Graphical user interfaces are used almost everywhere today. In a typical day you may interact with several different types of interfaces: gas pump, car stereo, self-checkout machine, ATM, printer, MP3 player, etc.

A graphical user interface (GUI) is what a user sees and interacts with. GUls are used for many industrial applications via keypad, mouse or touch screen.

Designing a user interface that is easy-to-understand yet accomplishes the necessary tasks is critical. A well-designed interface will not only make it easier for the end user, it may also reduce training and support costs for the organization.

The purpose of this white paper is to highlight the best practices of designing a GUI for a touch screen display.

Collecting User Information
Before you begin designing an interface, gather as much information as possible about the end user and the functions they are expected to perform. Below are some questions to address before you begin designing a user interface:

- Who is the end user (i.e., demographics, knowledge level and language spoken)?
- How frequently will the end user interact with the interface?
- Will the end user be sitting, standing, stationary or walking when using the interface?
- Will the display be viewed in sunlight?
- At what angle or distance will the display be viewed?
- Will the user be wearing gloves or interacting with a device while using the touch screen?
- Will the user likely touch the touch screen with handy items, such as car keys or credit cards?
- What are the key objectives the interface must perform?
- Can you test your design before going live?
- Once live, what kind of technical support will be available?
**Best Practice Guidelines**

The use of color, text, icons and buttons can direct the user’s attention to the most important or most often used items on the screen. Screen layout should be easy-to-use, highly legible and intuitive while performing the necessary functions. The major components of a well-organized interface are color, font, icons/images, layout and navigation.

**Color**

The use of color in an application is a very powerful means of communication. Color can show direction, relationship or highlight functions on the screen. People often find it easier to learn and remember when color is properly used (e.g., red=stop, green=go).

- Use color consistently throughout your application to maintain a common look and feel.
- Choose contrasting colors such as dark text on light backgrounds and light text on dark backgrounds. Our experience has shown dark text on a light-colored background is easiest to read.
- Keep in mind that colors can represent different things in other cultures. Read Jennifer Kyrnin’s *Color Symbolism Chart by Culture* http://webdesign.about.com/od/color/a/bl_colorculture.htm
- Use a light background color to hide fingerprints and reduce glare.
- Add supporting text to help communicate; some users may have a color-vision deficiency (color blindness).

![Figure 1: Good use of color](image1.png)

![Figure 2: Poor use of color](image2.png)
Font
Depending upon your font type and size, screen size, display resolution and dot pitch, text must always be legible.

- Choose a san serif font.
- Avoid using script or decorative fonts.
- Consider the user when choosing the point size of the font. In general, 10 point size is the smallest recommended size.
- Increase the point size if the user is referencing the interface from a distance.
- Use a mix of upper- and lower-case letters. Letters in all upper-case are difficult to read.

<table>
<thead>
<tr>
<th>Easy to read:</th>
<th>More difficult to read:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helvetica (10 point)</td>
<td>Garamond (10 point)</td>
</tr>
<tr>
<td>Helvetica (14 point)</td>
<td>GARAMOND (14 point)</td>
</tr>
</tbody>
</table>

Figure 3: Font examples

Images
Images and icons are great ways to help communicate large amounts of data and add visual appeal to your application.

- Use a good mix of images or icons along with supporting text.
- Universal icons (as the ones shown below) help in communicating to users from various backgrounds.
- The touchable area of an image or button should be large enough for all different sized finger tips. A standard recommended button size is 20 mm x 20 mm (3/4 x 3/4 inch) with 3 mm (1/8 inch) spaces between buttons. Buttons may need to be larger if users need to wear gloves.

Figure 4: Examples of universal icons

Sound
The use of sound can help enhance the user experience and help alert the user of an important action. Sound cues direct attention instantly and should be used logically. For instance, a buzzer or alarm can indicate dangerous levels. A musical cue might be used to signify a completed task. If sound is used, make sure the user can easily adjust the volume.
Haptic Technology
Haptic technology provides information to the end user through the sense of touch. This refers to vibrations the user feels when they touch a particular button on a touch screen. Commonly used in video games, haptic feedback can help communicate with the user, especially in noisy environments.

Layout and Navigation
A well organized, easy-to-navigate interface improves the user’s experience. Similar to a well designed website, you want the user to find their desired information in as few clicks as possible.

