototype was created, a series of experiments enabled assessment of the legibility regarding the existing aeronautical font and a reference font recognised for its readability and display qualities with low resolution [*Verdana*]. The essential aim of the following experiments was to test and progressively adjust the prototype font, taking into consideration reading conditions in ▸

ABCDEFG
HIJKLMN

CDS

ABCDEFG
HIJKLMN

B612

❸ Comparison between the characters of the current font in the cockpit [*CDS*] and *B612*

OCRA Std
ABCabc123

CDS
ABC

DIN Schrift
ABCabc123

Verdana
ABCabc123

Technical

B612
ABCabc123

PT Sans
ABCabc123

Formata
ABCabc123

Optima
ABCabc123

Georgia
ABCabc123
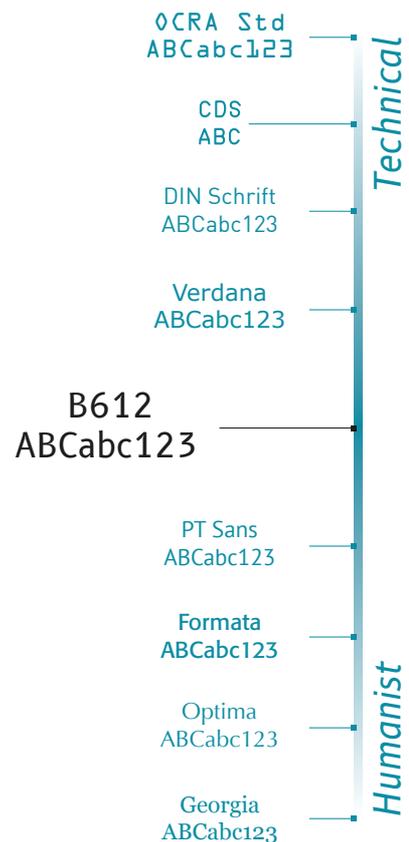
Humanist

❹ Classification of some classic fonts according to their humanistic and technical characteristics.

▸ an operational situation [size of letters, polarity of displayed pages, nature and distance of screens, deterioration of the contrast due to changing light, and so on]. The creation of confusion matrices from the experiment findings [systematic link between displayed characters and perceived characters] enabled the detection and correction of certain confusions [e.g. S and 5, 1 and I] and frequent non-perceived data. Each time the experiment findings, validated statistically, were quickly integrated in to the ongoing design, leading to the modification of the shape of the character concerned to increase its clarity and strength. In this way, each experiment done was fed into the typeface creation update.

The final prototype [*B612 V0*] was subject to an acceptability test done on a simulator with subjects similar to the final users [pilots]. The comparison with the aeronautical typeface shows clearly how much better the prototype font is in terms of legibility and comfort, including impaired conditions [strong rear three-quarter lighting and night conditions].

❶ Experimental device

Experiment #1: legibility assessment

A first series of experiments was carried out in order to check and optimise the legibility of the *B612* characters [upper case, figures, lower case] when on their own or in words. The aim was to assess the legibility and ease of recognition at each step of the creation of the character shapes – and so help with the font design.
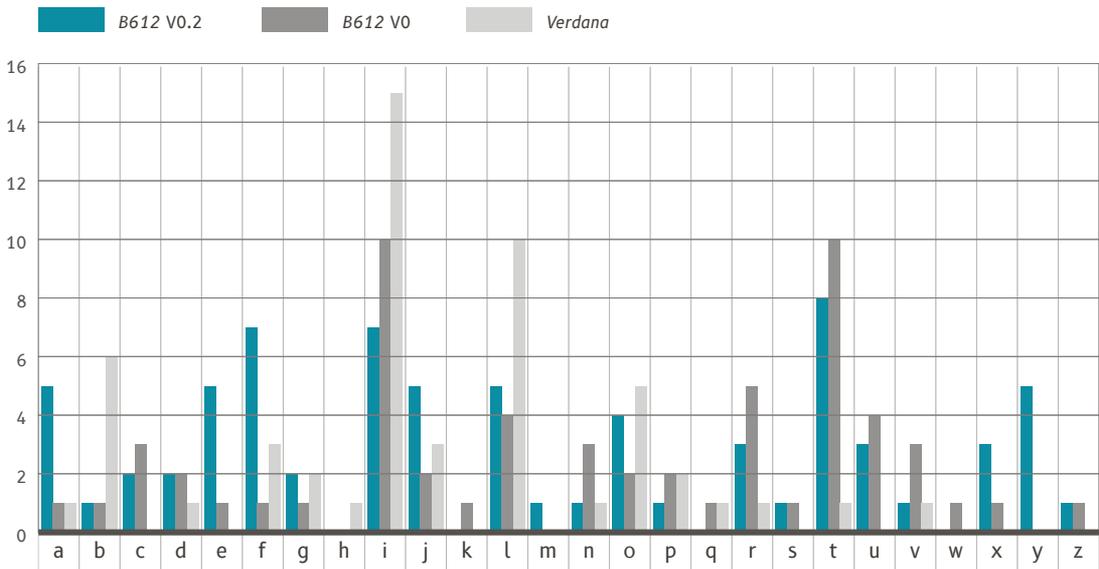
The subjects were asked to complete different tasks for which the character images were displayed on a screen either in normal or critical [low contrast] reading conditions. The conditions [distance and position] were similar to those in a standard cockpit, that is to say 80cm away and facing the centre of the screen. In certain experiments a second distance [100cm] was tested in order to assess the proximity of letters when they are less clear. A fixing device was used to maintain the distance and eye-position between the subject and the screen ❶.

❷ Example of a graph describing the experimental results used to optimize the design.

The graph shows the letters that were poorly identified [number of Wrong Answers for each lowercase character in each of the three fonts at a distance of 80 cm].

For example, poor performance on the letter 'i' has led to redesign work to optimize recognition.

❸ Illustration of
readability as measured
in Experiment #1 of
the second part of the
Evaluation of the Character
Font in Laboratory report.

Correct answers
Wrong answers
Non-responses
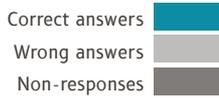
▸ *B612 V0.2* [an intermediary version
of *B612*] was compared with *B612 V0* [a prototype version] and
Verdana, a font well-known for its high legibility on screen. The
recognition of the form of each letter for peripheral vision and in
the context of words was also tested ❷.

The experiment findings showed which characters could be improved in terms of identification and recognition. Design work on
the characters could then be targeted more efficiently: the successive experiments allowed for optimized legibility.

