

Feature Article

Software Development A User-Centered Design Process

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A good man-machine interface is vital for users of medical analysis instruments to work efficiently in an increasingly complex environment, and the needs and work methods of future users must be taken into account in order to create ergonomic and user-friendly software packages. HORIBA ABX has successfully applied these principles in its new generation of products and design and ergonomics are often quoted by customers as being the reason for choosing HORIBA ABX products.

Striking a Balance between Esthetic Appeal and Functionality

Software interface design now plays a major role in our business, and contributes substantially to the success of HORIBA ABX products.

The design process requires close collaboration between different departments, including Marketing (development of specifications, project monitoring), Research & Development (software development and ergonomics) and the Communications department (software design). Before teams from these departments go to work, they all have to share a clear understanding of the final product, the final users and the goals of the project. Thereafter work typically focuses on striking the right balance between a product's ergonomic and functional aspects on the one hand and its esthetic and graphic aspects on the other.

A coherent and rigorous approach to these different aspects is essential. Our software not only plays a vital role in the presentation of the HORIBA ABX corporate image and values, it is also a vector of communication that enables customers to identify our products and to explore their functionalities via a user-friendly and familiar workspace.

Analyze the Environment

The role of an ergonomic user interface is to establish communication between the tool and the operator. Users' acceptance of a system, which is simple and efficient to use as well as being easy to learn, is mainly determined by its ergonomics. It is not possible to create "a good interface" or "an ergonomic" software package without taking into account the skills and work methods of future users.

The development of ergonomic software for analyzers now plays a key role in overcoming difficulties posed by the increasing complexity of medical analysis.

The ergonomics of our software have been optimized to take into account the stated needs of biologists and laboratory technicians:

- Test results must be made available rapidly.
 - Users must have easy and rapid access to equipment functions.
- Where necessary, users must receive rapid notification of reasons for the non-implementation of a test (missing reagent, missing sample, etc.).
 - Users must be able to monitor the progress of a test from the main screen.
- Users must be able to complete a test with a minimum of software manipulations and help menus must be readily available.

- Access to functions and analysis data must be simple and secure. The software must provide guidance for users and ensure that they are fully aware of actions they are implementing.
- Medical testing is often implemented in a workplace characterized by confined spaces. Users work standing up and are obliged to respect hygiene and safety restrictions.
 - The convenience and ease of use of the software must be optimized to adapt to this type of environment.
- The user-friendliness and esthetic appeal of the software must contribute to the creation of a non-stressful working environment.

Ergonomics and Design

The following paragraphs list the five essential qualities of “ergonomic” software with illustrative examples from the interface for the Pentra 400, the new Clinical Chemistry analyzer designed and manufactured by HORIBA ABX.

Rapid Access to Information and Software Functions

- The progress of testing is monitored from the main screen (Figure 1). Sample, reagent and analyzer data are updated in real time. Color-coded graphics allow users to make quick decisions without opening the hood of the unit.

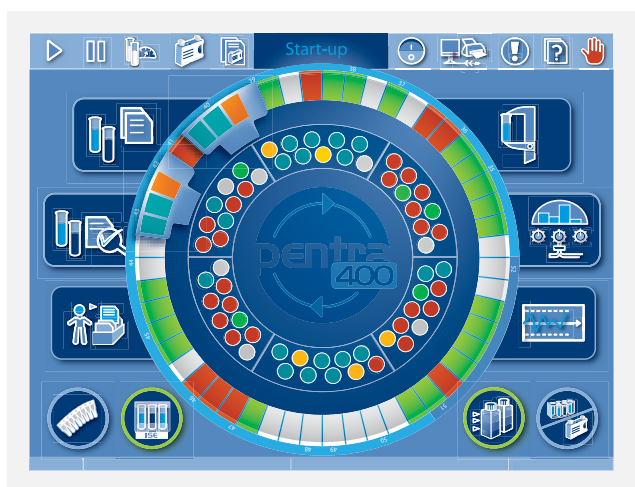


Figure 1 Pentra 400 Main Screen

- The touch-sensitive screen provides one-touch access to software functions. Icon sizes have been optimized to ensure easy selection (Figure 2).

