US00RE34842E

United States Patent [19]

Ejiri et al.

[11] E **Patent Number: Re. 34,842**

[45] **Reissued Date of Patent: Jan. 31, 1995**

[54] **FACSIMILE REMOTE DIAGNOSTIC SYSTEM**

[75] Inventors: **Koichi Ejiri**, Yokohama; **Tina Jeng**, Los Altos, Calif.; **Rithy Roth**, Richmond, Calif.; **Lak M. Lam**, Pleasanton, Calif.

[73] Assignee: **Ricoh Corporation**, San Jose, Calif.

[21] Appl. No.: **965,076**

[22] Filed: **Oct. 22, 1992**

Related U.S. Patent Documents

Reissue of:

[64] Patent No.: **4,965,676**
Issued: **Oct. 23, 1990**
Appl. No.: **317,190**
Filed: **Feb. 28, 1989**

[51] **Int. Cl.**[6] **H04H 1/00**
[52] **U.S. Cl.** **356/406**; 358/404
[58] **Field of Search** 358/404, 406

[56] **References Cited**

U.S. PATENT DOCUMENTS

3,830,962	8/1974	Mailloux	358/406
4,583,834	4/1986	Seko .	
4,727,429	2/1988	Ueno	358/406
5,077,582	12/1991	Kravette .	

OTHER PUBLICATIONS

Japanese Patent Laid-Open No. 59-22475, Laid Open Date: Feb. 4, 1984. Title: Remote Maintenance System For Facsimile Apparatus. Specification in English and Japanese.

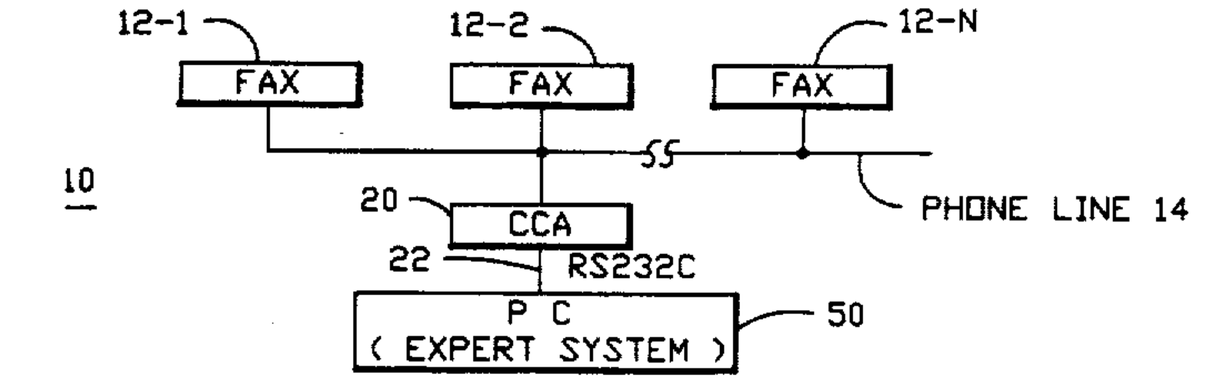
Japanese Patent Laid Open No. 61-251258, Laid Open Date: Nov. 8, 1986. Title: Communication Terminal Apparatus. Specification in English and Japanese.

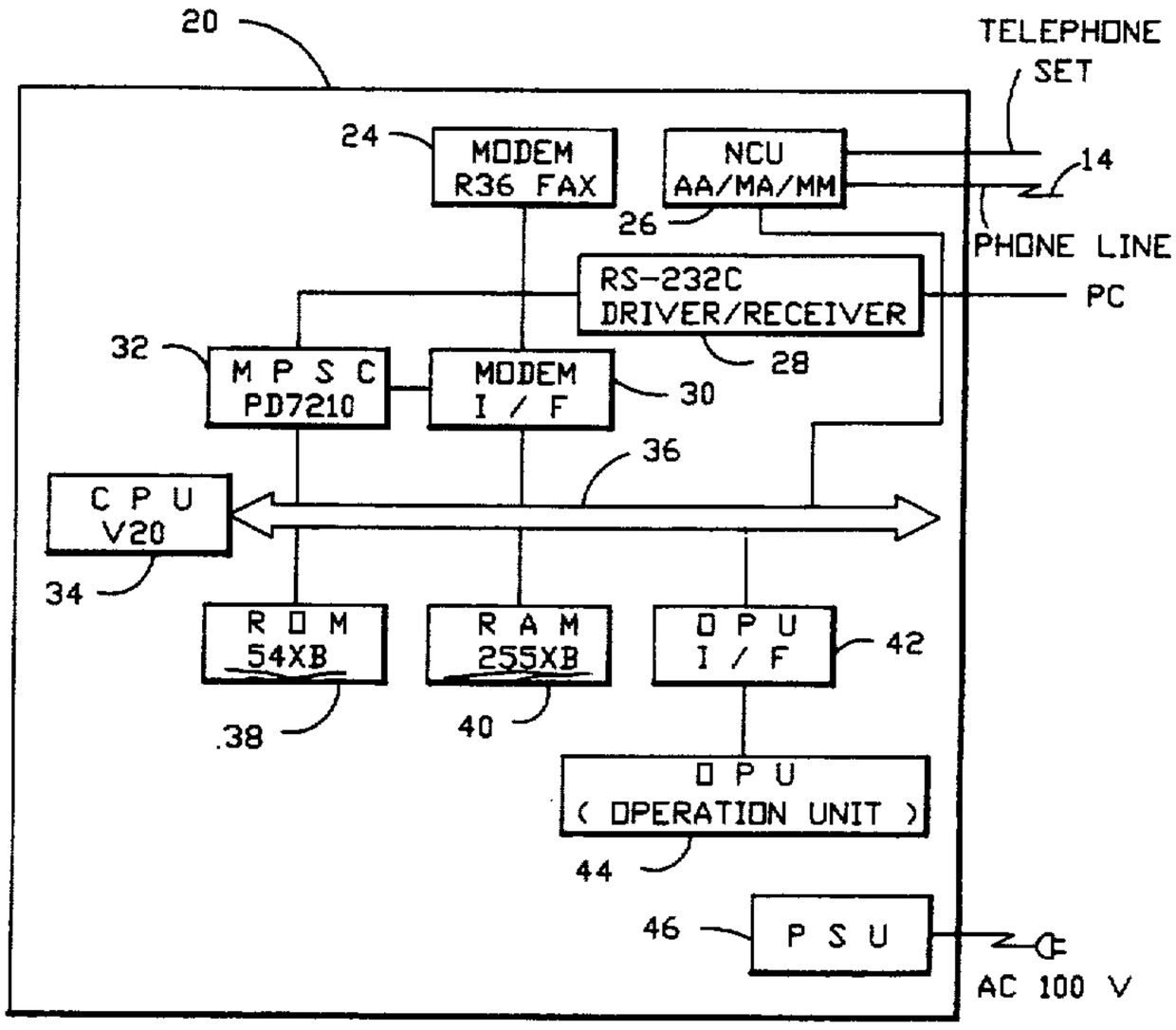
Primary Examiner—Stephen Brinich
Attorney, Agent, or Firm—Flehr, Hohbach, Test, Albritton & Herbert

[57] **ABSTRACT**

A remote diagnostic system provides remote diagnostics for one or more facsimile apparatus. The system comprises facsimile, a communication control adapter and a personal computer (with expert knowledge). The system includes several kinds of data files which work under a window environment, together with communication software, to look up and rewrite the buffer memory in each facsimile.

12 Claims, 23 Drawing Sheets





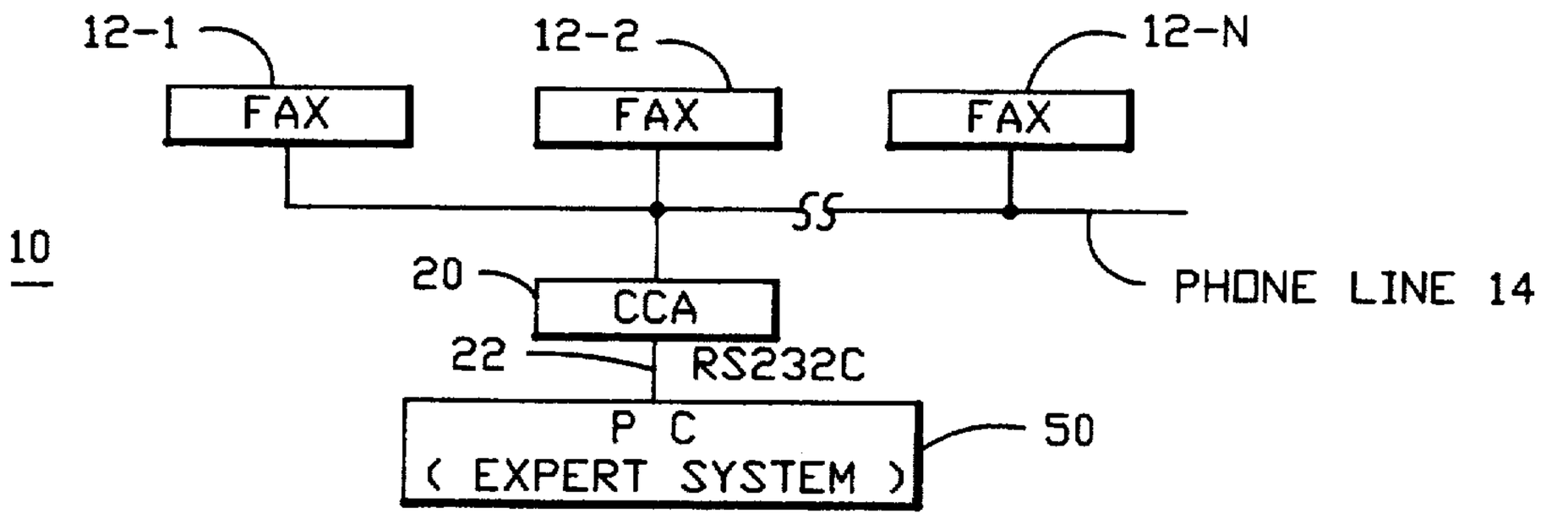

12-1
12-2
12-N
FAX
FAX
FAX
55
10
20
CCA
PHONE LINE 14
22
RS232C
P C
(EXPERT SYSTEM)
50

FIG.—1

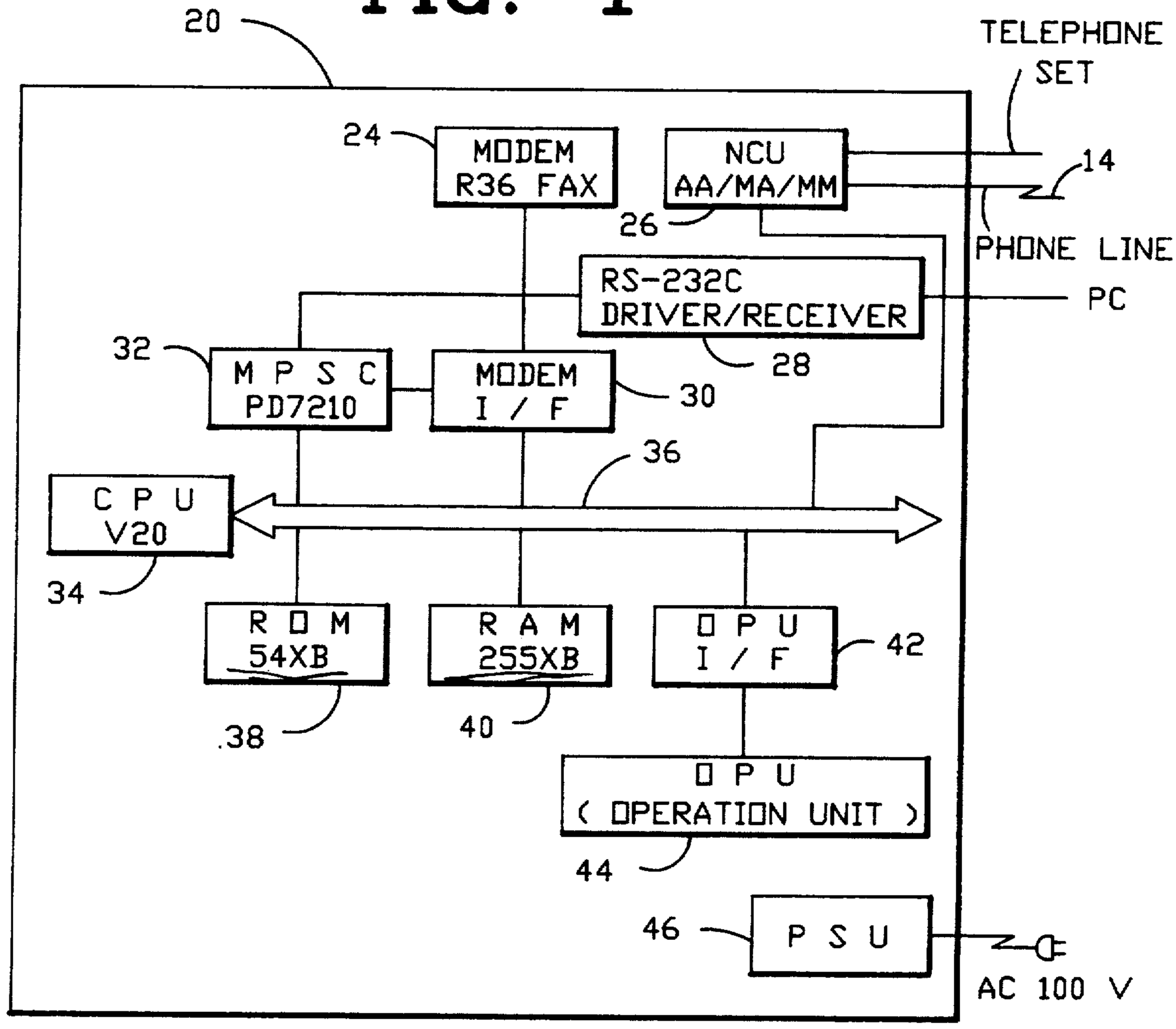

20
TELEPHONE SET
24
MODEM R36 FAX
NCU AA/MA/MM
14
26
PHONE LINE
RS-232C DRIVER/RECEIVER
PC
32
M P S C PD7210
MODEM I / F
30
28
36
C P U V20
34
R O M 54XB
R A M 255XB
O P U I / F
42
38
40
O P U (OPERATION UNIT)
44
46
P S U
AC 100 V

