

I/A Series[®] Software 50 Series Spreadsheet



The 50 Series Spreadsheet is an interactive, easy-to-use, tool that allows process operators, engineers, or managers to manipulate data in a row/column format, graph the data, and print the results for production control purposes.

The 50 Series Spreadsheet (Spreadsheet) is a UNIXcompatible software package that you operate from a workstation. It allows you to perform row/column operations, including "what if" calculations. You can mix live process data and historical data with keyboard-entered data.

Spreadsheet is based on Lotus 1-2-3 for Sun SPARC Systems, under license from Lotus Development Corporation. It includes additional functions for accessing real-time, historical, and relational database data. Spreadsheet is compatible with all Lotus 1-2-3 releases, including those for DOS. So you can share data and files, macros, and applications with anyone on your NFS network.

Spreadsheet provides a wide range of analytical, graphing, and formatting tools. You can display data in graphical form, e.g., line, bar, and pie charts. You can print spreadsheet data, text, and graphics on the same page to produce high quality reports.



You can use Spreadsheet to support production control functions such as:

- Energy balance calculations
- Process flowsheets
- Material balance calculations
- Inventory management

Spreadsheet is a powerful, analytical tool with an easy-to-use, graphical environment that supports X Windows with compatibility for the OPEN LOOK window manager. Under OPEN LOOK, you get mouse support, Smarticons, dialogue boxes, and pulldown menus; all to make your work fast and easy. Figure 1 shows a typical Spreadsheet window with OPEN LOOK and a Worksheet Graph Window. Figure 2 shows an example of OPEN LOOK pulldown menus and Smarticons. Spreadsheet provides 3-dimensional operation, that is, you can work down, across, and through worksheets to quickly analyze and express the meaning of process values. You can open up to 256 worksheets. You can view spreadsheets and graphs side by side.

You operate Spreadsheet from a Workstation Processor (WP), Application Workstation (AW), or VT-100 terminal. Spreadsheet runs on a 50 Series Application Processor (AP) or Application Workstation (AW). Spreadsheet supports windows on the 50 Series Workstations (WP and AW) but not on the WP30, which uses the character terminal mode.



Figure 1. Spreadsheet with OPEN LOOK and Worksheet Graph Window

Spreadsheet options allow it to be a part of the I/A Series production control domain (see Figure 3). The information flow between Spreadsheet and I/A Series Industrial Software and Workstations is shown in Figure 4. Spreadsheet allows you to:

- Read and write process variables via the Object Manager.
- Read from and write to a relational database via the Real-Time Database Manager.
- Read data from historical databases via the Historian.
- Transfer spreadsheet data to application programs for processing and return results to the spreadsheet.
- Calculate physical properties of steam and water via a subset of the Physical Properties Library, which is an optional software package.



Figure 2. Typical OPEN LOOK Pull-Down Menus and Smarticons



Figure 3. Spreadsheet Application Diagram



Figure 4. Spreadsheet Information Flow Diagram

APPLICATION EXAMPLE

You can use Spreadsheet for "what if" calculations. For example, you can create a spreadsheet to help you find the minimum cost of running a system of three boilers that feed a common header to generate steam required for plant utilities (see Figure 5). You enter the total load demand, Boiler1 load, and Boiler2 load. Then you recalculate the spreadsheet to display the Boiler3 load and total cost for this input data run (see Figure 6). You make additional runs using other Boiler1 and Boiler2 loads to find the minimum total cost for the given total load demand. You adjust the load among the boilers by looking at the total cost, and the incremental cost for each boiler.



Figure 5. Steam Generating System

RUN NO.	TOTAL LOAD DEMAND (klb/hr)	BOILER1 LOAD min=25 max=250 (klb/hr)	BOILER1 INCRE- MENTAL COST (\$/klb)	BOILER2 LOAD min=40 max=250 (klb/hr)	BOILER2 INCRE- MENTAL COST (\$/klb)	BOILER3 LOAD min=25 max=250 (klb/hr)	BOILER3 INCRE- MENTAL COST (\$/klb)	TOTAL COST (\$/hr)
1	600	180	3.02596	220	3.19702	200	3.14084	1777.59
2	600	190	3.04681	210	3.17234	200	3.14084	1776.10
3	600	200	3.06767	200	3.14765	200	3.14084	1775.08
4	600	210	3.08852	190	3.12297	200	3.14084	1774.50
5	600	220	3.10937	180	3.09829	200	3.14084	1774.39
6	600	230	3.13023	170	3.07361	200	3.14084	1774.72
7	600	190	3.04681	190	3.12297	220	3.17163	1776.27
8	600	195	3.05724	195	3.13531	210	3.15624	1775.54
9	600	225	3.11980	189	3.12050	186	3.11929	1774.12

Figure 6. Sample Application Spreadsheet

BASIC SPREADSHEET CAPABILITY

Spreadsheet is based on the Lotus 1-2-3 for Sun SPARC Systems. You access Spreadsheet from a pull-down menu in an I/A Series environment, e.g., from the "Tools" menu in the Plant Management Environment. You can also use the Password Environment Configurator (PassWd_EnvCfg) to establish the environments from which Spreadsheet is available.

