LV 127/31/53
AO 128/52/79
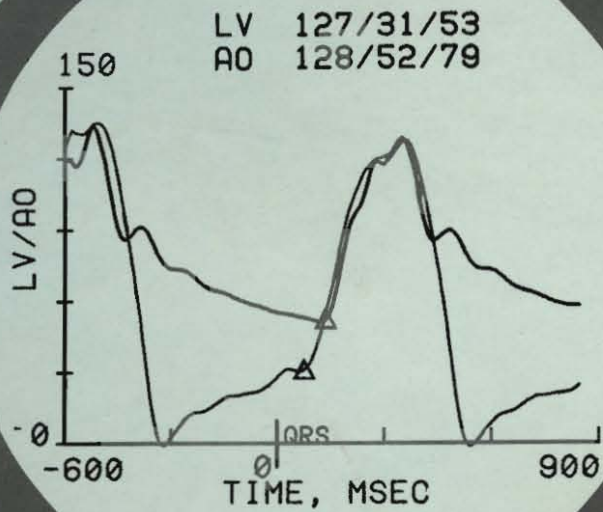
ABSTRACTS OF TECHNICAL MONOGRAPHS

TECHNICAL MONOGRAPH NUMBER 0001-0   DECEMBER 1979

CLINICAL CARDIOLOGY COMPUTER CENTER

The University of Alabama in Birmingham

UNIVERSITY STATION / BIRMINGHAM, ALABAMA 35294

ABSTRACTS OF TECHNICAL MONOGRAPHS

BY

THE STAFF OF THE
CLINICAL CARDIOLOGY COMPUTER CENTER

June 1983

Clinical Cardiology Computer Center
University of Alabama in Birmingham
University Station
Birmingham, Alabama   35294

Appendix O

INDEX TO TECHNICAL MONOGRAPHS

NOT
IBM
1800
APPLICATIONS

*The one digit numeric suffix denotes the current revision.

TECHNICAL MONOGRAPH NUMBER 0001 - ABSTRACTS OF TECHNICAL MONOGRAPHS

by

The Staff of the Clinical Cardiology Computer Center

This monograph presents abstracts of all the technical monographs released by the staff of the Clinical Cardiology Computer Center of the University of Alabama in Birmingham.

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TECHNICAL MONOGRAPH NUMBER 0002 - DESCRIPTION OF THE GROUP

by

Steve Wixson

This monograph describes Clinical Cardiology Computer Center by presenting the organization, funding sources, facilities, and a description of technical and personnel facilities.

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TECHNICAL MONOGRAPH NUMBER 0003 - CCCC SYSTEM HARDWARE

by

Steve E. Wixson

This monograph describes the hardware of the Clinical Cardiology Computer Center. The areas supported by the system include the Myocardial Infarction Research Unit (MIRU), the Adult Cardiac Catheterization Laboratories, the Angiographic Data Analysis Laboratory, Quarterback Towers and the Computer Room. This is the complete documentation for the system including both analog (patient) and digital information.

Included in the monograph are narrative descriptions, flow diagrams, mechanical drawings, electrical schematic diagrams and detailed wiring lists.

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TECHNICAL MONOGRAPH NUMBER 0004 - INSTRUMENTATION AND CABLING

by

Steve E. Wixson

This monograph describes the analog hardware of the CCCC system. It is a collection of pertinent drawings from the complete CCCC hardware documentation, Technical Monograph 0003. It was prepared so that the University Hospital Biomedical Engineering Department (or the respective instrument manufacturers) can maintain this part of the system.

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TECHNICAL MONOGRAPH NUMBER 0005 - CCCC PROGRAMMER'S MANUAL

by

Eugene Strand, Steve Wixson, William Cunningham

This technical monograph is the software description of the system. The purpose of the monograph is to aid the programmer in effectively utilizing the facilities of the Clinical Cardiology Computer Center. The monograph also serves as the system software description document.

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TECHNICAL MONOGRAPH NUMBER 0006 - CCCC SUBROUTINE LIBRARY INDEX

by

Eugene M. Strand

This technical monograph is an index to the library of user callable subroutines. It is prepared by running the subroutine library index program which processes the source code for all the subroutines in the library, extracts a standard header from each routine, and indexes the subroutines by the Class information provided in the header. The printed index (this monograph) includes an alphabetical name index, sub-indexes for each class of subroutine, and the complete header which describes the function and calling sequence of each routine.