FIG.—2

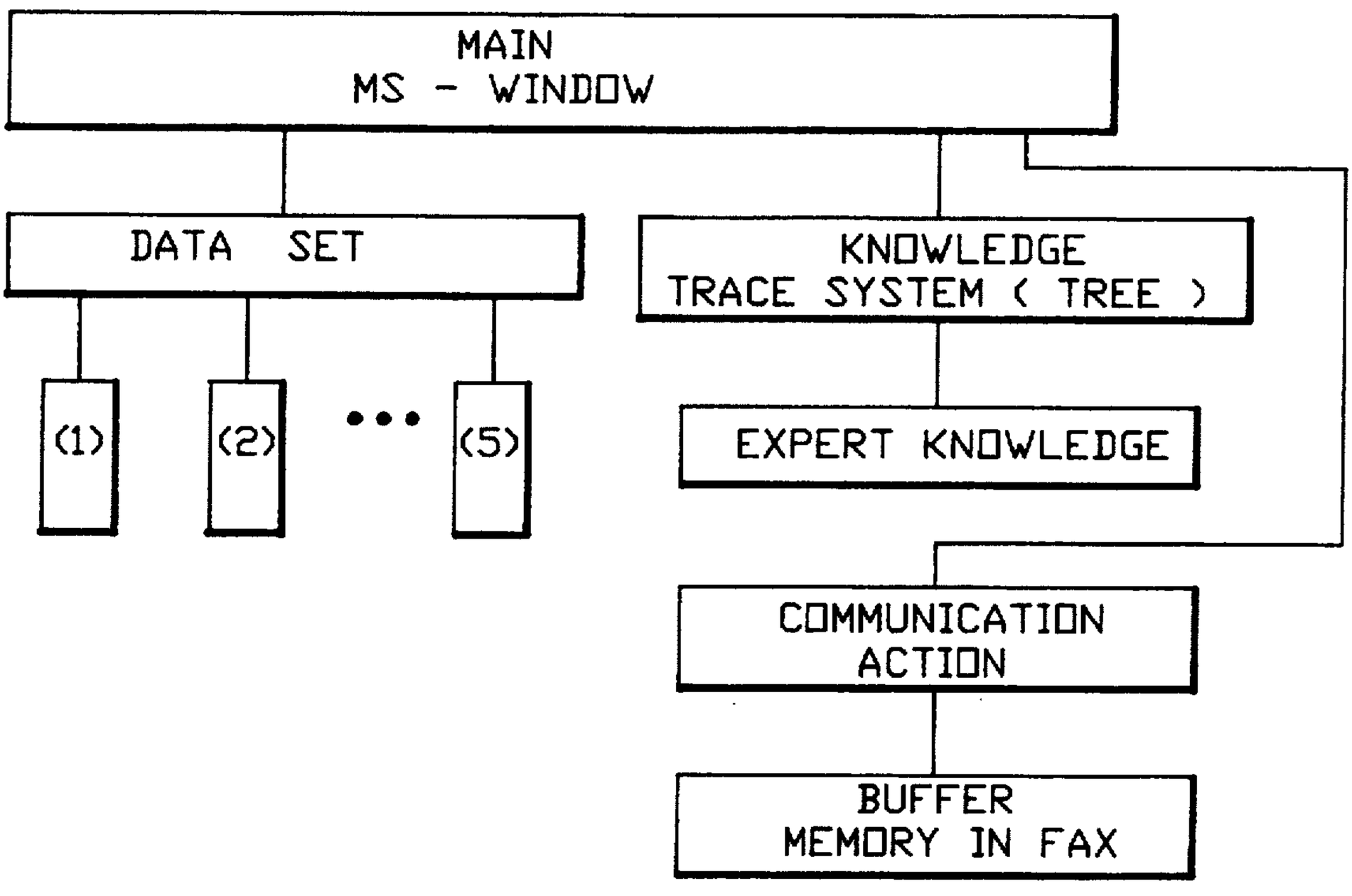

MAIN
MS - WINDOW
DATA SET
(1)
(2)
(5)
KNOWLEDGE
TRACE SYSTEM (TREE)
EXPERT KNOWLEDGE
COMMUNICATION
ACTION
BUFFER
MEMORY IN FAX

FIG.—3

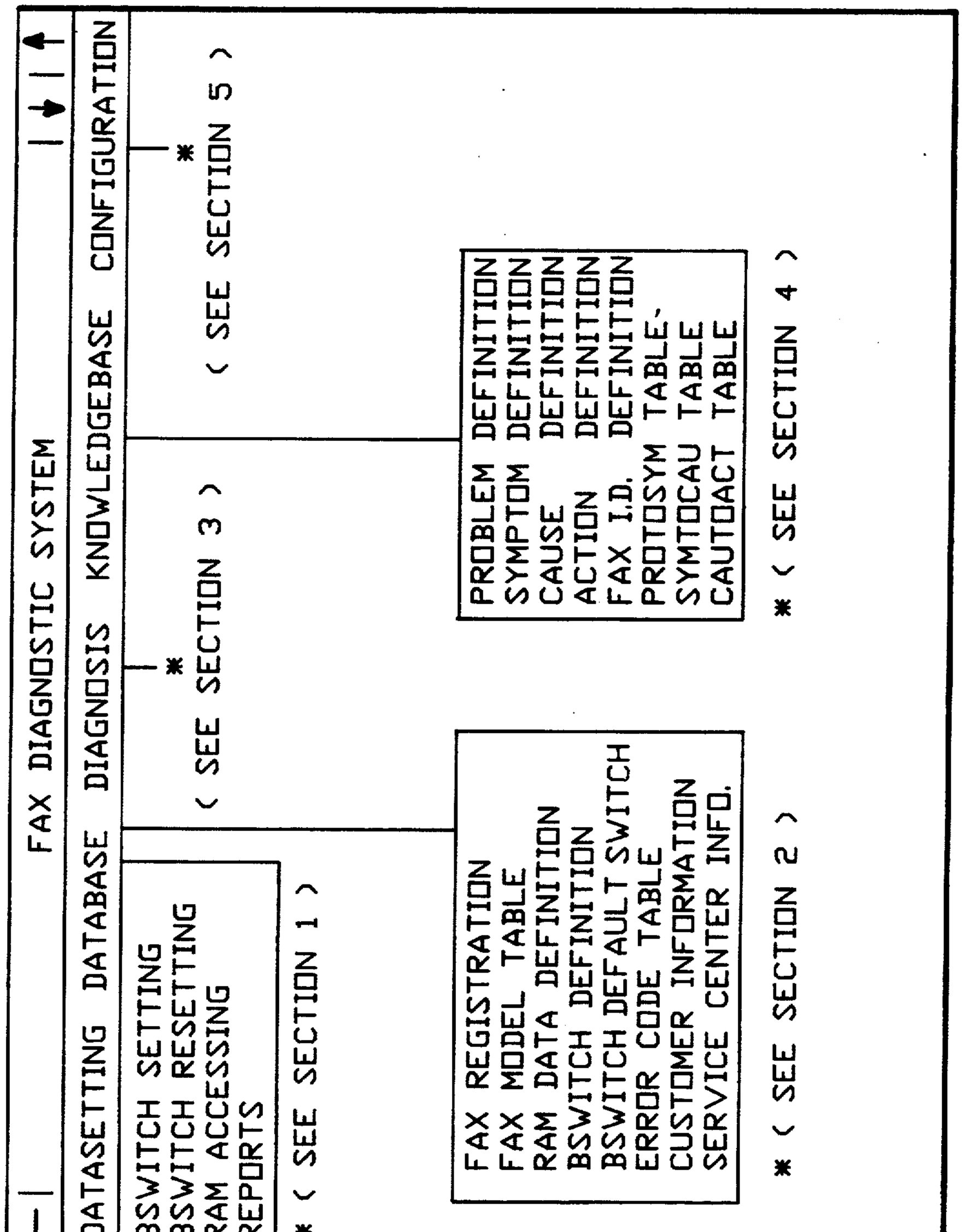

FAX DIAGNOSTIC SYSTEM
DATASETTING DATABASE DIAGNOSIS KNOWLEDGEBASE CONFIGURATION
BSWITCH SETTING
BSWITCH RESETTING
RAM ACCESSING
REPORTS
(SEE SECTION 1)
(SEE SECTION 3)
(SEE SECTION 5)
FAX REGISTRATION
FAX MODEL TABLE
RAM DATA DEFINITION
BSWITCH DEFINITION
BSWITCH DEFAULT SWITCH
ERROR CODE TABLE
CUSTOMER INFORMATION
SERVICE CENTER INFO.
(SEE SECTION 2)
PROBLEM DEFINITION
SYMPTOM DEFINITION
CAUSE DEFINITION
ACTION DEFINITION
FAX I.D. DEFINITION
PROTOSYM TABLE
SYMTOCAU TABLE
CAUTOACT TABLE
(SEE SECTION 4)

FIG.—4

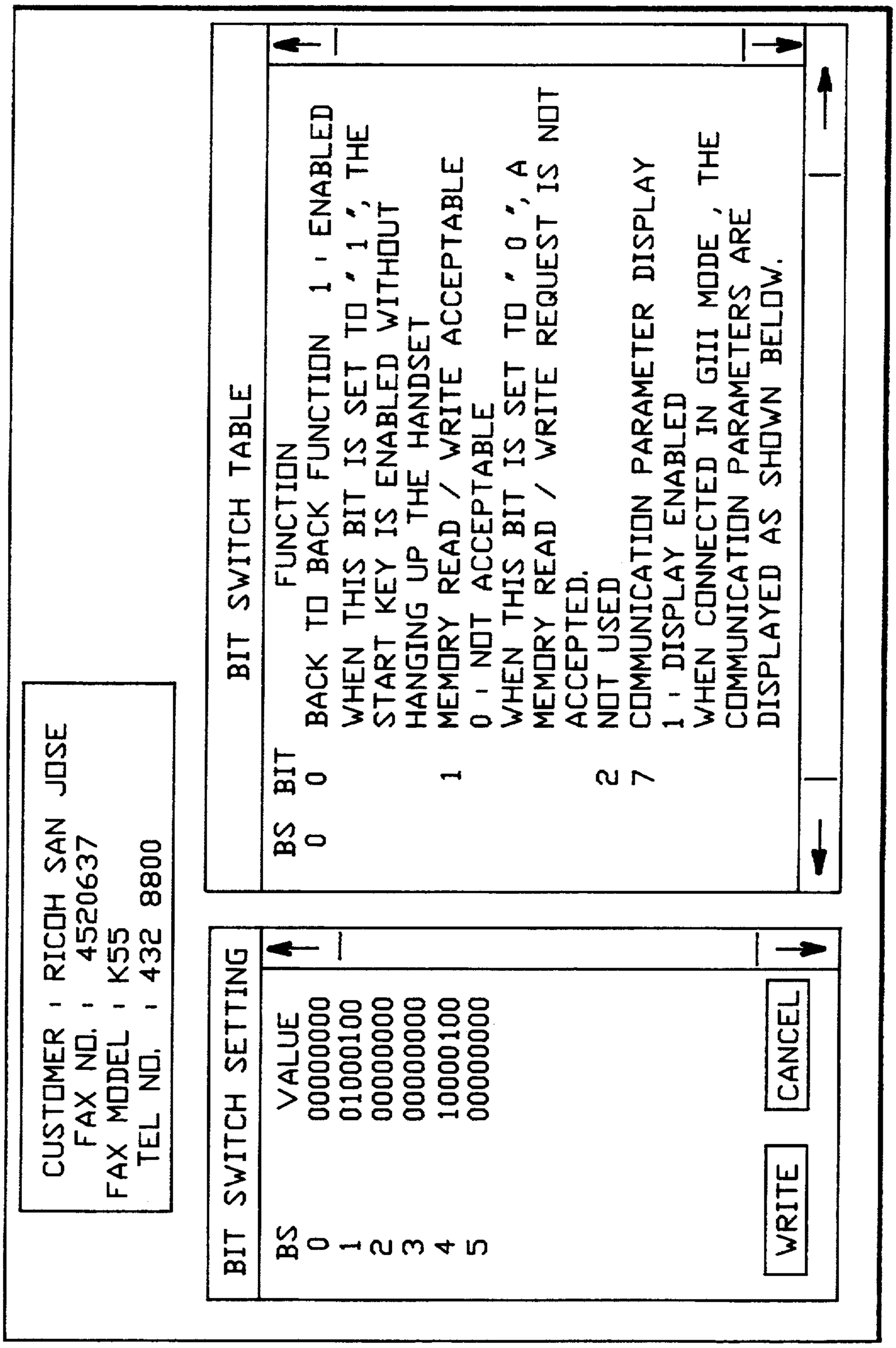

CUSTOMER : RICOH SAN JOSE
FAX NO. : 4520637
FAX MODEL : K55
TEL NO. : 432 8800
BIT SWITCH SETTING
BS VALUE
0 00000000
1 01000100
2 00000000
3 00000000
4 10000100
5 00000000
CANCEL
WRITE
BIT SWITCH TABLE
BS BIT FUNCTION
0 0 BACK FUNCTION 1 : ENABLED
WHEN THIS BIT IS SET TO ' 1 ', THE
START KEY IS ENABLED WITHOUT
HANGING UP THE HANDSET
1 MEMORY READ / WRITE ACCEPTABLE
0 : NOT ACCEPTABLE
WHEN THIS BIT IS SET TO ' 0 ', A
MEMORY READ / WRITE REQUEST IS NOT
ACCEPTED.
2 NOT USED
7 COMMUNICATION PARAMETER DISPLAY
1 : DISPLAY ENABLED
WHEN CONNECTED IN GIII MODE, THE
COMMUNICATION PARAMETERS ARE
DISPLAYED AS SHOWN BELOW.

