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Database Configuration Tool
User's Guide
DRAFT

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5/30/91

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PREFACE

This document describes the Epics Database Configuration Tool (DCT). This tool facilitates the creation and management of INPUT OUTPUT CONTROLLER (IOC) databases. The original work on this tool was performed by Bob Delesio of LANL/GTA. DCT has been extensively modified and enhanced to include extensible record and device support. With few exceptions, all information regarding record structure and field definitions has been removed from the DCT code. All such information is now loaded into DCT at run time and made part of each database. Everything is not perfect however, as DCT still knows and cares about fields NAME, PREC, DTYP, INP and OUT. Also, the addition of new link types to link.h requires code additions. Extensive error checking as been added to DCT and popup windows incorporated for choices (<SELECT>) and link fields (<ADDRESS>). This version of DCT is still curses based.

Because of the extensive changes, short reports of databases created with previous versions of DCT will produce copious errors when loaded into this version of DCT using "Modify from a Text File". A tool is provided elsewhere which does an effective job of modifying the short report to eliminate these "errors"

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1 Introduction

1.1 Changes From Previous Versions of DCT

The following features have been added to DCT:

Extensible record and device support.

Popup windows for <SELECT> and <ADDRESS> fields.

Extensive error checking.

Summary reports.

Ability to rename a process variable.

Link tree displays.

Two pass loading of short report files.

”e” and ”f” formats supported for floats and doubles.

Short and Long Reports use maximum precision for floats and doubles.

Utilities menu with tools for inspecting database structure.

Non interactive mode allowing reporting , deleting, creating and modifying databases from shell scripts and makefiles.

Capability to have multiple databases within on directory.

The following features have been removed from DCT;

Signal Lists.

1.2 Related Documents

Experimental Physics and Industrial Control System (EPICS) Source/Release Control

Experimental Physics and Industrial Control System (EPICS) Input Output Controller (IOC) Application Developer’s Guide.

DCT Release Notes

1.3 Documentation Conventions

The notation <keyname> is used to indicate a keyboard key. For example, <Return> indicates the Return key. Control keys are indicated by the prefix ”Ctrl”. Thus <CtrlE> indicates that the Control key and the ”E” key should be pressed simultaneously.

1.4 General

The following pages contain many examples. These examples were not taken from an operational database and are for illustrative purposes only. They are not meant to be examples of how a ”real” database would look.

2 Getting Started

2.1 Some Basic Concepts

This version of DCT implements extensible record and device support. Configuration information describing record types and field definitions is loaded into DCT from a ".dctsdr" file (see Section 7.2.2) when a database is created or opened. The ".dctsdr" file is a concatenation of a number of "Self Defining Record" (SDR) files containing arrays of description structures. When a database is created, the current default.dctsdr file is copied to "database_name.dctsdr" which becomes part of the named database. When a database is opened, DCT checks a timestamp on the ".dctsdr" file against the other files in the database to insure that the ".dctsdr" configuration file has not changed since the database was created.

2.2 Setting up Your Application Environment

(To be added)

2.3 Setting up Your Workstation Environment

DCT requires a fairly large window to operate properly. Under X–Windows or OpenWindows use an xterm window invoked as follows:

```
xterm -sf -fn 6x13 -geometry 110x64-0+0
```

Under SunView use a shelltool invoked as follows:

```
shelltool -Ww 110 -Wh 64 -Wt /usr/lib/fonts/fixedwidthfonts/screen.r.11
```

You may use any other fonts that you find pleasing and allow the window to fit on the screen.

2.4 Running DCT

2.4.1 The KeyPad and Special Keys

The following lists the notation for special keyboard keys (assuming a Sun type 4 keyboard):

<Exit>	Key R11 (5) on the righthand keypad, <CtrlE> also works.
<Quit>	Key R2 (PrSc) on the righthand keypad
<Up>	Key R8 (8) on the righthand keypad
<Down>	Key R14 (2) on the righthand keypad
<Left>	Key R10 (4) on the righthand keypad
<Right>	Key R12 (6) on the righthand keypad
<Return>	The Return Key

2.4.2 Navigating Through the Menus

DCT provides three menus, a main menu and two submenus described below. A menu may be exited by pressing the <Exit> key or selecting the "Exit" menu choice.

2.4.2.1 The Main Menu

DCT presents it's main menu upon invocation (Section 3). This menu generally presents choices that operate on an entire database. Two of the main menu choices select submenus. The "Open a Process Database" choice opens a selected database and presents the Process Variable Menu. The "DCT Utilities" choice presents the Utilities Menu.

2.4.2.2 The Process Variable Menu

This menu presents choices that operate on process variables within a database (Section 4). Use this menu to create and modify process variables.

2.4.2.3 The Utilities Menu

This menu presents a number of choices that are useful for displaying the structure of a database (See Section 5). This menu is mainly of interest to developers.

2.5 Creating Your First Database

Run DCT in the proper size window (Section 2.3). From the main menu select "Create a Process Database". DCT will ask you for a database name. Enter a name of your choice followed by a <Return>. DCT will create an empty database with the name you have chosen and return you to the main menu. To add process variables to your new database, select "Open a Process Database". DCT will present you with it's process variable menu. Since we want to create new process variables, select "Create a Process Variable". DCT will present you with a list of the defined record types (obtained from the "default.dctsdr" file). Using the <Up> and <Down> keys, position the cursor next to the type of process variable you wish to create and press <Enter>. DCT will prompt you for a name to assign to the new process variable. This name must be unique. Enter a name followed by <Return>. DCT will present a screen listing the usrer configurable fields for the record type selected. You may change field values from the defaults by using the <Up> and <Down> keys to position the cursor over the value to be changed and entering the new value. The allowable range for each field is indicated to the left of the value. Fields with ranges of <SELECT> or <ADDRESS> pop up a subwindow for selecting a choice or entering a multicomponent address. Exit a subwindow with either <Exit> or <Quit> keys. After the field values have been modified, press <Exit> to return to the process variable menu.

2.6 Importing a Previously Created Database

Databases may be imported to new releases of EPICS through a short report text file (Section 3.3). Run DCT. Create a new empty database using the "Create a Process Database" menu selection. Select "Modify From a Text File" in the main menu. If more than one database is present in the current directory, DCT will display a list of databases. Select the newly created database. DCT will ask for the name of a "modification file". Enter the name of the short report file containing database information to be loaded. DCT will make two passes

through the short report file. The first pass loads the record information. The second pass checks field values against allowed ranges. Any errors encountered will be listed in a file with the name ”short_report_name.err”.

3 The Main Menu

Figure 1 shows DCT's main menu. To select a menu item use the <Up> and <Down> cursor keys on the keypad to position the cursor nest to the desired item and press <Return>. The following sections describe each menu item in greater detail.

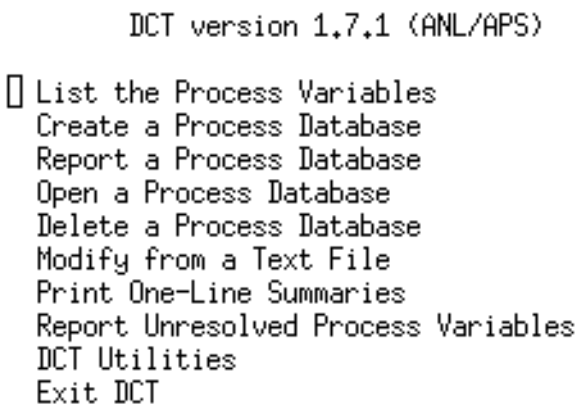

Figure 1: The Main Menu

3.1 List the Process Variables

This option will scan all databases within your directory and list the process variable names. You will be prompted for a process variable name mask. The "*" character is used as a 'wild card'. If you just hit <Return> at the process variable mask prompt, all process variables will be listed. The process variables are listed by database. Within a database the are listed by record type and ordered alphabetically. The selected process variables for each record type are listed on a separate page. You may abort the list at any time by hitting <Exit>.