- Run the application at full screen.
- Group similar tasks together and in a logically organized fashion. This helps the user find relevant information quickly and allows for easy navigation.
- Place boxes around common functions and use white space between groups.
- Do not clutter the screen with unnecessary information.
- Think about where the user’s hands will be oriented when operating the interface. You will want to ensure necessary information is seen at all times.
- Provide a way for the user to go back to the previous screen or to the “home” page. Fixed keys could be set for these common functions.
- Avoid using scroll bars or dragging. Use a simple point-and-click to scroll.

Multiple Screen Views
Show critical data several different ways. By providing different views of the data, you allow the user to interact with the interface and use it in a way that best suits them.

As an example, display a holding tank by using a gauge or tachometer with numerical representation for the tank level in text. This provides a quick view of the level from a distance (gauge or tachometer) and a more detailed view (text) when the user is next to the interface.

Figure 5: Good layout example. Actual display size 264 mm (10.4”) 640 x 480.
Test, Test, Test
Before going live, select a few end users to observe how they interact with the interface. Sample testing will help determine if the user is having difficulty touching the buttons, reading the text or finding the information they need.

☑️ GUI Design Checklist

☐ 1. High-contrast colors are used for text and backgrounds.

☐ 2. Color is consistent throughout the design.

☐ 3. Text is used along with color to add clarification.

☐ 4. Font type and size are easily readable.

☐ 5. A mix of upper-case and lower-case letters are used.

☐ 6. Images or icons are easily understood by the end user.

☐ 7. Buttons or icons are big enough for all finger tip sizes.

☐ 8. Sound or vibration is used to provide additional information (if appropriate).

☐ 9. A limited number of buttons or icons are used per screen.

☐ 10. Similar tasks are grouped together.

☐ 11. Navigation tabs are in a location that will not be blocked by user’s hand.

☐ 12. End user can backspace or navigate to another screen easily.

☐ 13. Different screen views (graphs and text) are available.

☐ 14. New interface has been tested before going live.

Where to Go For Help
QSI Corporation designed Qlarity Foundry® to create applications for their graphic terminals. Qlarity Foundry is based on the Qlarity programming language that uses objects to display information on the screen, accepts user input and communicates with other devices. With Qlarity Foundry, you can edit existing objects, create your own objects or write your own code.

Qlarity libraries assist with screen and application design (typeface, animation, gauge, graphic image, trend chart, etc.), user interaction and input (slider, spinner, list box, numeric keypad, QWERTY keypad, etc.), navigation and communication (Ethernet TCP/IP Modbus™, serial).

Configurable objects speed up application development time
Based on Qlarity language, Qlarity Foundry® is a free PC-based software tool (Windows® 2000, Windows® XP, Windows Vista®) to assist in developing screens and applications for graphic operator interface and mobile data terminals. This Windows® design environment allows you to use objects to create screens, simulate, debug and download applications to your Qlarity-based terminal. Go to www.qlarity.com to download your free copy today.
Figure 6: Qlarity Foundry Layout View

Figure 7: Qlarity Foundry Code View
The Bottom Line
As much as it is important to have an attractive interface, do not sacrifice usability for aesthetics. If it is difficult to use it will cause frustration for the user and be less efficient overall.

For more information about Qlarity and Qlarity Foundry, contact QSI Corporation at 801-466-8770 or visit www.qsicorp.com

About QSI Corporation
Established in 1983, QSI Corporation is a manufacturer of rugged operator interface and mobile data terminals (TREQ®) for industrial OEMs and commercial vehicle systems integrators. QSI's human machine interface and mobile data terminal products include character and graphic terminals that are programmable, customizable, CE Certified and NEMA 4/12/13 rated. Numerous interfaces are available, including EIA-232, EIA-422, EIA-485, J1708/1939, USB, Ethernet and Power-over-Ethernet. Qlarity® is an object-based programming language designed by QSI for their graphic terminals. QSI excels at building custom and semi-custom terminals able to withstand high levels of shock, vibration, extreme temperatures, humidity and other environmental parameters.

All QSI Corporation products are designed and manufactured in the USA at the company's headquarters in Salt Lake City, Utah.

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Additional Resources and References


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