AutoCad Data Base/Drawing SCADA System Program

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The SCADA project (Supervisory Control and Data Acquisition) consists of the upgrade of the electric power control devices at the INEL. Since the 50's when the INEL was born, many relays and protection devices have not being maintained properly, or some have become obsolete, and their operation during an emergency situation can not be guaranteed. This new high tech system will consists of the automatic data acquisition from six different sites; ICPP, TRA, TAN, NRF, EBR II, Spert and Scoville.

The SCADA project is quite large and has been divided into smaller projects, such as the AutoCad Data Base/Drawing SCADA System Program, the development of switch gear and data acquisition software.

The AutoCad Data Base/Drawing SCADA System Program is a set of LISP files running on the AutoCad environment and consists of; the display of current substation drawings, attached to a main Data Base containing information about every single device. This information will contain fields such as name of device, serial number, manufacturer, and other yet not defined items.

The retrieval of such information will be accomplished by the use of pulldown menus and/or the use of toolbar icons. The pulldown menu, once selected, will display another pulldown menu with the seven substation's names, where the user can choose the desire substation drawing. The toolbar icon, once selected will display a dialog box containing buttons with the substation's name, where the user can choose the desire substation drawing.

The technical staff at the main grid control can not keep up with all the changes on the power grid made throughout the large territory the INEL covers. Therefore, they need a program that can be updated by engineers and revised by technicians when needed, without the need to find accurate paper drawings and documentation on each device promptly.

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SCADA DATA BASE/DRAWINGS PROGRAM

SCADA Data Base/Drawings Program

Introduction:

After the development of the Atom bomb and during the cold war the Department of Energy decided to encourage the development of atomic energy, not just for weapons, but also for the use of atomic energy as a source of electric current. An isolated and remote place was needed, a place where in case of a mishap, casualties will be low and a place easy to guard against foreign interest. The state chosen was Idaho, particularly the south eastern part of Idaho, near the city of Idaho Falls. By 1960 the Idaho National Engineering Laboratory or INEL was founded for the research of atomic energy. The INEL main site is located in the high desert 100 miles west of the city of Idaho Falls and covers 2000 km^2. Since its creation, the laboratory has grown very quickly and produces 40 % of its own power, which comes from the nuclear reactor IBR-II. The rest of the power consumed is imported from the states of Utah and Montana. Nowadays, due to the enormous and ever increasing amount of power consumed, the extremely importance of national security projects being developed, and the insufficient reliability of the power system within the facility, the DOE has funded an upgrade project to improve the INEL's power system. This power system is to; control all input and output power, control and collect all data acquisition throughout the site, and the tracking of customer usage.

Description:

The SCADA Data Base/Drawing project consists of the development of an AutoCad menu that retrieves all drawings related to the SCADA system within the AutoCad environment. There are two types of menus; a pull down menu and a dialog box menu, and seven different drawings for all substations.

The pull down menu is located on the top right corner of the screen. Once selected, another menu comes down displaying the SCADA substations (Scoville, ICPP, TRA, EBR II, Spert, NRF). After selecting any of the substations, its corresponding drawing will be retrieved and displayed on the screen.

The tool bar icon is alternative way to bring any of the substations drawings. Once the SCADA icon is pressed, a dialog box will be displayed on the screen with the names of all substations. Then the user can select any drawing desired.

On these substation drawings, an AutoCad database is attached to each item, in a manner that whenever the mouse is clicked on any of these items a data base window will appear displaying data about that particular item. The fields displayed on this window are such as name, model number, manufacturer, serial number, working status, etc., more field will be appended later on.

Contents:

The following file tables contain the code necessary to open a drawing when selected from the pull down menu **SCADA** or the SCADA toolbar (fig 1.1):

Location: **\acadr13\win**

LISP File	
icpp.lsp	opens the ICPP drawing
ebrii.lsp	opens the EBR-II drawing
tan.lsp	opens the TAN drawing
tra.lsp	opens the TRA drawing
scoville.lsp	opens the SCOVILLE drawing
spert.lsp	opens the SPERT drawing
nrf.lsp	opens the NRF drawing

Table 1

Location: **\acadr13\win\inel**

AutoCad File	Description
icpp.dwg	ICPP drawing
ebrii.dwg	EBR-II drawing
tan.dwg	TAN drawing
tra.dwg	TRA drawing
scoville.dwg	SCOVILLE drawing
spert.dwg	SPERT drawing
nrf.dwg	NRF drawing

Table 2

Location: **\acadr13\win**

File	Description
inel.lsp	Runs the appropriate DCL file when selecting from the toolbar
inel.dcl	defines the SCADA dialog box
scada.bmp	toolbar icon

Table 3

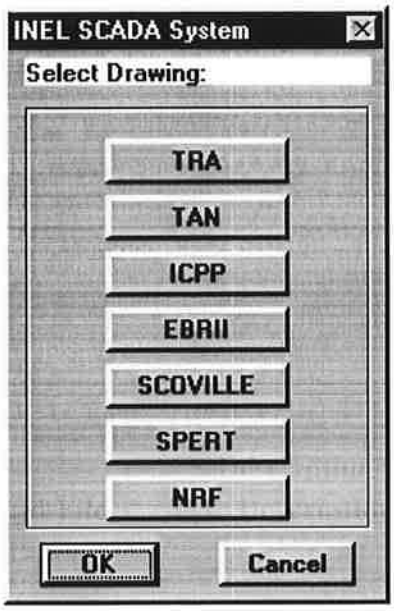


Figure 1. SCADA Pull-down menu and toolbar icon.