The final results show *B612* legibility superior to that of the current *CDS* typeface. These results ❸ correspond to the work of improving the character font design to make it not only as readable,
but also as recognisable as possible [lower non-response].
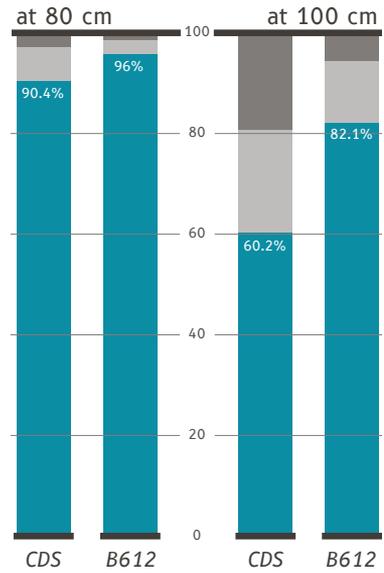
Experiment #2: satisfaction assessment
NB: The assessment below was done on the final version of the
B612 font. This final version therefore includes the latest improvements made as a result of the previously reported experiments.

A final experiment was done in order to collect information on how
the users felt, depending on the following conditions: 20 subjects
[HMI experts, ergonomists, pilots] had to choose between 2 cockpit
application versions; one was the original [using CDS typeface],
the other a copy using *B612* typeface – with a total of 29 pairs
of pages.

The figure ❹ shown presents the global results, all subjects included, organised according to the page displayed. On average the
subjects preferred the *B612* page 24.7 times out of 29, compared
with 4.3 times out of 29 for the CDS page. Concerning the results
for each page individually, the preference for the *B612* page varied
between 100% to 65%, the trend being 90%. The preferences did
not seem especially linked to particular page types; for example,
diagrams, alarms or forms.

The subjects also completed a questionnaire. The results show a
good response to the new typeface and comments on certain characters were collected, which could form the basis of a possible
typeface improvement phase. It is interesting to note that a lot of
the comments were regarding the implementation of the font within interfaces: for users the interface layout , on the prioritisation
of information, is unconsciously linked to the typeface which facilitates, or not, the readability. In general these display parameters
have been subject to criticism. So, whatever the intrinsic legibility
of *B612*, its implementation must fundamentally question the current display parameters. ■

❹ Subject preferences for
each presented page

Main characters

ABCDEFG
HIJKLMN
OPQRST
UVWXYZ
abcdefghi
jklmnopq
rstuvwxyz
01234
56789

Uppercase, lowercase and figures of the Regular version of the *B612* typeface.

Photo of the Regular Version of the *B612* typeface displayed on a screen at 20 pts.

B612 and its variants

An assessment of the current situation showed a large visual heterogeneity of cockpit interfaces. The typeface must include sufficient variation to enable the display of all information from every system and to ensure graphic consistency.

Four variants of *B612* typeface are available. The Regular version comes with a version in Italic, in Bold and in Bold Italic.

!?.,.:;...""'[/][\]{|}#$%&*@=+-
ABCDEFGHIJKLMNOPQRSTUV
WXYZabcdefghijklmnopqr
stuvwxyz0123456789
ÀÁÂÃÄÅÆàáâãäåæÇçÐÈÉÊË
èéêëÌÍÎÏìíîïÑñÒÓÔÕÖØŒ
òóôõöøœŠšÙÚÛÜùúûüÝŸýÿ

!?.,.:;...""'[/][\]{|}#$%&@=+-*
ABCDEFGHIJKLMNOPQRSTUV
WXYZabcdefghijklmnopqr
stuvwxyz0123456789
ÀÁÂÃÄÅÆàáâãäåæÇçÐÈÉÊË
èéêëÌÍÎÏìíîïÑñÒÓÔÕÖØŒ
òóôõöøœŠšÙÚÛÜùúûüÝŸýÿ

!?.,:;..."'[/][\]{|}#$%&*@=+-
ABCDEFGHIJKLMNOPQRSTUV
WXYZabcdefghijklmnopqr
stuvwxyz0123456789
ÀÁÂÃÄÅÆàáâãäåæÇçÐÈÉÊË
èéêëÌÍÎÏìíîïÑñÒÓÔÕÖØŒ
òóôõöøœŠšÙÚÛÜùúûüÝŸýÿ

BOLD
'Latin' Glyphs of the typeface
in its Bold version

!?.,:;..."'[/][\]{|}#$%&@=+-*
ABCDEFGHIJKLMNOPQRSTUV
WXYZabcdefghijklmnopqr
stuvwxyz0123456789
ÀÁÂÃÄÅÆàáâãäåæÇçÐÈÉÊË
èéêëÌÍÎÏìíîïÑñÒÓÔÕÖØŒ
òóôõöøœŠšÙÚÛÜùúûüÝŸýÿ

BOLD ITALIC
'Latin' Glyphs of the typeface
in its Bold Italic version

B612 Mono and its variants

The use of a monospaced typeface in interfaces is most often caused by technological constraints. Although the use of the proportional version is preferable to the monospaced version for everyday use, the monospaced version can be used in specific cases where the vertical word alignment is important.

This version is called *B612 Mono* – like the proportional version it is available in four variants; Regular, Italic, Bold, and Bold Italic.

!?.,:;…"' [/][\]{|}#$%&*@=+-
ABCDEFGHIJKLMNOPQRSTUV
WXYZabcdefghijklmnopqr
stuvwxyz0123456789
ÀÁÂÃÄÅÆàáâãäåæÇçÐÈÉÊË
èéêëÌÍÎÏìíîïÑñÒÓÔÕÖØŒ
òóôõöøœŠšÙÚÛÜùúûüÝŸýÿ

MONO REGULAR
'Latin' Glyphs of the typeface
in its Mono Regular version

!?.,:;…"' [/][\]{|}#$%&@=+-*
ABCDEFGHIJKLMNOPQRSTUV
WXYZabcdefghijklmnopqr
stuvwxyz0123456789
ÀÁÂÃÄÅÆàáâãäåæÇçÐÈÉÊË
èéêëÌÍÎÏìíîïÑñÒÓÔÕÖØŒ
òóôõöøœŠšÙÚÛÜùúûüÝŸýÿ

MONO ITALIC
'Latin' Glyphs of the typeface
in its Mono Italic version

!?.,:;…"' [/][\]{|}#$%&*@=+-
ABCDEFGHIJKLMNOPQRSTUV
WXYZabcdefghijklmnopqr
stuvwxyz0123456789
ÀÁÂÃÄÅÆàáâãäåæÇçÐÈÉÊË
èéêëÌÍÎÏìíîïÑñÒÓÔÕÖØŒ
òóôõöøœŠšÙÚÛÜùúûüÝŸýÿ

MONO BOLD
'Latin' Glyphs of the typeface
in its Mono Bold version

!?.,:;…"' [/][\]{|}#$%&*@=+-
ABCDEFGHIJKLMNOPQRSTUV
WXYZabcdefghijklmnopqr
stuvwxyz0123456789
ÀÁÂÃÄÅÆàáâãäåæÇçÐÈÉÊË
èéêëÌÍÎÏìíîïÑñÒÓÔÕÖØŒ
òóôõöøœŠšÙÚÛÜùúûüÝŸýÿ

MONO BOLD ITALIC
'Latin' Glyphs of the typeface
in its Mono Bold Italic version

Hinting

B^{612} is a typeface that has been created for digital media display: particular attention has been paid to screen rendering.

