KEKB Accelerator Control System

6 Mar. 1998

Tatsuro Nakamura
KEKB Controls Group

Overview

Hardware Installation

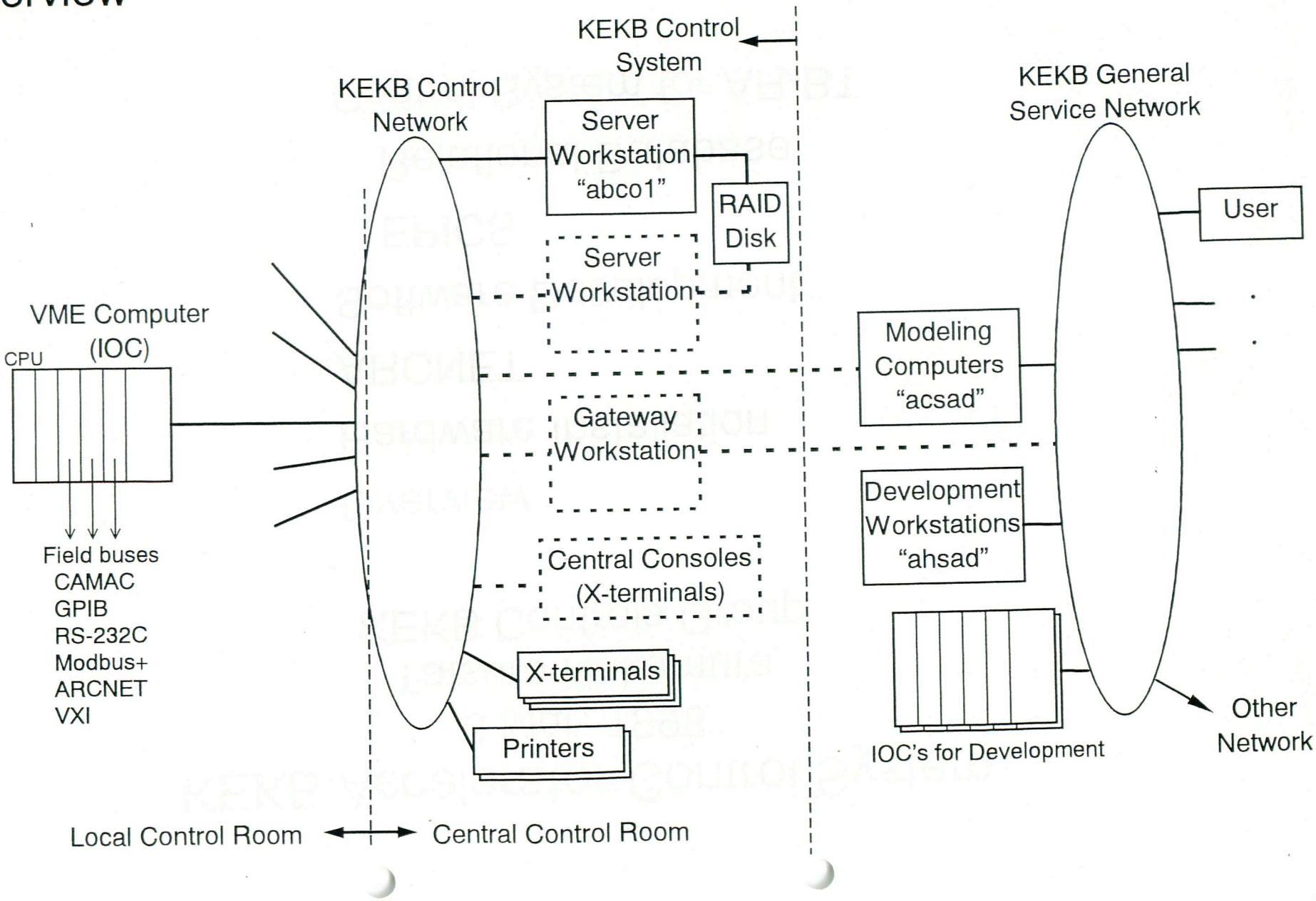
ARCNET

Software Development

- EPICS
- Relational Database

Control System for AR-BT

Overview


KEKB Control System
KEKB Control Network
Server Workstation "abco1"
RAID Disk
Server Workstation
KEKB General Service Network
User
VME Computer (IOC)
CPU
Modeling Computers "acsad"
Gateway Workstation
Development Workstations "ahsad"
Field buses
CAMAC
GPIB
RS-232C
Modbus+
ARCNET
VXI
Central Consoles (X-terminals)
X-terminals
Printers
IOC's for Development
Other Network
Local Control Room
Central Control Room

Overview

Role of the Controls Group

Development of Infrastructure of the Control Hardware & Software

High level application software → Operations Group

Low level Device specific I/O → Each Hardware Group

"Linkperson"

Contractor

Installation & Software Development

5 persons working at KEK (full-time)

mainly for software development and linkperson supports

Hardware Installation

Nov. 1996: Server WS (ME RK-460/HP-UX 10.20)

Mar. 1997: Network (FDDI backbone & Ethernet branches)

15 IOC's (FORCE CPU64(68060))

20 Local Consoles (X-Teminals)

this spring:

61 IOC's (FORCE Power Core(MPC750))

before Oct. 1998:

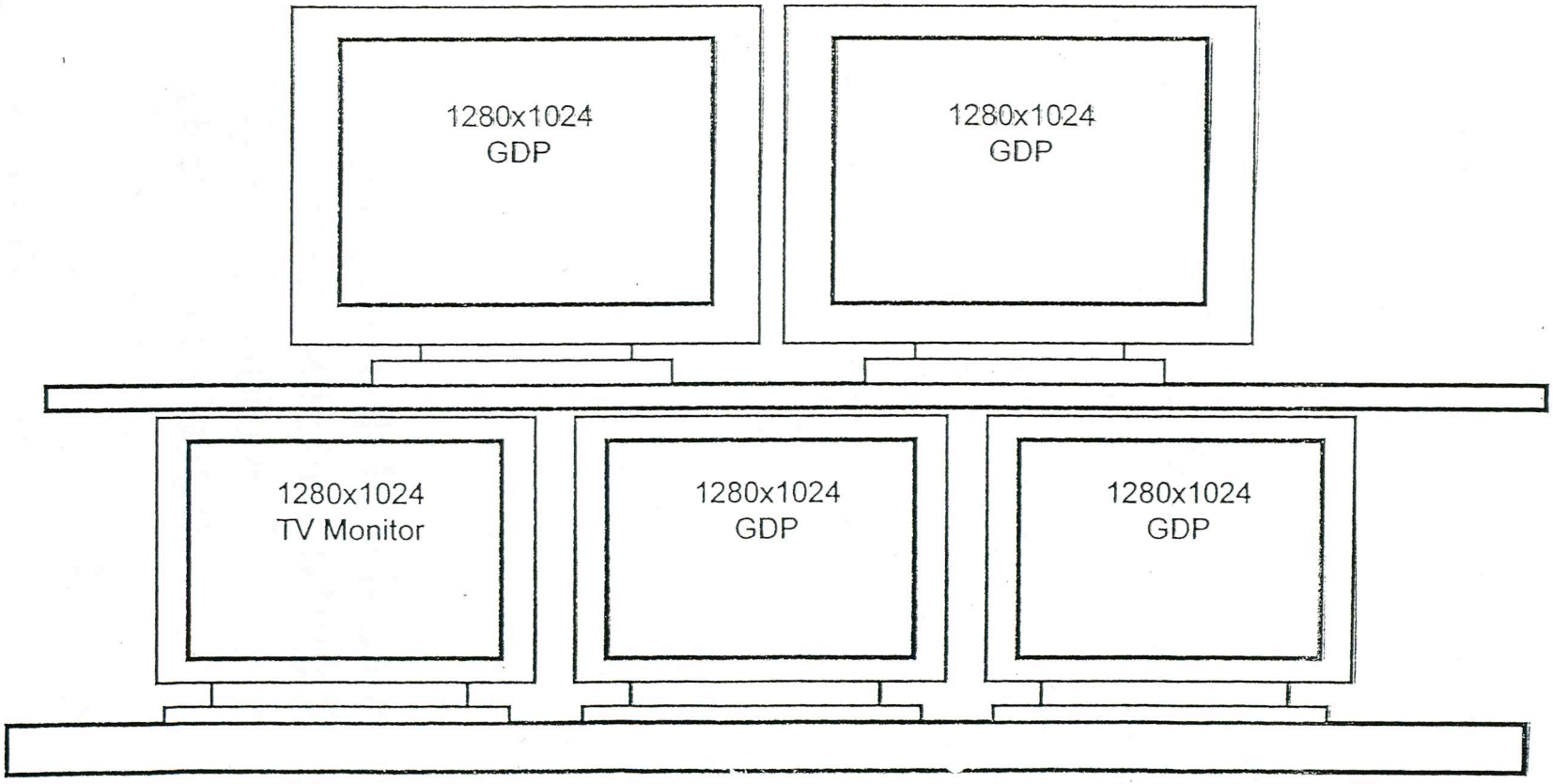
Central consoles (Multi-screen X-terminals)

