

## **“THE” SPRINKLER PROGRAM, V. 1.2, SOFTWARE REVIEW**

by

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### **SUMMARY**

Numerous computer programs are available for performing automatic sprinkler system hydraulic calculations. Many of these programs are designed for contractors and others designing new sprinkler systems. “THE” Sprinkler Program is one program in a series of software marketed by FPE Software Inc., created for the fire protection professional. “THE” Sprinkler Program was designed “with user friendliness and input/output efficiency in mind.” This review discusses the programs features of interest to the practicing fire protection engineer.

### **PROGRAM FEATURES**

“THE” Sprinkler Program has all the standard features one would expect in a sprinkler hydraulics program. It contains tree and grid generators, performs both supply and demand calculations, provides a comprehensive cover sheet and can print supply/demand graphs. The manual is thorough, and has a good index. Reports can be printed either to a printer or to a file on disk. Defaults can be set for the system colors, default type of pipe, default “C”-value and several other features.

The program can store pipe and fitting information for 10 different types of pipe. Data on black steel (Schedule 40, 10, and 30) copper (Types K, L, and M), polybutylene and CPVC pipe are preloaded. One additional pipe type can be added, or some of the predefined pipe types can be changed to the pipe types of your choice. The fitting table can hold fitting equivalent length data for up to 10 types of fittings in standard pipe sizes up to 32-inch diameter.

The program should be able to calculate most sprinkler system configurations. The limit of 300 pipes, 300 nodes, 100 loops, and 75 pipes in any loop should be adequate for most systems. Unlike many programs, “THE”

Sprinkler Program allows great flexibility in numbering the nodes. Nodes can consist any combination of eight alpha/numeric characters, including some “special” characters (@!#\$%^&\*). This allows the use of descriptive nodes or the use of existing node identification when checking or modifying calculations done by others. Calculations can be done in either demand or supply mode. In demand mode, the required flow and pressure for a specific density is determined. The supply mode determines the density available based on the water supply.

Also adding to the program’s versatility is the ability to calculate up to five supplies and five fire or booster pumps. Check valves (to control the direction of flow), closed pipes (this option allows pipes to be removed from a loop or grid without major data changes) and “flow dependent pressure loss devices” (FDPLD) can also be used. The FDPLD allows the modeling of meters, backflow preventers, and other devices where the friction loss varies with the flow rate. Up to six sets of data points are entered for the device (minimum 3 required) and the program will calculate the friction loss based on the flow rate, interpolating between the provided values. The program can handle variable flow (sprinklers) and fixed flow (hydrant/hose) discharge outlets. This combination of features allow

the analysis of water supply/distribution systems in large facilities with several water supplies and a looped or gridded underground — something that is not possible in most sprinkler hydraulics programs.

## PROGRAM OPERATION

Ease and efficiency of use were two of the goals the "THE" Sprinkler Program developers had for the program. Most areas of the program use a combination of menus and function keys to access the program features. The number of menu choices is kept to the minimum; the Main Menu contains only five options (Figure 1). Most of the user's time will be spent in the Input/Edit or Output menu options

The File Menu offers options to load, save, copy, and rename files. It also has a DOS option that allows the user to "shell out to DOS" and perform routine DOS operations such as formatting a data disk for storing data on floppy disks.

The Input/Edit Menu has options for the pipe editor, node editor, tree generator, grid generator, and a final option to reset or clear the current data. The tree and grid generators can also be reached from within the pipe or node edit screens.

The pipe and node screens allow for easy input of the system data. Each screen is arranged as a table (see Figure 2) and the cursor keys are used for navigation. The user can toggle among the four selections on the Input/Edit Menu using <Alt> <Key> combinations. Function keys are used to bring up special windows where check valves, fire pumps, FDPLD's and water supply data are entered and attached to a specific pipe or node.