3.2 Create a Process Database

Selection of this choice creates a database in your application directory. You will be prompted to enter a database name. You can enter up to a 32 character name consisting of alphanumeric characters and the underscore character. The name you enter must be valid for a Unix filename and must begin with an upper or lowercase letter. You may create as many databases in your application directory as you desire. Upon entry of a valid database name DCT will create the files that define the datatbase. (These files are described in Section 7).

3.3 Report a Process Database

This menu option is used to generate text file reports on the contents of a database. DCT will ask you to enter a file name to be used for the report. If you enter the name of an existing file, it will be overwritten. Typing a <Return> will cause DCT to send the report to the screen. If more than one database is present, DCT asks you chose a database to report. You may exit at this point by pressing the <Exit> key. If you select a database, and did not enter a file name, DCT will generate the report on the screen, pausing after each process variable is displayed. You may press <Return> to continue or <Exit> to quit the report. If you specified a filename for the report, DCT asks whether or not you want a long report. The long report gives a complete description of each process variable, including the description, name , range and value of each prompted field within the record. It is useful for documentation purposes. If you type a "n" followed by a <Return>, DCT will generate a "short report". The short report lists just field names and values for each record. The short report is used to create a "backup" of your database. It is used (and required) to move databases to new releases of the control software. It is a real good idea to periodically create "short reports" of your databases.

Within the report, process variables are grouped by record type and ordered alphabetically within each type. Each process variable appears on a separate page. Note that precision is set to 6 for reports regardless of the process variable's precision field value.

A sample page from a short report is shown if Figure 2.

```
PV: ai1                          Type: ai
  Time: Wed Feb 13 06:59:44 1991

DESC
SCAN .1 second
PHAS 0
EVNT 0
DTYP XYCOM-566 Dif Scanned
SDIS name.VAL .NPP.NMS
DISV 1
INP  #C4 S6
PREC 0
LINR LINEAR
EGUF 1.343e-28
EGUL 0
EGU  amps
HOPR 1200.000000
LOPR 0
AOFF 0
ASLO 0
SMOO 0
FLNK ao1.VAL
HIHI -25.000000
LOLO -1000.000000
HIGH -100.000000
LOW  -500.000000
HHSV MAJOR
LLSV VALID
HSV  MINOR
LSV  INFO
HYST 0
ADEL 0
MDEL 0^L
```

Figure 2: A page from a short report

A sample page from a long report is shown in Figure 3.

```
PV: ai1                          Type: ai
  Time: Wed Feb 13 07:27:43 1991

Descriptor              DESC  <28 chars>
Scan Mechanism          SCAN  <SELECT>                  .1 second
Scan Phase              PHAS  <0-> 100>                 0
Event Number            EVNT  <0-> 100>                 0
Device Type             DTYP  <SELECT>                  XYCOM-566 Dif Scanned
Scanning Disable        SDIS  <ADDRESS>                 name.VAL .NPP.NMS
Disable Value           DISV  <-32768-> 32767>          1
InputSpecification      INP   <ADDRESS>                 #C4 S6
DisplayPrecision        PREC  <0-> 5>                   0
Linearization           LINR  <SELECT>                  LINEAR
EngineerUnits Full      EGUF  <-1e+30 -> 1e+30>         1.343e-28
EngineerUnits Low       EGUL  <-1e+30 -> 1e+30>         0
EngineeringUnits        EGU   <8 chars>                 amps
HighOperating Range     HOPR  <0 -> 1e+30>              1200.000000
LowOperating Range      LOPR  <-1e+30 -> 1200.0>        0
AdjustmentOffset        AOFF  <-1e+30 -> 1e+30>         0
AdjustmentSlope         ASLO  <-1e+30 -> 1e+30>         0
Smoothing               SMOO  <0 -> 1.0>                0
FowardProcess Link      FLNK  <ADDRESS>                 ao1.VAL
HihiAlarm Limit         HIHI  <-100.0 -> 1e+30>         -25.000000
LoloAlarm Limit         LOLO  <-1e+30 -> -500.0>        -1000.000000
HighAlarm Limit         HIGH  <-500.0 -> -25.0>         -100.000000
LowAlarm Limit          LOW   <-1000.0 -> -100.0>       -500.000000
HihiSeverity            HHSV  <SELECT>                  MAJOR
LoloSeverity            LLSV  <SELECT>                  VALID
HighSeverity            HSV   <SELECT>                  MINOR
LowSeverity             LSV   <SELECT>                  INFO
AlarmDeadband           HYST  <-1e+30 -> 1e+30>         0
ArchiveDeadband         ADEL  <-1e+30 -> 1e+30>         0
MonitorDeadband         MDEL  <-1e+30 -> 1e+30>         0
```

Figure 3: Sample page from a long report.

3.4 Open a Process Database

This menu choice opens a database for operations on individual process variables. When you select this choice you will be asked to select the database you wish to open if there is more than one database within your directory. After selecting a database to open DCT will present you with another menu of operations, the process variable menu. This menu is described in detail in Section 4.

3.5 Delete a Process Database

This menu choice will delete all the files associated with a particular database (in particular, it will delete the files described in Section 7.2). If there is more than one database in your directory, DCT will present you with a list of databases. Select the database you want to delete using the cursor keys and either press <Return> to continue or press the <Exit> key to

abort the delete. If you pressed <Return>, DCT warns you that all process variables in selected database will be deleted and asks you if you want to continue. Type either a "y" followed by a <Return> to delete the database or a "n" followed by a <Return> to abort the delete. If you type a "y", DCT will delete all the files for this database.

3.6 Modify a Process Database from a Short Report

This choice loads a database with record descriptions from a short report (see Section 3.3). Both the database and the short report file must exist prior to running this option. If more than one database is present in your directory, DCT will present you with a list of databases. Select the database you wish to modify from a short report. DCT will then prompt you for the short report file name. Enter the name of an existing short report file followed by <Return>. DCT will then make 2 passes through the short report file, listing any errors on the second pass. A file with the same name as the short report file but with a ".err" appended will be created listing the process variables modified and any errors detected. If any errors are detected, you may correct them within DCT or, you may edit the short report file using the standard Unix tools (vi , sed, etc.) and repeat the operation.

3.7 Generate One–Line Summaries for a Process Database

This menu choice permits the generation of custom reports. The reports consist of a single line per process variable. The content of custom summary report form files is described in detail in Section 7.3.

Upon selecting this menu choice, DCT prompts for a filename to use for the report. If you just hit <Return>, DCT will write the summary report to the screen. Entering a name will cause DCT to create a file with that name and write the summary report to that file. If a file by that name already exists, DCT will over write the file and it's previous contents will be lost. DCT next lists the databases in the current directory and asks you choose one. After you select a database, DCT searches the current directory for form definition files and asks you choose one. After you choose a form, DCT creates the summary report.

DCT has a built-in default form which is always available. The default form consists of columns for the process variable record type, process variable name, process variable description, the process variable device type, and a column containing either the input specification or the output specification, whichever is appropriate. Figure 4 shows an example summary report using the built-in default form.

```
Type        Name                    DESC                    DTYP                    INP|OUT
ai          RFT_KLY:coilAFlow       Water Flow Coil A       AB-1771IL-Analog In     #L0 A0 C0 S0
ai          RFT_KLY:coilATemp       Water Temp Coil A       Soft Channel            0.00e+00
ai          RFT_KLY:coilInTemp                              Soft Channel            0.00e+00
ai          aai3                                            XYCOM-566 SE Scanned    #C0 S0
ai          ai1                                             XYCOM-566 Dif Scanned   #C4 S6
ai          ai2                                             Soft Channel            a2345678901234567890123456 7.
ao          ao1                     analog out              VXI-AT5-AO              #C3 S2
calc        RFT_KLY:coilAPwr                                                        **************************
calc        RFT_KLY:coilAPwrMon                                                     **************************
compress    comp1                                                                   test.VAL .NPP.NMS
mbbi        mbbi1                                           Soft Channel            0.00e+00
waveform    wave1                                           Joerger-VTR1            #C1 S4
```

Figure 4: Example Summary Report Using the Default Form

3.8 Report Unresolved Process Variables

This menu choice will report the names of process variables referred to in link fields but not defined within the current database.