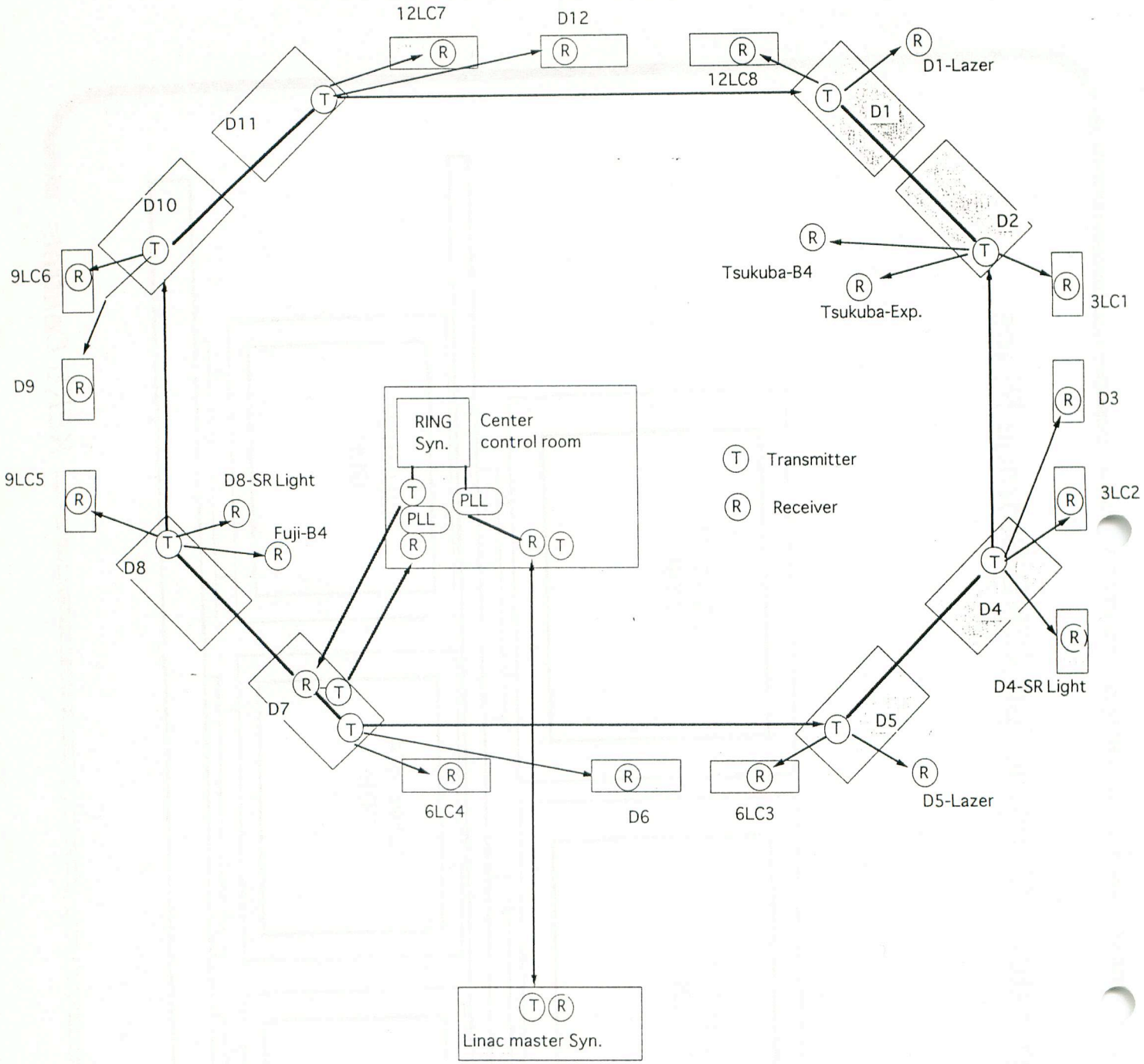
Network Computers as cheap X-terminals

Additional Server WS

Gateway WS

A Set of Operator's Console for KEKB Storage Rings





Reference signal distribution

Signals: RF(508MHz)

Revolution(100kHz)

Injection(e-)(50Hz)

Injection(e+)(50Hz)