Installation:

1) Copy the following files to the **\acadr13\win** subdirectory:

- ICPP.LSP
- EBRII.LSP
- TAN.LSP
- TRA.LSP
- SCOVILLE.LSP
- SPERT.LSP
- NRF.LSP
- INEL.LSP
- INEL.DCL

2) Copy the following files to the **\acadr13\win\inel** subdirectory:

- ICPP.DWG
- EBRII.DWG
- TAN.DWG
- TRA.DWG
- SCOVILLE.DWG
- SPERT.DWG
- NRF.DWG

3) Make a backup copy of your ACADR13.LSP file located at **\acadr13\common\support**

4) Using a text editor (for example EDIT from DOS), edit **ACADR13.LSP.** note: The NOTEPAD from Windows may not work due to the size of some of the files to be edited

5) Once **ACADR13.LSP** is on the screen, search for the following line:

;;;===== AutoLoad LISP Applications =====

6) Below this line enter the following text exactly as listed:

```
(autoload "inel" '("inel"))

(autoload "spert" '("spert"))

(autoload "scoville" '("scoville"))

(autoload "icpp" '("icpp"))

(autoload "ebrii" '("ebrii"))

(autoload "tan" '("tan"))

(autoload "tra" '("tra"))

(autoload "nrf" '("nrf"))
```

7) This portion of the file should look like figure 3 below.

```
;;===== AutoLoad LISP Applications =====
(autoload "inel" '("inel"))
(autoload "spert" '("spert"))
(autoload "scoville" '("scoville"))
(autoload "icpp" '("icpp"))
(autoload "ebrii" '("ebrii"))
(autoload "tan" '("tan"))
(autoload "tra" '("tra"))
(autoload "nrf" '("nrf"))
(autoload "appload" '("appload" "appload"))
(autoload "edge" '("edge"))
```

Figure 2

8) Save the file under the name: **ACADR13.LSP**

9) Make a backup copy of your **ACAD.MNU** file located at **\acadr13\win\support.**

10) Using a text editor (for example EDIT from DOS), edit **ACAD.MNU**.
note: The NOTEPAD from Windows may not work due to the size of some of the files to be edited.

11) Once **ACAD.MNU** is on the screen, search for the following lines:

```
ID_About   [&About AutoCAD...]^C^C_about

//
//  Begin AutoCAD ToolBars
//
```

12) Between the **ID_About** line and the // comments insert the following text exactly as listed:

```
***POP8
[&SCADA]
[&TAN]^C^Ctan
[&TRA]^C^Ctra
[&NRF]^C^Cnrf
[&ICPP]^C^Cicpp
[&EBRII]^C^Cebrii
[&SPERT]^C^Cspert
[&SCOVILLE]^C^Cscoville
```

13) The file should look like figure 3 below.

```
ID_Qtour   [&Quick Tour...]^P(playtbk "quiktour") ^P
ID_Lrnacad [&Learning AutoCAD...]^P(help "tutorial.hlp") ^P
[--]
ID_About   [&About AutoCAD...]^C^C_about

***POP8
[&SCADA]
[&TAN]^C^Ctan
[&TRA]^C^Ctra
[&NRF]^C^Cnrf
[&ICPP]^C^Cicpp
[&EBRII]^C^Cebrii
[&SPERT]^C^Cspert
[&SCOVILLE]^C^Cscoville


//
//  Begin AutoCAD ToolBars
//

***TOOLBARS
**STANDARD_TOOLBAR
```

Figure 3

14) In the **ACAD.MNU** file also search for the following lines:

```
***TOOLBARS
**STANDARD_TOOLBAR
ID_Stdtbar  [_Toolbar("Standard Toolbar", _Top, _Show, 0, 38, 1)]
```

15) Between the ***TOOLBARS** line and the ****STANDARD_TOOLBAR** comments insert the following text exactly as listed:

```
ID_Scada    [_Toolbar("SCADA", _Top, _Show, 500, 150, 5)]
ID_Scada    [_Button("SCADA", ICON, ICON)]^C^Cinel
ID_AttEdi   [_Button("Edit Attribute", ICON_16_ATTEDI, ICON_32_ATTEDI)]^C^C_ddatte
```