Upon selecting this menu choice, DCT prompts for a filename to use for the report. If you just hit <Return>, DCT will write the report to the screen. Entering a name will cause DCT to create a file with that name and write the report to that file. If a file by that name already exists, DCT will over write the file and it's previous contents will be lost. DCT next lists the databases in the current directory and asks you choose one. After you select a database, DCT scans the link fields of each process variable and checks whether or not that process variable is defined in that database. If it is not, then that process variable is reported as not resolved.

A sample unresolved process variables report for a database is shown in Figure 5. The report lists process variable names and field names which are linked to (——>) process variables not defined in the current database (testData4). For example, field INP of process variable comp1 is linked to field VAL of process variable test which is not defined in database testData4.

```
Unresolved Process Variables for database testData4 Wed Feb 13 16:14:00 1991

      process variable                              external pv

ai1                          .SDIS ----> name                          .VAL
ai2                          .INP  ----> a23456789012345678901234567 .VAL
RFT_KLY:coilAPwrMon          .FLNK ----> RFT_KLY:coilAPwrSw            .VAL
comp1                        .INP  ----> test                          .VAL
```

Figure 5: Sample Unresolved Process Variable Report.

3.9 DCT Utilities

This menu option will present the menu of utilities described in Section 5.

4 The Process Variable Menu

Figure 6 shows the process variable menu obtained when the open process database choice (Section 3.4) is selected from DCT's main menu. The current database name (testData4 in this case) is given in the second line of the header. The third line gives the current Process Variable Prefix (see Section 4.11). To select a menu item use the <Up> and <Down> cursor keys on the keypad to position the cursor nest to the desired item and press <Return>. Retrun to the Main Menu by pressing <Exit>. The following sections describe each menu item in greater detail.

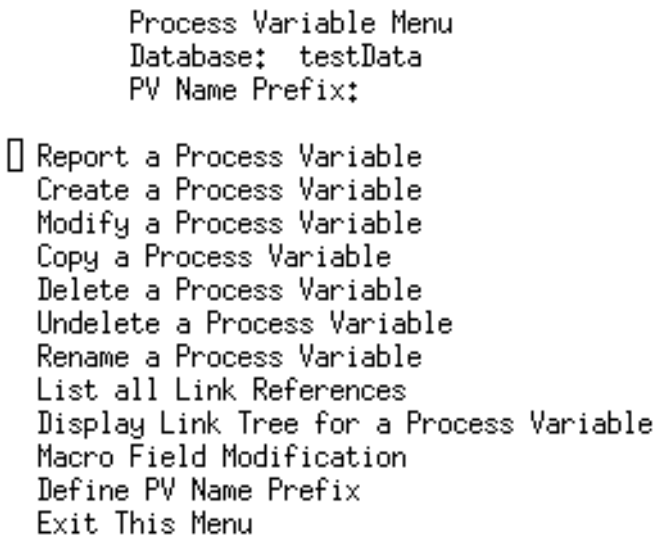

Figure 6: The Process Variable Menu

4.1 Report a Process Variable

This selection is used to report information for a particular process variable(s). DCT will ask you to enter a file name to be used for the report. If you enter the name of an existing file, it will be overwritten. Typing a <Return> will cause DCT to send the report to the screen. Next DCT will display a list of valid process variable record types for the current database. Using the <Up> and <Down> cursor keys, position the cursor next to the record type of the process variable you wish to report. Press <Enter> to select that record type or <Exit> to return to the Process variable menu. If you pressed <Enter>, DCT will present a list of process variable names of the selected record type. Use the <Up> and <Down> cursor keys to position the cursor next to the desired process variable name. Press <Enter> to generate the report for the selected process variable or <Exit> to return to the Process Variable menu. After the report is generated, DCT presents the list of process variable record types

again. You may return to the process variable menu by pressing <Exit> or select another process variable record type and process variable name to be appended to the report file. If you entered a filename, DCT reports the variable with the "short form" format (see Section 3.3). Thus, using this menu option, a short report containing selected process variables can be created. These process variables can then be loaded into another database (See Section 3.6). A sample page from such a report is shown in Figure 7. Note that the precision (specified by field PREC) is disabled for the short report. If no file name was specified for the report, DCT displays on the screen the information for the selected process variable in the "long" format.

```
PV: ai1                          Type: ai
  Time: Fri Feb 15 13:54:17 1991

DESC
SCAN .1 second
PHAS 0
EVNT 0
DTYP XYCOM-566 Dif Scanned
SDIS name.VAL .NPP.NMS
DISV 1
INP  #C4 S6
PREC 0
LINR LINEAR
EGUF 1.343000e-28
EGUL 0.000000e+00
EGU  amps
HOPR 1200.000000
LOPR 0.000000e+00
AOFF 0.000000e+00
ASLO 0.000000e+00
SMOO 0.000000e+00
FLNK ao1.VAL
HIHI -25.000000
LOLO -1000.000000
HIGH -100.000000
LOW  -500.000000
HHSV MAJOR
LLSV VALID
HSV  MINOR
LSV  INFO
HYST 0.000000e+00
ADEL 0.000000e+00
MDEL 0.000000e+00
```

Figure 7: Example report of a process variable.

4.2 Create a Process Variable

Select this menu option to create a new process variable. DCT will display a list of valid process variable record types for the current database. Using the <Up> and <Down> cursor keys, position the cursor next to the record type of the process variable you wish to create. Press <Enter> to select that record type or <Exit> to return to the Process variable menu. If you pressed <Enter>, DCT will ask you to enter a process variable name. Process variable names must begin with either an upper or lowercase letter. DCT will not let you create a process variable with a name identical to an existing (within the current database) process variable. DCT does not at as of this writing detect duplicate process variable names across databases. After accepting a process variable name, DCT presents a modify process variable

screen for the new process variable. This allows you to change the new process variable's field values from the defaults. (See Section 4.3 for a description on how to modify field values). After you are satisfied with the process variable field values, press <Exit> to return to the process variable menu.

4.3 Modify a Process Variable

Select this menu option to modify the field values of an existing process variable. DCT will display a list of valid process variable record types for the current database. Using the <Up> and <Down> cursor keys, position the cursor next to the record type of the process variable you wish to create. Press <Enter> to select that record type or <Exit> to return to the Process variable menu. If you pressed <Enter>, DCT will present a list of process variable names of the selected record type. Use the <Up> and <Down> cursor keys to position the cursor next to the desired process variable name. Press <Enter> to display the modify process variable screen for the selected process variable or <Exit> to return to the Process Variable menu.

Figure 8 shows an example of modify process variable screen.

