SAN/0499-79
MDC G9362

STMPO # 224
EXTRA O.K.S.

10 MWe Solar Thermal
Central Receiver Pilot Plant

SOLAR FACILITIES DESIGN INTEGRATION

SOLAR ONE PLANT CONTROL SEMINAR

25-26 February 1981

WORK PERFORMED UNDER CONTRACT
DE-AC03-79SF10499

STEARNS-ROGER ENGINEERING CORP
4500 CHERRY CREEK DRIVE
P.O. BOX 5888
DENVER, CO 80217

U.S. Department of Energy

Solar Energy

List of Acronyms

1. ADC	Analog to Digital Converter
2. AMP	Amplifier
3. BCS	Beam Characterization System
4. BOP	Balance of Plant
5. B/W	Black and White – Related to CRT Displays
6. CAL	Calibrate
7. CCP	Console Communication Processor
8. CCU	Central Control Unit
9. CON	Console
10. CPU	Cenral Processing Unit
11. CRT	Cathode Ray Tube
12. CRTF	Central Receiver Test Facility in Albuquerque
13. CS	Collector System
14. CSM	Configuration Storage Module
15. CTM	Communication Translator Module
16. DAC	Digital to Analog Converter
17. DARMS	Data Acquisition Remote Multiplexing System
18. DAS	Data Acquisition System
19. DBA	Data Behavior Analyzer
20. DMA	Direct Memory Access
21. EPGS	Electrical Power Generation System
22. EX PS	Excitation Power Supply
23. HAC	Heliostat Array Controller
24. HCP	Host Configuration Processor
25. HTP	Historic Trend Processor
26. ICC	Integrated Control Console
27. ILS	Interface Logic System
28. I/O	Input/Output
29. IPAC	Trademark of Data Acquisition System Supplier
30. MCS	Master Control System
31. METRO	Meteorological
32. MHD	Moving Head Disc
33. MOD COMP	Trade Mark of OCS and DAS Computer Manufacturer
34. MODAC	Trade Mark of Modular Computer Systems for Data Acquisition and Control Equipment
35. MTU	Magnetic Tape Unit
36. MUX	Multiplexor
37. MVCU	Multi-Variable Control Unit – The Control Loop Processor
38. OCS	Operational Control System
39. OSP	Operator Station Processor
40. PCI	Peripheral Control Interface
41. PIP	Plant Interface Processor
42. RAS	Remote Acquisition System – Related to Meterology System
43. RGP	Report Generation Processor
44. RMU	Remote Multiplexing Unit
45. RS	Receiver System or Remote Station
46. S/C	Signal Conditioner
47. SCE	Southern California Edison
48. SDPC	Subsystem Distributed Process Control – Beckman MV-8000 System
49. SFDI	Solar Facility Design Integration
50. SHIMMS	Special Heliostat Instrumentation Measurements and Meterological
51. SIL	System Integration Lab
52. STMPO	Solar Ten Megawatt Project Office
53. S&H	Sample and Hold
54. TCG	Time Code Generator
55. TSS	Thermal Storage System

VFJ167N

AGENDA

Overview	John Grosse
SDPC	Bill Dow
ILS and Trip Logic	Al Smee
SCU's and RLU's	George Batoog
DAS and OCS	Wayne King
DARMS, SHIMMS, and Timing System	Bob Ebert
BCS	Mike Caraway
HAC Interfaces	Bob Riedesel
SIL Tour	Bob Breece

LIST OF ACRONYMS

BCS	Beam Characterization System
BOP	Balance of Plant
CRTF	Central Receiver Test Facility in Albuquerque
CS	Collector System
DAS	Data Acquisition System
EPGS	Electrical Power Generation System
HAC	Heliostat Array Controller
ILS	Interface Logic System
MCS	Master Control System
MVCU	Multi-Variable Control Unit — The Control Loop Processor
OCS	Operational Control System
RS	Receiver System
SCE	Southern California Edison
SDPC	Subsystem Distributed Process Control — Beckman MV-8000 System
SFDI	Solar Facility Design Integration
SHIMMS	Special Heliostat Instrumentation Measurements and Meteorological System
SIL	System Integration Lab
STMPO	Solar Ten Megawatt Project Office
TSS	Thermal Storage System

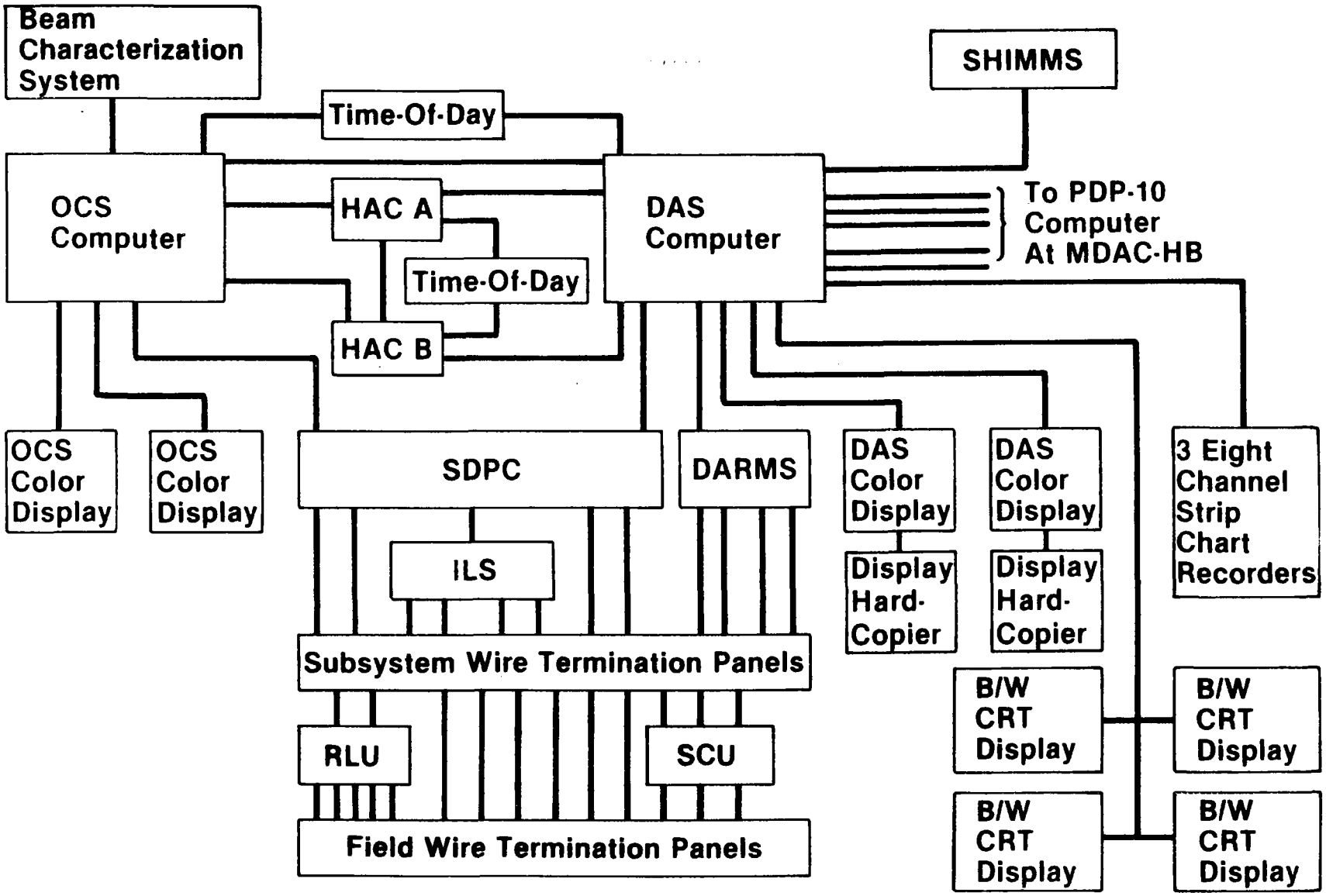
PLANT CONTROL SYSTEM REQUIREMENTS

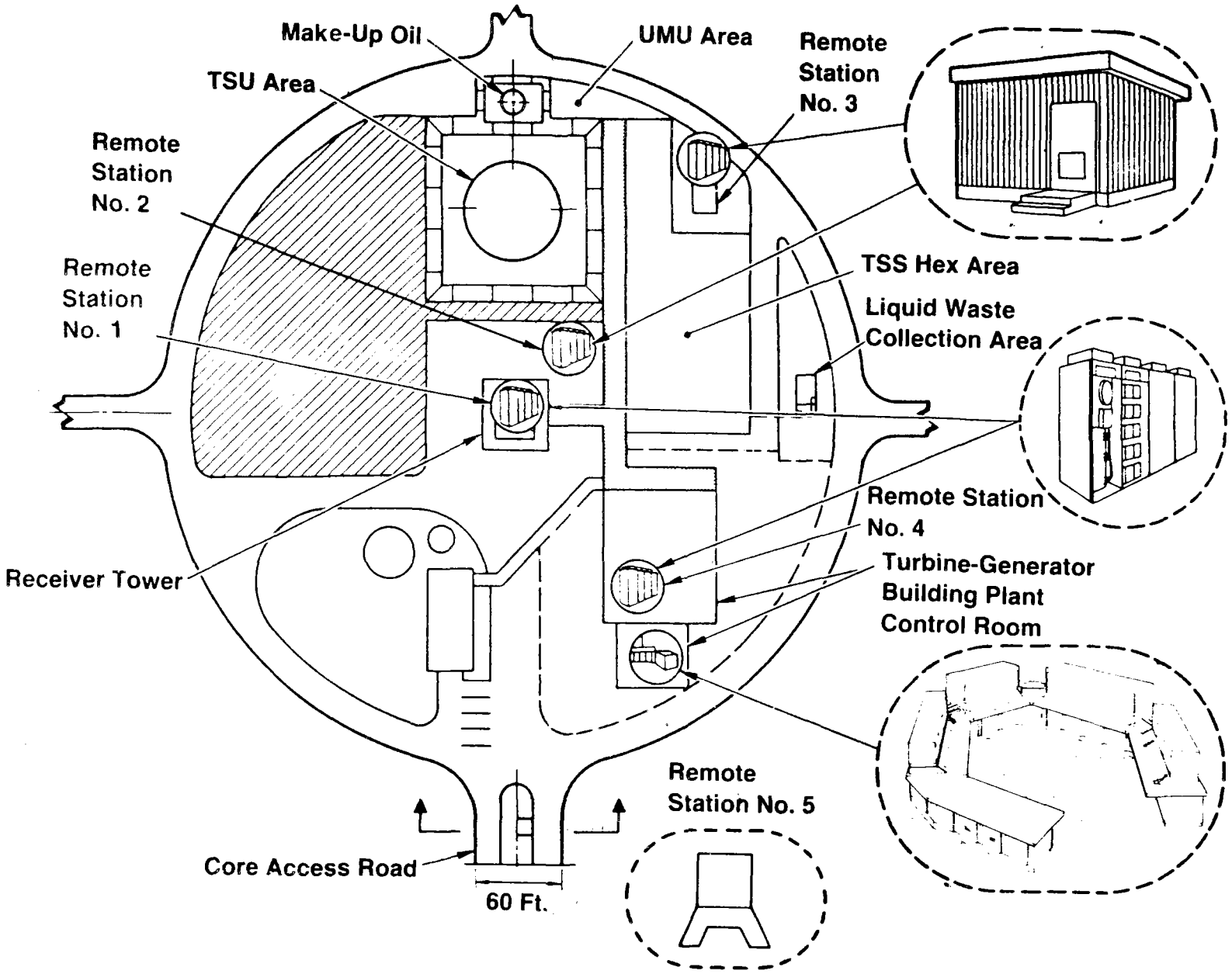
VFI789N

- Single Operator Control with Part Time Assistance
- Single Console Control
- Three Operating Modes
  - Manual
  - Computer Aided
  - Automatic
- Separate Control Functions From Evaluation Functions
- Controls Adaptable to Change
- Minimize Single Point Failures Where Cost Effective
- Provide a Flexible and Programmable Data Evaluation System

BASELINE CONTROL/MONITOR AND EVALUATION ARCHITECTURE

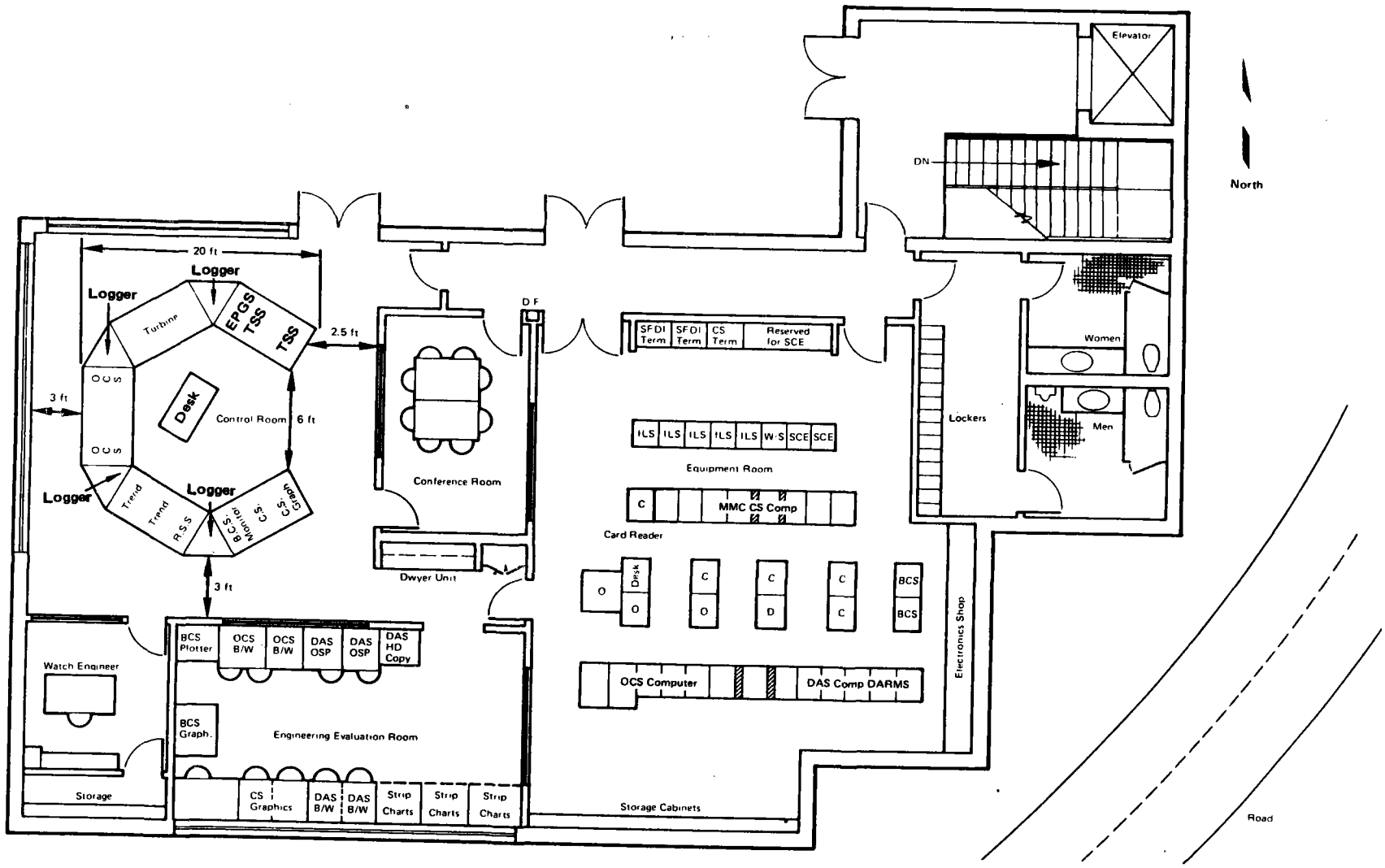
VFI775N




Make-Up Oil
UMU Area
TSU Area
Remote Station No. 3
Remote Station No. 2
Remote Station No. 1
TSS Hex Area
Liquid Waste Collection Area
Remote Station No. 4
Turbine-Generator Building Plant Control Room
Receiver Tower
Remote Station No. 5
Core Access Road
60 Ft.

PLANT CONTROL BUILDING: SECOND FLOOR PLAN
MCS EQUIPMENT LAYOUT

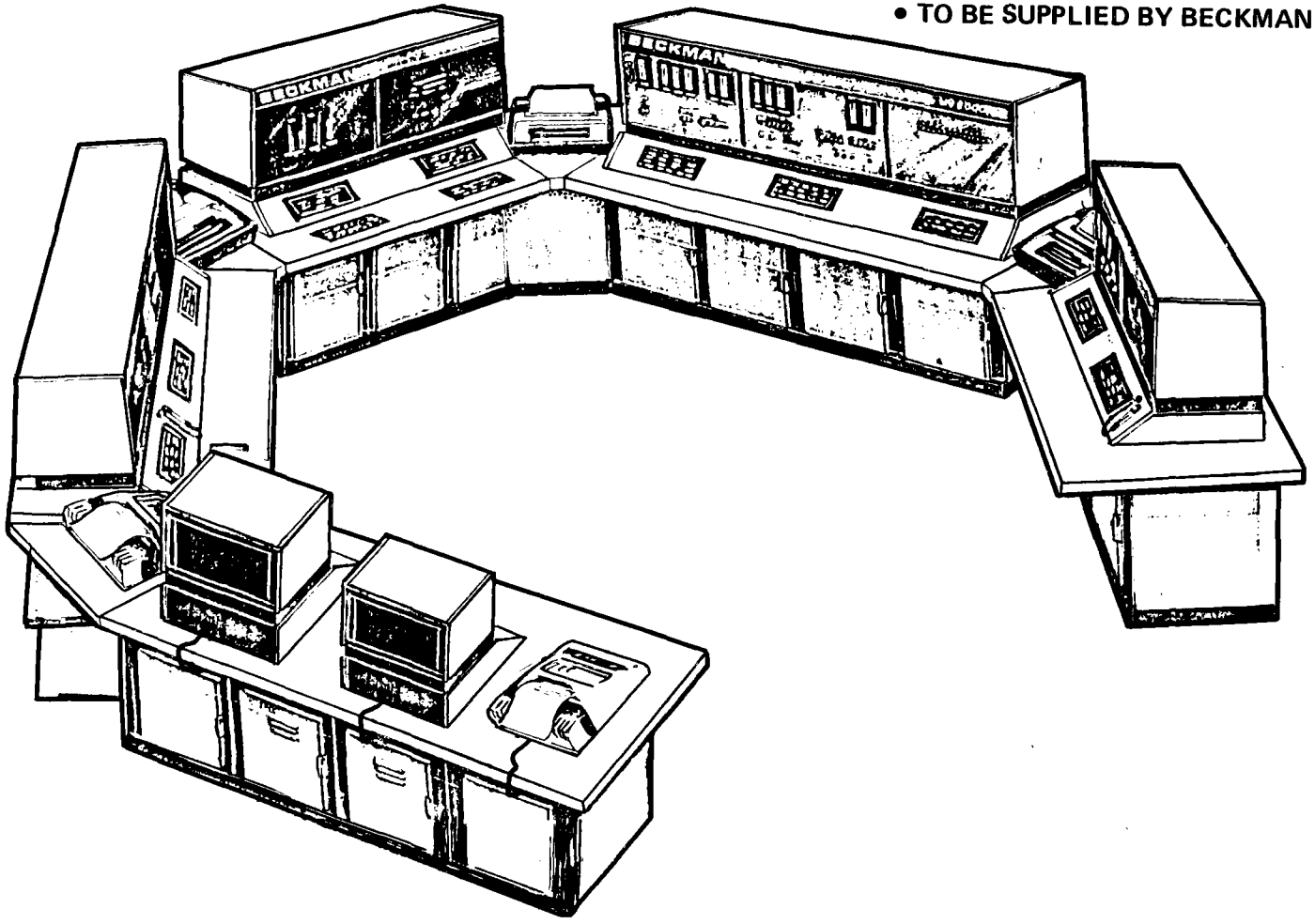
VFC741N

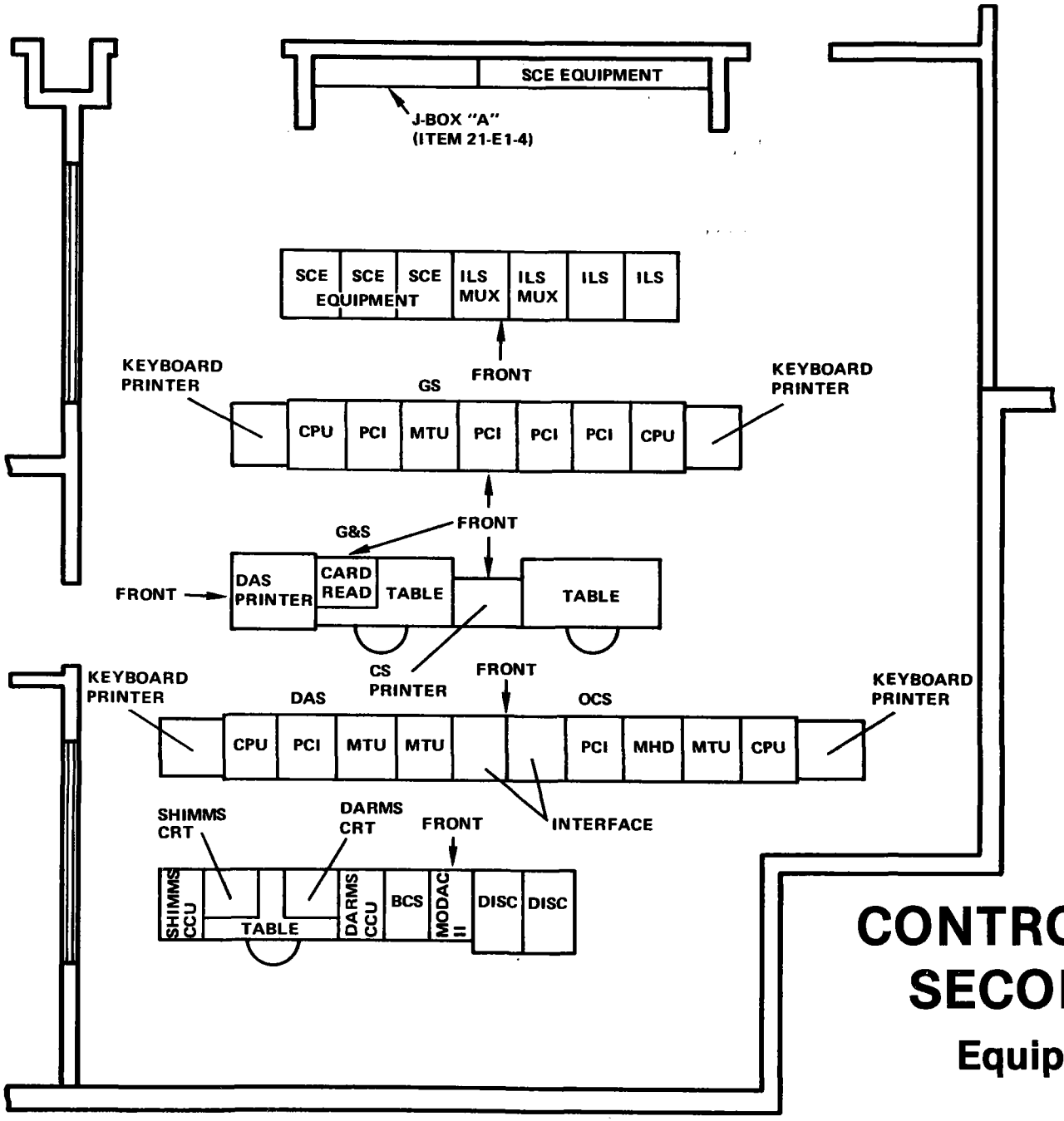


SOLAR 1 PLANT CONTROL CONSOLE

VFC728N

• TO BE SUPPLIED BY BECKMAN



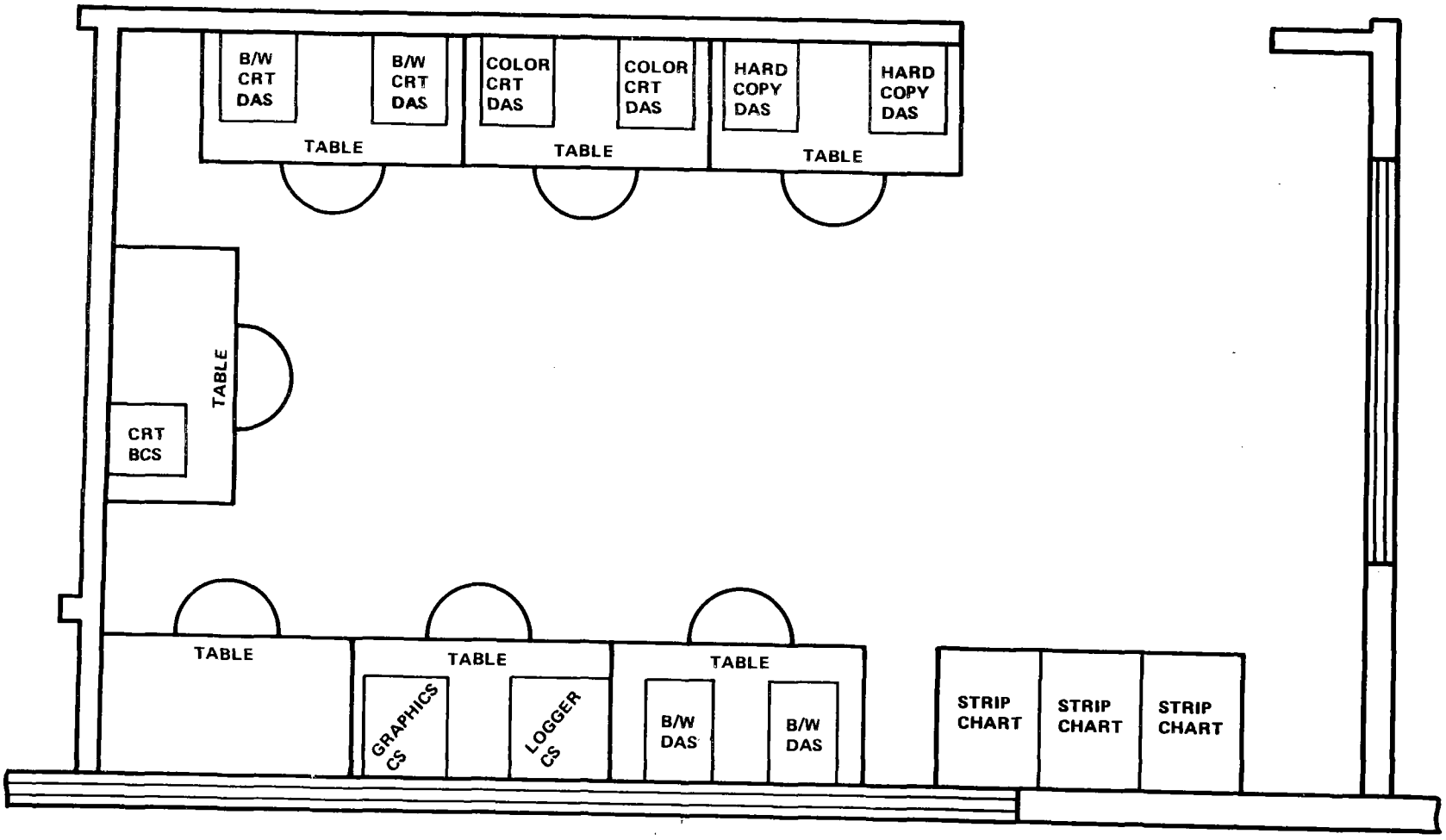


CONTROL BUILDING
SECOND FLOOR
Equipment Room

CONTROL BUILDING — SECOND FLOOR

VFJ177N

Evaluation Room



BASIC PLANT CONTROL METHODS

SUBSYSTEM MANUAL

- PLANT CONTROLLED FROM SUBSYSTEM CONSOLES BY OPERATOR
- OCS MAY BE USED FOR GUIDANCE AND MONITORING
- THIS WILL BE THE METHOD USED FOR:
    - PLANT STARTUP/SHUTDOWN
    - EQUIPMENT CONDITIONING
    - TOTAL PLANT CONTROL PRIOR TO OCS INTEGRATION

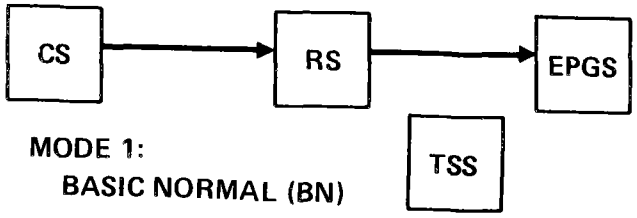
OCS MANUAL

- OPERATOR SELECTS OPERATING MODES, OCS CONTROLS PLANT WITHIN THE MODE
- OPERATOR INITIATES MODE TRANSITIONS

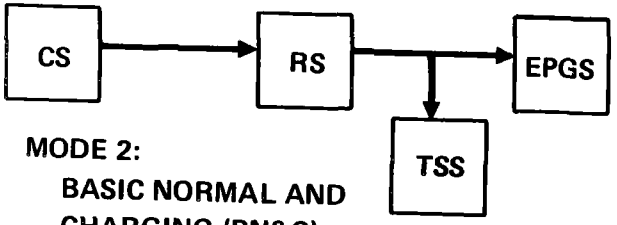
AUTOMATIC

- OCS PLANT CONTROL FOR A CLEAR DAY SCENARIO

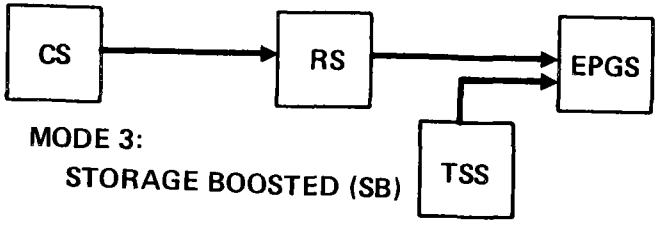
OPERATING MODES



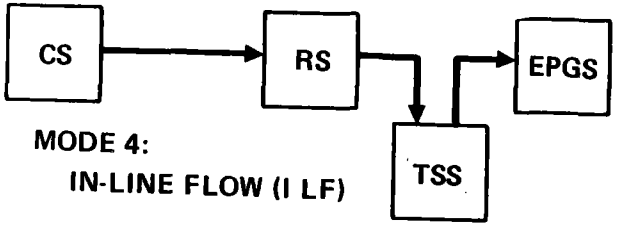
MODE 1:
BASIC NORMAL (BN)



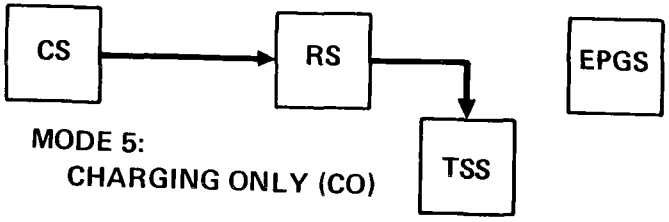
MODE 2:
BASIC NORMAL AND
CHARGING (BN&C)



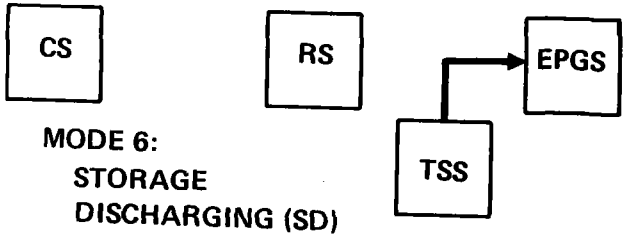
MODE 3:
STORAGE BOOSTED (SB)



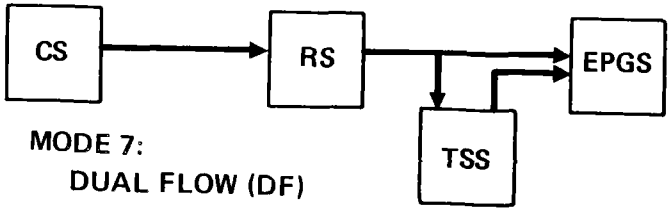
MODE 4:
IN-LINE FLOW (I LF)



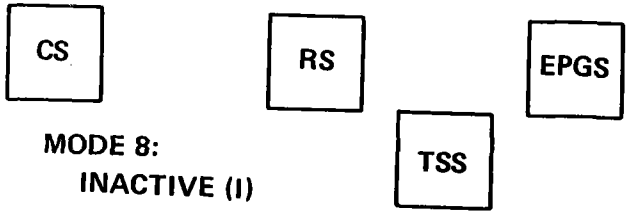
MODE 5:
CHARGING ONLY (CO)



MODE 6:
STORAGE
DISCHARGING (SD)



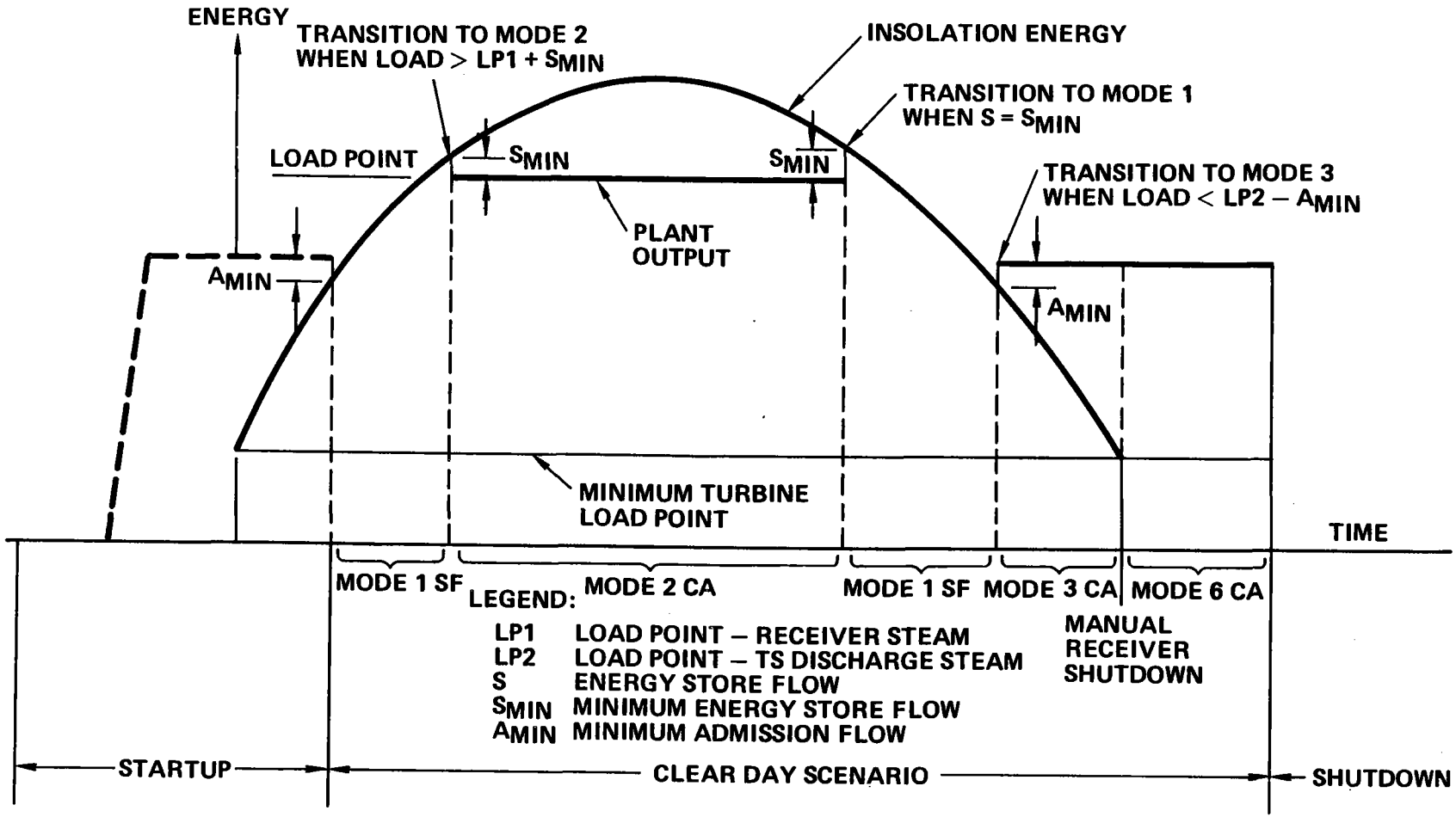
MODE 7:
DUAL FLOW (DF)



MODE 8:
INACTIVE (I)

CLEAR-DAY SCENARIO

VFF907N



VFI931N

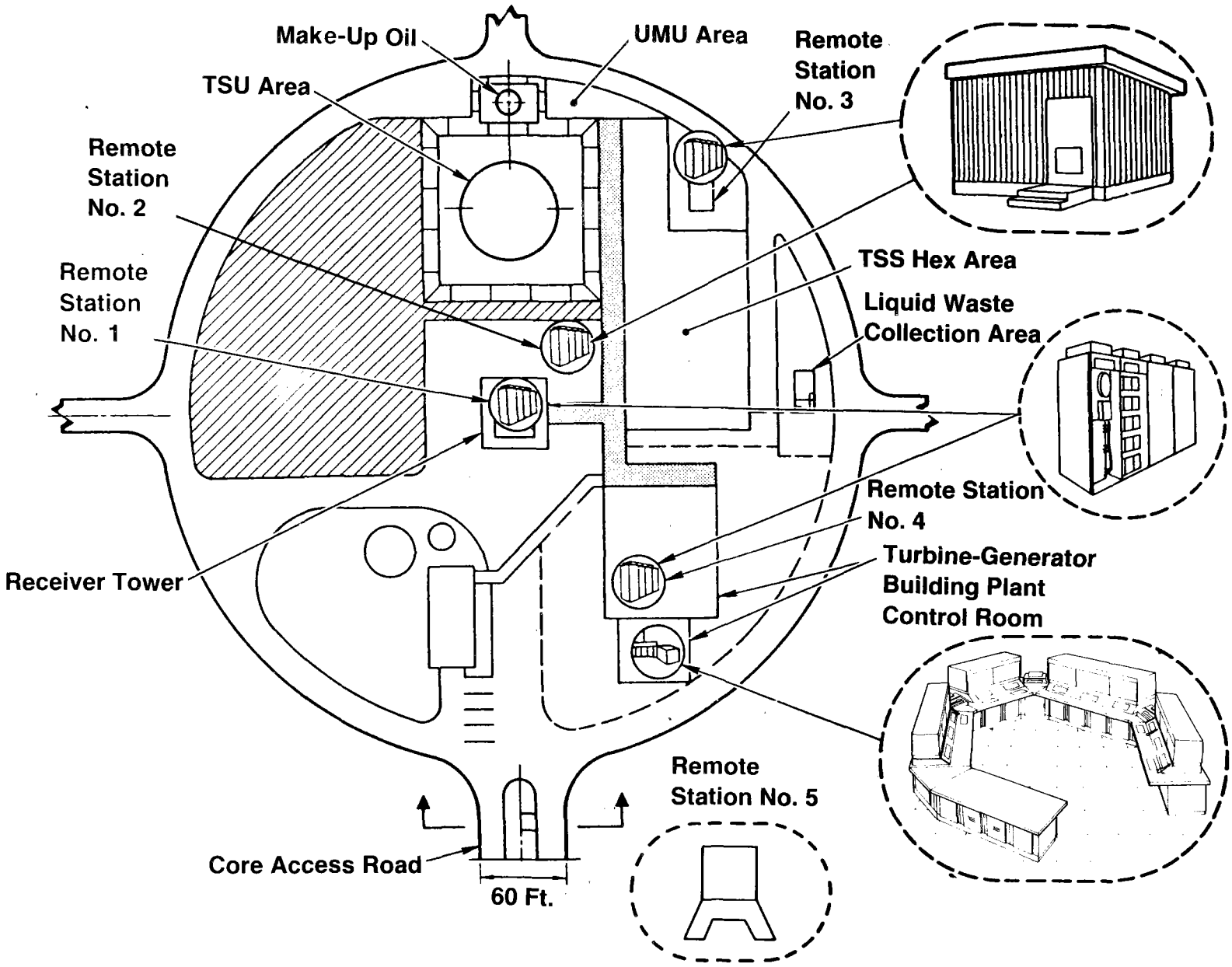
REQUIREMENTS

- Provide Standard and Special Algorithm Controls of the Process
- Provide a Distributive Control System
- Provide Three Display/Control Terminals That are Independent, Identical, and Interchangable
- Provide for a Single Operator
- Provide Access for Automatic Computer Control
- Provide Bumpless Switching to Redundant Controls
- Provide the Capability to Record 18 Channels of Trend Data
- Provide the Capability to Log Alarms, Process Changes and Trend Data

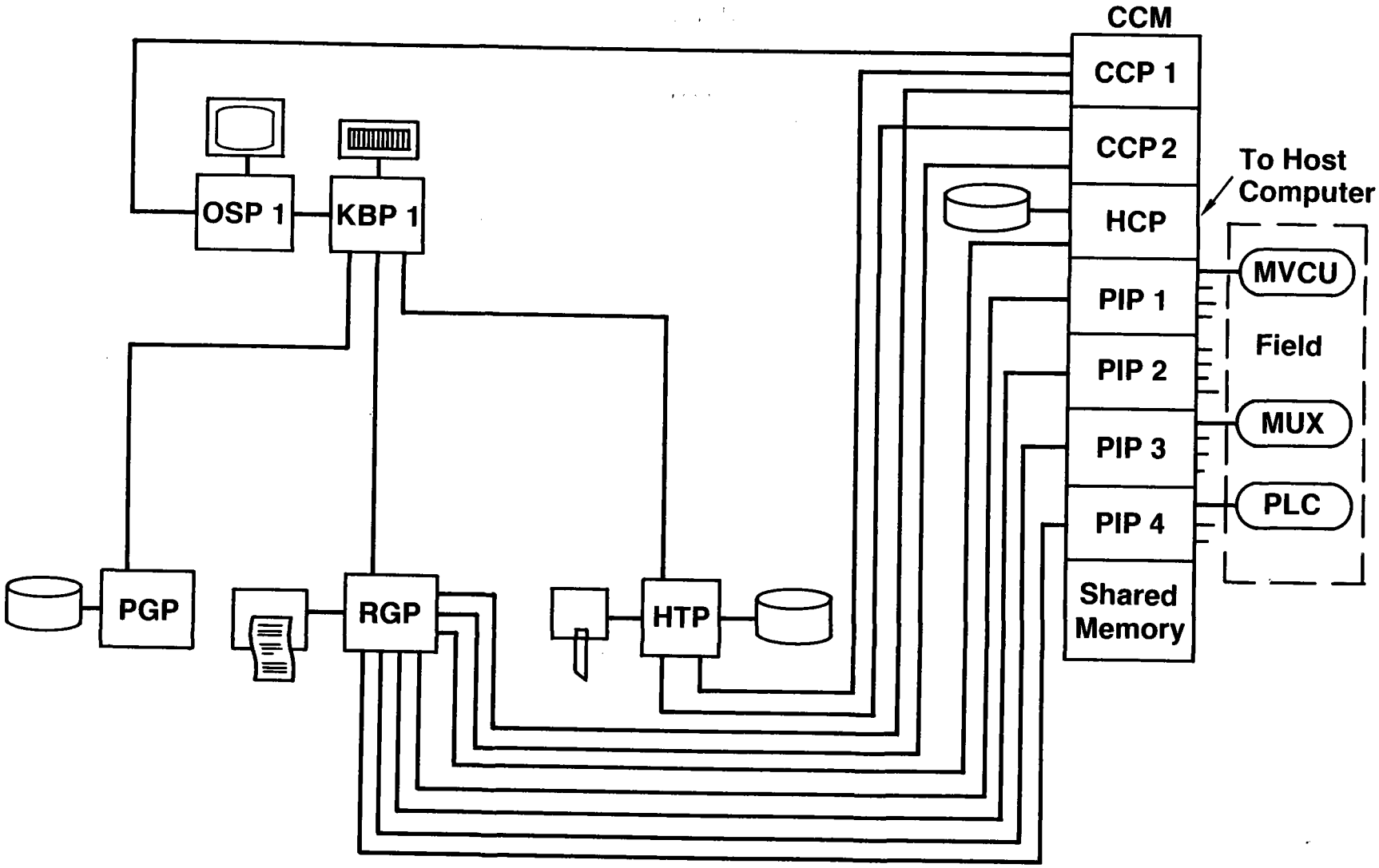
SUBSYSTEM MONITOR AND CONTROL REQUIREMENTS

VFJ003N

	Analog			Discrete		ILS		
	Monitor	Control		Monitor	Control	Inputs		Outputs
		Inputs	Outputs			Ana.	Dis.	
R.S.S.	69	155	34	28	0	16	32	32
T.S.S.	131	72	27	108	2	32		128
EPGS	130	50	29	1080	0	16	324	184


Make-Up Oil
UMU Area
TSU Area
Remote Station No. 3
Remote Station No. 2
Remote Station No. 1
TSS Hex Area
Liquid Waste Collection Area
Remote Station No. 4
Turbine-Generator Building Plant Control Room
Receiver Tower
Remote Station No. 5
Core Access Road
60 Ft.

MV 8000


CCM
CCP 1
CCP 2
HCP
PIP 1
PIP 2
PIP 3
PIP 4
Shared Memory
To Host Computer
MVCU
Field
MUX
PLC
OSP 1
KBP 1
PGP
RGP
HTP

VFJ009N

BECKMAN MV 8000 SYSTEM

Local

A. Operator Station (OSP)

B. Communication Control Module (CCM)

C. Communication Translator Module (CTM)

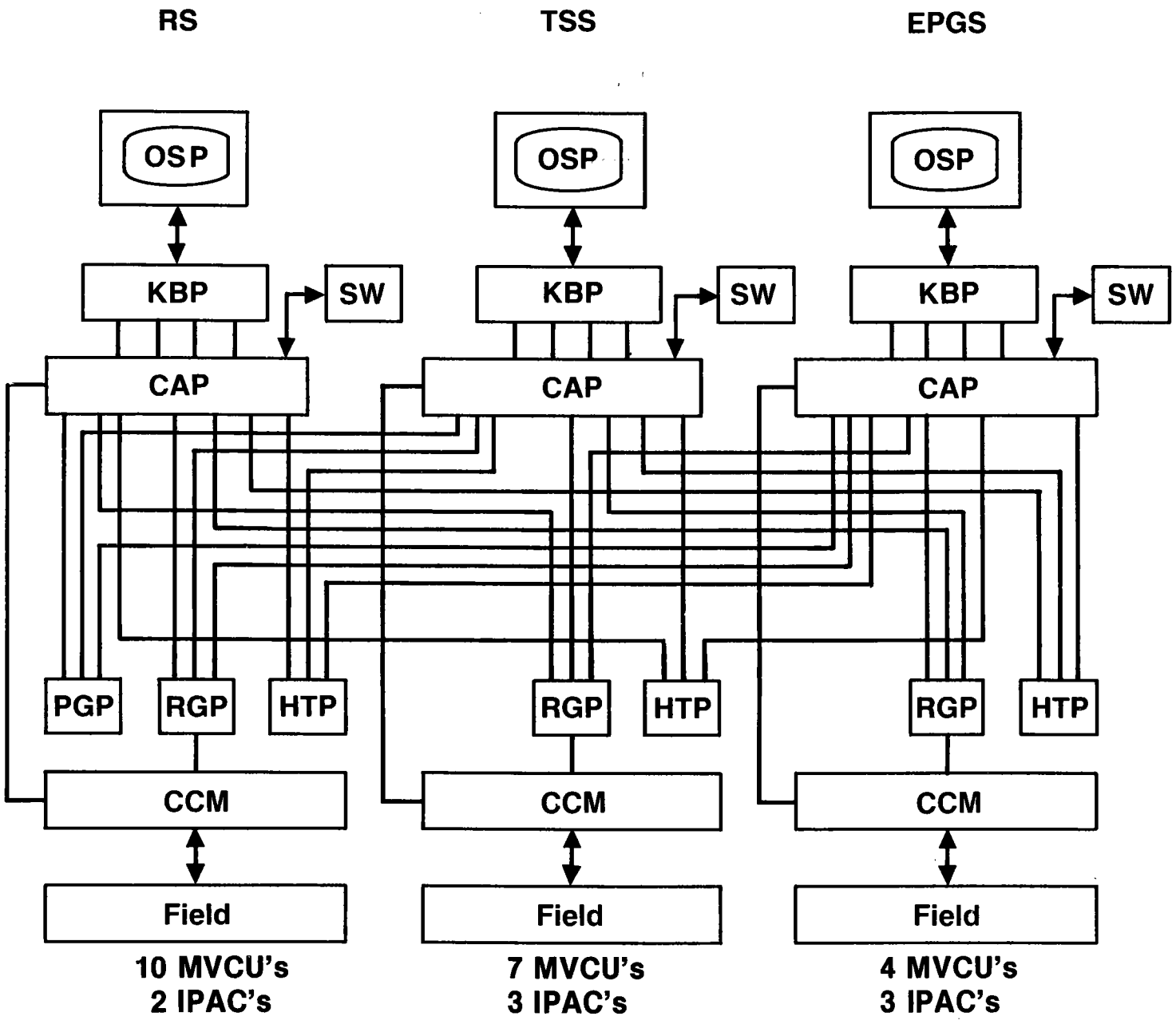
D. Historic Trend Processor (HTP)

E. Plant Graphic Processor (PGP)

F. Report Generation Processor (RGP)

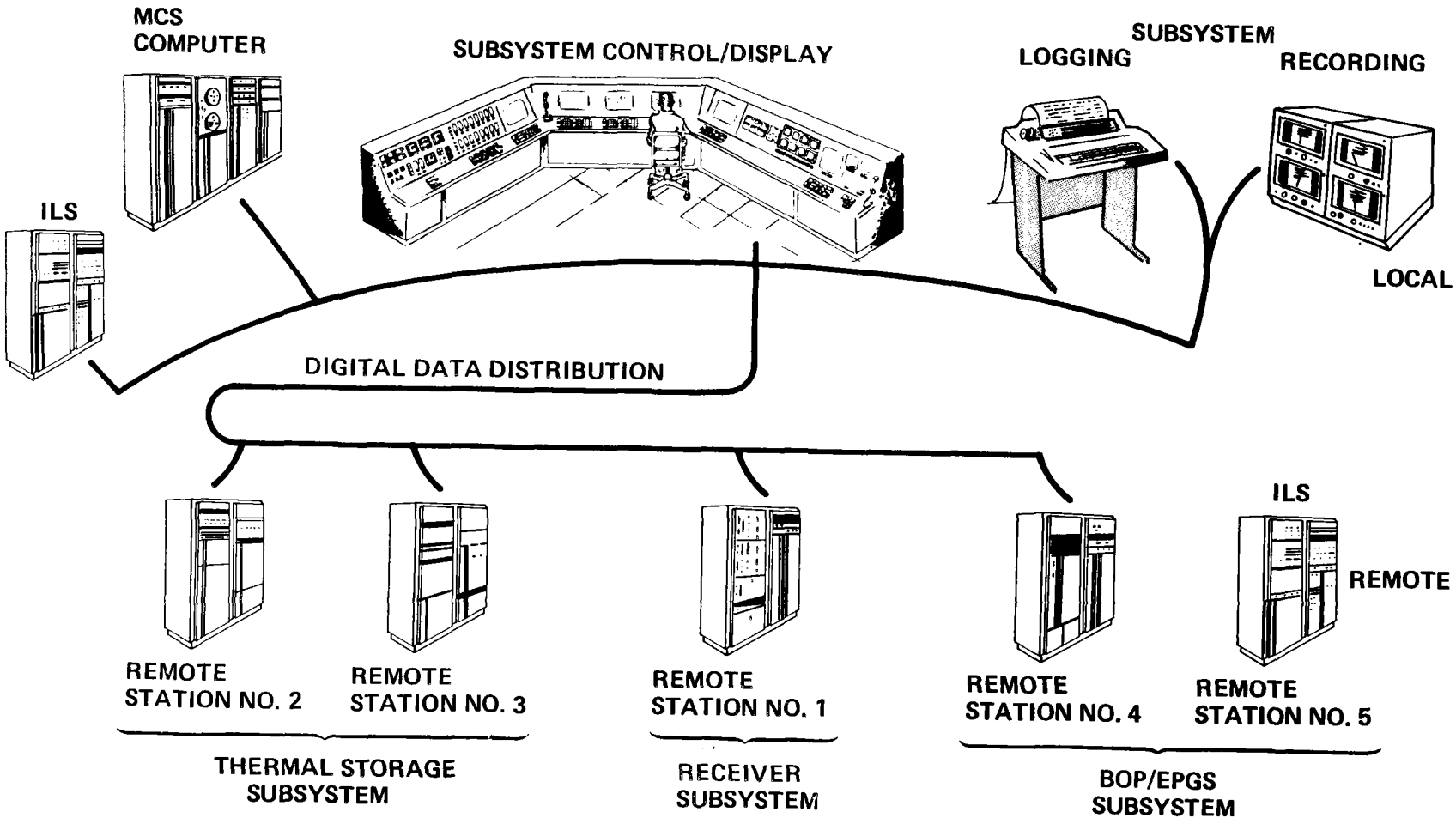
Remote

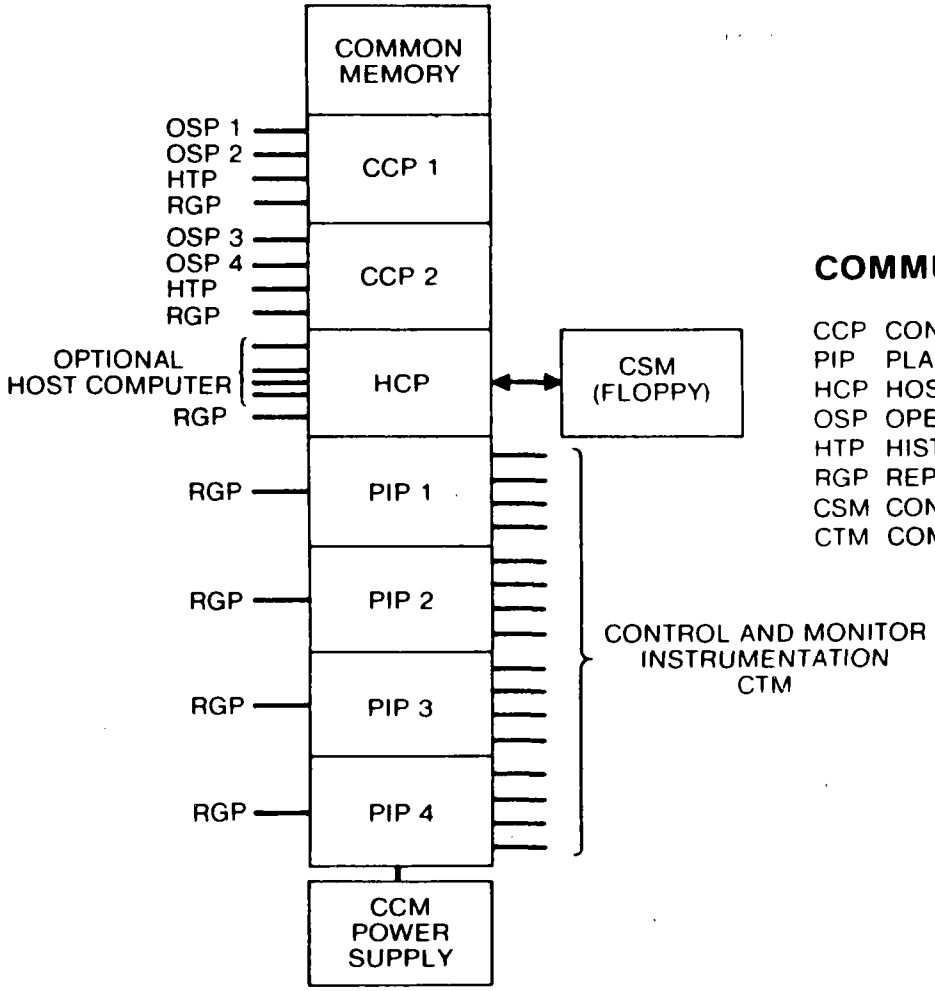
G. Field Hardware (MVCU, MUX, PLC)


