

# CADEX

## CATIA CADAM Drafting's Electrical Product

- o Schematic Capture

  - Quickly create and modify schematics or wiring diagrams
  - Pictorial representation plus built-in intelligence
  - Migrate unintelligent formats to CADEX

- o Create and Manage Libraries

  - Hierarchical libraries
  - Graphical and/or Text Interface

- o Intelligent Components

- o Customizable Report Generation

  - Bill of Material
  - From-To
  - Netlist
  - Comma Separated Values

- o Customizable Design Rule Checking



# CADEX

## An Overview

CADEX is a powerful schematic and wiring diagram creation tool that uses extremely productive CADAM drafting techniques. The power of CADEX comes from the ability to add information to an electrical drawing. This information can be extracted and output as customizable reports or in an easily exported format to downstream automated processes. Significant also is the ability to follow a connection from beginning to end automatically. CADEX can follow a wire run through connectors, splices, busses, and even from sheet to sheet.

CADEX also provides powerful utilities to retrofit existing “unintelligent” drawings. Drawings can be imported from mainframe CADAM, PROFESSIONAL CADAM, Helix, MICROCADAM, and through neutral formats such as IGES, NURESTOR, dxf/dwg, and others. CADEX can also read LDX drawings.

Libraries of intelligent CADEX electrical components can be created with effective methods for quickly identifying and retrieving the desired component. Hierarchical or relational data bases of components can be associated with CADEX components by using unique part numbers as well.

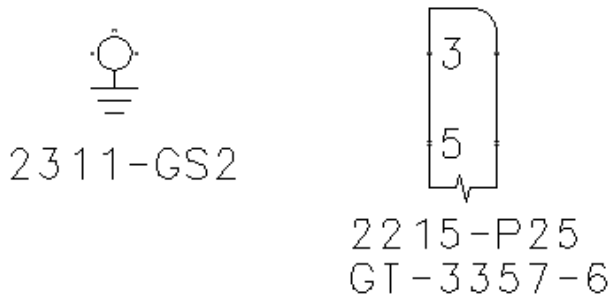
With CADEX you can choose design rules. These rules are evaluated interactively to warn the designer of specific problems such as duplicate pin IDs or components without reference designators, etc.

Perhaps the easiest way to gain a better understanding of CADEX is to follow a sample creation scenario. This scenario is not meant to completely describe all of the CADEX function, but it may help you to understand why CADEX

can be the right solution for your requirement. You will need some familiarity with CADAM/CCD and the requirements associated with creating and using electrical drawings to fully appreciate this scenario.

## A Sample Scenario

First create CADEX components using normal CCD drafting methods. Lines and arcs can be used to create different shapes representing different electrical components. For example, the following symbols often are used to represent a ground and a connector.



What makes these symbols powerful is that CADEX recognizes them as electrical components. The text and geometry are easily grouped in a CADEX set that is also defined as being either a ground or a connector symbol. The numbers “3” and “5” inside of the connector symbol are defined as being pin identifications. The notes underneath the symbols (they can be placed anywhere) are the reference

designator and the part number. The symbol acts as a single entity that can be moved, copied or deleted. It is different from a CCD ditto, because you can modify the individual notes and elements that are parts of the component.

At this point, if these were the only items on your drawing, you could run a CADEX

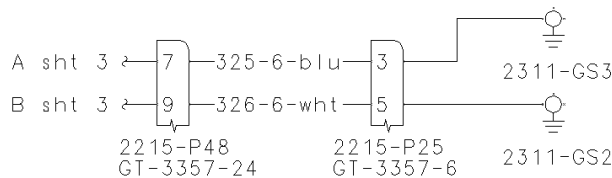


report, and ask for an equipment list. CADEX would tell you that you have one item, the connector. Because the ground is not typically a component, it might not be listed on this particular report. You can list the reference designator and part number associated with the component. You can add a user attribute for the manufacturer for example, as well. Such a report (fully customizable), might look similar to the following:

Ref Des	Part Number	Supplier
2215-P25	GT-3357-6	Acme

The ground and connector symbols can be stored in a library, a detail page, or simply selected and copied as symbols anywhere on the drawing. Using the standard note editor, the notes can be edited, and so several different connectors can be easily created similar to the following diagram. Other symbols can be created having different meanings and also having embedded intelligence.