The 50 Series Spreadsheet supports windows on the 50 Series Workstations (WP and AW) but not on any other WP types or the VT-100 terminal, which use the character terminal mode.

3-Dimensional Worksheet Environment

- Basic features:
- 1 to 512 character column widths
- Protected cells
- Move or copy any range of cells
- Range transportation
- Expanding cell pointer to paint ranges
- Label and cell formatting
- Zero suppression and replacement
- Up to 256 worksheets per file.
- Each worksheet up to 256 columns by 8192 rows.
- Multiple spreadsheet files in memory provides quick access.
- Perspective mode view up to 26 worksheets in stacked windows on the screen in each session.
- Create formulas that link spreadsheet files on disk or in memory. Linked files can be updated to reflect changes in worksheet and files.
- Windows horizontal, vertical, perspective, separate and resizable graph, separate and resizable worksheet, map view.
- Optimal recalculation minimal background, and restartable recalculation.
- Group mode formats all worksheets in a file in the same way.
- Undo command reverses changes made to the worksheet.

- Zoom key expands and contracts worksheet windows on screen.
- Search and Replace finds and replaces formulas or labels.
- Worksheet Mapping condenses a worksheet so you can see where formulas, numbers, and labels are located.
- Formula and range annotation up to 512 characters each.
- File sealing with password protects data and formatting options.
- Automatic cell display formatting on entry-date, time, percent, fixed, comma, scientific, currency.
- File password protection limits access to spreadsheet files.
- File back-up option.
- Set widths of range of columns.
- Supports box-drawing graphics characters.

Powerful Relational Database within Spreadsheet

- Relational database management:
 - Query multiple database tables.
 - Create tables using the build function.
 - Join database tables by key fields for relational data reporting.
- Easy query-by-example method of selecting database records.
- Generate calculated fields and field totals.
- Data Query modify command to edit and update database tables.
- Up to 8191 records and 256 fields per data table.
- Up to 255 sort keys.
- Query data tables with hundreds of search criteria.
- Access database tables in other worksheet files, in memory, or on disk.
- "What if" analysis and cross tabulations of database tables.

The relational database interface is part of the standard Lotus 1-2-3 package.

OPEN LOOK Interface

For 50 Series Workstations only:

- Mouse support, Smart Icons, pull-down menus, and dialogue boxes.
- Pull-down menus and submenus that list the mouse selectable Spreadsheet commands.
- Pop-up windows that allow you to specify in one place all the settings and information that affect the command.
- Range selection using the mouse directly on the worksheet.
- Scroll bars that allow you to navigate around a worksheet using the mouse.
- A clipboard for copying and pasting text within and between worksheets.
- A Help system that provides basic guidance for using the OPEN LOOK Interface.
- Window management using the mouse.
- · Full support for Spreadsheet menus

Flexible, Versatile Graphing

- Over 200 graph style combinations including line, bar, pie, mixed line and bar, scatter, area, highlow-close-open; use horizontal, stacked, area, and 100% scaling features. Figure 7 shows four sample graphs.
- HotView graph window automatically updates an on-screen graph when the related worksheet or graph settings are changed. This window can be moved and resized, closed to icon or left open independent of worksheet.
- Quick-Graph window creates graphs automatically from a table in the worksheet. This window can be moved and resized, closed to icon or left open independent of worksheet.
- Graph data from multiple worksheets and files.
- Graph editing tools change graph type, add graph title or legend, or change graph colors, hatch patterns, or fonts.
- Many fonts and text sizes, and 14 colors and hatching patterns for each graph.
- Graph Group sets all data ranges, X-axis labels, and labels for a graph at once.
- Scaling options including logarithmic and two Yaxes.
- High scaling indicators on X- and Y-axes.
- Save graphs in .PIC or .CGM (computer graphic metafile) file formats for integration with other programs.









Figure 7. Sample Graphs

Flexible Printed Output

- Presentation-quality output via spoolers to PostScript devices and laser printers on NFS network.
- Output via the following I/A Series printers on an I/A Series network:
 - Dot-Matrix Printer 80
 - Dot-Matrix Printer 136
 - Color Ink-Jet Printer
 - Line Printer
- Print text and graphics on the same page.
- Named print settings to save page layout.
- Rotate graph on page.
- Print graphs directly from print menu.
- Supports portrait or landscape mode with compressed option on laser printers on NFS network.
- Background printing while you work.

