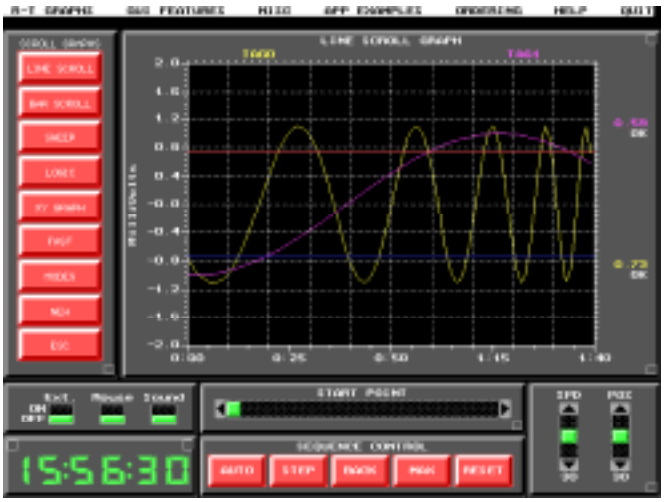
Real-Time Graphics and User Interface Tools

Revision 4.0

DOS

Real-Time Window Options - Windows can be moved, resized, hidden, iconized and closed using a mouse.
Scrolling Graph Types - Line, Bar, XY Plot, Logic, Sweep and Fast - all graphs can scroll in horizontal or vertical modes, left to right, right to left, top to bottom, bottom to top. Time axis labels can be in numeric or time formats.
Control Objects - Push buttons, Multi-pole switches, Knobs and Scroll bars.
Dialog Boxes - File list, General input, Check-off box, General list, Text output and Message dialog boxes.
Menus - Pull-down graphics mode menu system with help and hotkey support.
Bar Graph Types - Horizontal, Vertical, and PID.
Meter Types - Needle, Arc, Pie and Clocks.
Graphics Text Displays - Annunciators, Panel Meters, 7-Segment Displays.
Standard Charting Routines - Auto-scaling of axes, line, scatter, and bar charts. Multiple x and y axes for a single graph. Adjustable xy intercepts, grid lines, and text labeling routines.
Scheduler - Non-preemptive scheduler based on the PC's real-time clock can schedule periodic updates and events.
PID Control - Position and velocity algorithm, error term smoothing, output value and rate limits.
Data Compression and Digital Filtering
Fourier Analysis - FFTs, Power Spectrum, Windowing - 39 milliseconds for a 1024 point FFT on 33MHz 486.
CRT Graphics Adapter Support - The Borland Pascal and C versions use BGI graphics and fonts. The Microsoft C version uses MS C/C++ 7.0 or Visual C++ graphics drivers and fonts. The Watcom C/C++ version uses the Watcom C graphics drivers and a 8x8 font. These tools support EGA and VGA graphics adapters.
Hardcopy Support - High resolution printer drivers (not a screen dump) for Epson 9-pin and 24-pin printers, HP LaserJets (all), HP DeskJets (B&W and color) and HP PaintJet (B&W and color).
Royalty Free - When used to create application programs.
Source Code - 100 % source code except for our BGI printer drivers (for Borland Compilers). Source code for printer drivers available as a separate package.
Versions available for:
- Borland Pascal 7.0
- Borland C++ 4.x (16-bit protected mode supported)
- Microsoft C/C++ 7.0, Visual C++
- Watcom C/C++ 32 Rev. 9.5.



Create the entire user interface for an instrument using the Quinn-Curtis Real-Time Graphics and User Interface Tools.

The Real-Time Graphics and User Interface Tools (Rev. 4.0) combine an enhanced Quinn-Curtis Real-Time graphics library with a complete user interface library. These tools can be used to create a wide variety of computer based instrument interfaces running under DOS. The routines are compatible with most popular drivers for A/D boards, instruments and other sources of real-time data (contact your board supplier for information specific to a data acquisition board). The software is supplied in the form of procedures and functions in the source code of the target language. All routines can be used royalty free when compiled into an executable program. The Real-Time Graphics and User Interface Tools are available for Borland Pascal 7.0, Borland C++ 4.x, and Microsoft C/C++ 7.0 and Visual C++, and Watcom C/C++ 32 Rev. 9.5. It is essential that you are a C or Pascal programmer to utilize these tools.