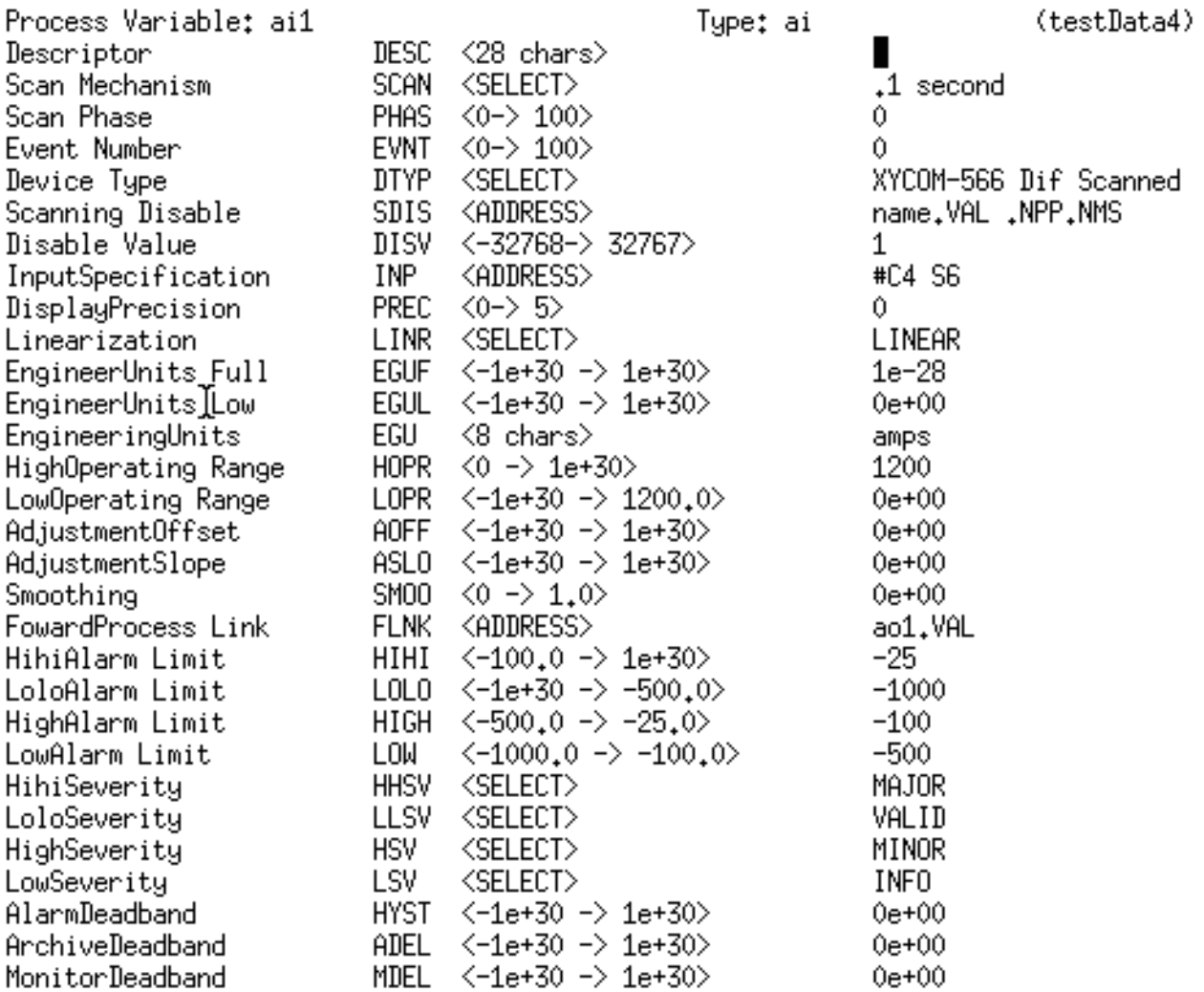

Figure 8: Modify a process variable screen

The screen contains a line for each setable field for the process variable. The format of a line is:

Prompt_string FLDNAME <Range or Entry_mode> VALUE

The information between the angle brackets, <>, indicates the type of information that can be entered into a field. Numeric fields have an allowable range specified. Fields that accept strings have the maximum allowed number of characters indicated. Fields with the <SELECT> designation, have a menu of choices. Pressing <Return> on one of these fields pops up a subwindow with a list of choices as shown in Figure 9. The pop-up was obtained by pressing <Return> on the DTYP field. Use the <Up> and <Down> cursor keys to position the cursor next to the desired choice and press <Return> to select that choice. You can quit the pop-up menu by pressing <Quit>. You may also cycle through the choices without popping up a subwindow by using the <Left> and <Right> cursor keys.

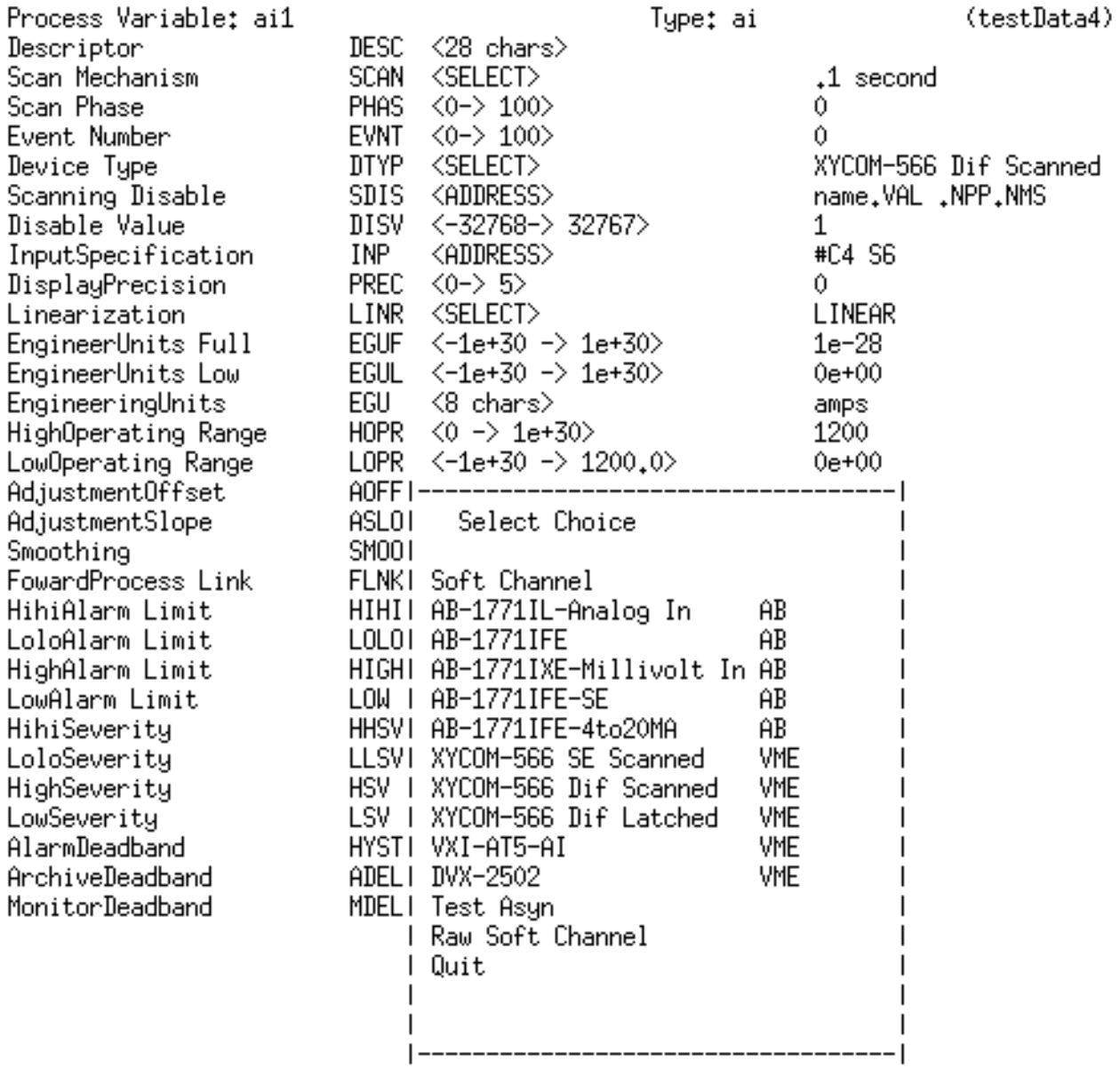

Figure 9: Pop-up choice window

Fields with the designation <ADDRESS> pop up submenus to select a link type and enter the link field values. Figure 10 show the sub window obtained by pressing <Return> on the SDIS field. Select the desired link type by using the <Up> and <Down> keys and pressing <Return>, or press <Quit> to quit the menu. If you press <Return>, a second subwindow pops up prompting for the appropriate link field values. Such a subwindow is shown in Figure 11. You may enter the information requested (process variable name and field name) or press <Quit> to abort the choice. The field name will default to VAL if left blank. The two fields with the <SELECT> designator have only certain allowable choices. You may cycle though the choices by using the <Left> and <Right> cursor key. Sorry, no pop subwindow at this level yet.