****

TECHNICAL MONOGRAPH NUMBER 0007 - CCCC BATCH UTILITIES MANUAL

by

Eugene M. Strand

This monograph is an index to the batch utility programs available from the Clinical Cardiology Computer Center. The monograph is prepared by running the batch utilities index program which processes the source code for each program, extracts a standard header from each program and indexes the program by the Class information provided in the header. The printed manual (this monograph) includes an alphabetical index of programs, sub-indexes for each class of program, and the complete header which describes the function performed and input required.

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TECHNICAL MONOGRAPH NUMBER 0008-1 - CCCC PATIENT ADMISSION AND
INSTRUMENT SETUP USERS' MANUAL

by

Thomas Ball, Eugene Strand, Dimitry Zisserman

This monograph presents information on how to enter patients into the system
and set up instruments for use by other programs.

****

TECHNICAL MONOGRAPH NUMBER 0009 - IDOL USERS' MANUAL

by

Susan Dean

This monograph is a programmer's manual for the Interactive Display Oriented
Language (IDOL). The monograph includes a brief overview of the language,
detailed syntax with examples, history file logging capability, and how to build
and execute display frames.

****

TECHNICAL MONOGRAPH NUMBER 0010 - VENTRICULAR FUNCTION USERS' GUIDE

by

Eugene M. Strand

This monograph is the Users' Guide for the Ventricular Function System. The
monograph includes an explanation for set up, data display, pressure measurement,
cardiac output measurement and report generation.

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TECHNICAL MONOGRAPH NUMBER 0011 - CATHETERIZATION LABORATORY
USERS' GUIDE

by

Dimitry Zissermann

This monograph is the Users' Guide for the Adult Cardiac Catheter-ization
Laboratory system. The monograph includes detailed explanation for the
measurement of blood pressures at various sites of the heart and the great
vessels. Patient and instrument set-up are described in Technical Monograph
Number 0008. Display frames which appear during the operation of the program are
discussed. Data review and report generation programs are discussed. Use of
auxiliary programs (such as the heart rate program) is explained.

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TECHNICAL MONOGRAPH NUMBER 0012 - THE COMPUTER IN THE CARDIAC
CATHETERIZATION LABORATORY
PART I - SYSTEM DESCRIPTION AND BASIC HEMODYNAMIC MEASUREMENT

by

E. M. Strand, S. E. Wixson, D. Zissermann, W. P. Hood, Jr.
J. A. Mantle, C. E. Rackley, and F. E. Harrell, Jr.

This monograph is the first part of a three-part description (Technical
Monographs 0012-0014) of the use of the computer in the Adult Cardiac
Catheterization Laboratory. This monograph provides a functional review of
several computerized catheterization systems described in the literature, with
special attention to the computer/cath lab interface, keyboards and waveform
editing and processing. Instrumentation, and detailed operation of the
University of Alabama Cath Lab system are described. Pressure processing
techniques and methods of selecting a representative waveform are discussed.
Detailed computer algorithms are presented. Finally report generating programs
are reviewed.

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TECHNICAL MONOGRAPH NUMBER 0013 - THE COMPUTER IN THE CARDIAC
CATHETERIZATION LABORATORY
PART II. PRESSURE DERIVED INDICES OF LV PERFORMANCE

by

Richard O. Russell, Jr., and Roger E. Moraski

This monograph is Part II of a three part description (Technical Monographs
0012-0014) of the use of the computer in the Adult Cardiac Catheterization
Laboratory.

The monograph describes the calculation of isovolumic pressure-derived
indices of left ventricular (LV) performance. Details of computer processing
algorithms are included. LV pressure is sampled via a manometer-tipped catheter
and is digitized by the computer in 15 second segments at 1000 samples per
second. For each cardiac cycle in each pressure recording sixteen indices of
muscle function are automatically computed, including max dp/dt, V_{pm}, V_{CE},
and V_{max} derived from both total pressure (TP) and developed LV pressure (DP).
The sampled signal is displayed to the user at the cardiac catheterization
laboratory graphic terminal where it can be rejected or accepted for computer
analysis. At the completion of the analysis the indices derived for each cycle
are stored for later report generation. The computer calculates the first
derivative of pressure dp/dt and uses the time of maximum dp/dt as a reference
time for each cycle. That point where dp/dt falls below 5% of max dp/dt is taken
as the point of end-diastole. Linear and quadratic regression equations are used
to calculate $V_{max}(TP)$ and $V_{max}(DP)$ respectively.