Ordering Information

Part #	Description	Price
IPC-TP-025	Borland Pascal	$300
IPC-TC-025	Borland C++	$300
IPC-MC-025	Microsoft & Visual C/C++	$300
IPC-WC-025	Watcom C/C++ 32	$300

Shipping Charges

UPS Ground	UPS Blue	UPS Red	DHL	Canada
9	14	24	38	12

Real-Time Graphics

There are 19 different real-time (real-time is abbreviated R-T elsewhere in these data sheets) displays for output:

Scrolling Line Graphs	Scrolling Bar Graphs
Sweep Graphs	Logic Graphs
XY Plot Graphs	Fast Graphs
Horizontal Bar Graphs	Vertical Bar Graphs
PID Bar Graphs	Needle Meters
Pie Meters	Arc Meters
Clocks	Annunciators
Panel Meters	General Graphics Text
7-Segment Panel Meter	7-Segment Text String
Process Control Text.	

Each display presents real world data in a R-T graphical format. Many of the displays can also display high and low alarm information, PID setpoints and other information associated with a channel in a R-T window. Different displays can be mixed on the same CRT screen.

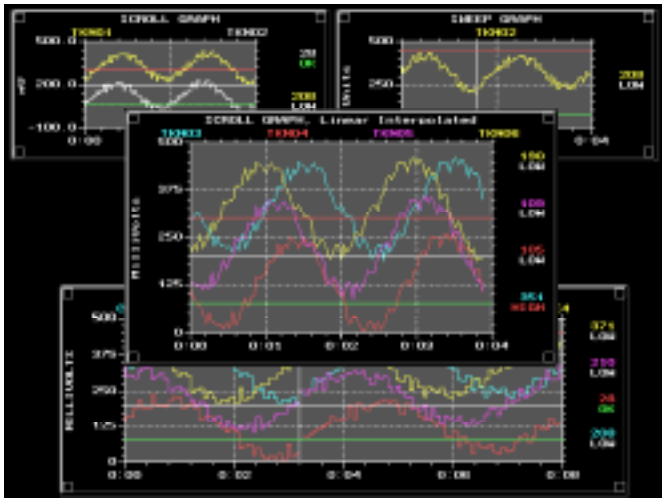
There are 6 different real-time control objects which can be used for user input:

Single Scroll bars	Scroll bar banks
Switch banks	Button banks
Knobs	Sliders.

The buttons and switches are used to input discrete values. The scroll bars, knobs and sliders allow a continuous range of values to be entered. In addition to the R-T control objects, user input can also be handled using the new pull-down menu system and the new standard dialog boxes. The R-T control objects are discussed in the section titled *User Interface Routines*.

Real-Time Window Options

Revision 4.0 of the Real-Time Graphics Tools adds an extremely powerful set of R-T window options to the software. Each R-T window can be created with one or more of the following control options:



Scrolling and Sweep Graphs can include alarms and numeric updates.

Value	Meaning
RT_MOVEABLE	Window is movable by dragging the mouse within the title area.
RT_RESIZE	Window is resizeable by dragging the ‘resize handle’ in the lower, right corner.
RT_MAXIMIZE	Window can be maximized by clicking the ‘maximize handle’ in the upper, right corner.
RT_CLOSE	Window can be closed by clicking the ‘close handle’ in the upper left corner.
RT_HIDE	Window can be hidden clicking the 'hide handle' in lower left, and is reduced to a numbered box at the bottom of the screen. This box can be clicked to redisplay the window.
RT_ICONIZE	Will display an icon containing a window number if a window is hidden with the 'hide handle' or with rthidewindow.
RT_SAVEWINIMAGE	Saves underlying window images for future update. This attribute should be set if any of the attributes defined above have been selected.
RT_BORDER	Draws a border around the window.
RT_3DBORDER	Draws a 3D border around the window in a highlight color corresponding to the window background color.
RT_3DINNER	Draws the inner cells of certain R-T window types in 3D. Used with buttons, sliders, annunciators, panel meters, and general text displays.
RT_WINSTD	Window is drawn with the standard options:RT_MOVEABLE, RT_RESIZE, RT_MAXIMIZE, RT_3DBORDER, RT_3DINNER, RT_SAVEWINIMAGE.