RS
TSS
EPGS
OSP
OSP
OSP
KBP
SW
KBP
SW
KBP
SW
CAP
CAP
CAP
PGP
RGP
HTP
RGP
HTP
RGP
HTP
CCM
CCM
CCM
Field
Field
Field
10 MVCU's
2 IPAC's
7 MVCU's
3 IPAC's
4 MVCU's
3 IPAC's

SUBSYSTEM CONTROL AND MONITOR ARCHITECTURE

55619



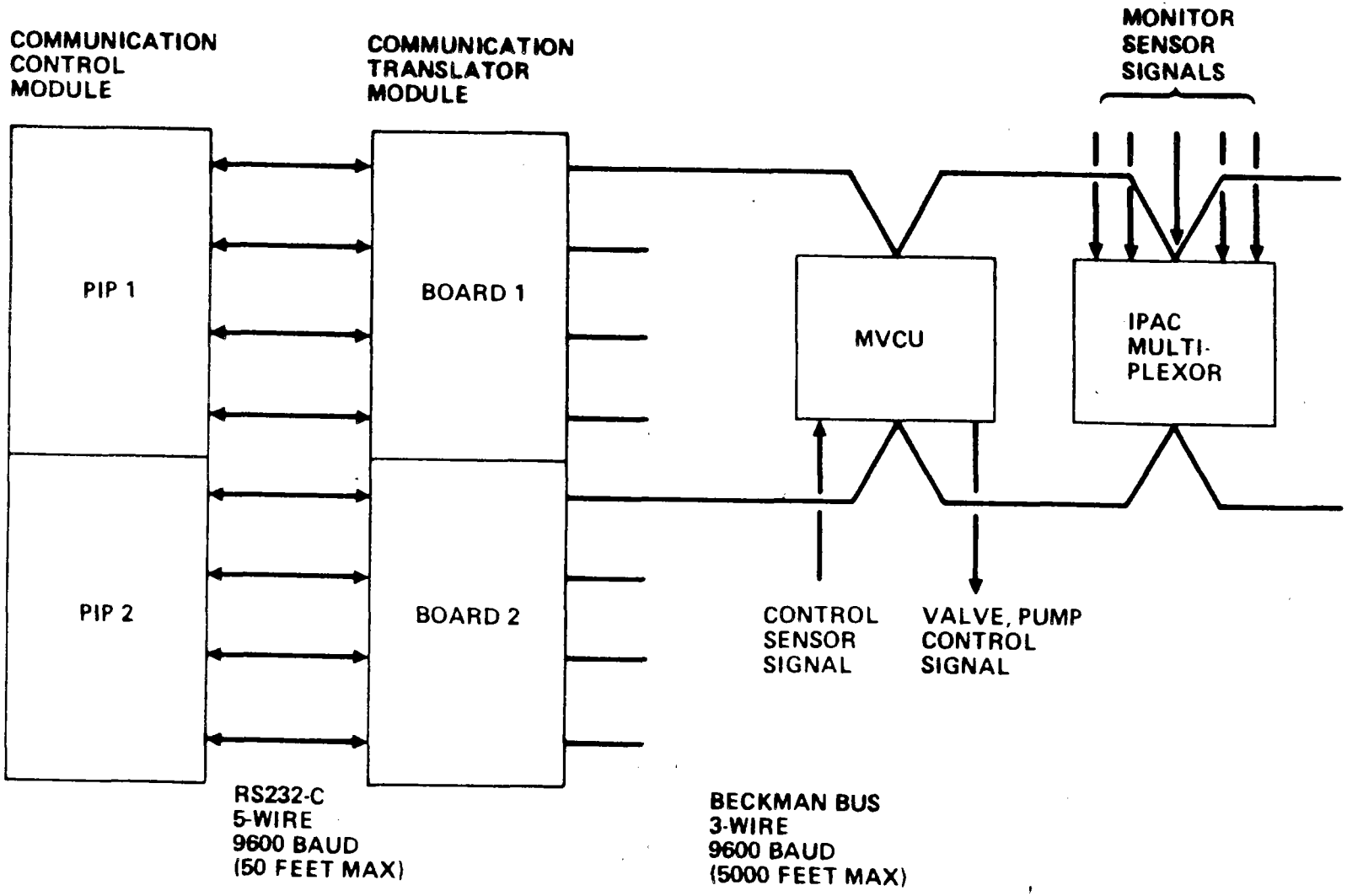


COMMUNICATION CONTROL MODULE

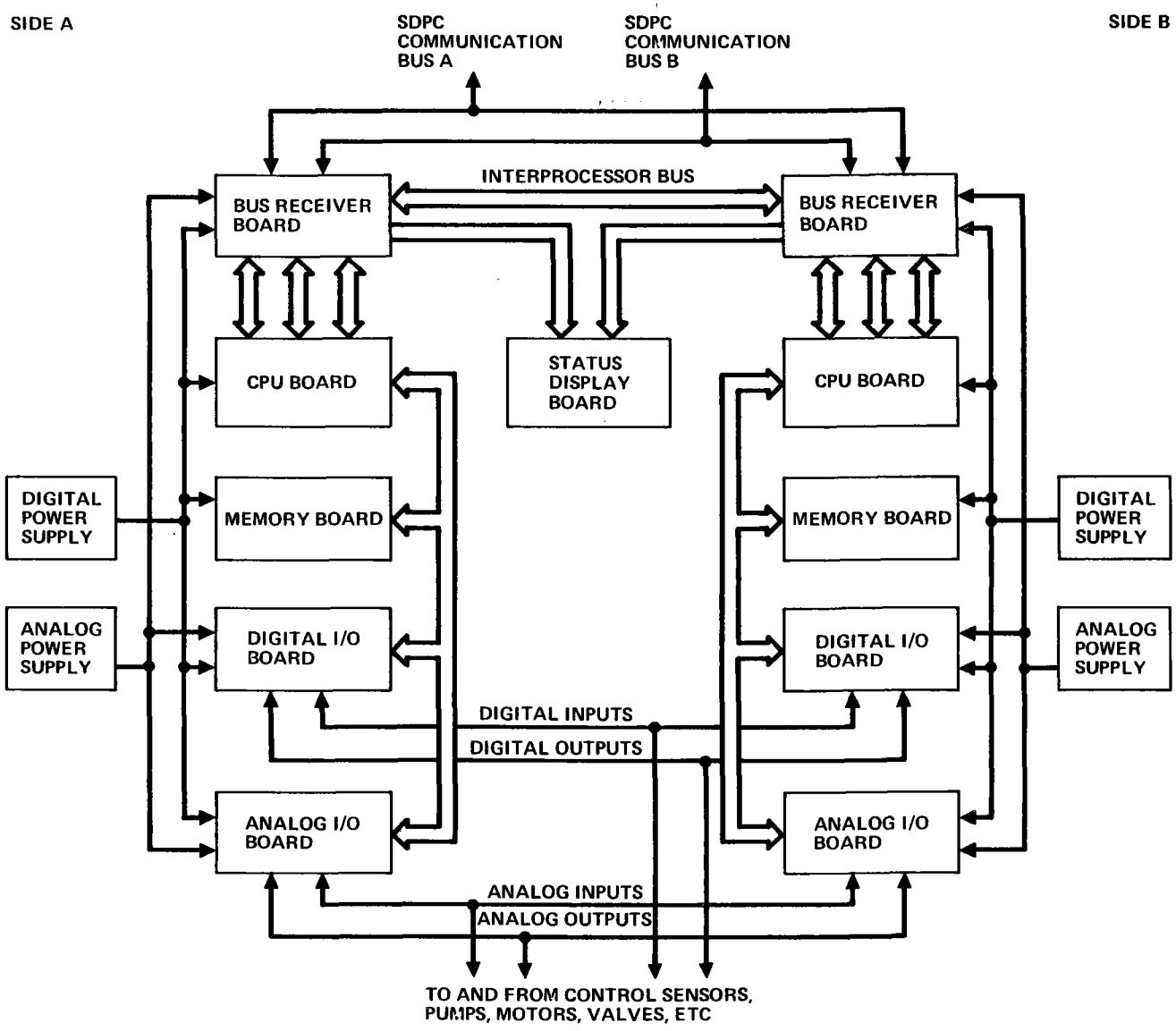
CCP CONSOLE COMMUNICATION PROCESSOR
PIP PLANT INTERFACE PROCESSOR
HCP HOST CONFIGURATION PROCESSOR
OSP OPERATOR STATION PROCESSOR
HTP HISTORIC TREND PROCESSOR
RGP REPORT GENERATION PROCESSOR
CSM CONFIGURATION STORAGE MODULE
CTM COMMUNICATION TRANSLATOR MODULE

SDPC MV8000 INTERFACE TO BECKMAN MULTIVARIABLE CONTROL AND INPUT/OUTPUT UNITS

VFC736N



MVCU ARCHITECTURE

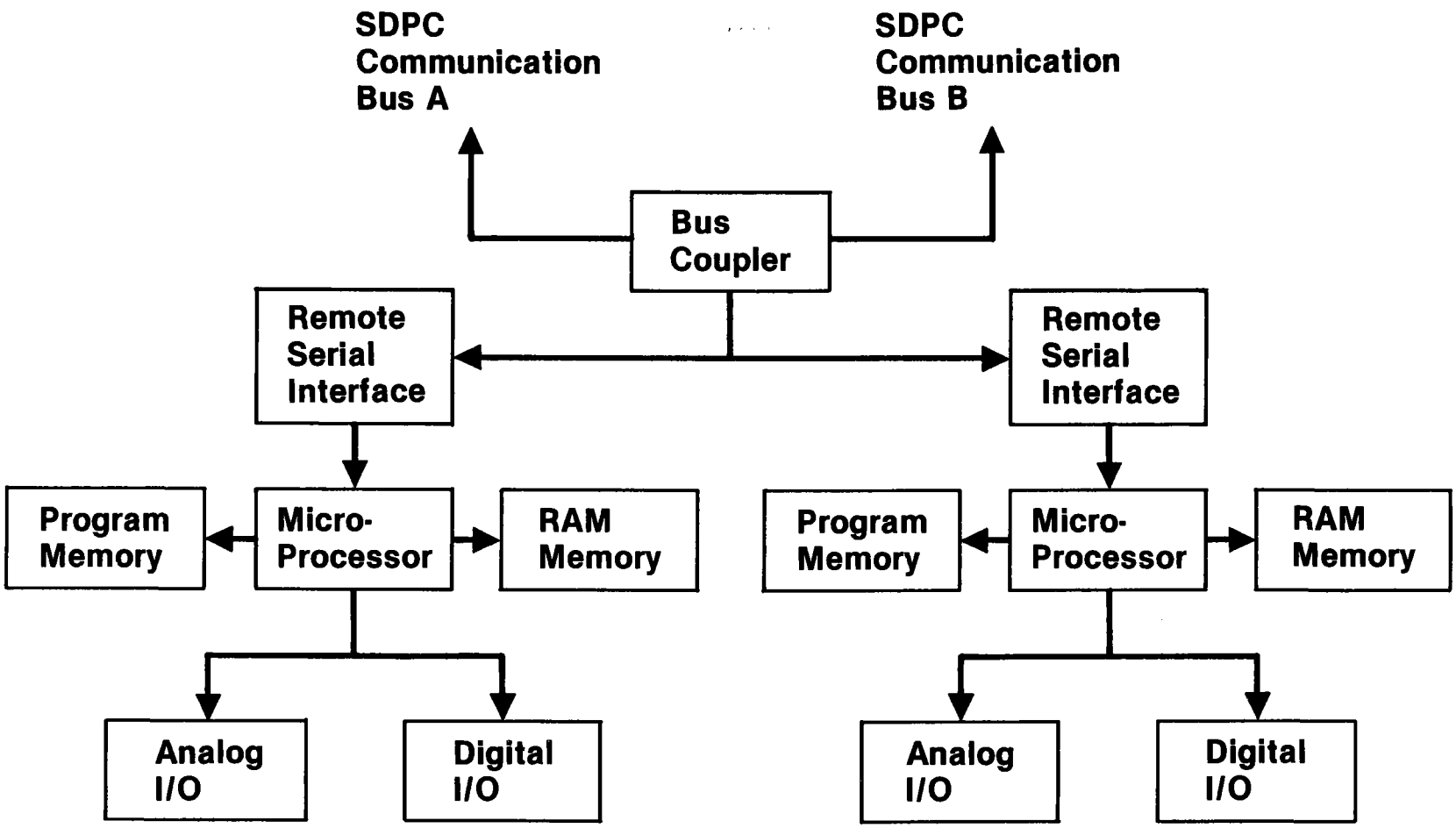


VFJ187N

MULTIVARIABLE CONTROL UNIT

- Microprocessor-Based Unit
- Redundant Systems
- Uses ASCII Bit Serial Communications
- 32 Analog Input Signal Capability
    - 1 to 5 VDC
    - 4 to 20 mADC
    - 10 to 50 mADC
- 16 Analog Output Signal Capability
    - 4 to 20 mADC
    - 850 Ohms Max Load

MULTIPLEXER ARCHITECTURE



MULTIPLEXER INPUT DEVICE

- IPAC Series 1500
- Analog Inputs — 8 Per Card
    - AC Voltage/Current
      (50 mv — 10 Vdc/4-20 ma)
    - Thermocouples
    - RTD's
- Digital Inputs — 16 Per Card
    - DC Contact Closures
    - AC Contact Closures
- Uses ASCII Bit Serial Communications

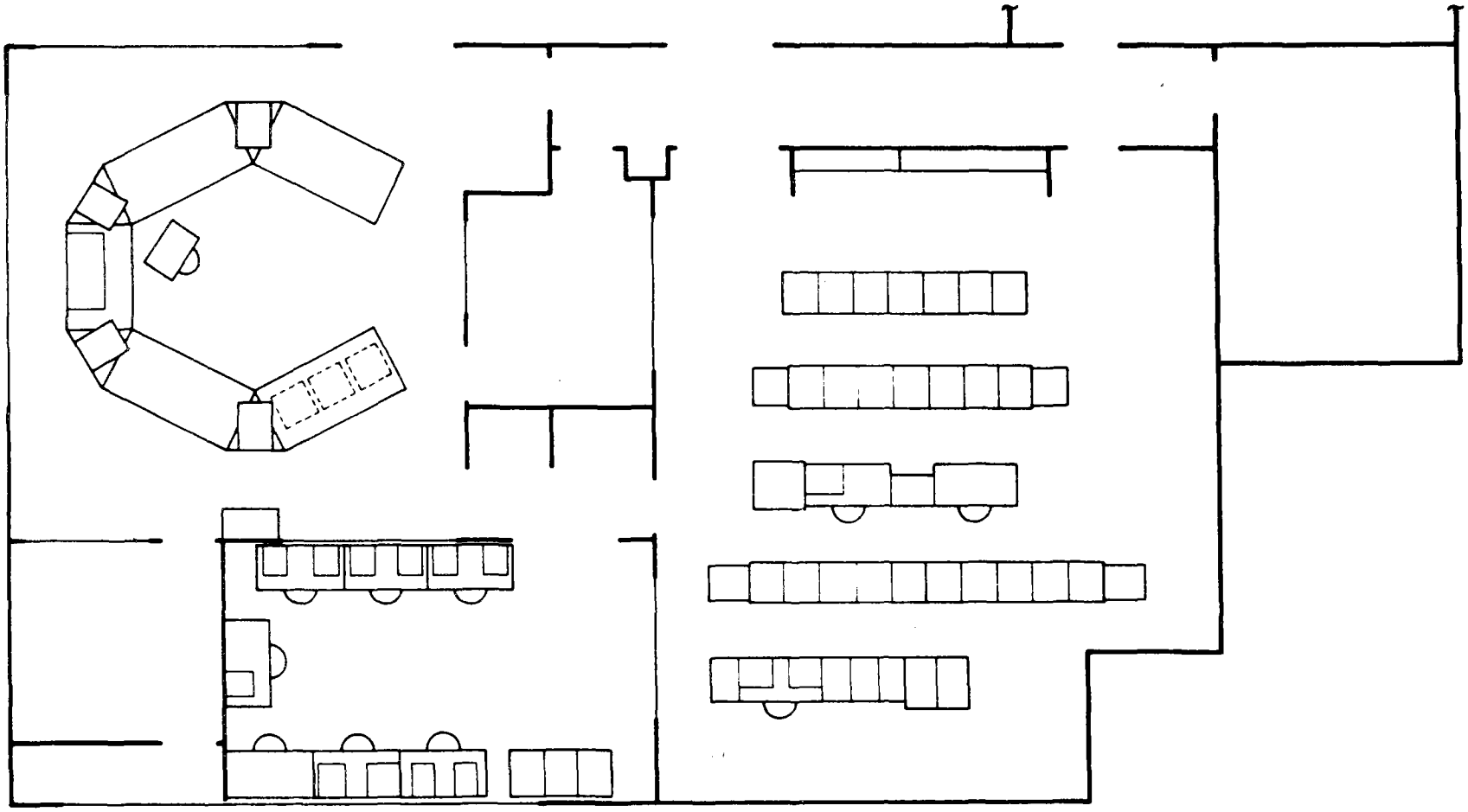
SDPC HARDWARE

- Local
  - 3 Operator Stations
  - 3 Communication Control Modules
  - 3 Communication Translator Modules
  - 3 Historic Trend Processors
  - 1 Plant Graphics Processors
  - 3 Report Generation Processors
  - 3 Console Access Processors
  - 8 Floppy Disks

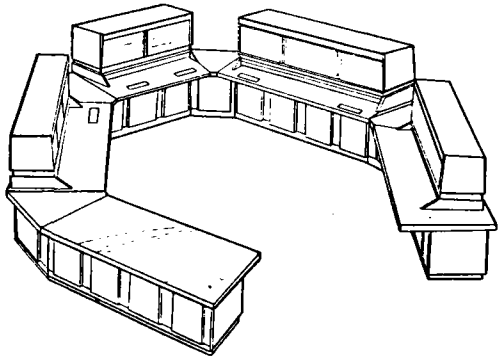
- Remote
  - 21 Multivariable Control Units
  - 8 IPAC Multiplexes
  - 3 3 Bay MVCU Enclosure Assembly
  - 5 2 Bay MVCU Enclosure Assembly
  - 7 1 Bay MVCU Termination Assembly
  - 2 Operator Interface Unit (OPIU)
  - 2 Floppy Disks

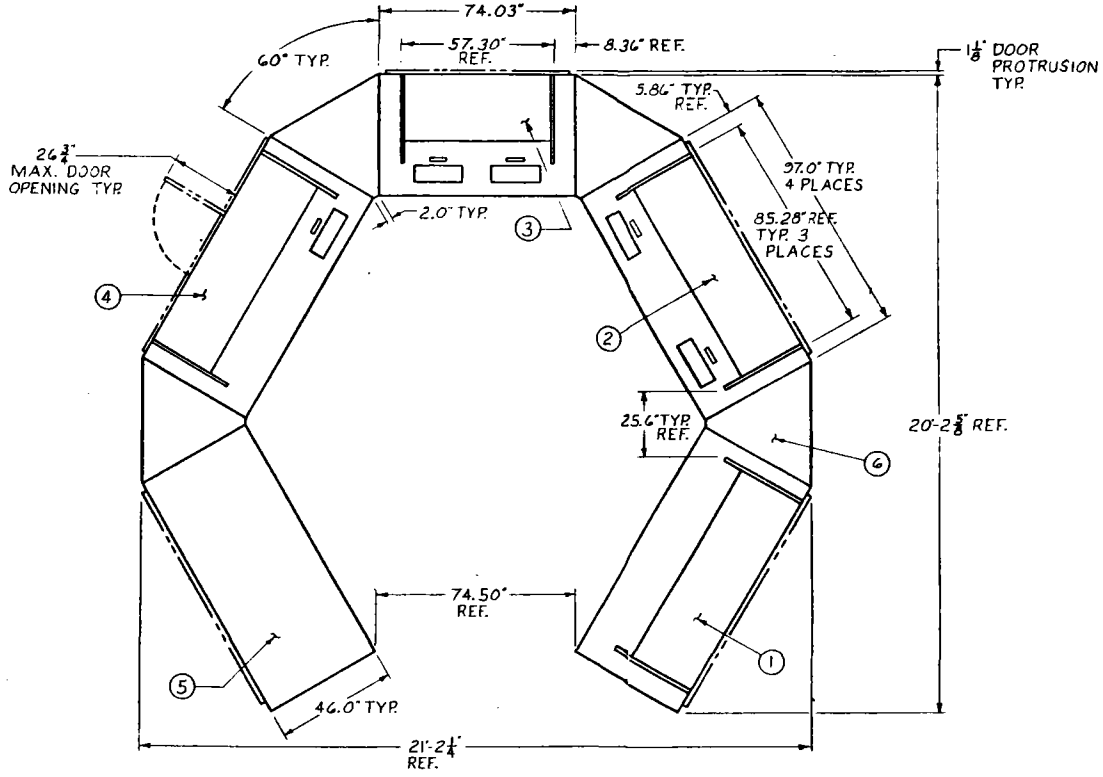
CONTROL BUILDING — SECOND FLOOR

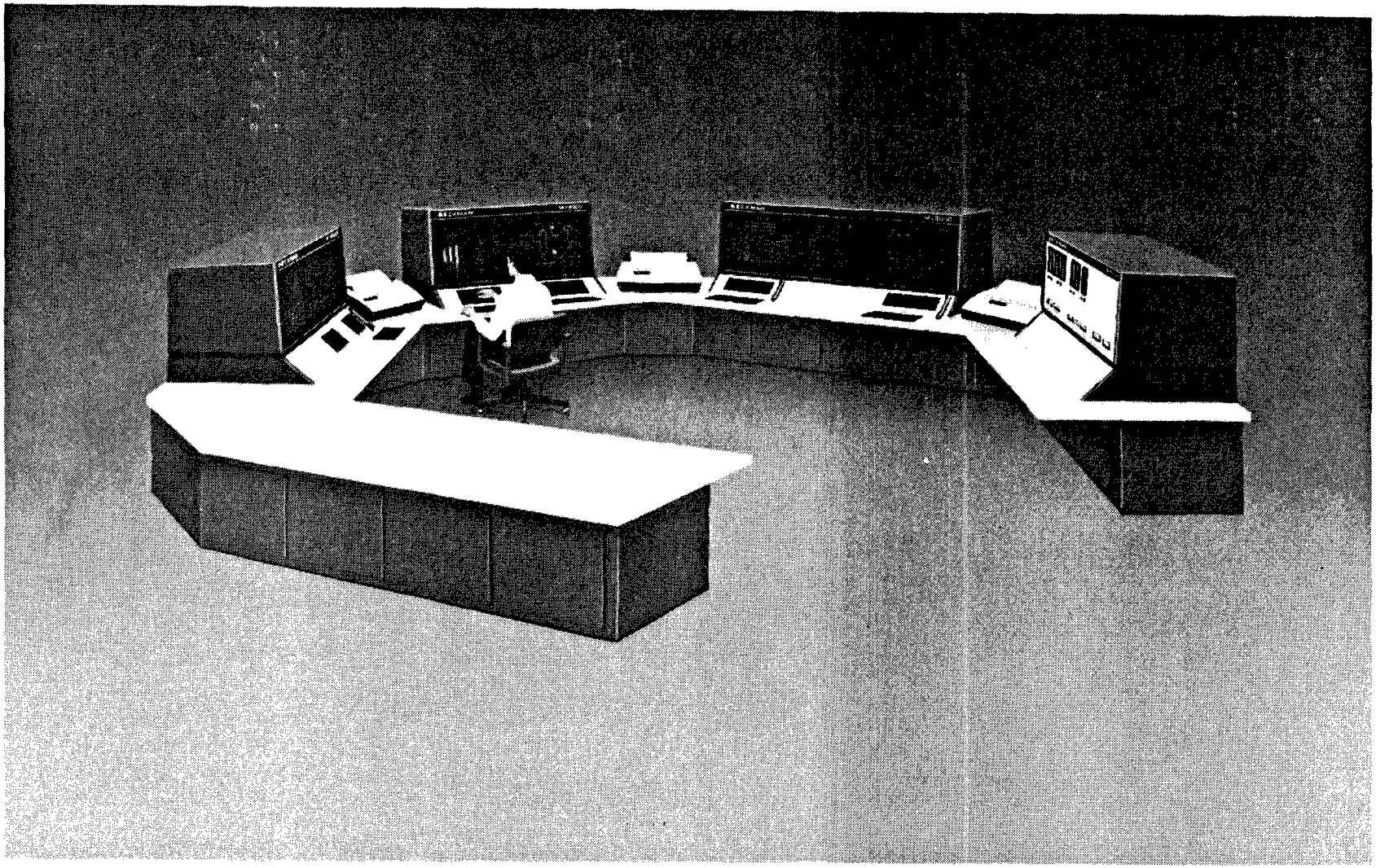
VFI884N-1

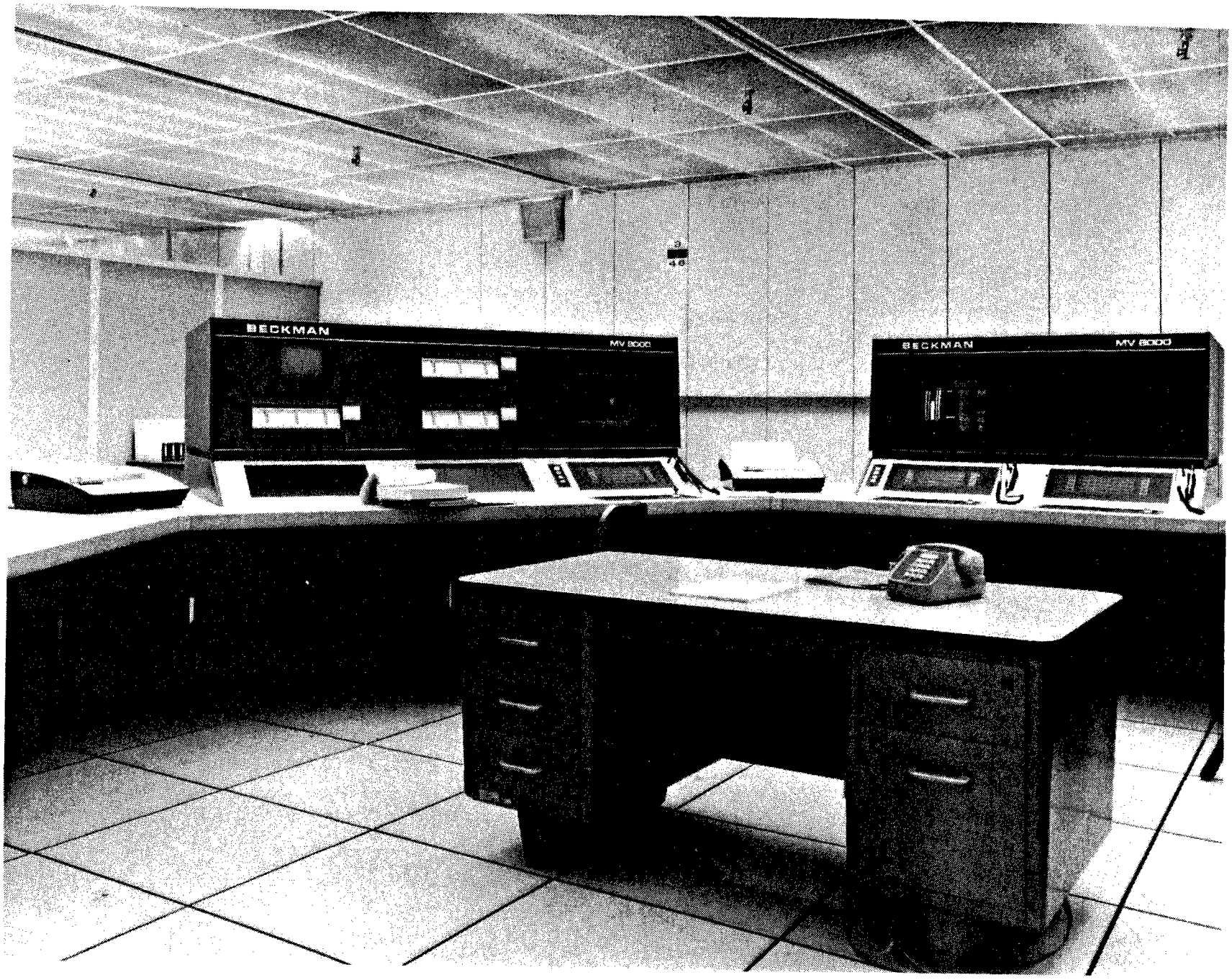


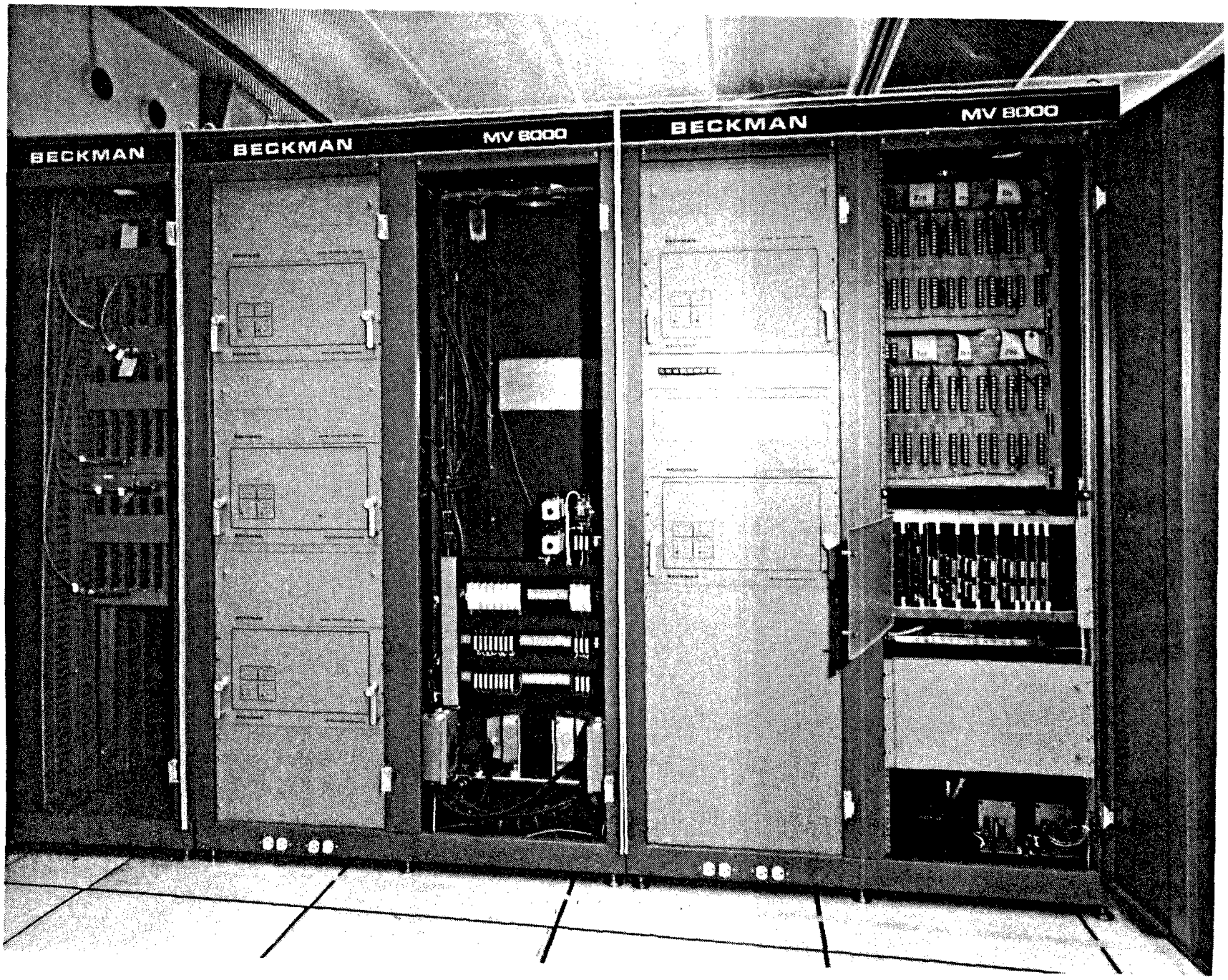
MV8000 SOLAR CONSOLE ASSEMBLY








BECKMAN
MV 8000
BECKMAN
MV 8000


BECKMAN
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MV 8000
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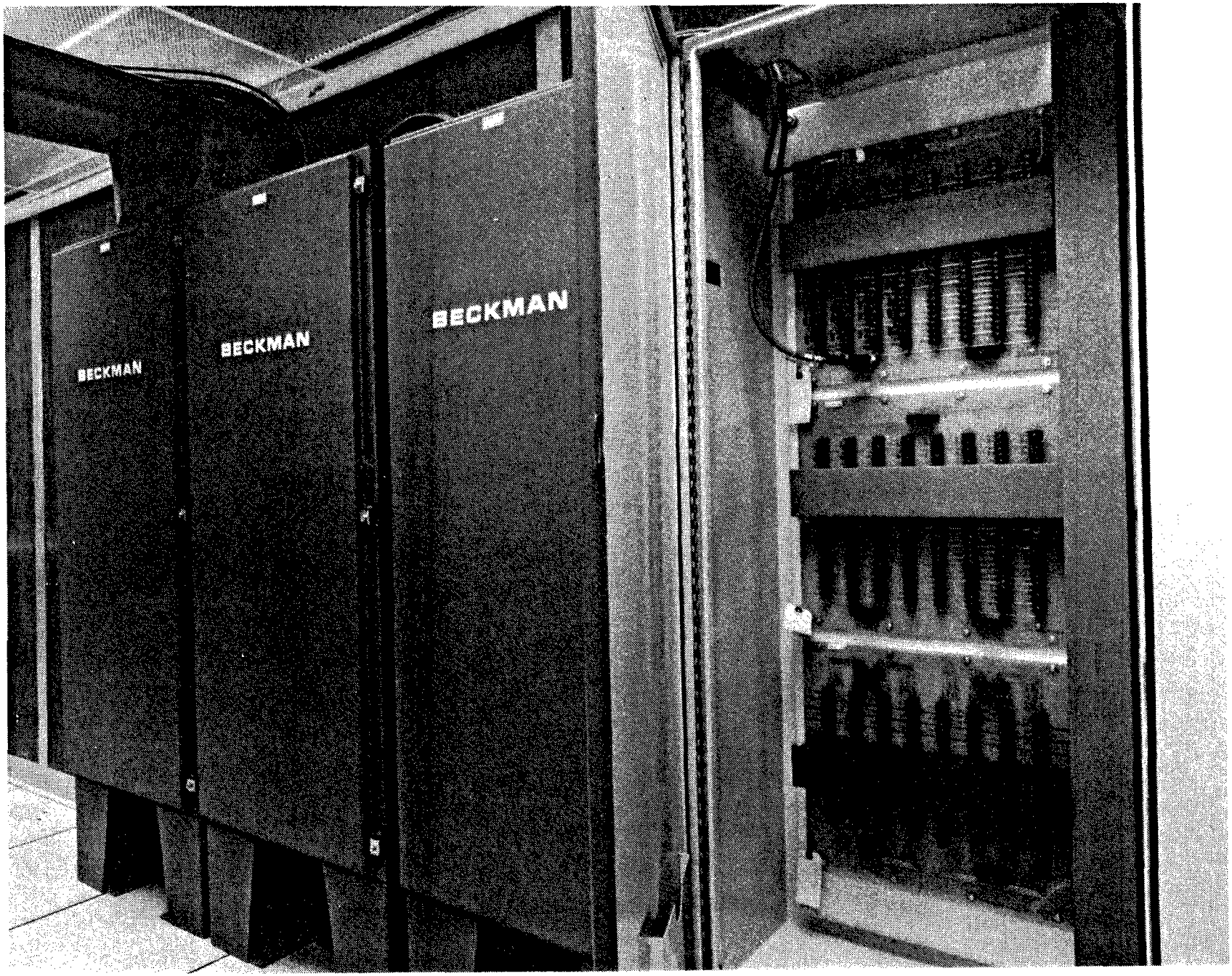
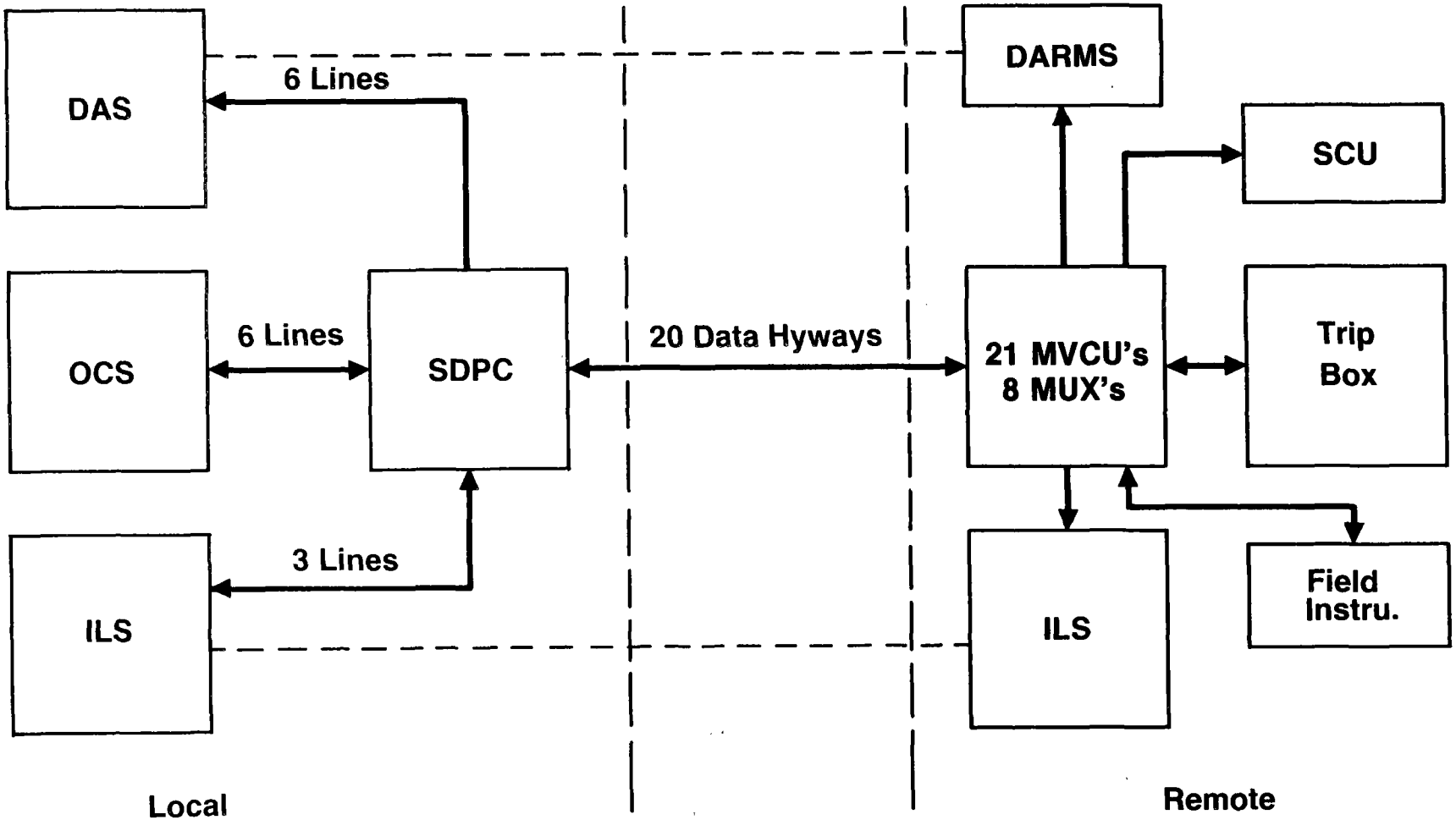
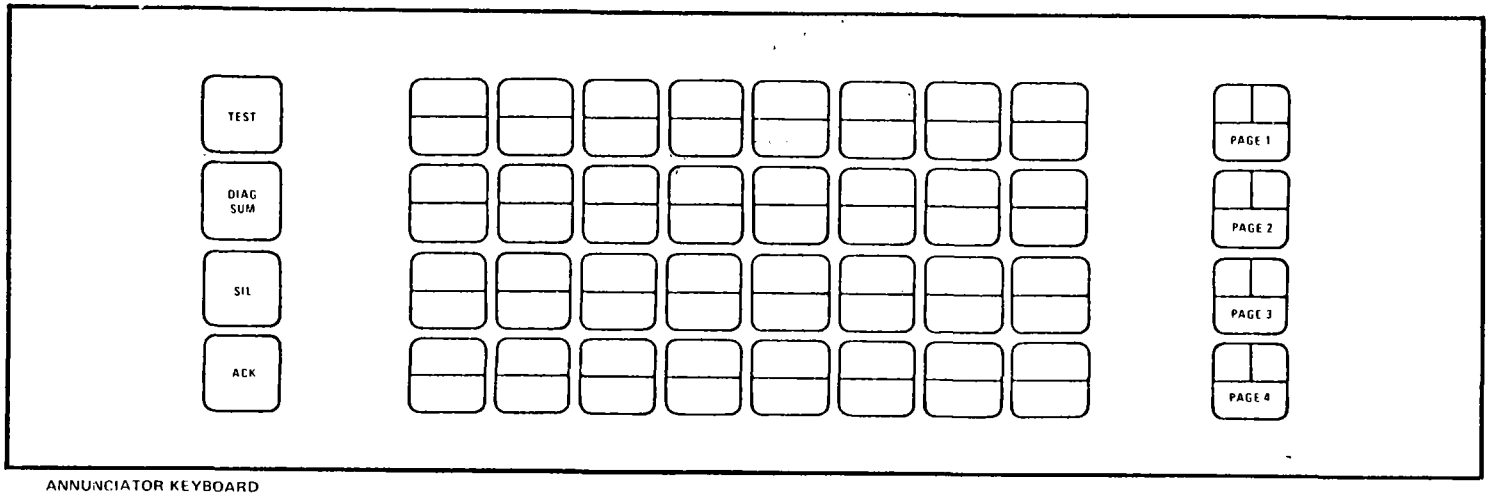
MV 8000

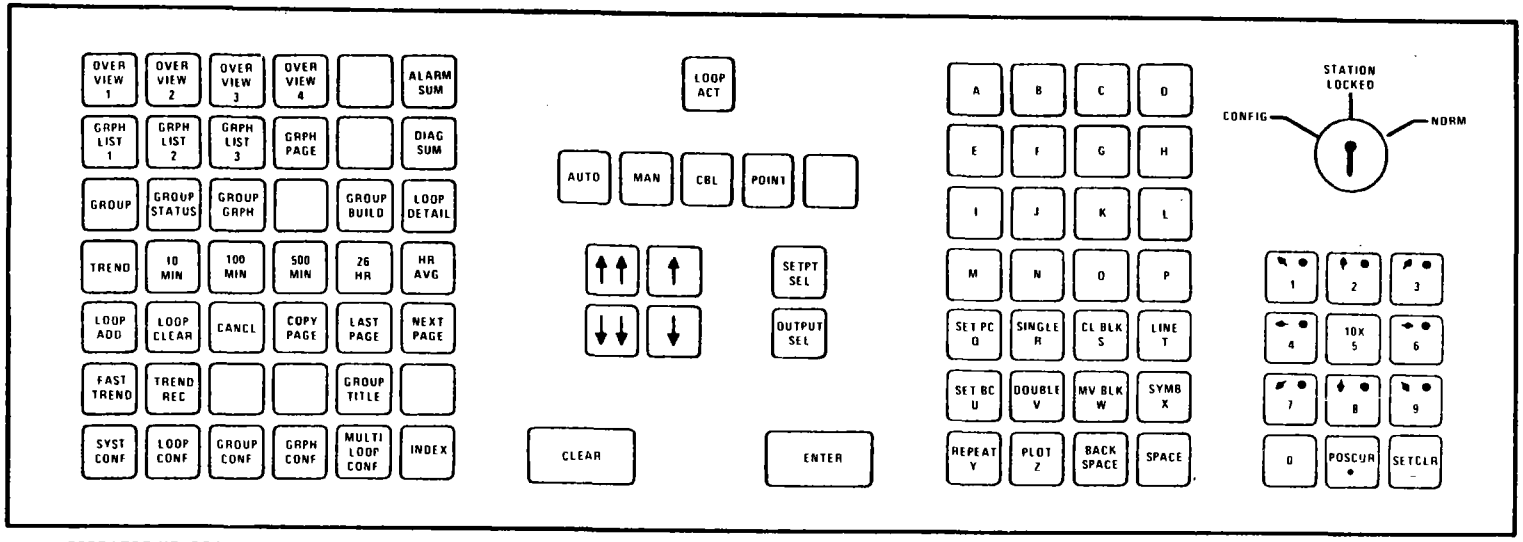

BECKMAN
BECKMAN
BECKMAN

INTERFACES

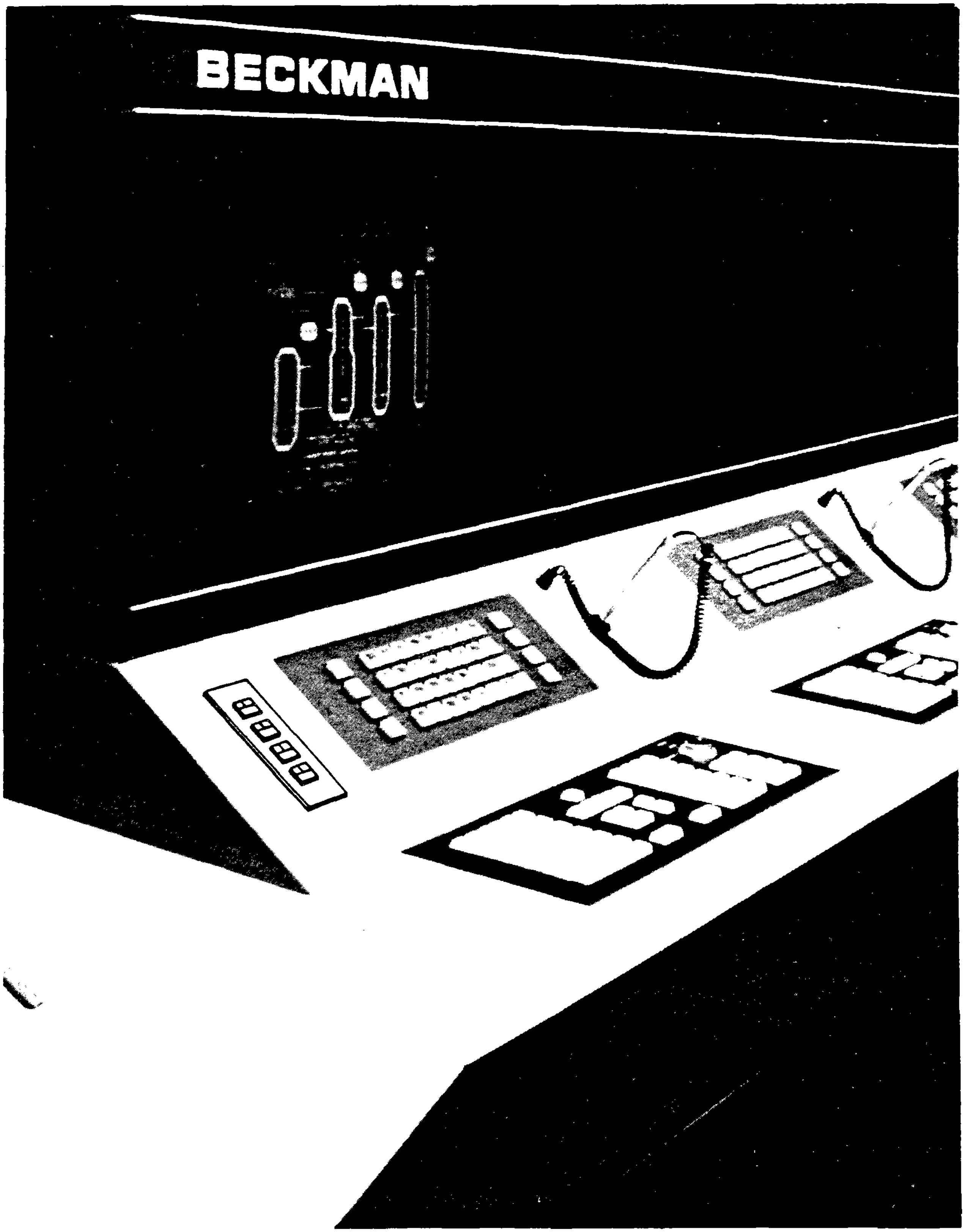

DAS
6 Lines
DARMS
SCU
OCS
6 Lines
SDPC
20 Data Hyways
21 MVCU's
8 MUX's
Trip
Box
3 Lines
ILS
ILS
Field
Instru.
Local
Remote

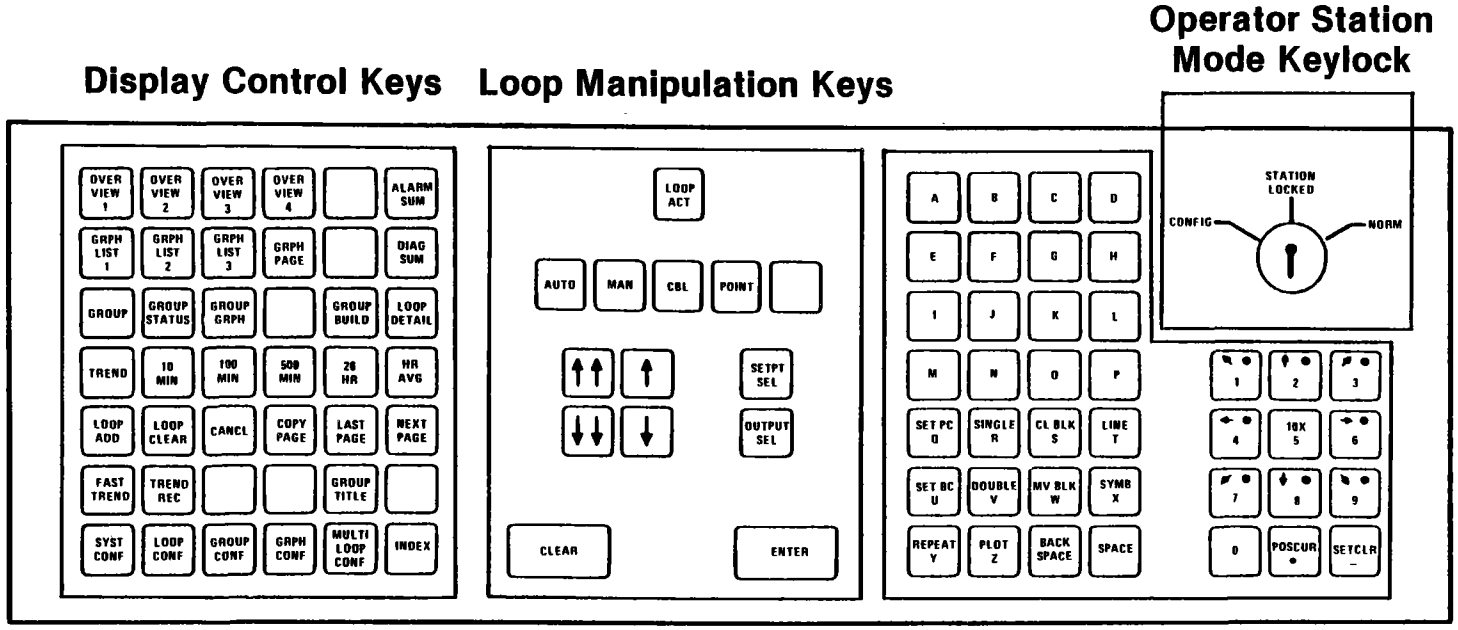


ANNUNCIATOR KEYBOARD



OPERATOR KEYBOARD


BECKMAN


Display Control Keys
Loop Manipulation Keys
Operator Station Mode Keylock
OVER VIEW 1
OVER VIEW 2
OVER VIEW 3
OVER VIEW 4
ALARM SUM
GRPH LIST 1
GRPH LIST 2
GRPH LIST 3
GRPH PAGE
DIAG SUM
GROUP
GROUP STATUS
GROUP GRPH
GROUP BUILD
LOOP DETAIL
TREND
10 MIN
100 MIN
500 MIN
2H HR
HR AVG
LOOP ADD
LOOP CLEAR
CANCL
COPY PAGE
LAST PAGE
NEXT PAGE
FAST TREND
TREND REC
GROUP TITLE
SYST CONF
LOOP CONF
GROUP CONF
GRPH CONF
MULTI LOOP CONF
INDEX
LOOP ACT
AUTO
MAN
CBL
POINT
SETPT SEL
OUTPUT SEL
CLEAR
ENTER
A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P
SET PC Q
SINGLE R
CL BLK S
LINE T
SET BC U
DOUBLE V
MV BLK W
SYMB X
REPEAT Y
PLOT Z
BACK SPACE
SPACE
1
2
3
4
10X 5
6
7
8
9
0
POSCUR .
SETCLR -
STATION LOCKED
CONFIG
NORM
Configuration Keys
Input Control Keys
Alphanumeric and Graphics Configuration Keys

VFI987N

CONFIGURATION PROCESS

1. Communications Control Module Data Base Configuration

   - Defines Loop and Group Information In Memory

2. Multi-loop Device Configuration

   - Defines Inputs, Outputs, and Control Functions Performed by the Device (i.e., MVCU, MUX, PLC)

3. System Configuration

   - Defines Manipulation of the Floppy Disks

4. Graphics Configuration

   - Builds the Graphic Displays and Enters Them into the System

DATA BASE CONFIGURATION

VFI988N

- Complete Loop Configuration Forms L1 — L6
- Complete Group Configuration Form G
- Enter Loop Configuration Data Via Operator Keyboard
- Enter Group Configuration Data Via Operator Keyboard

LOOP CONFIGURATION FORMS

Six Different Forms are Used for Loop Configuration. Only One of the Forms is to be Used for a Particular Loop. The Form to be Used is Dependent on the Type of Loop to be Displayed as Follows:

Form L1	**PID, Ratio Station, Auto/Manual Station, Manual Loader, (Internal MVCU Algorithm)**
Form L2	**Integrator/Totalizer (Internal MVCU Algorithm)**
Form L3	**Monitored Analog Input, Monitored or Controlled Analog Node, Monitored or Controlled Analog Output (Internal to MVCU, MVIO, IPAC, or 6750)**
Form L4	**Monitored or Controlled Digital Node, Monitored or Controlled Digital Output, Monitored Digital Input. (Internal to MVCU, MVIO, IPAC, or 5TI)**
Form L5	**8800 Controller**
Form L6	**MLD Status (MVCU, MVIO, IPAC, or 5TI)**