Existing data can easily be modified. In addition to changing individual items, "THE" has functions to search and replace data, add and delete rows, and allows the user replace, copy or move blocks of data. The replace function allows data replacement to

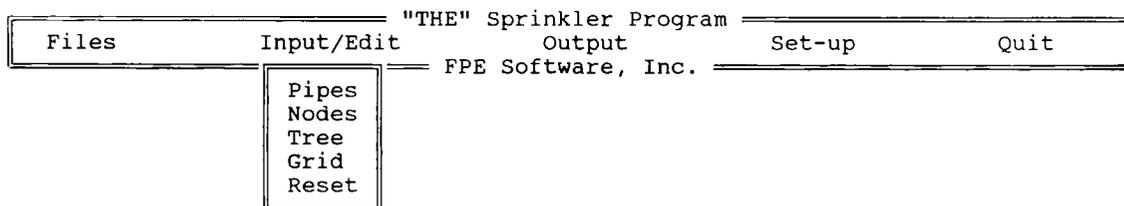


Figure 1. "THE" input data window.

"THE" Sprinkler Program							
Pipe Input Data							
Begin Node	End Node	+ " = Length	Diam	Type	Fitting Description	C-Value	
1	- 2	15.00	1	40		120	
2	- 3	15.00	1	40		120	
3	- 4	15.00	1Q	40		120	
4	- 5	5.00	1H	40	T	120	
5	- 6	2.00	2	40	T	120	
7	- 8	15.00	1	40		120	
8	- 9	15.00	1Q	40		120	
9	- 10	5.00	1H	40	T	120	
10	- 11	2.00	2	40	T	120	
6	- 11	15.00	2	40		120	
11	- 12	15.00	2H	40		120	
12	- 13	15.00	2H	40		120	
13	- 14	25.00	2H	40	EG20	*	120
14	- 15	100	6	AD	E	140	
-	-			40		120	
-	-			40		120	
-	-			40		120	
-	-			40		120	

Row: 1 F1-Function Menu      F10 - Calc. Required C:TREE1.THE      Esc-Exit

Figure 2. Pipe input data window.

be either conditional or unconditional. Care is needed when manipulating blocks of data since the program will overwrite existing data when performing a block move. Make room for the new data first. The manual contains a caution about this, but a warning would be helpful before the data is lost. Another useful feature is the mini-calculator in the pipe length column of the screen. Several lengths of pipe can be added together and the program will convert segments entered as inches to feet automatically. All of the special editing features are easily accessible through function keys and the <F1> key brings up a list of available options if you forget the proper key.

Tree and Grid generators (see Figure 3) are provided to speed the input of pipe and node data. Information about the branch and cross mains, sprinkler and line spacing, and other system design characteristics are entered into a single screen form and then the program generates most of the data required by the program. A few minor adjustments (such as riser details and supply data) must be added in the data entry windows. The generators will create a remote area of the proper shape (the remote area multiplier, typically 1.2 or 1.4, can be specified). The user can print a schematic of the system generated. This can be helpful when checking to make sure the tree or grid configuration is of the shape intended, and does not

include the riser connection or other data that must be added to complete the input. The generated data is placed in the input/edit window ready for final adjustment. The data from the tree and grid generators can also be merged into the current data set. This allows a tree segment to be easily added to a gridded system. The manual contains a tutorial that demonstrates the use of the program with both the tree and grid generators. Neither the tree nor grid generator automatically sizes branch, cross or feed mains.

## PERFORMING CALCULATIONS

Hydraulic calculations are performed by selecting <F10> from within the pipe or node edit screens. The type of calculation (demand or supply) is selected. If a demand calculation is selected, the minimum sprinkler flow or pressure required and most remote node can be selected. If these are left blank, the program will automatically select the required flows and most remote node based from the input data. If a supply calculation is requested, the desired density and maximum imbalance at any node are requested. The program then checks the data and performs the calculations. Peaking calculations as required by *NFPA 13* for gridded systems can be conducted automatically if the alternate areas have been defined.

```

"THE" GRID Generator Program
Total number of branch lines: 10      Sprinkler "K" factor: 8.0
Distance between branch lines: 10    Design density: .35
Sprinkler spacing: 10                 Remote area size: 3000
Branch line length: 75                 Square root multiplier: 1.4
Riser nipple length: 1                 Number of supply pieces: 2
Supply length: 45                      Pipe C value: 120

Sprinkler elevation: 29
Branch line elevation: 29
Cross Main elevation: 28
Supply elevation: 0

Branch line diameter: 2
Riser nipple diameter: 2
Near main diameter: 4
Far main diameter: 3
Supply diameter: 6

# Sprinklers Operating:
# Sprinklers per Branch Line:
# Branch Lines:
    
```

Press F10 to assemble Grid

Figure 3. Grid generator input screen

Calculations typically took less than 15 seconds on a 25 MHz 386 PC without a math coprocessor. Complex or very large systems may take longer. Calculation speed is good. Once the calculations are complete, a summary is displayed and the user is given the option to review detailed calculation on the computer screen.