Real-Time Scrolling Line, Scrolling Bar, Sweep, Logic, XY Plot and Fast Graphs

These graphs can move in a horizontal or vertical direction and scrolling can be carried out left to right, right to left, top to bottom and bottom to top. Time axis labels can be displayed in a numeric format (i.e. 1.25) or in a time format (i.e. 1:15:00) and the labels can also be updated on the fly without redrawing the entire graph. All scrolling graph types have optional numeric and alarm message updates. Tag names for each trace, a title for the window and engineering units are also displayed. Optional grid lines are displayed at major tick intervals. Line graphs can be displayed in either a linear format or with a staircase step between the data points. Graphs can also be rescaled without losing the original data. The new Fast Graph display lets you scroll forward and backward through up to 16 traces of 8K points each. Our special scrolling algorithms minimize CRT flicker when updating a large number of traces at high speed. Run the RTDEMO program from our demo disk to get a bench mark for scrolling graph updates for your computer.

Scrolling Line Graphs - A scrolling line graph will display data in a fashion analogous to an oscilloscope or strip chart

recorder. The smoothness of the scroll can be adjusted across a range of almost no scrolling effect to full scrolling.

Sweep Graphs - In a sweep graph a horizontal or vertical line moves across the graph, from the beginning of the time axis to the end. The data behind the sweep line is new while the data in front of the sweep line is erased as the line passes through it. Once the first pass of a sweep graph is finished, there will always be one complete time interval of data on the screen at once.

Logic Graphs - A logic graph is modeled after the display of a logic analyzer. The primary use of the logic style R-T graph is to display binary data across the screen as a digital waveform. Up to 16 traces can be displayed and updated in a single R-T logic window.

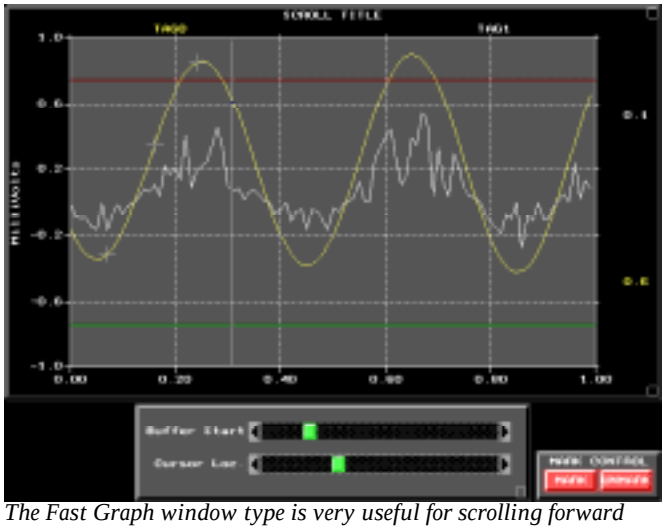
Scrolling Bar Graphs - A scrolling bar graph will display data as a time series of moving bars. Only one trace per window can be displayed using the scrolling bar format, otherwise this graph type is much like the scrolling line graph.

XY Plot Graphs - An XY plot graph is analogous to driving the horizontal and vertical inputs of an oscilloscope with different inputs. It can be used to plot one signal against the other in an XY format. The XY plot graph trace can have a history of up to 4K points displayed.

Fast Graphs - A fast graph is a static charting routine which updates extremely fast. The programmer specifies the starting point in an array of data and the fast graph routine plots the next N data points as fast as possible. A line marker can be used in conjuction with a fast graph to mark data points. Data values can be retrieved from the fast graph buffers for the marked point.