Digital typography is made up of vector curves ❶, The curves allow the typographer precise control over character drawing. Unfortunately, present day screens have a resolution which does not allow accurate display of the original drawing. When the screen displays a black character on a white background, the system calculates which pixels should be blackened to produce the best vector form. This stage is called character rasterization. This 'filling in' is done in a binary way. Pixels are either black or white ❷. The accuracy of the original drawing is lost and the glyph, upon closer inspection, has a serrated appearance.

To improve the appearance of the rasterized character, systems or software [Mac OS, Windows, Linux, MS Word, Illustrator, etc] apply smoothing algorithms - or antialiasing. These algorithms readjust the transparency of pixels forming the character [adding, if necessary] to create the illusion of a smooth line ❸.

This viewing process of converting vector curves to pixels is, in principle, handled automatically by the system. But the results calculated are not necessarily what is wanted from a typographical point of view.

The typographer can control a part of this process and include in the typography instructions [hints] to the system: this is called hinting. Hinting indicates to the system, and for each character whatever the size, how lines must be positioned relative to the pixel grid, and, as a result, how the drawing will be converted into pixels still remaining as close as possible to the original idea of the font.

The *B612* typeface is vectorially optimized for screen display, and full hinting has been added to all sizes of alphanumeric characters. However the display quality is still closely linked to smoothing algorithms. The rendering technology used when implementing should allow efficient smoothing [antialiasing] and guarantee optimal readability.
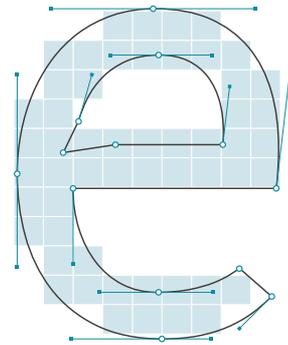
❶ A glyph formed by vector curves.
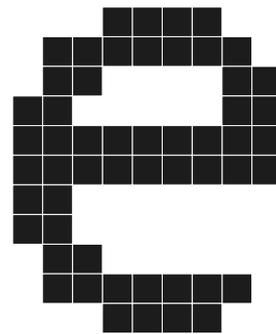
❷ The same glyph displayed on a grid of pixels in binary fashion.
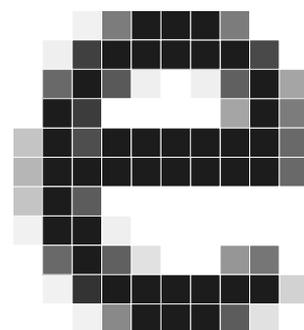
❸ The result once antialiasing is applied to the rasterized character

TrueType Preview

BBBBBBBBBBBBBBBBBB**B**B

Hinting of uppercase 'B'
using *Fontlab* software

Y: 144

Y: 153

Y: 162

YZ
XYZ
WXYZ
VWXYZ
UVWXYZ
TUVWXYZ
STUVWXYZ
STUVWXYZ
RSTUVWXYZ
QRSTUVWXYZ
QRSTUVWXYZ
QRSTUVWXYZ
PQRSTUVWXYZ
PQRSTUVWXYZ
PQRSTUVWXYZ
OPQRSTUVWXYZ
OPQRSTUVWXYZ
OPQRSTUVWXYZ
OPQRSTUVWXYZ
OPQRSTUVWXYZ
NOPQRSTUVWXYZ
NOPQRSTUVWXYZ
NOPQRSTUVWXYZ

5 6 7 8 9 : ; < = > ? @ A B C D E F G H I J K L M

Hinting — Regular

12 pts
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

14 pts
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

16 pts
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklm nopqrstuvwxyz
0123456789

18 pts
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

20 pts
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

22 pts
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklm nopqrstuvwxyz
0123456789

24 pts
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

26 pts
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

28 pts
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

'Hinted' characters of *B612* Regular typeface, without 'antialiasing'The following images were created on an operating system configured at 72ppi (pixels per inch). In this environment 20pts (pica) are equivalent to 20px (pixels) as 1pt is equal to 1/72nd of an inch

12 pts ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

14 pts ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

16 pts ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

18 pts ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

20 pts ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

22 pts ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

24 pts ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

26 pts ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

28 pts ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

'Hinted' characters of *B612* Regular typeface, with 'antialiasing' applied by *Adobe Illustrator* software.

Hinting — Bold

12 pts
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

14 pts
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

16 pts
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

18 pts
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

20 pts
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

22 pts
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

24 pts
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

26 pts
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

28 pts
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

12 pts ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

14 pts ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

16 pts ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

18 pts ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

20 pts ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

22 pts ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

24 pts ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

26 pts ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

28 pts ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

List of typographic signs by theme

Upper/lower case & figures

A	B	C	D	E	F	G	H
0041	0042	0043	0044	0045	004	0047	0048
I	J	K	L	M	N	O	P
0049	004A	004B	004C	004D	004E	004F	005
Q	R	S	T	U	V	W	X
0051	0052	0053	0054	0055	0056	005	0058
Y	Z						
0059	005A						

a	b	c	d	e	f	g	h
0061	0062	0063	0064	0065	0066	0067	0068
i	j	k	l	m	n	o	p
0069	006A	006B	006C	006D	006E	006F	0070
q	r	s	t	u	v	w	x
0071	0072	0073	0074	0075	0076	0077	0078
y	z						
0079	007A						