## PROGRAM OUTPUT

Output options are flexible. Input and output data can be printed to a printer or out-

put to a file on disk. The user can print either the pipe data, node (sprinkler) data, or both. The actual sprinkler density at each head can be printed as an option.

The program can also print a cover sheet that contains general job information, system design details, calculation summary, water supply details, and storage details. Several types of graphs can be generated, including a supply/demand graph (see Figure 4), fire pump curve and flow dependent pressure loss device flow characteristic curve.

File: TREE1.THE "THE" Sprinkler Program by FPE Software, Inc. Page: 1

NODE	PRESSURE (PSI)	FLOW (GPM)	ELEVATION (FEET)	K-FACTOR	AREA (SQ.FT.)	DENSITY (GPM/SQ.FT.)
1	16.14	22.50	24.00	5.60	225.00	0.100
2	18.57	24.13	24.00	5.60	225.00	0.107
3	27.92	29.59	24.00	5.60	225.00	0.131
4	34.02	32.66	24.00	5.60	225.00	0.145
5	38.84	0.00	24.00			
6	41.03	0.00	22.00			
7	28.65	29.97	24.00	5.60	225.00	0.133
8	32.77	32.06	24.00	5.60	225.00	0.142
9	36.94	34.03	24.00	5.60	225.00	0.151
10	40.77	0.00	24.00			
11	42.68	0.00	22.00			
12	44.92	0.00	22.00			
13	47.15	0.00	22.00			
14	64.44	0.00				
15	67.22	204.94	-6.00	SOURCE		

Figure 4a. Sample output—node data.

File: TREE1.THE "THE" Sprinkler Program by FPE Software, Inc. Page: 2

BEGIN NODE	END NODE	FLOW (GPM)	DIAMETER (INCHES)	TYPE	FITTINGS	LENGTH (FEET)	EQV LENGTH (FEET)	TOT LENGTH (FEET)	FRICTION (PSI/FT.)	C-VALUE	Pe (PSI)	Pf (PSI)	VELOCITY (FT/SEC)
2	1	22.50	1.049	40		15.00	0.00	15.00	0.162	120	0.00	2.43	8.35
3	2	46.63	1.049	40		15.00	0.00	15.00	0.623	120	0.00	9.35	17.31
4	3	76.22	1.380	40		15.00	0.00	15.00	0.407	120	0.00	6.10	16.35
5	4	108.88	1.610	40	T	5.00	8.00	13.00	0.371	120	0.00	4.83	17.16
6	5	108.88	2.067	40	T	2.00	10.00	12.00	0.110	120	0.87	1.32	10.41
8	7	29.97	1.049	40		15.00	0.00	15.00	0.275	120	0.00	4.13	11.13
9	8	62.03	1.380	40		15.00	0.00	15.00	0.278	120	0.00	4.17	13.31
10	9	96.06	1.610	40	T	5.00	8.00	13.00	0.295	120	0.00	3.83	15.14
11	10	96.06	2.067	40	T	2.00	10.00	12.00	0.087	120	0.87	1.05	9.18
11	6	108.88	2.067	40		15.00	0.00	15.00	0.110	120	0.00	1.65	10.41
12	11	204.94	2.469	40		15.00	0.00	15.00	0.149	120	0.00	2.24	13.73
13	12	204.94	2.469	40		15.00	0.00	15.00	0.149	120	0.00	2.24	13.73
14	13	204.94	2.469	40	EG20	25.00	27.00	52.00	0.149	120	5.53	7.76	13.73
15	14	204.94	6.000	AD	E	100	18.63	118.63	0.001	140	2.60	0.18	2.33

Figure 4b. Sample output—pipe data.

Graphs can be output to a dot matrix printer (9 or 24 pin, IBM/Epson compatible), HP LaserJet compatible printer (1 MB RAM required), screen, or an HPGL plotter file suitable for plotting or importing into a word processor. Postscript printers are not supported.