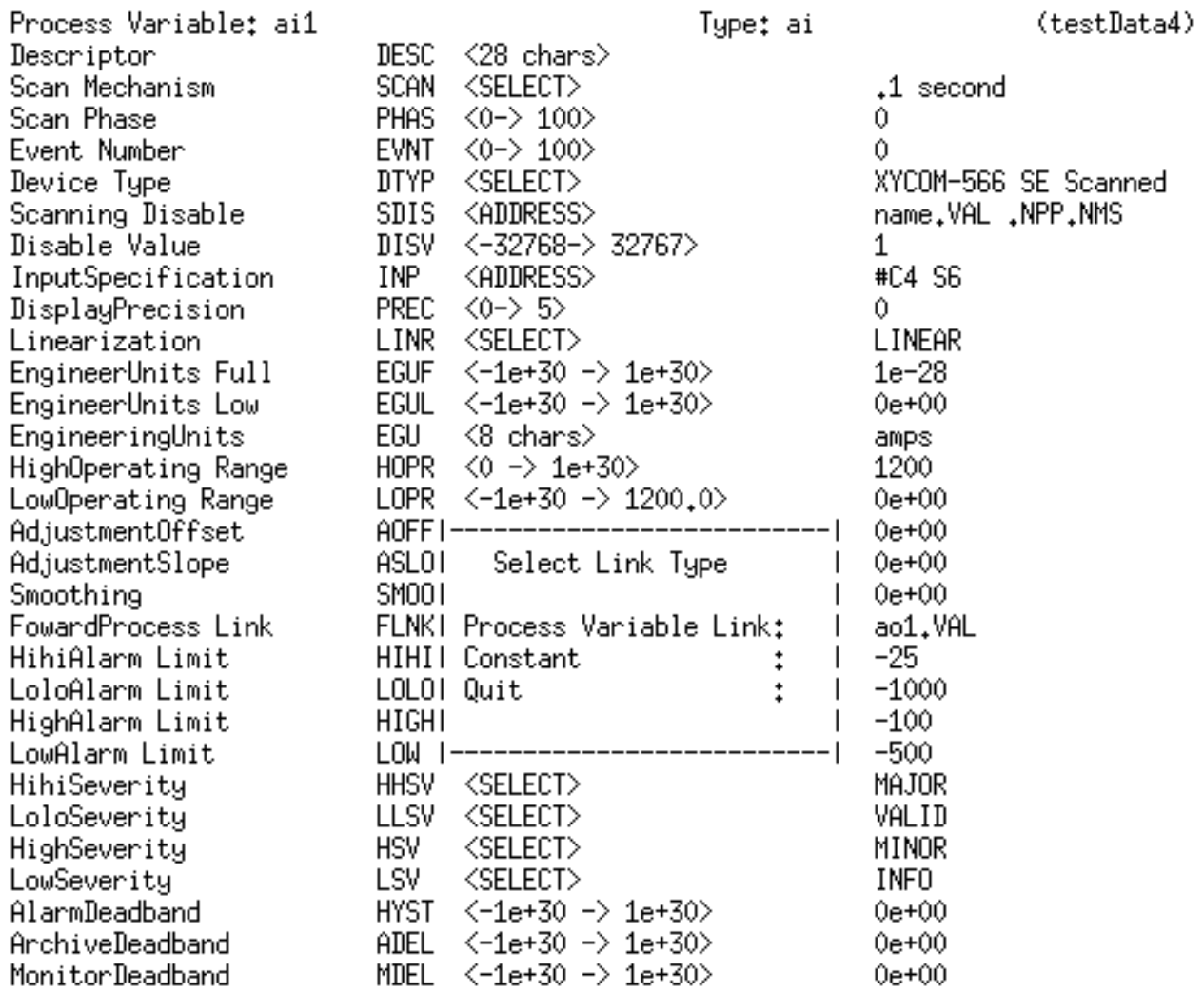

Figure 10: Select Link Type pop-up subwindow.

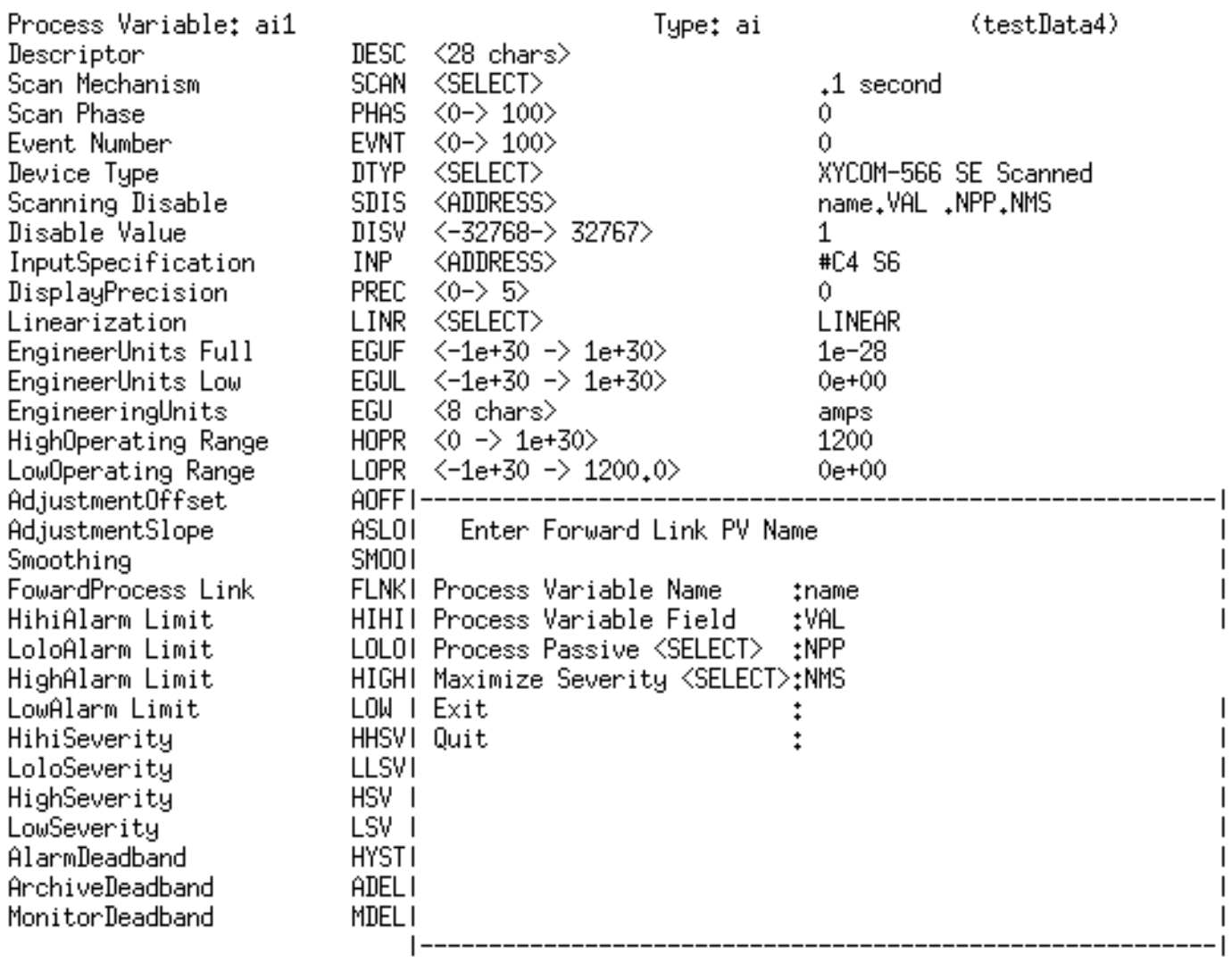

Figure 11: Subwindow to enter Process Variable Link

After you have finished modifying the process variable fields, press <Exit> to return to the process variable menu.

4.4 Copy a Process Variable

Select this menu option to copy the field values of an existing process variable to a new process variable. DCT will display a list of valid process variable record types for the current database. Using the <Up> and <Down> cursor keys, position the cursor next to the record type of the process variable you wish to copy. Press <Enter> to select that record type or <Exit> to return to the Process variable menu. If you pressed <Enter>, DCT will present a list of existing process variable names of the selected record type. Use the <Up> and <Down> cursor keys to position the cursor next to the desired process variable name. Press <Enter> to select a process variable or <Exit> to return to the Process Variable menu. If you press <Enter>, DCT will prompt you for the name of the new process variable to be created.

After a valid process variable name is entered, DCT will copy the contents of the selected existing process variable to the new process variable. A modify process variable screen as described in Section 4.3 is displayed for the new process variable so that it may be modified as desired.