Continuing with the sample scenario, as the drawing continues to be developed, lines representing wires or circuits can be added including lines with notes in them representing wire number, gage, color-code, etc. These notes can be embedded in the lines, or they can simply be notes that are just defined on top of a line.



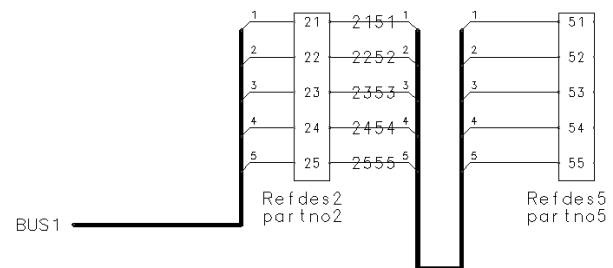
Either way, CADEX can trace a wire or circuit through components collecting all of the pertinent information such as what components are traversed, what pin numbers the wire

is connected to, etc. The tracing of the circuit is automatic, and there is no effort required by the designer other than drawing the lines representing wires.

All of this information including automated grouping into nets and describing types of components included in the net, is done automatically. This information can be output in hardcopy reports, or it can be output in CSV (Comma Separated Values) format and passed to other automated downstream processes. Other associations and characteristics include items such as twists, shields, cables, etc. CADEX also handles conditions such as splices where a net may branch. Please see the following sample report:

PartNo	RefDes	Manufactur	PIn	Wlredata	PartNo	RefDes	Manufacturer	PIn
GT-3357-24	2215-P48	Acme	7	325-6-BLU	GT-3357-6	2215-P25	Acme	3
GT-3357-6	2215-P25	ABC Co.	3		2311-GS3	ABC Co.		
GT-3357-24	2215-P48	Acme	9	326-6-WHT	GT-3357-6	2215-P25	Acme	5
GT-3357-6	2215-P25	ABC Co.	5		2311-GS2	ABC Co.		

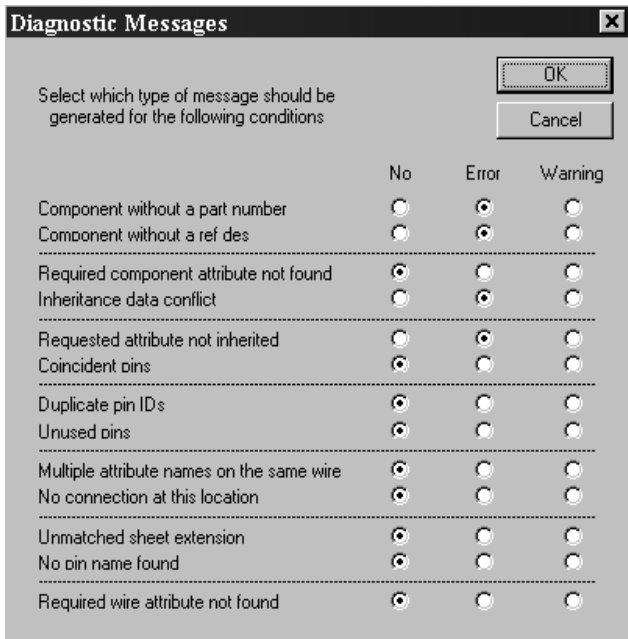
As a space saving and readability technique, wires/lines may be bundled together into what are called busses. These busses can bundle many wires that come from different components, indeed different pages and be distributed likewise to different components and different pages. CADEX maintains the continuity of each individual wire and keeps track of it through the bus and eventually to its final connection.