Real-Time Bar Graphs

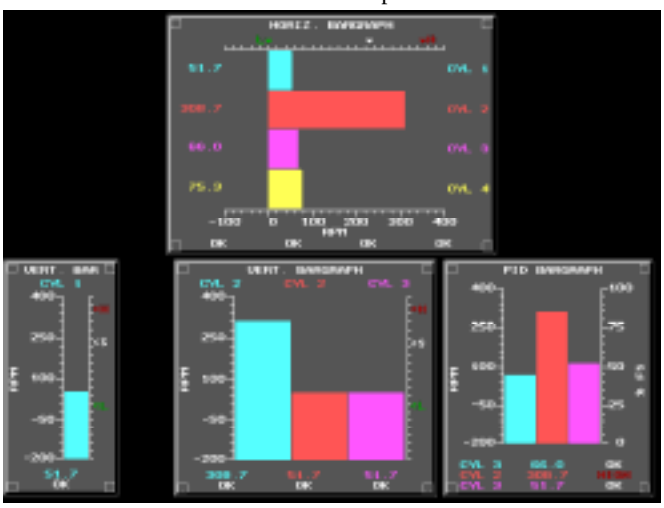
Bar graphs are used to display analog data in a style familiar to process control engineers. Three major bar graph types are supported: Horizontal, Vertical and PID bar graphs, and are modeled after general purpose and dedicated PID process control style faceplates. Bar graphs have an inverted scaling option for the bar graph x- and y-axes.



The Fast Graph window type is very useful for scrolling forward and backward through previously collected data.

Horizontal and Vertical Bar Graphs - Actual values are displayed in an analog fashion as a bar and in a digital readout at the bottom of the window. Up to 16 channels (bars) can be displayed and updated in a single R-T bar graph window. Minimum and maximum values set the y-axis scaling. Each window can have one set of high alarm, low alarm and setpoint values. Each bar in the window can be assigned a unique tag name. High, low and no alarm messages display the current alarm state for each bar.

PID Bar Graphs - A PID bar graph monitors three process variables associated with closed loop control: the measured



There are three types of real-time bar graph displays: Horizontal, Vertical and PID bar graphs.

variable, the PID setpoint value, and the PID output value. The values of these three variables are displayed in an analog fashion as a bar and in a digital readout at the bottom of the window. Left and right y-axis scales allow the scale of the bar graph to be displayed in both engineering units (for the measured variable and setpoint) and as 0-100% for the output variable. Each of the three PID process variables can have high and low alarm limits with individual alarm message strings. Each PID process variable can be assigned a unique tag name.

Meters and Clocks

Meters (gauges) are used to display analog data much like a voltmeter or car speedometer. A digital readout of each channel is displayed at the bottom of each meter window. Four types of meters are available: needle meters, pie meters, arc meters and clocks.

Needle Meters - A needle meter has a display much like a voltmeter. One or more channels of analog data can be

incorporated in a single meter. Actual values are displayed in a digital readout at the bottom of the window. Minimum and maximum values set the range of the meter scale. The sweep of the arc (arc start and arc end point) can be set for any value between 0 and 360 degrees. Setpoint, high and low alarm limits are marked on the meter. Tag names for each trace, a window title and engineering units are also displayed. High, low and no alarm messages display the current alarm state for each needle.

Pie Meters - Similar to a needle meter, a pie meter uses a pie shaped wedge to display R-T values. Only one channel is displayed in a pie meter window. Alarm limits, tag names, setpoints, meter arc and meter scaling options are available.

Arc Meters - Similar to a pie meter, an arc meter uses a fat arc to display R-T values. The tag name, units and the numeric value are placed inside the arc allowing for more compact displays than is possible with regular needle and pie meters. Only one trace is displayed in an arc meter. Alarm limits, tag names, setpoints, meter arc and meter scaling options are available.