4.5 Delete a Process Variable

Select this menu option to delete a process variable from the current database. DCT will display a list of valid process variable record types for the current database. Using the <Up> and <Down> cursor keys, position the cursor next to the record type of the process variable you wish to delete. Press <Enter> to select that record type or <Exit> to return to the Process variable menu. If you pressed <Enter>, DCT will present a list of existing process variable names of the selected record type. Use the <Up> and <Down> cursor keys to position the cursor next to the name of the process variable you wish to delete. Press <Enter> to select the process variable or <Exit> to return to the Process Variable menu. If you press <Enter> DCT searches the current database for link references to the selected process variable. If none are found, the process variable is deleted. If any link references are found, DCT will display a summary of the link references and ask if you still want to delete the process variable. If you answer 'y', DCT will ask whether or not you want to delete all the link references to the process variable. If you answer 'y', DCT will delete the process variable and all references to it. If you answer 'n', DCT will delete the process variable, but leave the link references intact. See Section 4.6 to undelete a process variable.

4.6 Undelete a Process Variable

Use this menu option to restore a deleted process variable. This option will restore the LAST process variable deleted during the current database session. This option WILL NOT RESTORE deleted link references. If this option is selected, DCT will recover the last deleted (during the current session) process variable and present a modify process variable screen for the restored process variable. (See Section 4.3).

4.7 Rename a Process Variable

Select this menu option to rename a process variable in the current database. DCT will display a list of valid process variable record types for the current database. Using the <Up> and <Down> cursor keys, position the cursor next to the record type of the process variable you wish to rename. Press <Enter> to select that record type or <Exit> to return to the Process variable menu. If you pressed <Enter>, DCT will present a list of existing process variable names of the selected record type. Use the <Up> and <Down> cursor keys to position the cursor next to the name of the process variable you wish to rename. Press <Enter> to select the process variable or <Exit> to return to the Process Variable menu. If you press <Enter> DCT searches the current database for link references to the selected process variable. If none are found, the process variable is renamed. If any link references are found, DCT will display a summary of the link references and ask if you still want to rename the process variable. If you answer 'y', DCT will ask whether or not you want to rename all the link references to the process variable. If you answer 'y', DCT will rename the process variable and all references to it. If you answer 'n', DCT will rename the process variable, but leave the link references intact.

4.8 List All Link References

This selection displays information on all the link references within the database. It is useful in determining what process variables refer to particular process variables. DCT will ask you to enter a file name to be used for a report. If you enter the name of an existing file, it will be overwritten. Typing a <Return> will cause DCT to send the report to the screen.

Figure 12 shows an example of a Link Reference report. The link references are grouped by record type and within a record type the process variables are ordered alphabetically. The example report shows that process variable ai1 is referred to by two other process variables, ai2 and ao1. Process variable ai1 's VAL field is referenced by the FLNK field of ai2 (of record type ai) and the field DOL of ao1 (a record type ao).

```
database testData4 type ai
        RFT_KLY:coilAFlow
                VAL     is referenced by       RFT_KLY:coilAPwr             INPB   (type calc)
        1 references
        RFT_KLY:coilATemp
                VAL     is referenced by       RFT_KLY:coilAPwr             INPC   (type calc)
        1 references
        RFT_KLY:coilInTemp
                VAL     is referenced by       RFT_KLY:coilAPwr             INPD   (type calc)
        1 references
        ai1
                VAL     is referenced by       ai2                          FLNK   (type ai)
                VAL     is referenced by       ao1                          DOL    (type ao)
        2 references
database testData4 type ao
        ao1
                VAL     is referenced by       ai1                          FLNK   (type ai)
        1 references
database testData4 type calc
        RFT_KLY:coilAPwr
                VAL     is referenced by       RFT_KLY:coilAPwrMon          INPA   (type calc)
                HIGH    is referenced by       RFT_KLY:coilAPwrMon          INPB   (type calc)
        2 references
        RFT_KLY:coilAPwrMon
                VAL     is referenced by       RFT_KLY:coilAPwr             FLNK   (type calc)
        1 references
database testData4 type compress
database testData4 type mbbi
database testData4 type waveform
```

Figure 12: Example Link Reference Report

4.9 Display Link Tree for a Process Variable

This selection is used to display link information for a particular process variable. DCT will ask you to enter a file name to be used for the report. If you enter the name of an existing file, it will be overwritten. Typing a <Return> will cause DCT to send the report to the screen. Next DCT will display a list of valid process variable record types for the current database. Using the <Up> and <Down> cursor keys, position the cursor next to the record type of the process variable you wish to report. Press <Enter> to select that record type or <Exit> to return to the Process variable menu. If you pressed <Enter>, DCT will present a list of process variable names of the selected record type. Use the <Up> and <Down> cursor keys to position the cursor next to the desired process variable name. Press <Enter> to generate the summary report for the selected process variable or <Exit> to return to the Process Variable menu. After the report is generated, DCT presents the list of process variable record

types again. You may return to the process variable menu by pressing <Exit> or select another process variable record type and process variable name to be appended to the link map report file.

Figure 13 shows a sample link map report for a process variable. The report is divided into three sections. The first section is a summary list of all the process variables in the link map. The form of each entry is:

```
PVNAME (info)
```

where PVNAME is the name of the process variable. (Info) contains the process variable's record type and scan mechanism if the process variable is defined in the current database, else the designation "External" appears.

The second section gives information for each link found to be in the tree. The form of these lines is:

```
Link# PVNAME1.FLDNAME (info) -> PVNAME2.FLDNAME (info)
```

Link# is a sequential index used to identify links. The "–>" designator indicates that process variable PVNAME1's field FLDNAME contains a link reference to process variable PVNAME2's field FLDNAME. The (info) field contains the record type, scan mechanism and field type for process variables defined in the current database or the designation "External" for process variables not found in the current database.

The third section contains a pictorial representation of the link tree for the selected process variable. The selected process variable appears at the extreme left position and is the "root" of the tree. The sublevels (branches) of the tree are indented with the depth of indentation representing the sublevel of the link. The syntax of an entry in the tree is:

```
Connectivity_Designator Link# (Link_type) PVNAME
```

The Connectivity_Designator indicates the relation of a link to the rest of the tree. The "v<–" designator indicates that the process variable PVNAME on this line has a link field that refers to the process variable at the next hider level (to the left) and below the designator. The "^–>" designator indicates that the process variable PVNAME is referred to by a field in the process variable at the next higher level (to the left) and above the designator. Thus in the example, process variable ai2 (link# 004) has a link field that refers to ("v<–") process variable ai1 (link# 000) (the root in this case) and another link field that refers to process variable a23456789012345678901234567 (link# 003) (i.e; process variable a23456789012345678901234567 is referred to by ("^–>") ai2). The Link# is a cross reference to the link information given in the second section of the report. The (Link_type) field indicates the field type of the link field for this branch of the tree where

```
F = Forward Link (FWDLINK)
  I = Input Link (INLINK)
 O = Output Link (OUTLINK)
```

```
****** LINK MAP INFO for PV: ai1 ******
```

Section 1

```
The following process variables are in the tree:

Legend: pvname [(record_type, scan_mech) | (External)]

ai1 (ai,.1 second)
ao1 (ao,Passive)
ai2 (ai,Passive)
name  (External)
a234567890123456789012345678  (External)

-----------------------------------------------
```

Section 2

```
The following links were found

Legend:
       Link# pvname.fldname (record_type, scan_mech, fld_type) <refers to>
              pvname.fldname.pp (record_type, scan_mech, fld_type)

000 ai1.SDIS (ai,.1 second,DBF_INLINK) -> name.VAL .NPP (External)
001 ai1.FLNK (ai,.1 second,DBF_FWDLINK) -> ao1.VAL . (ao,Passive,DBF_FLOAT)
002 ao1.DOL  (ao,Passive,DBF_INLINK) -> ai1.VAL .NPP (ai,.1 second,DBF_FLOAT)
003 ai2.INP  (ai,Passive,DBF_INLINK) -> a234567890123456789012345678.VAL .NPP
(External)
004 ai2.FLNK (ai,Passive,DBF_FWDLINK) -> ai1.VAL . (ai,.1 second,DBF_FLOAT)

-------------------------------------------------
```

Section 3

```
LINK TREE for PV ai1


Legend:
  <Direction Link# (Type) pvname>
       Direction: <- refers to, -> is referred by
       Link# = reference number for this link
       (Type): I = Inlink, O = Outlink, F = Fwdlink
       pvname = process variable name

     v<- 002 (I) ao1
     v<- 004 (F) ai2
          ^-> 003 (I) a234567890123456789012345678
 000 (I) ai1
     ^-> 000 (I) name
     ^-> 001 (F) ao1
```

Figure 14: Example link map report for a process variable

4.10 Macro Field Modification

This menu option is used to globally modify a particular field in a selected set of process variables. You will be prompted for a process variable name mask. The ”*” character is used as a 'wild card'. If you just hit <Return> at the process variable mask prompt, all process variables will be modified. Next DCT will ask you to enter the field name to modify. Enter the desired field name (DCT is case sensitive to field names). Next DCT asks for the new

value for the field. After the new value is entered, DCT reports each variable matching the pv mask and whether or not the selected field was modified.