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TECHNICAL MONOGRAPH NUMBER 0014 - THE COMPUTER IN THE CARDIAC
CATHETERIZATION LABORATORY
PART III.   LEFT VENTRICULAR DIMENSIONAL ANALYSIS

by

L. R. Smith, S. E. Wixson, J. A. Mantle, W. P. Hood, Jr.
and C. E. Rackley

This monograph is Part III of a three-part description (Technical Monographs
0012-0014) of the use of the computer in the Adult Cardiac Catheterization
Laboratory.

This monograph presents a historical review of the use of computers for
angiographic data analysis. The instrumentation needed for data analysis,
including the graphic digitizer is described. Calibration procedures required to
convert from digitizer units to millimeters are described. The processing
techniques described in this monograph include Dodge's area-length volumes, wall
segment methods and wall motion models. Detailed computer algorithms are
described. The system's review and report capabilities are reviewed.

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TECHNICAL MONOGRAPH NUMBER 0015 - VOLUMES LABORATORY USERS' GUIDE

by

L. Richard Smith

This monograph is the Users' Guide for the Volumes Analysis system. The
monograph includes a description of the system, individual pieces of equipment,
frame-by-frame explanation of the programs and use of report programs.

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TECHNICAL MONOGRAPH NUMBER 0016 - CCCC APPLICATIONS SYSTEMS
AND REPORTS

by

Staff

This monograph summarizes the major application programs in the Clinical
Cardiology Computer Center by presenting a short narrative description and
related computer generated reports.

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TECHNICAL MONOGRAPH NUMBER 0017 - GRAF/PEN SYSTEM OPERATIONS
AND MAINTENANCE MANUAL

by

Steve E. Wixson

This technical monograph describes the Graf/Pen graphic digitizer interface
added to the Clinical Cardiology Computer Center computer (an IBM 1800). It is a
collection of pertinent drawings from the complete CCCC hardware documentation,
Technical Monograph 0003. Included are interface description, block diagrams,
electrical schematic diagrams, mechanical drawings, and wiring lists, and with
this monograph, one can build, operate and maintain the interface.

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TECHNICAL MONOGRAPH NUMBER 0018 - VERSATEC OPERATIONS AND
MAINTENANCE MANUAL

by

Steve E. Wixson

This technical monograph describes the Versatec electrostatic plotter
interface added to the Clinical Cardiology Computer Center computer (an IBM
1800). It is a collection of pertinent drawings from the complete CCCC hardware
documentation, Technical Monograph 0003. Included in the monograph are interface
description, programming instructions, timing diagrams, block diagrams,
electrical shematic diagrams, and wiring lists. With this monograph, one can
build, operate and maintain the interface.

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TECHNICAL MONOGRAPH NUMBER 0019-0 - HEMODYNAMIC MONITORING STAND
CONSTRUCTION PLANS

by

Steve Wixson, Charlie Boyd, Jr., Charles Rackley

This monograph presents the construction plans for a hemodynamic monitoring
stand suitable for use with the Swan-Ganz thermodilution catheter. The stand
uses disposables for pressures (manufactured by Sorenson Research Company) and
cardiac output (manufactured by Travenol, Inc.).

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TECHNICAL MONOGRAPH NUMBER 0020 - CPK INFARCT SIZE USERS' GUIDE

by

L. Richard Smith

This monograph is the Users' Guide for the CPK infarct size project. The
monograph includes a description of the system, a frame-by-frame explanation of
the programs, and use of report programs.

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TECHNICAL MONOGRAPH NUMBER 0021 - CEI USERS' GUIDE

by

Eugene M. Strand and Clifford E. Waits

This monograph is the users' guide for the continuous EKG interval
application system. The manual includes a functional overview, opera-tional
information for the on-line processing and operational information for all report
programs. An appendix contains a descriptive paper of the processing and review
system.

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TECHNICAL MONOGRAPH NUMBER 0022 - COMPUTER ANALYSIS OF 35 LEAD
PRECORDIAL ELECTROCARDIOGRAPHIC MAPS

This technical monograph describes a computerized system to acquire, process
and display 35 lead precordial electrocardiographic maps. The monograph includes
a description of the 35 lead system, a precordial lead mapping protocol and a
users guide for the programs.

****

TECHNICAL MONOGRAPH NUMBER 0029 – LINEAR DISCRIMINANT CLASSIFICATION OF NORMAL AND PREMATURE VENTRICULAR BEATS USING TIME DOMAIN QRS WAVEFORM VARIABLES

by

Eugene M. Strand

A basic problem for rhythm monitoring systems is the classification of a QRS waveform as a "normal" or premature (PVC) ventricular contraction. "Normal" means the typical or characteristic waveform for a given subject, as opposed to electrocardiographically indistinguishable from normal.