LOOP CONFIGURATION

- Key in Config. Position
- Depress Loop Conf. Key

  (Prompt) Enter Loop Tag
- Type in Tag No. and Push Enter

If Previously Configured

- Menu Appears
- Complete Menu
- Enter, Update, Delete, Clear

If Not Previously Configured

(Prompt) Enter Device Type

- Menu
- Complete Menu
- Enter Update Complete Clear

L1 - LOOP CONFIGURATION

PID, Ratio Station, A/M Station, Manual Loader

Tag L C 2 4 A
Device Type M V C U
Subtype P (P, R, A, M)
Description Line 1
Description Line 2 2 P H L V C
Highway Number (1-32)
Device Address 1 (1-4)
Internal Address 0 1 (1-40)
Highway Type T (S, T, W)
Scan Priority 1 (0, 1, 4, 8)
Cascaded? N (PID only) (Y or N)
Host Control Allowed? Y (Y or N)
Engineering Units I N C H (ex: SCFM)
0% Calibration 0 . 0 (ex. 49.63)
100% Calibration 3 0 . 0 (ex. 2.945)
PV Scale L (L or S)
Low Setpoint Limit 1 0 . 0 (ex. 1250.)
High Setpoint Limit 2 0 . 0 (ex. 125.6)
Alarm Type P (P, D, R, N)
H/H Alarm Limit 2 5 . 0
H Alarm Limit 2 0 . 0
L Alarm Limit 1 0 . 0
L/L Alarm Limit 5 . 0
Output Direction D (D or R)
Low Output Limit 0 0 (00 to 99)
High Output Limit 9 9 (00 to 99)

GROUP CONFIGURATION

Group Number: 004 (1-128)
Group Title Line 1:
Group Title Line 2: FLO
Graphics Page Number (1-99) optional

Loop Slot 1
FI2303

Loop Slot 2
FI2401

Loop Slot 3
FI2402

Loop Slot 4
FI2403

Loop Slot 5
FI2501

Loop Slot 6
FI2502

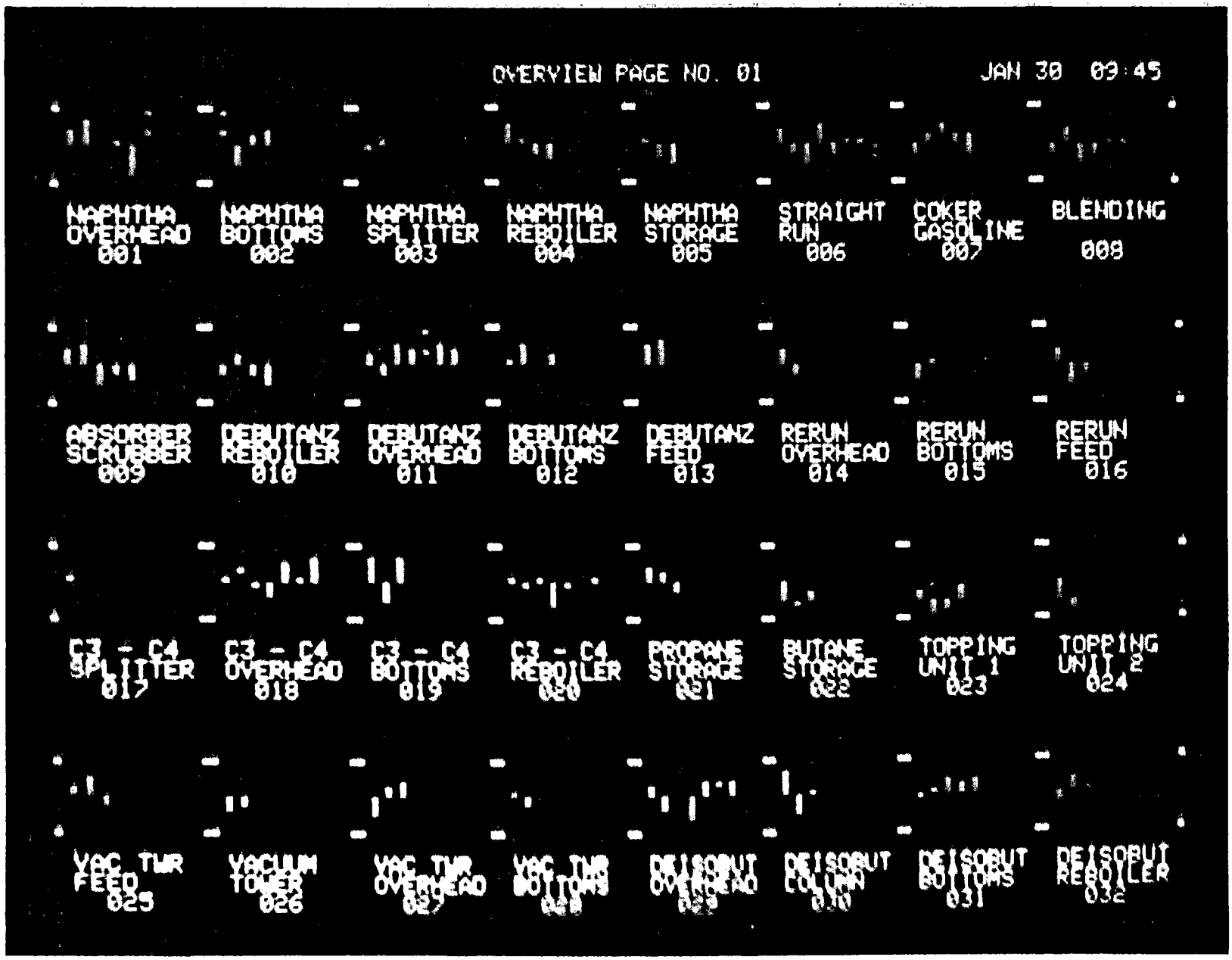
Loop Slot 7
FI2503

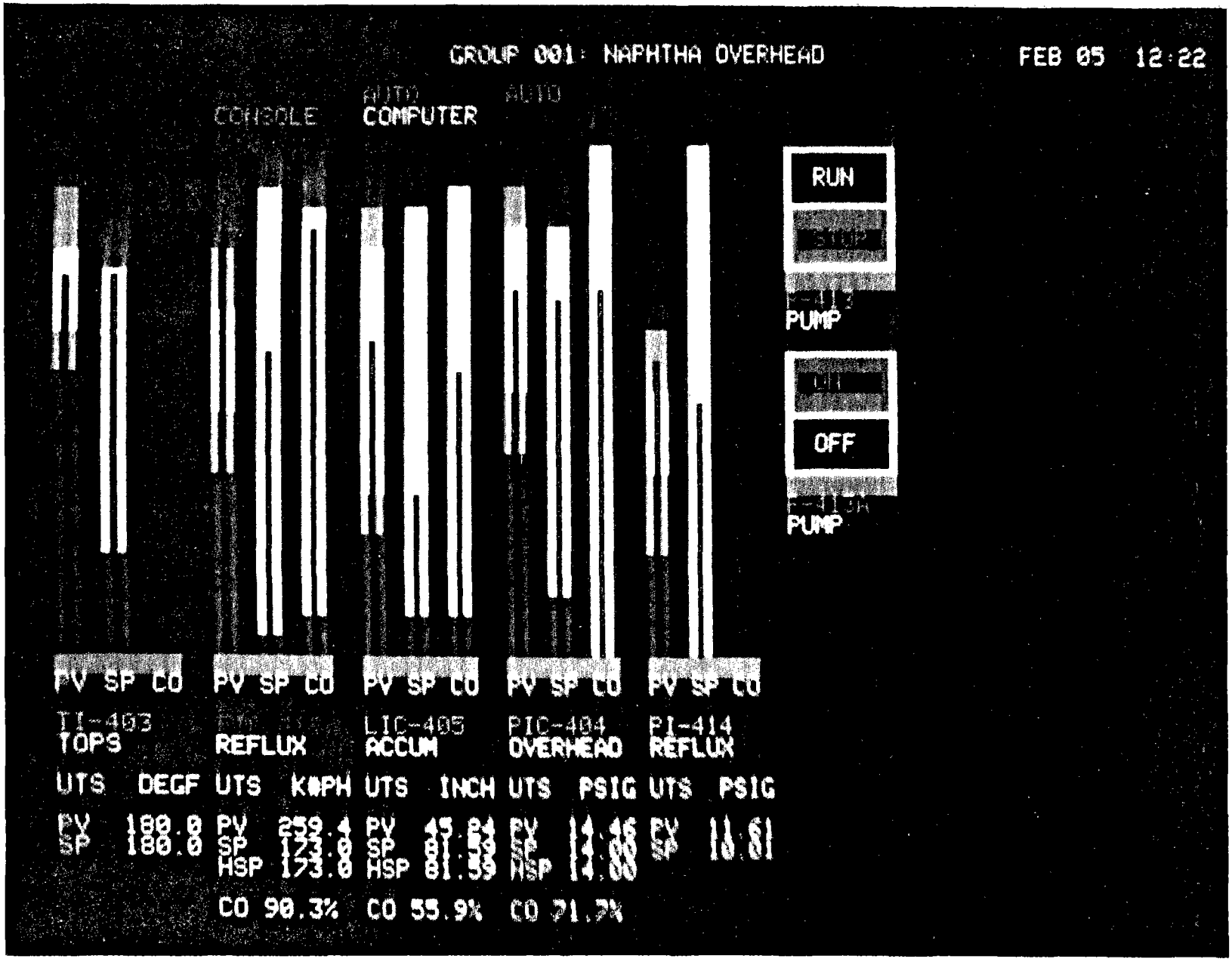
Loop Slot 8
FI2601

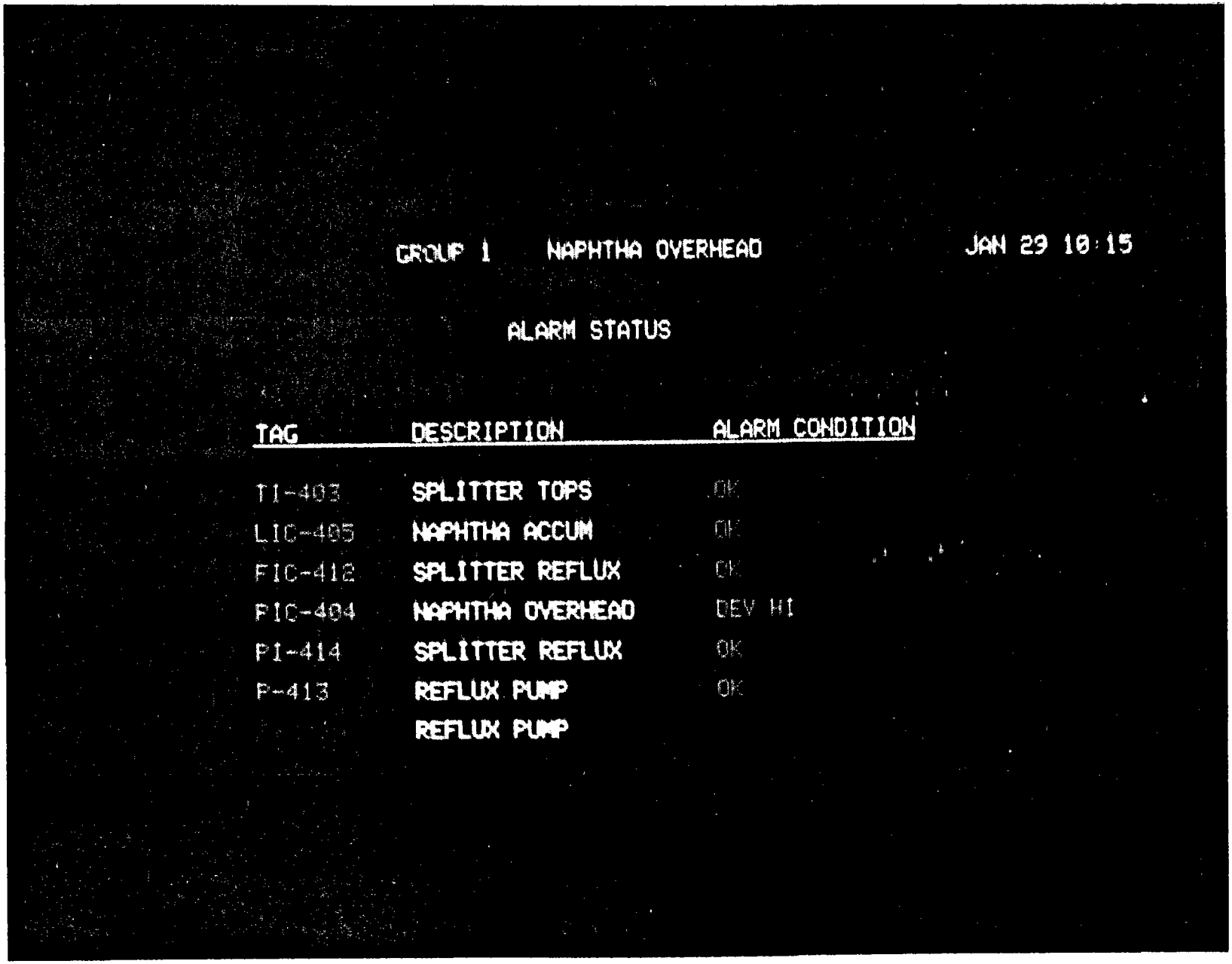
FOUR CLASSIFICATIONS OF DISPLAYS

VFJ188N

1. Operations Displays
   - Overview
   - Group
   - Group Status
   - Group Build
   - Loop Detail
   - Plant Graphics
   - Trend
   - Hourly Average
   - Alarm Summary
   - Diagnostic Summary
2. System Assignment Displays
   - Group Title
   - Graphics List
   - Trend Recorder List
   - Fast Trend List
3. Configuration Displays
   - System
   - Loop
   - Group
   - Multiloop
   - Graphics
4. Host Computer Utility Display
   - Allows the Operator Station to Be Used as an Addressable General Purpose Computer Input/Output Display Medium


OVERVIEW PAGE NO. 01
JAN 30 09:45
NAPHTHA OVERHEAD 001
NAPHTHA BOTTOMS 002
NAPHTHA SPLITTER 003
NAPHTHA REBOILER 004
NAPHTHA STORAGE 005
STRAIGHT RUN 006
COKER GASOLINE 007
BLENDING 008
ABSORBER SCRUBBER 009
DEBUTANZ REBOILER 010
DEBUTANZ OVERHEAD 011
DEBUTANZ BOTTOMS 012
DEBUTANZ FEED 013
RERUN OVERHEAD 014
RERUN BOTTOMS 015
RERUN FEED 016
C3 - C4 SPLITTER 017
C3 - C4 OVERHEAD 018
C3 - C4 BOTTOMS 019
C3 - C4 REBOILER 020
PROPANE STORAGE 021
BUTANE STORAGE 022
TOPPING UNIT 1 023
TOPPING UNIT 2 024
VAC TWR FEED 025
VACUUM TOWER 026
VAC TWR OVERHEAD 027
VAC TWR BOTTOMS 028
DEISOBUT OVERHEAD 029
DEISOBUT COLUMN 030
DEISOBUT BOTTOMS 031
DEISOBUT REBOILER 032


GROUP 001: NAPHTHA OVERHEAD
FEB 05 12:22
CONSOLE
AUTO
COMPUTER
AUTO
RUN
STOP
PUMP
OFF
PUMP
PV SP CO
PV SP CO
PV SP CO
PV SP CO
PV SP CO
TI-403
TOPS
REFLUX
LIC-405
ACCUM
PIC-404
OVERHEAD
PI-414
REFLUX
UTS DEGF
UTS K*PH
UTS INCH
UTS PSIG
UTS PSIG
PV 180.0
SP 180.0
PV 259.4
SP 123.0
HSP 173.0
PV 45.84
SP 81.59
HSP 81.59
PV 14.46
SP 14.00
HSP 14.00
PV 10.61
SP 10.61
CO 90.3%
CO 55.9%
CO 71.7%


GROUP 1 NAPHTHA OVERHEAD
JAN 29 10:15
ALARM STATUS
TAG
DESCRIPTION
ALARM CONDITION
TI-403
SPLITTER TOPS
OK
LIC-405
NAPHTHA ACCUM
OK
FIC-412
SPLITTER REFLUX
OK
PIC-404
NAPHTHA OVERHEAD
DEV HI
PI-414
SPLITTER REFLUX
OK
P-413
REFLUX PUMP
OK
REFLUX PUMP

SAN/0499-79
MDC G9362

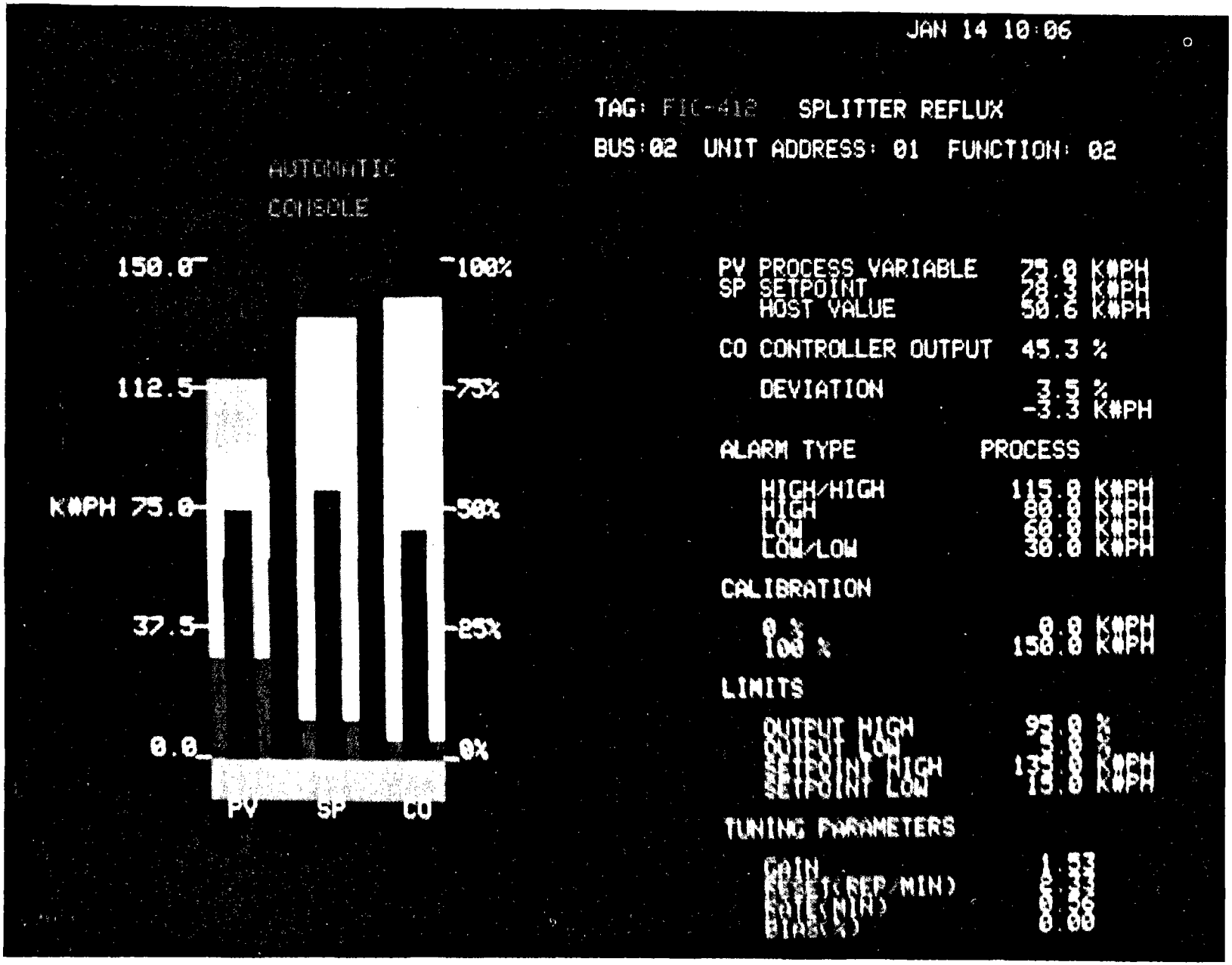
10 MWe Solar Thermal
Central Receiver Pilot Plant
Solar Facilities Design Integration

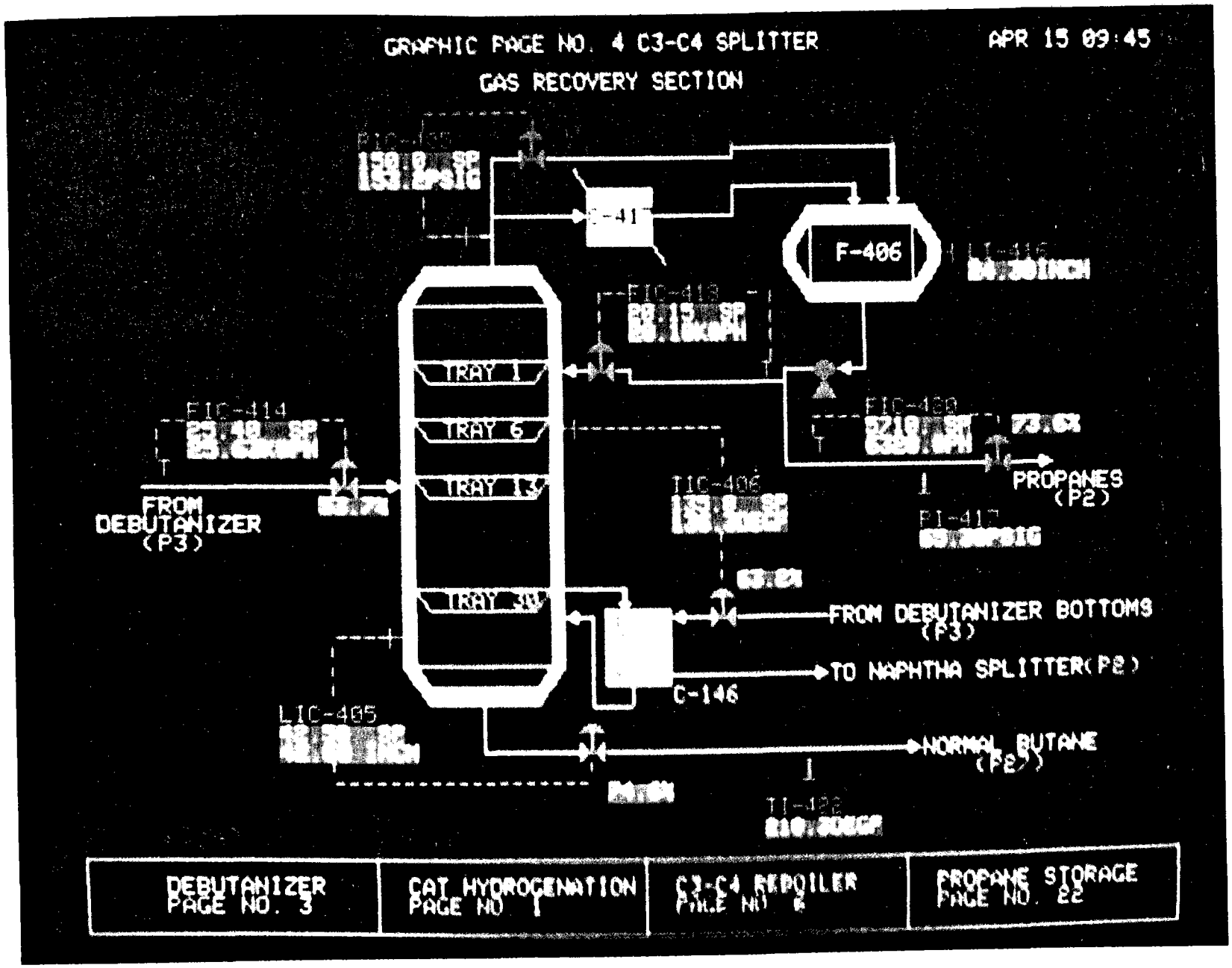
SOLAR ONE PLANT CONTROL SEMINAR

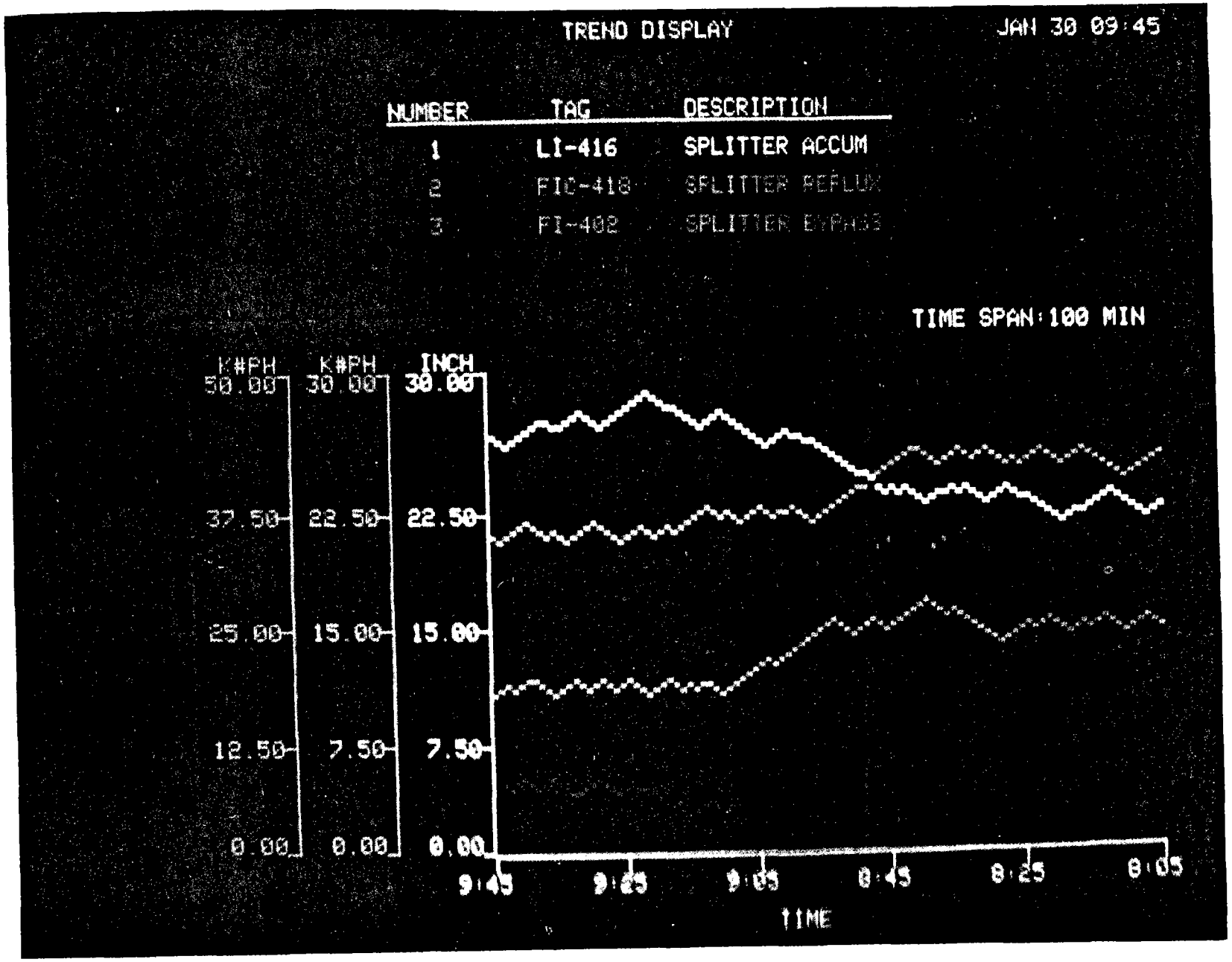
25-26 February 1981

MCDONNELL DOUGLAS ASTRONAUTICS COMPANY
5301 BOLSA AVENUE
HUNTINGTON BEACH, CA 92647

PREPARED FOR THE
U.S. DEPARTMENT OF ENERGY
SOLAR ENERGY
UNDER CONTRACT DE-AC-03-79SF10499


JAN 14 10:06
TAG: FIC-412 SPLITTER REFLUX
BUS:02 UNIT ADDRESS: 01 FUNCTION: 02
AUTOMATIC
CONSOLE
150.0
112.5
K*PH 75.0
37.5
0.0
100%
75%
50%
25%
0%
PV
SP
CO
PV PROCESS VARIABLE 75.0 K*PH
SP SETPOINT 70.3 K*PH
HOST VALUE 50.6 K*PH
CO CONTROLLER OUTPUT 45.3 %
DEVIATION 3.5 %
-3.3 K*PH
ALARM TYPE PROCESS
HIGH/HIGH 115.0 K*PH
HIGH 80.0 K*PH
LOW 60.0 K*PH
LOW/LOW 30.0 K*PH
CALIBRATION
0 % 0.0 K*PH
100 % 150.0 K*PH
LIMITS
OUTPUT HIGH 95.0 %
OUTPUT LOW 5.0 %
SETPOINT HIGH 130.0 K*PH
SETPOINT LOW 15.0 K*PH
TUNING PARAMETERS
GAIN 1.33
RESET(REP/MIN) 0.33
RATE(MIN) 0.00
BIAS(%) 0.00


GRAPHIC PAGE NO. 4 C3-C4 SPLITTER
APR 15 09:45
GAS RECOVERY SECTION
F-406
TRAY 1
TRAY 6
FIC-414
FROM
DEBUTANIZER
(P3)
TIC-406
PROPANES
(P2)
FROM DEBUTANIZER BOTTOMS
(P3)
TO NAPHTHA SPLITTER(P2)
C-146
LIC-405
NORMAL BUTANE
(P2)
DEBUTANIZER
PAGE NO. 3
CAT HYDROGENATION
PAGE NO. 1
PROPANE STORAGE
PAGE NO. 22

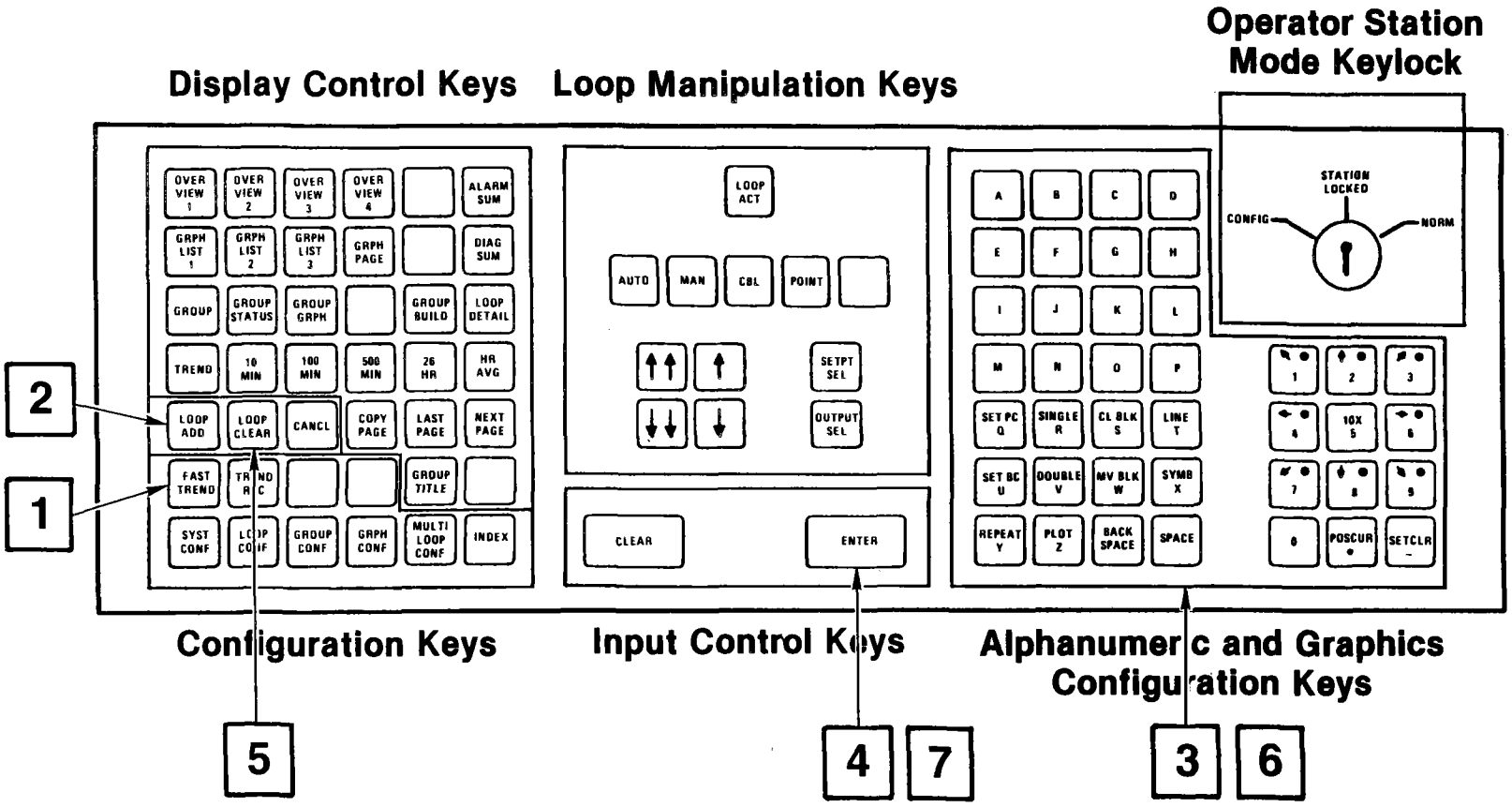

TREND DISPLAY
JAN 30 09:45
NUMBER
TAG
DESCRIPTION
1
LI-416
SPLITTER ACCUM
2
FIC-418
SPLITTER REFLUX
3
FI-402
SPLITTER BYPASS
TIME SPAN:100 MIN
K#PH
50.00
37.50
25.00
12.50
0.00
K#PH
30.00
22.50
15.00
7.50
0.00
INCH
30.00
22.50
15.00
7.50
0.00
9:45
9:25
9:05
8:45
8:25
8:05
TIME

JAN 30 11:45

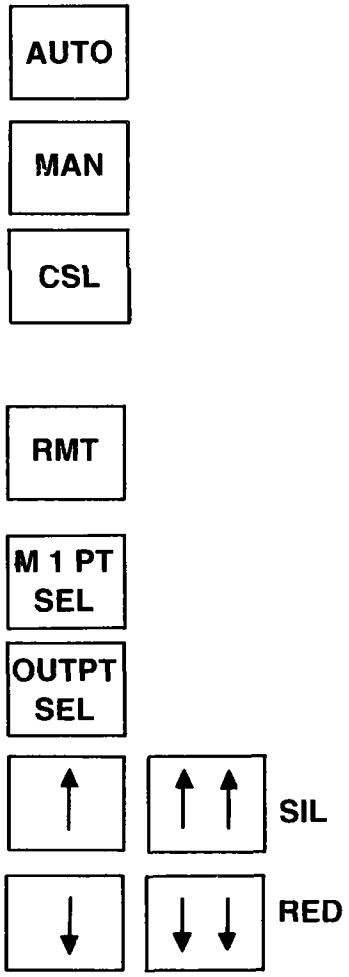
HOURLY AVERAGE

	TI-417 TOPS DEGF	LI-404 ACCUM INCH	FIC-413 REFLUX BPH	PIC-403 ACCUM PSIG	LIC-403 BTM LVL INCH	TI-419 BTM TEMP DEGF	TIC-404 BTM TEMP DEGF	TI-427 BTM TEMP DEGF
11:00	185.0	50.0	500.0	150.1	170.2	450.8	370.6	500.4
10:00	190.1	52.11	485.6	155.6	164.3	443.7	372.4	490.3
9:00	187.3	48.24	490.9	145.6	175.8	455.6	378.9	508.9
8:00	191.3	49.92	505.8	148.9	168.2	462.3	371.3	498.4
7:00	181.7	48.23	501.9	155.8	178.4	444.3	383.4	515.6
6:00	190.1	51.46	489.8	146.7	164.3	461.4	379.2	503.6
5:00	183.6	52.31	515.6	150.9	172.1	452.7	368.3	495.3
4:00	187.4	50.67	501.3	154.3	168.4	455.6	365.4	508.1
3:00	184.3	49.39	493.1	152.1	170.1	451.3	373.6	502.3
2:00	191.4	51.44	512.3	148.9	169.3	454.2	369.3	513.2
1:00	181.6	47.88	498.5	157.6	173.9	455.6	371.4	493.4
24:00	180.9	50.69	497.7	155.6	171.8	451.4	370.2	521.5
23:00	184.3	49.48	508.7	146.3	167.9	458.9	364.9	495.9
22:00	179.6	50.32	[illegible]	151.9	173.6	442.8	372.8	503.6
21:00	180.5	52.43	[illegible]	156.1	171.8	455.8	367.3	508.9
20:00	182.3	51.61	506.9	143.8	174.9	442.9	374.9	502.3
19:00	184.9	52.43	501.3	147.1	167.9	449.9	368.7	480.1
18:00	180.8	50.33	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	498.8
17:00	187.1	51.34	492.9	[illegible]	[illegible]	[illegible]	371.8	[illegible]
16:00	179.9	49.37	502.1	152.9	163.8	448.3	372.3	489.9
15:00	189.9	51.39	496.3	147.8	171.8	452.7	373.8	502.8
14:00	190.1	51.46	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13:00	191.5	48.24	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12:00	191.4	52.11	514.4	[illegible]	168.1	455.6	365.4	508.1

FAST TREND ASSIGNMENTS



LOOP MANIPULATION KEYS



This Key Places a Loop Type Into the Automatic Mode of Operation.

This Key Places a Loop Type into the Manual Mode of Operation.

This is Used for Placing Loops in the Console Mode of Operation. In Console Mode, Loops May Be Manipulated at an MV8000 Operator Station.

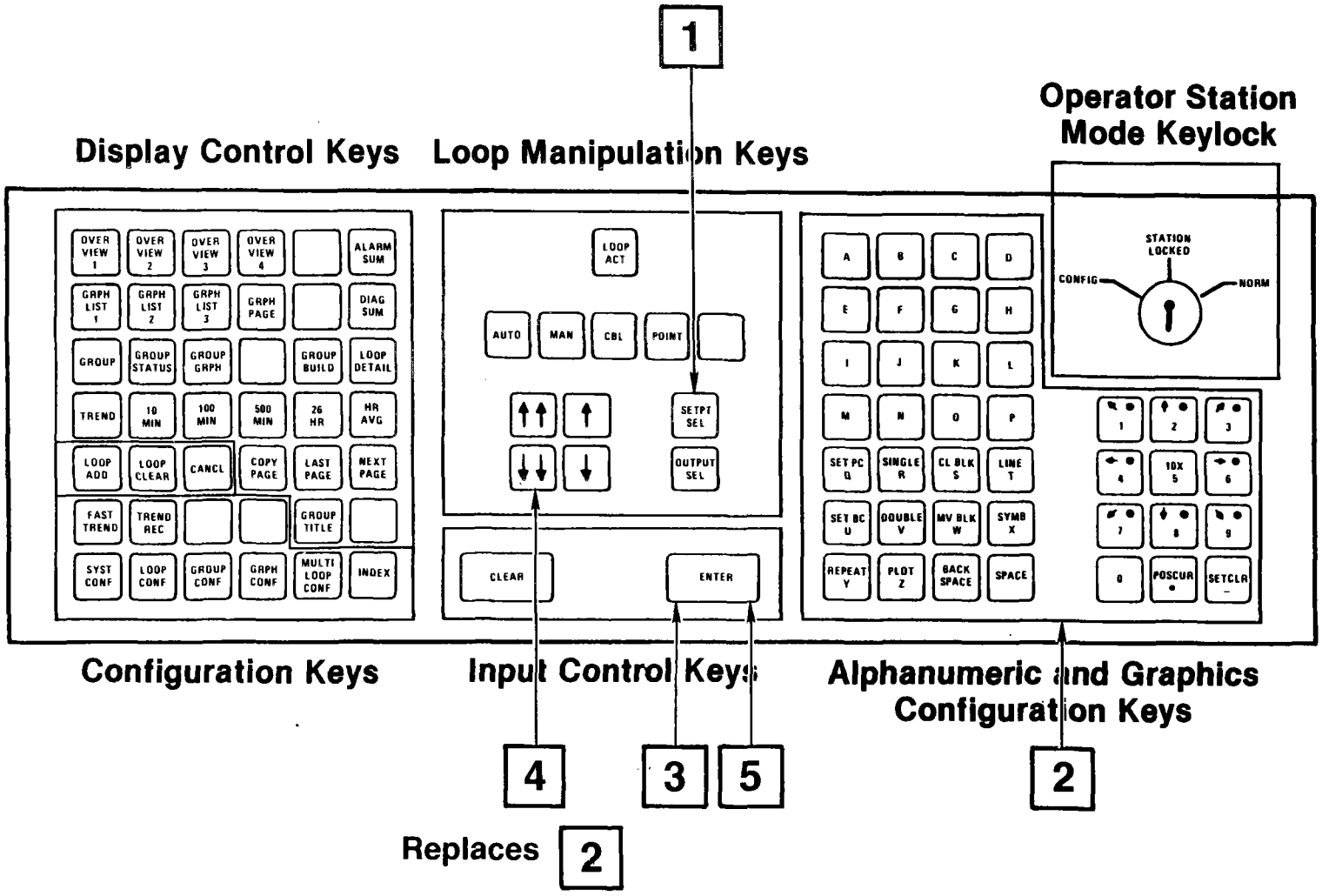
This Key is Used for Placing Loops in Preconfigured Modes of Remote Operation. Through Configuration, This Key is Identified to Represent Either Computer or Cascade Modes of Operation for Each Loop.

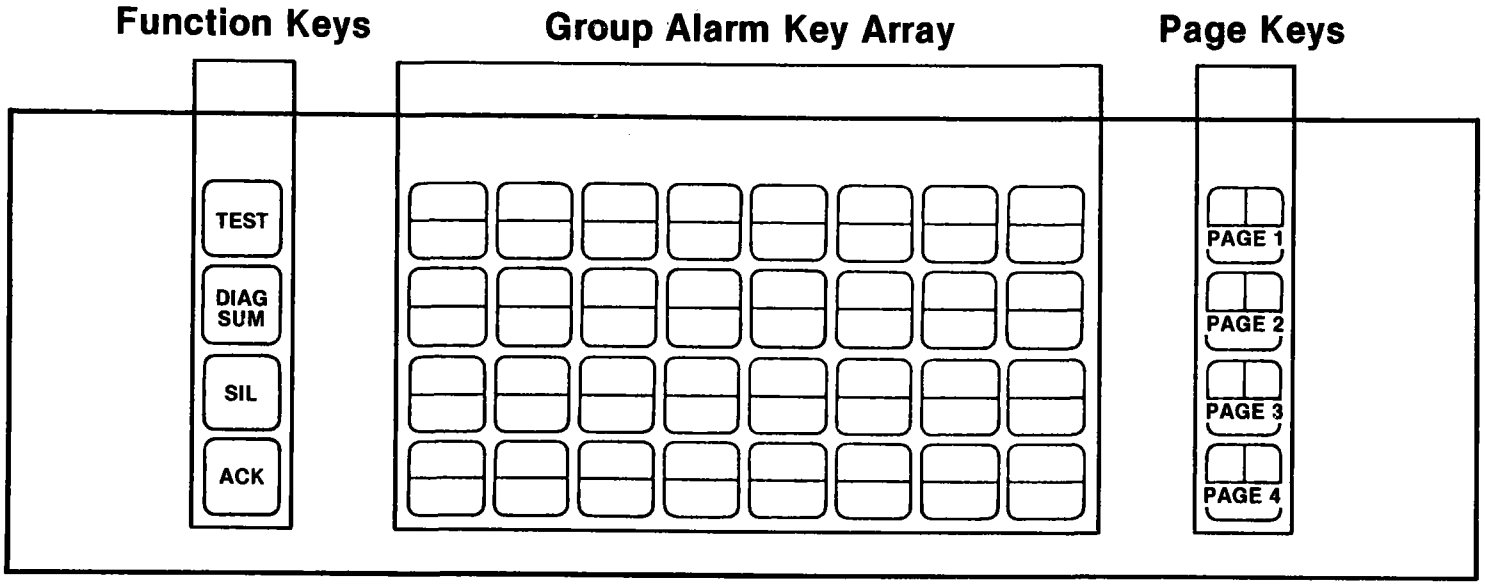
This Key is Used for Initiating Loop Setpoint Changes.

This Key is Used for Initiating Loop Output Selections.

These Keys are Used for Digital Loop State Changes and Analog Loop Setpoint and Output Ramping. When Used for Ramping Purposes, the Single Arrow Keys Ramp the Present Value at 1% Per Second in the Direction Indicated, and the Double Arrow Keys are Used to Ramp the Present Value at 10% Per Second.

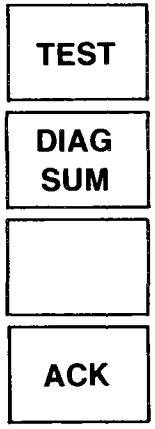
SETPOINT MANIPULATION




Function Keys
Group Alarm Key Array
Page Keys
TEST
DIAG SUM
SIL
ACK
PAGE 1
PAGE 2
PAGE 3
PAGE 4

ALARM KEYBOARD KEYS

Function Keys



The Test Key Illuminates Each Light and Sounds the Horn

The Diag Sum Key Calls Up the Diagnostic Summary Display

The Silence Key is Used to Silence the Console Based Horn.

The Acknowledge Key is Used for the Positive Acknowledgement of Console Based Alarming and System Diagnostics.

Group Alarm Keys

The Group Alarm Key Calls Up the Group Alarm Status Display for the Group Represented

Page Keys

The Page Key Provides Dedicated Alarm Status of the 32 Groups on That Page

VFI936N

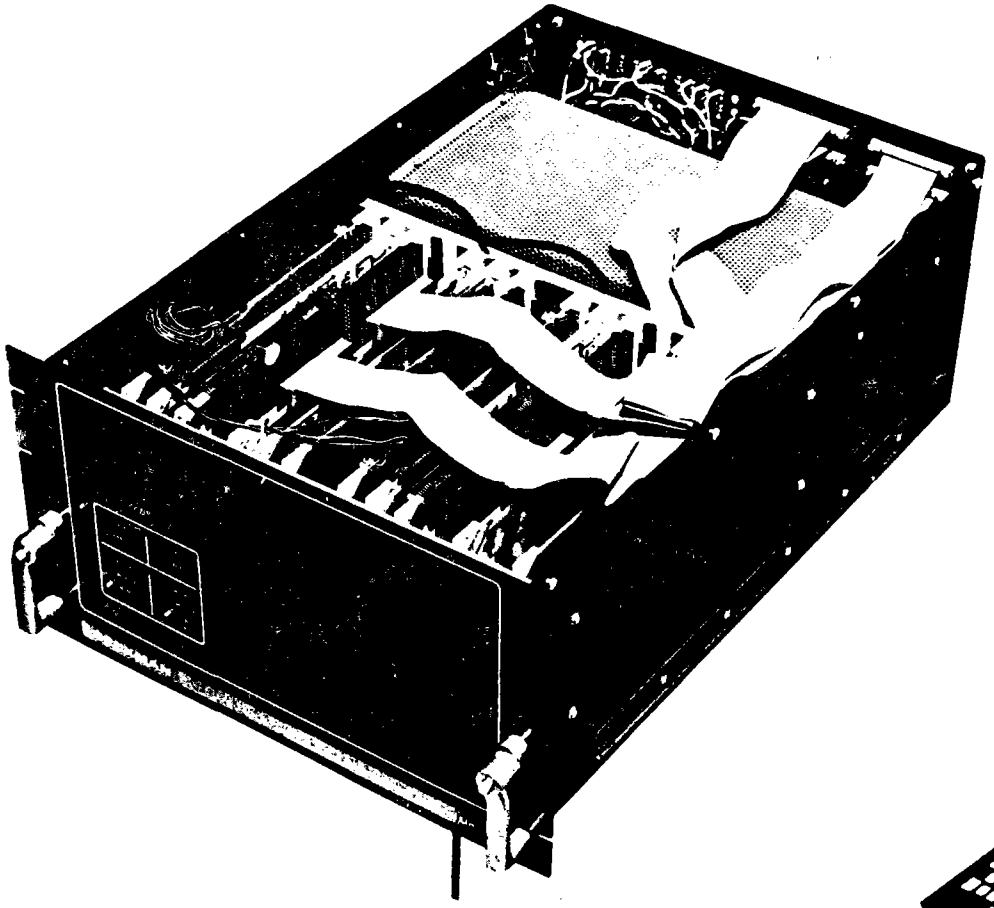
INTERFACE LOGIC SYSTEM (ILS)

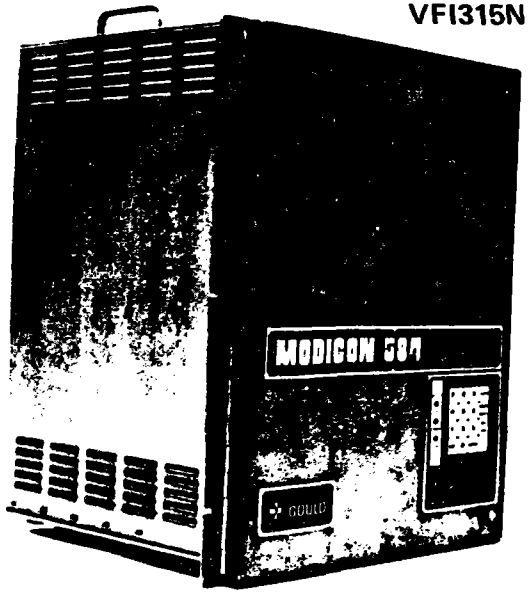
The ILS is the Hardware and Software That Contains the Logic Which Provide the Interlockes, Permissives and Sequencing Which Must Be Satisfied Before Starting Motors, Moving Selected Valves, Starting the Turbine or Other Pieces of Equipment.

(NOTE: Trip Logic/Hardware is Completely Separate From ILS Logic/Hardware — Trip Functions are Hardwired to a Particular Piece of Equipment for Safety in the Event of a Malfunction).