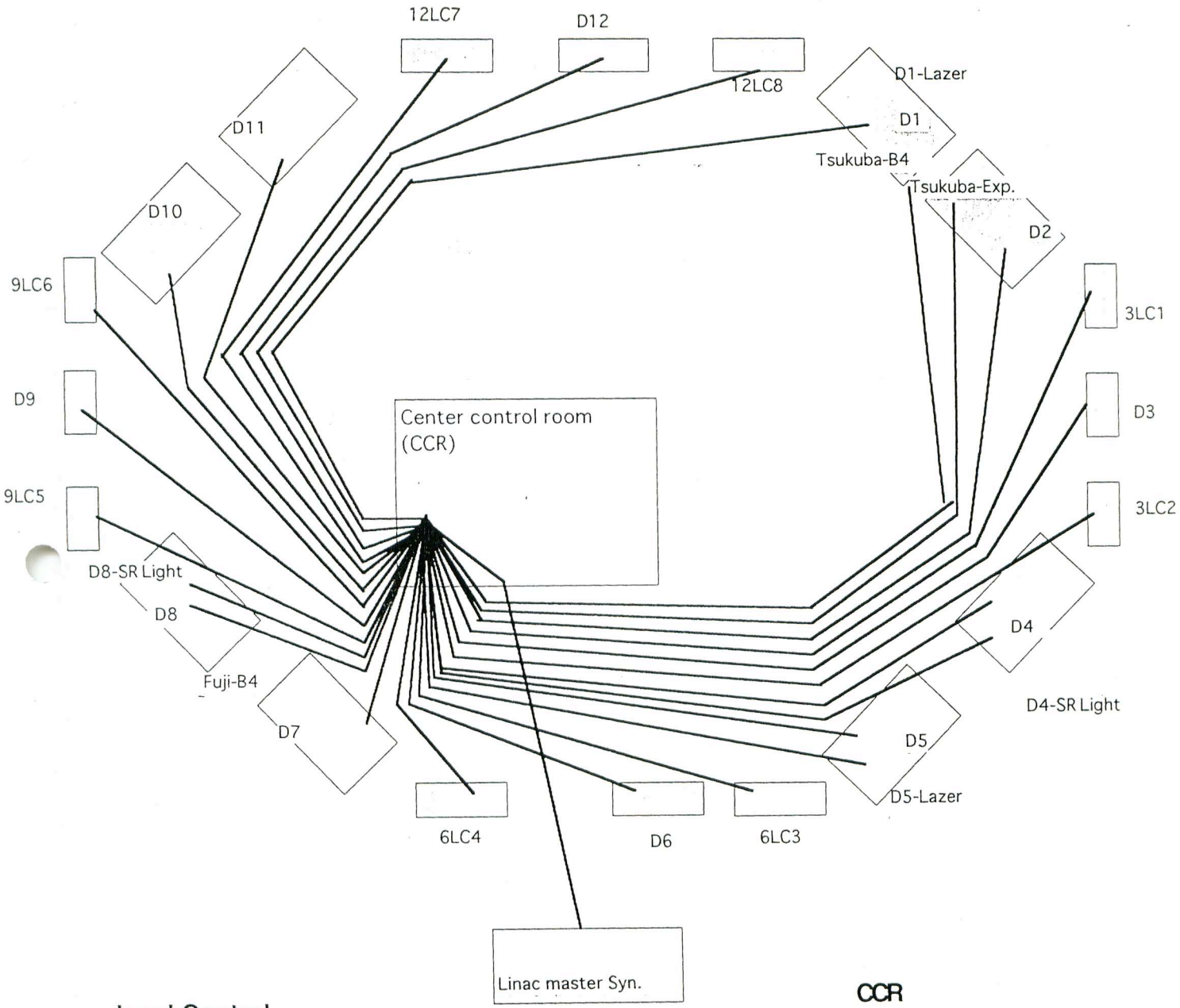
Optical Link system

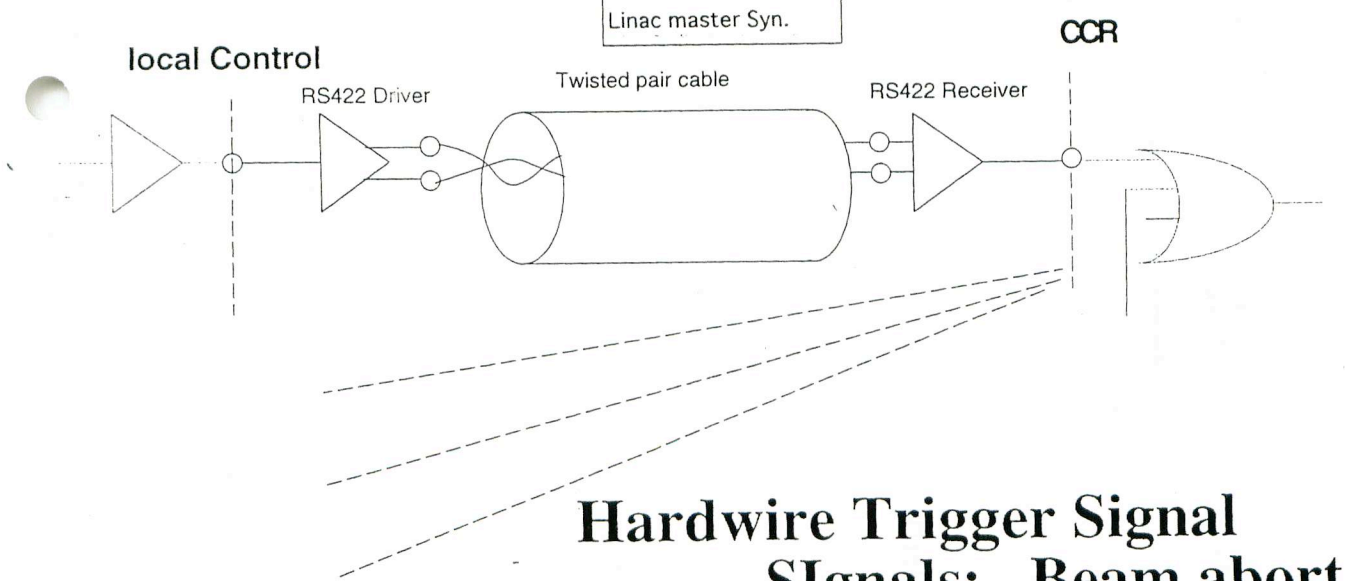
Phase stabilized optical fiber

Stability

RF section ~5ps

Others ~30ps

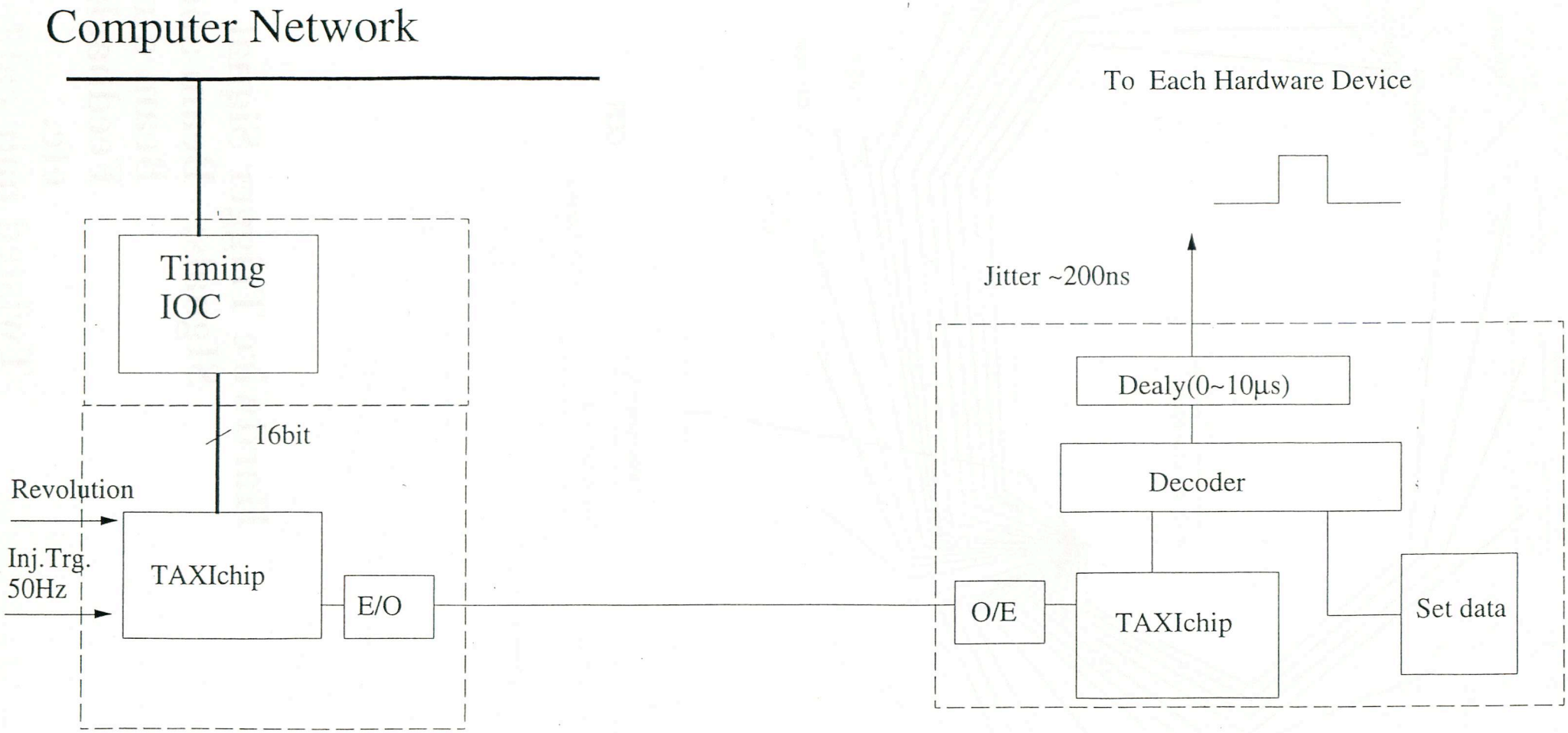




Hardwire Trigger Signal

SIgnals: Beam abort
Beam dump
Feedback status
etc.

Twisted pair cable



Software Timing Signal for synchronize at each satellite station

Sftware driven signals

Coded signal generation & detection (16bit)

Hardware Evaluation

PowerPC performance in EPICS environment

MPC604e(200MHz) VME board ～ 10 times FORCE CPU64

Network Computer as a cheap X-terminal

for Local Console, Status Display on CATV

ILIOS IT100 : Test in progress

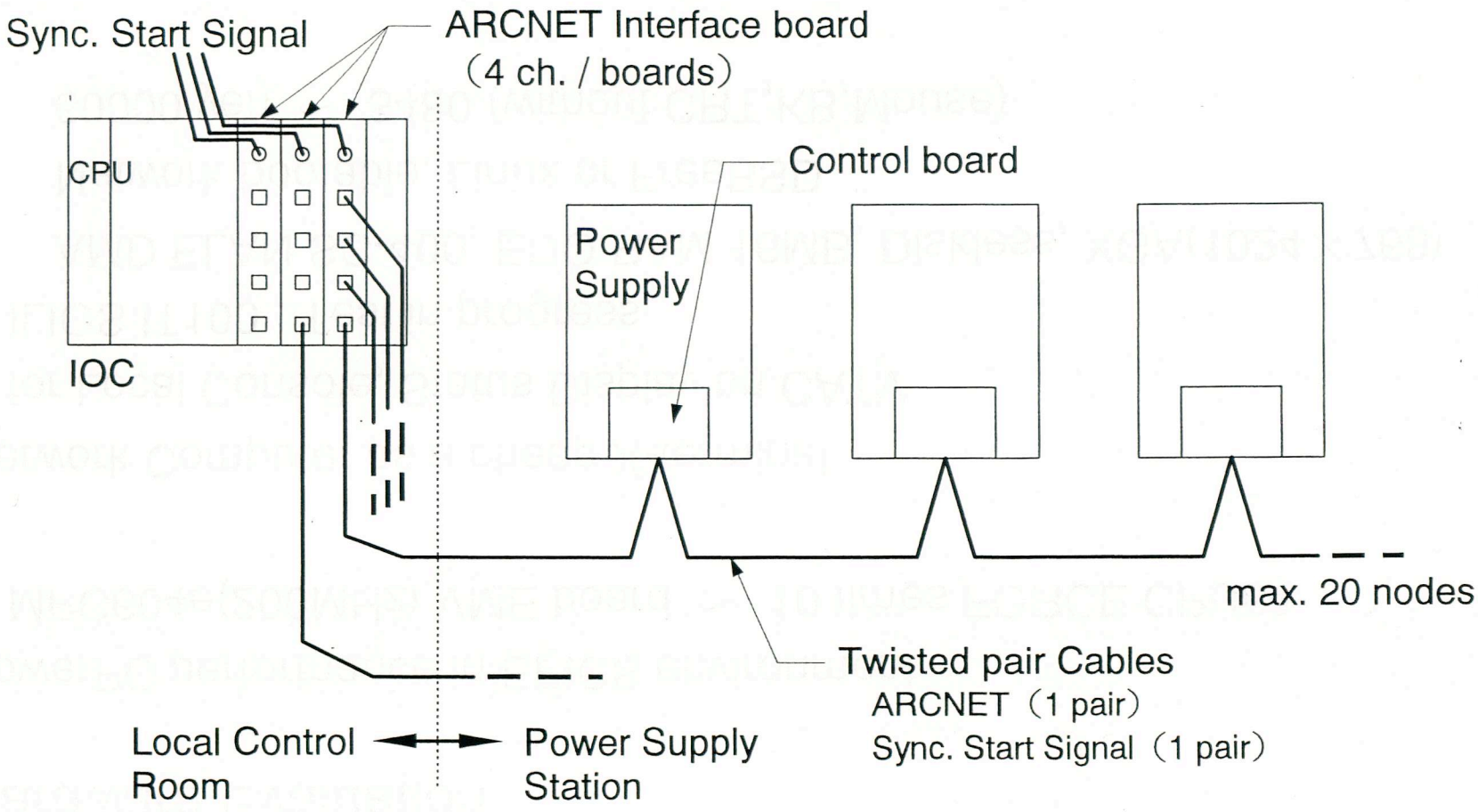
AMD ELAN SC-400, EDO RAM 16MB, Diskless, XGA(1024×768)