Clocks - Actual time is displayed in an analog fashion using clock hands to display hours, minutes and seconds and in a digital readout at the bottom of the window.

Annunciators, Panel Meters and 7-Segment

Designing instrument panels is a very quick process since Real-Time windows can be moved, resized and overlapped.

Displays

Annunciator panels are an efficient way of displaying the alarm status and current value of real-time data. If an annunciator channel is in alarm, the background color of the channel will change, giving a very strong visual indication that an alarm has occurred. The annunciator display is modeled after standard annunciator panels used in industry. Panel meter displays are modeled after ubiquitous digital panel meters found in industry.

Annunciators - A tag name, current value, engineering units and alarm status can be displayed for each annunciator channel. The background color of an annunciator block will change state when a high or low alarm occurs.

Panel Meters - A tag name, current value and engineering

Annunciators are used to warn you about alarm conditions.

units can be displayed for each panel meter channel. The current value can be displayed in larger than normal text for easy reading from a distance.

General Graphics Text - Other R-T graphics text functions are available for creating simple annunciator panels or user interface panels.

7-Segment Panel Meters - This display type is a variant of the standard panel meter type. The numeric updates are displayed in a bold 7-Segment numeric format.

7-Segment General Text - This display type uses a 7-Segment format to output strings which contain time, numeric or hexadecimal data.

Static Charting Functions

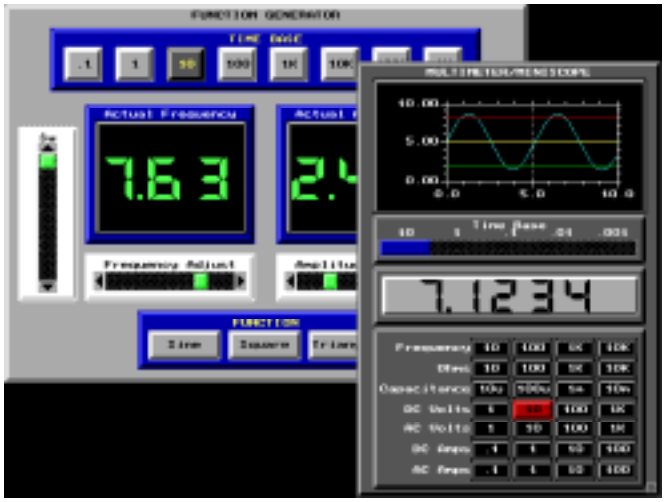
A set of static charting functions are included with these tools that includes routines which can be used to display data which is not changing rapidly. The static charting functions are drawn in a generic R-T window that can be moved, resized, maximized, etc. similar to the other R-T windows types. Graph types include line, scatter, and bar charts. An auto-scaling function will analyze the min and max values in a data set and draw the x- and y- axes accordingly. Multiple x- and y-axes for a single graph, adjustable xy intercepts, grid lines, and text labeling routines are also included.

User Interface Routines

There are 6 different real-time control objects which can be placed in R-T windows. These are: single scroll bars, scroll bar banks, switch banks, button banks, knobs and sliders. Each control object is created in a unique R-T window and can be assigned any of the window options (RT_MOVEABLE, RT_RESIZE, etc.) described under the Real-Time Window Options section. All of the R-T control objects use callback functions to process control inputs.

Single Scroll Bars - A single scroll bar works in the same fashion as the scroll bars found in many DOS and Windows application programs. Scroll bars can be scaled to return engineering units rather than simple integer values.

Scroll Bar Banks - A scroll bar bank is a collection of up to 16 scroll bars in a single R-T window. It is useful for applications



Real-Time windows can be "locked" together, creating virtual instruments that can be moved, resized, opened and closed as a group.

where a large number of related user inputs need to be grouped together. The slider inputs for a stereo equalizer or level controls for a sound mixing panel are examples of typical applications.

Switch Banks - A switch bank has between 1-16 switches in a single R-T window. Switches are used to select between several different ranges, options or discrete values. The switches are multi-pole with each switch having between 2-16 poles.