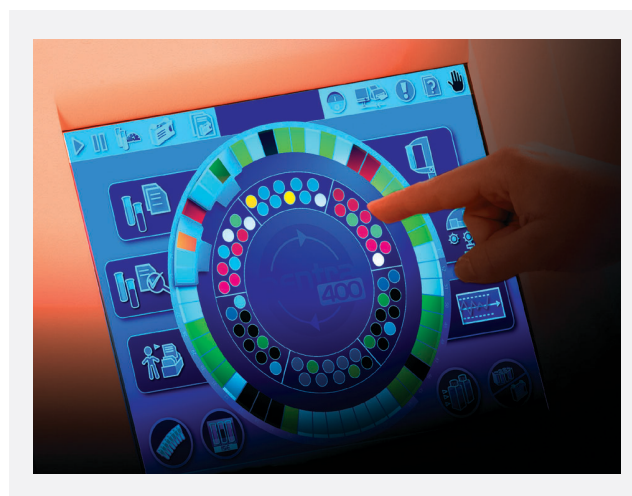


Figure 2 Icon with Finger

- Reports on reagent levels, alarms, and calibration data as well as flow management screens facilitate quick decisions.
- Quick access is provided to features associated with routine Clinical Chemistry testing functionalities, notably the rapid input of commands, the management of reagents, etc.

Simple Access to Data

There is no access to the functions of the Windows™ operating system from within the software. The application has been deliberately limited to avoid multiple windows arising from complex usage and windows that cannot be moved using the touch-sensitive interface. All the tasks to complete a procedure can be implemented from within the software without recourse to additional windows.

To limit translation requirements and save space, wherever possible access to all functions is via icons rather than text. The icons specifically developed by HORIBA ABX are sufficiently explicit to provide a clear representation of associated functions.

To help users find their way around, a standard topography is used for display of data and buttons providing access to functions:

- Buttons for the most common functions (“Cancel”, “Validate”, “Add”, etc.) are always at the bottom of the screen (Figure 3):

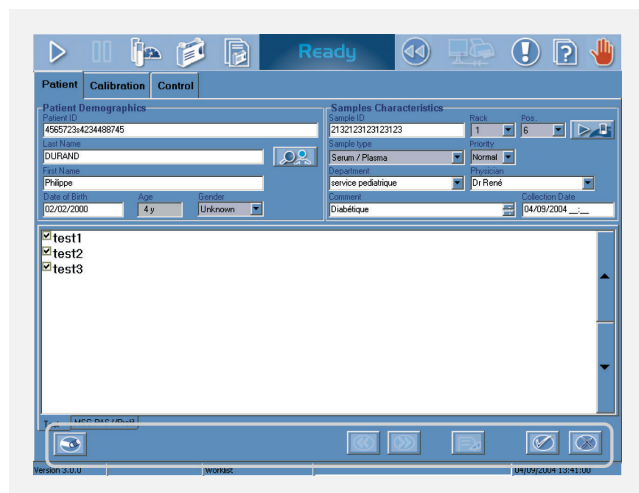


Figure 3 Entering a Patient Request

- Tabs are selected at the top of the screen (Figure 4):

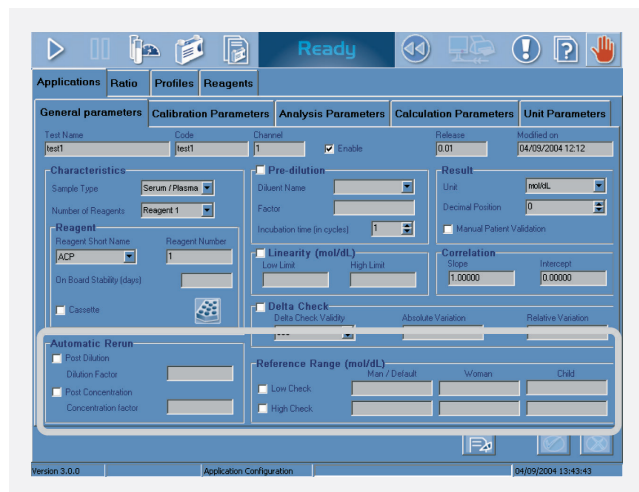


Figure 4 System Configuration

- Data filtering interfaces are located below list data tables (Figure 5).