Network bootable, Linux or FreeBSD

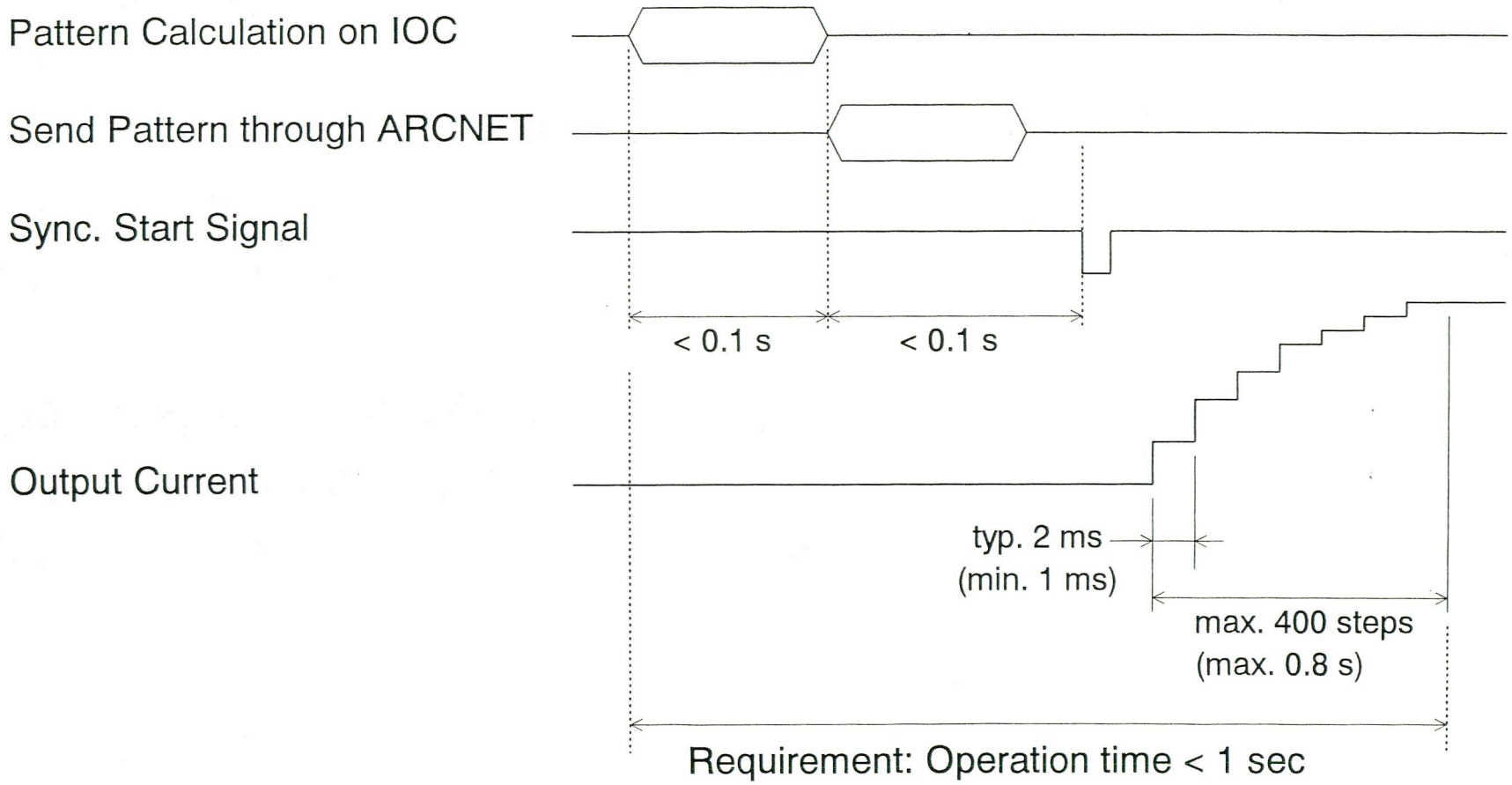
60000 yen ～ $480 (without CRT,KB,Mouse)

ARCNET

＊Magnet Power Supply Control System



Synchronous Operation of Steering Power Supply



ARCNET (Continued)

＊Control board

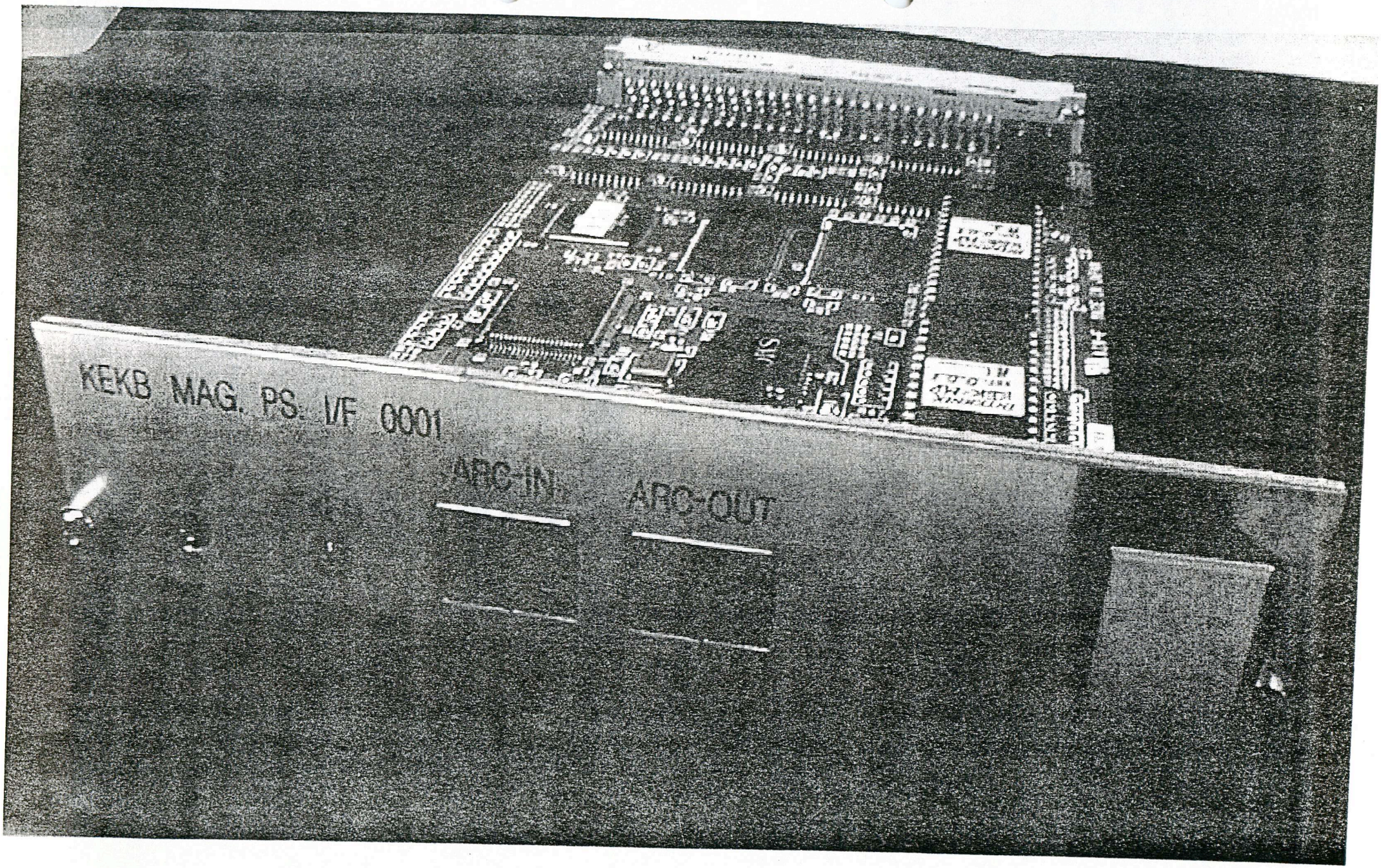
- CPU AM186EM 25MHz（i80186 equivalent）
  ROM 256KB, RAM 256KB
- Mass production in progress