Button Banks - A button bank has 1-36 buttons in a single R-T window. Buttons are used to select between several different ranges, options or discrete values. A button can display different colors and text depending on the button state.

Knobs - A knob control combines the visual image of a volume control style knob with a single scroll bar. User input is handled through the scroll bar input and the position of the knob is updated to reflect the current position of the scroll bar.

Sliders - A slider control combines a large numeric update window with a single scroll bar. User input is handled through the scroll bar input and the value of the numeric text in the window is updated to reflect the current position of the scroll bar.

Pull-Down Menus

Our libraries provide menu and dialog box support in graphics mode. The entire menu system is controlled using only 5 function calls. It makes extensive use of callbacks as menu selection processing functions. The menu system can be operated with the mouse or the keyboard cursor control keys.

Menu Bar Options - The size, color, text and position of the menu bar is program selectable. A menu bar can have up to 10 selections printed horizontally across it.

Pull Down Menu Options - Each item on the menu bar can have a pull-down menu box with up to 25 additional items. Each menu item has a user specified callback function associated with it. Menu items can be selected using program definable hotkeys, mouse clicks, or by pressing the Enter key. The pull-down menu system automatically saves and restores graphics images underneath menu boxes. A help file can be assigned to each menu item.

Dialog Boxes

Our user interface libraries provide dialog box support in graphics mode. There are 5 standard dialog boxes which can

Printer parameters are very easy to enter using our dialog boxes.

be used individually or combined together into complex forms. Buttons (OK, CANCEL, HELP, and MORE), colors and size are all options for dialog boxes. Dialog boxes can also be made moveable.

File Dialog - The standard file dialog box supports entering a file name, drive and directory. DOS wild cards are supported in file names and all matching names are listed in a file list box. File names can be selected from the file list box using the mouse or the cursor keys.

List Dialog - A list dialog box can display a list of text strings in a scrolling window. List items can be selected with the mouse or the cursor keys.

General Input Dialog - General string and numeric input is handled through general input dialog boxes. A general dialog box can have up to 16 fields for entering string and numeric data. Input error checking is handled by user written callback functions.

Check-Off Dialog - This dialog box can have up to 32 check-off boxes. Each check-off box has its own identifying string. Check-off boxes can be made mutually exclusive, though this does not have to be the case. Check off boxes are selected using the mouse or cursor keys.

General Text and Message Dialog - A very useful dialog box for Help displays. Text strings of arbitrary length can be displayed in a scrollable window. String wrap options allow text strings which are too long to appear in the current dialog

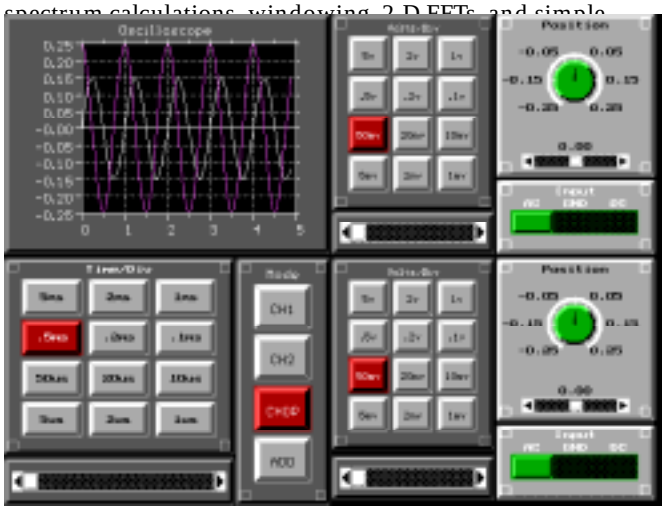
window to wrap around to the next line. This dialog box can be maximized, filling the whole screen.