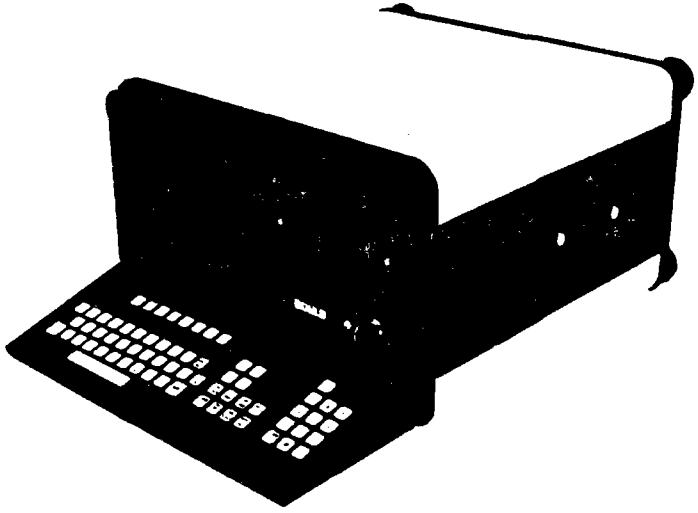
VFI315N

Multi Variable Control Unit





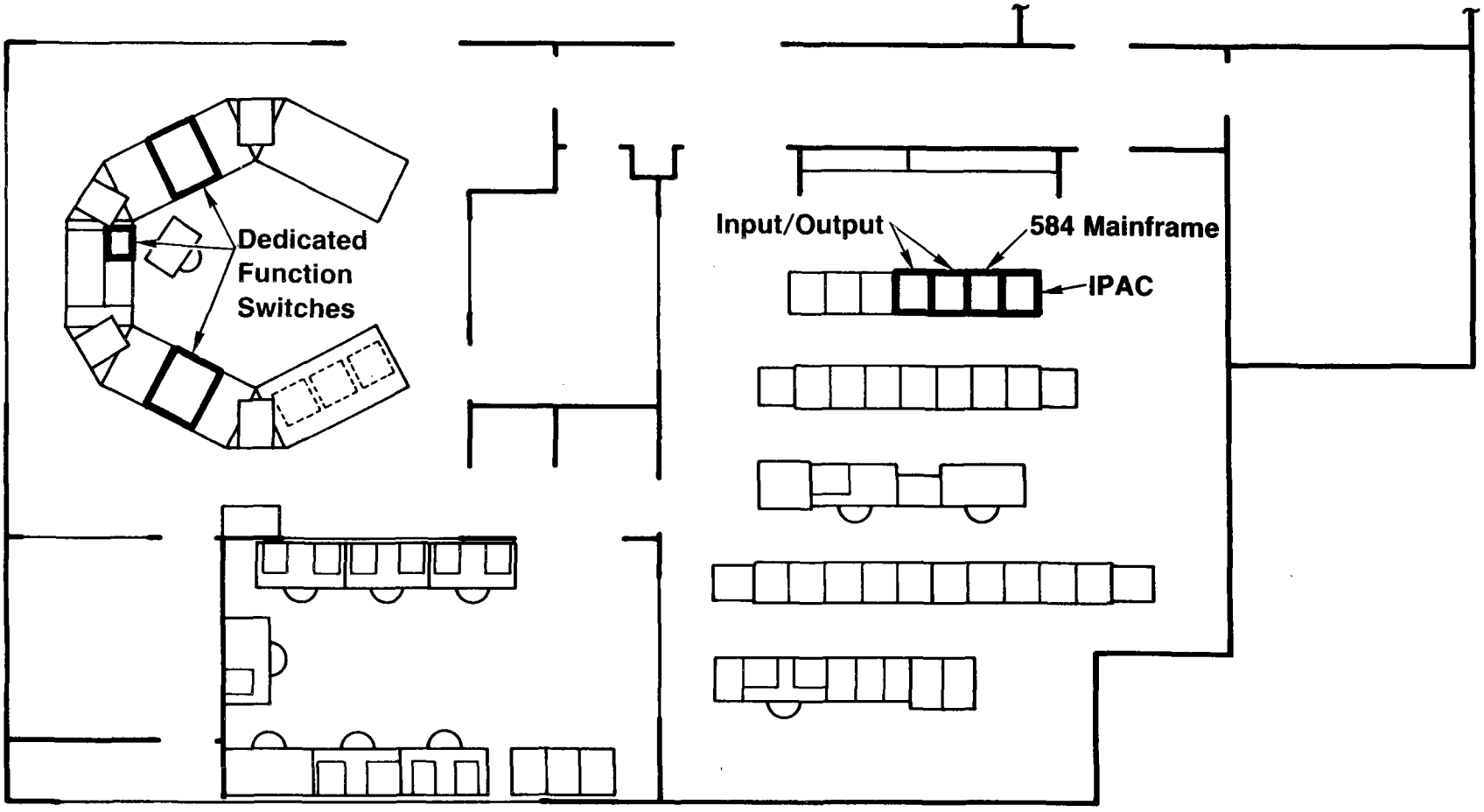
584 Controller



P190 Programmer

CONTROL BUILDING — SECOND FLOOR

ILS



ILS HARDWARE CAPABILITIES

Modicon 584 Controller (2)

- 32K Memory
- 2048 Discrete Inputs*
- 2048 Discrete Outputs
- Programmable
- Perform Arithmetic Functions, Compares, Timers, Counters, Etc.
- 24V DC Inputs and Outputs, 120V AC Outputs, 140 V DC Outputs (Isolated Circuits)
- Has Key Lock For Memory Protect

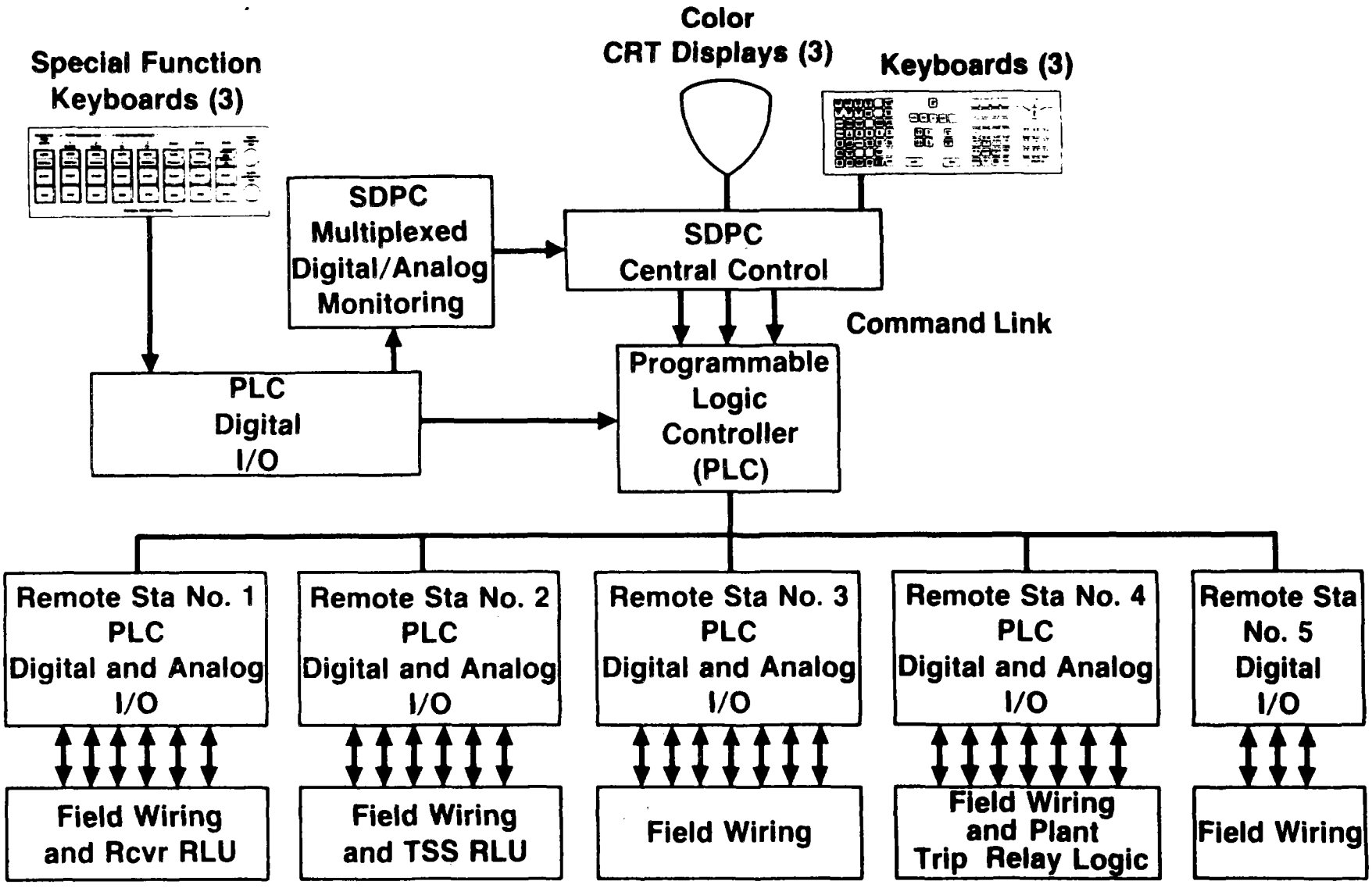
P190 Programmer

- Provides Online Programming of the 584 Using Relay Ladder Diagrams
- Allows Checkout of the Logic
- Allows Modification of Existing Ladder Diagrams
- Records Program on Tape

*1 Analog Module (16 Analog Inputs) Uses up 64 Discrete Inputs

INTERLOCK LOGIC SYSTEM (ILS) ARCHITECTURE

VFI788N



ILS I/O

Control Console Dedicated Pushbuttons

144 Discrete Inputs
448 Discrete Outputs

RS1

16 — Analog Inputs
32 — 24V DC Inputs
32 — 24V DC Outputs

RS2

16 Analog Inputs
64 — 24 V DC Inputs
48 — 24V DC Outputs
24 — 120V AC Outputs
8 — 140V DC Outputs

RS3

16 Analog Inputs
48 — 24V DC Inputs
32 — 24V DC Outputs
8 — 120V AC Outputs
8 — 140V DC Outputs

RS4

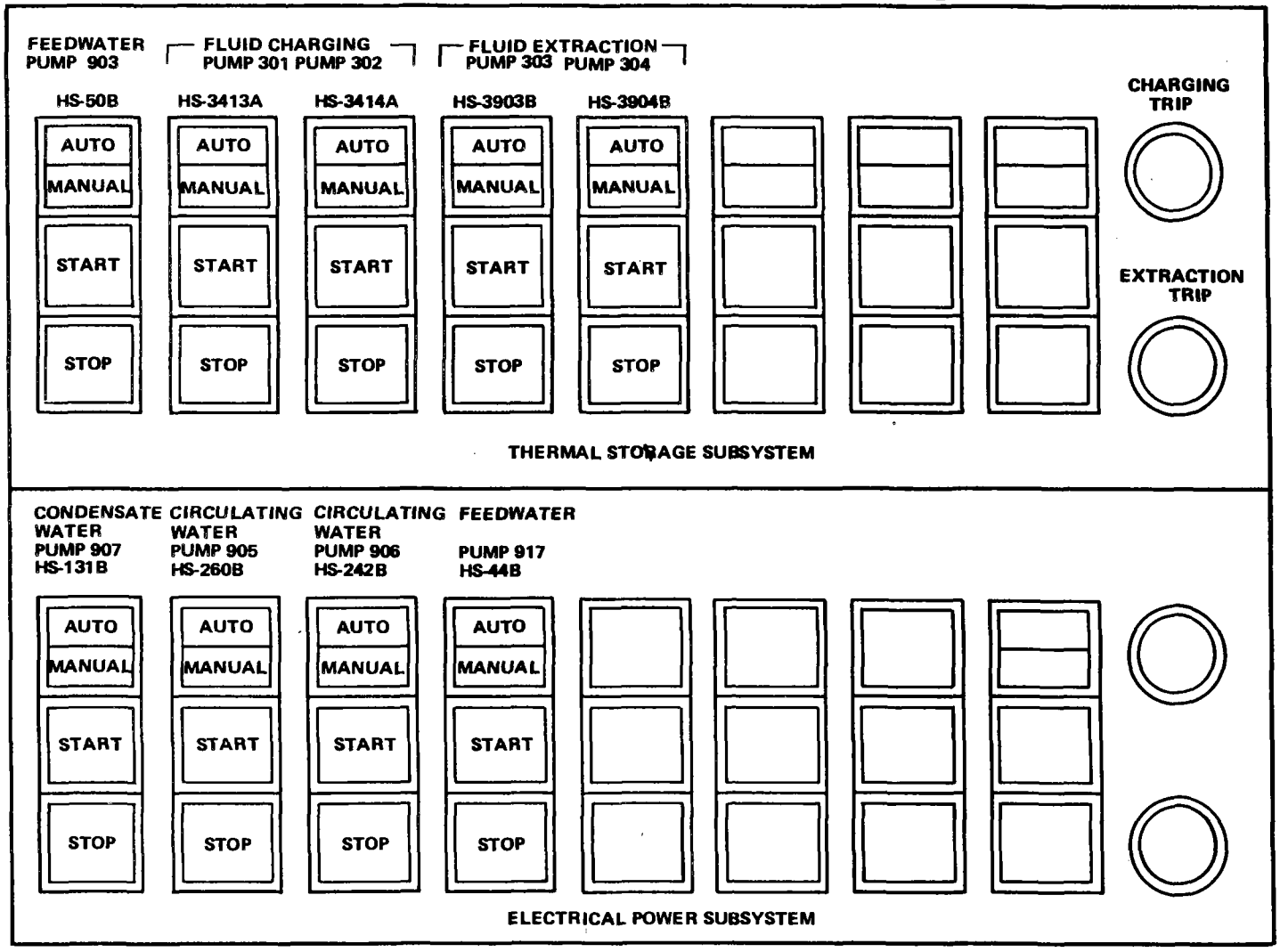
16 Analog Inputs
244 — 24V DC Inputs
104 — 120V AC Outputs
32 — 140V DC Outputs

RS5

No Analog
80 — 24V DC Inputs
40 — 120V AC Outputs
8 — 140V DC Outputs

THERMAL STORAGE SUBSYSTEM AND ELECTRICAL POWER SUBSYSTEM DEDICATED PUSH BUTTONS

VFJ126N

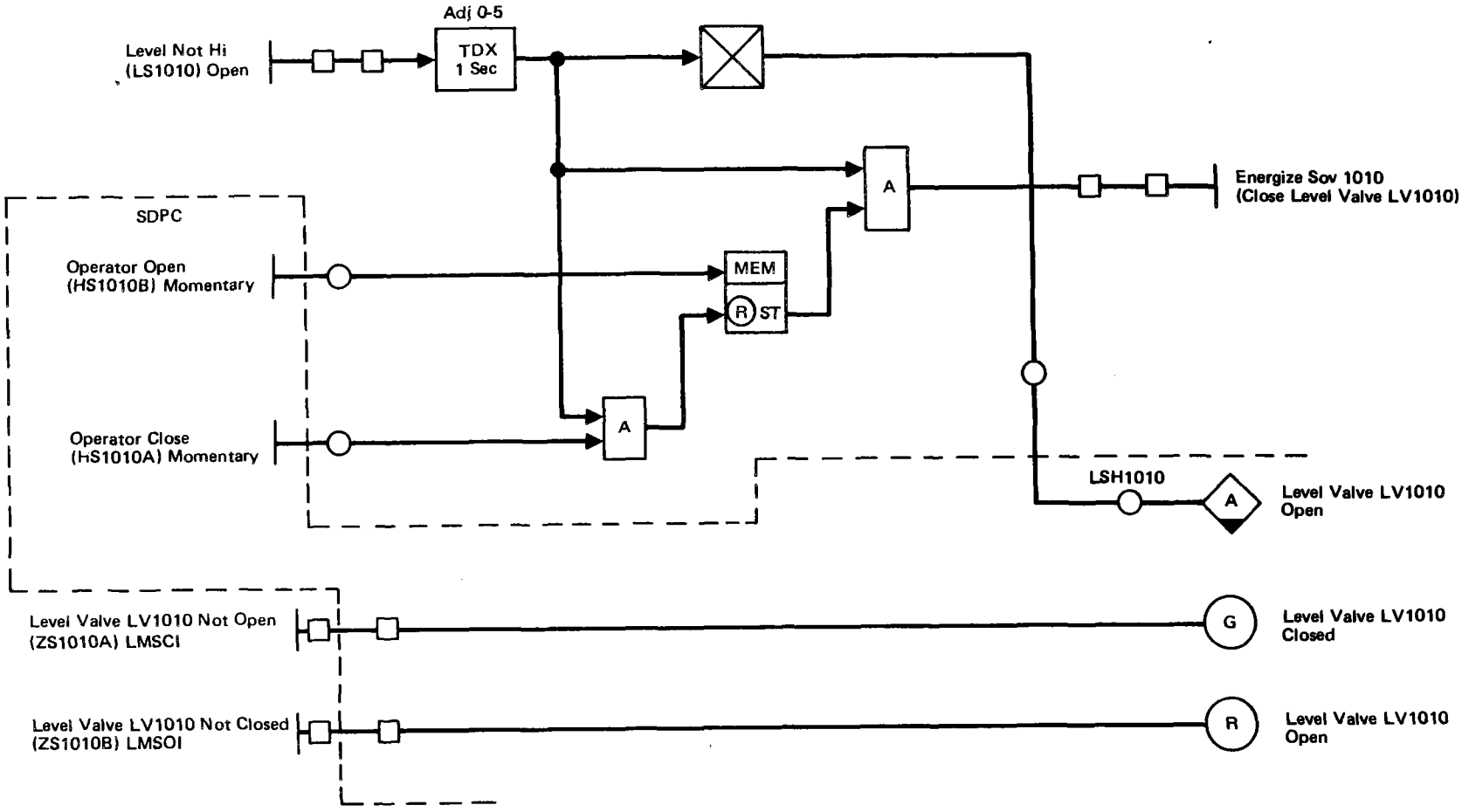


ILS SPECIFICATION

- Logic Criteria Drawings (I 15)
  - Equip Description and Use
  - Operator Interface
  - Operation
  - Alarms
- Logic Diagrams (I5)
- Ladder Diagrams

DRAIN POT LEVEL CONTROL LOGIC
I5-15

VFI457N

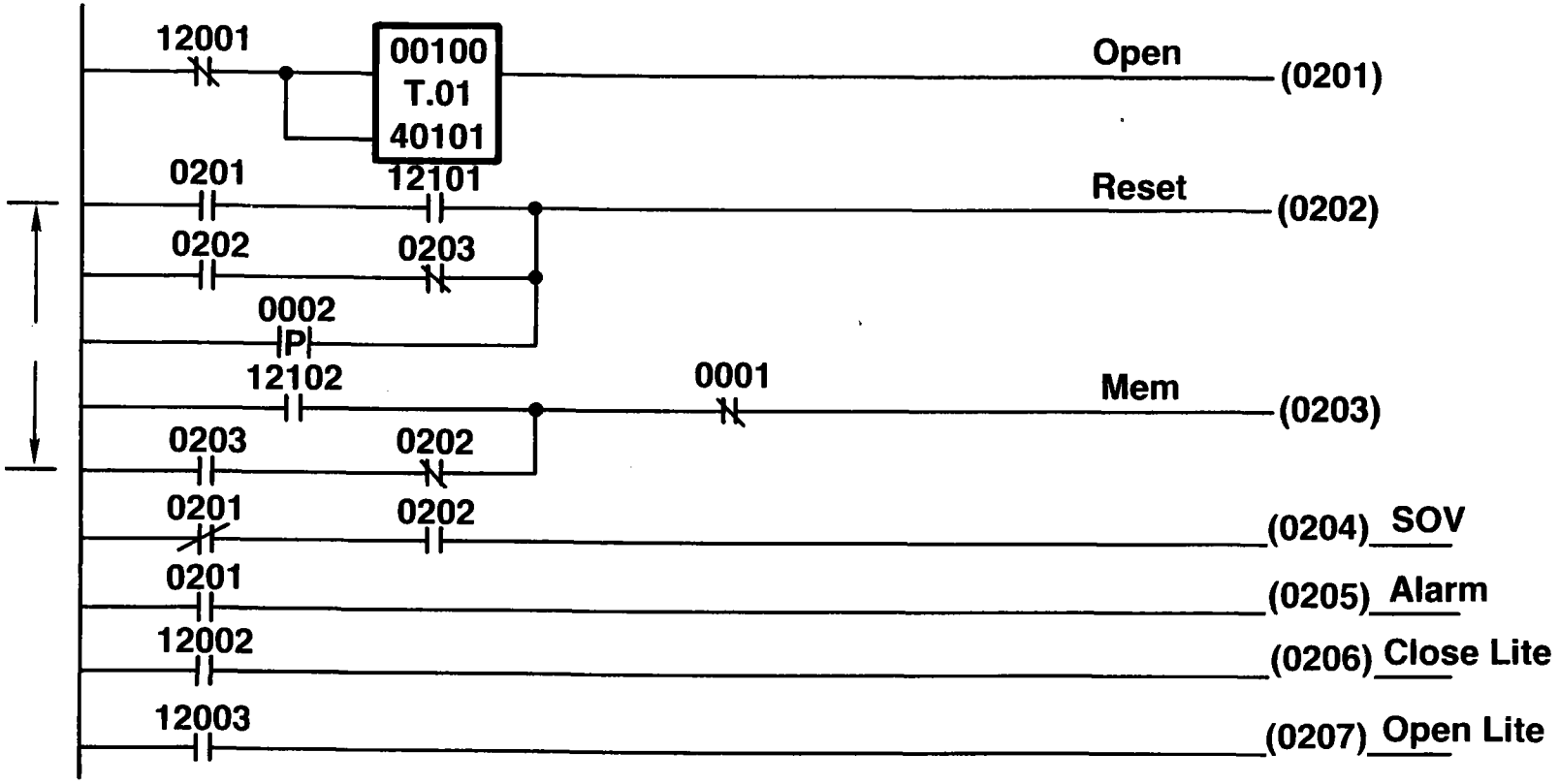


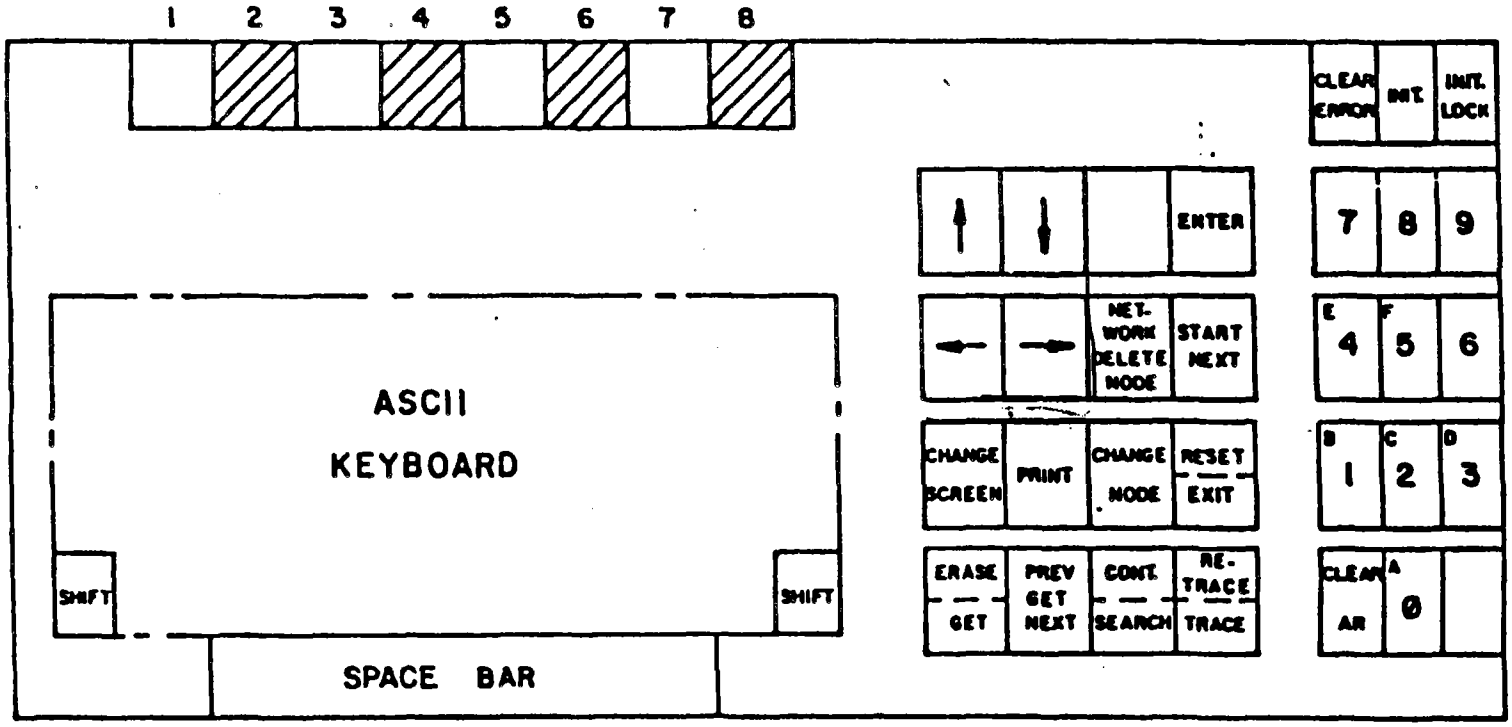
DRAIN POT LEVEL CONTROL LADDER DIAGRAM (I5-15-LV1010)

VFI939N

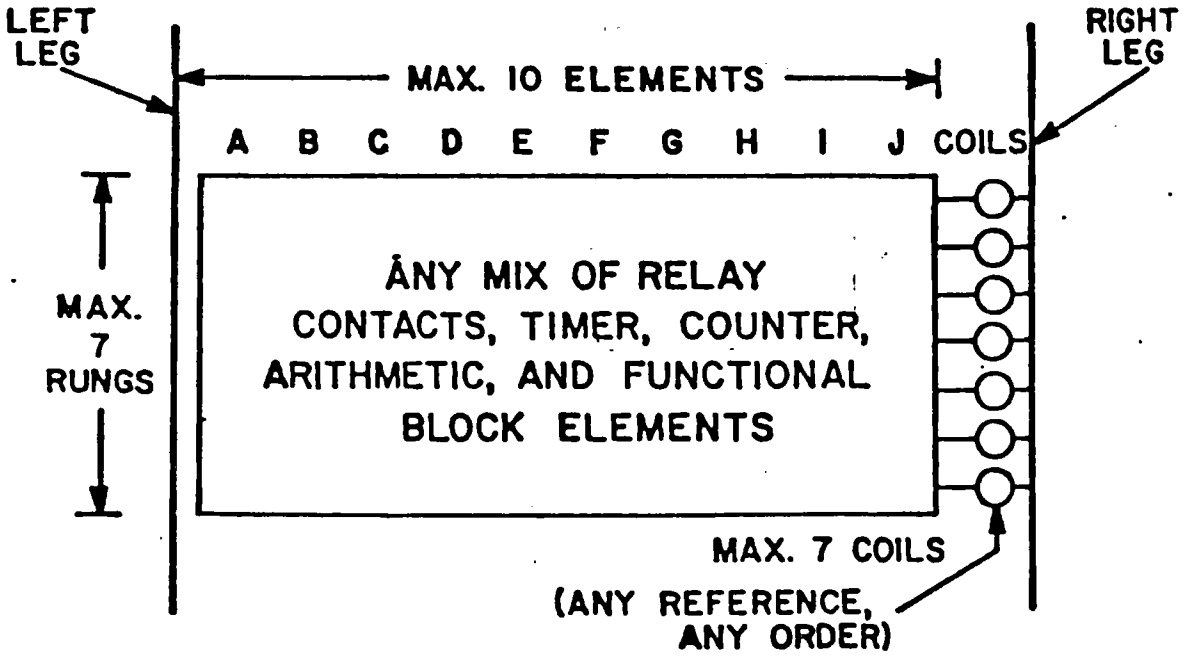
Inputs		
Device		Address
LS1010		12001
ZS1010A	Closed	12002
ZS1010B	Open	12003
HS1010A	Close	12101
HS1010B	Open	12102

Outputs	Address
Device	0204
SOV1010	





P190 Keyboard Layout



General Network Format

VFJ020N

TRIP LOGIC

Provides Independent Safety Systems for Each Subsystem

- Red Line Units (RLU)
  - — Receiver RLU
  - — Thermal Storage RLU
- Turbine — Generator
  - — Provided by GE
- Overall Plant Trip Logic
  - — Hardwired Subsystem Trip Push Buttons
  - — Hardwired Master Trip Push Button (All Subsystems)

RED LINE UNITS (RLU)

- Safe's Each Subsystem Separately
- Modicon 584 (2)
  - RS1 — Receiver Cutoffs
  - RS2 — TSS Charge Cutoffs
    TSS Extraction Cutoffs
- Same Capabilities as ILS (Programmable, Etc.)
- Sensors Hardwired to RLU's
- Trip Signals Hardwired to End Item

RECEIVER CUTOFFS

Condition	Instrument Cut Off Level	
1. High Inlet Water Pressure	PT 2002 (RWIP)	⩾2135 Psig
2. High Boiler Panel Temperature	TE 2301 A&B	⩾1300°F
3. High Downcomer Steam Outlet Temperature	TE 2903	⩾1060°F
4. High Downcomer Steam Outlet Pressure	PT 2902	⩾1660 Psig
5. Hand Switch on RS Console — RS Shutdown		
6. Hand SW and OCS Console — Plant Shutdown		
7. Receiver Feedwater Pump Stopped		
8. RS Trip-T-G/TS chg/SDS Tripped (from Plant Trip Logic)		

THERMAL STORAGE CUTOFFS

Condition	Instrument Cutoff Level	
1. High Desuperheater Steam Outlet Temperature	TE 3105 A TE 3105 B	⩾ 690°F
2. High Thermal Storage Heater Inlet Steam Pressure (CL)	PT 3210 A PT 3210 B PT 3311 A PT 3311 B	⩾ 1500 Psig
3. High Thermal Storage Heater Fluid Outlet Pressure (CL)	PT 3208 PT 3308	⩾ 75 Psig
4. High Thermal Storage Heater Fluid Outlet Temperature (CL)	TE 3211 A TE 3211 B TE 3310 A TE 3310 B	⩾ 600°F
5. High Flash Tank Steam Pressure (CL)	PT 3114	⩾ 150 Psig
6. High Flash Tank Water Level (CL)	LT 3112	⩾ 90%
7. Low Thermal Storage Unit Fluid Level (CL, EL)	LT 3008	⩽ 10%
8. High Thermal Storage Unit Fluid Level (CL, EL)	LT 3008	⩾ 90%
9. High Thermal Storage Unit Pressure (CL, EL)	PT 4008	⩾ 16 In. w.c.

THERMAL STORAGE CUTOFFS (CONT)

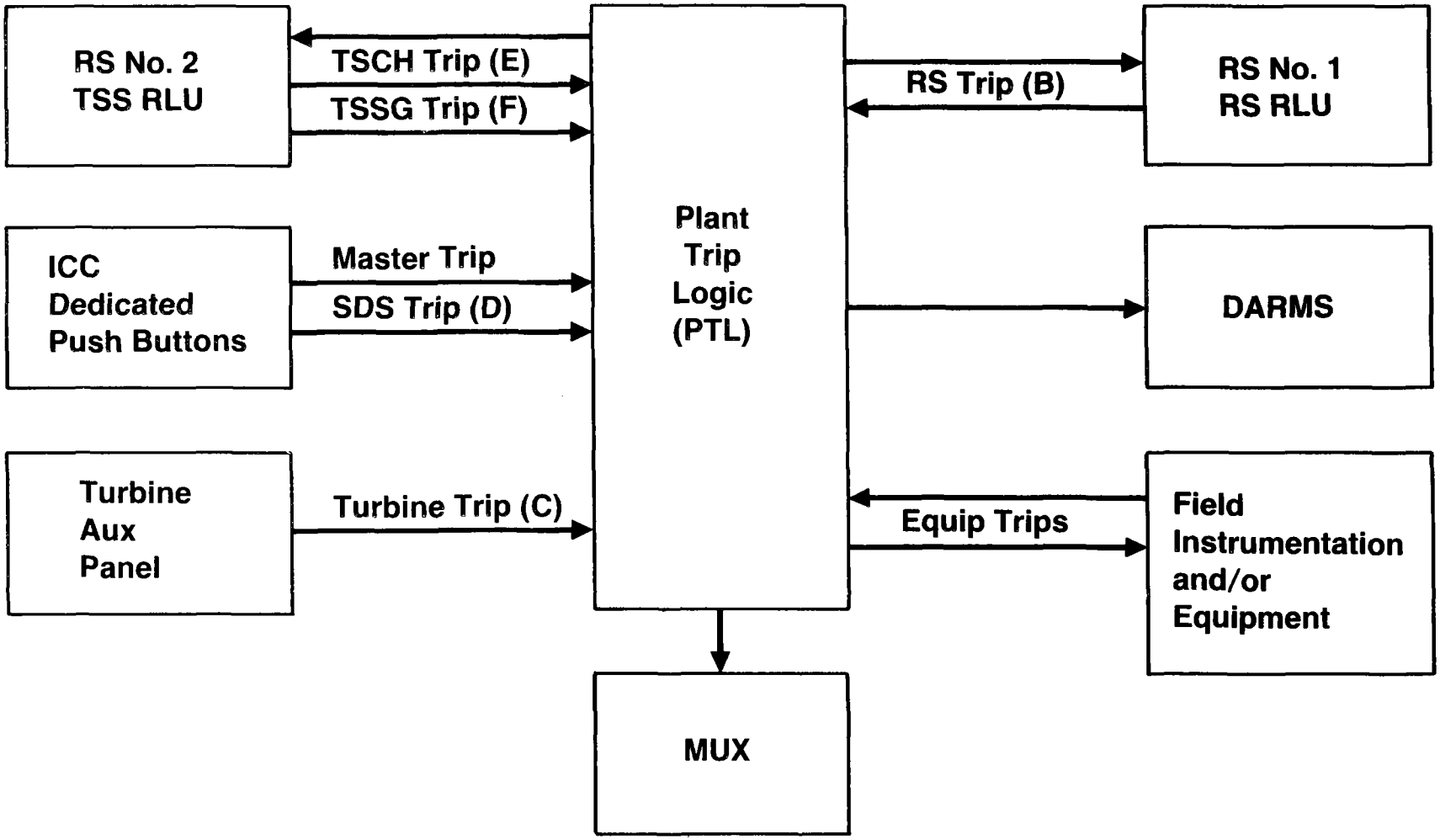
Condition	Instrument Cutoff Level	
10. Low Thermal Storage Unit Pressure (CL, EL)	PT 4008	≤ 2 In. w.c.
11. High Boiler Outlet Steam Pressure (EL)	PT 3702 A PT 3702 B PT 3802 A PT 3802 B	≥ 435 Psig
12. High Boiler Fluid Inlet Pressure (EL)	PT 3703 PT 3803	≥ 100 Psig
13. Low Superheater Outlet Steam Temperature	TE 3701 A TE3701 B TE3801A TE 3801 B	≤ 525 F
14. Hand Switch on TSS Console – TSS Extraction System Shutdown		
15. Hand Switch on TSS – Console – TSS Charging System Shutdown		
16. Hand Switch on OCS Console – Plant Shutdown		
17. TSS Extraction Shutdown – T-G Tripped (from Plant Trip Logic)		
18. TSS Charging Shutdown – RS Tripped (from Plant Trip Logic)		

VFJ130N

OVERALL PLANT TRIP LOGIC (PTL)

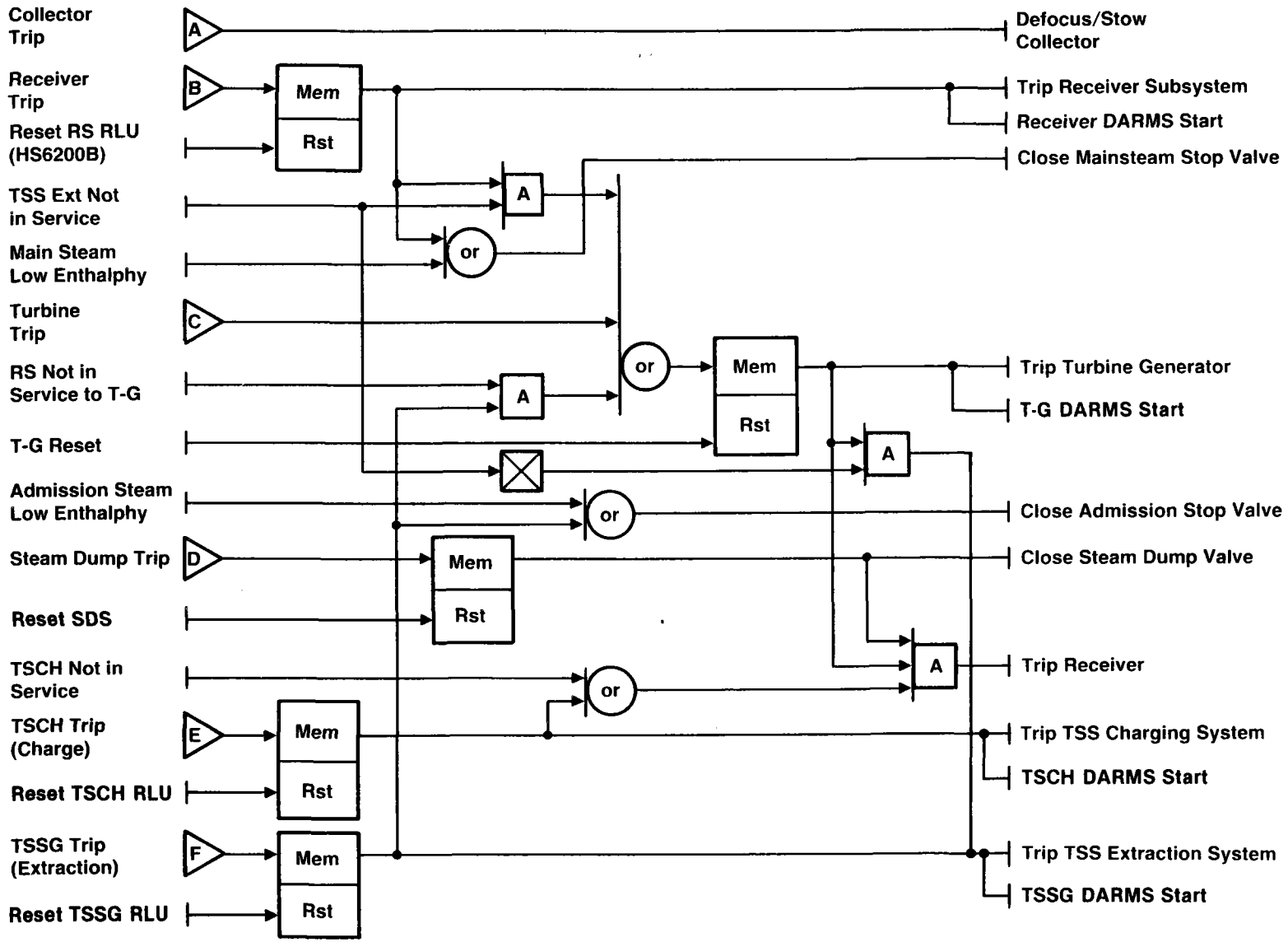
- Safe's One or More Subsystems After Trip of One Subsystem
- Hardwired Relays (Remote Station 1)
- Completely Independent
- Sensors Hardwired to PTL
- Trip Signals Hardwired to RLU's and/or End Items

PLANT TRIP LOGIC INTERFACE



OVERALL PLANT TRIP LOGIC (ELECTRICAL — E2-14)

VFJ131N



VFJ072N

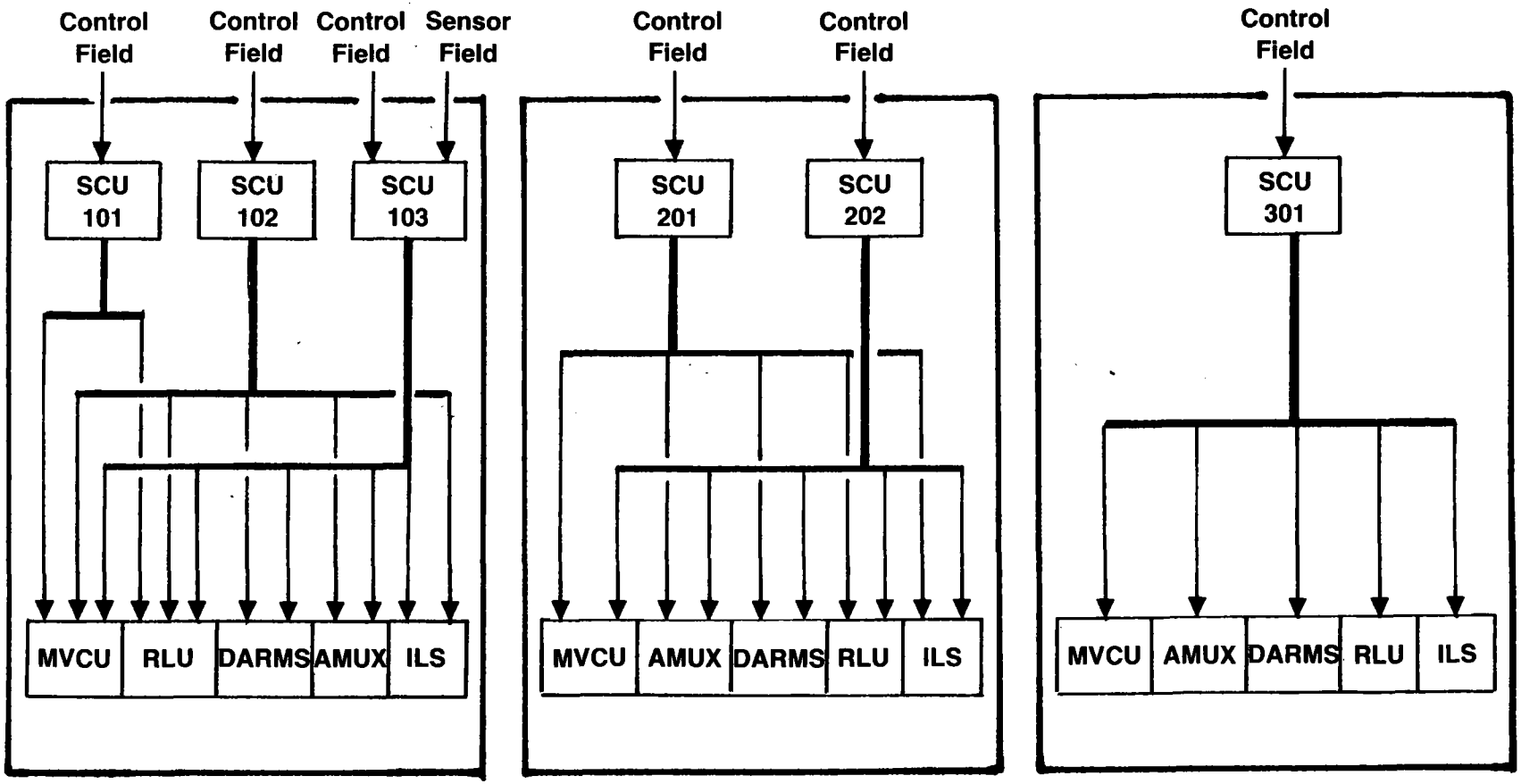
SIGNAL CONDITIONING UNIT (SCU)

- **Purpose**

  1) **To Convert Signals From the Control and Data Sensor Fields to Signal Levels That are Acceptable By the AMUX, DARMS, RLU, ILS and MVCU**

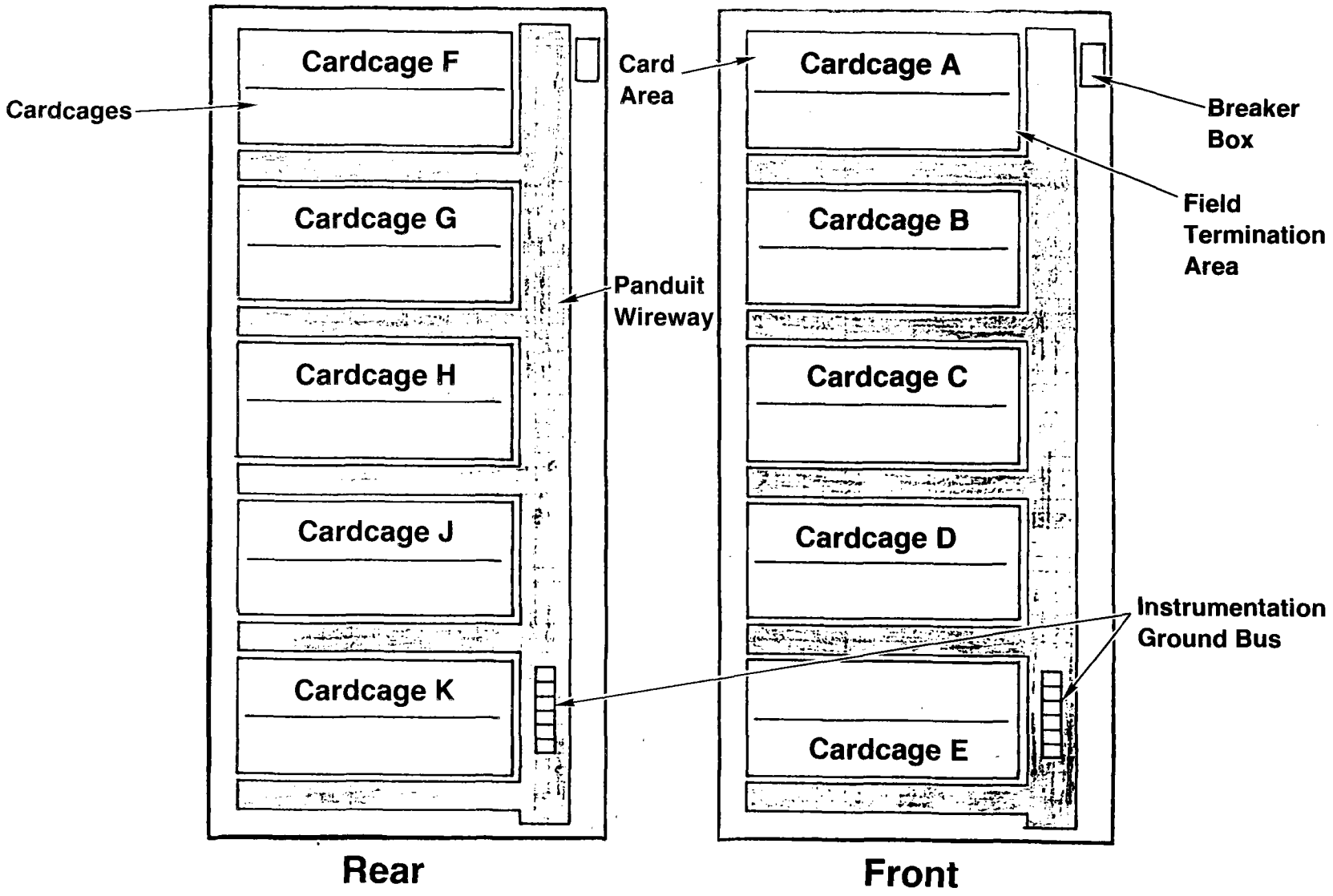
  2) **To Provide Multiple Outputs of a Signal if More Than One Device is to Monitor That Signal**

SCU DATA FLOW



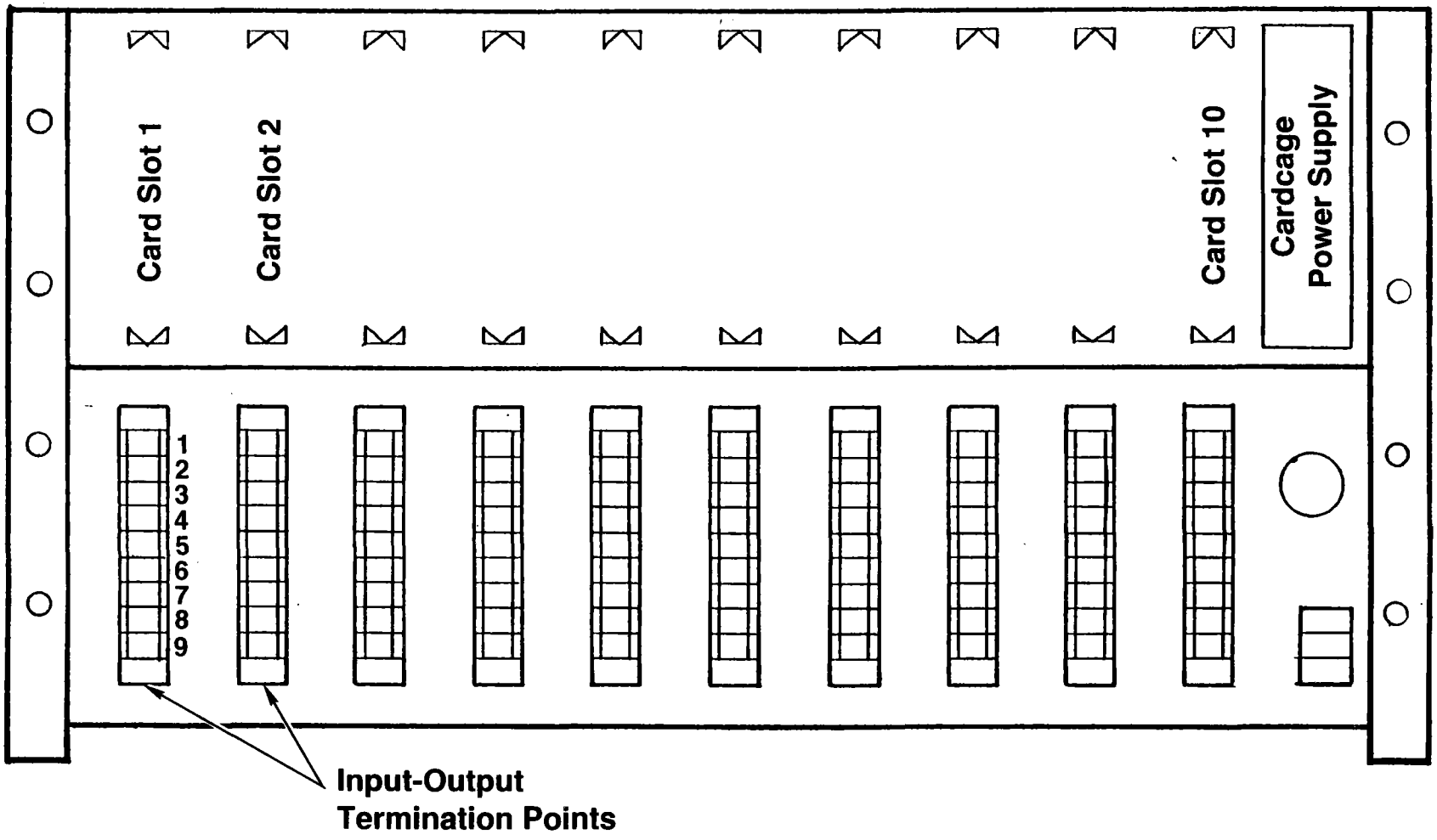
VFJ074N

SCU CABINET



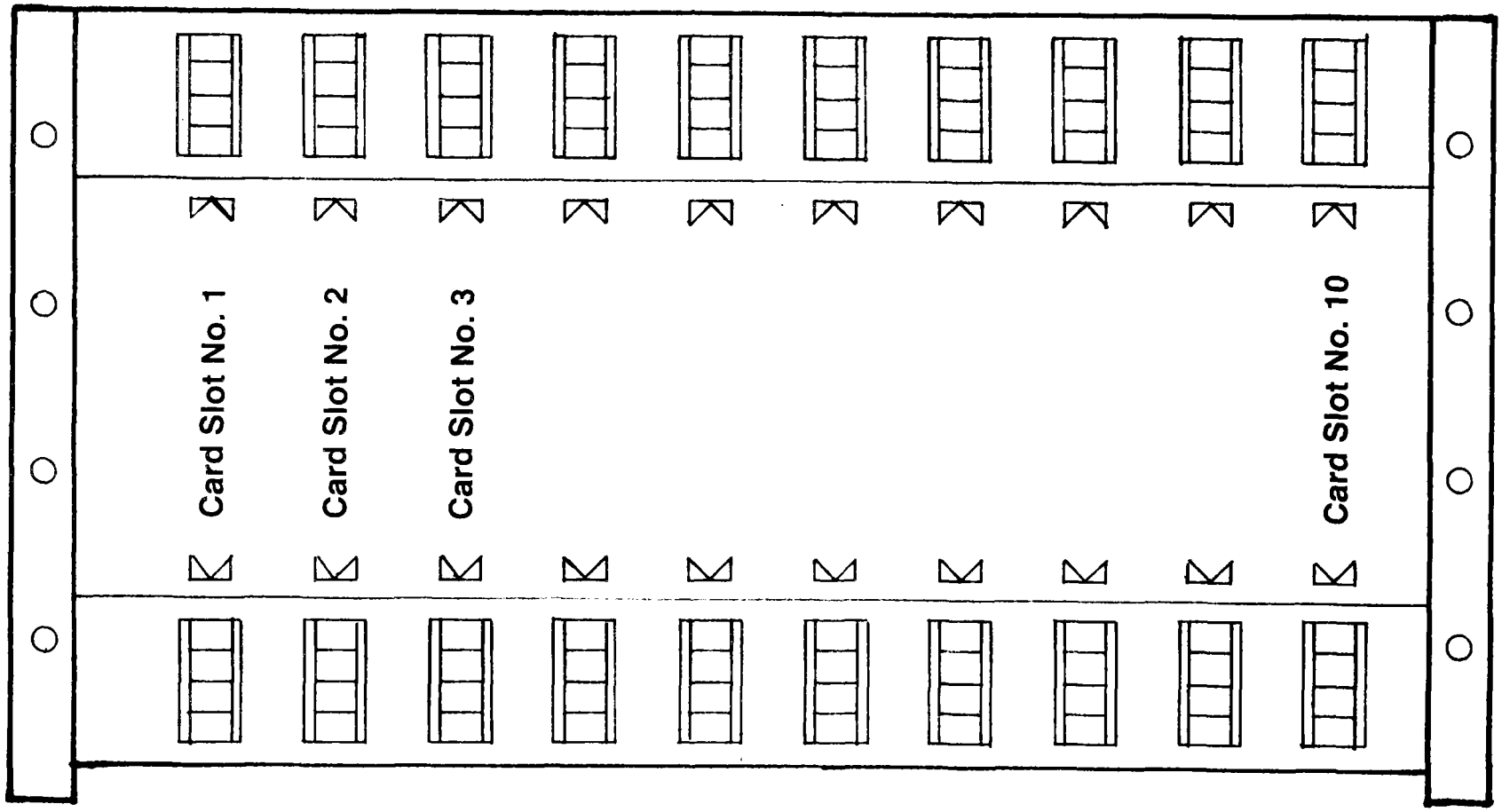
SIGNAL CARD CARDCAGE MODEL 793)

VFJ075N



TRANSMITTER EXCITATION CARDCAGE (MODEL 923)

VFJ076N

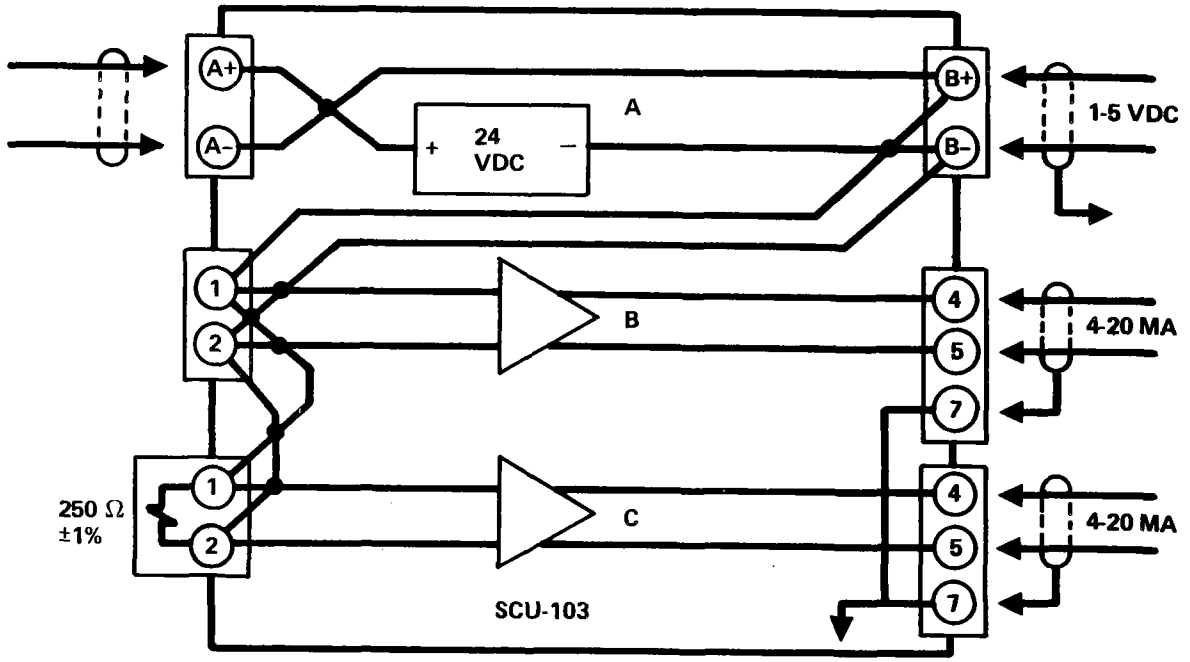


SIGNAL INPUTS

VFJ077N

Instrument	Model	Quantity
■ Thermocouples	3894-M	89
■ Flux Gauges	3894-M	36
■ 4-20 ma Transmitters	3872	
• Pressures		52
• Flows		25
• Liquid Levels		13
■ Linear Potentiometers	3896-P	32
■ RTD's	3895-RB	3
■ LVDTs	3890-V	34

TYPICAL MULTI-SIGNAL SCHEMATIC



Parameter	Position	Slot	Card Type	Destination
LT2908	A	3H7	3872	—
	B	3J7	3897-L	MVCU Remote Station No. 4
	C	3J8	3897-L	AMUX
LT2901	A	3H9	3872	—
	B	3J9	3897-L	AMUX
	C	3E10	3897-L	ILS

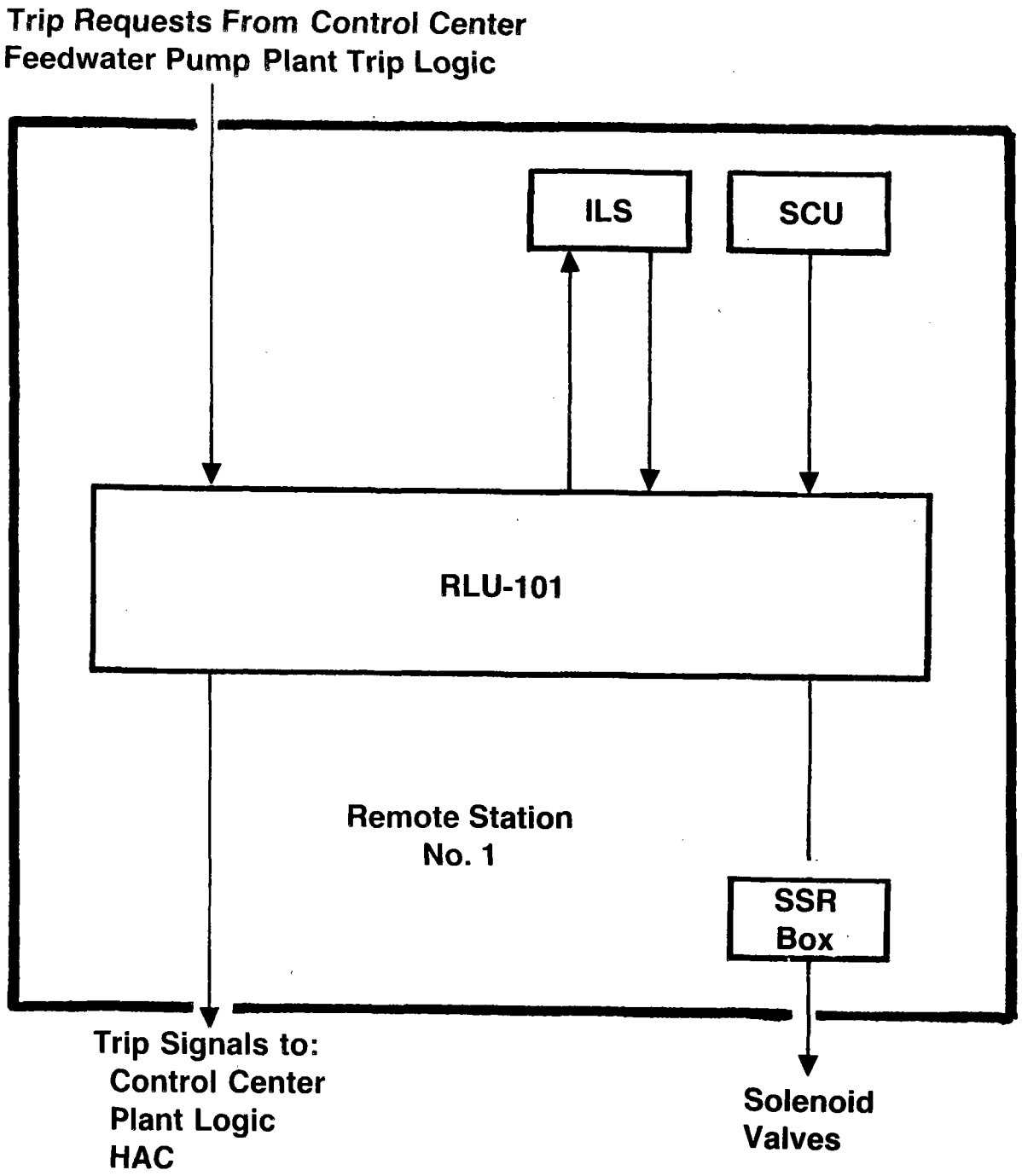
VFJ079N

REDLINE UNIT (RLU)