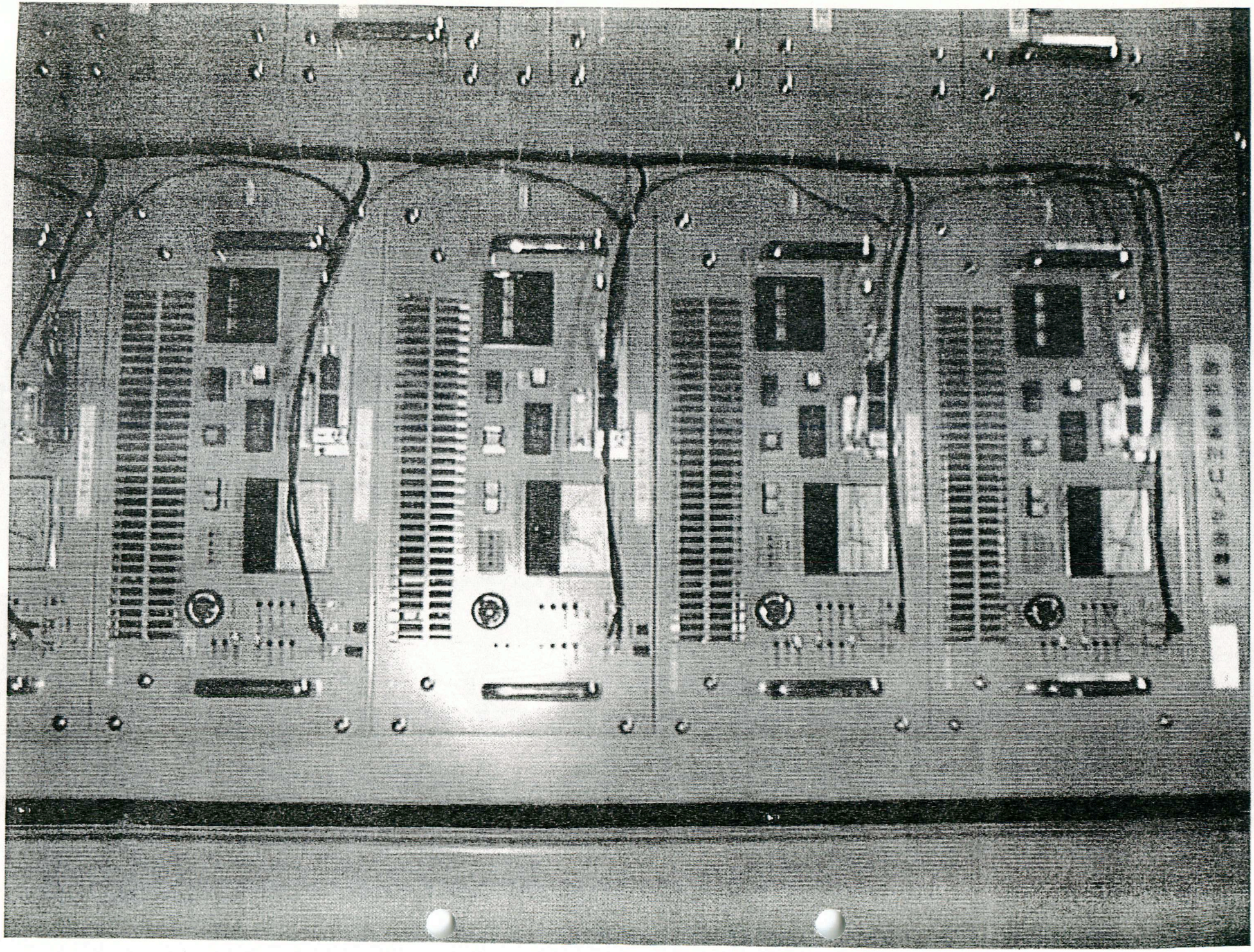
＊ARCNET Interface board

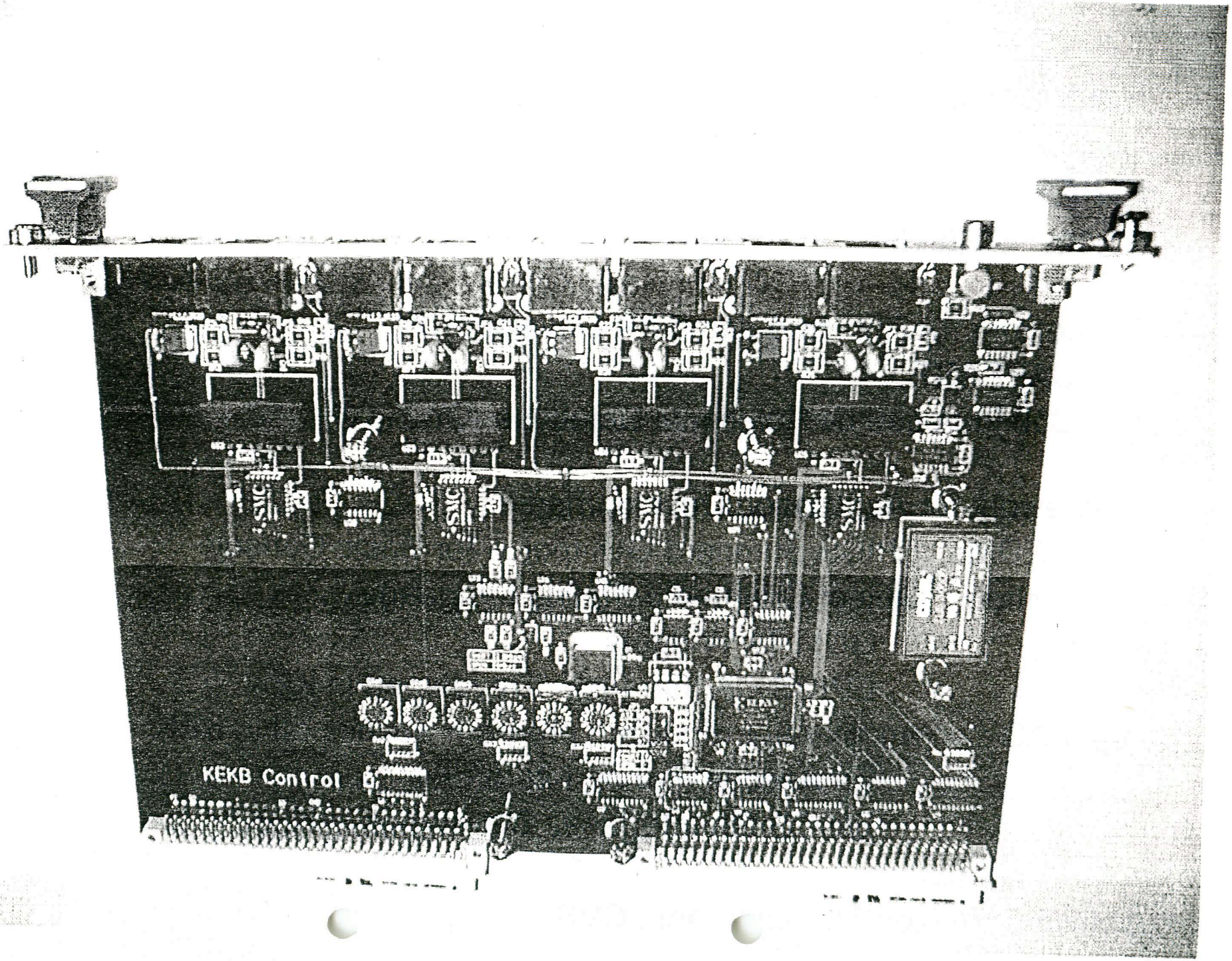
- 4 ch. / board
- Mass production completed

＊Other application

- Relay Control for BBA（Beam Based Alignment）System
- Control of Video Switch Matrix (for CATV and Screen Monitors)