Hardcopy Support

Rev. 4.0 uses the Quinn-Curtis, high resolution printer drivers. These drivers can reproduce a R-T screen at the maximum resolution of the output device. Printer drivers are included for the following printers: Epson 9-pin, Epson 24-pin, HP LaserJet Family and HP DeskJet family (including the new HP DeskJet C color inkjet printer) and the HP PaintJet family (B&W and color). Printers compatible with those listed above will also work. The printer drivers leave the CRT in graphics mode while sending output to a printer or a file. The contents of any R-T window, including control objects and static graphs, can be output to a printer. Dialog boxes and menus cannot be reproduced on a printer.

Fourier Analysis

The most common algorithms used in digital signal processing are included. Functions are supplied for FFTs, power spectrum calculations, windowing, 2-D FFTs, and simple



A software engineer with no oscilloscope experience was able to duplicate (and improve) the user interface in a short time using the Real-Time Tools.

digital filter design. Our FFT routines have a bench mark of 39 milliseconds for 1024 real FFT using 33MHz 486 DX. New functions make real-time digital filtering practical even for programmers not familiar with DSP theory.

PID Functions

The most common calculation used in process control is the PID (Proportional - Integral - Derivative) function. This library includes position and velocity algorithms, anti-reset windup, bumpless transfer and error term smoothing. A 33 MHz 486 DX can calculate a single PID update in 0.05 milliseconds. All PID loop calculations are carried out in engineering units and can be scaled to match the output characteristics of any output device.

Scheduler

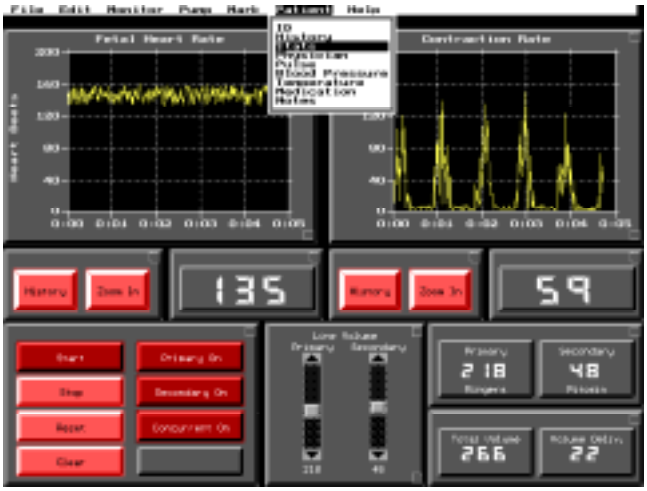
A non-preemptive scheduler, based on the PC's real-time time clock, simplifies task scheduling in complex programs. Once the scheduler is installed, event handling functions are added to a task list. Each task can be assigned an update rate (up to 18 times / second) and a priority. A single task can update one or more R-T windows. Tasks can also be used to process R-T window options, menu and dialog box events. Since the scheduler is non-preemptive and based on the PC's 18.2 timer ticks / sec. real-time clock rate, it should not be used for applications requiring precise timing.

Real-Time Data Reduction

We always recommend that users compress their data for display purposes so that the number of data points they are displaying in a scrolling graph is similar to the horizontal resolution in pixels of the window the scrolling graph is in. For high speed data this may mean data reduction on the order of 10-1000 times. We offer a special real-time data reduction function which can compress data using an average, skip, minimum value, maximum value and min-max value data compression algorithm.

Thermocouple Linearization and Curve Fitting

Thermocouples are the most widely used transducers for measuring temperature. This package contains the most complete collection of thermocouple tools currently available for the measurement and control programmer. All IPTS-68 Thermocouple (T / C) types are supported: J, K, R, S, T, B, E, JN, JP, KN, KP, BN, BP, TN and TP. The entire usable temperature range of each thermocouple is supported. The programmer can use the Quinn-Curtis linearization equations for linearization of thermocouples or develop new ones using our high resolution curve fitting tools. We find that very few Real-Time Tools programmers use the T / C and curve fitting functions and as a result we have not enhanced the product at all in this area. The documentation for all related functions has been reduced to a MS Windows Write file on the master diskette.



An expectant father designed this user interface for fetal monitoring instruments during a break between contractions in the delivery room.