CADEX also checks for certain error conditions. Errors such as components without a part number or components without a reference designator, or unused pins, or missing attribute numbers, and many others -- all can be identified as either errors, warnings, or be ignored. In addition to reporting these potential problems,

each instance can be circled to point it out, and you can even step through each condition, panning and zooming to each instance to determine if a change is required.

The following panel shows the list of conditions that can be labeled as either warnings, errors, or not a problem.



Application mode = ELECTRICAL

PROCESSING drawing: kyrstin\_out 0001  
PROCESSING all views

```

*** WARNING *** Unused pin found:
Reference designator: 2121-P15
Part number: PARTNO 21      Pin: 13
Sheet: 1      xloc, yloc:   -2.000   0.625

*** WARNING *** Unused pin found:
Reference designator: 2121-P15
Part number: PARTNO 21      Pin: 14
Sheet: 1      xloc, yloc:   -2.000   0.250

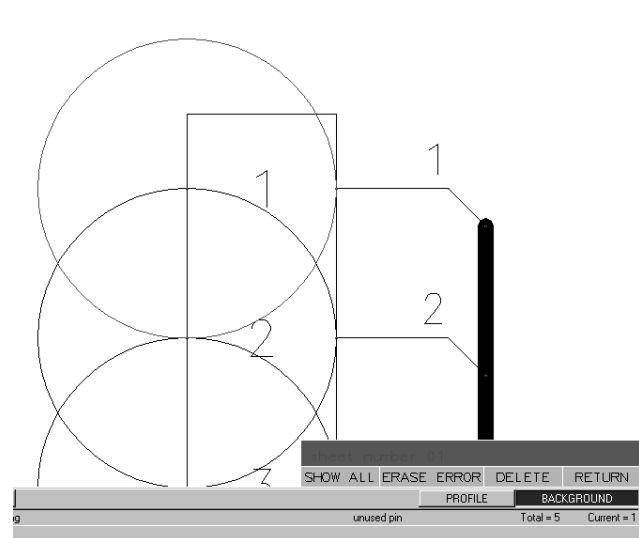
*** WARNING *** Unused pin found:
Reference designator: 2121-P16
Part number: PARTNO 27      Pin: 58
Sheet: 1      xloc, yloc:   -2.000  -2.875

*** WARNING *** Unused pin found:
Reference designator: 2121-P15
Part number: PARTNO 21      Pin: 15
Sheet: 1      xloc, yloc:   -2.000  -0.125

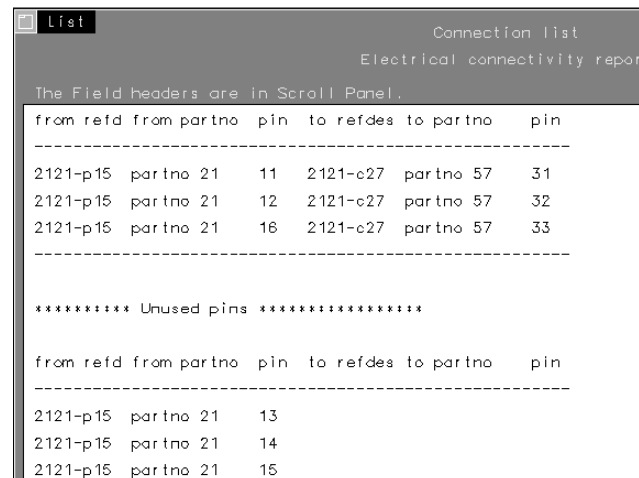
```

In the report above you can see that a number of unused pins have been found. In this case we have chosen to identify unused pins as a warning condition and not an error condition. CADEX has determined that these are pins on components to which wire lines have not been attached. The pins are identified by their ID, the reference designator and part number in which they were found, the sheet number and the actual

location on the sheet. Again, these locations can be automatically located interactively, or located later on a plot. The following screen capture shows a warning condition that has been circled, highlighted, and moved to the center of the display in a CADEX session.