FIG.—5

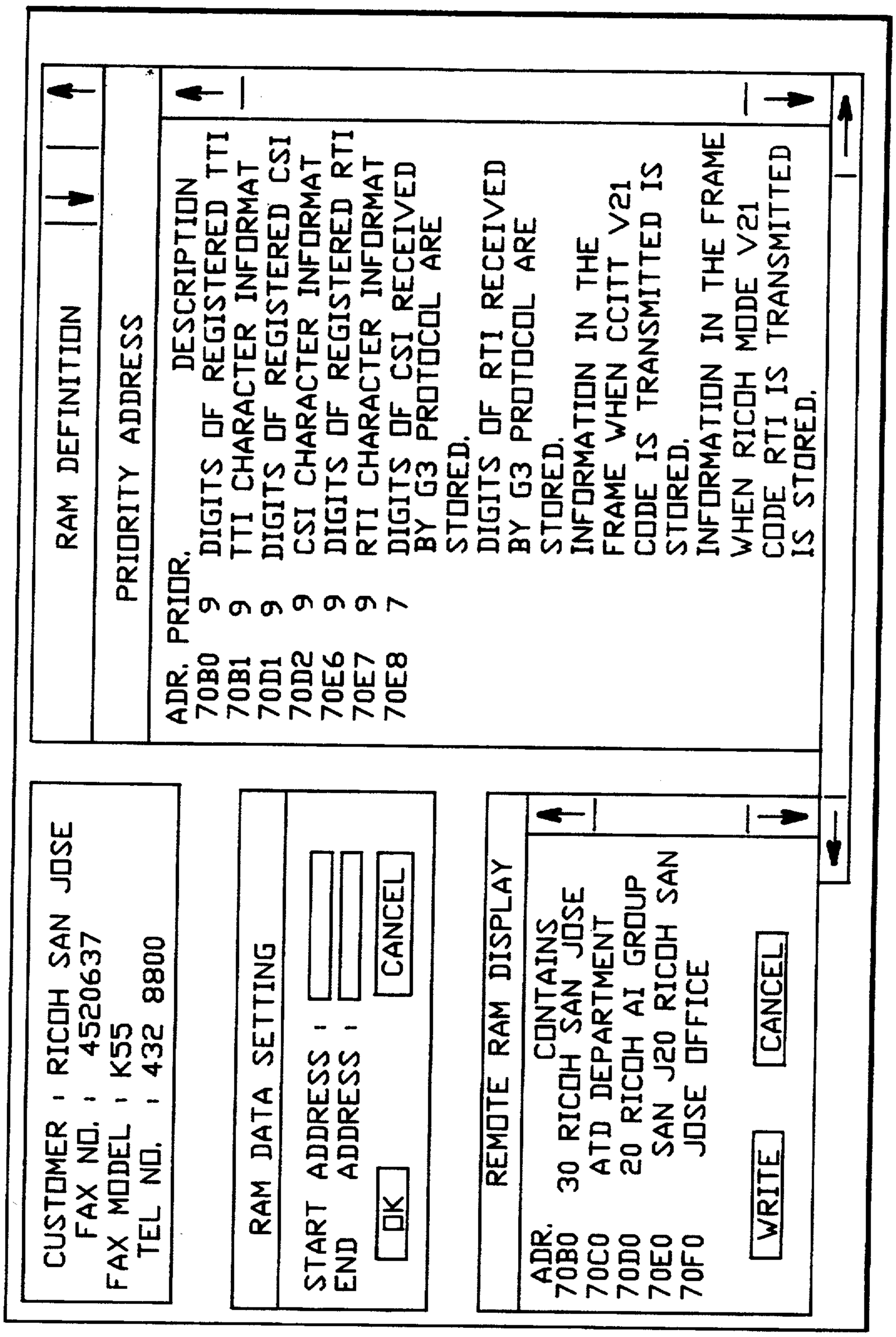

RAM DEFINITION
PRIORITY ADDRESS
PRIOR. DESCRIPTION
9 DIGITS OF REGISTERED TTI
9 TTI CHARACTER INFORMAT
9 DIGITS OF REGISTERED CSI
9 CSI CHARACTER INFORMAT
9 DIGITS OF REGISTERED RTI
9 RTI CHARACTER INFORMAT
7 DIGITS OF CSI RECEIVED BY G3 PROTOCOL ARE STORED.
DIGITS OF RTI RECEIVED BY G3 PROTOCOL ARE STORED.
INFORMATION IN THE FRAME WHEN CCITT V21 CODE IS TRANSMITTED IS STORED.
INFORMATION IN THE FRAME WHEN RICOH MODE V21 CODE RTI IS TRANSMITTED IS STORED.
ADR.
70B0
70B1
70D1
70D2
70E6
70E7
70E8
CUSTOMER ' RICOH SAN JOSE
FAX NO. ' 4520637
FAX MODEL ' K55
TEL NO. ' 432 8800
RAM DATA SETTING
START ADDRESS '
END ADDRESS '
CANCEL
OK
REMOTE RAM DISPLAY
CONTAINS
ADR.
70B0 30 RICOH SAN JOSE
70C0 ATD DEPARTMENT
70D0 20 RICOH AI GROUP
70E0 SAN J20 RICOH SAN
70F0 JOSE OFFICE
CANCEL
WRITE

FIG.—6

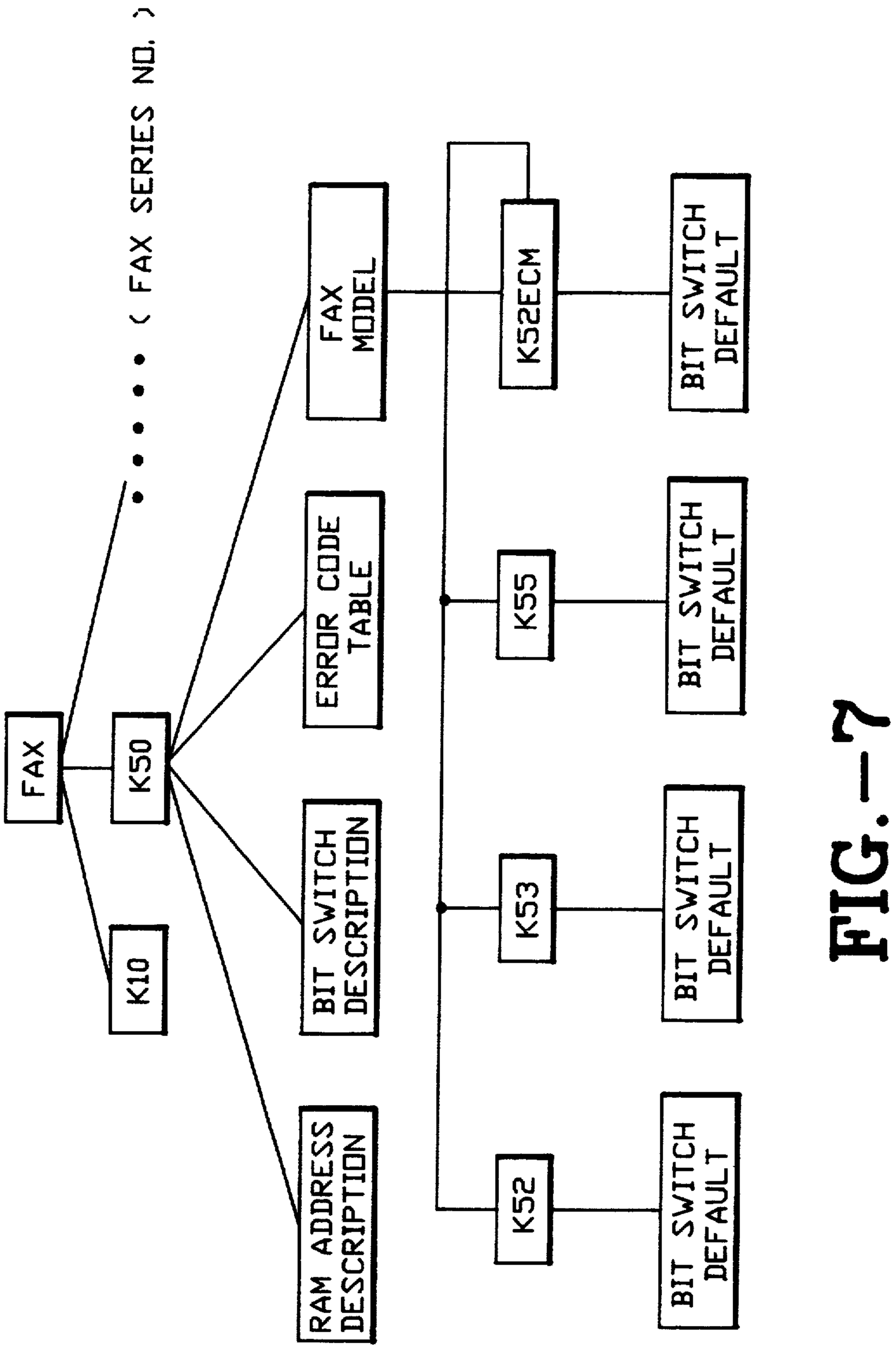
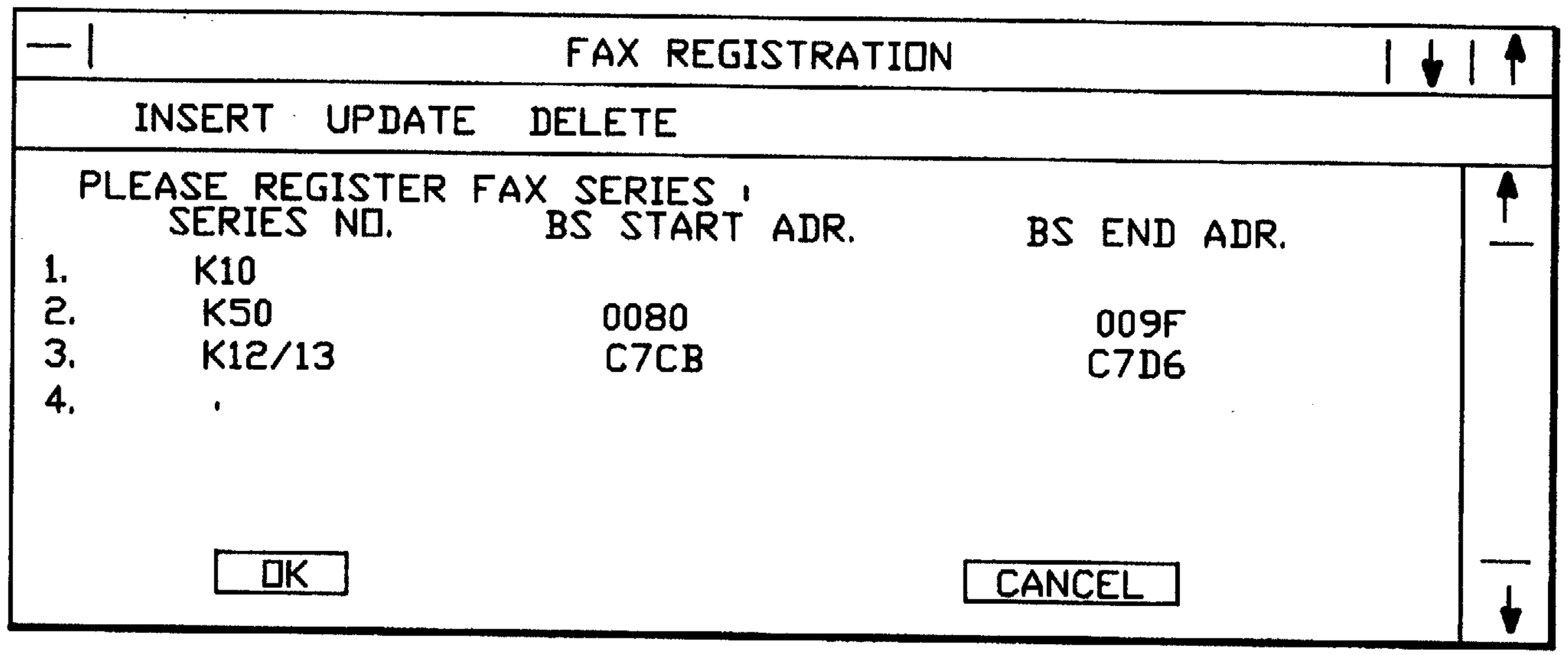

(MODEL NO.)
FAX
K50
K10
K52
K55
K53
K52
FAX MODEL
ERROR CODE TABLE
BIT SWITCH DESCRIPTION
RAM ADDRESS DESCRIPTION
K52ECM
BIT SWITCH DEFAULT
BIT SWITCH DEFAULT
BIT SWITCH DEFAULT
BIT SWITCH DEFAULT
BIT SWITCH DEFAULT
(FAX SERIES NO.)