0	1	2	3	4	5	6	7
0030	0031	0032	0033	0034	0035	0036	0037
8	9	0					
0038	0039	E007					

Punctuation & symbols

.	:	⋮	,	;	…	!	?
002E	003A	22EE	002C	003B	2026	0021	003F

[	]	[	]	{	}	-	‐
0028	0029	005B	005D	007B	007D	002D	2010

–	―	—	‾	·	●	▶	'
2013	2015	2014	00AF	00B7	2022	2023	0027

'	'	"	"			"	‟
2018	2019	201C	201D			0022	02DD

‚	„					
201A	005A					

‹	›	«	»	*	⁑	⁂	§
2039	203A	00AB	00BB	002A	2051	2042	00A7

¶	#	&	@	€	$	¥	₹
00B6	0023	0026	0040	20AC	0024	00A5	20B9

£	ƒ	¢	¤	†	‡	©	®
00A3	0192	00A2	00A4	2020	2021	00A9	00AE

™	¡	¿	ß	Đ	ð	Þ	þ
2122	00A1	00BF	00DF	00D0	00F0	00DE	00FE

Accents & ligatures

`	´	ˆ	ˇ	˜	¨	˝	·
0060	00B4	02C6	02C7	02DC	00A8	02D8	02D9

˚	^	¸	˛	À	Á	Â	Ã
02DA	005E	00B8	02DB	00C0	00C1	00C2	00C3

Ä	Å	à	á	â	ã	ä	å
00C4	00C5	00E0	00E1	00E2	00E3	00E4	00E5

Ç	ç	È	É	Ê	Ë	è	é
00C7	00E7	00C8	00C9	00CA	00CB	00E8	00E9

ê	ë	Ì	Í	Î	Ï	ì	í
00EA	00EB	00CC	00CD	00CE	00CF	00EC	00ED

î	ï	Ñ	ñ	Ò	Ó	Ô	Õ
00EE	00EF	00D1	00F1	00D2	00D3	00D4	00D5

Ö	Ø	ò	ó	ô	õ	ö	ø
00D6	00D8	00F2	00F3	00F4	00F5	00F6	00F8

Ù	Ú	Û	Ü	ù	ú	û	ü
00D9	00DA	00DB	00DC	00F9	00FA	00FB	00FC

Ý	Ÿ	ý	ÿ	Š	š	Æ	æ
00DD	0178	00FD	00FF	0160	0161	00C6	00E6

Œ	œ	ff	fi	fl	st		
0152	0153	FB00	FB01	FB02	FB06		

Greek alphabet & roman numerals

Α	Β	Γ	Δ	Ε	Ζ	Η	Θ
0391	0392	0393	0394	0395	0396	0397	0398
Ι	Κ	Λ	Μ	Ν	Ξ	Ο	Ρ
0399	039A	039B	039C	039D	039E	039F	03A1
Σ	Τ	Υ	Φ	Χ	Ψ	Ω	
03A3	03A4	03A5	03A6	03A7	03A8	03A9	
α	β	γ	δ	ε	ζ	η	θ
03B1	03B2	03B3	03B4	03B5	03B6	03B7	03B8
ι	κ	λ	μ	ν	ξ	ο	π
03B9	03BA	03BB	03BC	03BD	03BE	03BF	03C0
ς	σ	τ	υ	φ	χ	ψ	ω
03C2	03C3	03C4	03C5	03C6	03C7	03C8	03C9
ϑ	ϒ	φ	ϖ				
03D1	03D2	03D5	03D6				

Ⅰ	Ⅱ	Ⅲ	Ⅳ	Ⅴ	Ⅵ	Ⅶ	Ⅷ
2170	2171	2172	2173	2174	2175	2176	2177
Ⅸ	Ⅹ	Ⅺ	Ⅻ	Ⅰ	Ⅱ	Ⅲ	Ⅳ
2178	2179	217A	217B	2160	2161	2162	2163
Ⅴ	Ⅵ	Ⅶ	Ⅷ	Ⅸ	Ⅹ	Ⅺ	Ⅻ
2164	2165	2166	2167	2168	2169	216A	216B

31

Subscripts & exponents

a	o	i	n	1	2	3	4
0060	00B4	02C6	02C7	02DC	00A8	02D8	02D9

5	6	7	8	9	0	+	=
02DA	005E	00B8	02DB	00C0	00C1	00C2	00C3

–	[	]
00C4	00C5	00E0

1	2	3	4	5	6	7	8
00C7	00E7	00C8	00C9	00CA	00CB	00E8	00E9

9	+	=	–	[	]
00EA	00EB	00CC	00CD	00CE	00CF

Mathematics & measurement

+	−	✕	÷	=	∼	≃	≅
002B	2212	00D7	00F7	003D	223C	2243	2245
≈	≙	≠	≡	±	∓	≤	≥
2248	2259	2260	2261	00B1	2213	2264	2265
<	>	|	¦	‖	⊥	⊲	⊕
003C	003E	007C	00A6	2016	22A5	2222	2295
⊖	⊗	⊘	∝	∞	√	~	∘
2296	2297	2298	221D	221E	221A	007E	2218
¬	∴	∵	∂	∃	∄	∅	∁
00AC	2234	2235	2202	2203	2204	2205	2201
∫	∮	∇	∀	∧	∨	∩	∪
222B	222E	2207	2200	2227	2228	2229	222A
⊂	⊃	⊆	⊇	∈	∉	∋	∌
2282	2283	2286	2287	2208	2209	220B	220C
%	‰	‱	¼	½	¾	⅓	
0025	2030	2031	00BC	00BD	00BE	2153	
⅔	⅕	⅖	⅗	⅘	⅙	⅚	⅛
2154	2155	2156	2157	2158	2159	215A	215B
⅜	⅝	⅞	⅟				
215C	215D	215E	215F				

′ ″ ‴ ‵ ° ℃ ℉ µ

2032	2033	2034	2035	00B0	2103	2109	
							00B5

Ω ℓ ℘ ℴ ℑ ℜ ℵ

03A9	2113	2118	2134	2111	211C	2135

Circled figures

① ② ③ ④ ⑤ ⑥ ⑦ ⑧

2780	2781	2782	2783	2784	2785	2786	2787

⑨ ⓪ ➊ ➋ ➌ ➍ ➎ ➏

2788	2189	278A	278B	278C	278D	278E	278F

➐ ➑ ➒ ➓

2790	2791	2792	2793
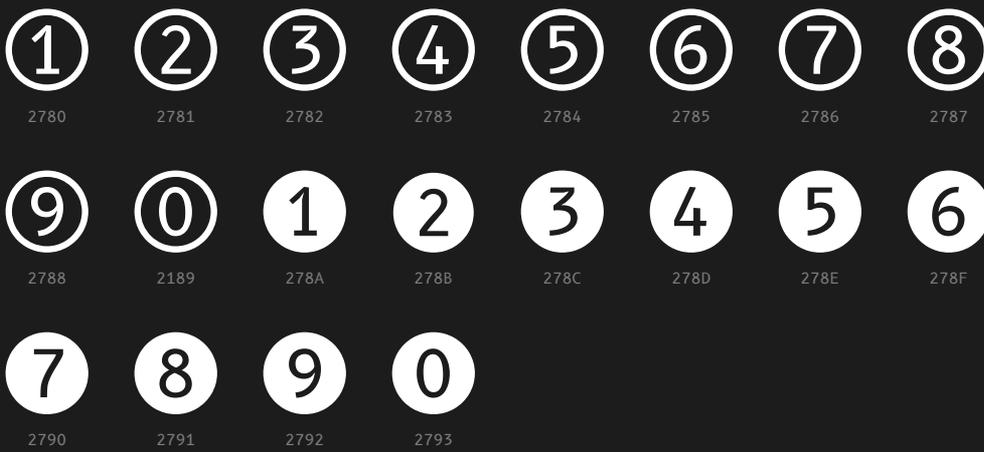
Arrows & directions

⇧	⇪	⇞	⇟	↶	↷	↻	‾
21E7	21EA	21DE	21DF	21B6	21B7	E0B2	005F
/	\	⌈	⌉	⌊	⌋	⌜	⌝
002F	005C	2308	2309	230A	230B	231C	231D
⌞	⌟	▶	▷	▸	▹	▼	▽
231E	231F	25B6	25B7	25B8	25B9	25BC	25BD
▾	▿						
25BE	25BF						
←	↑	→	↓	↔	↕	↖	↗
2190	2191	2192	2193	2194	2195	2196	2197
↘	↙	↩	↪	↳	↵	↶	↷
2198	2199	21A9	21AA	21B3	21B5	21B6	21B7
⇐	⇑	⇒	⇓	⇔	⇕	⇖	⇗
21D0	21D1	21D2	21D3	21D4	21D5	21D6	21D7
⇘	⇙	⇠	⇡	⇢	⇣	➔	
21D8	21D9	21E0	21E1	21E2	21E3	2794	
◉	◎	●	◐	◑	◒	◓	
25C9	25CE	25CF	25D0	25D1	25D2	25D3	