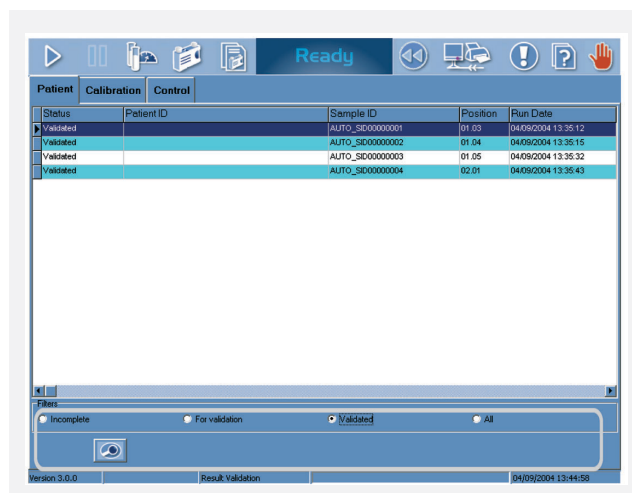


Figure 5 Validation Patient/Calibrator Screen

For the successful implementation of certain functions (Modification of a methodology), users are guided by graphically enhanced messages (Figure 6).

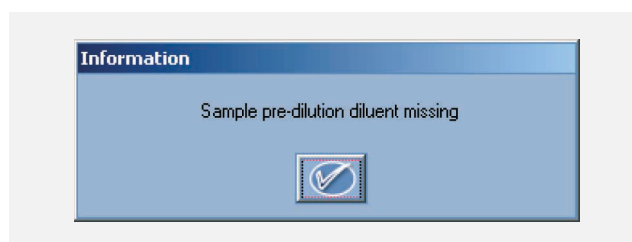


Figure 6 User Guide “Message Box”

List and Details modes allow for the monitoring and rapid input of data from all the software's windows (Figure 7).

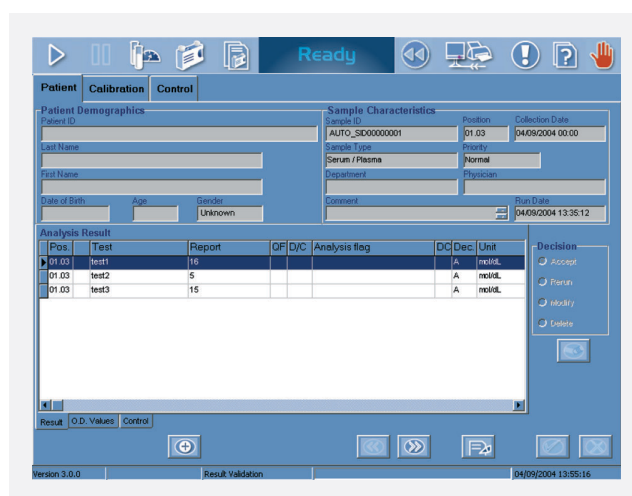


Figure 7 Validation Screen: Patient Results

A consistent color-coding system is used throughout the application (colors for calibrator, reagent, sample controls) (Figure 8).

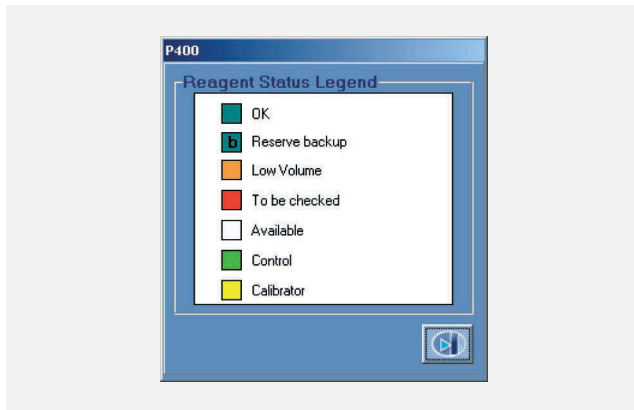


Figure 8 Reagent Status: Color Information

Safe Access to Data

Analysis data must be carefully controlled and checked. Laboratory technicians implement a wide range of tasks to produce results. It follows that they should be able to make rapid and efficient use of equipment without any risk to the quality of data.