16) The file should look like figure 4 below. Save the file under the name: **ACAD.MNU.**

```
//
//   Begin AutoCAD ToolBars
//

***TOOLBARS
**SCADA_TOOLBAR
ID_Scada    [_Toolbar("SCADA", _Top, _Show, 500, 150, 5)]
ID_Scada    [_Button("SCADA", ICON, ICON)]^C^Cinel
ID_AttEdi   [_Button("Edit Attribute", ICON_16_ATTEDI, ICON_32_ATTEDI)]^C^C_ddatte

**STANDARD_TOOLBAR
ID_Stdtbar  [_Toolbar("Standard Toolbar", _Top, _Show, 0, 38, 1)]
ID_New      [_Button("New", ICON_16_NEW, ICON_32_NEW)]^C^C_new
ID_Open     [_Button("Open", ICON_16_OPEN, ICON_32_OPEN)]^C^C_open
ID_Save     [_Button("Save", ICON_16_SAVE, ICON_32_SAVE)]^C^C_qsave
```

Figure 4

17) To force AutoCad to compile the new menu file delete the following files from the **\acadr13\win\support** subdirectory. **ACAD.MNS ACAD.MNR ACAD.MNC**.

18) Invoke AutoCad from windows.

19) From the **TOOL** menu select **CUSTOMIZE TOOLBARS**.

20) Find and highlight the **ACAD.SCADA** toolbar.

21) From the Toolbars window, select the **PROPERTIES** button.

22) Deselect **HIDE**, by clicking on the radio box.

23) Select **APPLY**.

24) Close the Toolbars Property window (do not close the Toolbars window).

25) With the Toolbars window open, point the mouse to the happy face on the SCADA toolbar and click the right hand side button (The SCADA toolbar should be on the upper right corner of the screen). Wait a few seconds until the Button Properties window appears.

26) From the Button Properties window, Button Icon section, select **EDIT**.

27) From the Button Editor window, select **OPEN**.

28) From the Open window, select the **SCADA.BMP** file from the **\acadr13\win\inel** subdirectory and click OK.

29) From the Button Editor window, select **SAVE**.

30) Select **CLOSE**.

31) From the Button Properties window, select **APPLY**.

32) Close the Button Properties window.

33) Close the Toolbars windows.

34) Wait a few seconds until AutoCad compiles the new menu.

35) Click on the **SCADA** icon to open a drawing or select a drawing from the pull down menu.

Note: In case of any trouble call me at (619) 642-0170

Conclusion:

This project is unique, no other facility in the world has attempt to develop such as system and when completed, the technology developed will be transferred to US. private sector as an upgrade to their systems, making them more reliable and efficient.

Software Listings:

INEL Lisp file:

```
(defun c:inel ()

        (setq file_path "d:\\acadr13\\win\\inel\\")

        (setq dcl_id (load_dialog "inel.dcl"))

        (if (not (new_dialog "inel" dcl_id) ) (exit))
        (action_tile "accept" "(done_dialog 1)")
        (action_tile "tra" "(setting_to_tra)")
        (action_tile "tan" "(setting_to_tan)")
        (action_tile "nrf" "(setting_to_nrf)")
        (action_tile "ebrii" "(setting_to_ebrii)")
        (action_tile "spert" "(setting_to_spert)")
        (action_tile "icpp" "(setting_to_icpp)")
        (action_tile "scoville" "(setting_to_scoville)")

        (setq exitcode (start_dialog))
        (if (= 1 exitcode)
                (load_drawing)
        )
        (unload_dialog dcl_id)
        (princ)
)

(defun load_drawing()
        (command "line" "0,0" "0,1" "")
        (command ".open" "yes" (strcat file_path file_name))
)

(defun setting_to_tan ()
        (setq file_name "tan")
)

(defun setting_to_tra ()
        (setq file_name "tra")
)

(defun setting_to_nrf ()
        (setq file_name "nrf")
)

(defun setting_to_ebrii ()
        (setq file_name "ebrii")
)

(defun setting_to_spert ()
        (setq file_name "spert")
)
(defun setting_to_icpp ()
        (setq file_name "icpp")
)
(defun setting_to_scoville ()
        (setq file_name "scoville")
)
```

EBRII Lisp file:

```
(defun c:ebrii ()
    (command "line" "0,0" "0,1" "")
    (command ".open" "yes" "d:\\acadr13\\win\\inel\\ebrii")
    (princ)
    )
```

ICPP Lisp file:

```
(defun c:icpp ()
    (command "line" "0,0" "0,1" "")
    (command ".open" "yes" "d:\\acadr13\\win\\inel\\icpp")
    (princ)
    )
```

TAN Lisp file:

```
(defun c:tan ()
    (command "line" "0,0" "0,1" "")
    (command ".open" "yes" "d:\\acadr13\\win\\inel\\tan")
    (princ)
    )
```