General & special pictograms

In addition to the general symbols already present in classic typefaces, a range of specific aeronautic pictograms has been added to *B612*. These pictograms, used in cockpit HMI, aim at the clarification and standardization of common functions between tools. They have been classified in the table UNICODE Private Use Area (E000) – cf. page 47.

General pictograms

2302	2600	263E	2601	2602	2603	260E	22C6
2605	2660	2661	2663	2662	2690	2691	26A0
E0B1	2639	263A	2709				
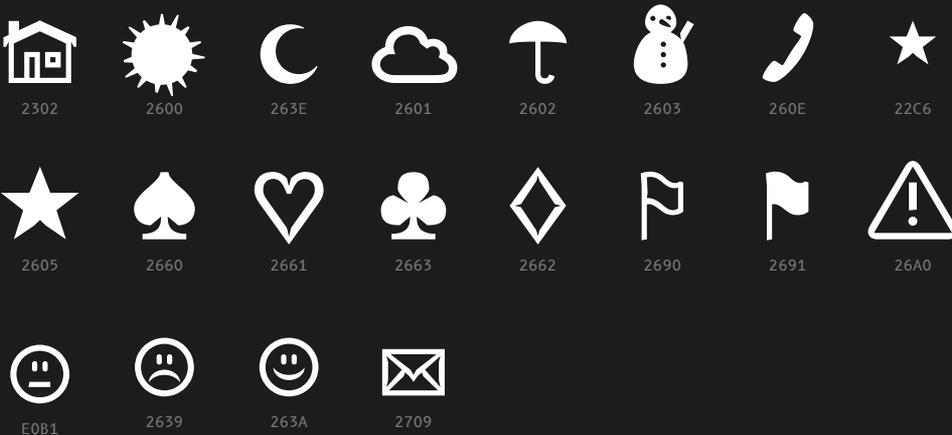
Specific pictograms: avionics

2708	E000	E001	E002	E003	E004	E005	E006
PLANE	TAKE OFF	CLIMB	CRUISE	DESCENT	LANDING	LEVEL UP	LEVEL DOWN

Specific pictograms: weather

E020	E021	E022	E023	E024	E025	E026	E027
HOT	COLD	DRY	WET	SLUSH	ICE	LIGHTNING	FOG
E028	E029	26A1					
WIND	WINDBARB	HIGH VOLTAGE					

Specific pictograms: telecommunications

E063	E064	E065	E066	E067	E068	E069	E06A
MAIL IN	MAIL OUT	SLASHED MAIL	WIFI IN	WIFI OUT	SLASHED WIFI	COMSAT IN	COMSAT OUT

E06B	E06C	E06D	E06E	E060	E061	E062
SLASHED COMSAT	RADIO IN	RADIO OUT	SLASHED RADIO	PHONE IN	PHONE OUT	SLASHED PHONE

Specific pictograms: computer science

E08E	E083	E084	E085	E086	E087	E088	E089
STANDBY	EJECT	PLAY	REWIND	PAUSE	STOP	START	END

E08C	E08D	E0A0	E0A1	E080	E081	E082	E0A5
BACK	NEXT	ZOOM IN	ZOOM OUT	SLASHED SPEAKER	SPEAKER LOW	SPEAKER HIGH	TRASH

E0A6	E0A7	E0A8	E0A9	E0AA	E0AB	E0A3	E0A2
IMPORT	EXPORT	SEND	RETURN	COPY	PASTE	ERASE	SAVE

E0A4	E040	E041	E042	E043	E0AF	E0B0	E0D0
PRINT	HOURGLASS	CLOCK	CLOCKWISE	COUNTER CLOCKWISE	HELP	INFO	NO ENTRY

E0D1	E0AC	E0AD	E0AE	2610	2611	2612	2713
NO PARKING	CLOSE	SUPPR	ADD	EMPTY BOX	BOX WITH A CHECK	BOX WITH A X	CHECK MARK

Examples of use 1/3
Technical texts

APU engine

The APU has two rotors:

› The Low Pressure (LP) rotor

   The LP provides power for bleed air and electrical generation. The N1 indication on the ECAM indicates the rotation speed of the power rotor.

   • The LP is made of a turbine that drives the load compressor. The air compressed by the load compressor is delivered to the aircraft's bleed air system.
   • The LP is connected to a shaft that drives the two APU electrical generators.

› The High Pressure (HP) rotor

   The HP rotor provides power to the power rotor.

   The N2 indication on the ECAM indicates the rotation speed of the HP rotor.
 The APU drives two APU generators (APU GEN A and B). When the APU is running, it simultaneously drives both generators that provide power **at a constant frequency** of 400 Hz. Each generator can provide a power of 120 KVA. Any APU generator can replace any engine generator (within the APU operational envelope). Two APU generators can supply the entire aircraft network.

Dynamical system

A dynamical system is a manifold M called the phase (or state) space endowed with a...

1. No likeness or description of Euclid's physical appearance made during his lifetime survived antiquity. Therefore, Euclid's depiction in works of art depends on the artist's imagination (see *Euclid*).

2. "mathematics, n.". *Oxford English Dictionary*. Oxford University Press. 2012. Retrieved June 16, 2012. "The science of space, number, quantity, and arrangement, whose methods involve logical reasoning and usually the use of symbolic notation, and which includes geometry, arithmetic, algebra, and analysis."

3. Kneebone, G.T. (1963). *Mathematical Logic and the Foundations of Mathematics: An Introductory Survey*. Dover. pp. 4. ISBN 0486417123. "Mathematics...is simply the study of abstract structures, or formal patterns of connectedness."

4. LaTorre, Donald R., John W. Kenelly, Iris B. Reed, Laurel R. Carpenter, and Cynthia R Harris (2011). *Calculus Concepts: An Informal Approach to the Mathematics of Change*. Cengage Learning. pp. 2. ISBN 1439049572. "Calculus is the study of change—how things change.