KEKB MAG. PS. I/F 0001
ARC-IN
ARC-OUT




KEKB Control

Software Development

EPICS

R3.12 → R3.13

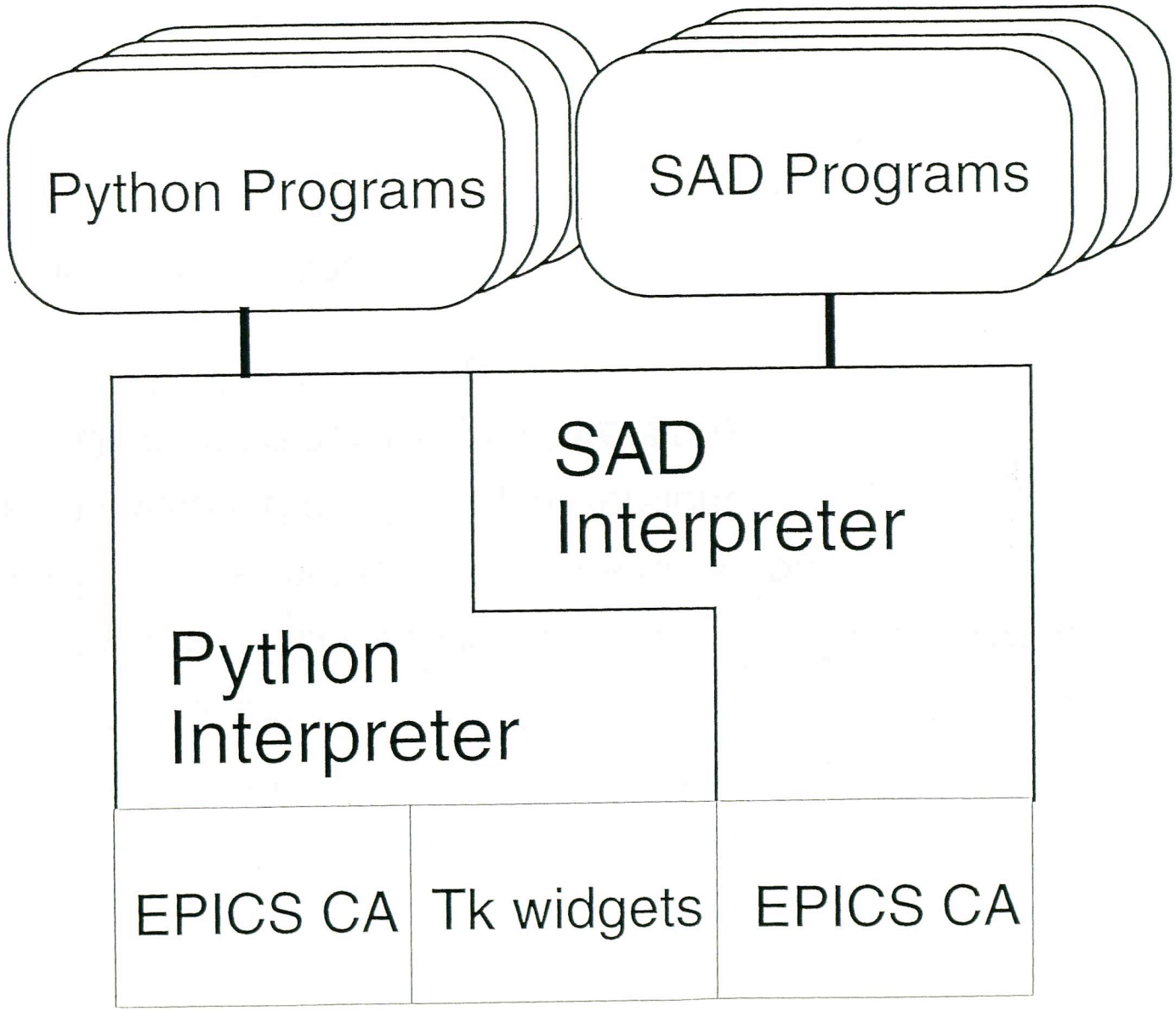
Framework for Run time database Development

- CAPFAST
- Configuration by Relational Database (Oracle 7)

Framework for Application Development

- MEDM : EPICS Standard GUI tool ... for Basic Console
- Python : Object Oriented Scripting Language
  - GUI : Tk Widgets
  - EPICS CA Interface : Developed in KEK
- SAD : Accelerator modeling program developed in KEK
  - Embedded Python Interpreter
  - EPICS CA Interface : Developed in KEK

Software Version Management : CVS


Python Programs
SAD Programs
SAD
Interpreter
Python
Interpreter
EPICS CA
Tk widgets
EPICS CA

EPICS Device Driver & Device Support

CAMAC :	EPICS standard + minor modification
GPIB :	EPICS standard + GDL
	GDL = GPIB Description Language : Developed at KEK
RS-232C :	EPICS standard + minor modification
Modbus+ :	Developed at KEK (First Version)
ARCNET :	Developed at KEK (First Version)
VXI :	Under Development

Linac CA Server : Developed

Relational Database (Oracle7)

Device parameters
Wiring information
Magnetic Field Measurement Data
BPM Mapping Data
Other Calibration Constants
Lattice information
.....

Data are partially available
User interface using WWW → Easy to maintain client programs

ファイル 編集 表示 ジャンプ ブックマーク オプション ディレクトリ
戻る 進む ホーム 再読込 検索 印刷 停止
場所: http://abcol.kek.jp:80/dbco/co/owa/www_co.ow_rack.form2?pid=3.
最新情報 おすすめ リンク集 ネット検索 人々 ソフトウェア

KEKB データベース(WWW_CO)
user:kawaguti on abcol (98-02-17)