The From-To report following helps to demonstrate that CADEX is capable of putting all of the pieces together to provide extremely useful information. This report is only one example of a wealth of information that can be extracted and used for different downstream processes.



In addition to the predefined characteristics and categories for adding information/intelligence to the drawing, you can define your own attributes or characteristics. For example, you can have categories of components or wires that have been approved for extreme environmental conditions. You can specify that certain parts are

only available through a certain vendor. You have the capability of defining any category you want to create, assign, and track. You can assign these attributes and make these predefined characteristics available to all of your users. You can even add help information, default data definitions and use your customized data in predefined reports.

The above scenario gives a view of some of the core CADEX function. Following we will step through some of the functions in greater depth.

## Libraries

### User

CADEX provides two kinds of libraries, User and System. The User library consists of CCD drawings that have CADEX components in them. These drawings, up to five, are identified in the CADEX profile, and the components on these drawings are available to any CADEX session. The drawings are accessible through either a graphical interface called "PANEL" or by using text-based "LISTS". Either method can use hierarchical links to create a very efficient path to finding the correct component.

The key identifier for all CADEX components is the part number. All part numbers must be unique. That is, you cannot have duplicate part numbers attached to different components. In the case of System libraries, you can have multiple unique part numbers attached to the *same* component.

### System

The System library format is different from the User library format in several ways. The System library is meant to be maintained by the system administrator and requires a few more steps to create. By controlling access to the management of the System library, you can ensure that all changes are managed. The System library format also provides more information about each component than the User library, and allows you to associate several part numbers with one component.

For example, the symbol for a variable resistor might always be the same, but it is

possible that variable resistors may be provided by different vendors. Also, of course, different types of variable resistors from the same vendor will have different part numbers. The System library allows you to have one symbol for a variable resistor, yet have multiple part numbers associated with that symbol.

### RDBMS

It is possible to create a link between an external data base and CADEX. Although this requires a small amount of customization, it is possible to pass part number data from a data base system to CADEX. This allows you to use the full capabilities of the data base user interface to identify a part and then to pass that number to CADEX. CADEX provides both the PANEL and LISTS method for displaying information about this component including showing a graphical preview of the component.

You can place the component immediately either on a pre-defined grid or by defining the x-y coordinates.

## Automatic Tracing

CADEX traces wire runs automatically through components, busses, and from sheet to sheet. It recognizes intersections of wire lines as either crossovers or splice points. At splice points, the net expands to include all of the wires that meet at the splice point. It can be restricted to trace only certain line types and through specific views. CADEX also keeps track of all of the useful information about a particular wire run. The list of information it collects and can report about include the following:

- o Component data
  - Part number
  - Reference designator
  - Pin Identification
  - X,Y location
  - Signal
  - Type
    - Shield
    - Cable
    - Ground
    - etc.
- o Wire data

- o Net number
- o Any attribute (user or system)

## Reports

CADEX creates several types of reports automatically. Customized reports can be created as well where both contents and format can be defined to meet the particular purpose. Reports can be generated interactively, as a background process, or output to files such as CSV format to be exported to other processes.

Because the user can define User attributes, and those User attributes can also be included in reports and exportable files, the CADEX system really provides you with ultimate flexibility in defining data in your CADEX drawing and reporting or exporting it in an intelligent way.

## Design Rule Checking

With CADEX you can define certain rules and check for compliance. Conditions can be labeled as warnings, errors, or they can be ignored. The list of conditions that can be identified include the following:

- o Component without a part number
- o Component without a ref des
- o Required component attribute not found
- o Inheritance data conflict
- o Requested attribute not inherited
- o Coincident pins
- o Duplicate pin IDs
- o Unused pins
- o Multiple attribute names on the same wire.
- o No connection at this locations
- o Unmatched sheet extension
- o No pin name found
- o Required wire attribute not found

This extensive list of conditions can be reported through a background process or can be reported interactively as well. Interactively, the display can be centered on each instance of error or warning condition with a highlighted circle drawn temporarily around the condition. The user has the option of immediately resolving the warning or error or continuing to center the display on each condition. This powerful function helps to catch errors early in the process

thereby saving manufacturing and production costs later.