FIG.—7



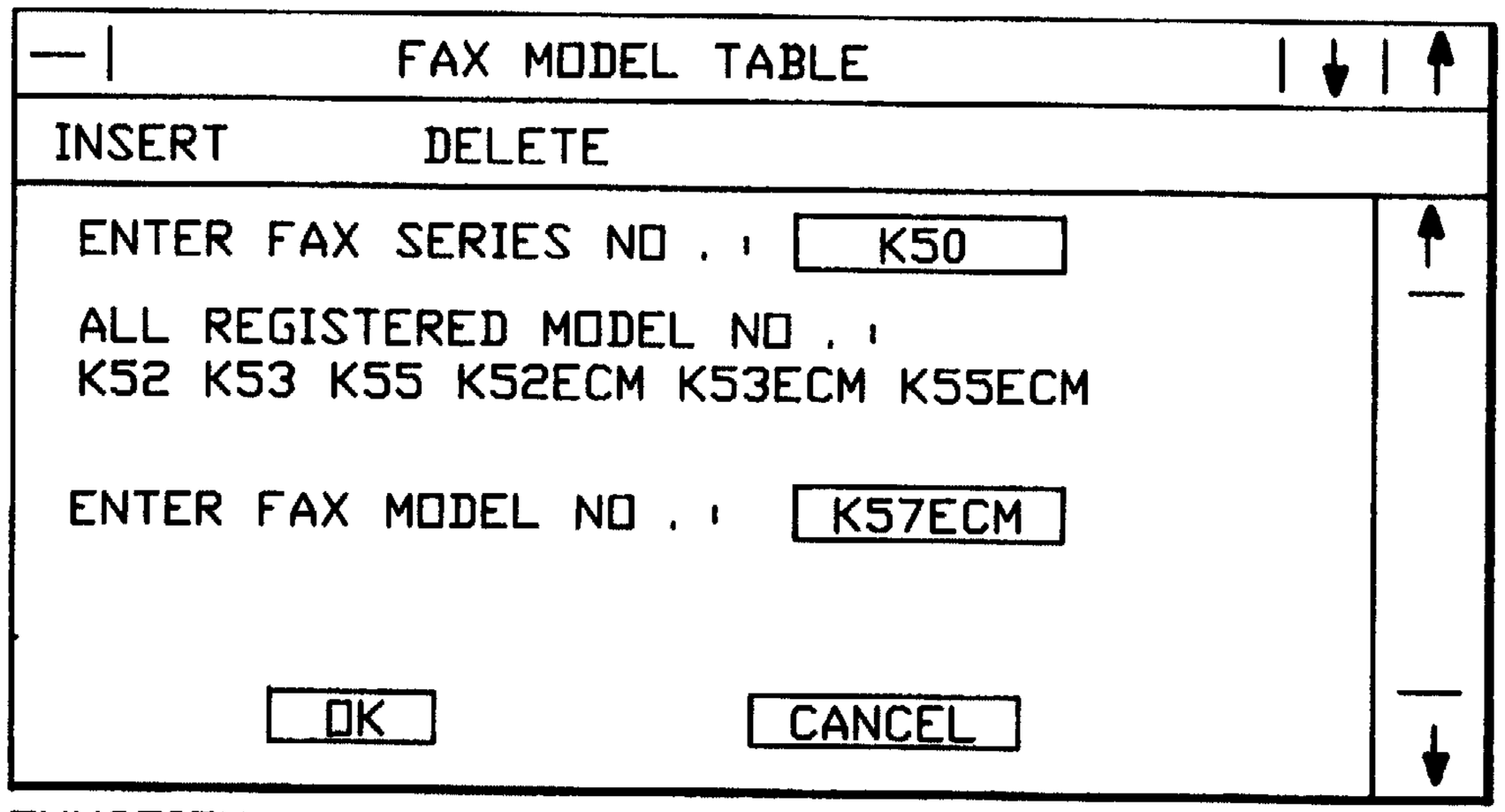
(1) DATA FILE :

FAX . DAT : | K10 | START | END | K50 | START | END | ..... |

THE FAX SERIES REGISTERED ABOVE WILL AUTOMATICALLY CREATE 1 DATA FILE - FIRST 5 CHARACTERS OF FAX SERIES + : . : + : DAT : ; THEREFORE , HERE , WE HAVE K10 . DAT , K12/1 . DAT AND K50 . DAT .
THEN , EACH FILE WILL ALSO CREATE 4 SUB FILES .
FOR EXAMPLE , K50 . DAT WILL GENERATE K50RAM . DAT , K50BS . DAT , K50ERR . DAT AND K50MOD . DAT THESE FILES WILL BE DEFINED LATER .

K50 . DAT : | K50RAM . DAT | K50BS . DAT | K50ERR . DAT | K50MOD . DAT |

FIG.—8



NOTE : FUNCTION -
INSERT : REGISTER A NEW FAX MODEL .
DELETE : DELETE A SPECIFIED FAX MODEL .

||) DATA FILE : THIS PARTICULAR FAX SERIES MUST HAVE BEEN REGISTERED DURING FAX REGISTRATION STEP . A FAX MODEL FILE NAME IS DEFINED AS THE FIRST 5 CHARACTERS OF FAX SERIES + ' MOD ' + ' DAT ') ALSO THOSE FAX MODELS WHICH REGISTER ABOVE WILL AUTOMATICALLY CREATE 1 DATA FILE - THE FIRST 5 CHARACTERS OF FAX MODEL + ' DEF ' + ' . ' + ' DAT ') THEREFORE , HERE , WE HAVE K52DEF . DAT , K53DEF . DAT AND K55DEF . DAT , THESE FILES WILL BE DEFINED LATER .
FOR EXAMPLE : FAX K50 SERIES WILL GENERATE A DATA FILE CALLED K50MOD . DAT .

K50MOD . DAT :

K52	K53	K55	K52ECM	. . . . .

FIG.-9

RAM DATA DEFINITION

INSERT SEARCH DELETE

ADR	PRIOR	TYPE	DESCRIPTION	REMARK
0402	5	0	TELINF CONTROL HEADER	
0602	5	0	RAM FOR TELEPHONE NUMBER REGISTER ..	
1002	4	0	TELOS INPUT PARAMETER STORING RAM .	
1102	4	0	TELOS OUTPUT DATA STORING RAM	
1202	5	0	ONE TOUCH DIAL PROPER NOUN REGISTERING AREA .	
140F	5	0	GROUP PROPER NOUN REGISTERING AREA .	
14A2	6	0	TOP ADDRESS OF EMPTY AREA OF TELINF (LOW) .	
14A3	6	0	TOP ADDRESS OF EMPTY AREA OF TELINF (HIGH) .	

UPDATE CANCEL

NOTE :
PRIORITY WILL BE RATED BETWEEN 10 TO 1 (HIGH TO LOW).

TYPE - 0 : HEX DATA TYPE.
1 : DECIMAL DATA TYPE.
2 : ASCII DATA TYPE. (UPPER CASE)

FUNCTION -
INSERT : INSERT A NEW RECORD TO THE DATA FILE .
SEARCH : SEARCH A PARTICULAR RECORD BASED ON ADDRESS .
DELETE : DELETE A SPECIFIED RECORD .

||) DATA FILE : NAME IS DEFINED AS THE FIRST 5 CHARACTERS OF FAX SERIES + ' RAM ' + ' DAT '
FOR EXAMPLE : K50RAM . DAT WHICH MUST HAVE BEEN CREATED DURING FAX REGISTRATION STEP .

K50RAM . DAT :

ADRS	PRIOR	TYPE	DESCRIPTION	REMARK
(4)	(1)	(1)	(120)	(100)

FIG.—10

K50 BIT SWITCH INFORMATION

START ADDRESS : [0080] END ADDRESS : [009F]

[OK] [CANCEL]

BIT SWITCH DEFINITION

INSERT SEARCH DELETE

BS	BIT	DESCRIPTION	REMARK
0	0	BACK TO BACK FUNCTION 1:ENABLED WHEN THIS BIT IS SET TO "1", THE START KEY IS ENABLED WITHOUT HANGING UP THE HANDSET.	TO DIRECTLY CONNECT TWO MACHINES AND CHECK THE COMMUNICATION.
	1	MEMORY READ/WRITE ACCEPTABLE 0:NOT ACCEPTABLE WHEN THIS BIT IS SET TO "0" A MEMORY READ/WRITE REQUEST IS NOT ACCEPTED.	THIS BIT SHOULD BE "1" WHEN RAM DATA IS TO BE CHANGED FROM THE SERVICE CENTER BY A K10 MACHINE.
	2	NOT USED	
	7	COMMUNICATION PARAMETER DISPLAY 1 :DISPLAY ENABLED	TO CONFIRM THE COMMUNICATION PARAMETERS.
1	0	FAX/TEL SELECTION 0:FAX 1:TEL THIS BIT CAN BE CHANGED BY FUNCTION 51(K53/55/57) OR TEL MODE KEY (K52)	

[UPDATE] [CANCEL]

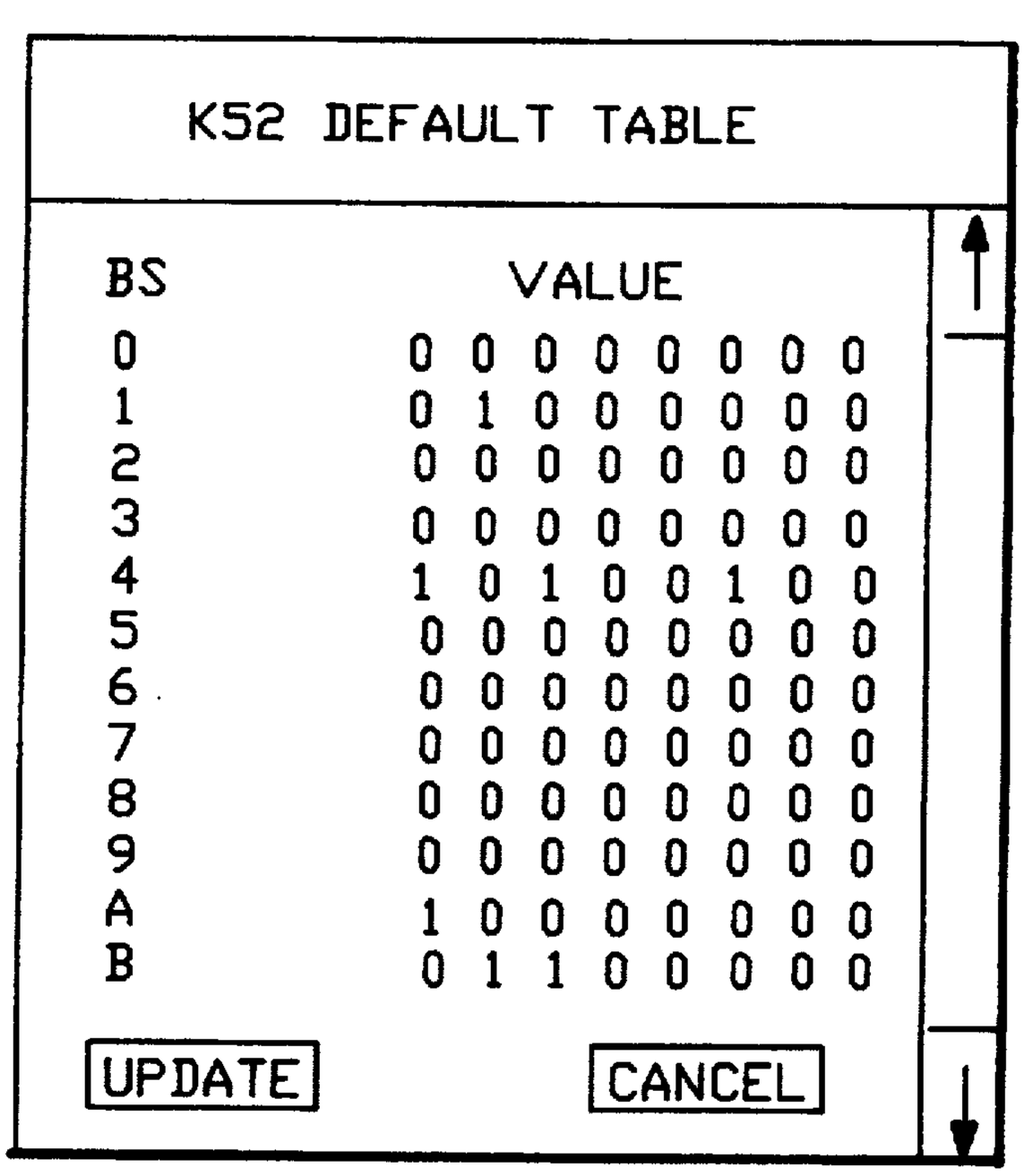
NOTE : FUNCTION - INSERT : INSERT A NEW RECORD IN THE MIDDLE.
SEARCH : SEARCH A RECORD BASED ON BIT SWITCH NUMBER.
DELETE : DELETE A SPECIFIED RECORD.