Examples of use 2/3
Lists & formulas

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$\sum_{i=0}^{\infty} x_i$$

$$\delta_{ij} = \begin{cases} 1, & \text{if } i = j \\ 0, & \text{if } i \neq j \end{cases}$$

KJUIO58DDFVC215	542	013	20.05	**OT**
FGJRS45ZSZC44DF	569	130	05.10	**OP**
FHCBZH44597DZD4	741	078	00.09	**UI**
BCRYTUXD456D899	634	215	12.14	*TO*
FGJERS48862SFD5	458	001	84.89	**IT**
SCBVKES452C1EZ2	378	096	17.46	*UT*
SCSJ478XCG2SGHM	845	154	23.01	**PO**
5454GHDDFG97D45	572	045	24.08	**OL**
DGBVTUSFG11D2EF	635	003	10.00	*MP*
GUUIGF555R14D0F	478	009	74.23	**LO**
HB4G5TF6F6B5T41	856	248	26.35	*MI*

Examples of use 3/3
Abbreviated terms, acronyms & numbers

345

340   000   020   040

320

300

280

270

260

240

220

200   180   160   140

040

060

080

090

100

120

0   100

POV

53.2

0   30 000

TM

6410

40%

10%

50%

300

150

.05

.10

.15

0
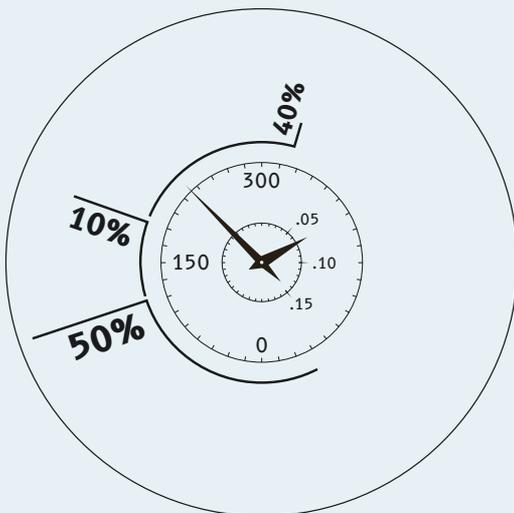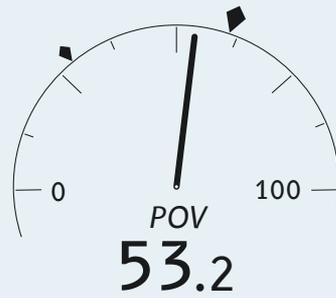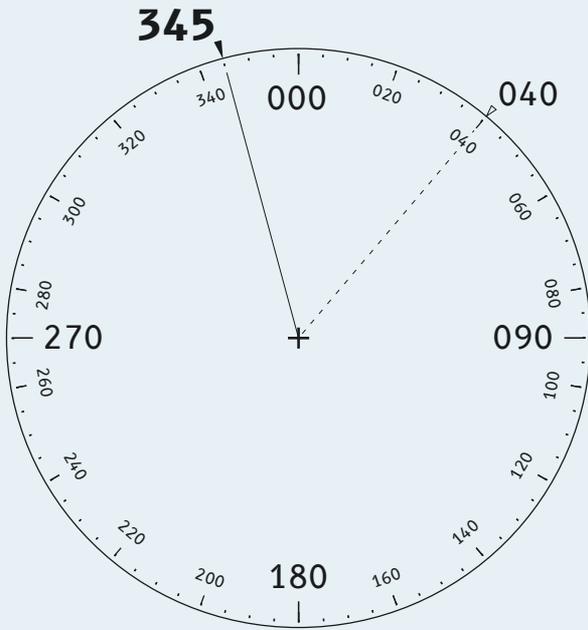
List of glyphs classified according to the unicode index

0000 | Basic Latin

space 0020	exclam 0021	quotedbl 0022	numbersign 0023	dollar 0024	percent 0025	ampersand 0026	quotesingle 0027
	!	"	#	$	%	&	'

parenleft 0028	parenright 0029	asterisk 002A	plus 002B	comma 002C	hyphen 002D	period 002E	slash 002F
(	)	*	+	,	-	.	/

0 0030	1 0031	2 0032	3 0033	4 0034	5 0035	6 0036	7 0037
0	1	2	3	4	5	6	7

8 0038	9 0039	colon 003A	semicolon 003B	less 003C	equal 003D	greater 003E	question 003F
8	9	:	;	<	=	>	?

at 0040	A 0041	B 0042	C 0043	D 0044	E 0045	F 0046	G 0047
@	A	B	C	D	E	F	G

H 0048	I 0049	J 004A	K 004B	L 004C	M 004D	N 004E	O 004F
H	I	J	K	L	M	N	O

P 0050	Q 0051	R 0052	S 0053	T 0054	U 0055	V 0056	W 0057
P	Q	R	S	T	U	V	W

X 0058	Y 0059	Z 005A	bracketleft 005B	backslash 005C	bracketright 005D	asciicircum 005E	underscore 005F
X	Y	Z	[	\	]	^	_

grave	a	b	c	d	e	f	g
0060	0061	0062	0063	0064	0065	0066	0067
`	a	b	c	d	e	f	g

h	i	j	k	l	m	n	o
0068	0069	006A	006B	006C	006D	006E	006F
h	i	j	k	l	m	n	o

p	q	r	s	t	u	v	w
0070	0071	0072	0073	0074	0075	0076	0077
p	q	r	s	t	u	v	w

x	y	z	braceleft	bar	braceright	asciitilde	
0078	0079	007A	007B	007C	007D	007E	
x	y	z	{	|	}	~	

0080 | Latin-1

nbspace	exclamdown	cent	sterling	currency	yen	brokenbar	section
00A0	00A1	00A2	00A3	00A4	00A5	00A6	00A7
	¡	¢	£	¤	¥	¦	§

dieresis	copyright	ordfeminine	guillemotleft	logicalnot	sfthyphen	registered	macron
00A8	00A9	00AA	00AB	00AC	00AD	00AE	00AF
¨	©	ª	«	¬		®	¯

degree	plusminus	twosuperior	threesuperior	acute	mu	paragraph	periodcentered
00B0	00B1	00B2	00B3	00B4	00B5	00B6	00B7
°	±	2	3	´	μ	¶	·

cedilla	onesuperior	ordmasculine	guillemotright	onequarter	onehalf	threequarters	questiondown
00B8	00B9	00BA	00BB	00BC	00BD	00BE	00BF
¸	1	º	»	¼	½	¾	¿

Agrave	Aacute	Acircumflex	Atilde	Adieresis	Aring	AE	Ccedilla
00C0	00C1	00C2	00C3	00C4	00C5	00C6	00C7
À	Á	Â	Ã	Ä	Å	Æ	Ç

Egrave	Eacute	Ecircumflex	Edieresis	Igrave	Iacute	Icircumflex	Idieresis
00C8	00C9	00CA	00CB	00CC	00CD	00CE	00CF
È	É	Ê	Ë	Ì	Í	Î	Ï