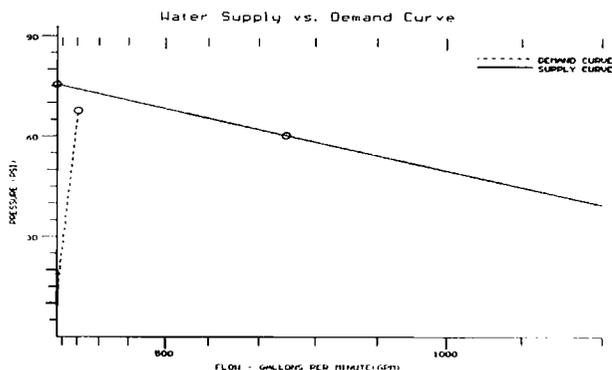


Figure 5. Water supply vs. demand curve.

## POTENTIAL PROBLEMS

Despite all of the things to like about "THE" Sprinkler Program, the program has several problems and limitations that may affect users, though none are fatal if hydraulic calculations are all you need.

- Many programs (including most Windows applications, databases, and others) use the <Tab> key to advance to the next item on the screen. Pressing <Tab> within "THE" Sprinkler Program while in the pipe or node window erases the data under the cursor and inserts a small circular character. Unfortunately, there is no undo command to get the data back. Hopefully future versions of "THE" will adopt this convention or at least ignore this keystroke when in the pipe data, node data or other screens where existing data would be lost.

- Printer configuration options are minimal. The program allows the user to configure simple 2 digit decimal print codes used to set normal print, condensed print and form feeds on most dot matrix and daisy

wheel printers. These options are inadequate to configure most laser printers. A laser printer that can emulate an IBM or Epson dot matrix printer is required for quality laser printed text output. Given the low cost and popularity of laser printers available today, this is considered a major deficiency.

- The print to HPGL file option (supply/demand graph, pump curve plot, and FDPLD plot options) displays the graph on the screen but does not create the disk file. Version 1.0 of the program created the file correctly. The main purpose of this option is to create an HPGL file that can be imported into WordPerfect 5.1 and other word processing programs. The documentation stated that this feature works with WordPerfect 5.1, but the HPGL file generated by Version 1.0 would not import into Microsoft Word for Windows 2.0, Micrografx Designer 3.1, or Aldus PageMaker 4.0. Ventura Publisher was able to import the file.

- The print to a 9 pin dot matrix printer option (supply/demand graph, pump curve plot, and FDPLD plot options) did not complete the border on the right side of the plot. On a 24 pin printer, the paper did not advance properly and the graph printed on a single line.

- Fitting equivalent length data is not adjusted to type of pipe used—a single equivalent length is used for each fitting regardless of the pipe type. For example, when Schedule 10 pipe is used, the equivalent lengths of the fittings are not adjusted and a smaller fitting loss is obtained than if the fitting was attached to a piece of schedule 40 pipe. While this adjustment is not currently required by *NFPA 13*, proposals are being processed to add this requirement to the next edition of the sprinkler standard. The program does adjust equivalent lengths for changes in C-factor.

- The Reset option on the Input/Edit menu does not offer a way to cancel without saving data—it is possible to enter the file name, save and recover. Similarly, there is no obvious way to cancel or "back out" of the

**Result or Input options of the Output Menu.** The print job can be canceled by continuing to answer the prompts, selecting print to file, and pressing <Esc> when asked for a file name. While neither is a major problem, an option to cancel would be helpful.

- Metric data is not supported (neither input nor output).

## CONCLUSIONS

"THE" Sprinkler Program is a versatile program that offers several conveniences not found in many sprinkler hydraulic programs. Data entry is flexible and changes are easily made. The ability to support multiple water supplies and pumps, and the inclusion of flow dependent friction loss devices are features not found in other many programs. The program

will perform sprinkler system hydraulic calculation in accordance with *NFPA 13* with few limitations. Version 1.2 of the program suffers from several problems, some of which will not affect all users. Hopefully, the next version of "THE" Sprinkler Program will fix these problems.

"THE" Sprinkler Program will run on any IBM PC, XT, 286, 386, or 100% compatible computers with 512K RAM and a hard drive. Most video boards are supported including MGA, CGA, EGA, VGA, Hercules and AT&T 400. A math coprocessor is recommended but not required. The program supports most IBM/Epson compatible dot matrix printers. HP LaserJet compatible printers which emulate IBM/Epson text printers are also supported. "THE" Hydraulics Program is available from FPE Software at a cost of \$1,500.