Two categories of QRS waveform variables are used in cardiac rhythm monitoring systems. Simple descriptive variables quantify a waveform independently of prior knowledge of the electrocardiogram (ECG) of a subject. Template variables quantify a waveform through comparison with a known waveform from the subject. The goal of this study was to determine which variables suggested in the literature classify "normal" and premature ventricular (PVC) waveforms with highest sensitivity and specificity.

This paper describes a linear discriminant function which correctly classified 99.3% of the QRS waveforms in the test data set. A two-variable (duration difference and absolute distance described below) first order model is the basis for the discriminant function.

The coefficients for the function were developed using a training data set of 566 QRS observations from 50 subjects. The function was tested using an independently collected data set of 688 observations from 58 subjects. In each data set, 50% of the observations were "normal" and 50% were PVC's. Each group of subjects was a sequential set of patients being monitored for ventricular arrhythmias.

This study demonstrates that the linear discriminant function can successfully classify QRS waveforms as "normal" or PVC. Moreover, this study shows that a discriminant function including template variables performed significantly better than functions based only on a simple descriptive variable.

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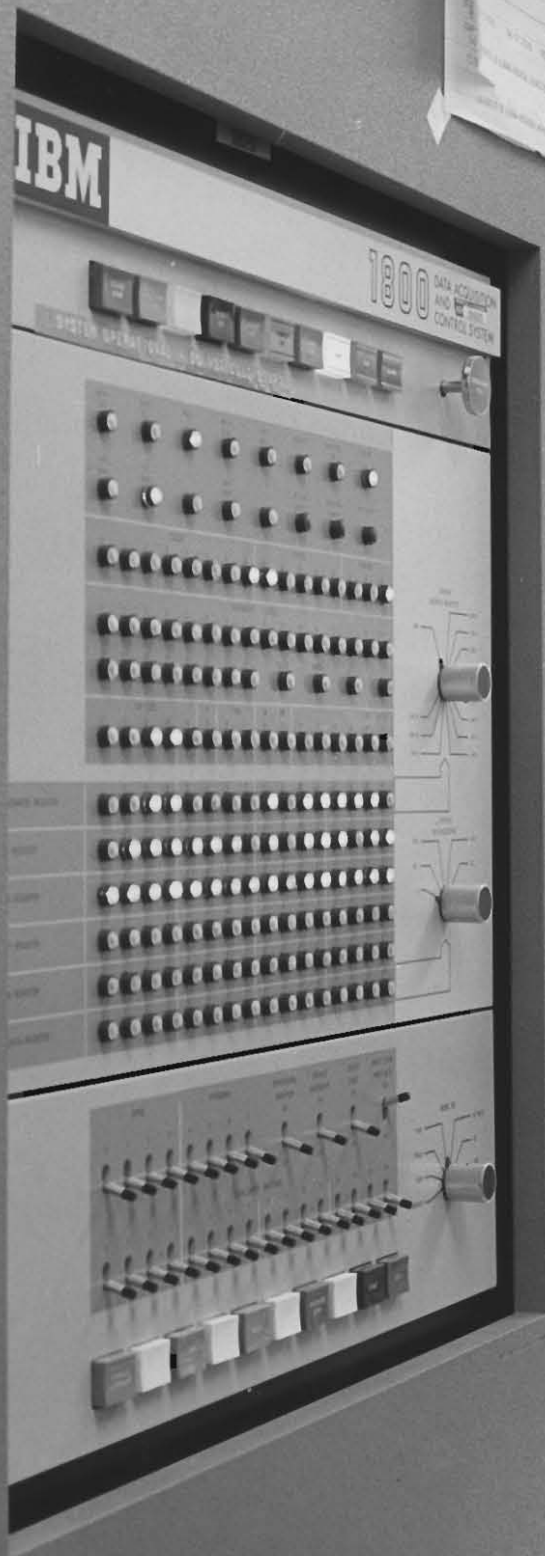
Staff of the Clinical Cardiology Computer Center in 1979 (note CCCC logo on left.)
From left to right; Standing, Steve Wixson, Ginny Quick, Thomas Ball, Deborah Glenn, L Richard Smith, Eugene Strand, Marcus Waits, Robert Holmes, Robert Beavers; Sitting, Robert Taylor, Samuel Scalisi, William Cunningham, Andrew Ferretti, Dimitry Zissermann, Steve Williams.

Also shown is IBM Series/1 (with vintage stethoscope) used in a hospital clinical laboratory project.