Eth	Ntilde	Ograve	Oacute	Ocircumflex	Otilde	Odieresis	multiply
00D0	00D1	00D2	00D3	00D4	00D5	00D6	00D7
Ð	Ñ	Ò	Ó	Ô	Õ	Ö	×

Oslash	Ugrave	Uacute	Ucircumflex	Udieresis	Yacute	Thorn	germandbls
00D8	00D9	00DA	00DB	00DC	00DD	00DE	00DF
Ø	Ù	Ú	Û	Ü	Ý	Þ	ß

agrave	aacute	acircumflex	atilde	adieresis	aring	ae	ccedilla
00E0	00E1	00E2	00E3	00E4	00E5	00E6	00E7
à	á	â	ã	ä	å	æ	ç

egrave	eacute	ecircumflex	edieresis	igrave	iacute	icircumflex	idieresis
00E8	00E9	00EA	00EB	00EC	00ED	00EE	00EF
è	é	ê	ë	ì	í	î	ï

eth	ntilde	ograve	oacute	ocircumflex	otilde	odieresis	divide
00F0	00F1	00F2	00F3	00F4	00F5	00F6	00F7
ð	ñ	ò	ó	ô	õ	ö	÷

degree	plusminus	twosuperior	threesuperior	acute	mu	paragraph	periodcentered
00B0	00B1	00B2	00B3	00B4	00B5	00B6	00B7
°	±	2	3	´	µ	¶	·

oslash	ugrave	uacute	ucircumflex	udieresis	yacute	thorn	ydieresis
00B8	00B9	00BA	00BB	00BC	00BD	00BE	00BF
ø	ù	ú	û	ü	ý	þ	ÿ

0100 | Latin Extended-A
0180 | Latin Extended-B

OE	oe	Scaron	scaron	Ydieresis		florin
0152	0153	0160	0161	0178		0192
Œ	œ	Š	š	Ÿ		ƒ

02B0 | Spacing Modifier Letters

circumflex	caron	breve	dotaccent	ring	ogonek	tilde	hungarumlaut
02C6	02C7	02D8	02D9	02DA	02DB	02DC	02DD
ˆ	ˇ	˘	˙	˚	˛	˜	˝

0370 | Greek And Coptic

Alpha	Beta	Gamma	Deltagreek	Epsilon	Zeta	Eta
0391	0392	0393	0394	0395	0396	0397
Α	Β	Γ	Δ	Ε	Ζ	Η

Theta	Iota	Kappa	Lambda	Mu	Nu	Xi	Omicron
0398	0399	039A	039B	039C	039D	039E	039F
Θ	Ι	Κ	Λ	Μ	Ν	Ξ	Ο

Rho	Sigma	Tau	Upsilon	Phi	Chi	Psi	Omegagreek
03A1	03A3	03A4	03A5	03A6	03A7	03A8	03A9
Ρ	Σ	Τ	Υ	Φ	Χ	Ψ	Ω

alpha	beta	gamma	delta	epsilon	zeta	eta	theta
03B1	03B2	03B3	03B4	03B5	03B6	03B7	03B8
α	β	γ	δ	ε	ζ	η	θ

iota	kappa	lambda	mugreek	nu	xi	omicron	pi
03B9	03BA	03BB	03BC	03BD	03BE	03BF	03C1
ι	κ	λ	μ	ν	ξ	ο	π

sigma1	sigma	tau	upsilon	phi	chi	psi	omega
03C2	03C3	03C4	03C5	03C6	03C7	03C8	03C9
ς	σ	τ	υ	φ	χ	ψ	ω

theta1	Upsilon1	phi1	omega1
03D1	03D2	03D5	03D6
ϑ	ϒ	ϕ	ϖ

2000 | General Punctuation

hyphentwo	endash	emdash	quotationdash	doubleverticalline	quoteleft	quoteright	quotesinglbase
2010	2013	2014	2015	2016	2018	2019	201A
-	—	——	—	‖	'	'	,

quotedblleft	quotedblright	quotedblbase	dagger	daggerdbl	bullet	triangularbullet	ellipsis
201C	021D	201E	2020	2021	2022	2023	2026
"	"	„	†	‡	●	▶	•••

perthousand	pertenthousandsign	prime	doubleprime	tripleprime	reversedprime	guilsinglleft	guilsinglright
2030	2031	2032	2033	2034	2035	2039	203A
‰	‰o	′	″	‴	‵	‹	›

asterism	twoasterisksvertica
2042	2051
***	*

2070 | Superscripts And Subscripts

zerosuperior	ismallsuperior	foursuperior	fivesuperior	sixsuperior	sevensuperior	eightsuperior	ninesuperior
2070	2071	2074	2075	2076	2077	2078	2079
0	i	4	5	6	7	8	9

plussuperior	minussuperior	equalsuperior	parenleftsuperior	parenrightsuperior	nsuperior	zeroinferior	oneinferior
207A	207B	207C	207D	207E	207F	2080	2081
+	−	=	(	)	n	0	1

twoinferior	threeinferior	fourinferior	fiveinferior	sixinferior	seveninferior	eightinferior	nineinferior
2082	2083	2084	2085	2086	2087	2088	2089
2	3	4	5	6	7	8	9

plusinferior	minusinferior	equalinferior	parenleftinferior	parenrightinferior
208A	208B	208C	208D	208E
+	−	=	(	)

20A0 | Currency Symbols

Euro	indianrupee
20AC	20B9
€	₹

2100 | Letterlike Symbols

centigrade	fahrenheit	Ifraktur	lsquare	weierstrass	Rfraktur	trademark	Ohm
2103	2109	2111	2113	2118	211C	2122	2126
℃	℉	ℑ	ℓ	℘	ℜ	™	Ω

angstrom	scriptsmallo	aleph
212B	2134	2135
Å	ℴ	ℵ

2150 | Number Forms

onethirds	twothirds	onefifth	twofifths	threefifths	fourfifths	onesixth	fivesixths
2153	2154	2155	2156	2157	2158	2159	215A
⅓	⅔	⅕	⅖	⅗	⅘	⅙	⅚

oneeighth	threeeighths	fiveeighths	seveneighths	fractionnumeratorone	Oneroman	Tworoman	Threeroman
215B	215C	215D	215E	215F	2160	2161	2162
⅛	⅜	⅝	⅞	⅟	Ⅰ	Ⅱ	Ⅲ

Fourroman	Fiveroman	Sixroman	Sevenroman	Eightroman	Nineroman	Tenroman	Elevenroman
2163	2164	2165	2166	2167	2168	2169	216A
Ⅳ	Ⅴ	Ⅵ	Ⅶ	Ⅷ	Ⅸ	Ⅹ	Ⅺ

Twelveroman	oneroman	tworoman	threeroman	fourroman	fiveroman	sixroman	sevenroman
216B	2170	2171	2172	2173	2174	2175	2176
Ⅻ	ⅰ	ⅱ	ⅲ	ⅳ	ⅴ	ⅵ	ⅶ

eightroman	nineroman	tenroman	elevenroman	twelveroman
2177	2178	2179	217A	217B
VIII	IX	X	XI	XII