4.11 Define a Process Variable Name Prefix

This menu option is used to specify a process variable name prefix to be prepended to newly created process variables using the Create (Section 4.2) or Copy (Section 4.4) options. The current process variable name prefix is displayed in the process variable menu header.

5 The Utilities Menu

The Utilities Menu is shown in Figure 15. Each menu choice is described in more detail in the following sections.

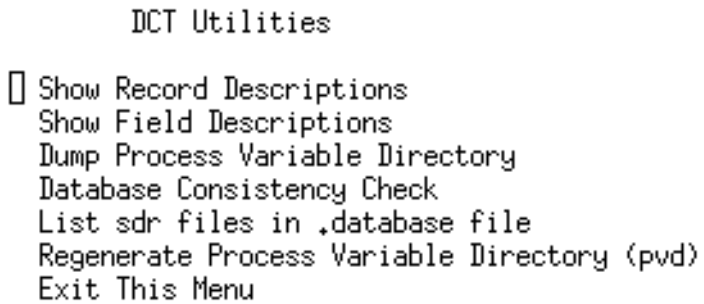

Figure 15: The Utilities Menu

5.1 Show Record Descriptions for a Process Database

This menu option displays record description information contained in the .dctsdr file (see Section 7.2.2) for a database. It is mainly of interest to system developers. When this menu option is selected, DCT displays a list of databases (if there's more than one) in the current directory and asks you to choose one. Select a database using the cursor keys and either press <Return>. You may return to the utilities menu by pressing the <Exit> key. A sample display is shown in Figure 16. A line is displayed for each record type defined for the database. The format of a line is:

Rectype Recname Size #Fields #Prompts #Links LinkFields

where Rectype is the numerical index of the record type, Recname is the ascii name for the record type, Size is the record size in bytes, #Fields is the number of fields within the record type, #Prompts is the number of fields that are modifiable through DCT, #Links is the number of fields that are link types and LinkFields is a list of the array indices of the link type fields within the field definition array.

```
Record Definitions for testData4

Type   Name       Size  #Flds #Prompts #Links  Link Fields


001 ai            00364  056    030     003    009 023 034
002 ao            00412  059    033     004    009 022 025 038
003 bi            00312  035    014     003    009 026 029
004 bo            00368  042    017     004    009 024 025 029
005 calc          00640  063    030     008    009 024 025 026 027 028 029 030
006 compress      00308  042    018     003    009 023 033
007 fanout        00412  029    013     007    009 023 024 025 026 027 028
008 mbbi          00632  084    060     003    009 024 025
009 mbbo          00680  089    062     004    009 026 029 062
010 permissive    00192  025    008     001    009
011 pid           00408  057    030     004    009 023 024 034
012 sel           00572  063    031     008    009 025 026 027 028 029 030 034
013 state         00248  025    008     002    009 024
014 sm            00488  077    041     005    009 027 028 042 043
015 sub           00612  067    032     008    009 028 029 030 031 032 033 037
016 timer         00476  066    026     004    009 022 023 030
017 waveform      00296  039    017     003    009 025 033

Hit any key to continue
```

Figure 16: Sample Record Definition Display

5.2 Show a Record's Field Descriptions for a Process Database

This menu option displays field description information for record types contained in the .dctsdr file (see Section 7.2.2) for a database. It is mainly of interest to system developers. When this menu option is selected, DCT displays a list of databases (if there's more than one) in the current directory and asks you to choose one. Select a database using the cursor keys and either press <Return>. You may return to the utilities menu by pressing the <Exit> key. DCT next presents a list of record types defined for the selected database. Again, either select one using the <Up> and <Down> cursor keys and the <Enter> key, or press <Exit> to return to the utilities menu. After a record type is selected, DCT displays a list of field names (prompted fields only) for the selected record. Select a field name or press <Exit> to return to the utilities menu. A sample display is shown in Figure 17.

```
      Field Description for HIHI

prompt string   HihiAlarm Limit
field name      HIHI
offset          292
size            4
special         nil
field_type      DBF_FLOAT
dbr field type  DBR_FLOAT
process_passive 1
choice set      0
convert type    CT_DECIMAL
prompt flag     20
low limit type  VAR
high limit type CON
interest level  1
initial val     0e+00
low limit       HIGH
high limit      1e+30
```

Figure 17: Sample Field Definition Display

5.3 Dump Process Variable Directory

This menu option dumps to the screen the contents of a database's process variable directory (.pvd file). When this menu option is selected, DCT displays a list of databases (if there's more than one) in the current directory and asks you to choose one. Select a database using the cursor keys and either press <Return>. You may return to the utilities menu by pressing the <Exit> key.

The hash table is displayed first. The left most column contains the hash value in decimal. The remaining columns display the index (in hex) into the process variable directory corresponding to the hash value. A value of '0xffffffff' indicates an unused hash value. Following the hash table, the process variable directory entries are displayed, one to a line. Each line contains the index value, process variable name, record type (in decimal), record number within the record file (in decimal), the index of the next process variable in a collision chain (in hex) with '0xffffffff' indicating the end of a collision chain.

An example dump of a process variable directory is shown in Figure 18.

```
PVD Entries
Index     PVname                    Rec Type  Rec No.   Next

00000 RFT_KLY:coilAFlow              00001    00000   ffffffff
00001 RFT_KLY:coilATemp              00001    00001   ffffffff
00002 RFT_KLY:coilInTemp             00001    00002   ffffffff
00003 ai1                            00001    00003   ffffffff
00004 ai2                            00001    00004   ffffffff
00005 ai33                           00001    00005   ffffffff
00006 ao1                            00002    00000   ffffffff
00007 bi1                            00003    00000   ffffffff
00008 RFT_KLY:coilAPwr               00005    00000   ffffffff
00009 RFT_KLY:coilAPwrMon            00005    00001   ffffffff
00010 comp1                          00006    00000   ffffffff
00011 mbbi1                          00008    00000   ffffffff
00012 frl                            00014    00000   ffffffff
00013 wave1                          00019    00000   ffffffff
```

Figure 18: Process Variable Directory Dump

5.4 Database Consistency Check

This menu option checks the consistency of a database's files. When this menu option is selected, DCT displays a list of databases (if there's more than one) in the current directory and asks you to choose one. Select a database using the cursor keys and either press <Return>. You may return to the utilities menu by pressing the <Exit> key. The following checks are performed:

1 The process variable directory is scanned for illegal record types.

2 Each process variable name's hash value is checked against the hash table.

3 The process variable directory is scanned for duplicate names.

4 Each process variable directory entry's process variable name and record number is checked against the corresponding record number in the appropriate record file.

5 Each record type file is scanned for process variables. Each process variable name found is looked up in the process variable directory.