To safeguard the integrity of data, the automatic analyzer has two different modes: “view” and “edit”. By default, all of the application windows open in View mode. The data displayed cannot be modified. This is indicated by a gray background in each of the data fields. Users who wish to modify data must access the “edit” mode by clicking a button located on the tool bar. Once the Edit mode has been accessed, the background color in the data fields switches to white to indicate that the data can now be modified. Figure 3 shows a data field in read-only and edit modes.

To guide users inputting data, each of the data fields is equipped with a character analyzer that checks the data while it is entered and again when the user wishes to move on to another field. The character analyzer safeguards against typos (for example letters in a date of birth field or unprintable characters) and establishes a boundary between each of the fields.

The analyzer will automatically display a dialog box requesting confirmation before implementing sensitive actions that cannot be undone by the user.

All data (especially patient and sample identification numbers) are displayed in their entirety and in all languages. As far as possible captions are placed over data fields. This has the added advantage of providing additional screen space required for the specific needs of foreign language versions of the software.

Ease of Use

The rapid acquisition of proficiency in the use of HORIBA ABX software plays a key role in enabling users to take full advantage of the time-saving benefits provided by the automatic analyzer. The software ergonomics have been designed to accelerate this process.

Rapid access via control strips of action buttons (on continual display) enables users to access functionalities that are used the most without returning to the main screen. Reports listing tasks can be consulted at any time for information on ongoing operations or operations that have already been completed, and any problems that may have been encountered.

Biologists using the machine can consult a user guide via a context-sensitive help module, which is accessible from all of the application screens. Help modules, which are available in all languages, are in HTML format and feature hypertext links to facilitate navigation and the search for data.

User-Friendliness / Esthetic Appeal

The visual appearance of an interface and the subjective impressions it engenders play a major role in determining users’ experience of software quality.

The design of an interface should always produce a positive reaction. It follows that given equal levels of usability, users will almost always find it easier to work with an interface that has a carefully thought-out design. An appreciation of this concept is crucial in view of the growing importance of esthetic qualities to the point where they form an integral part of today’s software packages. The operating systems developed by Apple™ (Macintosh) are the best example of this trend.

Special attention has therefore been paid to the rules relating to how icons are read. Each of the individual designs has been carefully developed so that users intuitively understand the significance of the icons.

The standardization of symbols and designs within the software also facilitates training on the analyzer. The consistent use of the same symbol for the same function in different contexts has made self-training a possible option for a range of different users.

As a general rule, icon and screen background colors have been chosen to create a positive and relaxing atmosphere. The use of pictograms with rounded forms also adds to an overall impression of a comforting environment.

The latest Microsoft™ operating system, Windows XP™ Embedded, plays a major role in the implementation of our graphics policy, and has contributed largely to the unique character of our software packages.

Evaluate and Refine

The observations of users in the field provide a major source of inspiration for the ergonomics of our software packages. The biochemistry department at Lapeyronie hospital in Montpellier was used as a pilot site for the validation of all aspects of the Pentra 400 including the development of methods and reagents as well as the software that controls the analyzer. It also played a key role in the development of our interfaces.

Professor Cristol

“The members of our team were impressed with the Pentra 400. It is a very compact analyzer, and its interactive software and screen make it very pleasant to use. Real-time monitoring of analysis progress and the status of samples and reagents is available directly from the screen. This is a great feature because it allows you to see what is going without having to lift off the cover.”

Doctor Dupuy

“The unit was very quick to set up and was fully functional in just one morning. The Pentra 400’s software makes it

very easy to use. All five members of the team using the analyzer were trained in a minimum amount of time.”

Our partnership with Lapeyronie enabled us to optimize the ergonomics of our software and to better fulfill the needs of biologists using our equipment.

Implement

The study to improve the ergonomics of HORIBA ABX software paved the way for a harmonization of interfaces in most of our products. Graphic conventions in the Pentra 400 software are now used in software for our Pentra 80 and Pentra XL 80 hematology analyzers and on the validation station for the Pentra DX 120.