TRA Lisp file:

```
(defun c:tra ()
    (command "line" "0,0" "0,1" "")
    (command ".open" "yes" "d:\\acadr13\\win\\inel\\tra")
    (princ)
    )
```

NRF Lisp file:

```
(defun c:nrf ()
    (command "line" "0,0" "0,1" "")
    (command ".open" "yes" "d:\\acadr13\\win\\inel\\nrf")
    (printc)
    )
```

SPERT Lisp file:

```
(defun c:spert ()
    (command "line" "0,0" "0,1" "")
    (command ".open" "yes" "d:\\acadr13\\win\\inel\\spert")
    (princ)
    )
```

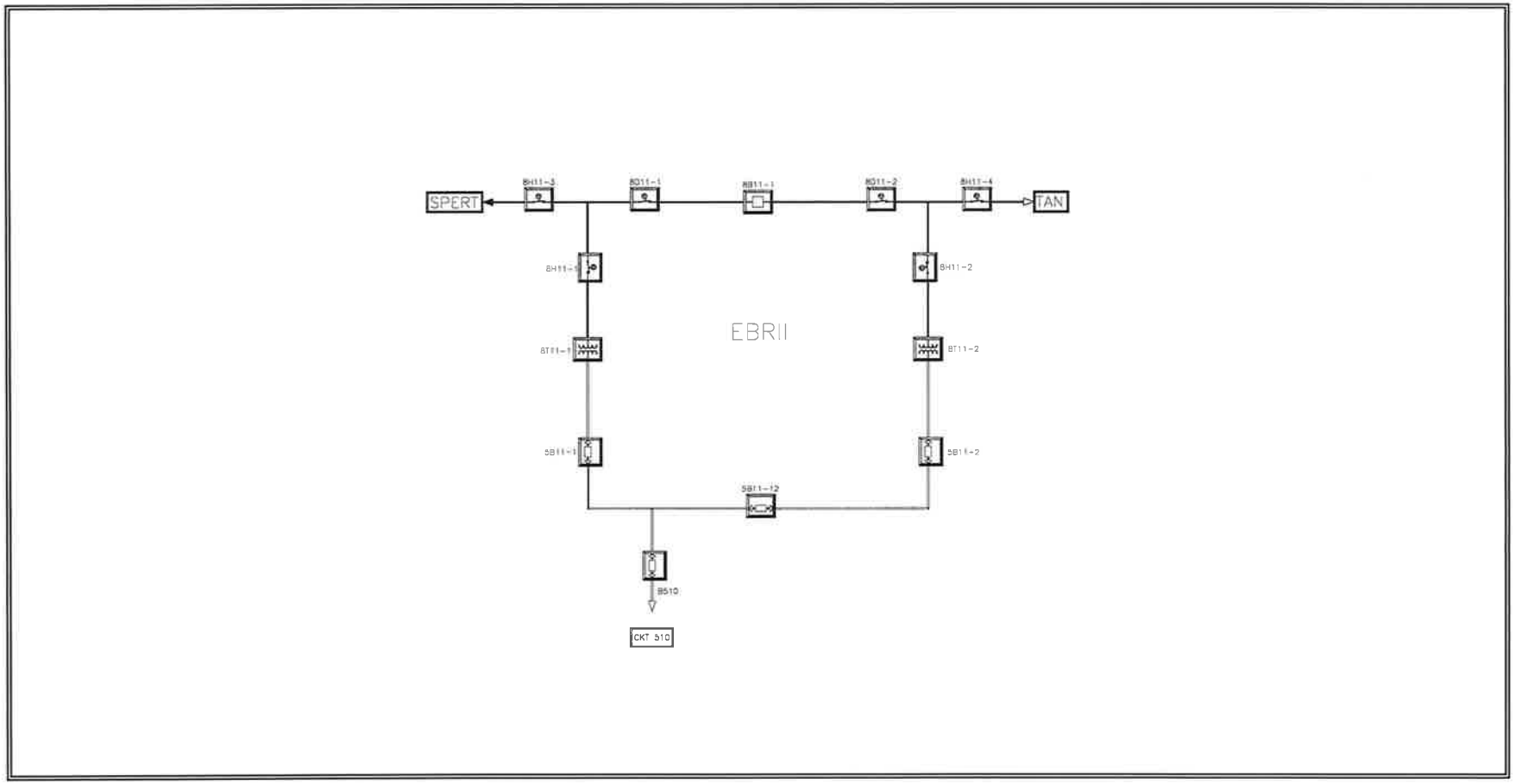
SCOVILLE Lisp file:

```
(defun c:scoville ()
    (command "line" "0,0" "0,1" "")
    (command ".open" "yes" "d:\\acadr13\\win\\inel\\scoville")
    (princ)
    )
```