II) DATA FILE NAME IS DEFINED AS THE FIRST 5 CHARACTER OF FAX SERIES + "BS" + "." + "DAT".
FOR EXAMPLE : K50BS.DAT WHICH MUST HAVE BEEN CREATED DURING FAX REGISTRATION STEP.

K50BS.DAT :

BS	BIT	DESCRIPTION	REMARK
(2)	(1)	(120)	(100)

FIG.—11



ii) DATA FILE :
NAME IS DEFINED AS FAX MODEL + "DEF" + "." + "DAT"
FOR EXAMPLE :
K52DEF.DAT WHICH MUST HAVE BEEN
CREATED DURING FAX MODEL TABLE STEP.

K52DEF.DAT :

BIT SWITCH	VALUE

FIG.-12

K50 ERROR CODE TABLE

INSERT UPDATE DELETE

PREFIX	CODE	DESCRIPTION
0	00	INITIAL ID SIGNAL UNDETECTED
0	01	RECEIVED "DCN FRAME" FROM REMOTE FAX
0	03	MODEM INCOINCIDENCE
0	04	FAIL TO RECEIVE THE TRAINING RESPONSE "CFR/FTT"
0	05	TRAINING FAILURE AFTER SHIFTDOWN TO 2400 BPS.
0	06	REMOTE-FAX-FAIL TO RECEIVE THE "DCN" FRAME
0	07	FAIL TO RECEIVE THE RESPONSE,"MCF/RTP/RTN/ PIP/PIN" AFTER MESSAGE EXCHANGE.
0	08	RECEIVED COPY NG(RTN/PIN)
0	14	RECEIVED UNKNOWN CODE AFTER MESSAGE EXCHANGE.
0	15	THE REMOTE FAX HAS NO FUNCTION OF "CONFIDENTIAL" OR "RELAY-TRANSMISSION"
0	16	FAIL TO RECEIVE THE RESPONSE (CFR/FTT) FOR "CONFIDENTIAL" OR "RELAY-TRANSMISSION"
0	52	SIGNAL TURNED OVER
4	01	LINE CUT (ELECTRIC CURRENT CUT) DETECTED.

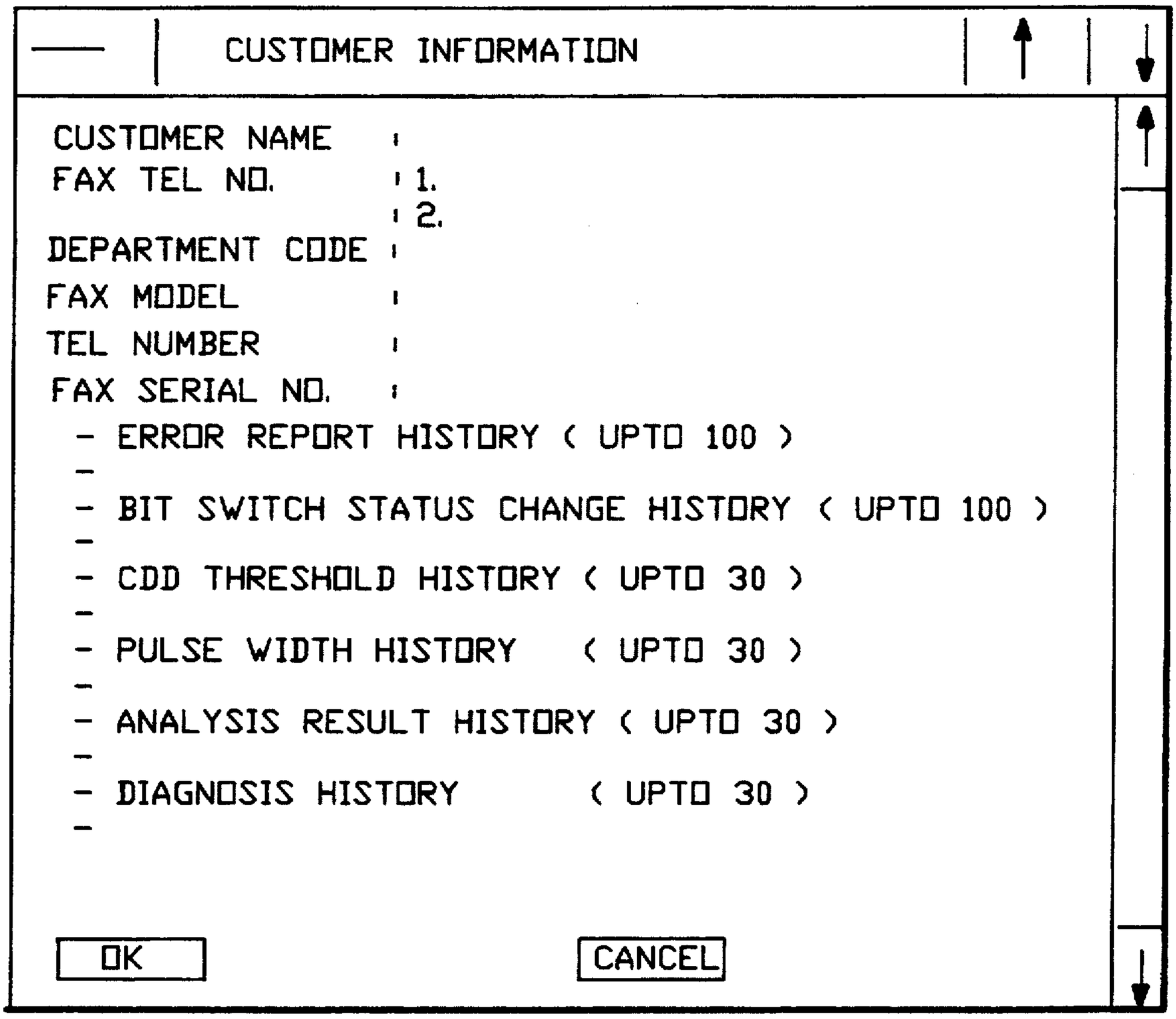
UPDATE CANCEL

NOTE : FUNCTION - INSERT : INSERT A NEW RECORD IN THE MIDDLE.
SEARCH : SEARCH A RECORD BASED ON THE PREFIX.
DELETE : DELETE A SPECIFIED RECORD.

II) DATA FILE : NAME IS DEFINED AS THE FIRST 5 CHARACTERS OF FAX SERIES + "ERR" + "." + "DAT"
FOR EXAMPLE : K50ERR.DAT WHICH MUST HAVE BEEN CREATED DURING FAX REGISTRATION STEP.

R50ERR.DAT : | PREFIX | CODE | DESCRIPTION |

FIG.-13



NOTE : FUNCTION -
INSERT : ADD A NEW CUSTOMER RECORD.
UPDATE : UPDATE A SPECIFIED CUSTOMER RECORD.
DELETE : DELETE A SPECIFICM CUSTOMER RECORD.
KEY : CUSTOMER NAME
OR
FAX TEL NO.

FIG.—14

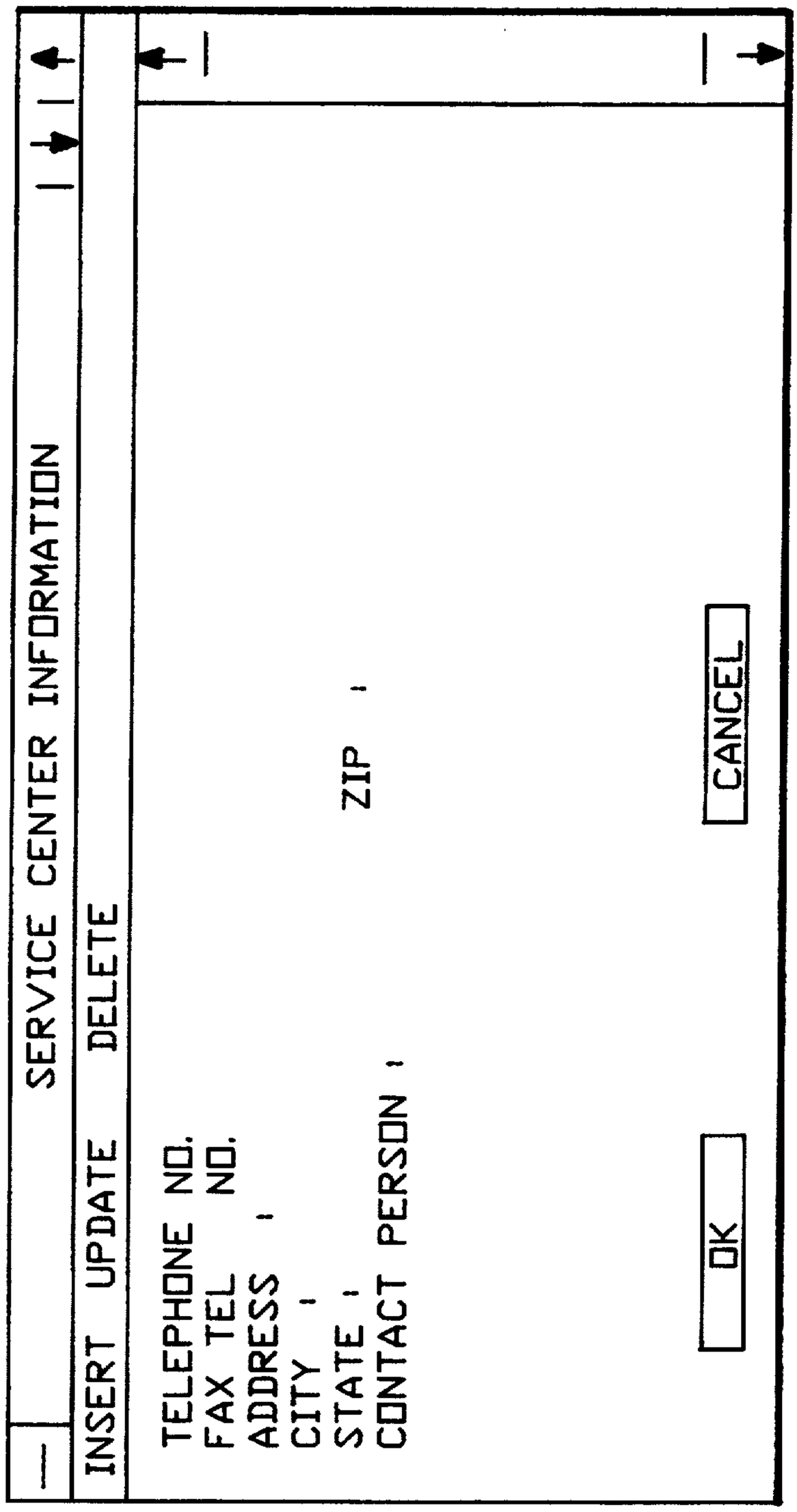

SERVICE CENTER INFORMATION
INSERT
UPDATE
DELETE
TELEPHONE NO.
FAX TEL NO.
ADDRESS
CITY
STATE
ZIP
CONTACT PERSON
OK
CANCEL
FUNCTION –
INSERT : ADD A NEW SERVICE CENTER RECORD.
UPDATE : UPDATE A SPECIFIC RECORD BASED ON ZIP CODE, STATE OR CITY.
DELETE : DELETE A SPECIFIC RECORD BASED ON ZIP CODE, STATE OR CITY.
NOTE :