Location: ARE

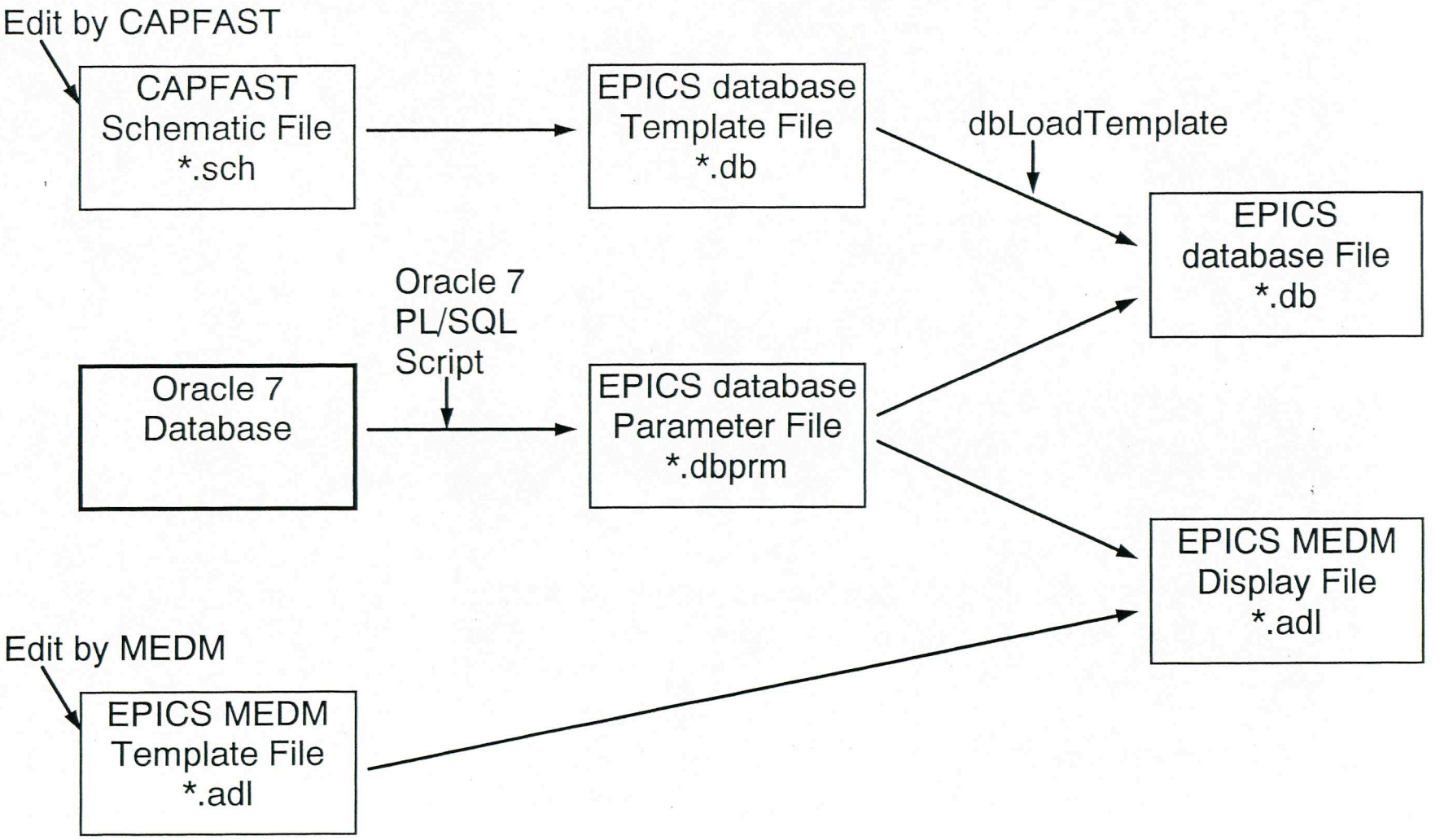
Rack Menu CBT ARS

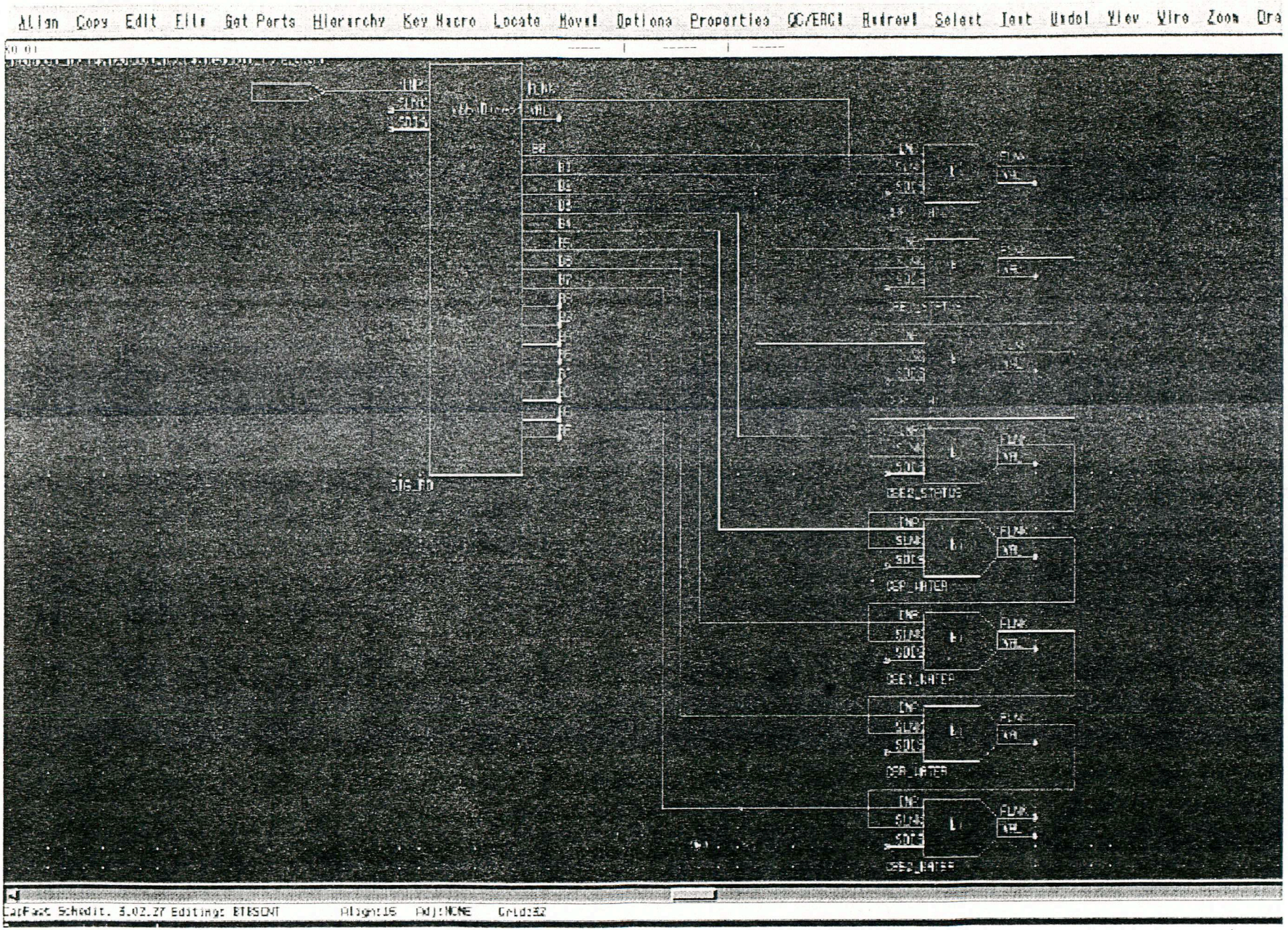
[Rack | VME | VXI | CAMAC]

Racks:

Rack Name	Maker	Type	Comments
ARE-BT-C1	RITTAL		(Subracks: 2)
ARE-BT-C2			(Subracks: 3)
ARE-BT-P2	RITTAL		電源室
ARE-BT-TP1	RITTAL		電源室
ARE-QM-1			BT Magnet PS (Subracks: 4)
ARE-QM-2			BT Magnet PS (Subracks: 4)
ARE-QMU-1			電源室
ARE-QMU-3			電源室
ARE-QMU-5			電源室
ARE-QMU-6			電源室
ARE-STH			BT Magnet PS (Subracks: 10)
ARE-STV			BT Magnet PS (Subracks: 8)

EPICS database Configuration by Oracle




Align Copy Edit File Get Parts Hierarchy Key Macro Locate Move! Options Properties QC/ERC! Redraw! Select Text Undo! View Wire Zoom Dra
SIG_RD
CEE2_STATUS
CEP_WATER
CEE1_WATER
CEA_WATER
CEB2_WATER
CapFast Schedit. 3.02.27 Editing: BTBSCNT Align:16 Adj:NONE Grid:32

EPICS database Template File “BTMGPS.db”

```
                    :
                    :
record(ai,"$(HEAD):$(NAME):INP_AMP") {
        field(DESC,"analog input record")
        field(SCAN,"Passive")
        field(PINI,"NO")
        field(PHAS,"0")
        field(EVNT,"0")
        field(DTYP,"Soft Channel")
        field(DISV,"1")
        field(SDIS,"0.000000000000000e+00")
        field(DISS,"NO_ALARM")
        field(PRIO,"LOW")
        field(FLNK,"$(HEAD):$(NAME):INP_AMP_PUT.VAL")
        field(INP,"0.000000000000000e+00")
        field(PREC,"0")
        field(LINR,"NO CONVERSION")
        field(EGUF,"0.0000000e+00")
        field(EGUL,"0.0000000e+00")
        field(EGU,"volts")
        field(HOPR,"$(PS_MAX)")
        field(LOPR,"$(PS_MIN)")
        field(AOFF,"0.0000000e+00")
                    :
                    :
```

EPICS database Parameter File “MGPS_B.dbprm”

```
                    :
                    :
file BTMGPS.db {
    {
        CHANNEL="1",
        DV_ADR="1",
        DV_AO=".00827",
        DV_AS="1.0000389",
        DV_CH="101",
        DV_K="20",
        DV_P_HI="65",
        DV_P_LO="5",
        HEAD="BTePS",
        NAME="BOE",
        NODE_NO="1",
        PS_MAX="200",
        PS_MIN="0",
        THRU_COEFF=" 3.333333"
    }
}
                    :
                    :
```

MEDM Parameter File “tmp_bt_ps_b.adl”

```
                    :
                    :
"text entry" {
        object {
                x=1027
                y=163
                width=100
                height=25
        }
        control {
                chan="$(H):$(N):INP_AMP"
                clr=14
                bclr=1
        }
}
                    :
                    :
```

Control System for AR-BT

First operation of a part of KEKB BT line (AR-BT) : 3-Mar.～

AR-BT control system was developed.

- 55 Magnet Power Supplies (with Current Monitors)
- 6 Screen Monitors
  - Beam Shutter Status
  - Magnet Interlock Status
- 12 Ion Pumps
- 8 Vacuum Switches
- 4 Cold Cathode Gauges
- 7 Gate Valves

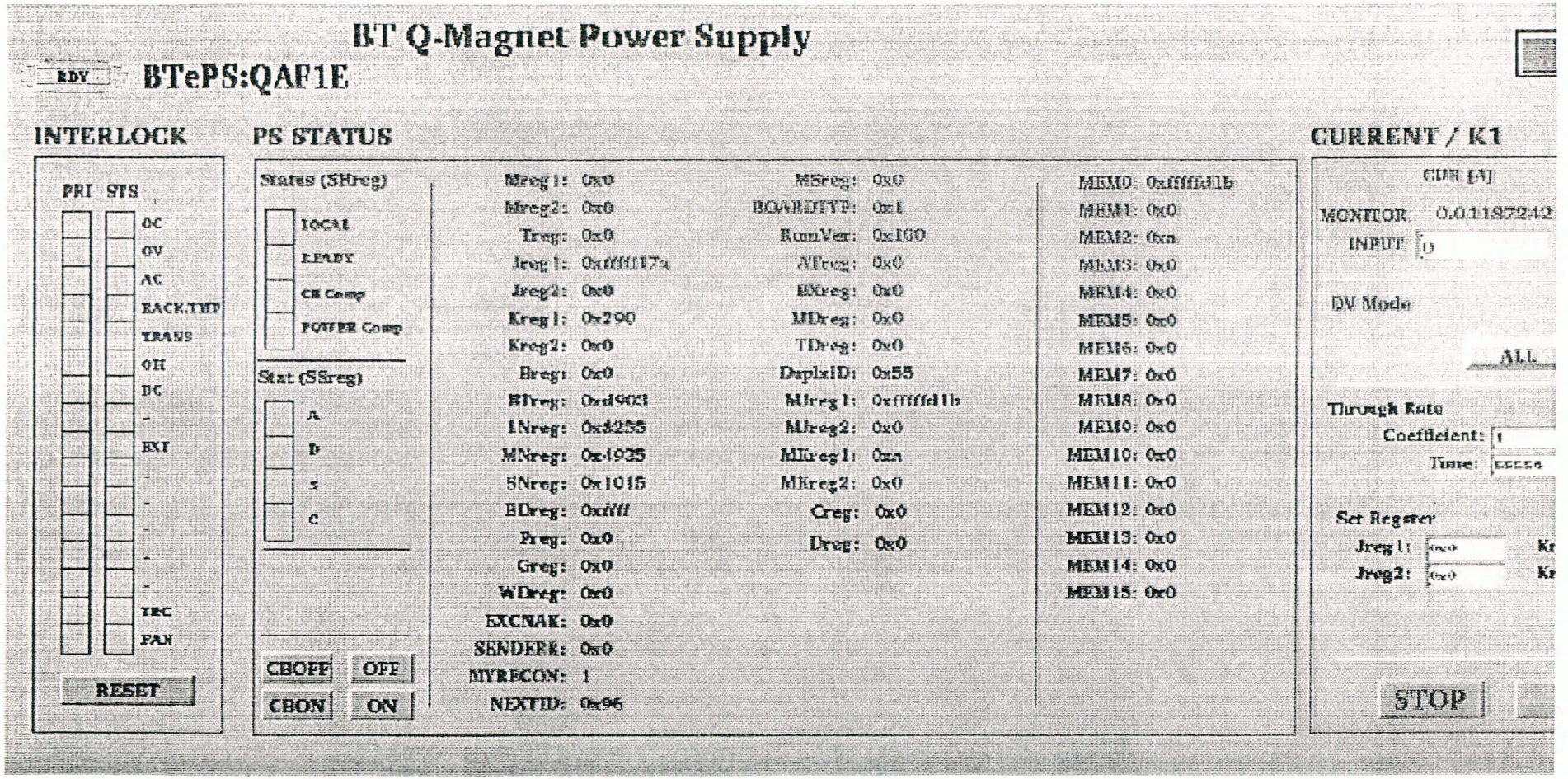
"First KEKB Control System" ----- Now Ready