## Other Productivity Enhancers

### User Assigned Attributes

Assign attributes capable of adding any user data to components, wire lines, or any element in a CADEX drawing. User attributes may include special help information, default values, be specified as being required, and be protected. They may be restricted to different data types (alpha or numeric) and be categorized. This is more than just adding additional data to a drawing. It is a complete implementation with user help and syntax checking.

As suggested in the preceding, these attributes can be added to reports and become part of the data output to downstream processes.

### Hierarchy

Special hierarchy attributes can be added to your drawing that reference other drawings. When selected, those elements with the hierarchy attributes assigned will automatically take you to another drawing. This capability can be used to provide additional detail to a drawing, where such detail is not needed on the main drawing.

In mechanical drawings, this capability can be used to create a family of drawings where the highest level might be an assembly drawing. Each of the parts in the assembly drawing may be drawn as separate detail drawings. Further detail can be added to the detail drawings by adding another level of drawings. In fact, you can have as many as 99 levels of hierarchy.

The entire hierarchy tree can be displayed, and you can move up and down or skip levels by using this tree.

### Component Management

CADEX components, although just a collection of lines, arcs, notes, etc., can be managed as a single entity. Components can be moved, copied, turned, flipped, deleted, and scaled. One very useful function is that they can be moved with the "STRETCH" option, and any wire lines that are connected will be moved with the component and the connectivity integrity will

be maintained.

### **Automatic Numbering and Back Annotation**

CADEX can automatically assign pin numbers on a drawing. Wire data also can be automatically assigned, either for background reports only or can be back annotated to the drawing. That is, you have the choice of using the automatic numbers for output reports, only, or actually modify the drawing (back annotate). The wire data feature is useful when the entire wire data or a portion of the wire data requires sequential and unique numbers that can be computer assigned.

### **Part Number Replacement Tables**

Rather than place the same part number multiple times on a drawing such as the multiple instances (reference designators) of a single connector, you can use a part number replacement table. Such a table allows you to define a part number for each reference designator. All reports generated will show the part number even though it is not actually drawn or displayed on the CADEX drawing.

### **Relay Automation**

CADEX provides several tools for automating the creation of relays, automatically assembling them checking for errors, automatically assigning pin numbers, and automatically back annotating this information into an electrical diagram.

### **Ladder Diagrams**

CADEX provides automated techniques for quickly creating horizontal or vertical ladder diagrams. Components such as relays can be easily added to the diagram. Relays without reference designators or part numbers can be inserted that are later defined through a CADEX background process.

## **The Beginning (Rather than the End)**

CADEX provides a full set of function that can be used to produce intelligent electrical drawings. Many companies already rely on CADEX to create all of their electrical drawings. Indeed entire aircraft electrical systems have been designed using CADAM/CCD and CADEX. CADEX also provides the flexibility to be customized to meet needs that are unique to your project.

Much more function is available in CADEX than has been introduced by this article. By using CCD and the other products in the CCD suite: Hybrid Raster, Interactive User Exit (IUE), Variational Design, and the various translators, many more solutions become available to meet your needs. For example, as part of V5 CCD, at no additional cost, you are able to create separate programs using IUE capable of interacting directly with the CCD/CADEX data base.

If you are interested in using CADEX, please give us a call or contact us through our website at [www.cadam.com](http://www.cadam.com). If you are a current user of CADEX and were not aware of all of the function available in CADEX, please contact us as well. Help yourself by implementing a new and much more productive solution by taking advantage of CCD and CADEX today.