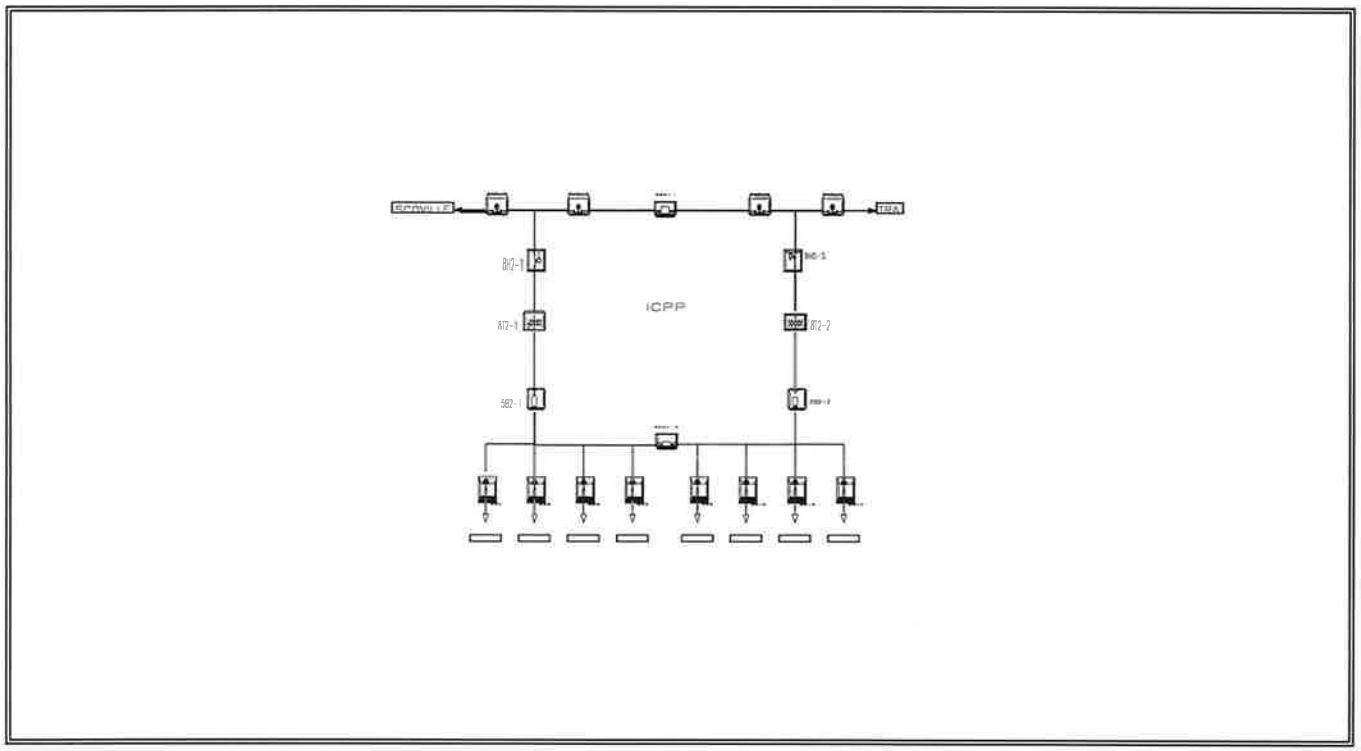
INEL DCL file:

```
inel : dialog {
                label = "INEL SCADA System";
        : text {
                label = "Select Drawing:";
                }
        :boxed_column{
                : column{
                        : button {
                                label = "TRA";
                                key = "tra";
                                width = 13;
                                alignment = centered;
                                fixed_width = true;
                        }
                        : button {
                                label = "TAN";
                                key = "tan";
                                width = 13;
                                alignment = centered;
                                fixed_width = true;
                        }
                        : button {
                                label = "ICPP";
                                key = "icpp";
                                width = 13;
                                alignment = centered;
                                fixed_width = true;
                        }
                        : button {
                                label = "EBRII";
                                key = "ebrii";
                                width = 13;
                                alignment = centered;
                                fixed_width = true;
                        }
                        : button {
                                label = "SCOVILLE";
                                key = "scoville";
                                width = 13;
                                alignment = centered;
                                fixed_width = true;
                        }
                        : button {
                                label = "SPERT";
                                key = "spert";
                                width = 13;
                                alignment = centered;
                                fixed_width = true;
                        }
                        : button {
                                label = "NRF";
                                key = "nrf";
                                width = 13;
                                alignment = centered;
                                fixed_width = true;
                        }
                }
        }
        ok_cancel;
        }
```