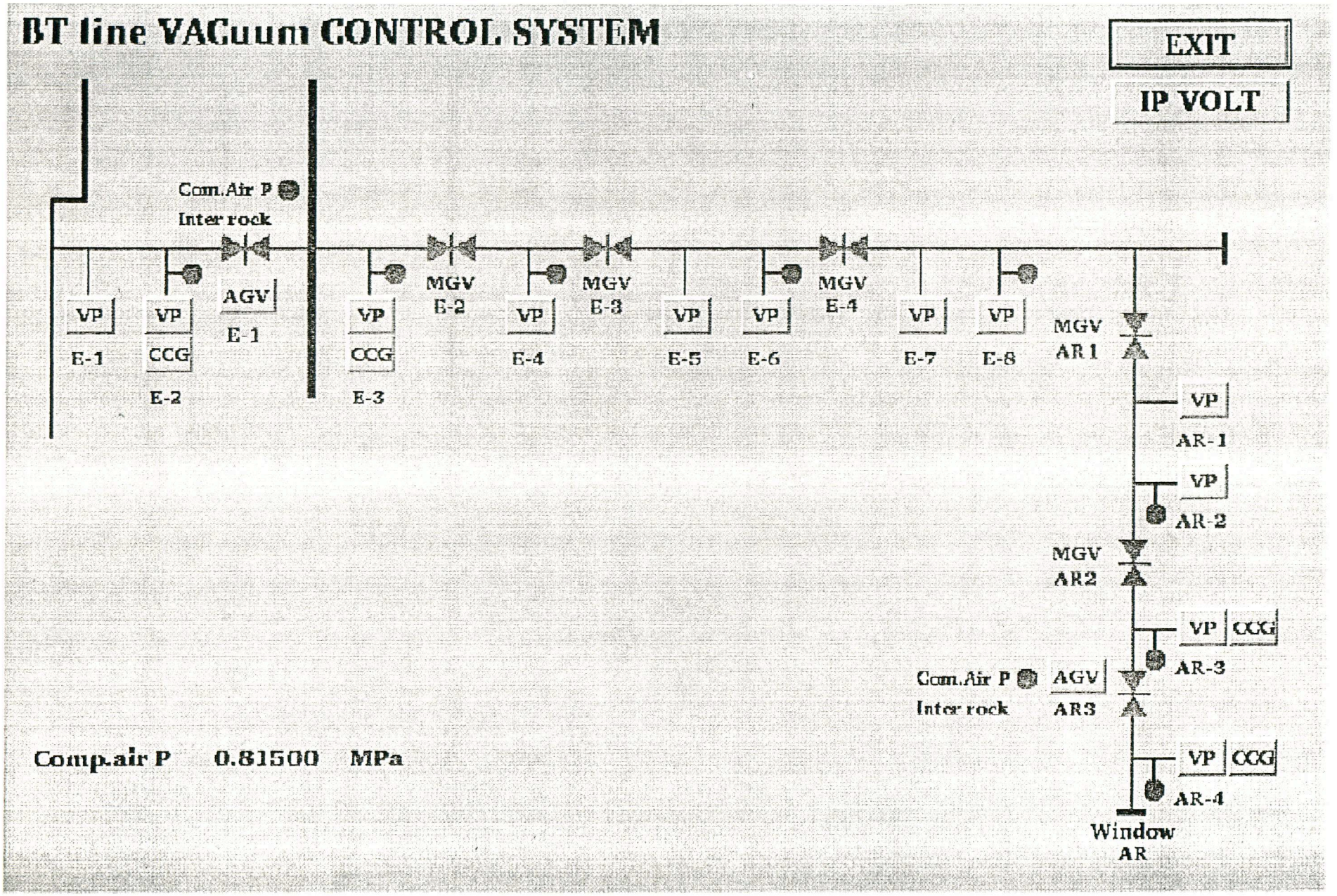
BT Q-Magnet Power Supply Controller

EXIT

NAME	POWER	STATUS	CURRENT [A] SET	CURRENT [A] MONITOR	K1 SET	K1 MONITOR	
QAD2E	○	N/A	0	-0.3885			CTRL
QAF1E	○	RDY	0	0.01187			CTRL
QAF2E	○	N/A	0	0.2430C			CTRL
QWDE_L3	○	RDY	0	0.00735			CTRL
QWFE_L3	○	RDY	0	38.3631			CTRL
QX1E	○	RDY	0	0.00795			CTRL
QX2E	○	RDY	0	0.00685			CTRL
QX3E	○	N/A	0	0.0079C			CTRL
QX4E	○	N/A	0	0.00937			CTRL
QX5E	○	RDY	0	0.01716			CTRL
QXD1E	○	RDY	0	0.00704			CTRL
QXD2E	○	RDY	0	0.01134			CTRL

NAME	POWER	STATUS	CURRENT [A] SET	CURRENT [A] MONITOR	K1 SET	K1 MONITOR	
QXD3E	○	RDY	0	0.0100S			CTRL
QXD4E	○	RDY	0	0.00042			CTRL
QXD5E	○	RDY	0	41.1458			CTRL
QXD6E	○	RDY	0	0.00535			CTRL
QXD7E	○	RDY	0	0.00834			CTRL
QXF1E	○	RDY	0	0.01187			CTRL
QXF2E	○	RDY	0	0.00740			CTRL
QXF3E	○	RDY	0	0.00728			CTRL
QXF4E	○	RDY	0	-0.0048			CTRL
QXF5E	○	RDY	5	0.0156C			CTRL
QXF6E	○	RDY	0	38.5308			CTRL


BT Q-Magnet Power Supply
RDY
BTePS:QAF1E
INTERLOCK
PS STATUS
CURRENT / K1
PRI STS
OC
OV
AC
RACK.TMP
TRANS
OH
DC
-
EXT
-
-
-
-
-
-
TEC
FAN
RESET
Status (SHreg)
LOCAL
READY
CH Comp
POWER Comp
Stat (SSreg)
A
D
S
C
CBOFF
OFF
CBON
ON
Mreg1: 0x0
Mreg2: 0x0
Treg: 0x0
Jreg1: 0xffff17a
Jreg2: 0x0
Kreg1: 0x290
Kreg2: 0x0
Breg: 0x0
BIreg: 0xd903
INreg: 0x8255
MNreg: 0x4935
SNreg: 0x1015
BDreg: 0xffff
Preg: 0x0
Greg: 0x0
WDreg: 0x0
EXCNAK: 0x0
SENDERR: 0x0
MYRECON: 1
NEXTID: 0x96
MSreg: 0x0
BOARDTYP: 0x1
RunVer: 0x100
ATreg: 0x0
EXreg: 0x0
MDreg: 0x0
TDreg: 0x0
DuplxID: 0x55
Mlreg1: 0xfffffd1b
Mlreg2: 0x0
MIlreg1: 0xa
MIreg2: 0x0
Creg: 0x0
Dreg: 0x0
MEM0: 0xfffffd1b
MEM1: 0x0
MEM2: 0xa
MEM3: 0x0
MEM4: 0x0
MEM5: 0x0
MEM6: 0x0
MEM7: 0x0
MEM8: 0x0
MEM9: 0x0
MEM10: 0x0
MEM11: 0x0
MEM12: 0x0
MEM13: 0x0
MEM14: 0x0
MEM15: 0x0
GUN [A]
MONITOR 0.011972412
INPUT 0
DV Mode
ALL
Through Rate
Coefficient: 1
Time: 55556
Set Register
Jreg1: 0x0
Jreg2: 0x0
STOP


BT line VACuum CONTROL SYSTEM
EXIT
IP VOLT
Com.Air P
Inter rock
VP
E-1
VP
CCG
E-2
AGV
E-1
VP
CCG
E-3
MGV
E-2
VP
E-4
MGV
E-3
VP
E-5
VP
E-6
MGV
E-4
VP
E-7
VP
E-8
MGV
AR1
VP
AR-1
VP
AR-2
MGV
AR2
VP
CCG
AR-3
Com.Air P
Inter rock
AGV
AR3
VP
CCG
AR-4
Window
AR
Comp.air P 0.81500 MPa