- **Purpose — To Assure Safe Operation of the Receiver System and Thermal Storage System and to Prevent Damage to Their Hardware**
  - **Enter the Trip Mode Whenever Any Monitored Parameter Reads Unsafe**
  - **Enter the Trip Mode Upon Request**
  - **Command Selected Valves to Their Trip Position During the Trip Mode**
  - **Store First Out Trip**
  - **Monitor and Select Redundant Instrument for Trip Input if the Primary Instrument is Suspected of Giving False Data**

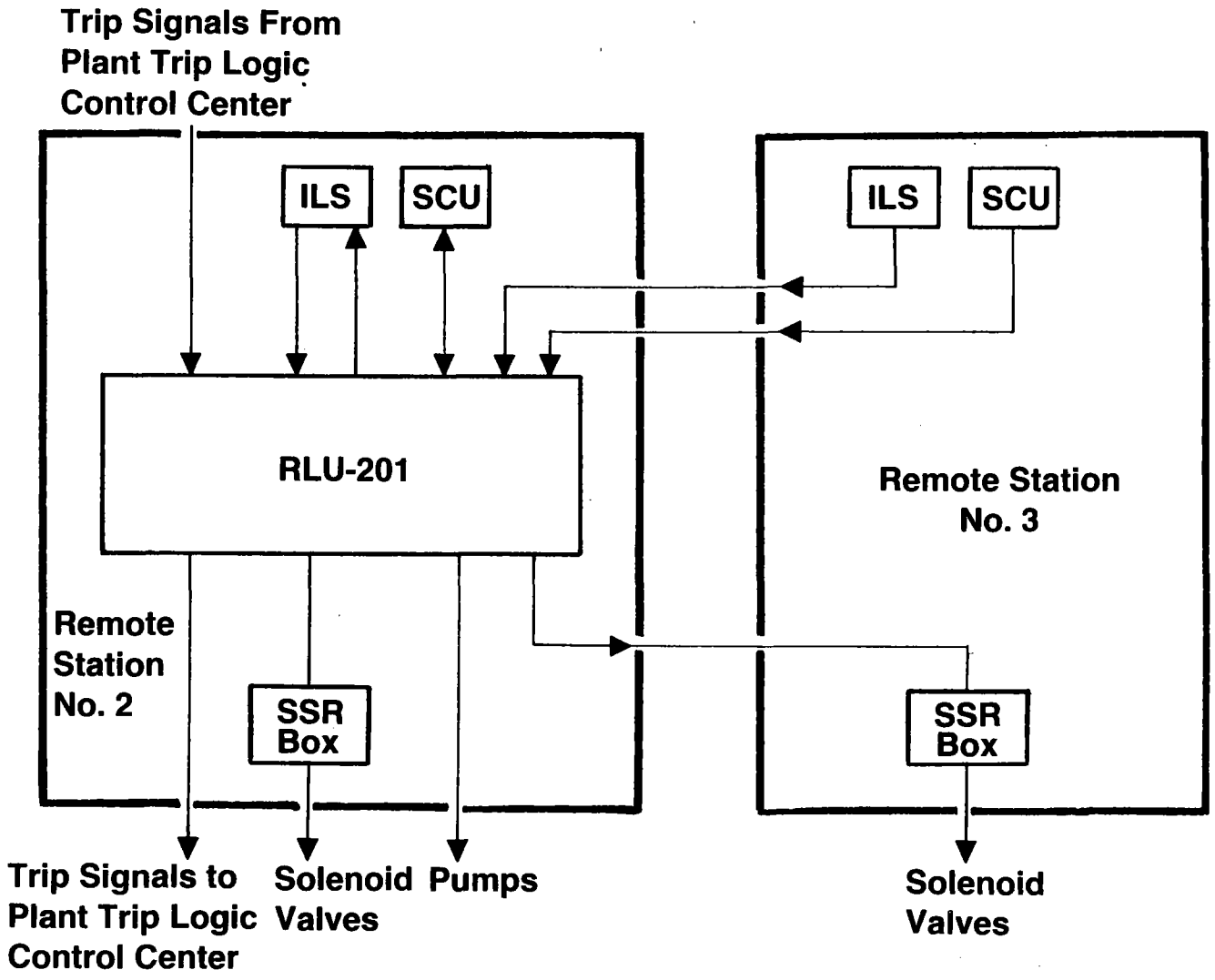
VFJ080N

RECEIVER RLU SIGNAL FLOW

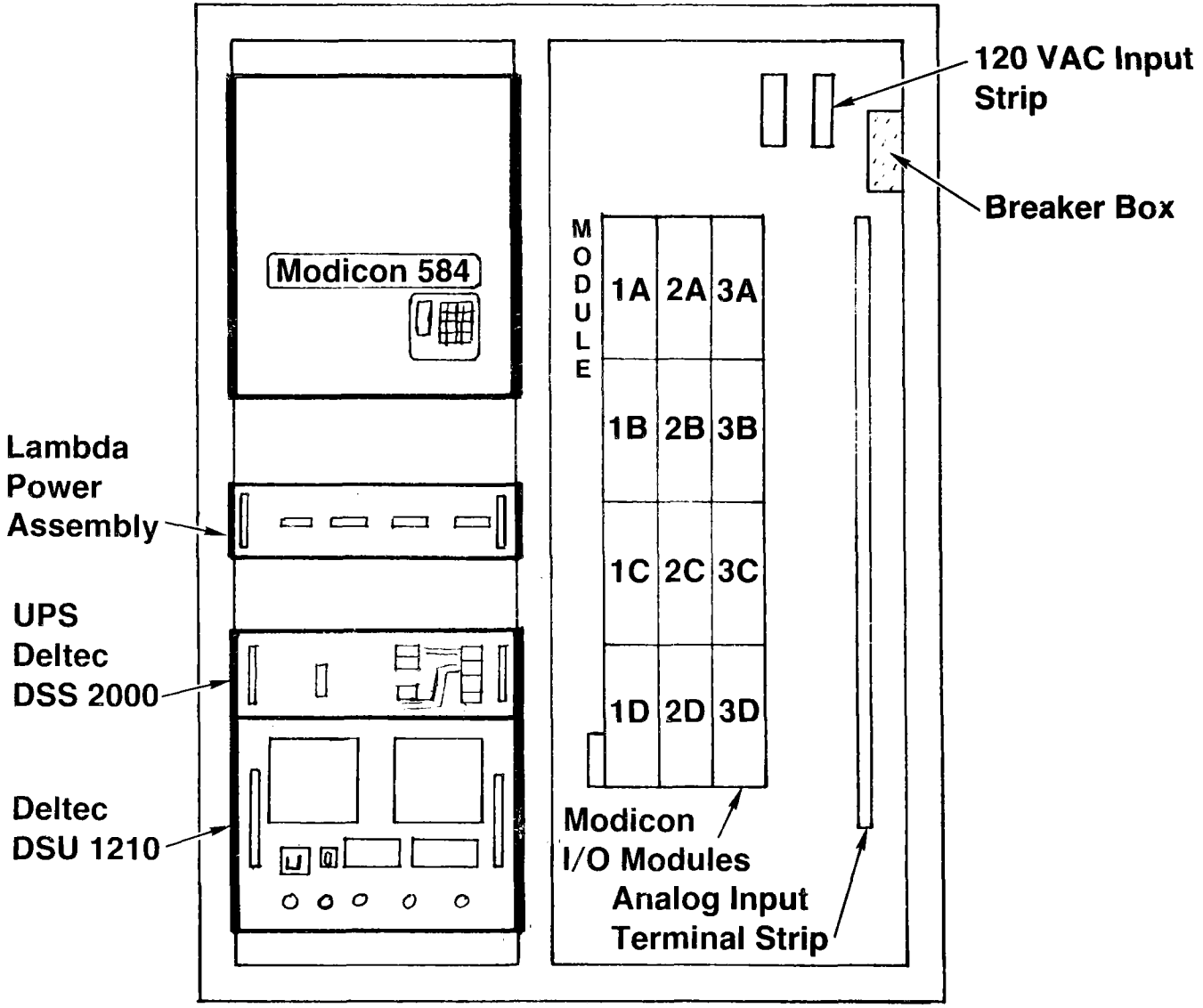


VFJ081N

THERMAL STORAGE RLU DATA FLOW

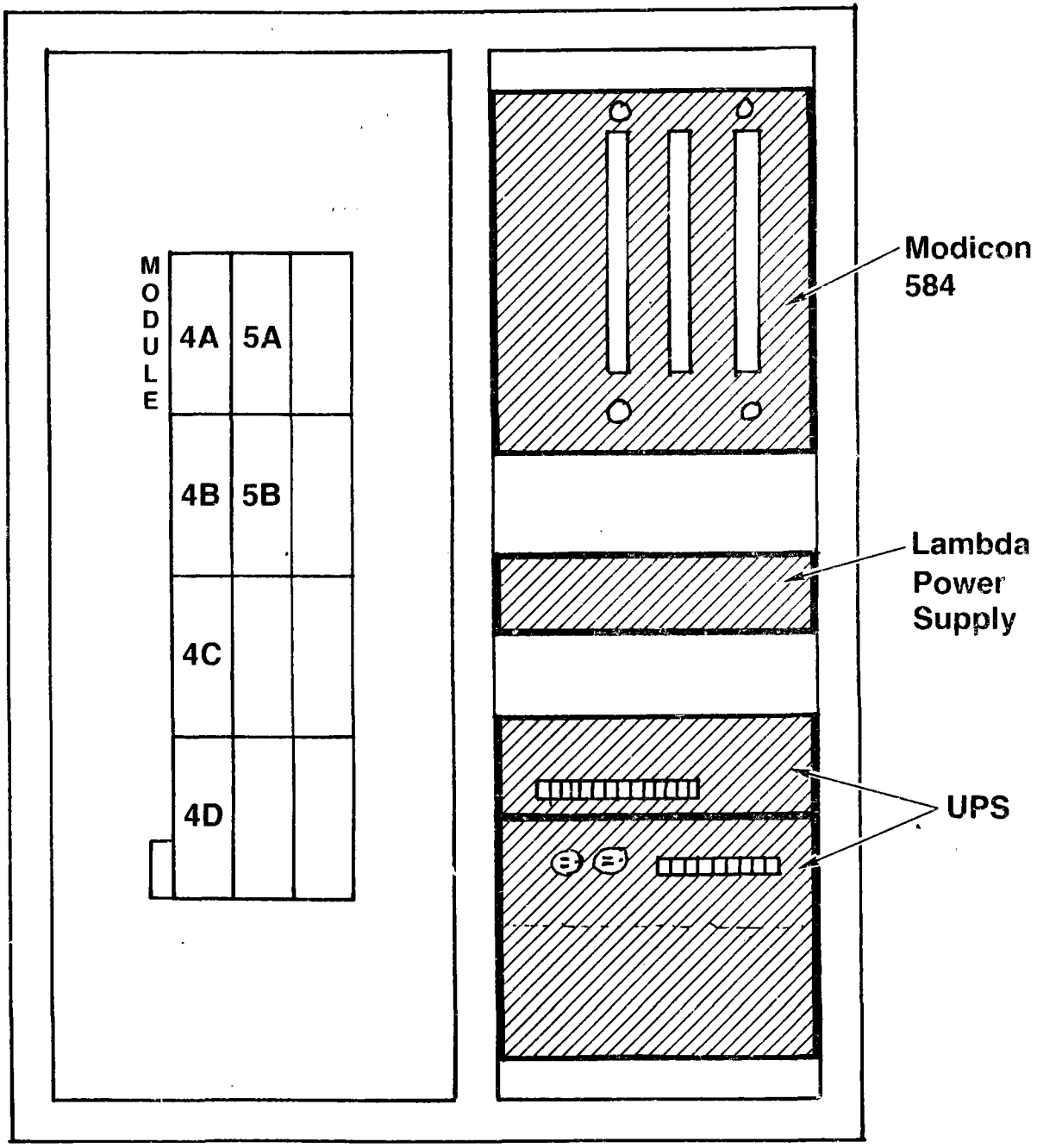


RECEIVER RLU, FRONT VIEW



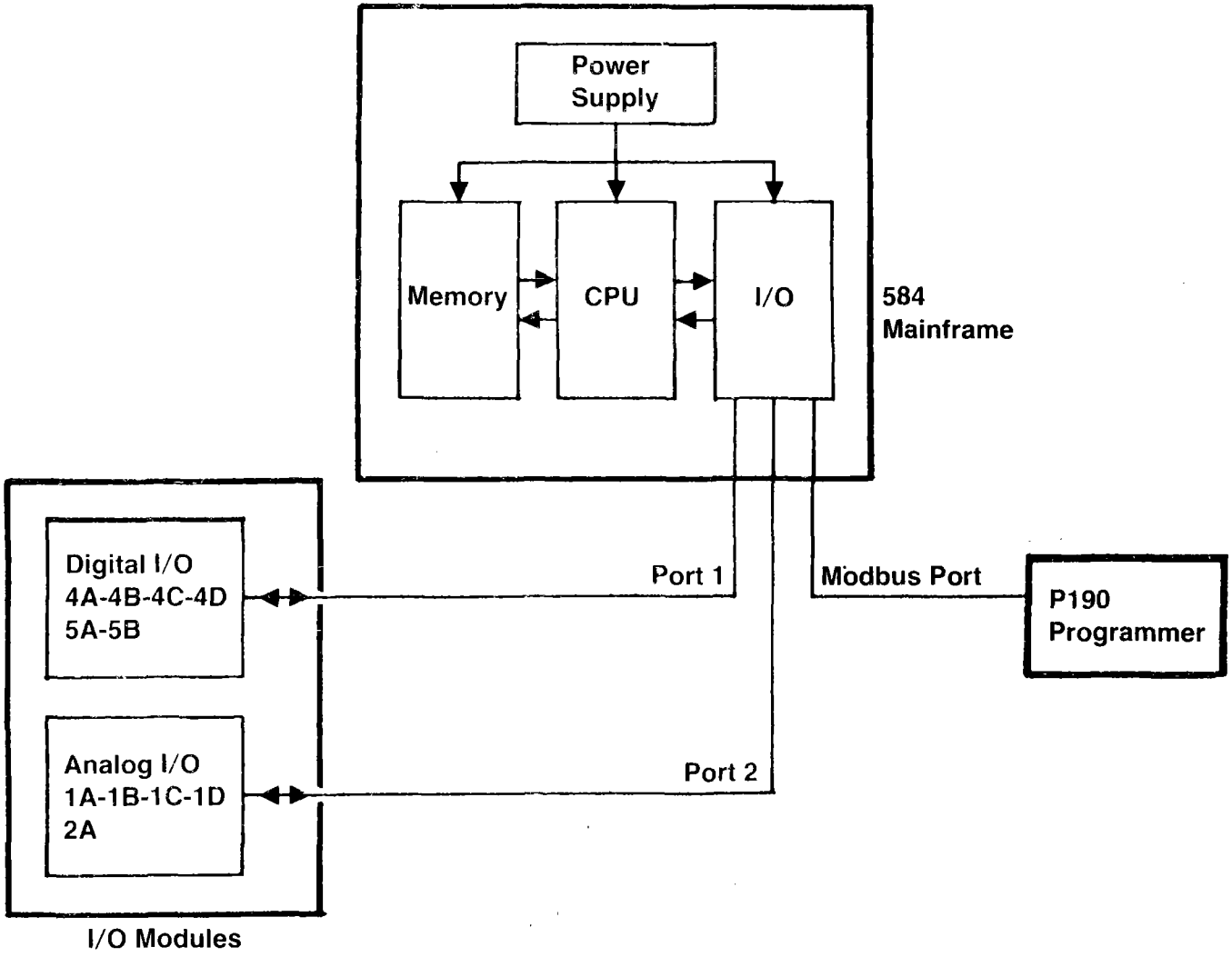
VFJ071N

RECEIVER RLU, REAR VIEW



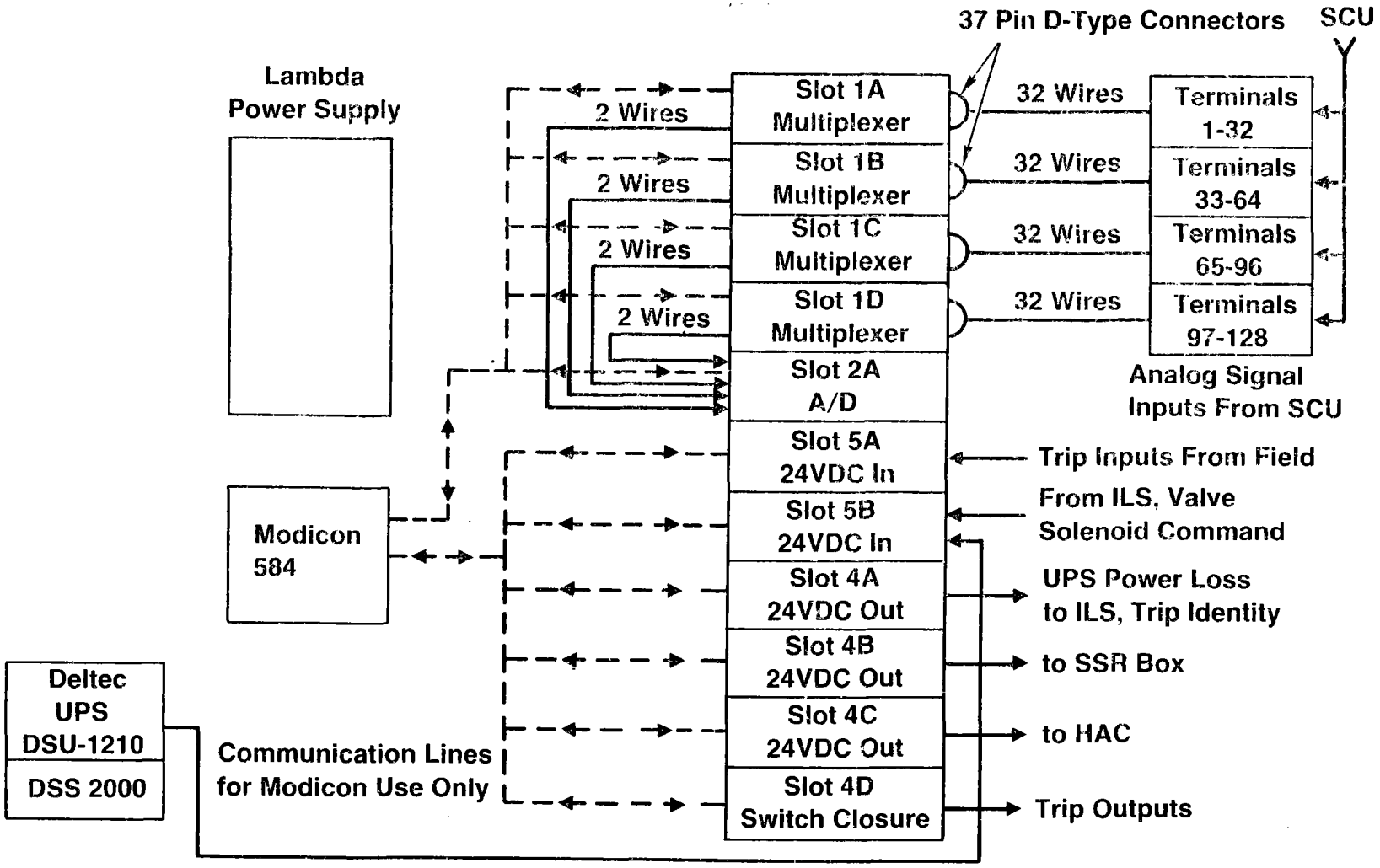
VFJ069N

MODICON 584 SYSTEM

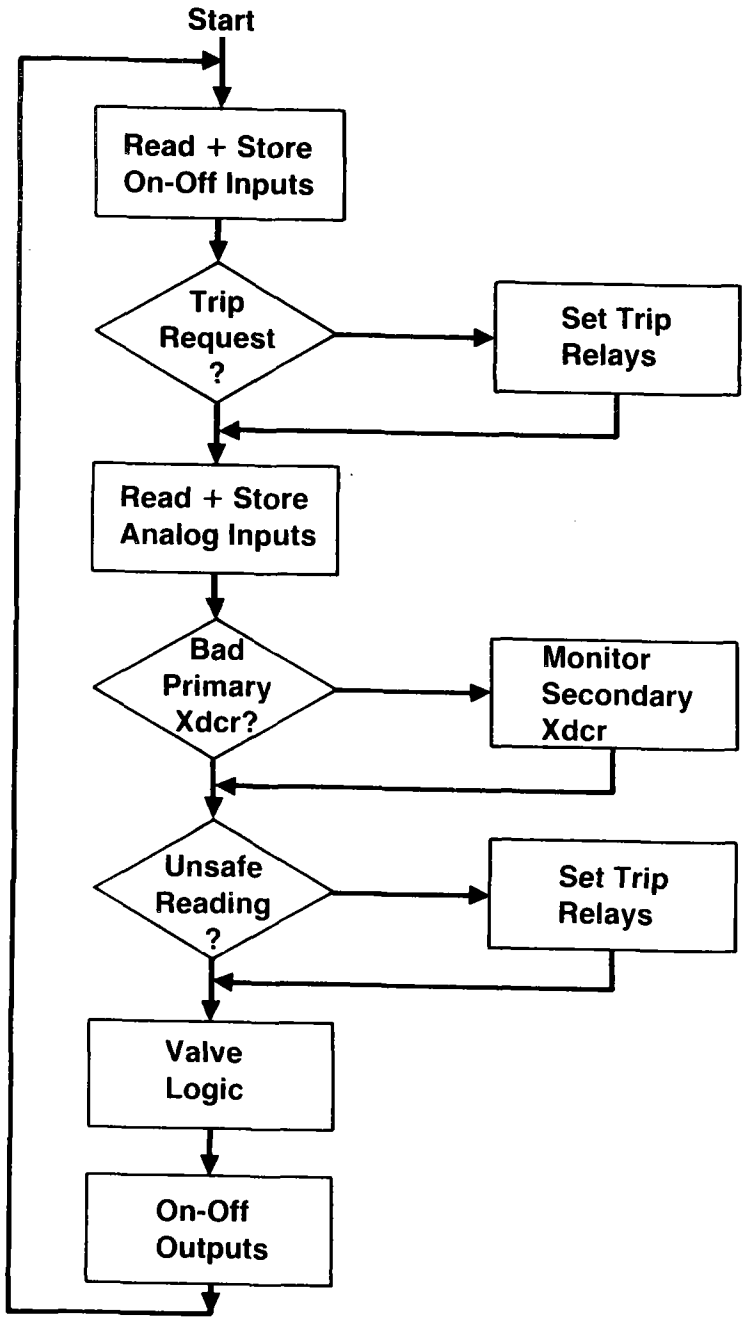


VFJ068N

RLU SIGNAL DISTRIBUTION

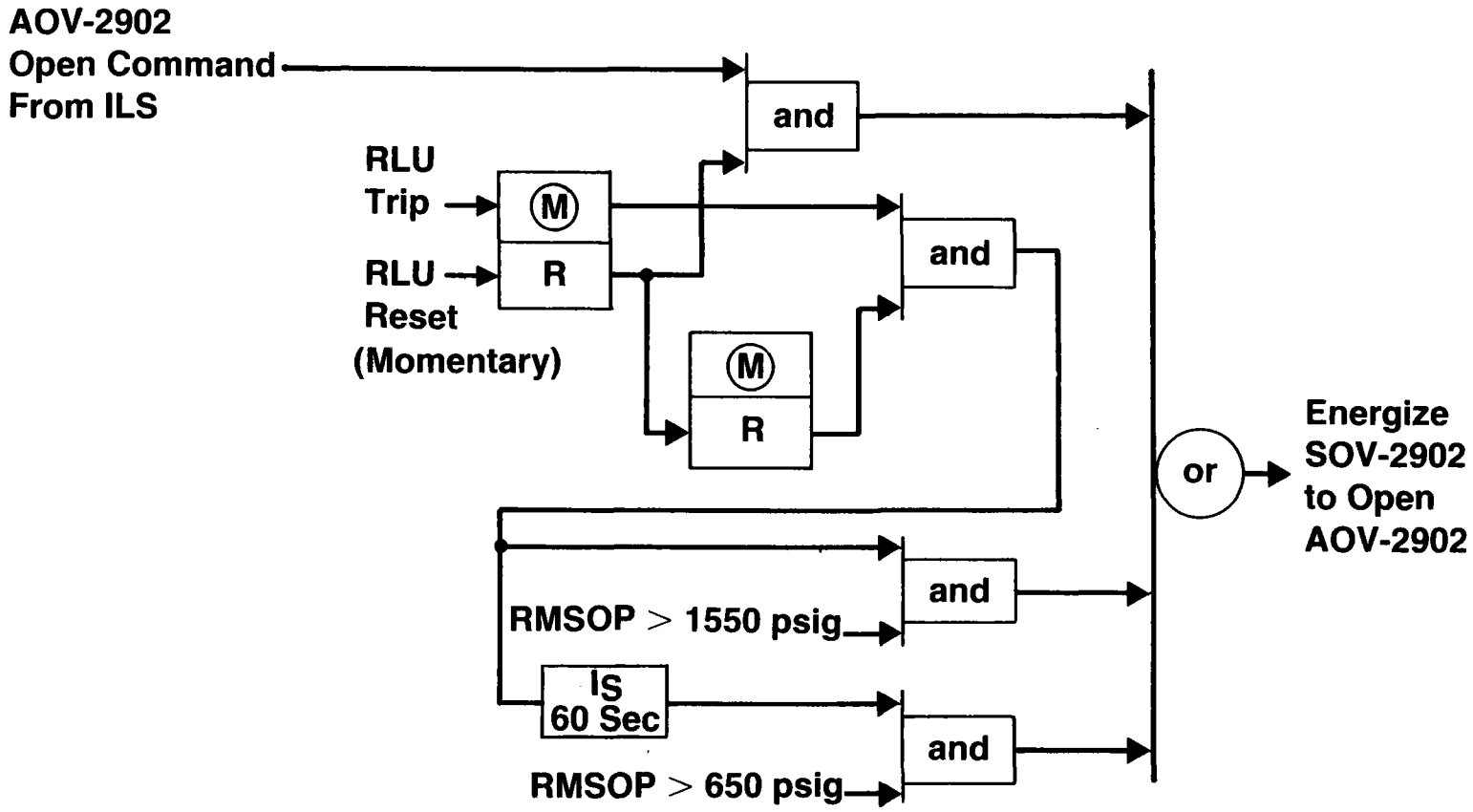


TYPICAL RLU FLOW CHART

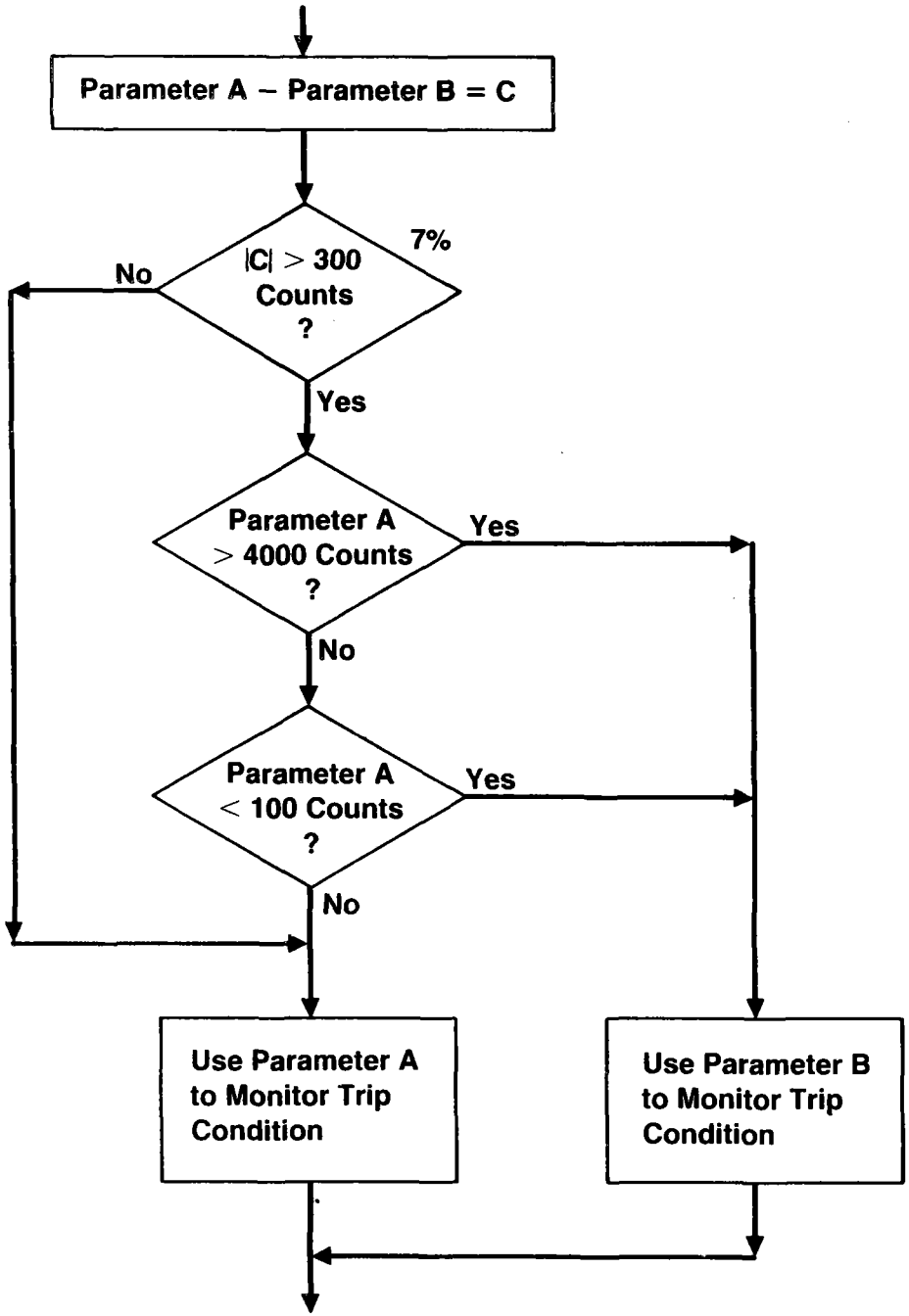


VFJ063N

STEAM MANIFOLD VENT VALVE



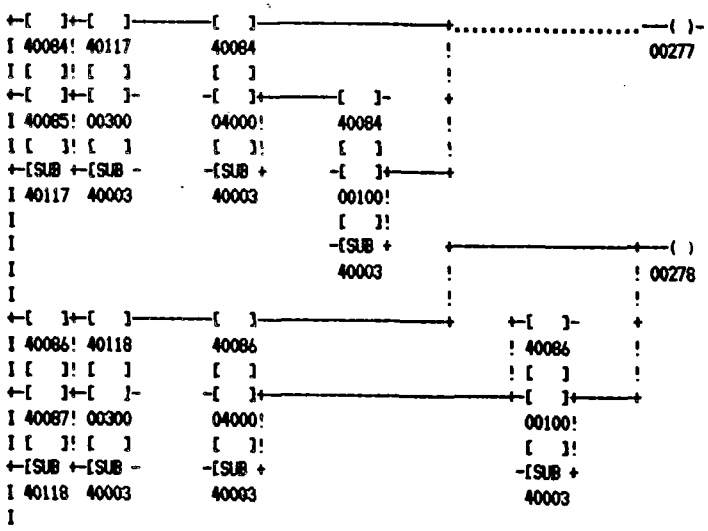
PARAMETER SELECT FLOW CHART



PROGRAM — LADDER DIAGRAMS

- Scan Time ~ 10 msec
- Analog Inputs — Monitored Once Every 300 msec
- On-Off Inputs — Monitored Once Every Scan
- Analog Trip Delay — 1 Sec
- On-Off Trip Delay — 0.1 Sec
- Receiver — 1 Trip Mode
- Thermal Storage — 3 Trip Modes
  - Charging Loop Trip
  - Extraction Loop Trip
  - Both

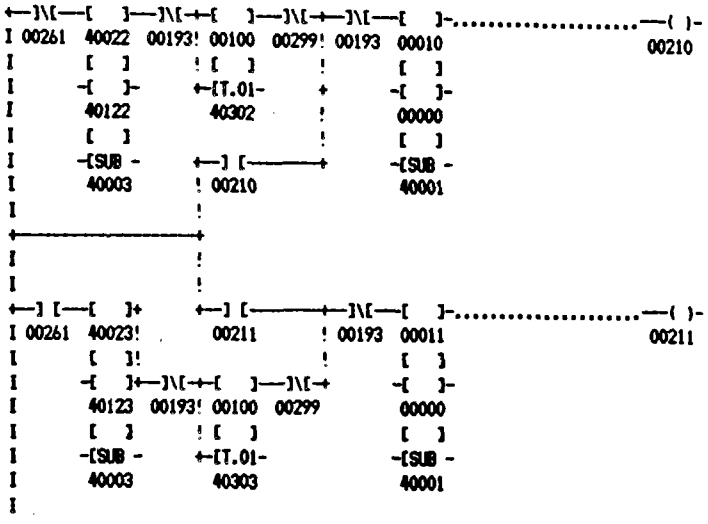
NETWORK: 00024 SEGMENT: 001



TE 2802 Select

TE 2803 Select

NETWORK: 00025 SEGMENT: 001



TE 2301A Trip

TE 2301B Trip

VFI940N

BASIC REQUIREMENTS OF DAS

- Independently Collect, Store, and Transmit Subsystem Data Used to Evaluate Plant Performance

- Provide Limited Real Time Data Evaluation Capability

DAS SOFTWARE REQUIREMENTS

- Schedule and Implement Repetive Data Collection
- Provide Quick Look Capability — Via;
  - Colorgraphic Real Time Plots
  - Real Time Tabular Displays
  - Software Driven Stripchart Displays
  - Sequence of Events During Trip (in DARMS)
- Archive Data to Tape
- Transmit Data to:
  - OCS
  - MDAC-HB
- Playback and Display Archived Data (Post Test)
- Provide Support Functions for the Above

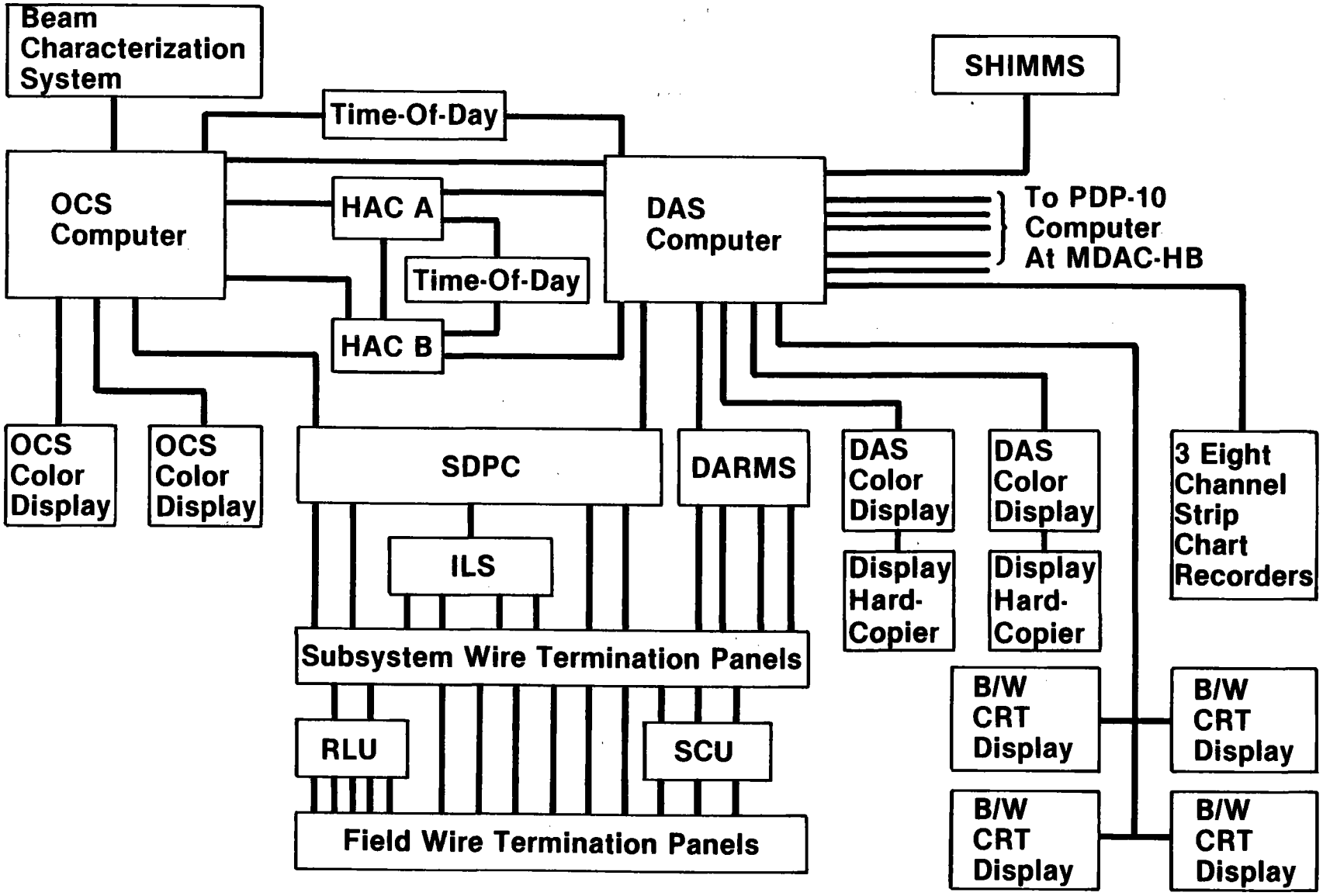
DAS CONTROLS MEASUREMENT REQUIREMENTS

VFI943N

- Monitoring Selected Process Variables and Control Elements in DAS for Special Controls Tests (Step Response, Setpoint Change)
  - Ten Samples Per Second
  - 45 Measurements
- Record Selected Variables for Controls Frequency Response Tests
  - Analog Strip Charts
  - 24 Measurements Per Test

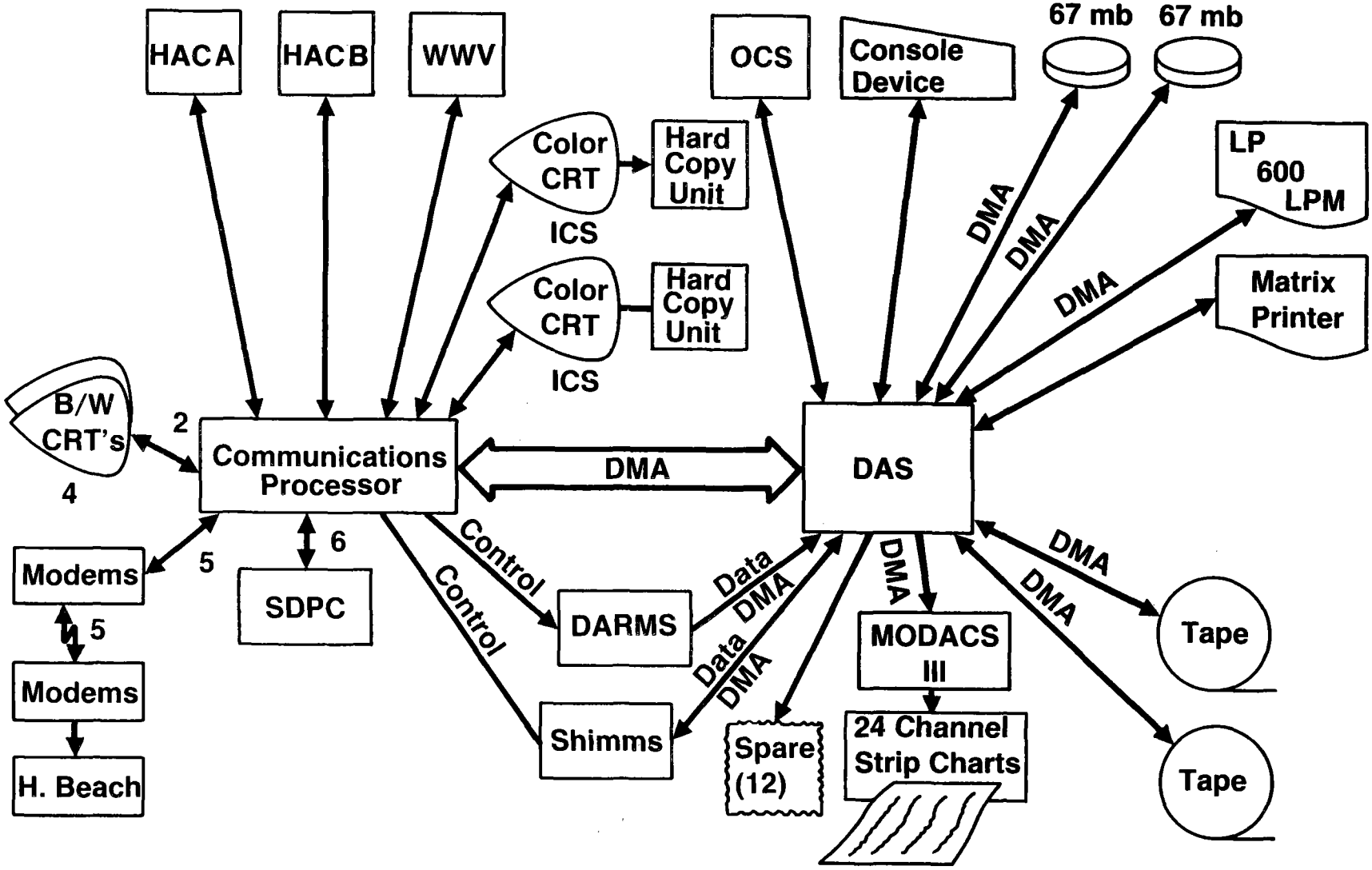
BASELINE CONTROL/MONITOR AND EVALUATION ARCHITECTURE

VFI775N



VFI945N

DAS (ON SITE) CONFIGURATION



DAS DATA ACQUISITION — ON LINE

The DAS Shall Be Capable of Collecting Data From the Following External Sources:

a. Collector System HACA Computer

b. Collector System HACB Computer

c. OCS

d. SDPC

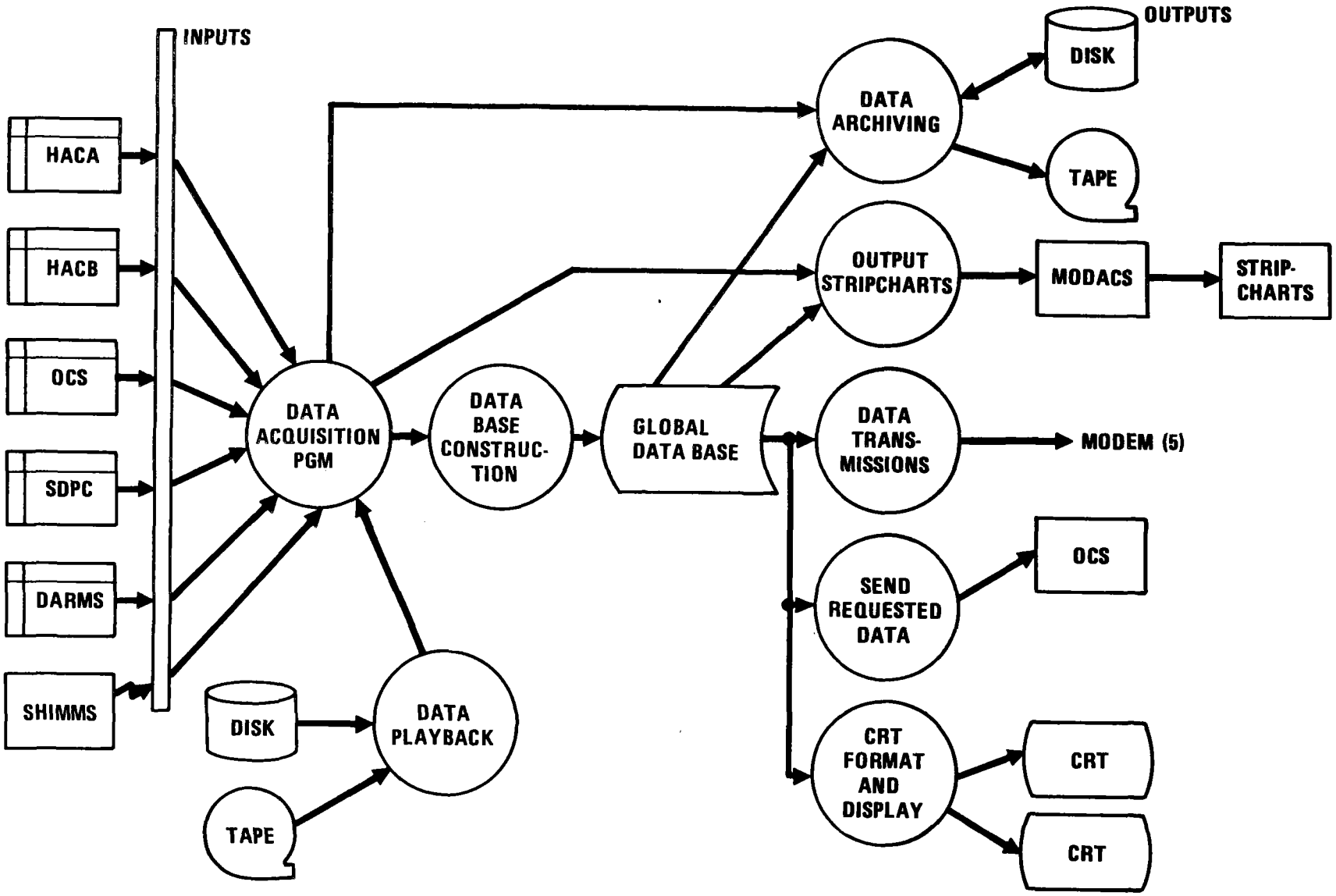
e. DARMS

f. SHIMMS

g. WWV Receiver Time

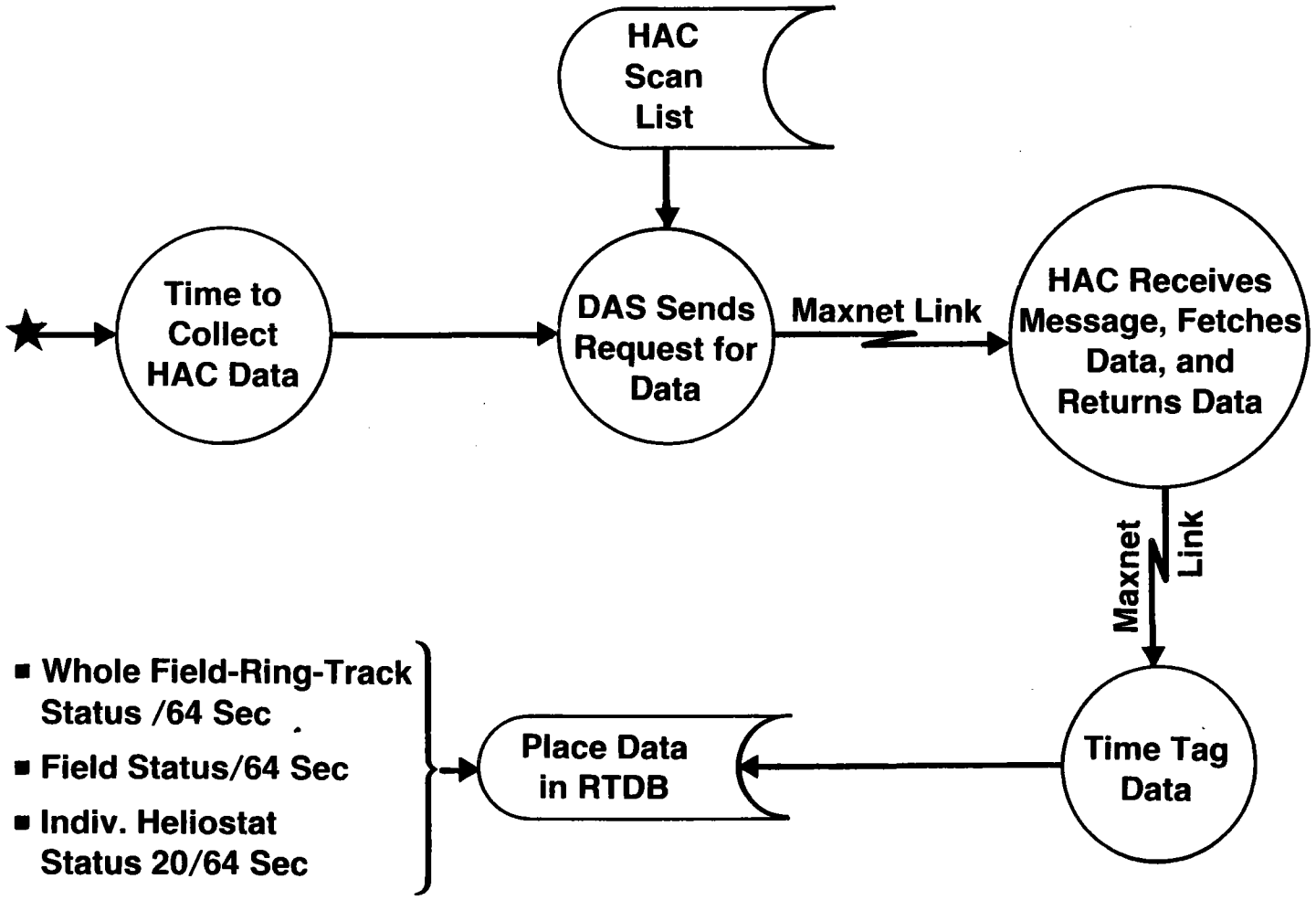
ON-LINE DATA ACQUISITION AND PROCESSING SYSTEM - DATA FLOW

VFC157N-1



HAC DATA COLLECTION

VFI947N



VFI948N

OCS DATA ACQUISITION

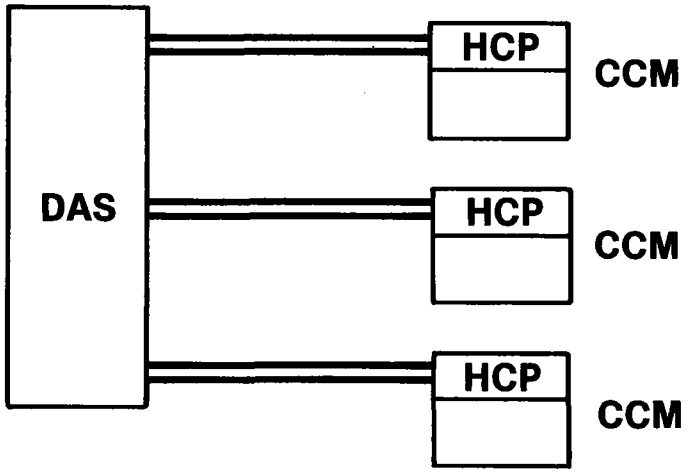
DAS Reads OCS Channel 1/Sec

Data Type;

1. **Status of OCS**
2. **Text Messages (80 Char (80 Character Max)**
3. **200 Parameters (in Scan List Order)**

SDPC DATA ACQUISITION

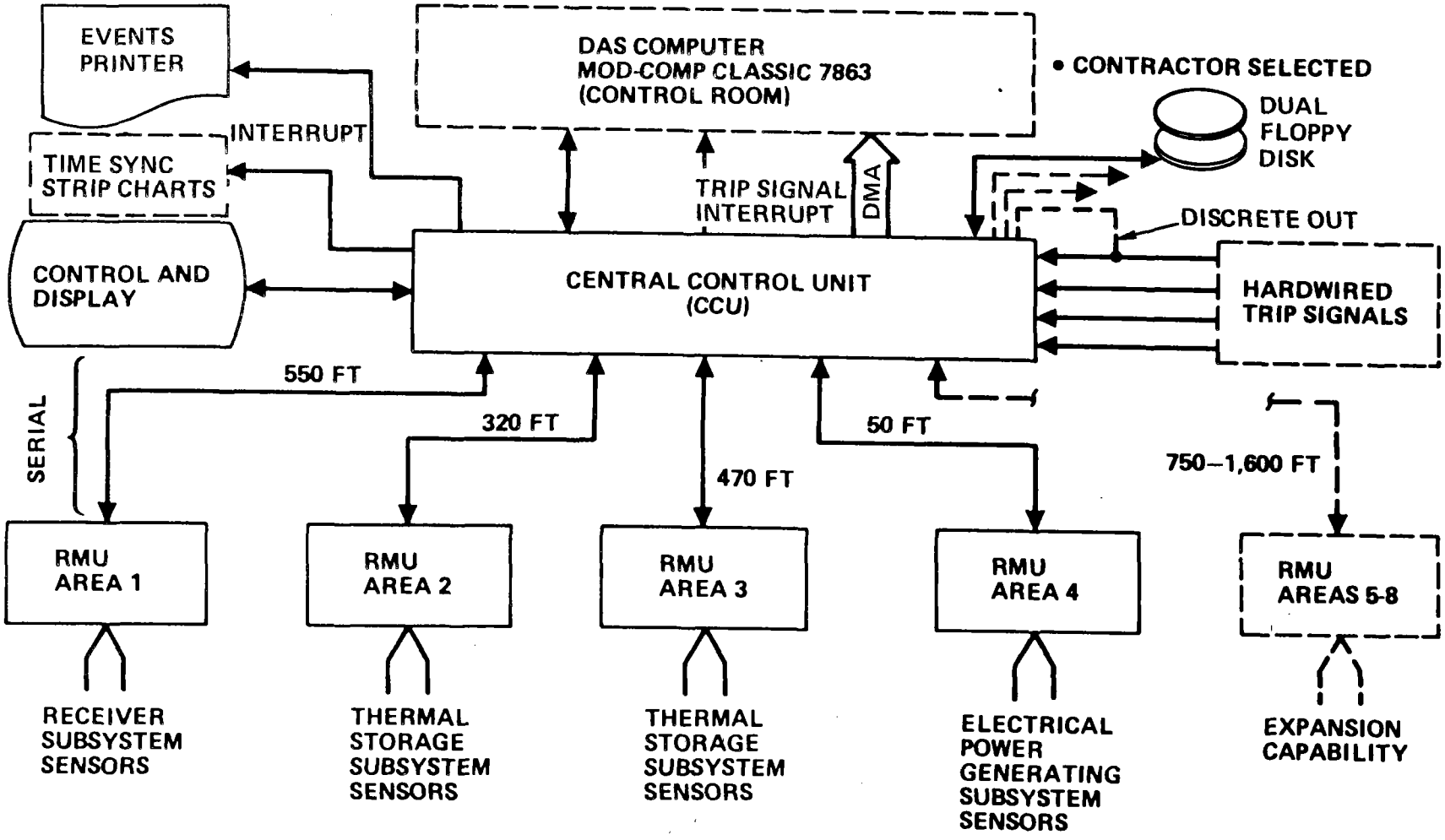
- SDPC Scan List — (200 to 500 Parameters)
- Frequency — Every Two Seconds or Slower



Max Size
768
× 3
2304 Loops

VFC733N

BLOCK DIAGRAM
DATA ACQUISITION REMOTE MULTIPLEXER SYSTEM



DAS BASELINE MEASUREMENTS

SENSORS	SUBSYSTEM			
	RECEIVER (RS) NO. 1 (BASIC)	THERMAL STORAGE (TSS) NO. 2 (BASIC)	THERMAL STORAGE (TSS) NO. 3 (BASIC)	ELEC PWR GEN (EPGS) NO. 4 (BASIC)
TEMPERATURE – TC	278	43	8	6
TEMPERATURE – RTD	27			
PRESSURE	14	24	9	14
VIBRATION				
FLOW	7	10	4	1
LINEAR POSITION	32			
VALVE POSITION	10	12	3	13
SPEED				1
ENTHALPY				2
STRAIN GAGE		10		
POWER			2	13
FLUX	1	3		
DISCRETES	2			64
TOTAL	371	102	26	114