FIG. — 15

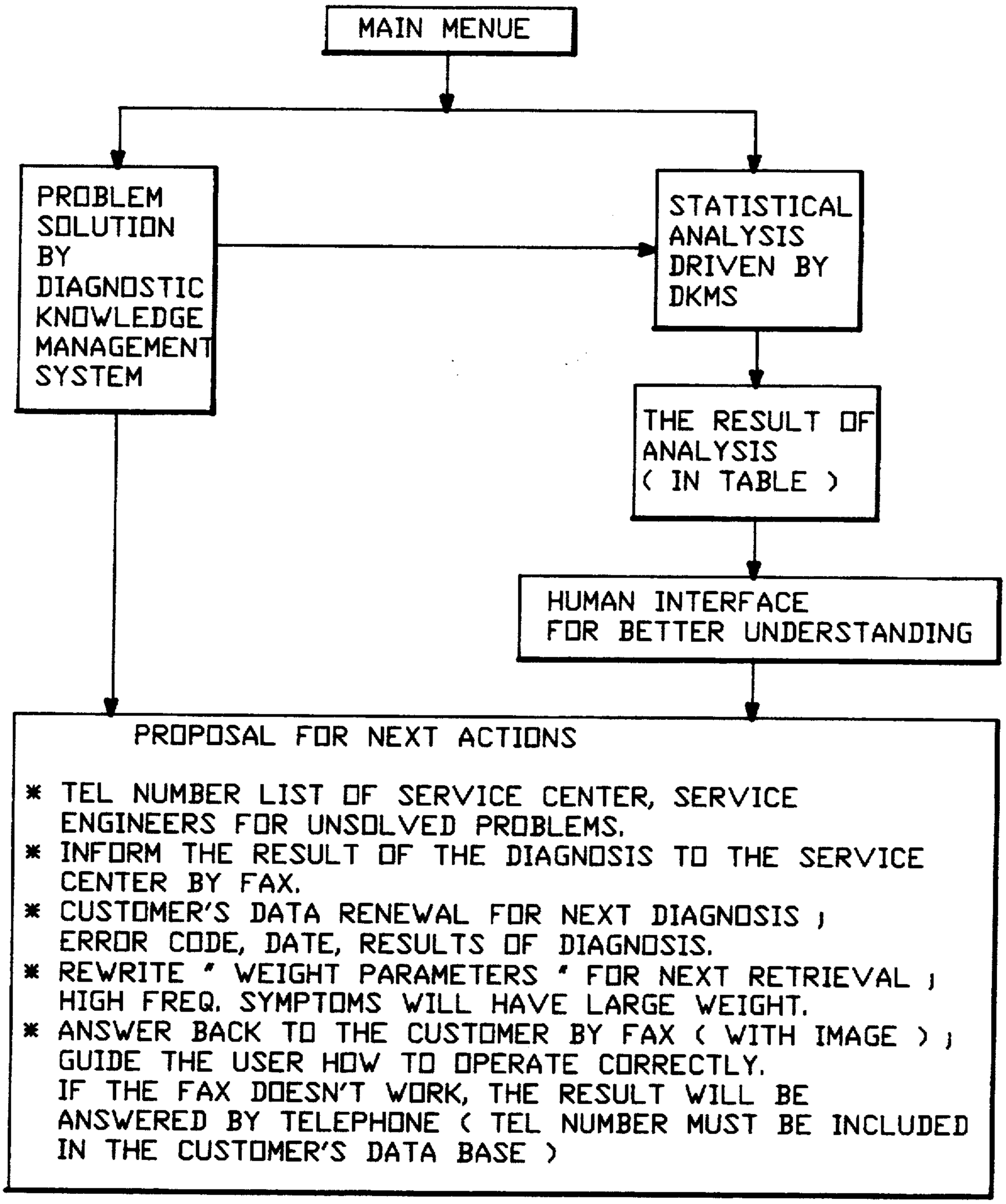

MAIN MENUE
PROBLEM SOLUTION BY DIAGNOSTIC KNOWLEDGE MANAGEMENT SYSTEM
STATISTICAL ANALYSIS DRIVEN BY DKMS
THE RESULT OF ANALYSIS (IN TABLE)
HUMAN INTERFACE FOR BETTER UNDERSTANDING
PROPOSAL FOR NEXT ACTIONS
* TEL NUMBER LIST OF SERVICE CENTER, SERVICE ENGINEERS FOR UNSOLVED PROBLEMS.
* INFORM THE RESULT OF THE DIAGNOSIS TO THE SERVICE CENTER BY FAX.
* CUSTOMER'S DATA RENEWAL FOR NEXT DIAGNOSIS ; ERROR CODE, DATE, RESULTS OF DIAGNOSIS.
* REWRITE " WEIGHT PARAMETERS " FOR NEXT RETRIEVAL ; HIGH FREQ. SYMPTOMS WILL HAVE LARGE WEIGHT.
* ANSWER BACK TO THE CUSTOMER BY FAX (WITH IMAGE) ; GUIDE THE USER HOW TO OPERATE CORRECTLY.
IF THE FAX DOESN'T WORK, THE RESULT WILL BE ANSWERED BY TELEPHONE (TEL NUMBER MUST BE INCLUDED IN THE CUSTOMER'S DATA BASE)

FIG.—16

ADDRESS ID	SUCCESS TIMES *	WEIGHT	NEXT NODE ID	SUCCESS TIMES *	CONDITIONAL BIT PATTERN
P0001	0	10	S0010	0	BIT (1101000..)
		9	S0011	0	BIT (1110111..)
P0002	0	10	S0020	0	BIT (1101000..)
••		••	••		••
••		••	••		••

SymToCau

ADDRESS ID	SUCCESS TIMES *	WEIGHT	NEXT NODE ID	SUCCESS TIMES *	CONDITIONAL BIT PATTERN
S0001	0	9	C0101	0	BIT (1101000..)
		10	C0102	0	BIT (1110111..)
S0011	0	10	C0103	0	BIT (1101000..)
••		••	••		••
••		••	••		••

CauToAct

ADDRESS ID	SUCCESS TIMES *	WEIGHT	NEXT NODE ID	SUCCESS TIMES *	CONDITIONAL BIT PATTERN
C0101	0	10	A1001	0	BIT (1101000..)
		10	A1002	0	BIT (1110111..)
	0	10	A1003	0	BIT (1101000..)
••		••	••		••
••		••	••		••

NOTE : (*) THESE COLUMNS WILL BE INITIALIZED TO 0 FIRST, AND THEN EACH TIME, AFTER FINISHING DIAGNOSIS, IT WILL AUTOMATICALLY INCREASE 1 TO THE SUCCESS TIMES OF FOUNDED PROBLEM, SYMPTOM, CAUSE AND ACTION.

FIG.—17

PROBLEM	
P0001	" LINE FAIL " AFTER 30 - 40 SEC WITHOUT DOCUMENT SCANNING
P0002	" LINE FAIL " AFTER 5 SEC

SYMPTOM	
S0010	" CED " NOT DETECTED IN AUTO DIALING MODE
S0011	" DIS " OR " NSF " NOT DETECTED FROM REMOTE FAX
S0012	TRAINING FAILURE WITHOUT RESPONSE FROM REMOTE TERMINAL

CAUSE	
C0101	TOO LONG DELAYED SIGNAL OR EXCESSIVE WHITE NOISE ON TEL LINE
C0102	POSSIBLY, THE LOCAL TERMINAL CAN'T DETECT CED
C0103	POSSIBLY, NSF/DIS SIGNAL DOESN'T COME FROM REMOTE TERMINAL
C0104	SN RATIO IS TOO LOW

ACTION		
		CONDITIONS
A1001	ECHO COUNTERMEASURES INSTALL A CARRIER-ON RETROFIT ROM	FX3300 RAPI3300
A1002	SET THE ECHO COUNTERMEASURE SW2 BIT #6 ON	FX5000 I6500, R5000
	IF MACHINE IS NOT GROUNDED, REMOVE CAPACITORS C1, C2, C3 ON AA-NCU1	FX5000
C0103	CHANGE CED TO 2100Hz	FX5000