Application Development Power

- Extensive macro command language for data manipulation, program flow, file access, user prompting, menus and screen display.
- Ability to develop custom @ functions, macros, and add-ins with the "C" Add-In Toolkit.
- 103 @ functions 11 database, 13 date and time, 12 financial, 8 logical, 17 mathematical, 10 statistical, 18 string manipulation, and 14 special functions.
- On-line menu of @ function names.
- On-line menu of keynames and advanced macro commands.
- 42 key names for macro use.

- Automatic keystroke recording, playback, and macro creation.
- Macro run key displays and selects macros for execution.
- Unlimited number of macro names.
- Step mode for macro development and debugging.
- Create and use macro libraries.
- Support UNIX file mode or MS-DOS format.
- User configurable keyboard layout.

Lotus 1-2-3 Compatibility

- Compatible with all releases of Lotus 1-2-3, including those for DOS.
- Retains familiar 1-2-3 menus.
- Reads and writes .WK1 and .WK3 files.
- Reads all Symphony files.
- Reads .WKS files.

Other Features

- X Windows driver.
- Non-interactive video mode.
- Option to load specific file at run-time.
- Character terminal support.
- Monochrome monitor support.
- Address all available virtual memory.
- Over 700 context-sensitive help screens.
- Background operation.

EXTENDED SPREADSHEET CAPABILITY

Spreadsheet provides extended capability beyond Lotus 1-2-3. You invoke the extended Foxboro functions from the spreadsheet as "@" functions or "registered macros."

You simply enter the desired function call statement. For example, to bring one process variable value from the Object Manager into a spreadsheet cell, you enter "@OMGET("name")" where "name" is the variable name.

Object Manager Functions

You can read and write process variables in Control and I/O databases anywhere in the I/A Series network by using the functions listed below. Process variables are global variables, that is, either Compound:Block.Parameters or shared variables created by I/A Series or user-written application programs. Object Manager is the software interface between Spreadsheet and Control Processors.

OMGET	reads the value of one variable into a spreadsheet from the process.
OMSET	writes the value of one variable from a spreadsheet to the process.
OMREAD	reads values for a list of variable names into a spreadsheet from the
OMWRITE	writes values for a list of variable names from a spreadsheet to the

process.

Foxboro Database Functions

You can read, write, and delete variable values in local, user-defined, INFORMIX-OnLine databases by using the following functions.

DBREAD	reads values from an INFORMIX- OnLine database table into a spreadsheet.
DBUPDATE	writes values from a spreadsheet into an INFORMIX-OnLine database table.
DBINSERT	inserts rows of values from a spreadsheet into an INFORMIX- OnLine database table.
DBDELETE	deletes rows from an INFORMIX- OnLine database table.

Historian Function

You can read reduced values of process variables (points) from Historian reduction groups anywhere in the network by using the following functions:

HLIST	reads the names of all reduction groups for a Historian database into a spreadsheet.
HREDUC	reads reduced values of variables (points) for a time period from a Historian reduction group into a spreadsheet.

Physical Properties Library Functions

If the optional Physical Properties Library is installed on the same 50 Series AP/AW as Spreadsheet, you can use the following functions to perform calculations on spreadsheet data. For example, to calculate the volume of steam, you enter "@vptstm(p,t)" where p and t are the required input parameters.

vptstm	calculates steam volume as a function
hptstm	calculates steam enthalpy as a function
	of steam pressure and temperature.
sptstm	calculates steam entropy as a function
	of steam pressure and temperature.
ptsw	calculates steam/water saturation
	pressure as a function of temperature.
vptwtr	calculates water volume as a function
	of water pressure and temperature.
hptwtr	calculates water enthalpy as a function
	of water pressure and temperature.
sptwtr	calculates water entropy as a function
	of water pressure and temperature.

SYSTEM CONFIGURATION

Spreadsheet runs on a 50 Series AP in conjunction with a WP or VT-100 terminal or on a 50 Series AW. Spreadsheet software residing on a 50 Series AP can service all WPs on the I/A Series network, subject to licensing agreements. File access across AP's is not supported at this time. The 50 Series Spreadsheet supports windows on the 50 Series Workstations but not on any other WP types or the VT-100 terminal, which use the character terminal mode.

The Foxboro Company 33 Commercial Street Foxboro, Massachusetts 02035-2099 United States of America <u>http://www.foxboro.com</u> Inside U.S.: 1-508-543-8750 or 1-888-FOXBORO (1-888-369-2676) Outside U.S.: Contact your local Foxboro Representative.

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