Consistent deployment of the same ergonomic values and a common man-machine interface across our entire range will contribute significantly to the strength of the HORIBA ABX brand and its reputation for innovation.

Functions available on all of our automatic analyzers are represented by similar icons on each of the machines (Figure 9). They are differentiated simply by the use of different component colors.

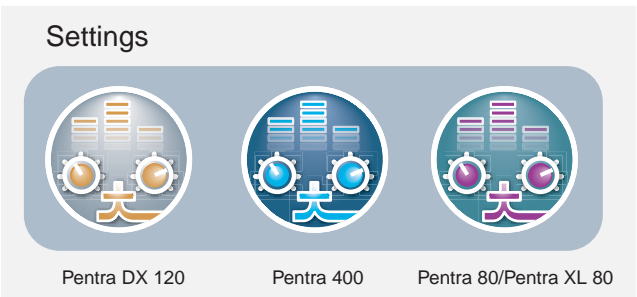


Figure 9 The Settings Icons for the Following Automatic Analyzers: Pentra 400, Pentra 80, Pentra XL 80, Pentra DX 120

Real-time monitoring of the unit's operation has also been introduced on the hematology analyzers, notably on the Pentra XL 80. The “view status” command provides a breakdown of analysis results in the form of a pie chart and a real-time representation of the status of loading and unloading racks inside the machine.

The different types of analyzer are distinguished by a number of software differences. The hematology analyzers have a tool bar at the bottom right of the screen, which is absent on the Pentra 400. Each of the software interfaces has its own color scheme, which is deployed alongside with the standard graphic conventions. These include:

- the use of rounded icons and a graduated palette of colors.
- the same symbols are used to represent the same functionalities.
- the screen layout is standard, as is the harmonized color palette.

Special interfaces have been created to expedite the implementation of specific hematology tasks.

The “view rack” feature on the Pentra XL 80 provides a graphic representation of the different racks that have been loaded and unloaded (Figure 10). Users can access information about the sample contained in a specific tube just by clicking on the cap of the tube in the display. The color of the tube cap is determined by the tests that have been performed on the sample.

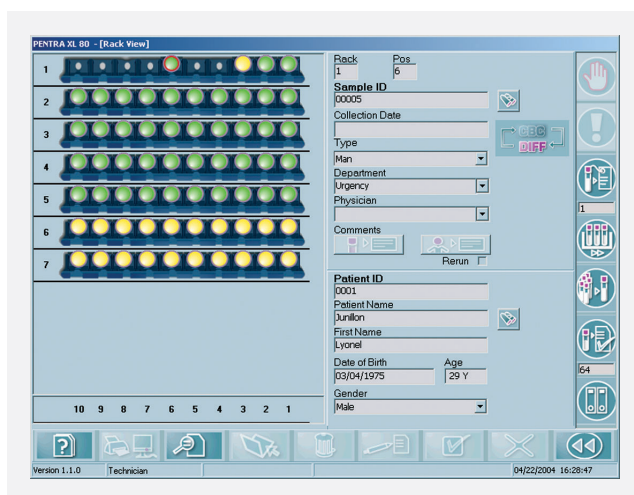


Figure 10 View Status: Realtime Rack View

Conclusion

Feedback from a wide range of different users has been very positive and encouraging. The HORIBA ABX brand image and brand recognition have been reinforced by the software interfaces and the user-friendly workspace they provide.

The enthusiasm of professionals who have seen HORIBA ABX products at trade fairs (JIB, MEDICA, etc.) has also been a source of inspiration for the company in its ongoing quest to provide ever more precise solutions to its customers' needs.

Allied with these benefits, the esthetics and ergonomics of HORIBA ABX software have also engendered concrete gains in the form of reduced costs and increased efficiency. Making the software easier to learn has generated savings in the areas of documentation and training. The provision of context-sensitive help modules has also resulted in a lighter workload for our hotline service. All of the above serve to promote HORIBA ABX's expertise, define the company's territory and further its mission to provide all users with an innovative alternative that takes into account their needs for simplicity and efficiency.



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