FIG.—18

MODEL ID	NAME	BIT POSITION
F0001	R600s	0
F0002	R700	1
F0003	RX5000	2
F0004	Rapi600	3
F0005	FX3300	4

BIT PATTERN
0000000 00000001
0000000 00000010
0000000 00000100
0000000 00001000
0000000 00010000

FIG.—19

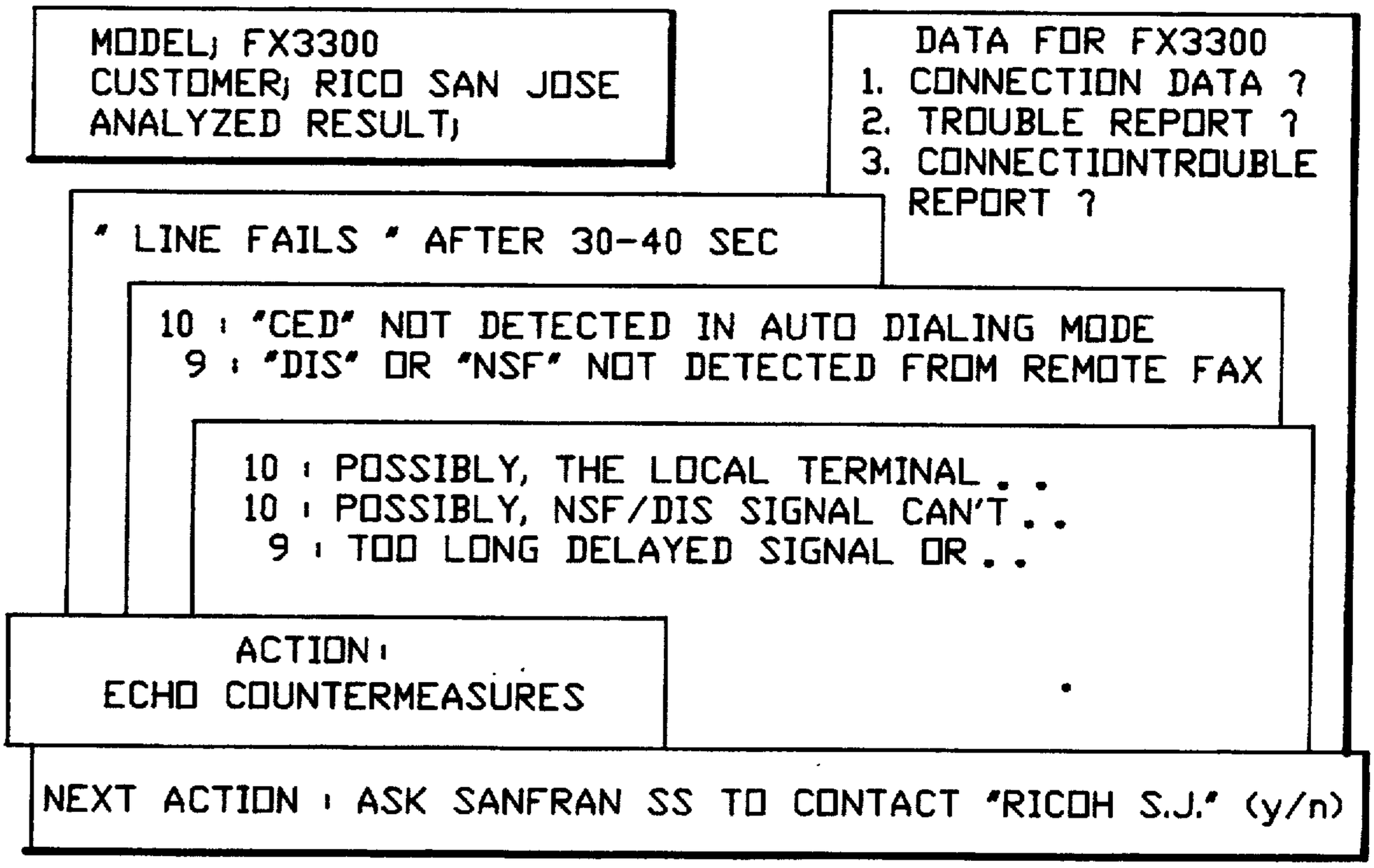


FIG.—20

4. OPERATION
4-1. MAIN MENU

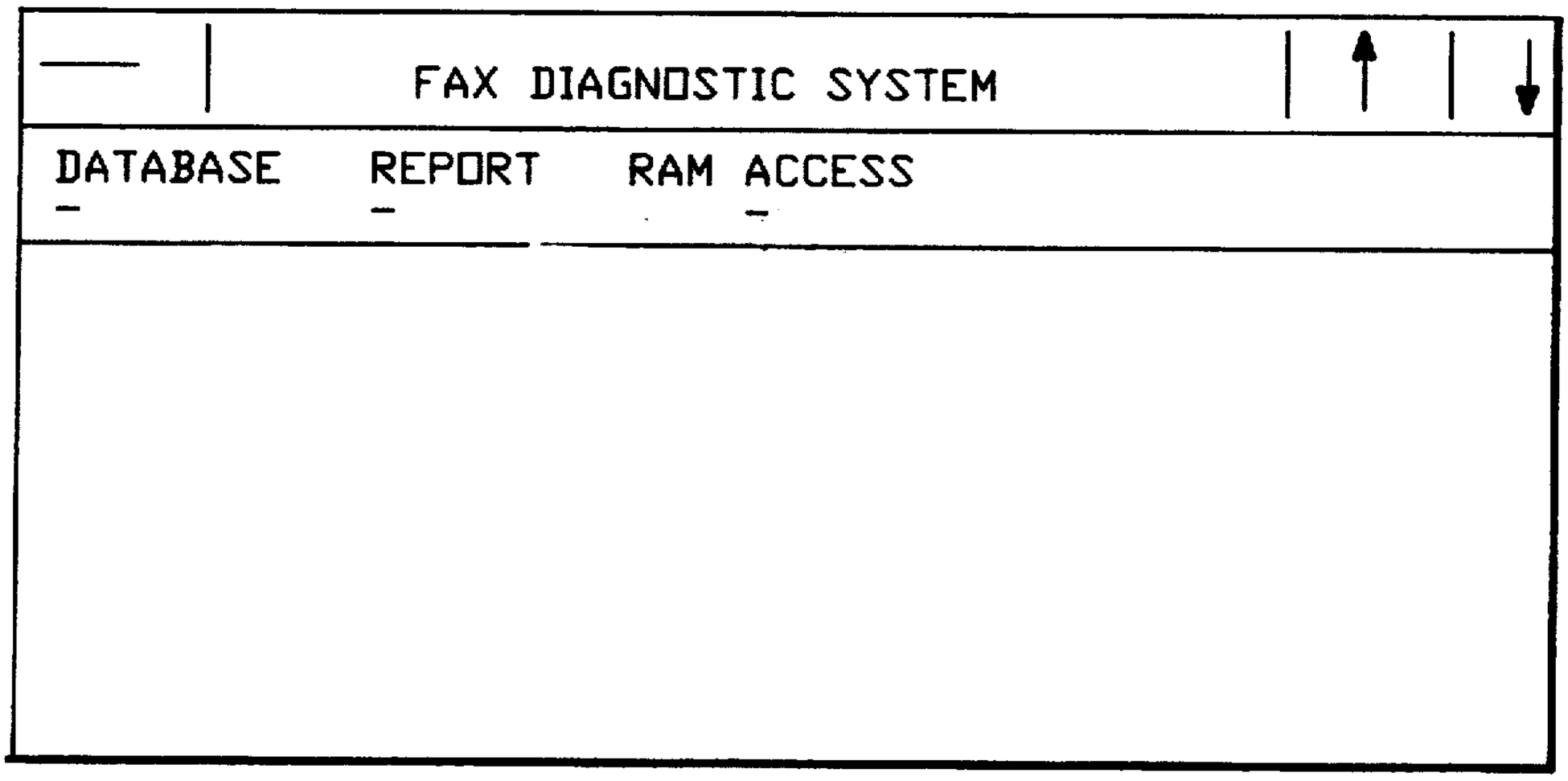


FIG.-21

4-4. THE RAM ACCESS MENU

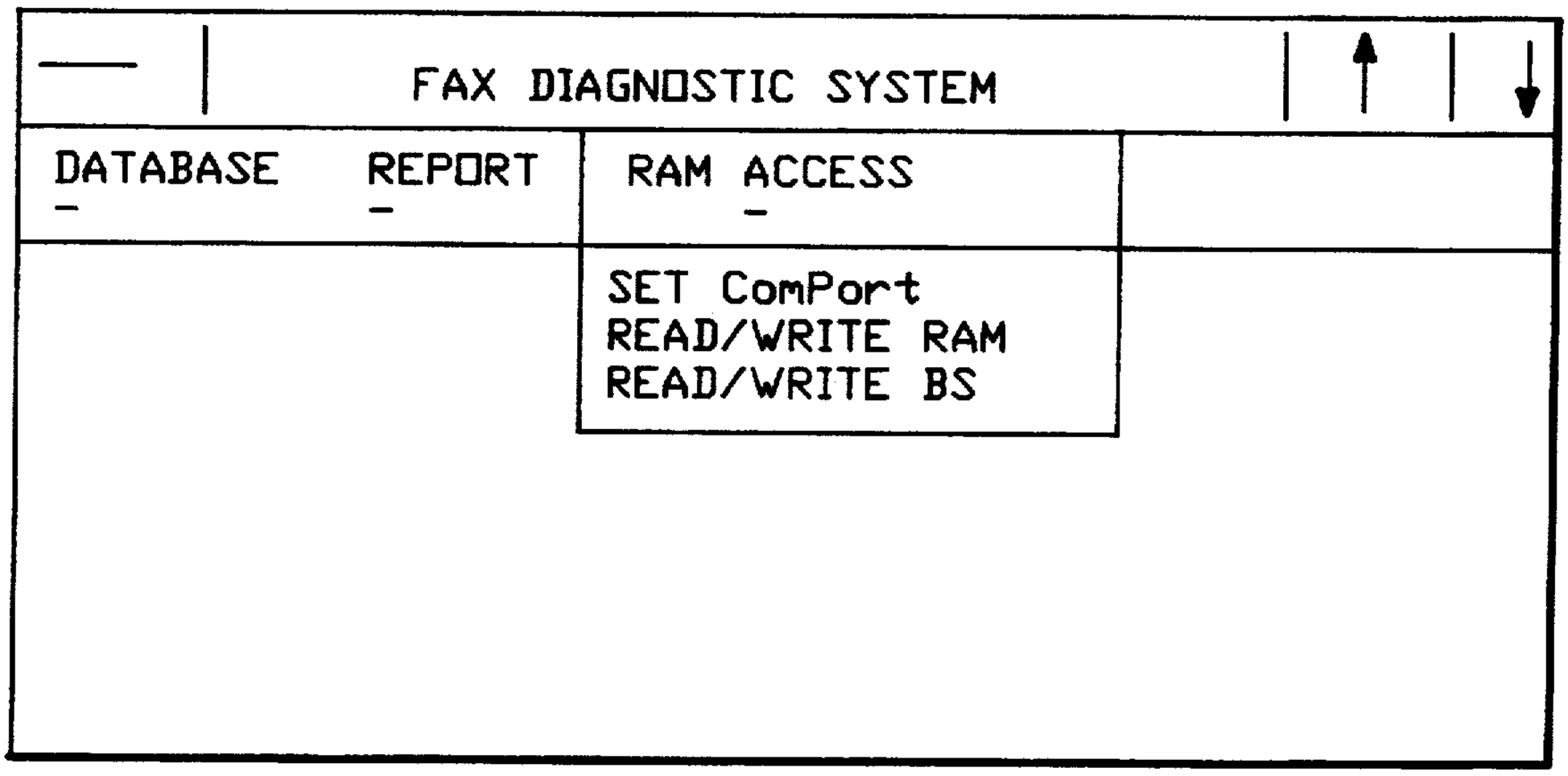


FIG.-22

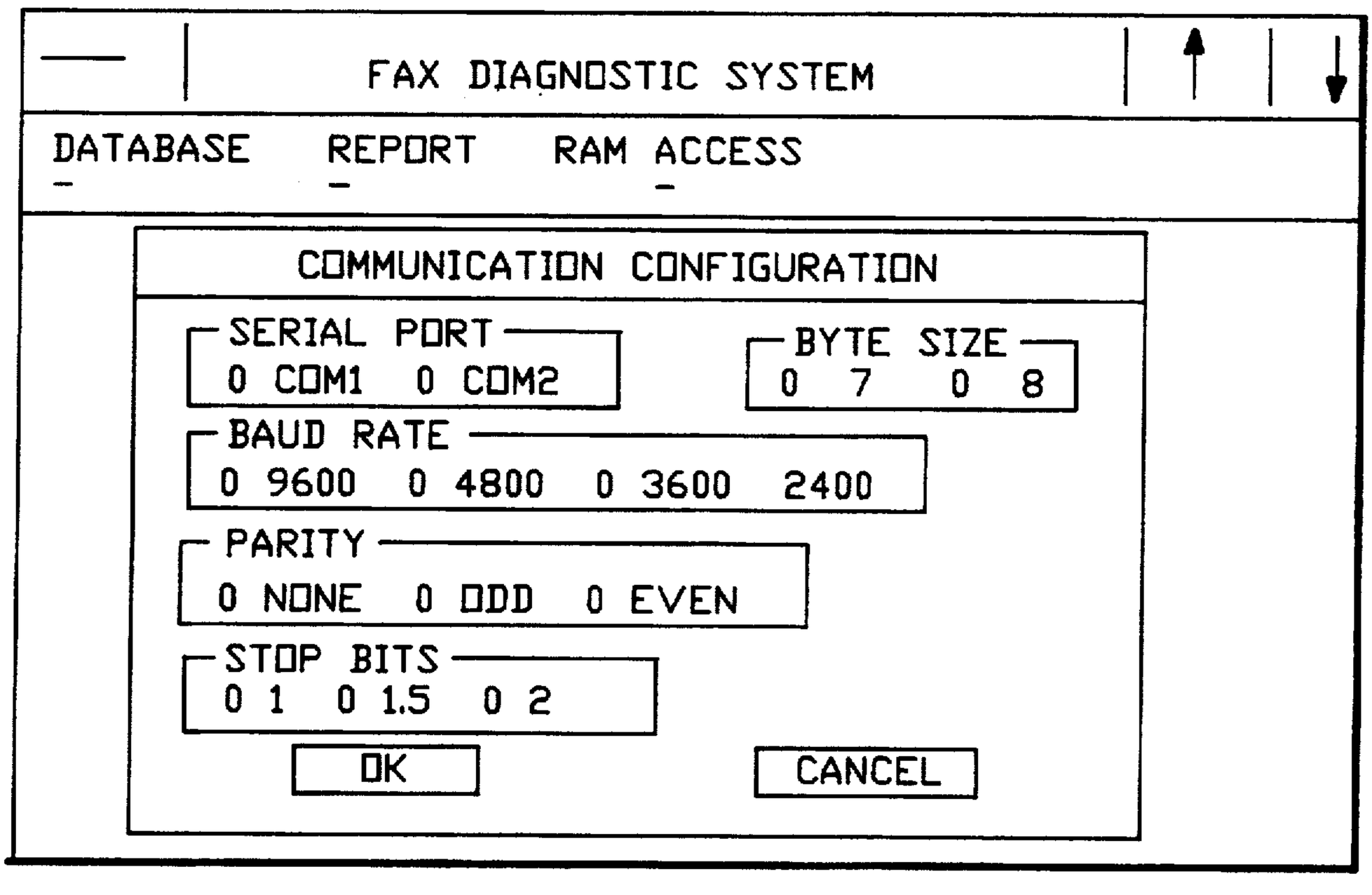

FAX DIAGNOSTIC SYSTEM
DATABASE
REPORT
RAM ACCESS
COMMUNICATION CONFIGURATION
SERIAL PORT
0 COM1 0 COM2
BYTE SIZE
0 7 0 8
BAUD RATE
0 9600 0 4800 0 3600 2400
PARITY
0 NONE 0 ODD 0 EVEN
STOP BITS
0 1 0 1.5 0 2
OK
CANCEL