2190 | Arrows

arrowleft	arrowup	arrowright	arrowdown	arrowboth	arrowupdn	arrowupleft	arrowupright
2190	2191	2192	2193	2194	2195	2196	2197
←	↑	→	↓	↔	↕	↖	↗

arrowdownright	arrowdownleft	leftwards arrowwithhook	rightwards arrowwithhook	downwardsarrow withtiprightwards	carriagereturn	undo	redo
2198	2199	21A9	21AA	21B3	21B5	21B6	21B7
↘	↙	↩	↪	↳	↵	↶	↷

arrowdblleft	arrowdblup	arrowdblright	arrowdbldown	arrowdbl leftright	arrowdbl updown	arrowdbl northwest	arrowdbl northeast
21D0	21D1	21D2	21D3	21D4	21D5	21D6	21D7
⇐	⇑	⇒	⇓	⇔	⇕	⇖	⇗

arrowdbl southeast	arrowdbl southwest	pageup	pagedown	leftwards dashedarrow	upwards dashedarrow	rightwards dashedarrow	downwards dashedarrow
21D8	21D9	21DE	21DF	21E0	21E1	21E2	21E3
⇘	⇙	⇞	⇟	⇠	⇡	⇢	⇣

shift	capslock
21E7	21EA
⇧	⇪

2200 | Mathematical Operators

universal	complement	partialdiff	existential	theredoesnotexist	emptyset	gradient	element
2200	2201	2202	2203	2204	2205	2207	2208
∀	∁	∂	∃	∄	∅	∇	∈

notelement	suchthat	doesnotcontain asmember	minus	minusplus	ringoperator	radical	proportional
2209	220B	220C	2212	2213	2218	221A	221D
∉	∋	∌	−	∓	∘	√	∝

infinity	sphericalangle	parallelto	logicaland	logicalor	intersection	union	integral
221E	2222	2225	2227	2228	2229	222A	222B
∞	⊲	∥	∧	∨	∩	∪	∫

contourintegral	therefore	because	similar	asymptoticallyequal	congruent	approxequal	estimate
222E	2234	2235	223C	2243	2245	2248	2259
∮	∴	∵	∼	≃	≅	≈	≙

notequal	equivalence	lessequal	greaterequal	propersubset	propersuperset	reflexsubset	reflexsuperset
2260	2261	2264	2265	2282	2283	2286	2287
≠	≡	≤	≥	⊂	⊃	⊆	⊇

circleplus	circleminus	circlemultiply	circledivide	perpendicular	staroperator	verticalellipsis	
2295	2296	2297	2298	22A5	22C6	22EE	
⊕	⊖	⊗	⊘	⊥	⋆	⋮	

2300 | Miscellaneous Technical

house	leftceiling	rightceiling	leftfloor	rightfloor	topleftcorner	toprightcorner	bottomleftcorner
2302	2308	2309	230A	230B	231C	231D	231E
⌂	⌈	⌉	⌊	⌋	⌜	⌝	⌞

bottomrightcorner
231F
⌟

25A0 | Geometric Shapes

blackright pointingtriangle	whiteright pointingtriangle	blackright pointingsmall	whiteright pointingsmall	blackdown pointingtriangle	whitedown pointingtriangle	blackdownpointing smalltriangle	whitedownpointing smalltriangle
25B6	25B7	25B8	25B9	25BC	25BD	25BE	25BF
▶	▷	▸	▹	▼	▽	▾	▿

fisheye	bullseye	blackcircle	circlewithleft halfblack	circlewithright halfblack	circlewith lowerhalfblack	circlewith upperhalfblack	
25C9	25CE	25CF	25D0	25D1	25D2	25D3	
◉	◎	●	◐	◑	◒	◓	

2600 | Miscellaneous Symbols

day	cloud	umbrella	snowman	blackstar	phone	emptybox	boxwithacheck
2600	2601	2602	2603	2605	260E	2610	2611
☀	☁	☂	☃	★	☎	☐	☑

boxwithax	frowningface	smileface	sun	night	spade	heartsuitwhite	diamondsuitwhite
2612	2639	263A	263C	263E	2660	2661	2662
☒	☹	☺	☼	☾	♠	♡	♢

club	flag1	flag2	warning	highvoltage
2663	2690	2691	26A0	26A1
♣	⚐	⚑	⚠	⚡

2700 | Dingbats

plane	mail	checkmark	whitecircledone	whitecircledtwo	whitecircledthree	whitecircledfour	whitecircledfive
2708	2709	2713	2780	2781	2782	2783	2784
✈	✉	✓	①	②	③	④	⑤

whitecircledsix	whitecircledseven	whitecircledeight	whitecirclednine	whitecircledzero	blackcircledone	blackcircledtwo	blackcircledthree
2785	2786	2787	2788	2789	278A	278B	278C
⑥	⑦	⑧	⑨	⓪	❶	❷	❸

blackcircledfour	blackcircledfive	blackcircledsix	blackcircledseven	blackcircledeight	blackcirclednine	blackcircledzero	widerightwards arrow
278D	278E	278F	2790	2791	2792	2793	2794
❹	❺	❻	❼	❽	❾	⓿	→

FB00 | Alphabetic Presentation Forms

ff	fi	fl	ffi	ffl	ft	st
FB00	FB01	FB02	FB03	FB04	FB05	FB06
ﬀ	ﬁ	ﬂ	ﬃ	ﬄ	ﬅ	ﬆ

E000 | Private Use Area

takeoff	climb	cruise	descent	landing	levelup	leveldown	slashedzero
E000	E001	E002	E003	E004	E005	E006	E007

hot	cold	dry	wet	slush	ice	lightning	fog
E020	E021	E022	E023	E024	E025	E026	E027

wind	windbarb	hourglass	clock	clockwise	counterclockwise	phonein	phoneout
E028	E029	E040	E041	E042	E043	E060	E061

slashedphone	mailin	mailout	slashedmail	wifiin	wifiout	slashedwifi	comsatin
E062	E063	E064	E065	E066	E067	E068	E069

comsatout	slashedcomsat	radioin	radioout	slashedradio	slashedspeaker	speakerlow	speakerhigh
E06A	E06B	E06C	E06D	E06E	E080	E081	E082

eject	play	rewind	pause	stop	start	end	fastrewind
E083	E084	E085	E086	E087	E088	E089	E08A

fastforward	back	next	standby	zoomin	zoomout	save	erase
E08B	E08C	E08D	E08E	E0A0	E0A1	E0A2	E0A3

print	trash	import	export	send	return	copy	paste
E0A4	E0A5	E0A6	E0A7	E0A8	E0A9	E0AA	E0AB

close	suppr	add	help	info	smileyneutral	update	noentry
E0AC	E0AD	E0AE	E0AF	E0B0	E0B1	E0B2	E0D0

Colophon