TOTAL BASELINE: 613

VFI949N

DARMS — MAX. AS BUILT CAPACITY

RMU No. 1 (Receiver)	RMU No. 2 (TSS)	RMU No. 3 (TSS)	RMU No. 4 (EPGS)
381 A 12 D (1 Word (16-Bits))	207 A 12 D (1 Word (16-Bits))	49 A 12 D (1 Word (16-Bits))	67 A 72 D (6 Words (16-Bits))
405 Channels	219 Channels	61 Channels	139 Channels

Total = 704 Analogs
108 Discretes
812 Channels

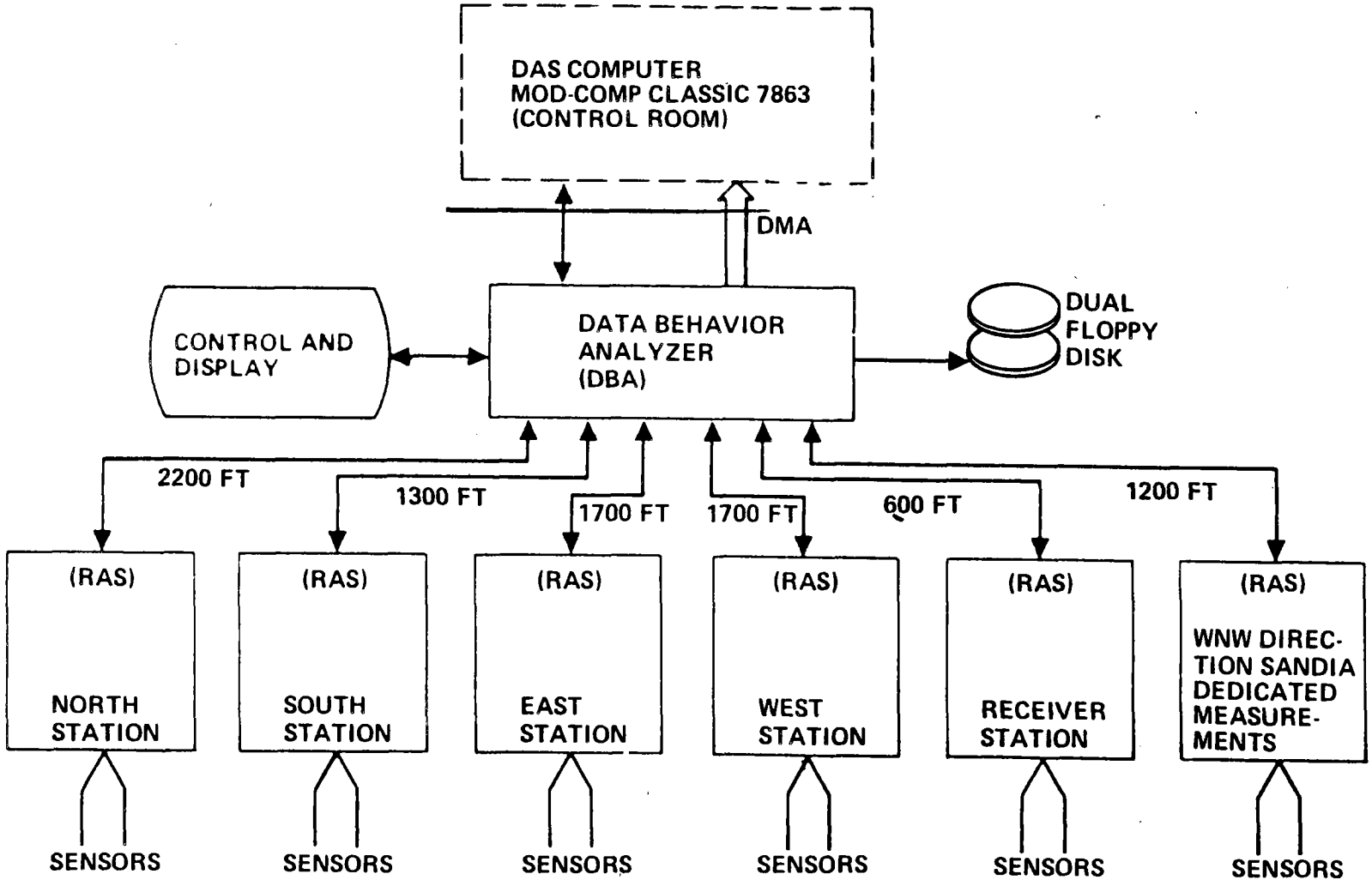
40 Channels Reserved for Self Test (Internal Voltages)

DARMS CHANNEL MEASUREMENT CAPACITY

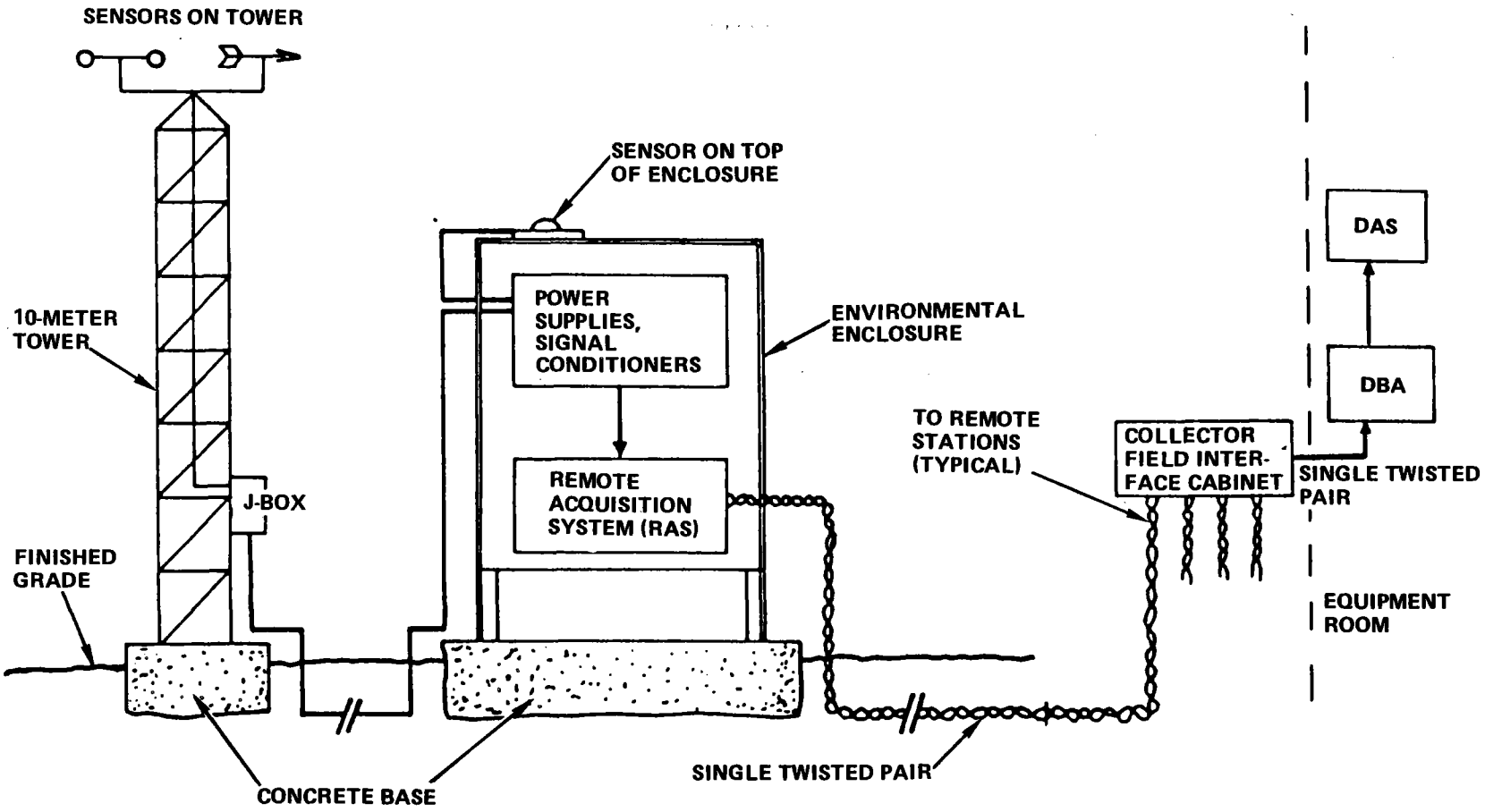
What	Freq/Sec	Number
Events Parameters	200 (5 ms)	10 Discrete words (120 Discretes) +15 Analogs
Strip Chart Parameters	40 (25 ms)	24
10 X Parameters	10	45
1 X Parameters	1	1307
Max Parameter Capacity		1401

SPECIAL HELIOSTAT INSTRUMENTATION AND METEOROLOGICAL MEASUREMENTS SYSTEM DIAGRAM

VFI953N



TYPICAL DATA ACQUISITION SYSTEM



SHIMMS — MAX. AS-BUILT CAPACITY

RAS No. 1 South Station	RAS No. 2 West Station	RAS No. 3 North Station	RAS No. 4 East Station	RAS No. 5 Receiver Tower	RAS No. 6 SANDIA
24 Analog Channels (8 for Internal Monitoring) 5 Discrete Channels (12 Signals/ Channel)	16 Analog Channels (8 for Internal Monitoring) (2 Spares)	16 Analog Channels (8 for Internal Monitoring)	16 Analog Channels (8 for Internal Monitoring) (2 Spares)	16 Analog Channels (8 for Internal Monitoring)	192 Analog Channels (16 for Internal Monitoring) (5 Spares)
29 Channels	16 Channels	16 Channels	16 Channels	16 Channels	192 Channels

Total = 280 Analogs
5 Discretes
285 Channels

DAS OUTPUTS

VFI957N

On-Line

a. Archived Data Stored on Magnetic Tape

b. CRT Displays (Real-Time or Playback)
   1. Colorgraphic Plots
   2. Tabular Displays

c. Software Driven Stripchart Displays (Real-Time or Playback)

d. CRT Hard Copy Outputs

e. Data Sent to MDAC-HB

f. Data Sent to OCS

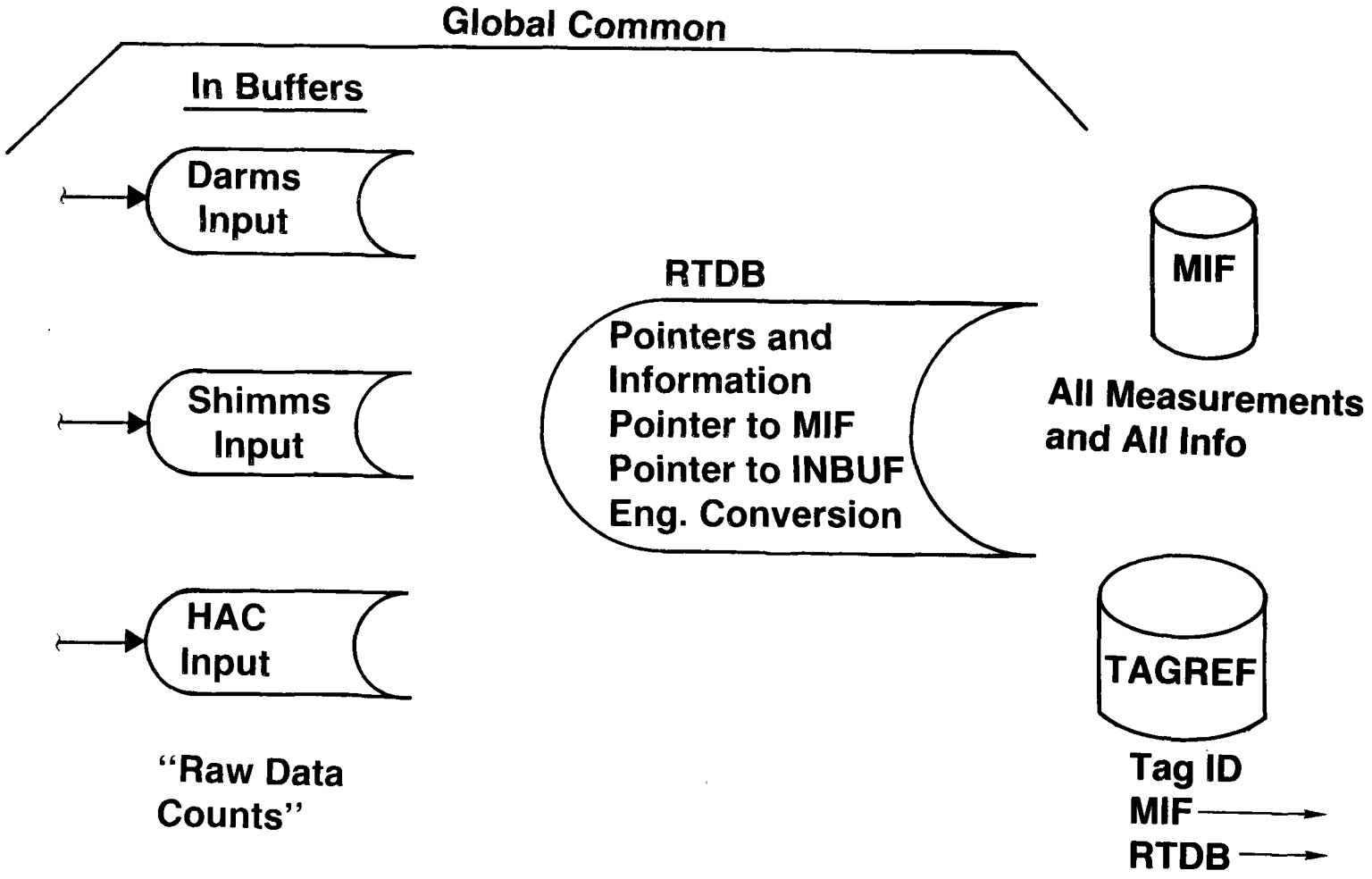
Off-Line

Down Load DARMS

Down Load SHIMMS

DAS REAL TIME DATA BASE

VFI958N



DATA ARCHIVING

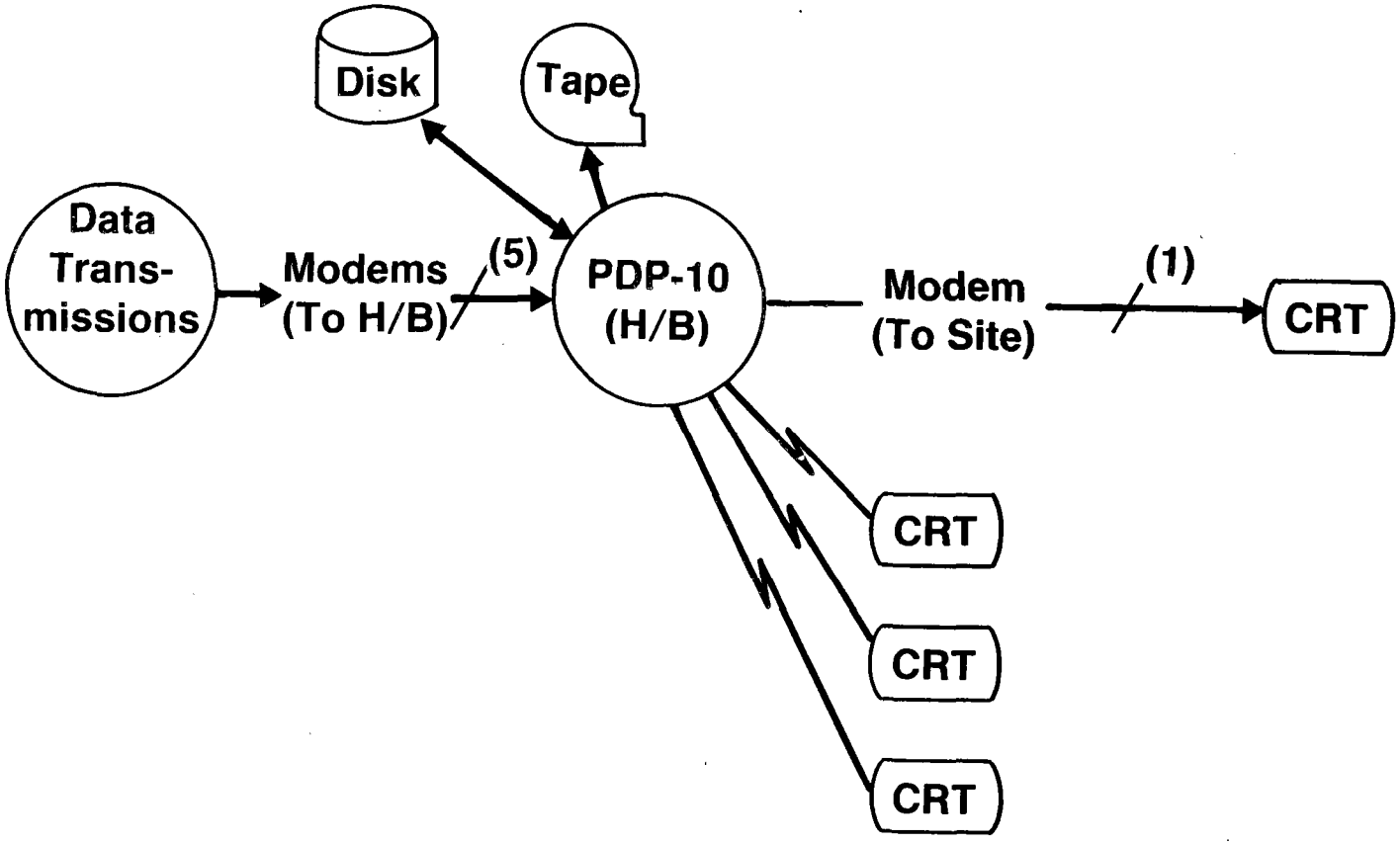
Pre Test

- Operator Selects Data Subgroups (DARMS, SHIMMS, SDPC HAC OCS) Also Frequency of Sampling

Real Time

- Input Buffers are Copied to Magnetic Tape Via Disk (Spooling) at Sampling Rate
- Operator Notified When Tape is Full

DATA TO MDAC-HB



DATA TO MDAC-HB

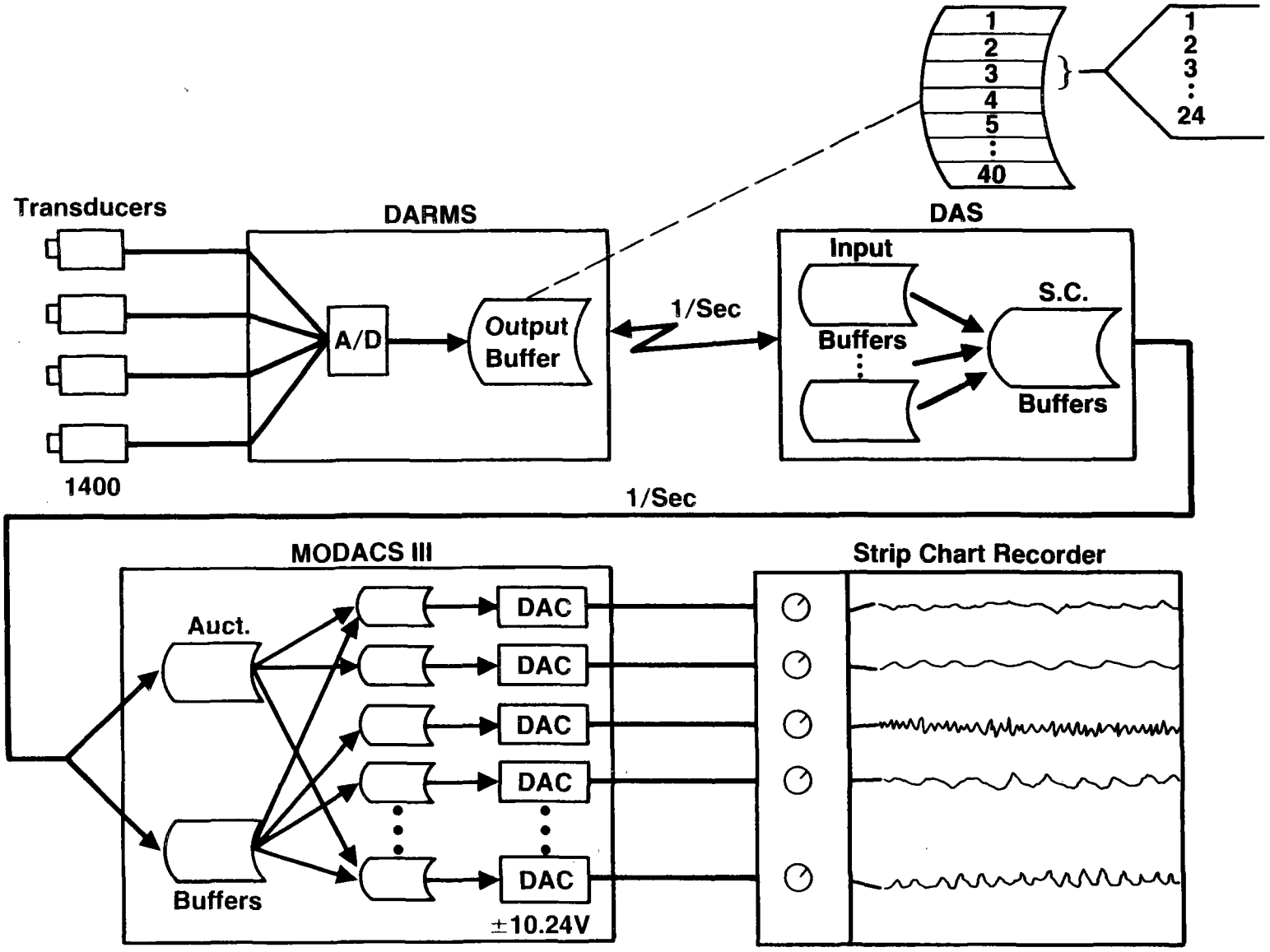
Pre Test

- Operator Selects Data Subgroups (DARMS, SHIMMS, SDPC, HAC, OCS) Also Frequency of Sampling
- Data Link Status

Real Time

- Input Buffers are Copied and Sent to MDAC Via Modems
- Status of Lines and PDP-10 is Monitored

STRIP CHARTS



DAS CRT'S

- Plot Menu (20 Selections)
- 4 Parameters/Plot
- Scales Selected Pre Test
- Once Selected, Plot Starts, History Not Available When Plot Called
- Limited On-Line Editing
- Major Editing Off-Line
- Hard Copy Available

- Same as B/W
- Can Have Hard Copy

- Tab Menu (15 Selection)
- Two Types, Static and Scrollable
- Static Has 48 Parameters
- Scrollable Has 5 Parameters
- Limited On-Line Editing
- Can Edit Everything Off-Line
- "Freeze" Available on Fixed Tab. only
- Line Printer Copy of What is on Screen

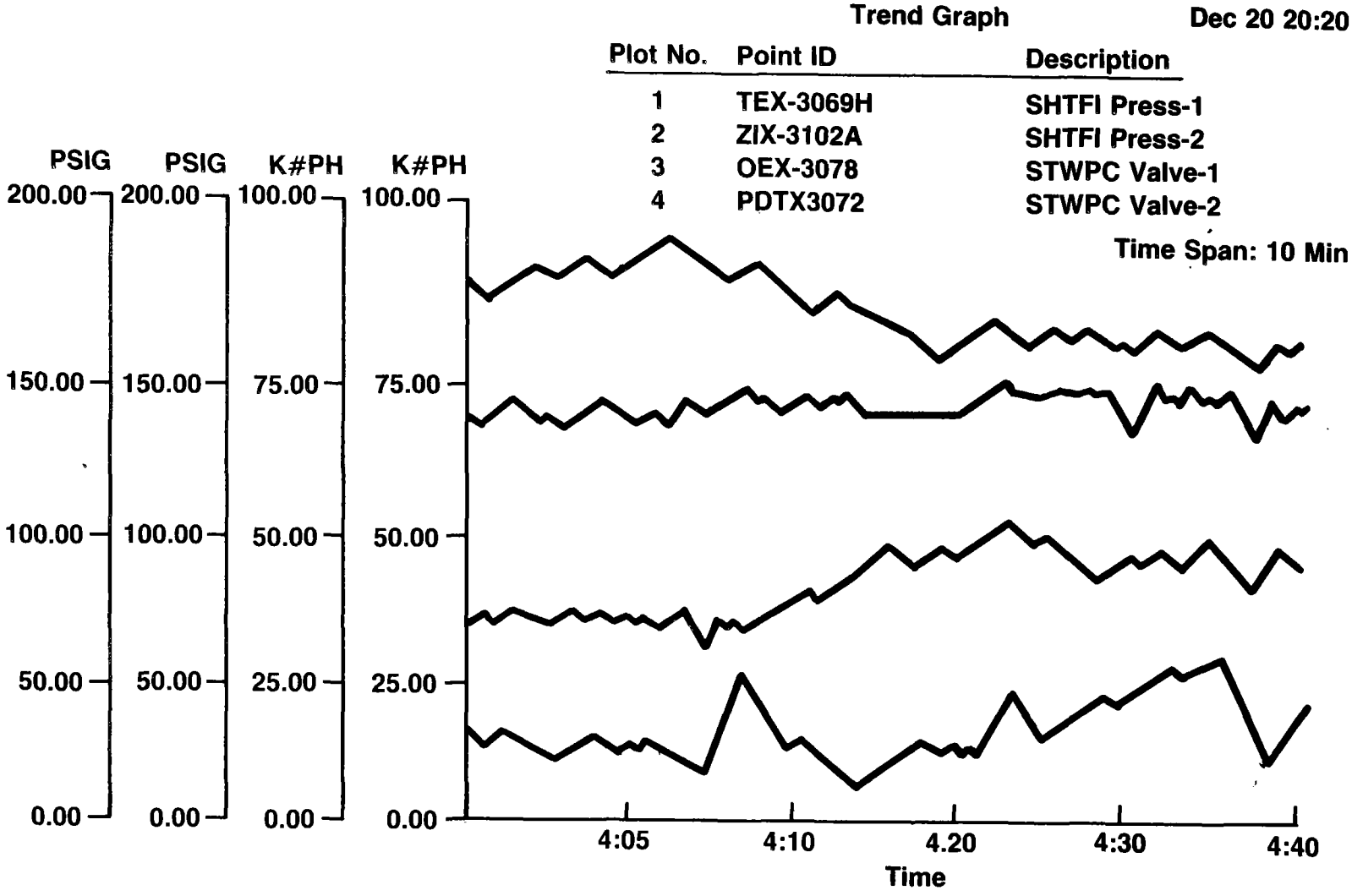
PLOT MENU

Plot Number	Plot Name
1	Turbine Group
2	TSS Set
3	Receiver Temps
4	Downcommer Press
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	Cooling Tower Temps
19	Operator Defined
20	Operator Defined

TABULAR LIST MENU

Tab List No.	Tab List Name
1	Receiver Temps
2	Down Comer Temp
3	Receiver Pressures — Inlet
4	Receiver Pressures — Outlet
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	Operator Optional

SAMPLE PLOT DISPLAY



SCROLLABLE TAB LIST

Date_____

Tab List No._____ Tab List Name_____

Time	Tag ID	Tag ID	Tag ID	Tag ID	Tag ID
HH:MM:SS	1600.3 DEG F	950.4 PSIG	1605 DEG F	1203 RPM	1346 GPM
HH:MM:SS	1601.2 DEG F	950.2 PSIG	1608 DEG F	1200 RPM	1355 GPM
HH:MM:SS	1605.3 DEG F	988.5 PSIG	1610 DEG F	1197 RPM	1360 GPM
•	•	•	•	•	•
•	•	•	•	•	•
•	•	•	•	•	•
•	•	•	•	•	•
HH:MM:SS	1650.9 DEGF	1033.2 PSIG	1650 DEGF	1120 RPM	1393 GPM

Reserved for System Messages

FIXED TABULAR CRT DISPLAY

48 CHANNELS — UPDATE EVERY 5 SEC.

VFJ089N

11:45:16 EXAMPLE OF TAB LISTING FOR MAXIMUM 2/13/81

	TAGID	VALUE		TAGID	VALUE		TAGID	VALUE	
1	FLOWZ001	1000.6	GPM	FLOWZ002	2000.7	GPM	FLOWZ003	3000.8	GPM
2	FLOWZ001	1000.6	GPM	FLOWZ002	2000.7	GPM	FLOWZ003	3000.8	GPM
3	FLOWZ001	1000.6	GPM	FLOWZ002	2000.7	GPM	FLOWZ003	3000.8	GPM
4	FLOWZ001	1000.6	GPM	FLOWZ002	2000.7	GPM	FLOWZ003	3000.8	GPM
5	FLOWZ001	1000.6	GPM	FLOWZ002	2000.7	GPM	FLOWZ003	3000.8	GPM
6	FLOWZ001	1000.6	GPM	FLOWZ002	2000.7	GPM	FLOWZ003	3000.8	GPM
7	FLOWZ001	1000.6	GPM	FLOWZ002	2000.7	GPM	FLOWZ003	3000.8	GPM
8	FLOWZ001	1000.6	GPM	FLOWZ002	2000.7	GPM	FLOWZ003	3000.8	GPM
9	FLOWZ001	1000.6	GPM	FLOWZ002	2000.7	GPM	FLOWZ003	3000.8	GPM
10	FLOWZ001	1000.6	GPM	FLOWZ002	2000.7	GPM	FLOWZ003	3000.8	GPM
11	FLOWZ001	1000.6	GPM	FLOWZ002	2000.7	GPM	FLOWZ003	3000.8	GPM
12	FLOWZ001	1000.6	GPM	FLOWZ002	2000.7	GPM	FLOWZ003	3000.8	GPM
13	FLOWZ001	1000.6	GPM	FLOWZ002	2000.7	GPM	FLOWZ003	3000.8	GPM
14	FLOWZ001	1000.6	GPM	FLOWZ002	2000.7	GPM	FLOWZ003	3000.8	GPM
15	FLOWZ001	1000.6	GPM	FLOWZ002	2000.7	GPM	FLOWZ003	3000.8	GPM
16	FLOWZ001	1000.6	GPM	FLOWZ002	2000.7	GPM	FLOWZ003	3000.8	GPM

$$

OCS DATA — METHOD

BCS

- Fixed List of Parameters 1/Sec Collect and Send

OCS

- OCS Sends Request Message with Indices
- DAS Collects Out of Data Base (Using Indices) and Sends to OCS (Raw Counts)
- OCS Must Convert to Real Floating Point Eng. Values with Units

VFJ029N

SEND DATA TO OCS

1. BCS Required Data Weather, Insolation (1/Sec)

2. OCS Required Data for Control, Monitor and/or CRT Display (On Request)

3. DAS Status (When Required)

4. Text String Messages for OCS Operator (When Required)

DATA PLAYBACK

- User Selects Time Bracket
- User Select/Revise
  - — CRT Parameter Assignments
  - — Plot Parameter Assignments
  - — Strip Chart Parameter Assignments
- Begin Replay

Note — If it Wasn't Recorded on Tape, it Can't be Looked at Again

VFJ090N

DAS INITIALIZATION (INPUTS)

- MIF — (Master Information File)

- HAC Request Messages — (What Data is Needed)

- DARMS

Events List	25 Max.
Strip Chart List	24 Max.
10 x Parameters List	45 Max.
1 x Parameters List	1307 Max.
	1401 Total

DAS INITIALIZATION (INPUTS)

SHIMMS

- Scan List (All 1/Sec)
  285 Channels

OCS

- Scan List (200 Channels Max)

DAS INITIALIZATION (OUTPUTS)

Archiving

- Select What Subgroups and Frequency
- Change, Log, Store Tapes

MDAC-HB

- Select What Subgroups and Frequency

OCS

- Responds to OCS Requests Only
  (No Operator Action Needed)

DAS INITIALIZATION — OUTPUTS

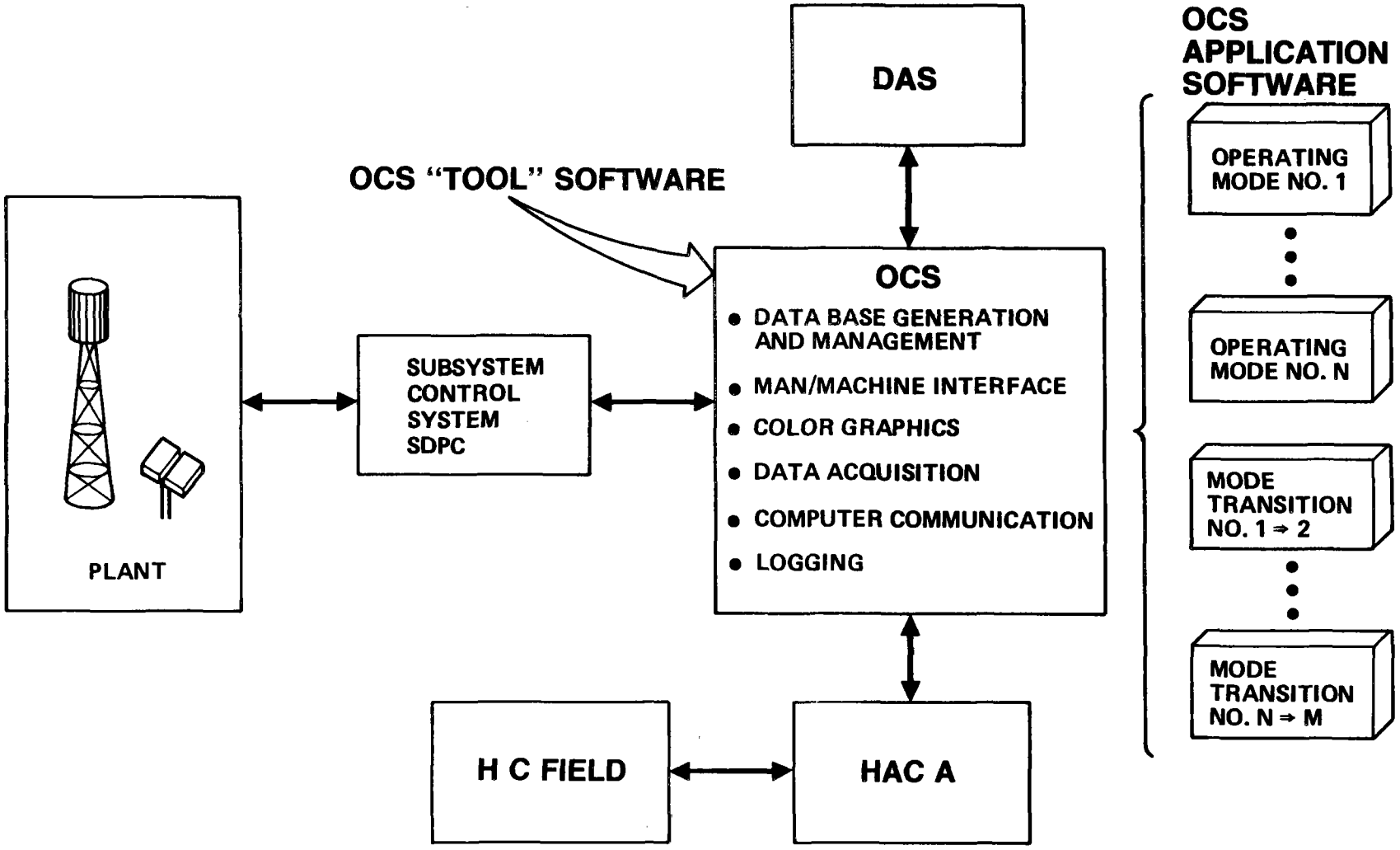
CRT's

- Plots (20, 4 Parameters Each)
- Tabs (15, Static-48, Scrollable-5)

Strip Charts

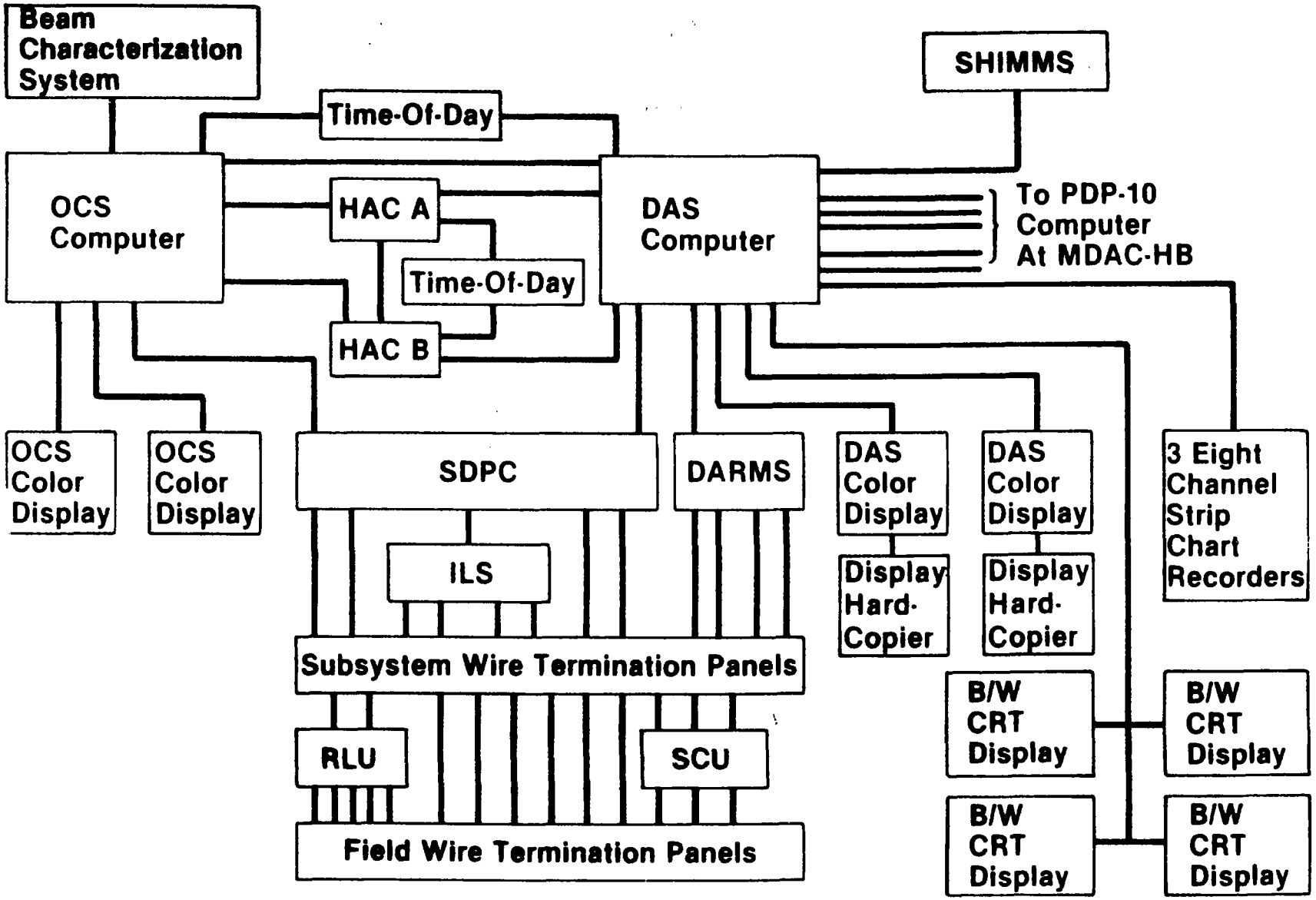
- Assign 24 Channels
- Calibrate All Channels — Manual Operator Interactive

REQUIREMENTS — TWO TYPES

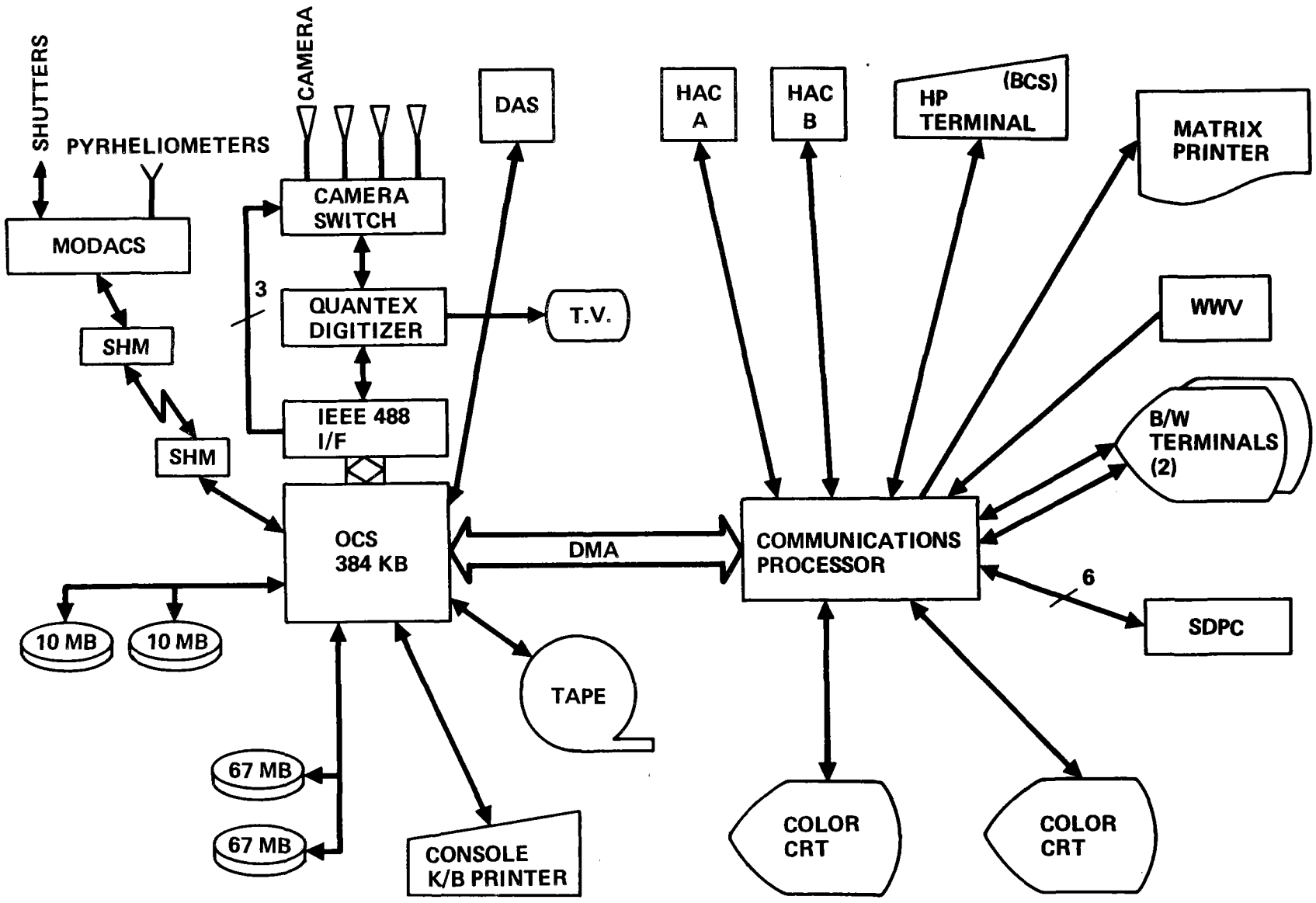


BASELINE CONTROL/MONITOR AND EVALUATION ARCHITECTURE

VFI775N



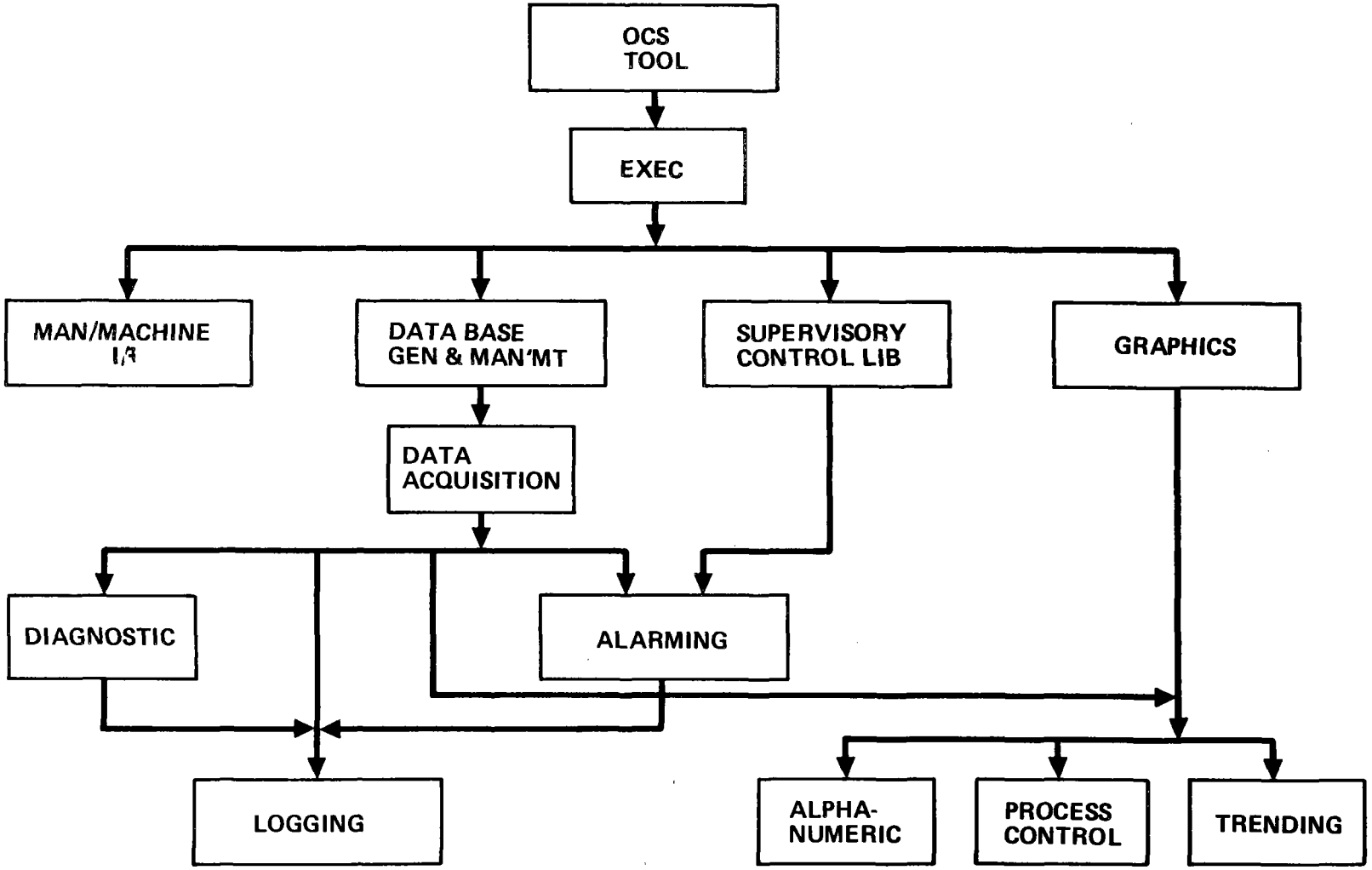
OCS (ON SITE) CONFIGURATION



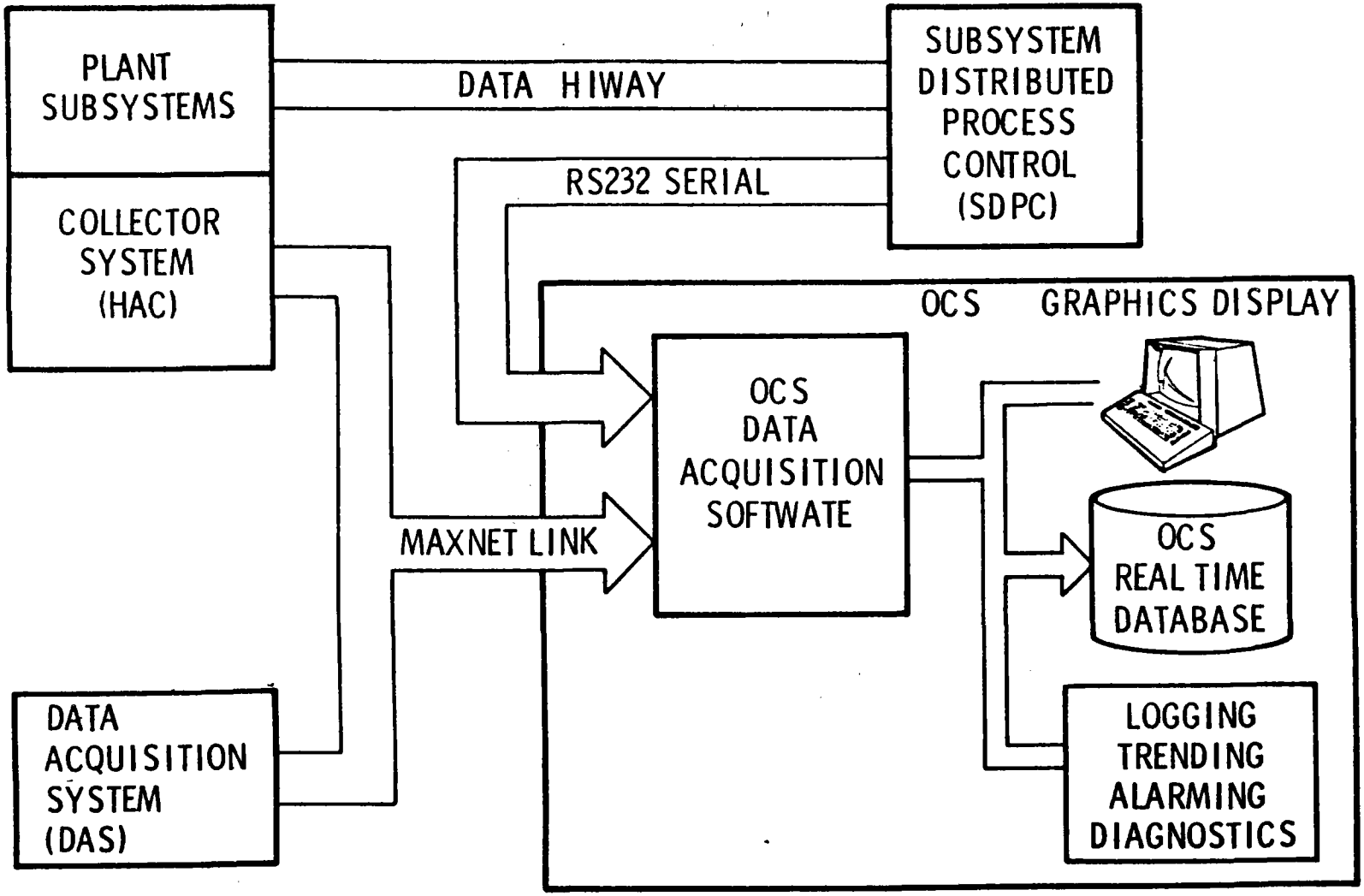
MAJOR ELEMENTS OF THE OCS 'TOOL' SOFTWARE

- DATA BASE GENERATION AND MANAGEMENT
- DATA ACQUISITION
- COMPUTER TO COMPUTER COMMUNICATIONS (INTERFACE SOFTWARE)
- EXECUTIVE
- MAN MACHINE INTERFACE
- PLANT GRAPHICS
- POWER FAILURE RECOVERY
- DIAGNOSTICS
- LOGGING
- ALARM PROCESSING
- TREND PROCESSING
- SUPERVISORY CONTROL SUBROUNTINES

OCS "TOOL" SOFTWARE HIERARCHY



OCS DATA ACQUISITION



OCS DATA ACQUISITION

- COLLECT ANALOG DATA FROM SDPC
- COLLECT DISCRETE DATA FROM SDPC
- COLLECT DATA MESSAGES FROM CS (HAC)
- COLLECTION TO BE DONE ACCORDING TO COLLECTION SCHEDULE (SCAN TABLE)
- NEW DATA GOES TO DATA BASE

COMPUTER TO COMPUTER COMMUNICATION

- CONVERTS AND DISTRIBUTES INCOMING DATA MESSAGES TO THE OCS DATA BASE

  INPUT DATA TYPES
  - ANALOG
  - DIGITAL
  - ASC II
  - DISCRETES
- FORMULATES AND ISSUES OUTPUT REQUESTS TO OBTAIN DATA OR PERFORM CONTROL FUNCTIONS
- THIS SOFTWARE SETS UP AND DECODES THE BASIC INTERFACE MESSAGES PROCESSED BY THE OCS
- PROVIDES STATUS OF EXTERNAL INTERFACES TO OCS OPERATOR

EXECUTIVE

- SCHEDULES CPU CONTROL AND OVERALL SYSTEM RESOURCE ALLOCATION ON A PRIORITY BASIS
- CONTROLS THE INTERFACE OF ALL OCS PROGRAMS WITH THE MODCOMP MAX IV OPERATING SYSTEM
- PERFORMS OCS DATA BASE AND DATA FILE INITIALIZATION
- SCHEDULES EXECUTION OF REAL-TIME OCS SOFTWARE DESIGNATED TO RUN ON A PERIODIC BASIS
- PERFORMS 'TIME' PROCESSING
- PERFORMS THOSE FUNCTIONS RELATED TO SYSTEMATIC TERMINATION OF REAL TIME OCS PROCESSING ACTIVITIES

MAN/MACHINE INTERFACE

- THE M/M I/F SHALL PROVIDE THE OPERATOR THE MEANS TO MONITOR AND CONTROL THE PLANT

- I/F DEVICES
  - COLOR CRTS
  - ALPHA NUMERIC KEYBOARDS
  - AUDIO ANNUNCIATORS
  - SPECIAL FUNCTION KEYS
  - DATA LOGGERS
  - CRT HARD COPY

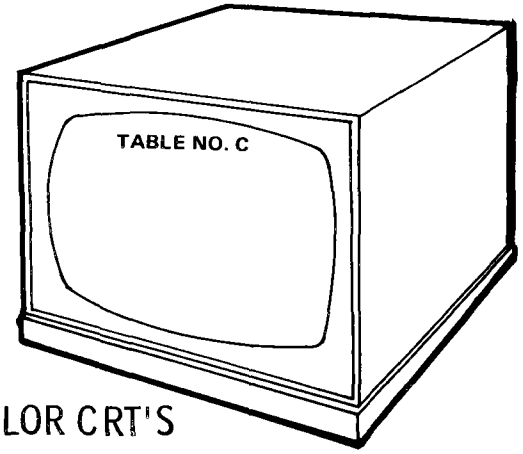
- THE MAN/MACHINE INTERFACE SHALL SUPPORT THE FOLLOWING
  - OPERATOR INPUT OF CONTROL COMMANDS
  - STATUS REQUESTS AND RESPONSES
  - DISPLAY FORMAT SELECTION
  - ALARM ANNUNCIATION AND ACKNOWLEDGEMENT

- OPERATOR INPUTS SHALL BE VALIDATED AND DIAGNOSTIC RESPONSES SHALL BE PROVIDED WHEN AN INVALID INPUT IS DETECTED

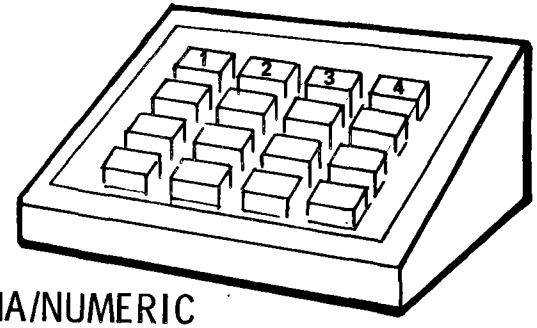
- COLOR CODING AND BLINKING SHALL BE USED ON THE DISPLAYS AS AN AID IN OPERATOR COMMUNICATION

VFA206N

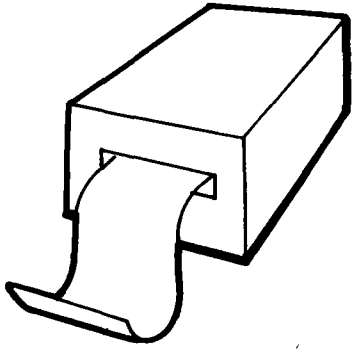
MAN/MACHINE INTERFACE



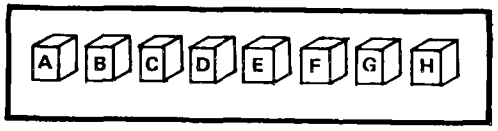
COLOR CRT'S



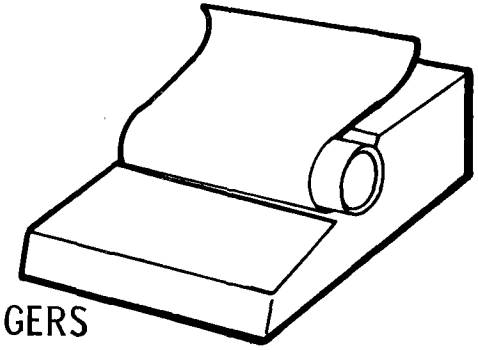
ALPHA/NUMERIC
KEYBOARDS



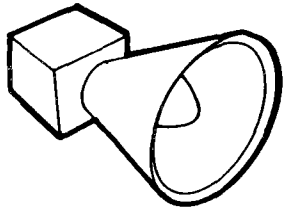
CRT HARD
COPY DEVICE



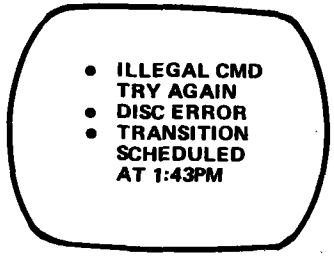
SPECIAL FUNCTION KEYS
(WITH BACK LIGHTS)



DATA LOGGERS



AUDIO
ANNUNCIATORS (ALARMS)



MESSAGES/PROMPTS, ERRORS

GRAPHICS

- ALPHA NUMERIC DISPLAYS
- PROCESS CONTROL GRAPHICS
- TRENDING PLOTS

GRAPHICS DEFINITION

VFA209N

- DISPLAYS WILL BE COLOR CRT'S
- TWO DISPLAYS WILL BE DEDICATED TO OCS
- THE DISPLAYS WILL BE INDEPENDENT
- OCS SHALL PROVIDE FOR 50 FIXED FORMAT DISPLAYS
- DISPLAYS SHALL TAKE ONE OF THE FOLLOWING FORMS:
    1. ALPHA/NUMERIC TABULAR DISPLAYS
    2. PIPING SCHEMATICS
    3. BAR CHARTS
    4. X/Y PLOTS
    5. ONE LINE ELECTRICAL DIAGRAMS
- LIVE DATA FIELDS OR SYMBOLS SHALL DYNAMICALLY CHANGE TO REPRESENT CURRENT PARAMETER CONDITIONS AT SELECTED FREQUENCIES

COLOR GRAPHICS BY US GRAPHICS

"REACT" SYSTEM - DESIGNED FOR ISC TERMINALS

FIRMWARE

GRAPHICS EDITOR

HOST COMMUNICATIONS I/F

USE

- USING GRAPHIC EDITOR, BASIC DISPLAY CAN BE BUILT ON LINE IN FRONT OF TUBE.