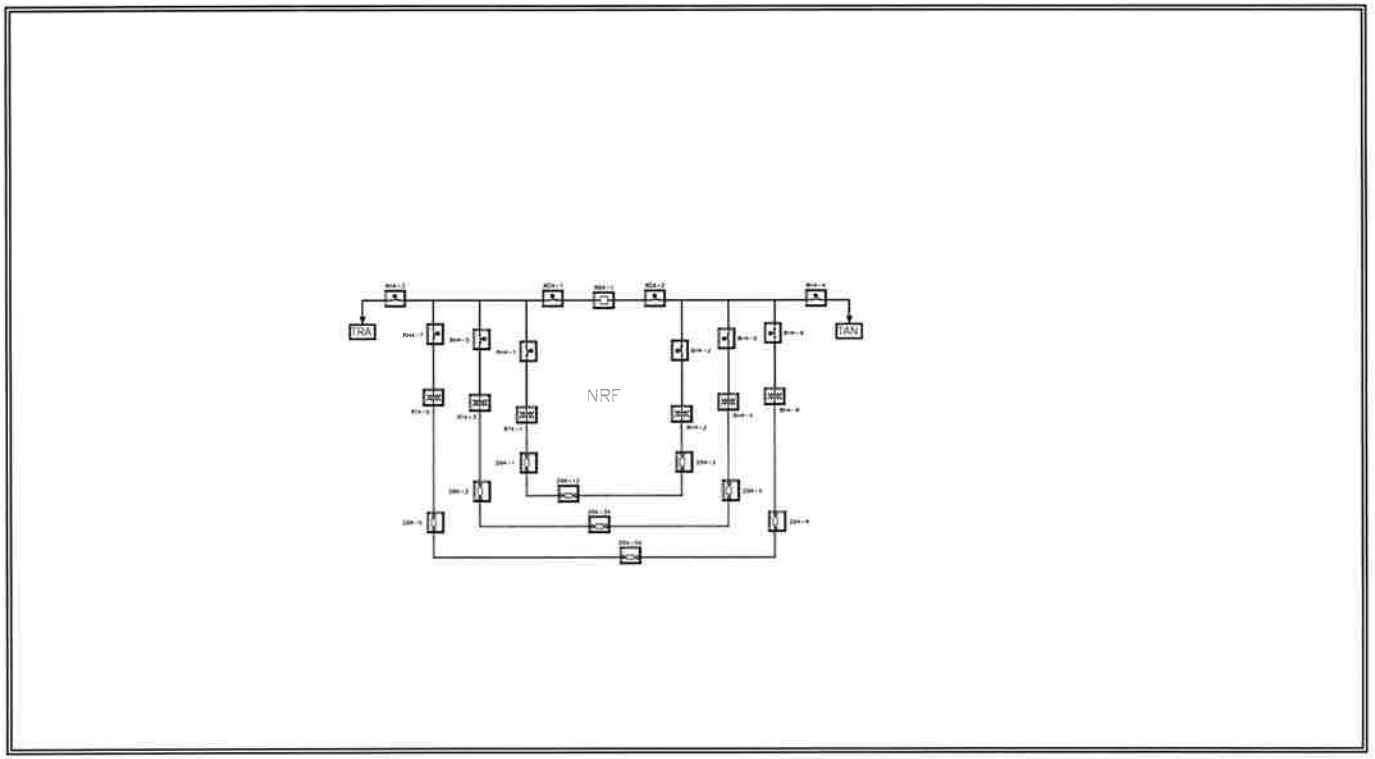
Drawing Listings:



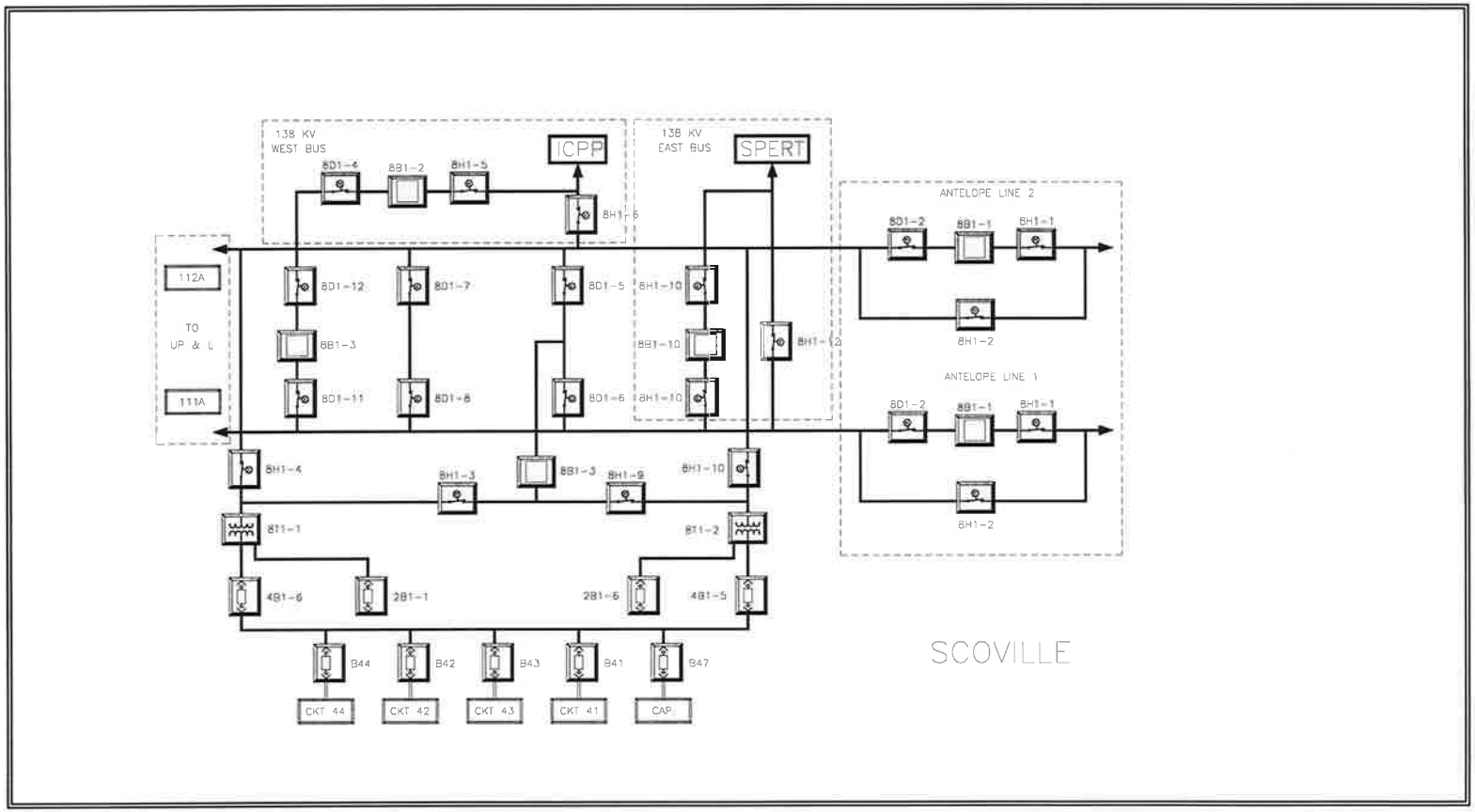
EBR II Substation



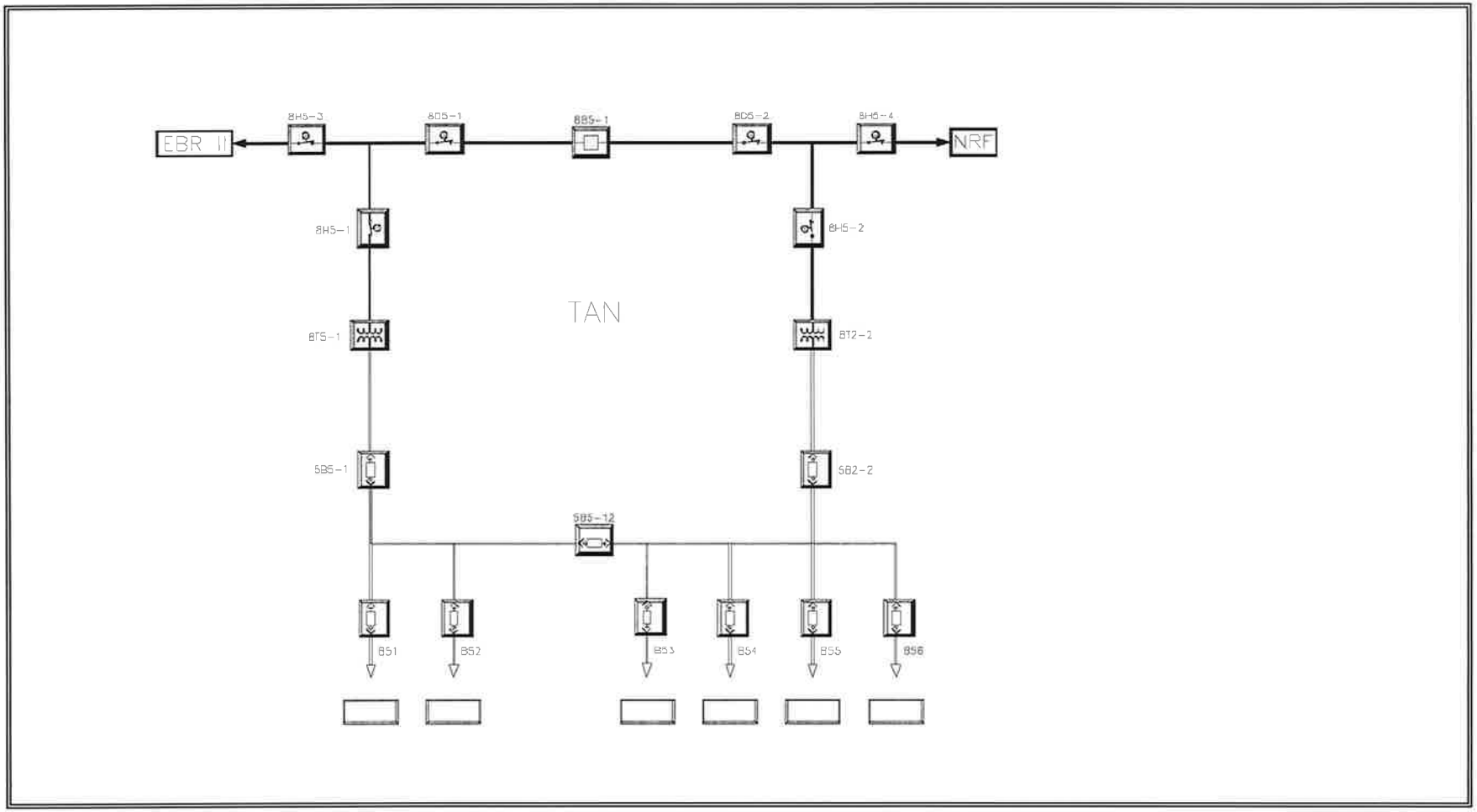
ICPP Substation