5.5 List sdr files in a .database file.

This menu option scans the .database file of a database and lists the "sdr" types on the screen of the files concatenated to form the that file. An example of such a listing is shown in Figure 19. The warning at the bottom of the example about "incomplete read" is an artifact that will be fixed in a future release.

```
nbytes     type

00000208 SDR_DB_RECTYPE
00000776 SDR_CHOICEGBL
00000900 SDR_CHOICEREC
00001472 SDR_DEVSUP
00000276 SDR_DRVSUP
00000648 SDR_CVTTABLE
00109632 SDR_DB_RECDES
00000096 SDR_CHOICECVT
00001620 SDR_CHOICEDEV
00037024 SDR_DB_PVD
00002876 SDR_DB_RECORDS
                         Record Type = 00001, Record Size = 00408
00000964 SDR_DB_RECORDS
                         Record Type = 00002, Record Size = 00472
00000660 SDR_DB_RECORDS
                         Record Type = 00003, Record Size = 00320
00000772 SDR_DB_RECORDS
                         Record Type = 00004, Record Size = 00376
00003212 SDR_DB_RECORDS
                         Record Type = 00005, Record Size = 01064
00000692 SDR_DB_RECORDS
                         Record Type = 00006, Record Size = 00336
00000852 SDR_DB_RECORDS
                         Record Type = 00007, Record Size = 00416
00001284 SDR_DB_RECORDS
                         Record Type = 00008, Record Size = 00632
00001396 SDR_DB_RECORDS
                         Record Type = 00009, Record Size = 00688
00000500 SDR_DB_RECORDS
                         Record Type = 00010, Record Size = 00240
00000884 SDR_DB_RECORDS
                         Record Type = 00011, Record Size = 00432
00002004 SDR_DB_RECORDS
                         Record Type = 00012, Record Size = 00992
00000516 SDR_DB_RECORDS
                         Record Type = 00013, Record Size = 00248
00001028 SDR_DB_RECORDS
                         Record Type = 00014, Record Size = 00504
00000692 SDR_DB_RECORDS
                         Record Type = 00015, Record Size = 00336
00000772 SDR_DB_RECORDS
                         Record Type = 00016, Record Size = 00376
00002084 SDR_DB_RECORDS
                         Record Type = 00017, Record Size = 01032
00000972 SDR_DB_RECORDS
                         Record Type = 00018, Record Size = 00476
00000636 SDR_DB_RECORDS
                         Record Type = 00019, Record Size = 00308
scan_database_file:  Warning, incomplete read of file testData.database
```

Figure 19: Example listing of sdr component files of a database

5.6 Regenerate Process Variable Directory

This option can be used to regenerate a (corrupted) process variable directory from the process variable record files. Upon activation of this option, the existing process variable directory is initialized, each process variable record file is scanned and process variable records found within the file are added to the process variable directory.

6 DCT Batch Mode Commands

DCT has a number of noninteractive commands that may be incorporated in shell scripts to automate some database management functions. Invoking dct as "dct anything" will cause dct to print a "usage" message. The commands available in noninteractive mode are described in the following sections. Pathnames (both relative and absolute) may be used for database and report names.

6.1 Report a Database

This command will generate a short report for the database database_name. The report_name argument is optional. If it is omitted the report will be named "short_report.database_name".

```
dct -r <database_name> [ -o <report_name> ]
```

A report name must be specified when reporting a database not located in the present directory.

6.2 Delete a Database

This command will delete the database database_name.

```
dct -d <database_name>
```

6.3 Create a Database

This command will create an empty database named database_name.

```
dct -c <database_name>
```

6.4 Modify a Database

This command will modify an existing database, database_name, from the contents of a short report. The report_name argument is optional. If it is omitted, dct will use "short_report.database_name" as the report name.

```
dct -m <database_name> [ -i <report_name> ]
```

A report name must be specified when modifying a database not located in the present directory.

7 Files DCT Uses and Creates

7.1 The Database Configuration File

Every database must have a configuration file which describes the database. This file is a concatenation of a number of "self defining record" (SDR) files. The SDR files contain information on record types, field descriptions, allowable choices for <SELECT> type fields, etc., which are derived from ascii description files. Before a database is created, DCT looks for a file "default.dctsdr" containing the default database description for the current release. DCT copies this file to a new file with the name "database_name.dctsdr" which becomes part of the newly created database. Each time an existing database is opened, DCT looks for it's corresponding ".dctsdr" file and checks the ".dctsdr" file's timestamp against the process variable directory and record files, to detect if the ".dctsdr" file has been modified since database creation.

7.2 The Database Files

7.2.1 The .pvd file

The ".pvd" file contains the process variable directory for the database. A hashing scheme is used to convert a process variable name to a process variable directory entry. Each process variable directory entry contains the process variable name, record type, and record number within the record file. The process variable directory is used to determine the record file and record number of a process variable given it's name.

7.2.2 The .dctsdr file

The ".dctsdr" file contains the configuration information for the database. (See Section 7.1).

7.2.3 The record files

These files contain the actual process variable field values. There is one file for each record type with a name of the form "database_name.record_type" (for example, testData.ai is the file containing the process variable information for all the analog input records in the database name "testData".

7.2.4 The .database file

This file the concatenation of the ".dctsdr", ".pvd" and record files of a database. DCT creates this file automatically each time a database is closed. This is the file that actually gets downloaded into an IOC at IOC init time.

7.3 Summary Report Definition Files

DCT interprets files ending with the extension ".frm" as a summary report definition file. (See Section 3.7 for a description of summary forms). An example of a summary definition file is shown in Figure 20. Lines beginning with a "#", "$", "%", or "!" are treated as comments and not processed. Each noncomment line in the file defines a column to appear in

the summary report. The summary report generator always assigns the process variable record type to the first column and the process variable name to the second column so there's no need to specify these in the file. The syntax of a column specifier line is:

FIELDNAME delimiter COLUMNWIDTH

where "FIELDNAME" is the name of a process variable field, "delimiter" is one or more ",", <tab>, or <space> and "COLUMNWIDTH" is the desired width of the column. Another allowed form of a column specifier line is:

FIELDNAME1|FIELDNAME2 delimiter COLUMNWIDTH

With this form of specifier, the summary report generator will display the value of either "FIELDNAME1" or "FIELDNAME2" within the column. This form is most useful with fields such as INP and OUT which are normally mutually exclusive. The summary report generator will display the value of the field it finds first. It searches first for FIELDNAME1 and then FIELDNAME2.

The report generator fills a report entry with "*" for those fields that are not defined within a record type.

```
# This is an example summary report form
$  comments may begin with '#' , '$' or
%      a '%' or
!      a '!'
# the format of a line is FIELDNAME DELIMITER DISPLAYSIZE
#  DELIMITER may be a space, tab or comma such as
DESC,16
DTYP   16
# a conjunction of 2 mutually exclusive fields may be specified as
INP|OUT      24
# where the '|' bar denotes the conjunction of 2 mutually
$ exclusive fields.  For the above example the report will contain
# the value of either  field INP or OUT.
# non existant fields are space filled.
# The first 2 columns of the summary are forced to be "Record Type"
# and "Record Name".
```

Figure 20: Example of a Summary Definition Form

The summary report produced by the form shown in Figure 20 is shown below in Figure 21.

```
Type         Name                    DESC            DTYP             INP|OUT
ai           RFT_KLY:coilAFlow       Water Flow Coil AB-1771IL-Analog #L0 A0 C0 S0
ai           RFT_KLY:coilATemp       Water Temp Coil Soft Channel     0.00e+00
ai           RFT_KLY:coilInTemp                      Soft Channel     0.00e+00
ai           aai3                                    XYCOM-566 SE Sca #C0 S0
ai           ai1                                     XYCOM-566 Dif Sc #C4 S6
ai           ai2                                     Soft Channel     a23456789012345678901234
ao           ao1                     analog out      VXI-AT5-AO       #C3 S2
calc         RFT_KLY:coilAPwr                                         **********************
calc         RFT_KLY:coilAPwrMon                                      **********************
compress     comp1                                                    test.VAL .NPP.NMS
mbbi         mbbi1                                   Soft Channel     0.00e+00
waveform     wave1                                   Joerger-VTR1     #C1 S4
```

Figure 21: Summary report produced by form shown in Figure 20

DCT Change Log

February 11, 1991

Original Issue

March 22, 1991

Chapter 6: Intro, 6.1, 6.4

May 20, 1991

Chapter 4:

Section 4.7, Rename Process Variable inserted

Chapter 5:

Sections 5.3, 5.4, 5.5, 5.6 added

May 30, 1991

Many of the blanks filled in with ”boiler plate”.