- SYMBOLS CAN BE CREATED AND STORED.

POWER FAILURE RECOVERY

POWER FAILURE = MODCOMP AUTOMATIC SHUT DOWN

MATRIX PRINTER FAILURE = OUTPUT REASSIGNED TO DAS LINE PRINTER

DIAGNOSTICS (SYSTEM ENGINEER — NOT OPERATOR)

SYSTEM

- WHAT TASKS ARE ACTIVE? PENDING?
- PERIPHERAL DEVICE ERRORS
- FILE MANAGEMENT
  - FILES CAPACITY REMAINING?
  - FILE PROTECTION KEYS?

DATA COLLECTION (FOR DISC STORAGE) (MIN STORAGE AVAILABLE)

- OPERATOR/PLANT ENGINEER INPUTS
- ALL PLANT INPUT DATA
- ALL OCS COMMANDS TO SDPC
- ALL CPU-CPU MESSAGES
- SPECIAL APPLICATION PROGRAM DATA

REPORTS

- USE UTILITY TYPE REPORT GENERATION S/W OR FORMATS DEVELOPED FOR LOGGING

LOGGING (REAL TIME)

ALL OPERATOR COMMANDS

STATUS MESSAGES - OCS OR PERIPHERAL

ALL ALARMS

EVENTS DETECTED BY APPLICATIONS PROGRAMS

ALARMING

- OCS SHALL HAVE CAPABILITY TO DETECT, DISPLAY, GENERATE AUDIBLE ALARM, ACKNOWLEDGE AND LOG EVENTS/PARAMETERS THAT CROSS PREDEFINED ALARM LIMITS
- REAL PLANT DATA (ANALOGS/DISCRETES) OR CALCULATED PARAMETERS
- ALARM WHEN DEVICES FAIL TO OPERATE
- ALARM WHEN SYSTEM DEVICES FAIL (LINE PRINTER, ETC)
- ALARM WHEN RATE OF CHANGE PARAMETER EXCEEDED
- ALL ALARMS SENT TO LOGGING DEVICE FOR PERMANENT RECORD
- ALL ALARMS ADDED TO ALARM SUMMARY (SEEN ON GRAPHICS). COLOR SHALL INDICATE STATUS

TRENDING

- OCS SHALL PROVIDE TRENDING CAPABILITY (STORE, RECALL, DISPLAY HISTORY PARAMETERS)
  - 100 PARAMETERS (SELECTABLE)
  - 3, 6, 12 AND 24 HOUR HISTORY PRESENTATION (SELECTABLE BY OPERATOR)
  - MAXIMUM OF 3 PARAMETERS ON ONE DISPLAY

APPLICATION SOFTWARE

- SUPERVISORY CONTROL SOFTWARE DEFINED FOR OCS SHALL PROVIDE FOR
  1. 5 MODES
  2. 8 TRIPS
  3. 12 TRANSITIONS
  4. SPECIAL LOGS
- OPTIONAL SOFTWARE
  - COORDINATED CONTROL
  - CLEAR DAY CONTROL

SUPERVISORY CONTROL LIBRARY (EXAMPLES)

- GET PROCESS MEASUREMENT (FROM DATA BASE)
  CALL MEASURE (AP106, RETURN ADD)

- SET A SET POINT (ON A REMOTE CONTROLLER IN FIELD)
  CALL SETPT (CL136, %)

APPLICATION PROGRAMS WILL USE THESE SPECIAL SUBROUTINES FOR INTERFACING WITH THE DATA BASE AND THE PLANT. OTHERWISE STANDARD FORTRAN WILL BE USED

SUPERVISORY CONTROL LIBRARY

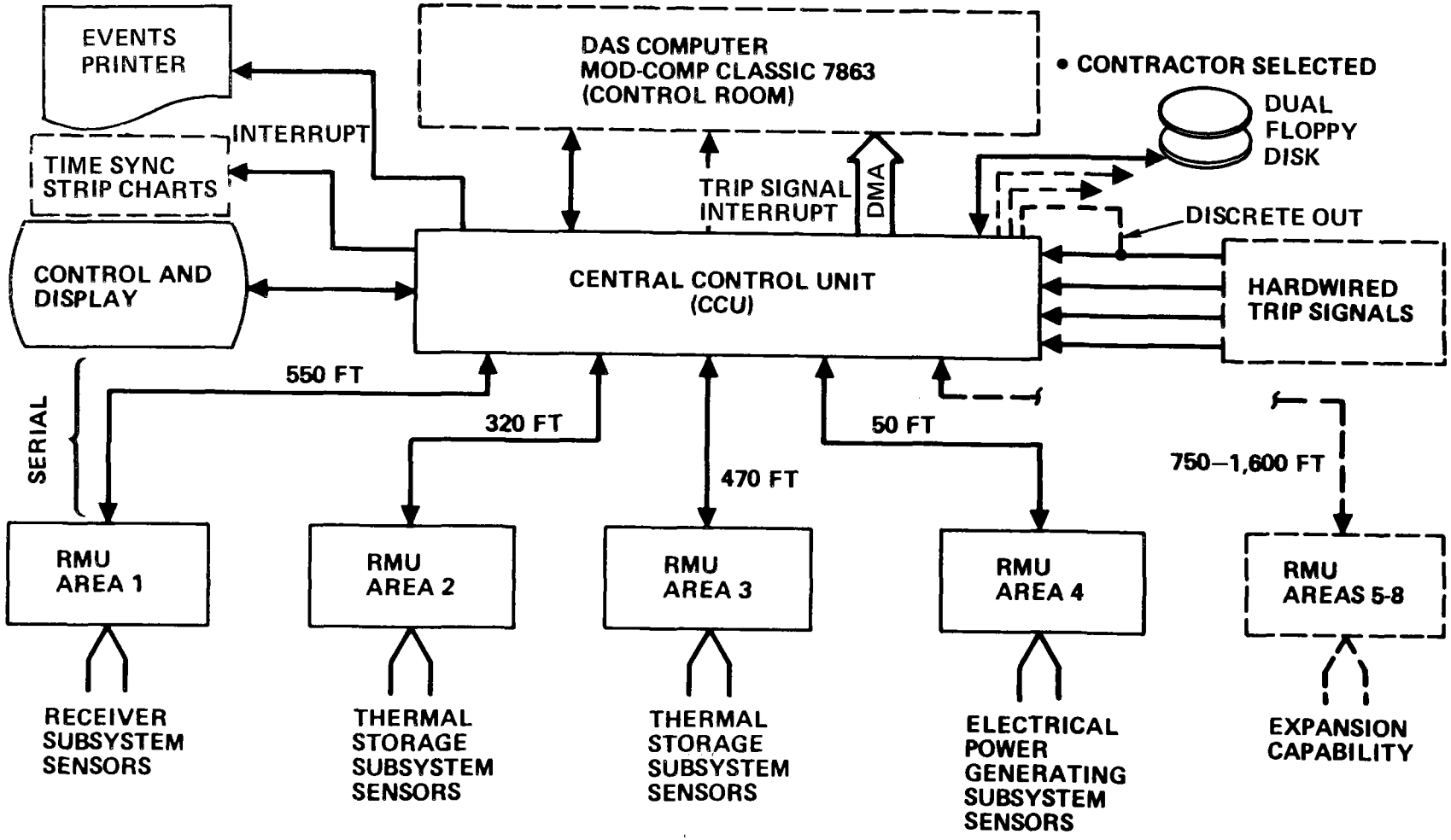
- ≈ TEN GENERAL PURPOSE SUBROUTINES

GAIN	SET/CHANGE	CONTROLLER RELATED "MODE TRANSFER"
LIMITS	SET/CHANGE	
DEAD BAND	SET/CHANGE	
SET POINTS	SET/CHANGE	
WAIT		
GET (FROM DATA BASE)		
BINARY COMMANDS (TURN ON/OFF)		
SEND (ANALOG)		
WRITE, DISPLAY, PRINT		

- APPLICATION PROGRAMS WILL USE THESE SUBROUTINES AND STANDARD FORTRAN

VFC733N

BLOCK DIAGRAM
DATA ACQUISITION REMOTE MULTIPLEXER SYSTEM



DARMS REQUIREMENTS

	As Built Capability
■ Measurements	
• 613 Expandable to 1226	812
• RMS 1 (Receiver) 369A, 2D	381A, 12D
• RMU 2 (Thermal Storage) 102A, 0D	207A, 12D
• RMU 3 (Thermal Storage) 26A, 0D	49A, 12D
• RMU 4 (IPGS) 50A, 64D	67A, 72D
• Expandable to 8 RMU's	Maximum 1307 Channel
• Operable to 1600 Feet Between RMUand CCU	

VFC734N

DAS BASELINE MEASUREMENTS

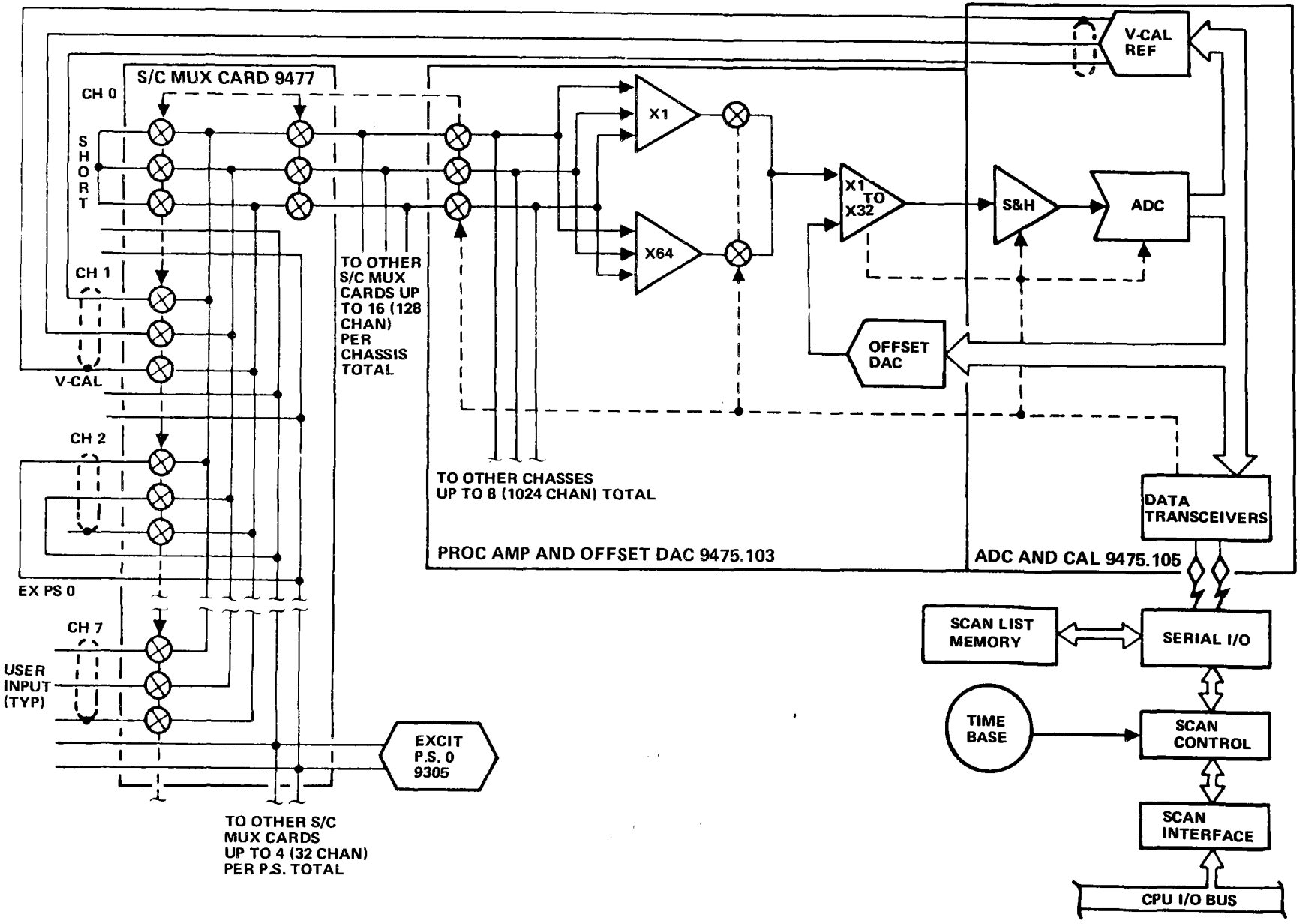
SENSORS	SUBSYSTEM			
	RECEIVER (RS) NO. 1 (BASIC)	THERMAL STORAGE (TSS) NO. 2 (BASIC)	THERMAL STORAGE (TSS) NO. 3 (BASIC)	ELEC PWR GEN (EPGS) NO. 4 (BASIC)
TEMPERATURE – TC	278	43	8	6
TEMPERATURE – RTD	27			
PRESSURE	14	24	9	14
VIBRATION				
FLOW	7	10	4	1
LINEAR POSITION	32			
VALVE POSITION	10	12	3	13
SPEED				1
ENTHALPY				2
STRAIN GAGE		10		
POWER			2	13
FLUX	1	3		
DISCRETES	2			64
TOTAL	371	102	26	114

TOTAL BASELINE: 613

DARMS REQUIREMENTS (CONT)

- Signal Conditioning
- Calibration
- Excitation
- Local Monitor and Control
- Limit Checking
- Monitor Access to Conditioned Signals
- Trip Signal Monitoring
- Event Recording

BLOCK DIAGRAM ANALOG INPUT SYSTEM VFJ120N



EVENT PRINTOUT FORMAT

First Message: Trip Occurred At: HH:MM:SS.MM

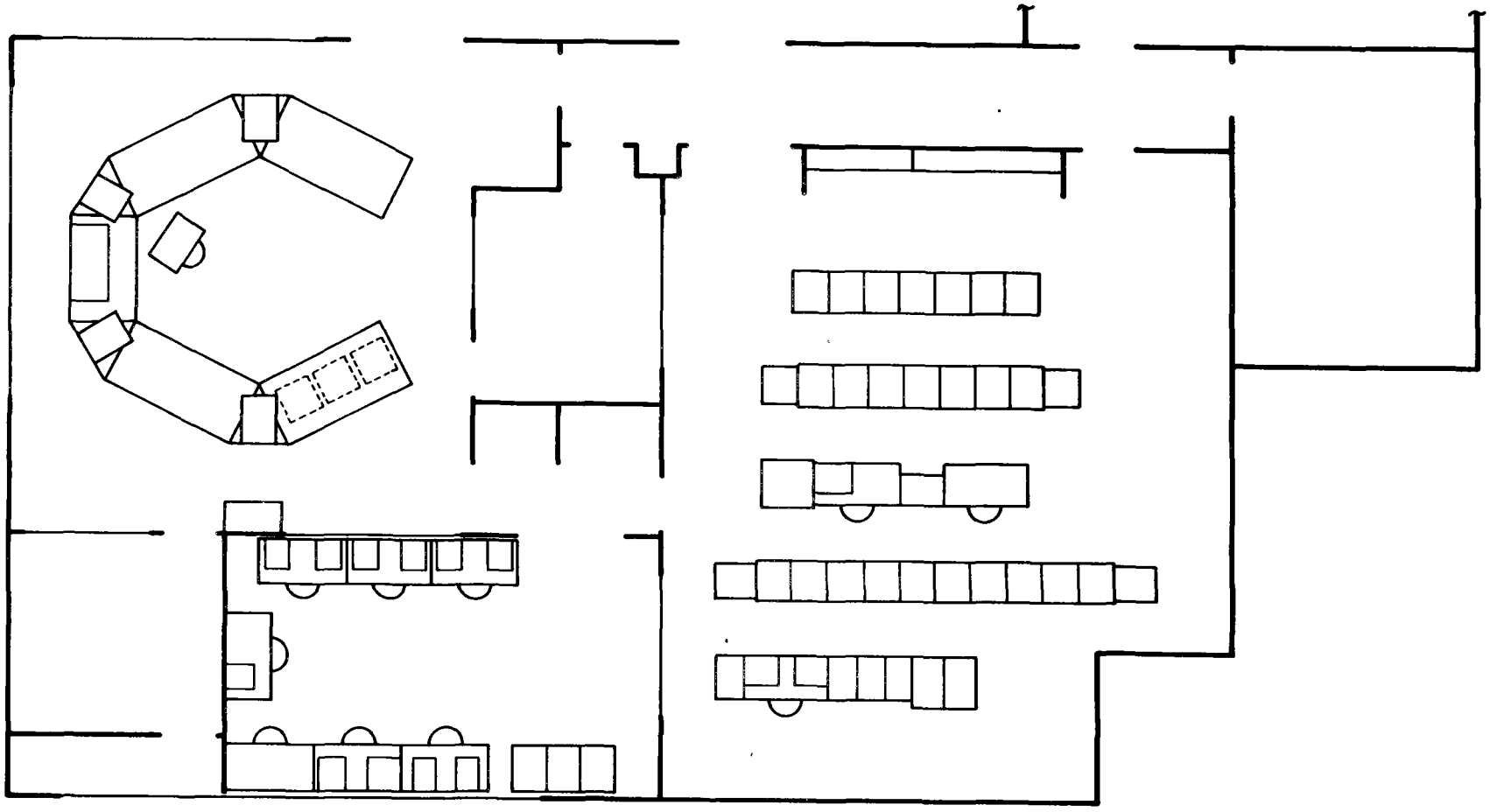
```
  CHAN CCCC          CHAN DDDD
010101010101       101010101010        . . . (12 Per Line)
Analog Channel Values:
CCCC   XXXXXX     DDDD   XXXXXX       . . . (8 Per Line)
MMMM   XXXXXX     NNNN   XXXXXX       . . .
```

Subsequent Messages:

```
Event Occurred At:   HH:MM:SS.MMM
CHANNEL CCCC BIT AA WENT ON
CHANNEL DDDD BIT BB WENT OFF
    •
    •
  CHAN CCCC          CHAN DDDD
010101010101       101010101010        . . . (12 Per Line)
Analog Channel Values:
CCCC   XXXXXX     DDDD   XXXXXX       . . .
MMMM   XXXXXX     NNNN   XXXXXX       . . .
```

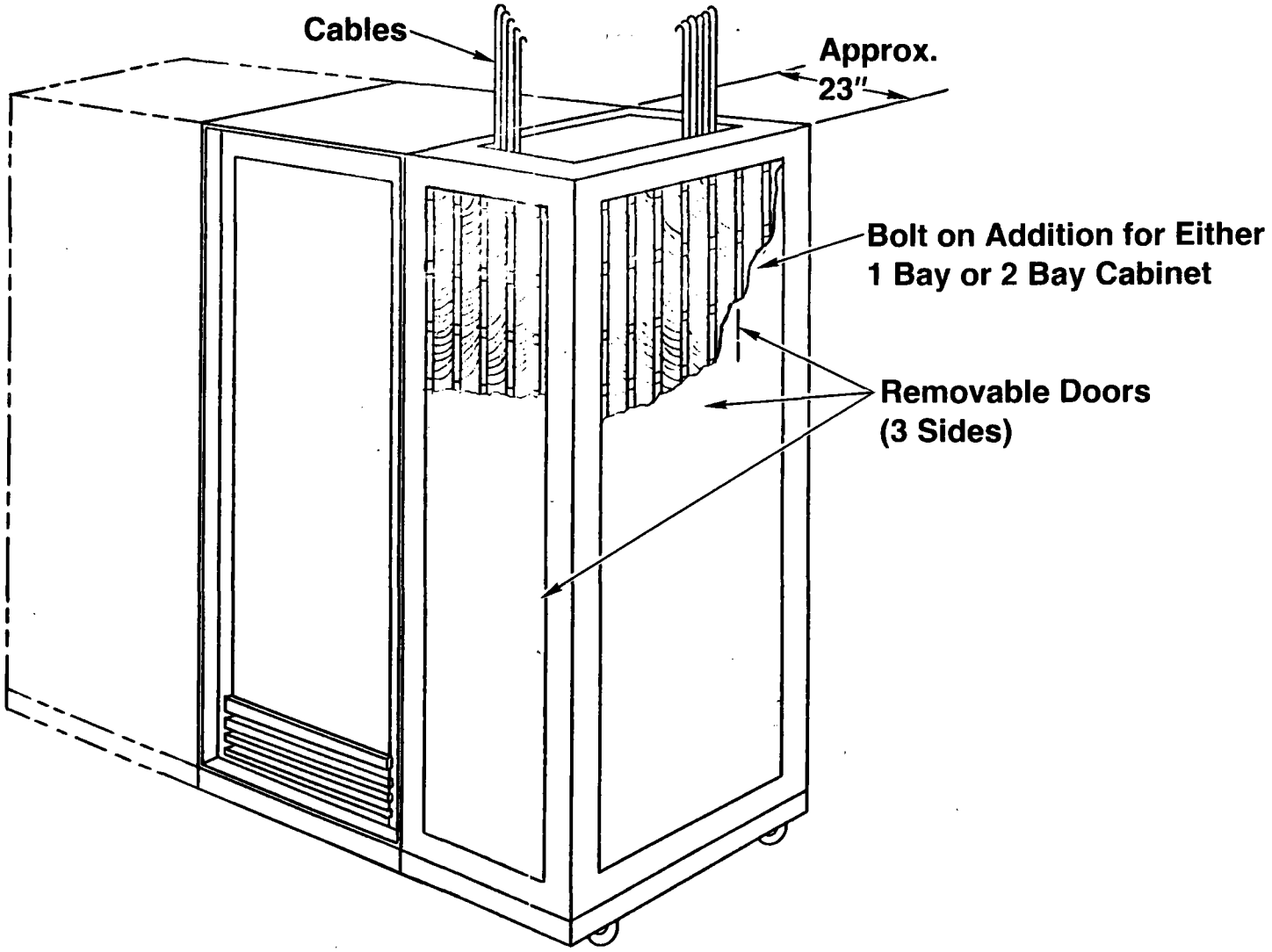
CONTROL BUILDING — SECOND FLOOR

VFI884N-1



VFJ122N

REMOTE RMU — TYPICAL



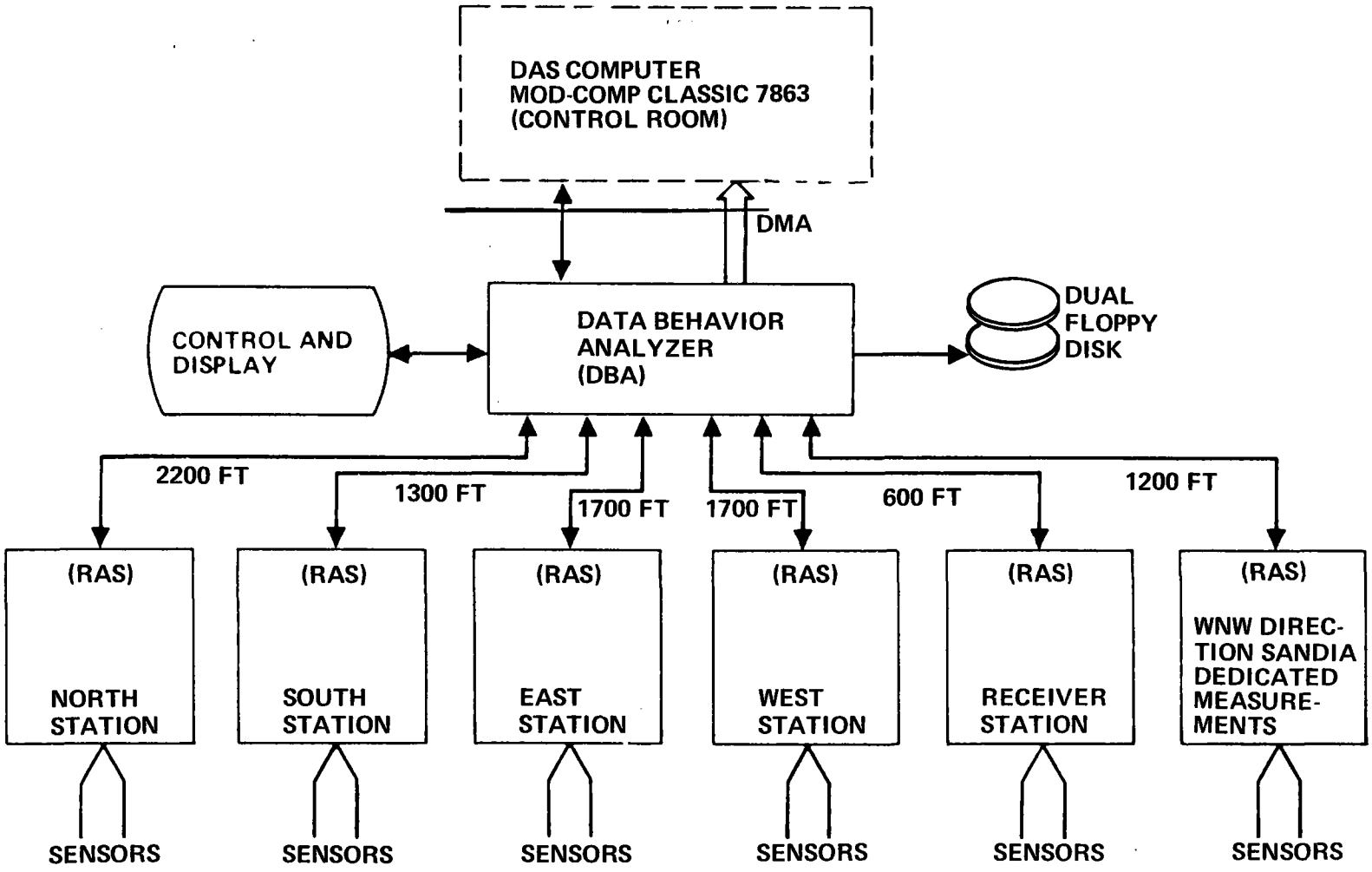
VFJ124N

DARMS MAN MACHINE INTERFACE

- DARMS Acquisition Program Loaded Via Disk and CRT
- Downloading From DAS Computer
  - Scan Lists Strip Chart, Events, Major, Super Commutate, Limit, Quick Look
  - Calibration Information
  - Gains
- DARMS Diagnostic Program Loaded Via Disk and CRT (Off Line)
  - Scan List Generation
  - Monitor any Channel (Up to 20 Simultaneously)
  - Initiate Calibration
  - Select Calibration Voltages
    0, 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048, 4096, 8192 MV
  - Select Gains
    1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048
- Formatting and Initialization of Disks
- Copying Disks
- Reprogram Disks
- Events Printer
  - Power Verification
  - Paper Load

SPECIAL HELIOSTAT INSTRUMENTATION AND METEOROLOGICAL MEASUREMENTS SYSTEM DIAGRAM

VFI953N



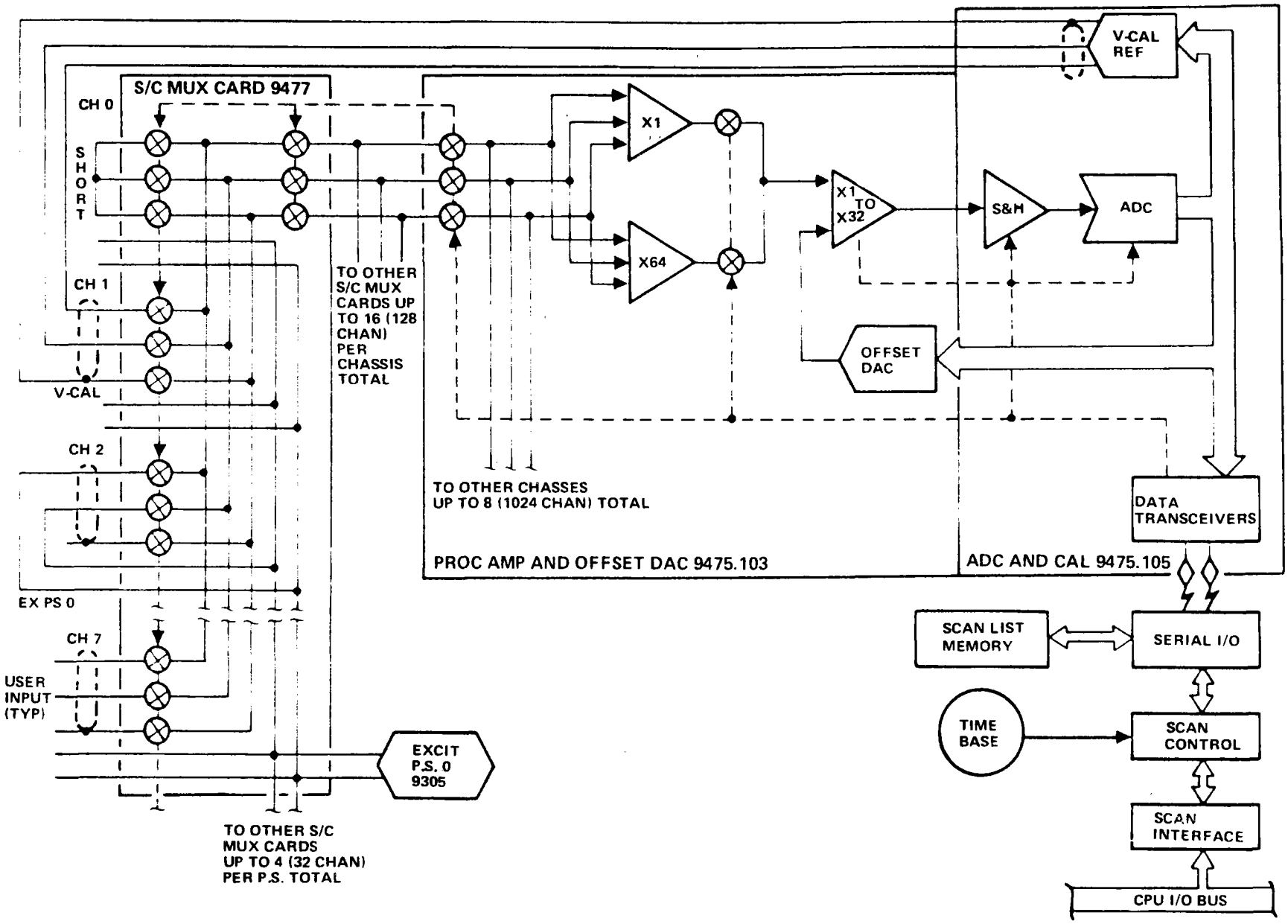
SHIMMS REQUIREMENTS

VFJ117N

	As Built Capability
■ Measurements	
• 209	280A, 5D
• RAS 1 (South Station) 8A, 5D	24A, 5D
• RAS 2 (West Station) 6A, 0D	16A
• RAS 3 (North Station) 8A, 0D	16A
• RAS 4 (East Station) 6A, 0D	16A
• RAS 5 (Receiver Station) 8A, 0D	16A
• RAS (Sandia Station) 171A, 0D	192A

BLOCK DIAGRAM ANALOG INPUT SYSTEM

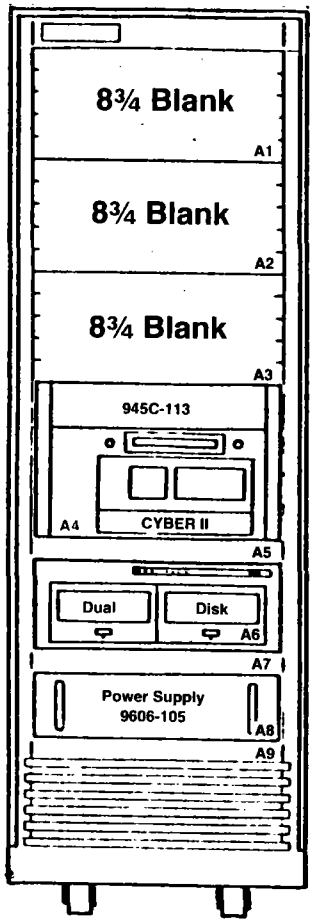
VFJ120N

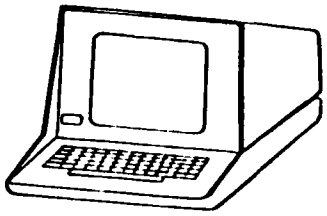


SHIMMS REQUIREMENTS (CONT)

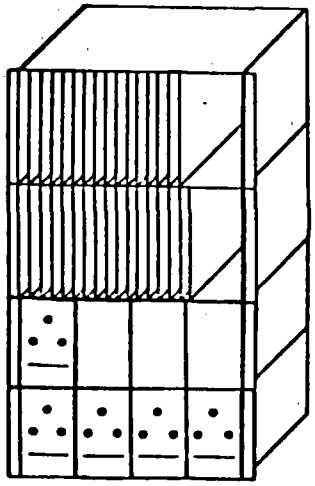
- Signal Conditioning
- Calibration
- Excitation
- Local Monitor and Control
- Limit Checking
- Peak Data

SHIMMS CONFIGURATION ELEMENTS

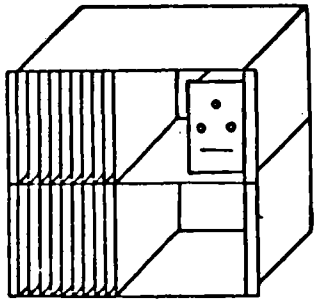




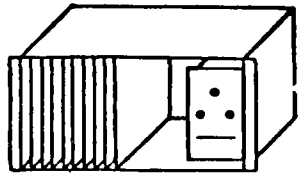
Keyboard CRT



Sandia Station



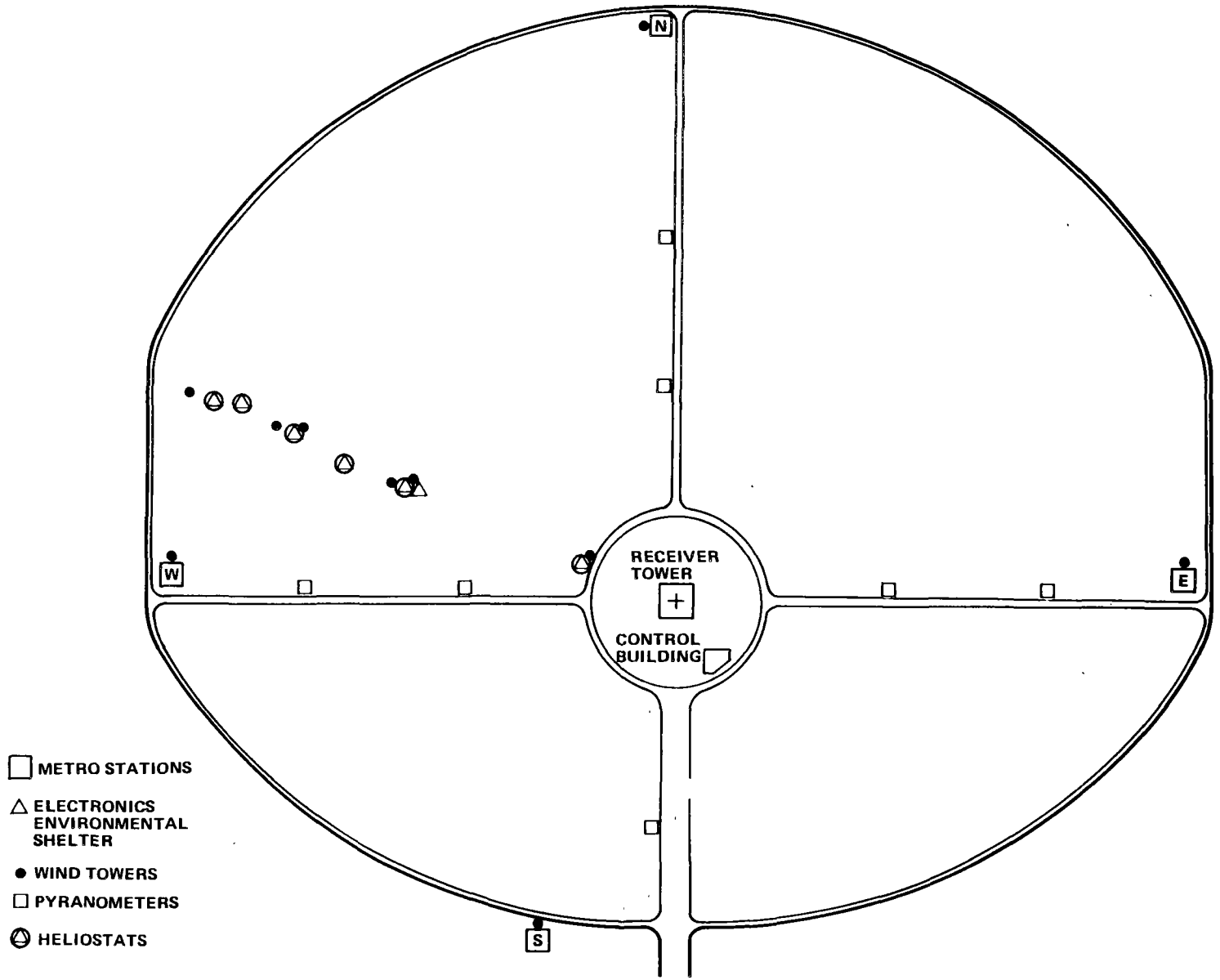
South Station



Receiver, East, West and North Stations

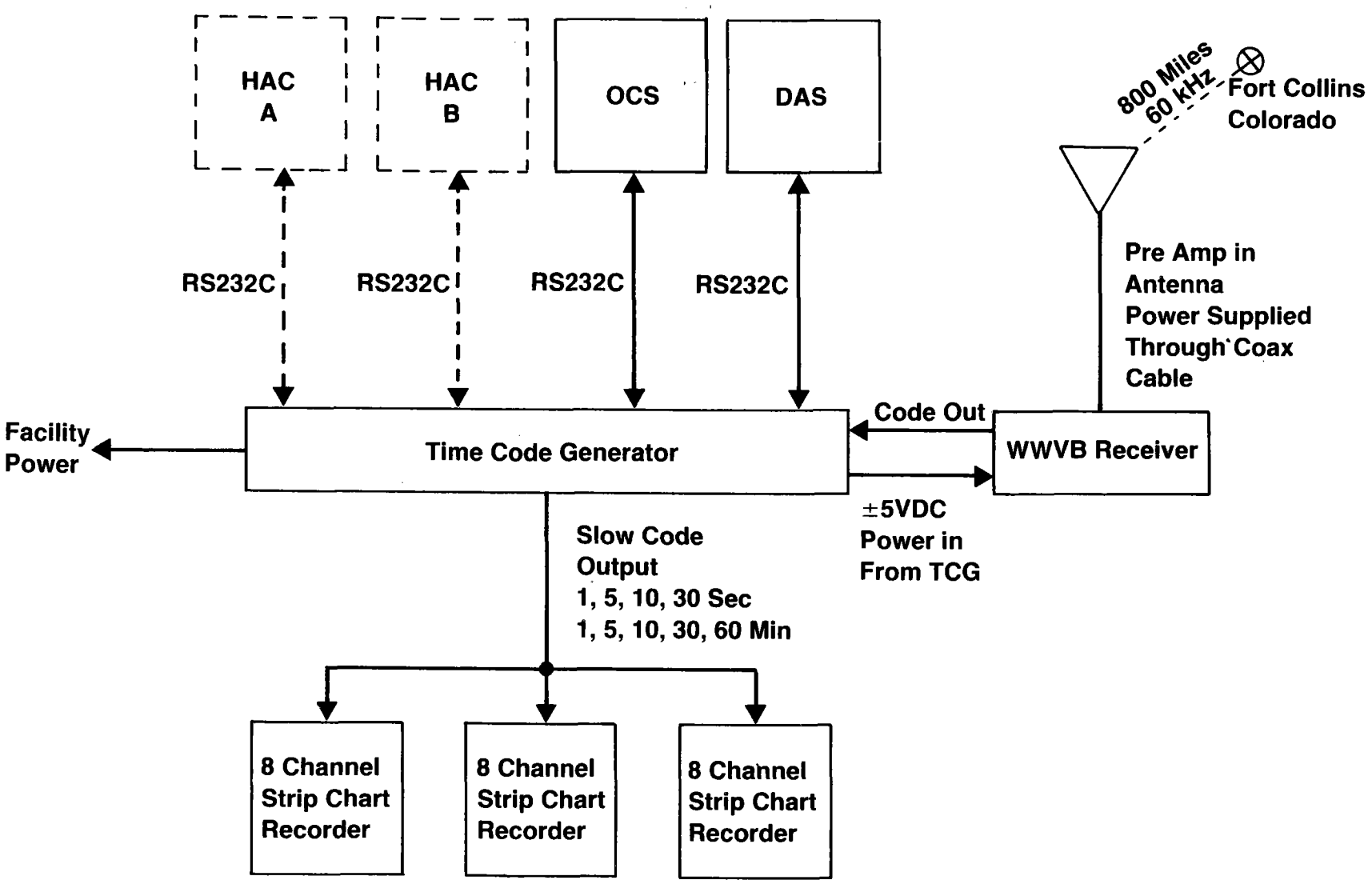
SHIMMS EQUIPMENT LOCATIONS

VFJ166N



VFJ114N

MCS TIMING SYSTEM

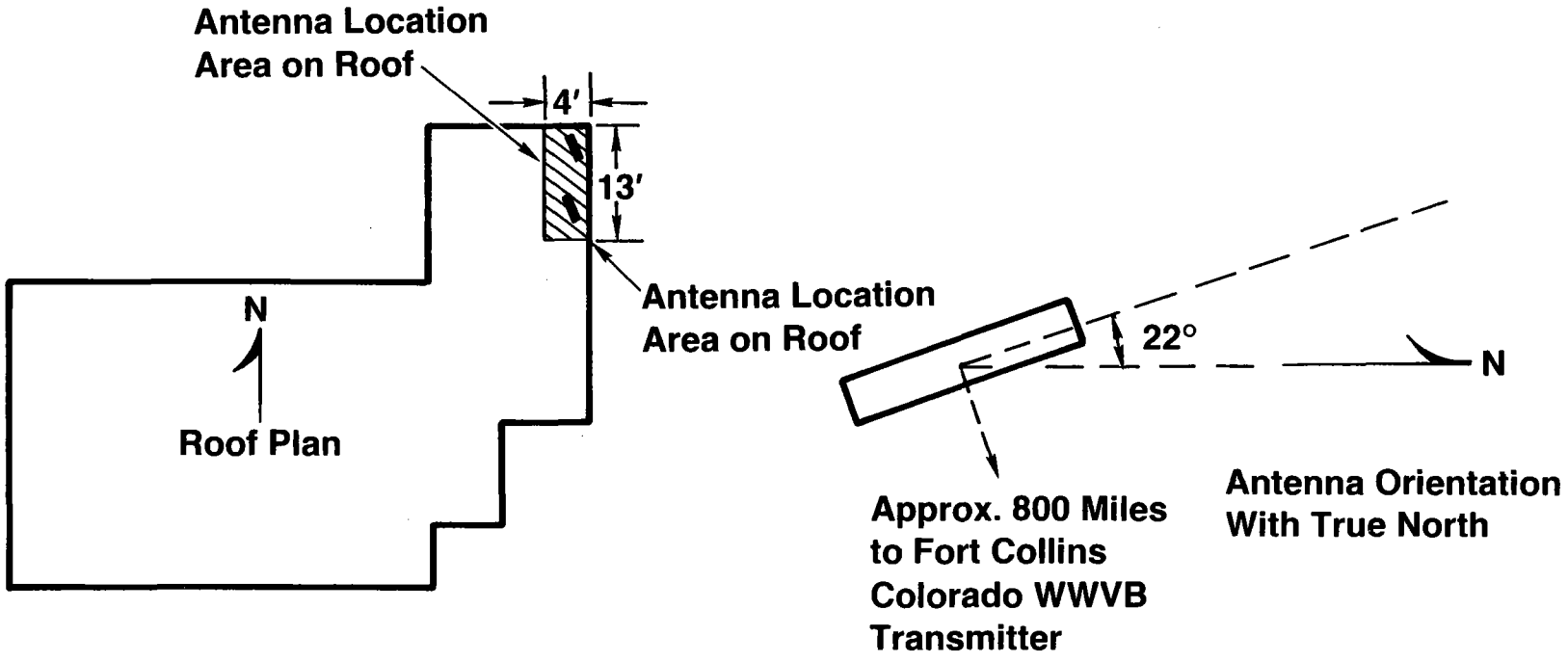


VFJ113N

MCS TIMING SYSTEM REQUIREMENTS

- Universal Standard Time, Days, Hours, Minutes, Seconds
- Supply 4 Computers Independently of Each Other
- 2 Modes (Compatible with Martin's System)
  - Time on Request (T)
  - Continuous Time (C)
- Slow Code Outputs for Strip Chart Recorders
- Automatic Synchronization to WWVB Signal
- Propagation Delay Correction
- Local Display
- Remote Display Capability

WWVB ANTENNA INSTALLATION



MCS TIMING MAN MACHINE INTERFACE

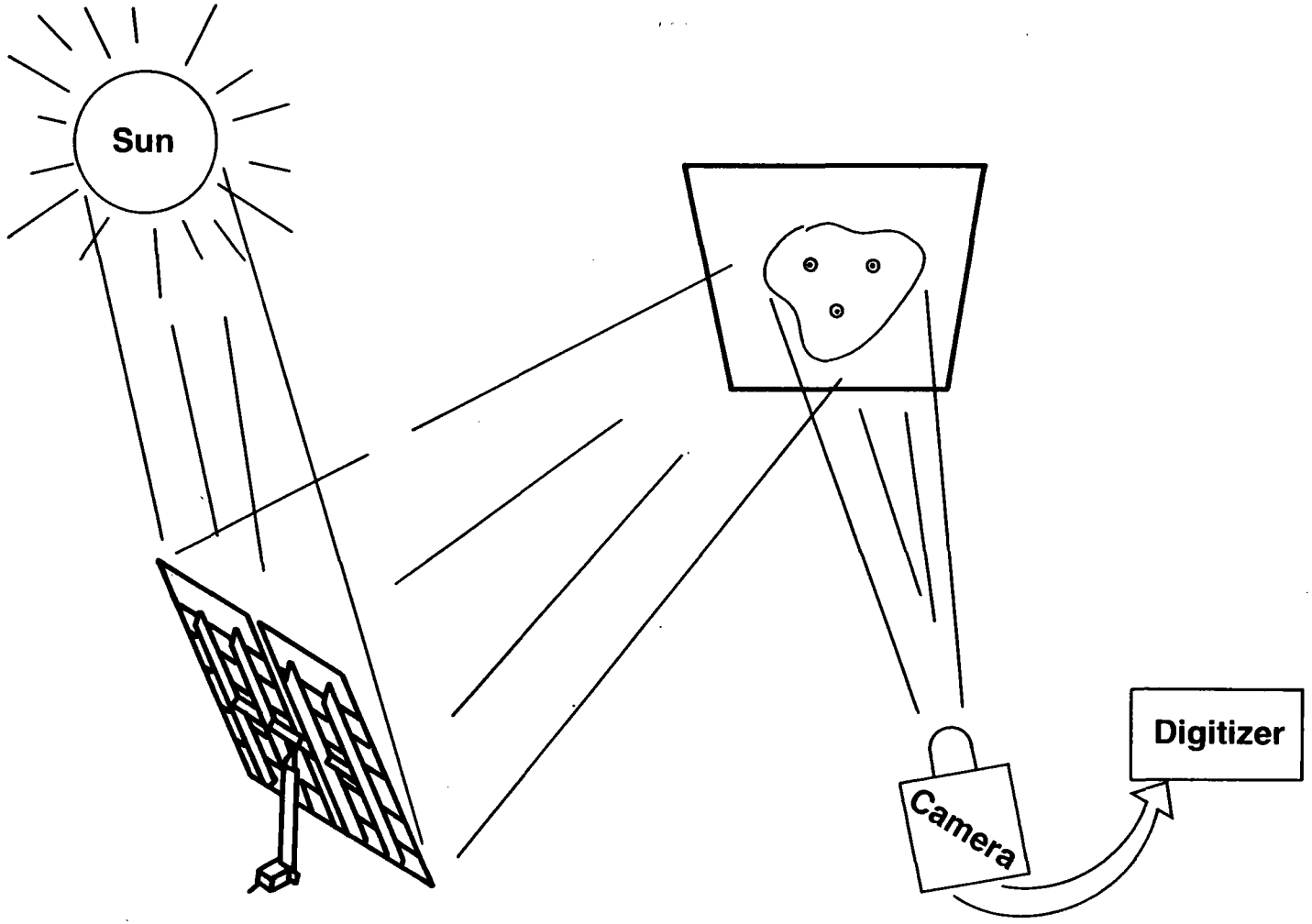
- Power Verification
- Time Synchronization Verification Via Front Panel Displays
- Selection of Slow Code Output

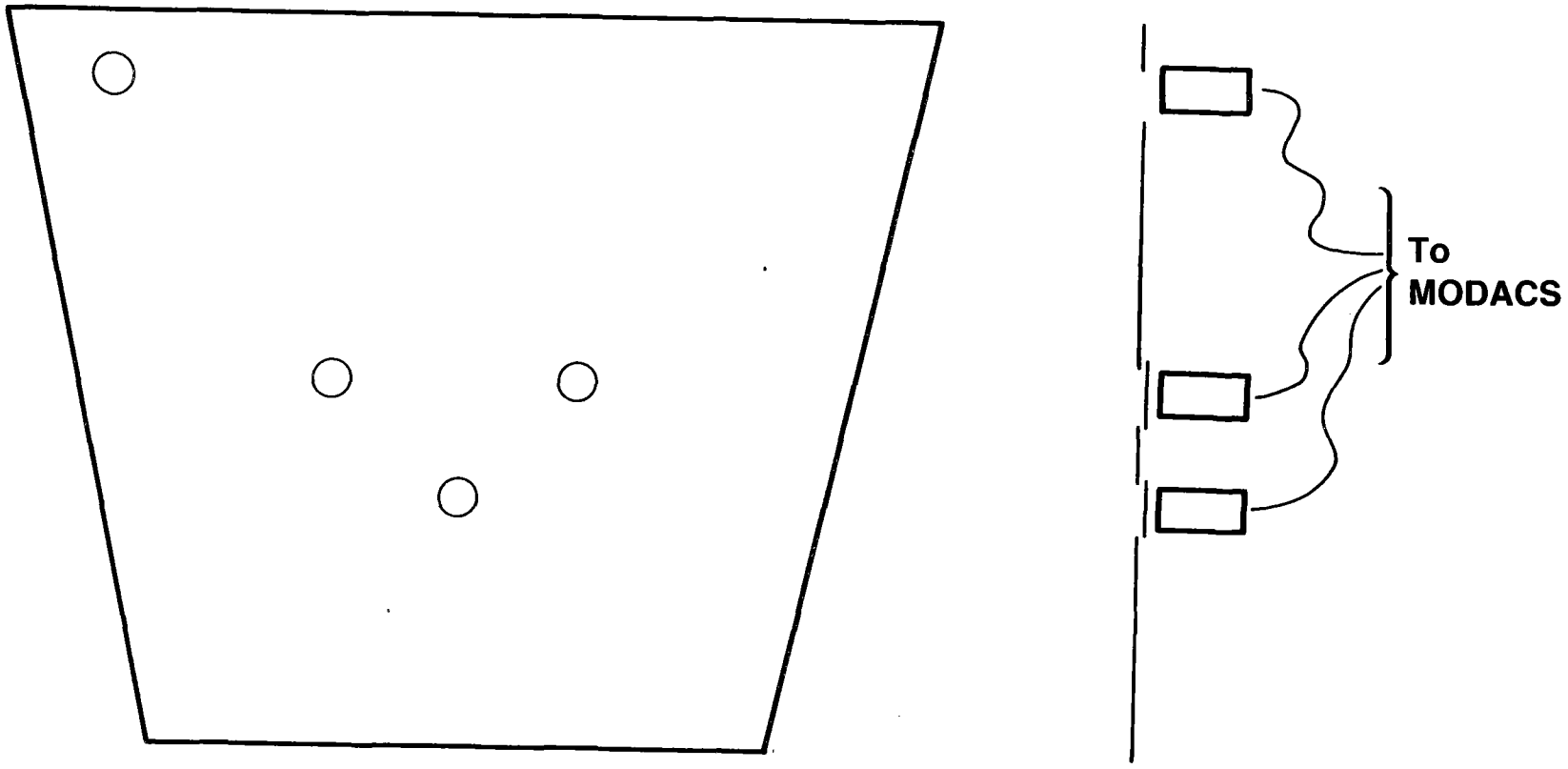
BEAM CHARACTERIZATION SUBSYSTEM (BCS)