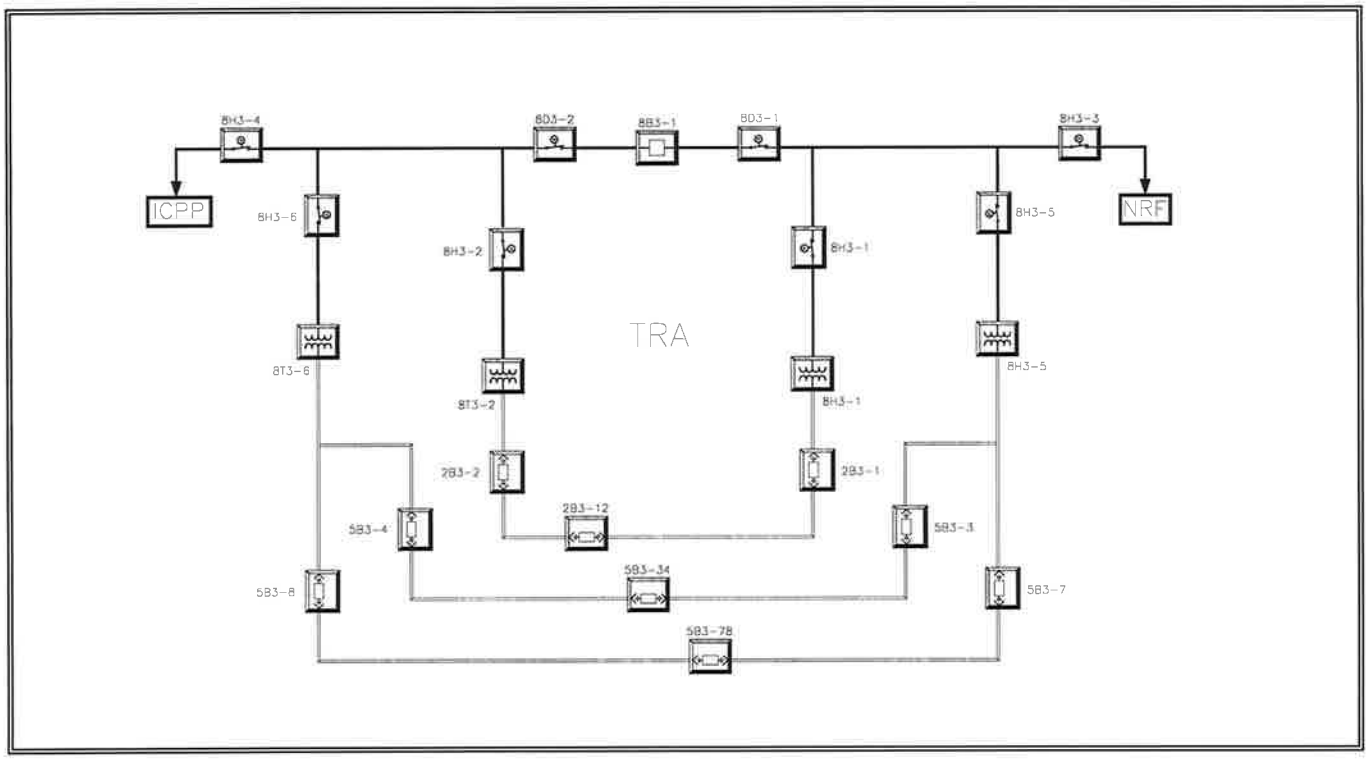
NFR Substation



Scoville Substation



TAN Substation



TRA Substation