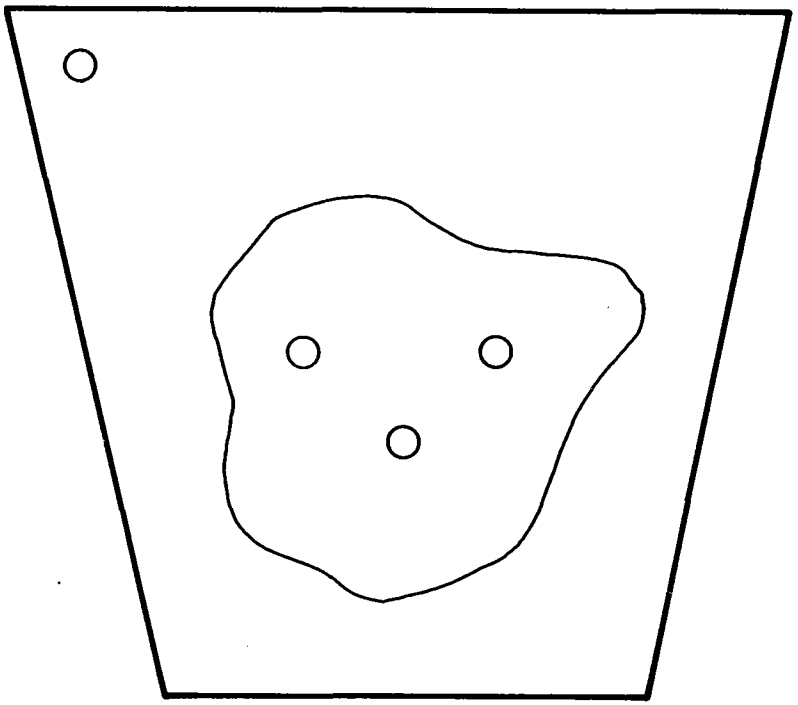
VFI909N

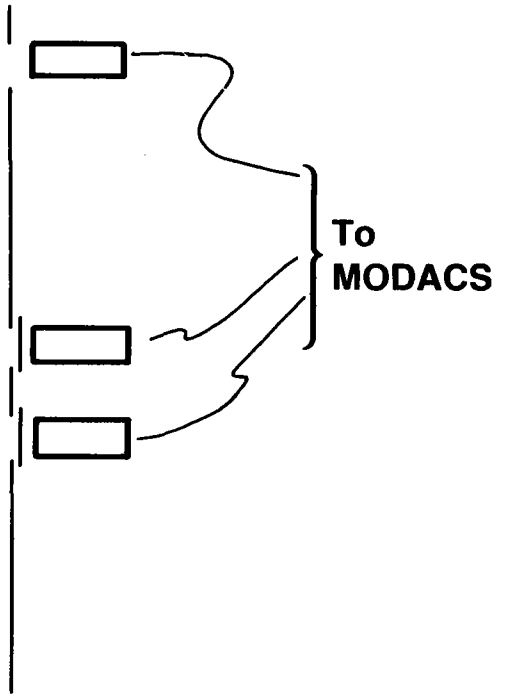
PRINCIPLE OUTPUTS

- Centroid Offsets of Heliostat Beam Projected Onto BCS Target
- Net Power of Heliostat Beam Projected Onto BCS Target
- Theoretical Power of Heliostat Beam
- Centroid Alarm Flag
- Power Alarm Flag


Sun
Digitizer
Camera


To
MODACS




To
MODACS

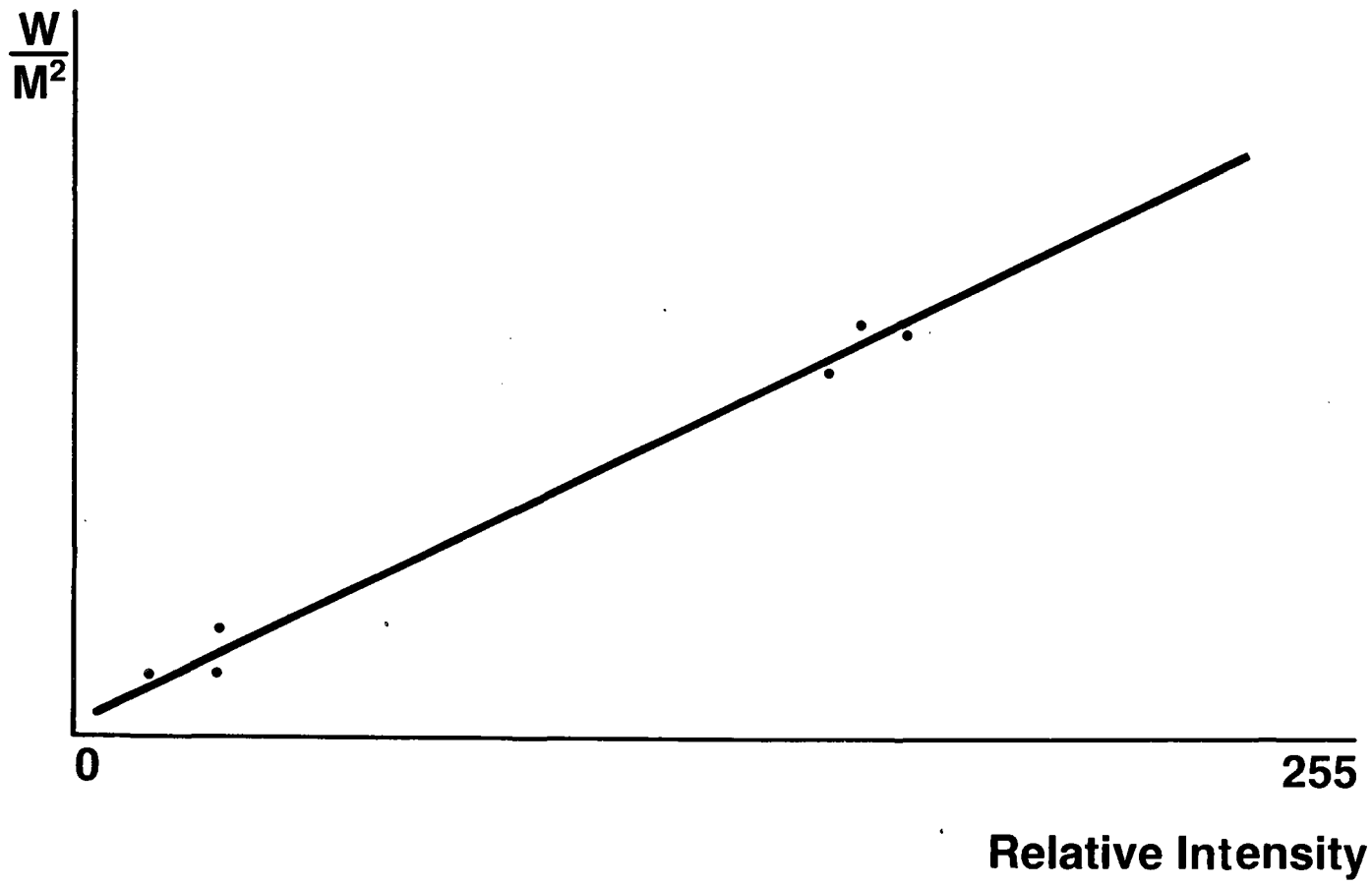
RELATIVE AND ABSOLUTE INTENSITY VALUES

VFI916N

1	X_1	Y_1	
2	X_2	Y_2	Constructed By Low Level Calibration
3	X_3	Y_3	
4	X_4	Y_4	
5	X_5	Y_5	Constructed By High Level Calibration
6	X_6	Y_6	

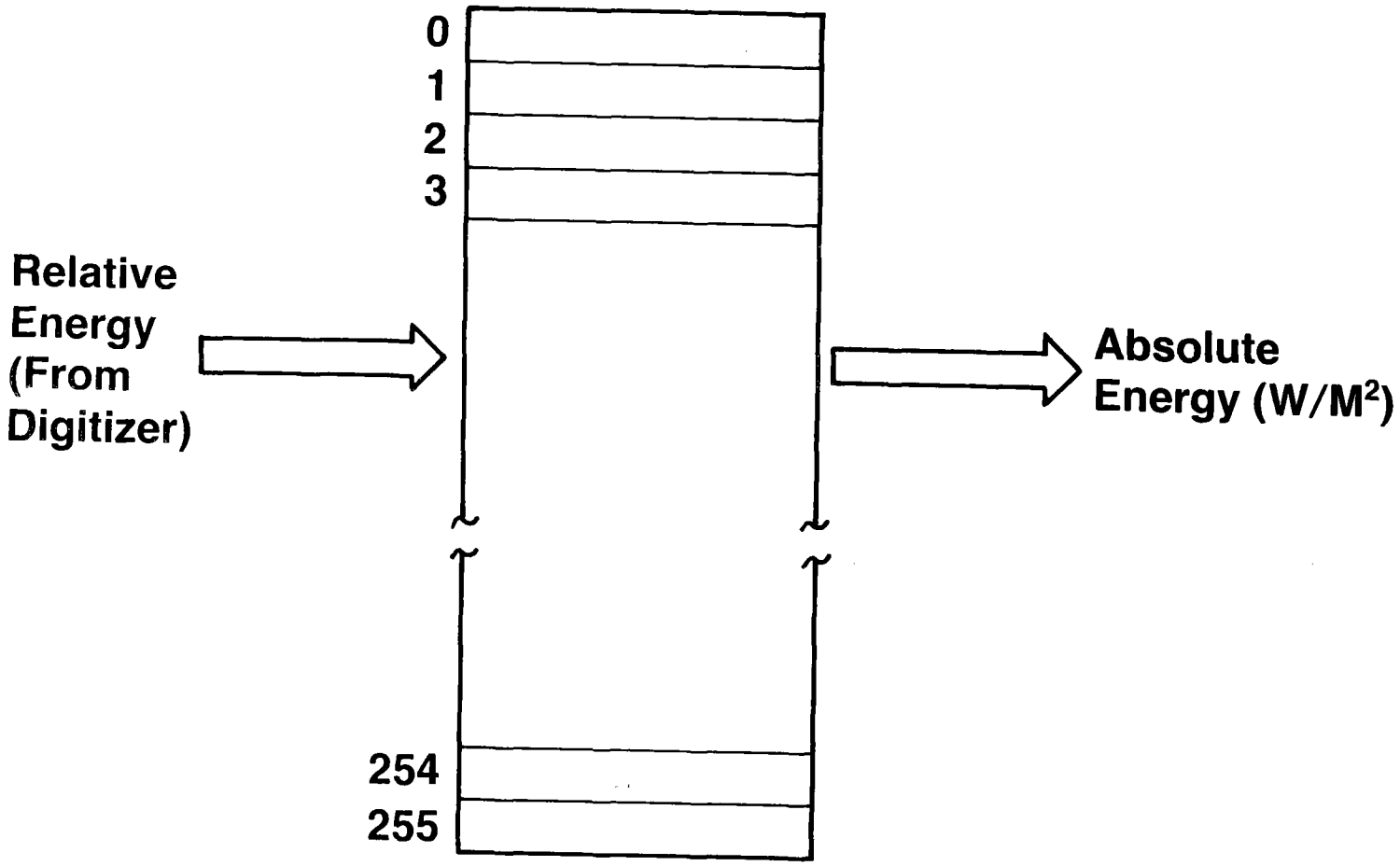
RELATIVE VERSUS ABSOLUTE IMAGE INTENSITY

VFI917N

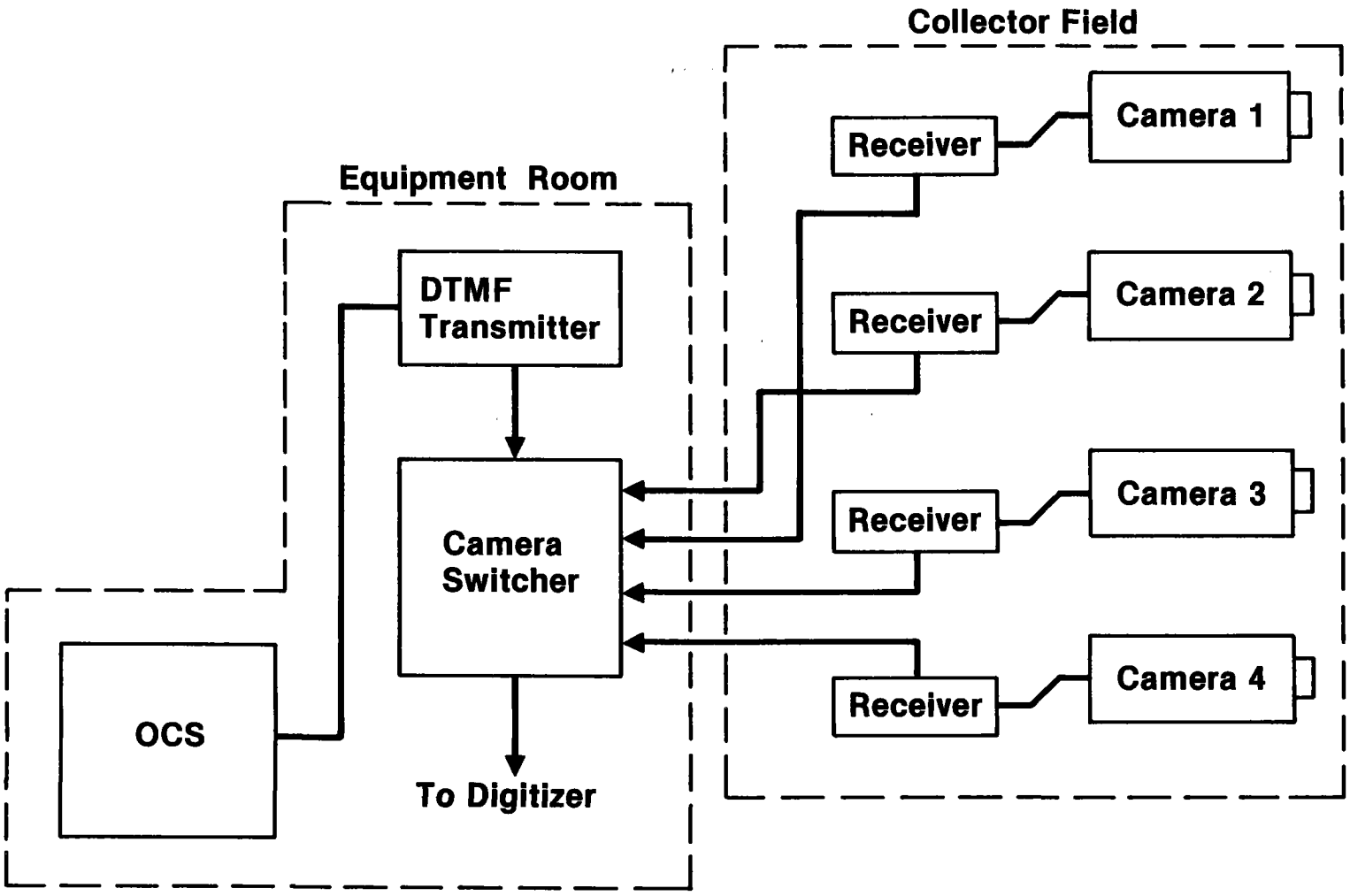


VFI918N

CALIBRATION TABLE

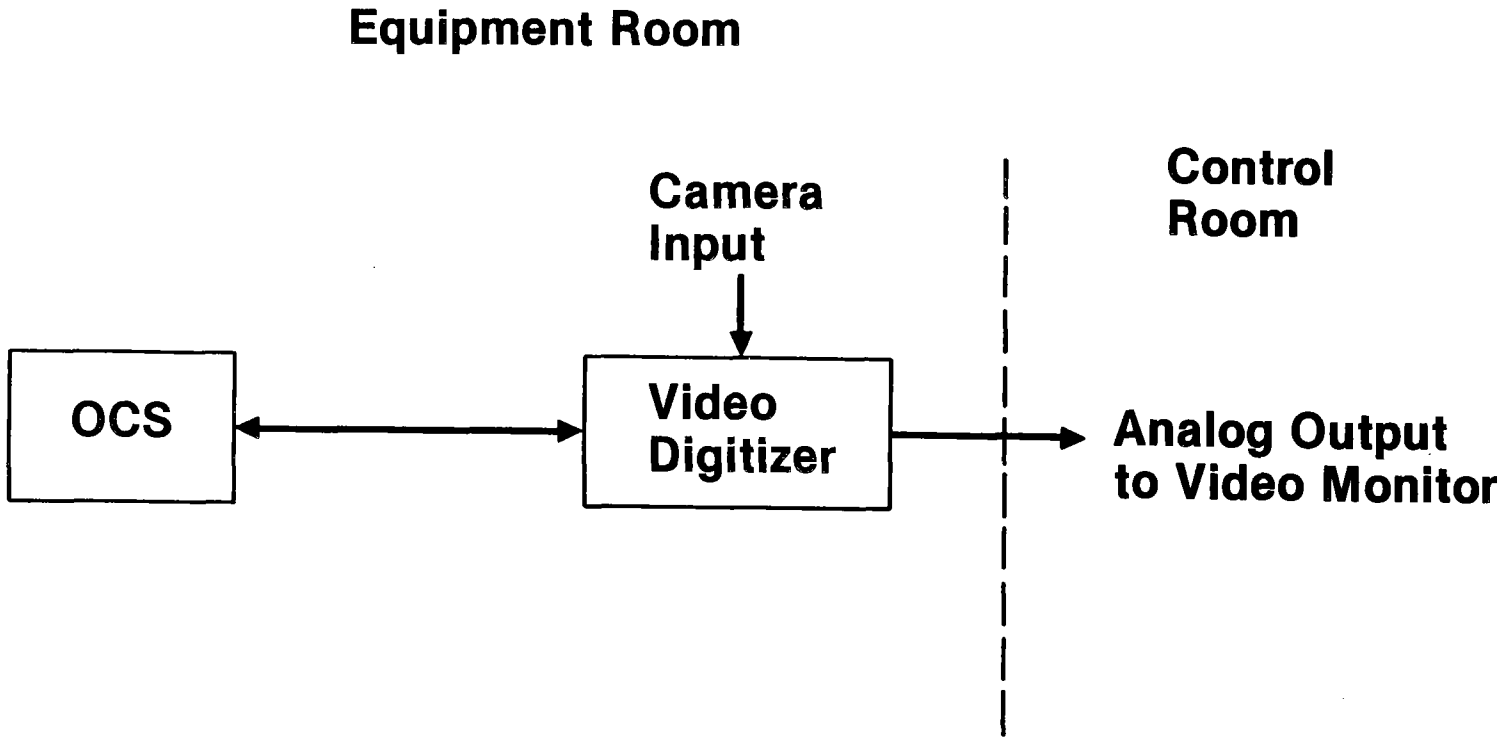


BCS CAMERA SETUP AND CONTROL



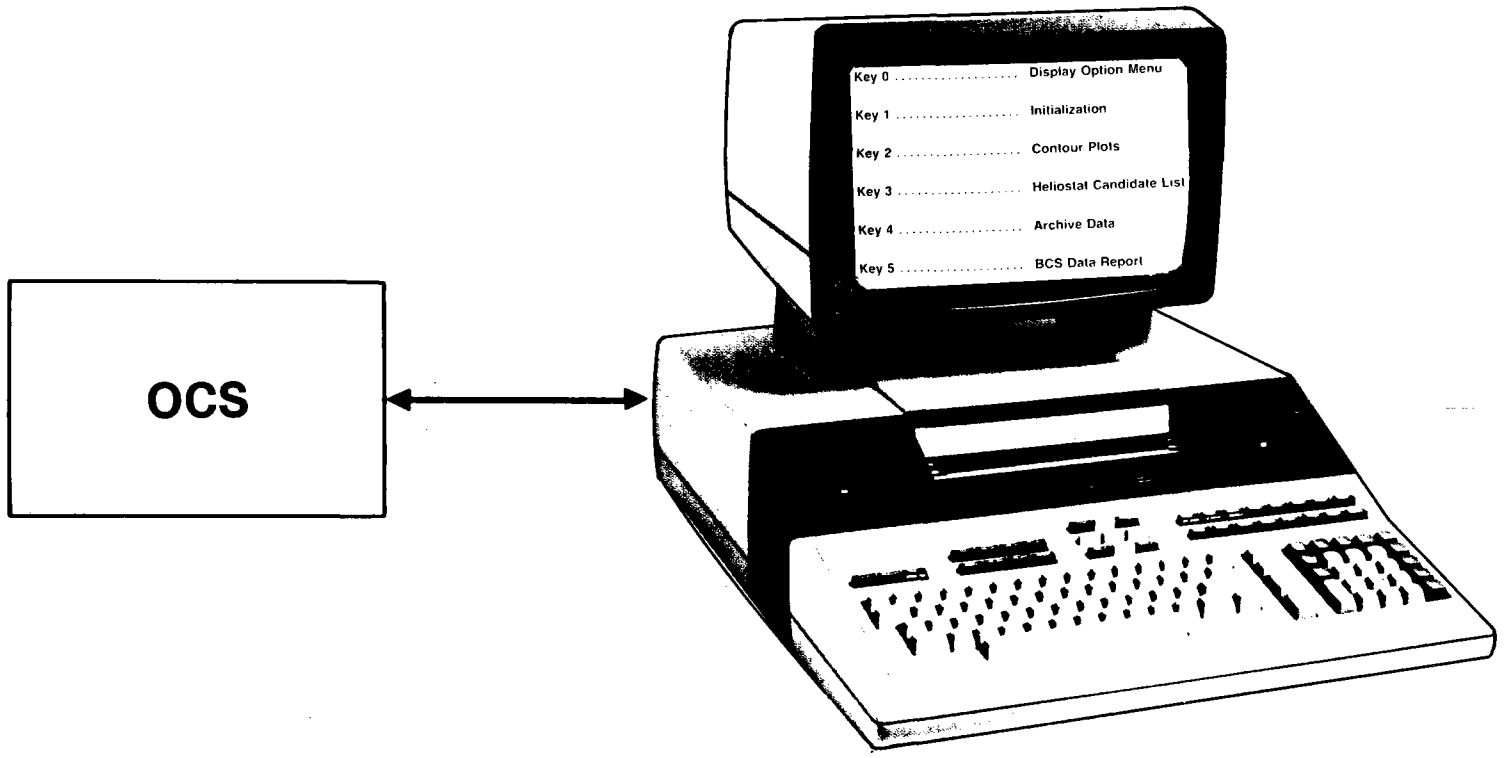
VIDEO DIGITIZER

VFJ172N



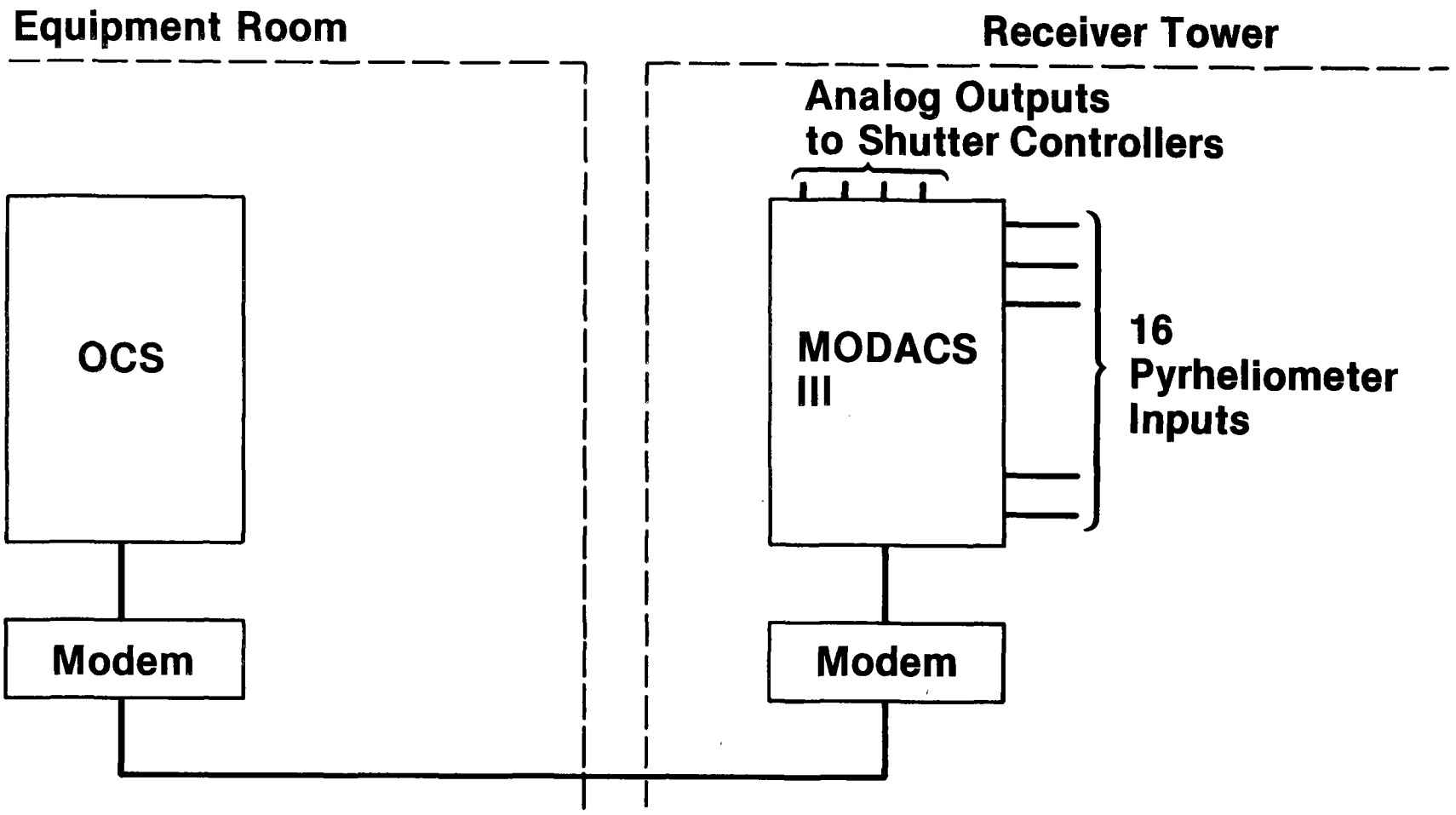
BCS CONSOLE HEWLETT-PACKARD 9845 DESKTOP COMPUTER

VFJ175N



VFJ173N

MODACS III ACQUISITION SYSTEM

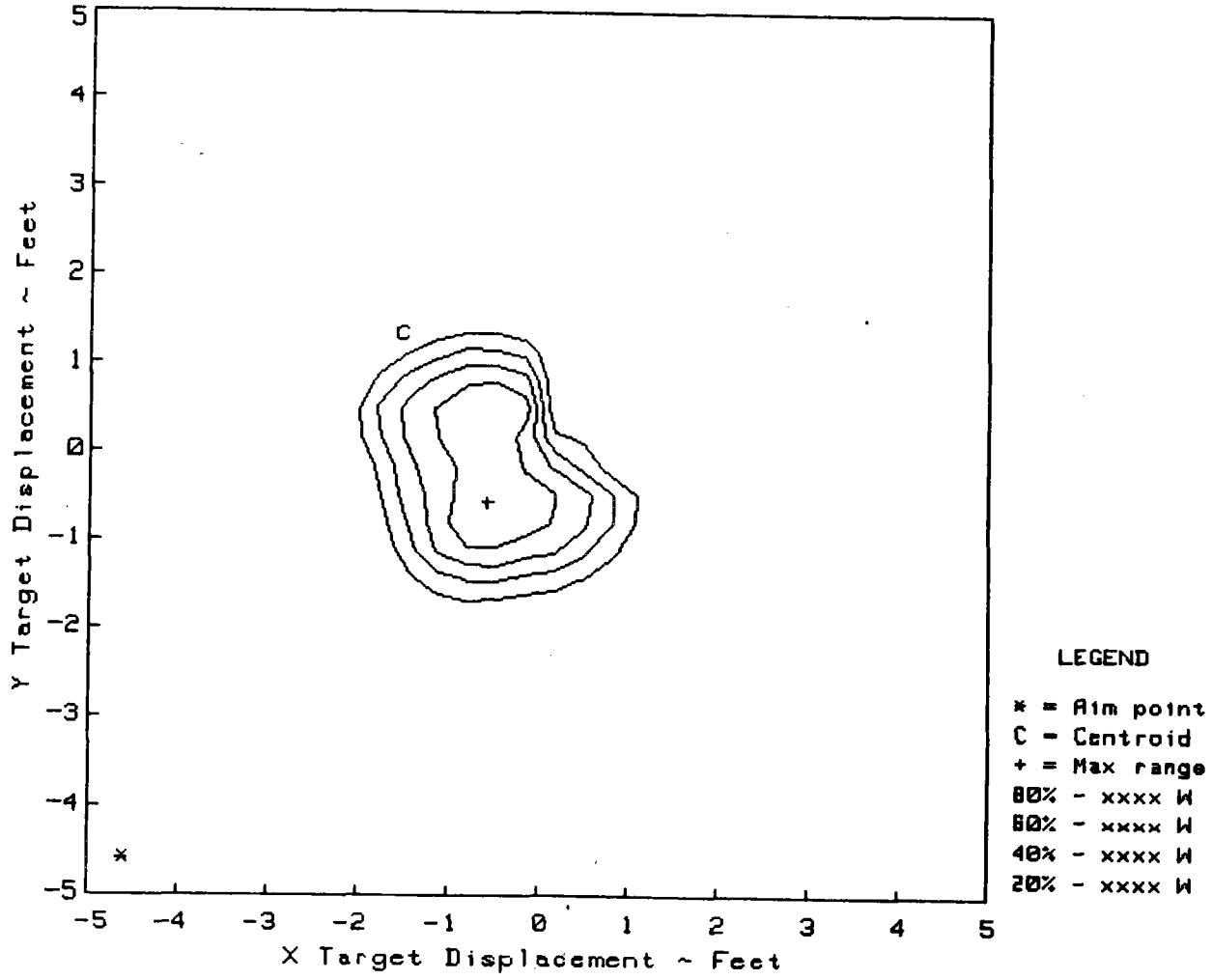


FEATURES OF BCS SOFTWARE

- BCS Responds to Command Messages Sent by the HAC
- BCS Records all Measurement and Bias Update Information into the Master File
- All Error Messages Occuring During BCS Processing are Logged to the H.P. 9845
- Operator can Obtain Plots of any HC Processed Within the Last Three Days
- Summary Report of Measurement Data is Automatically Generated at the End of a Measurement Sequence
- BCS has the Capability to Store Three Days Worth of Reduced and Support Data Files
- Upon Operator Request BCS will Archive to Mag. Tape all Information in the Reduced, Support, and Master Files
- Normalize Beam Data for an Off Center Heliostat
- Generates Three Files of Heliostats to be Measured During Next Measurement Process

VFI912N

2-D ISO-FLUX CONTOUR PLOT

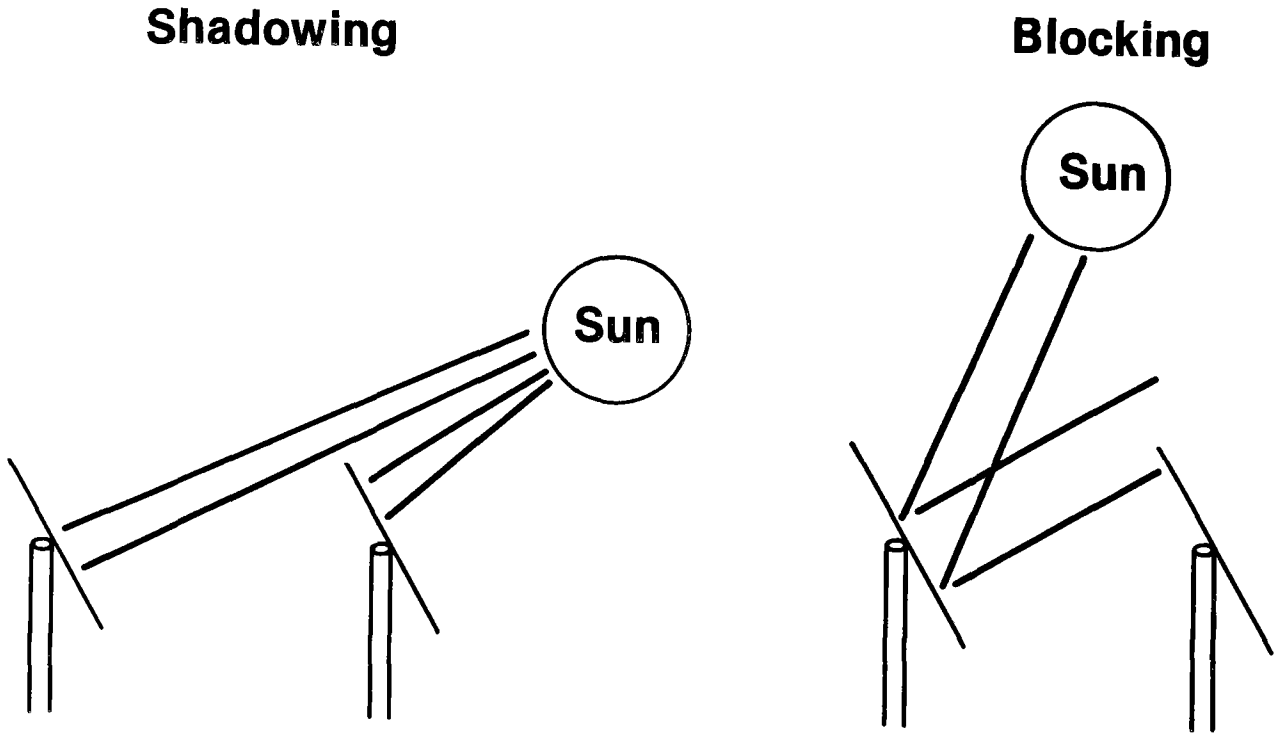


HELIOSTAT CANDIDATE LIST GENERATION

- USING THE MASTER FILE CREATES LISTS OF HELIOSTATS FOR MORNING, NOON AND AFTERNOON PROCESSING
- REQUIRES OPERATOR TO SELECT AN EARLIEST START TIME AND LATEST END TIME FOR EACH LIST
- REQUIRES OPERATOR TO INPUT NUMBER OF HELIOSTATS FOR EACH LIST. (MAX. = 60)
- OPTIONALLY ALLOWS OPERATOR TO ADD HELIOSTATS TO THE LIST

HELIOSTAT BLOCKING AND SHADOWING

VFJ174N



Key 0 ..... Display Option Menu

Key 1 ..... Initialization

Key 2 ..... Contour Plots

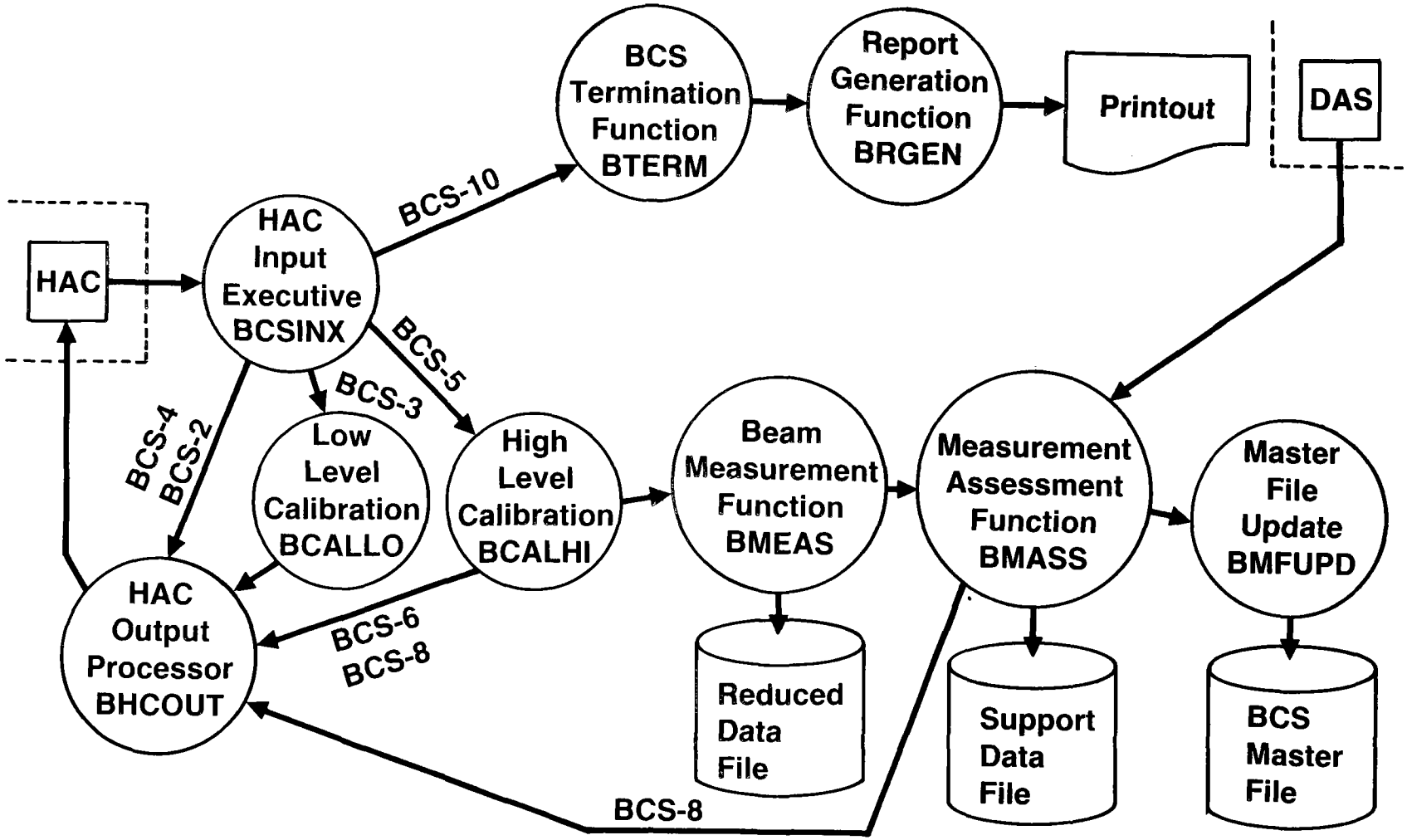
Key 3 ..... Heliostat Candidate List

Key 4 ..... Archive Data

Key 5 ..... BCS Data Report

BCS TOP LEVEL FLOW FOR MEASUREMENT MODE

VFI922N



SUMMARY OF BCS DATA

HEL. NO.	CENTROID AVERAGE TIME	CENTROID (FT) X	Y	CENTROID FLAG	MEAS. POWER (W)	THEO. POWER (W)	% OF THEO. POWER	POWER FLAG	INSOL. (W/SQM)	WIND SPEED (MPH)	WIND DIR. (DEG)	AMBIENT TEMP. (DEG F)
1234	12:00	12.34	12.34	O.K.	12345	12345	123.4	O.K.	1234	123.4	123	123.4
1234	12:01	12.34	12.34	O.K.	12345	12345	123.4	**LOW**	1234	123.4	123	123.4
1234	12:02	12.34	12.34	O.K.	12345	12345	123.4	**HIGH**	1234	123.4	123	123.4
1234	12:03	12.34	12.34	O.K.	12345	12345	123.4	*CLOUDS*	1234	123.4	123	123.4
1234	12:04	12.34	12.34	O.K.	12345	12345	123.4	*NO DAS*	1234	123.4	123	123.4
1234	12:05	12.34	12.34	O.K.	12345	12345	123.4	O.K.	1234	123.4	123	123.4
1234	12:06	12.34	12.34	O.K.	12345	12345	123.4	**LOW**	1234	123.4	123	123.4
1234	12:07	12.34	12.34	O.K.	12345	12345	123.4	**HIGH**	1234	123.4	123	123.4
1234	12:08	12.34	12.34	O.K.	12345	12345	123.4	*CLOUDS*	1234	123.4	123	123.4
1234	12:09	12.34	12.34	O.K.	12345	12345	123.4	*NO DAS*	1234	123.4	123	123.4
1234	12:10	12.34	12.34	O.K.	12345	12345	123.4	O.K.	1234	123.4	123	123.4
1234	12:11	12.34	12.34	O.K.	12345	12345	123.4	**LOW**	1234	123.4	123	123.4
1234	12:12	12.34	12.34	O.K.	12345	12345	123.4	**HIGH**	1234	123.4	123	123.4
1234	12:13	12.34	12.34	O.K.	12345	12345	123.4	*CLOUDS*	1234	123.4	123	123.4
1234	12:14	12.34	12.34	O.K.	12345	12345	123.4	*NO DAS*	1234	123.4	123	123.4
1234	12:15	12.34	12.34	O.K.	12345	12345	123.4	O.K.	1234	123.4	123	123.4
1234	12:16	12.34	12.34	O.K.	12345	12345	123.4	**LOW**	1234	123.4	123	123.4
1234	12:17	12.34	12.34	O.K.	12345	12345	123.4	**HIGH**	1234	123.4	123	123.4
1234	12:18	12.34	12.34	O.K.	12345	12345	123.4	*CLOUDS*	1234	123.4	123	123.4
1234	12:19	12.34	12.34	O.K.	12345	12345	123.4	*NO DAS*	1234	123.4	123	123.4
1234	12:20	12.34	12.34	O.K.	12345	12345	123.4	O.K.	1234	123.4	123	123.4

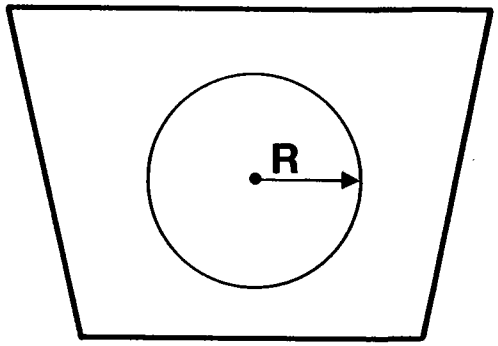
OPERATOR STRATEGY-CENTROID & POWER FLAGS

Flag Set C	P	Without Power Profile	With Power Profile	Power Profile Recommended
0	0	Assume →Good Helio	Would determine if symmetric Spilling	No.
0	1	• If helio is believed to be clean and if many other (0,1) combination →EXCESSIVE ATMOS ATTENUATION • If it is known that attenuation is minimal HELIO NEED WASHING	Would determine if symmetric spilling	No
1	0	• If helio has (1,0) history after bias updates→PERTURBED HELIO • If helio has no (1,0) history →BIAS UPDATE	Would determine if mispointed or assymmetric perturbation	Possible
1	1	Very likely indicates→SPILLING		Yes

POWER AND CENTROID ALARM THRESHOLDS

VFI910N

Centroid

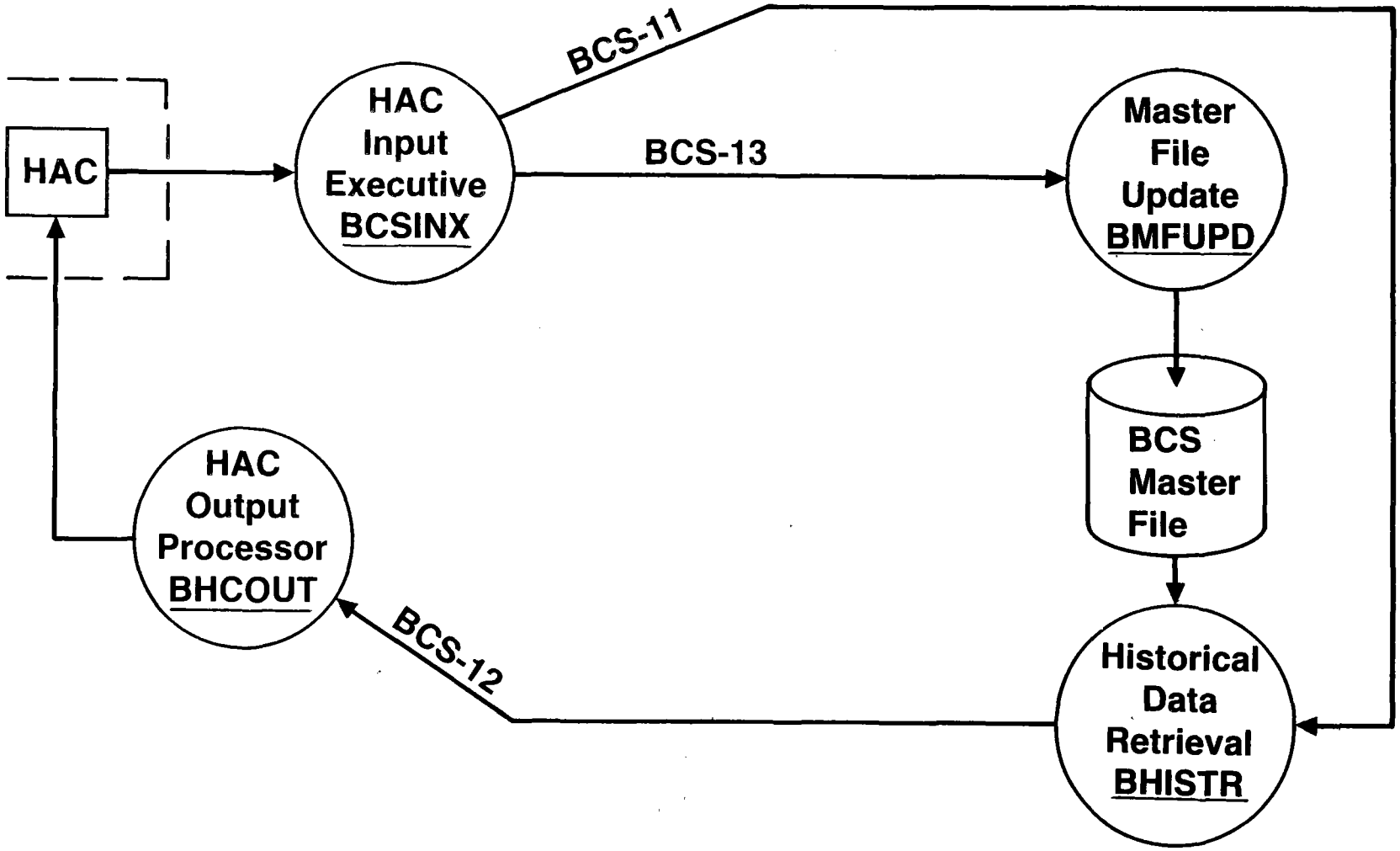


Power

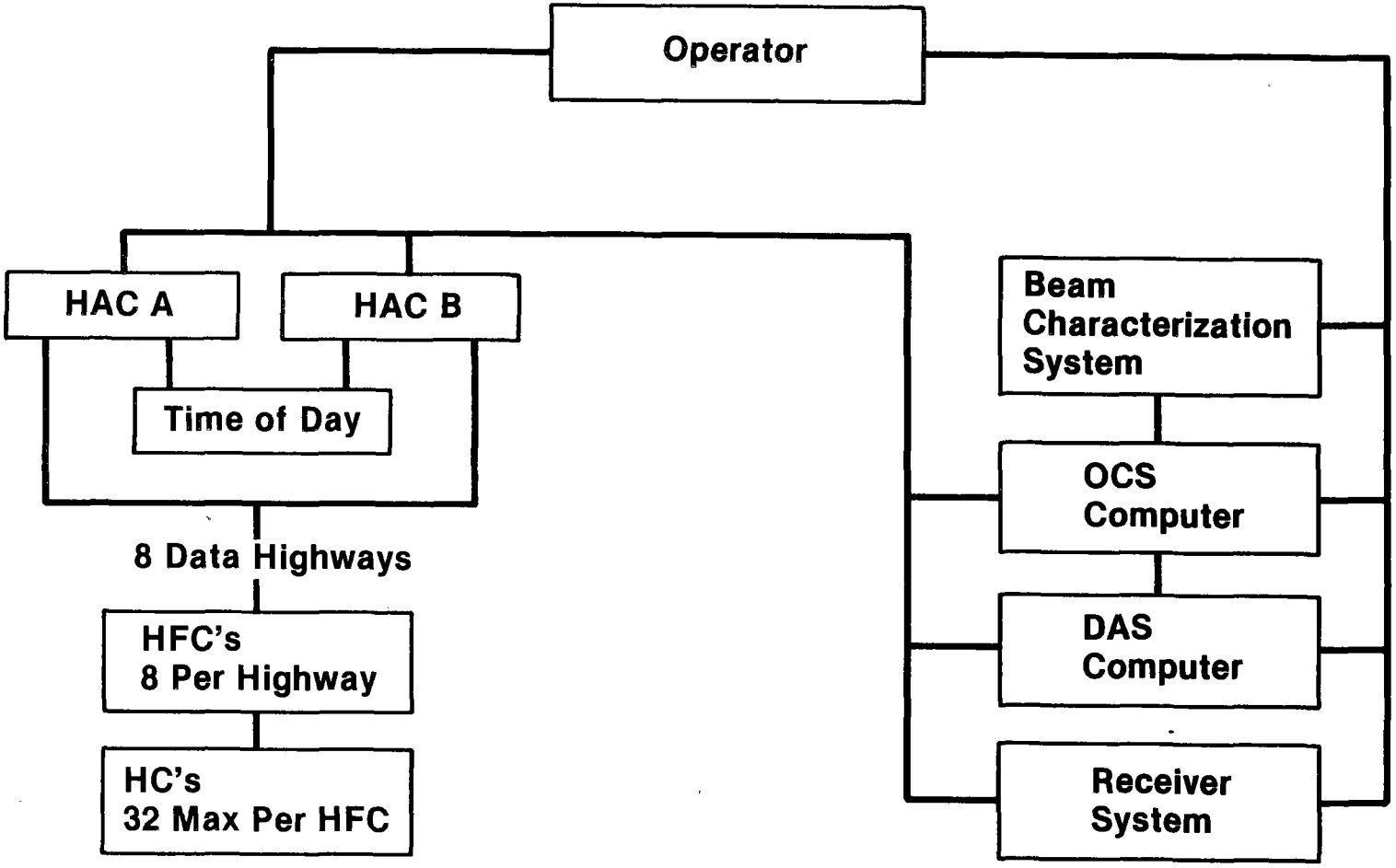
$$|P_{THEO} - P_{MEAS}| > P_{THEO} * \frac{PWRPCT}{100}$$

BCS TOP LEVEL FLOW FOR BIAS UPDATE MODE

VFI921N



HAC INTERFACES



COLLECTOR CONTROL SYSTEMS CHARACTERISTICS

AUTOMATIC TRACKING CONTROLLED BY A DISTRIBUTED COMPUTER CONTROL SYSTEM

SUN POSITION COMPUTED AND TRANSMITTED TO ALL HELIOSTATS ONCE PER SECOND

DUAL REDUNDANT MODCOMP COMPUTERS IN THE CONTROL ROOM

DUAL REDUNDANT DATA BUSES FROM HELIOSTAT ARRAY CONTROLLERS TO HELIOSTAT FIELD CONTROLLERS

COLOR CRT TERMINAL FOR OPERATOR'S CONSOLE

COLOR GRAPHIC DISPLAYS OF HELIOSTAT STATUS - WHOLE FIELD OR PORTION OF A FIELD

SEPARATE PRINTERS FOR STATUS LOGGING AND ALARM LOGGING

STATUS DATA FROM EACH HELIOSTAT UPDATED ONCE EVERY EIGHT SECONDS

HAC-DAS INTERFACE

VFJ183N

This Interface Is Limited to Status Requests From DAS to HAC

Type of Status	Frequency
• Total Field Status	Every 64 Seconds
• Ring-Track Status	Every 64 Seconds
• Individual Heliostat Status (Up to 20 Maximum)	Every 64 Seconds

HAC — OCS INTERFACE

- BCS Operations
- OCS-to-HAC Commands

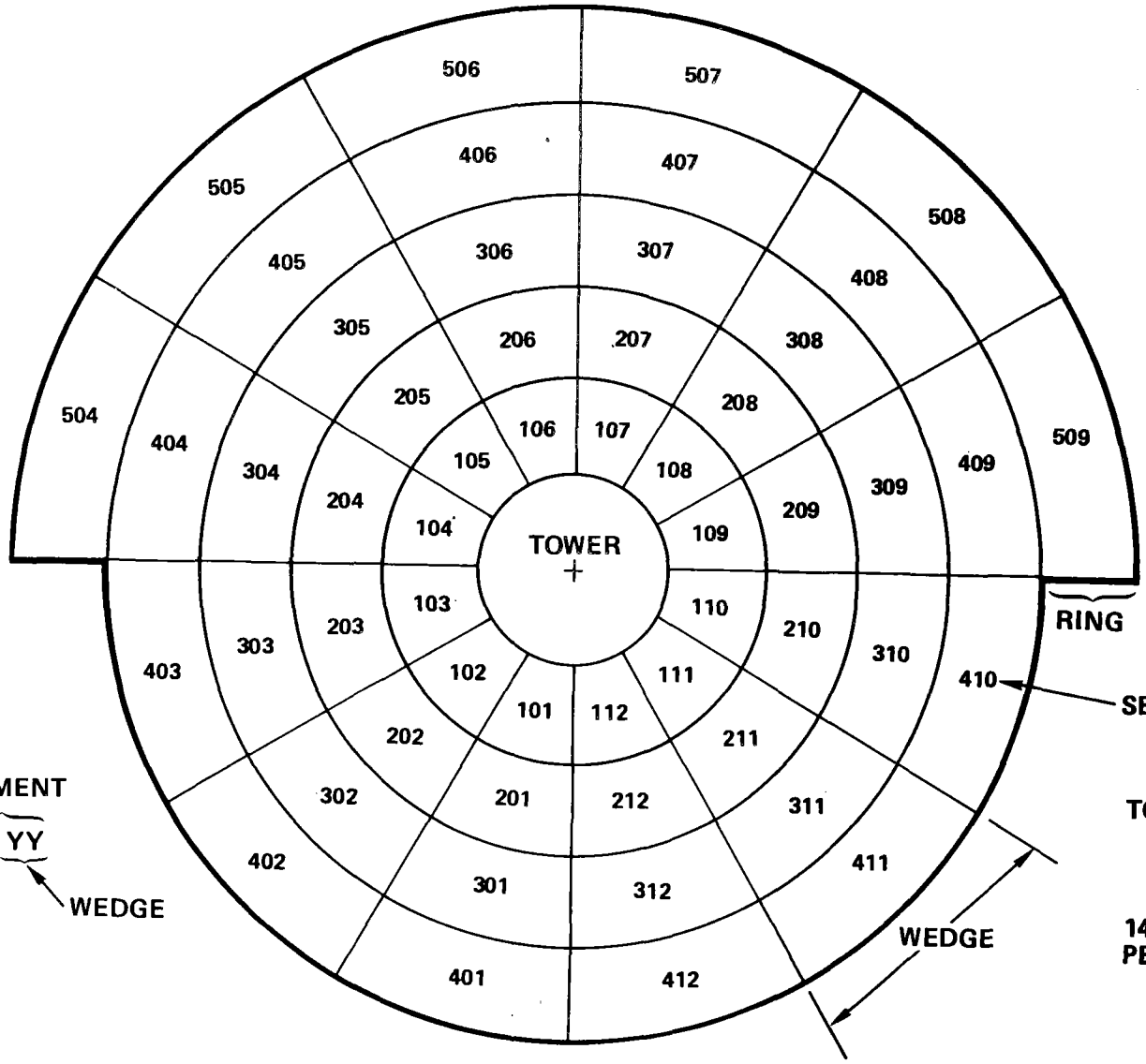
  Stow
  Unstow
  Standby
  Track
  Decrease
  Increase
  Defocus
  STHIWIND
  Status

- HAC-to-OCS Alarm or Error
- HAC-to-OCS Status

  Field
  Mode
  Individual HC
  Ring-Track

VFB756N

COLLECTOR FIELD SEGMENTATION CONCEPT



LEGEND: SEGMENT (X YY); RING = X; WEDGE = YY

TOTALS

- 5 RINGS
- 12 WEDGES
- 54 SEGMENTS
- 14* 48 HELIOSTATS PER SEGMENT

COLLECTOR FIELD SEGMENTATION
1818 MMC HELIOSTATS

VFB757N