FIG.-23

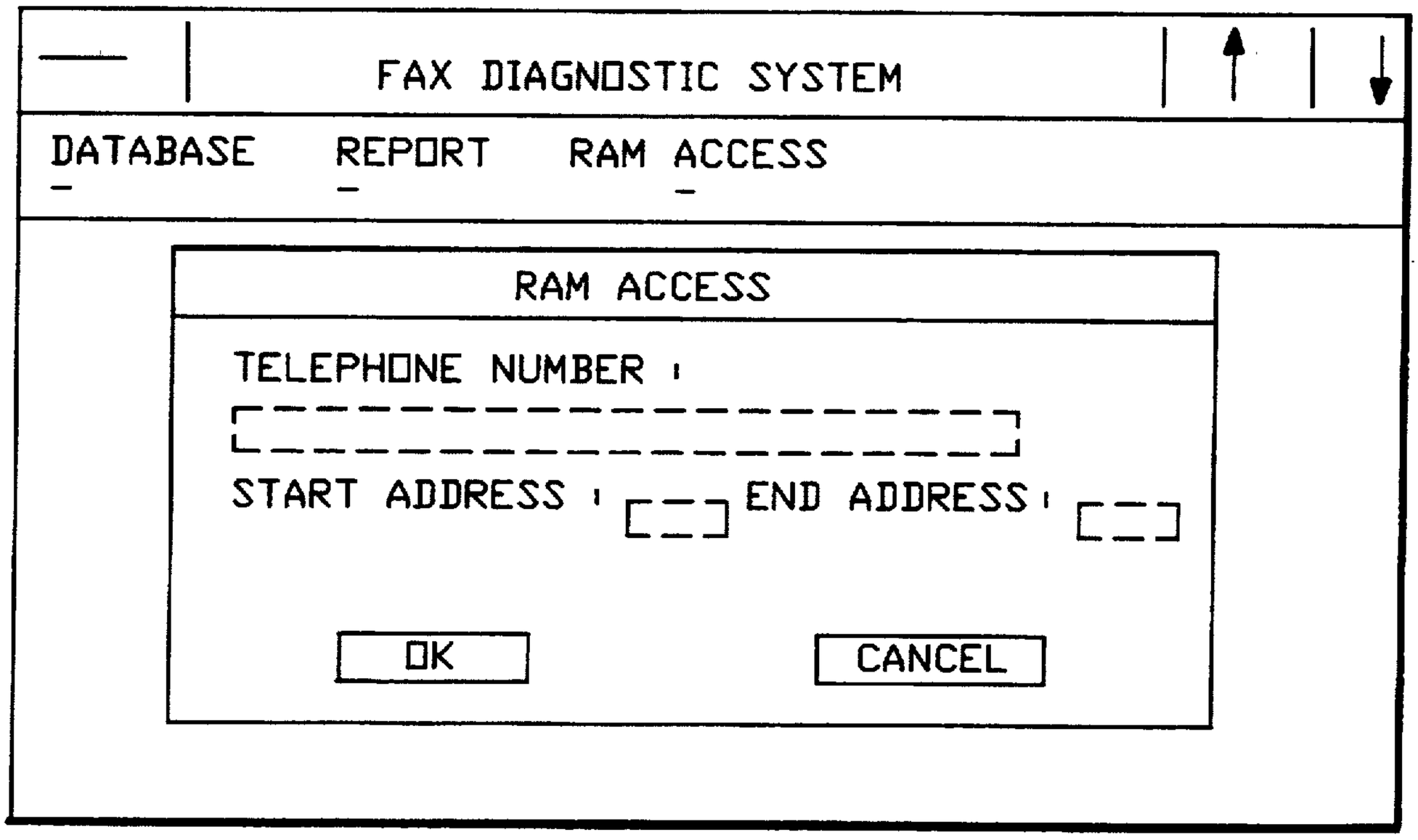

FAX DIAGNOSTIC SYSTEM
DATABASE
REPORT
RAM ACCESS
RAM ACCESS
TELEPHONE NUMBER
START ADDRESS
END ADDRESS
OK
CANCEL

FIG.-24

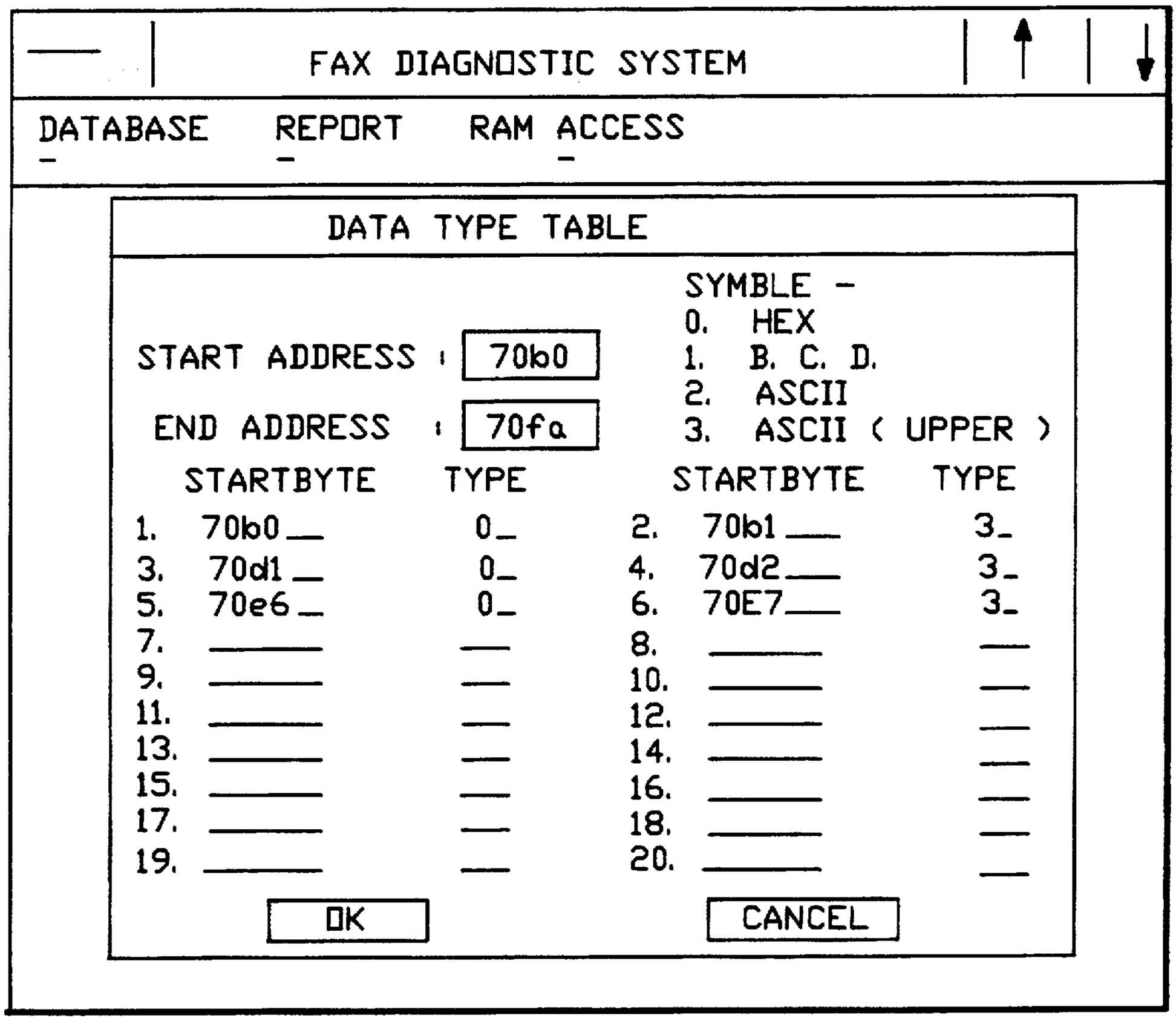

FAX DIAGNOSTIC SYSTEM
DATABASE
REPORT
RAM ACCESS
DATA TYPE TABLE
START ADDRESS : 70b0
END ADDRESS : 70fa
SYMBLE -
0. HEX
1. B. C. D.
2. ASCII
3. ASCII (UPPER)
STARTBYTE TYPE STARTBYTE TYPE
1. 70b0 0 2. 70b1 3
3. 70d1 0 4. 70d2 3
5. 70e6 0 6. 70E7 3
7. 8.
9. 10.
11. 12.
13. 14.
15. 16.
17. 18.
19. 20.
OK
CANCEL

FIG.—25

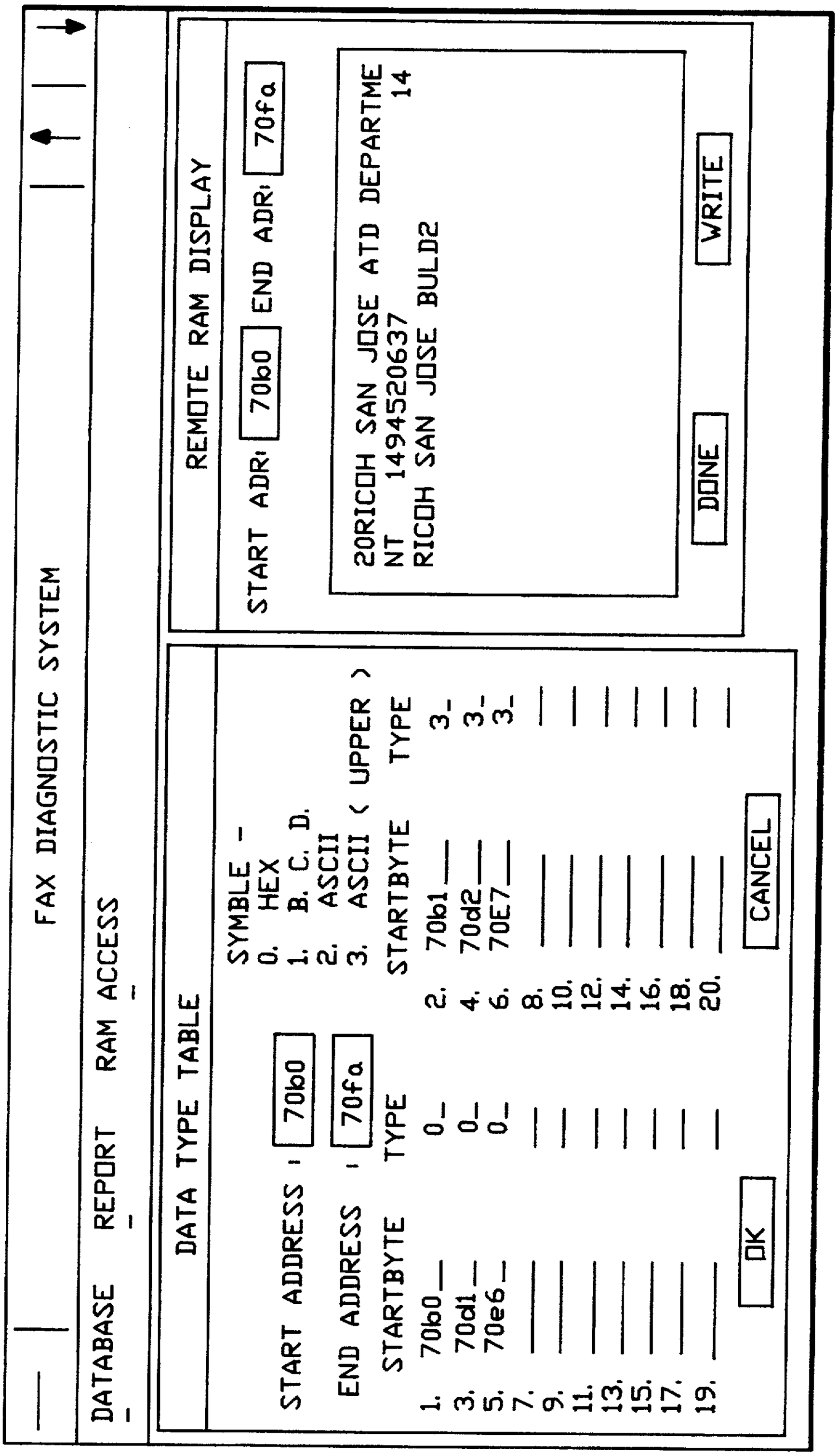

FAX DIAGNOSTIC SYSTEM
DATABASE REPORT RAM ACCESS
REMOTE RAM DISPLAY
START ADR: 70b0 END ADR: 70fa
20RICOH SAN JOSE ATD DEPARTME
NT 14945206 37
RICOH SAN JOSE BULD2
WRITE
DONE
DATA TYPE TABLE
SYMBLE -
0. HEX
1. B. C. D.
2. ASCII
3. ASCII (UPPER)
START ADDRESS : 70b0
END ADDRESS : 70fa
TYPE STARTBYTE TYPE
0_ 2. 70b1___ 3_
0_ 4. 70d2___ 3_
0_ 6. 70E7___ 3_
8.
10.
12.
14.
16.
18.
20.
CANCEL
STARTBYTE TYPE
1. 70b0___
3. 70d1___
5. 70e6___
7.
9.
11.
13.
15.
17.
19.
OK

FIG.-26

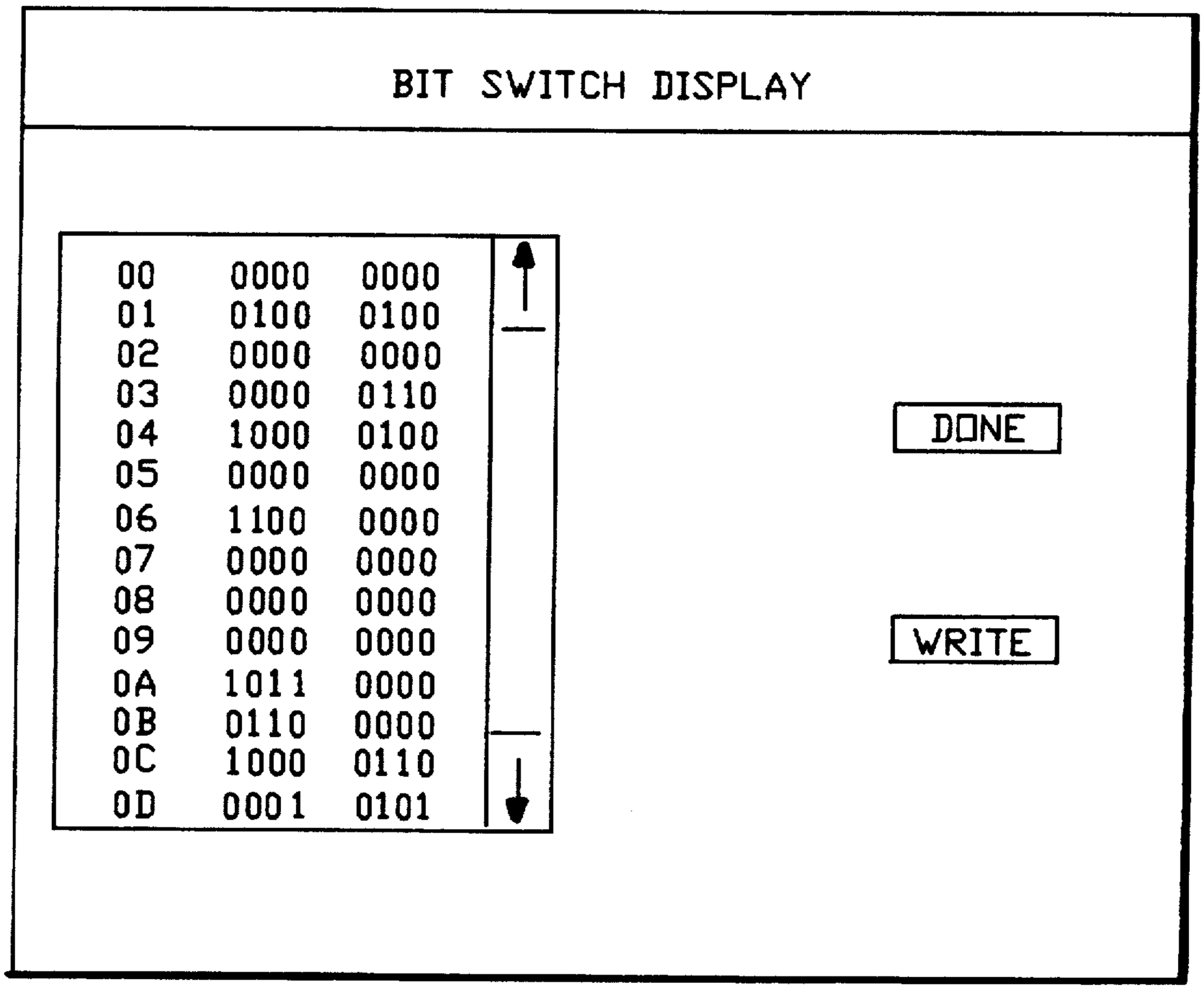

BIT SWITCH DISPLAY
00 0000 0000
01 0100 0100
02 0000 0000
03 0000 0110
04 1000 0100
05 0000 0000
06 1100 0000
07 0000 0000
08 0000 0000
09 0000 0000
0A 1011 0000
0B 0110 0000
0C 1000 0110
0D 0001 0101
DONE
WRITE

FIG.—27

FACSIMILE REMOTE DIAGNOSTIC SYSTEM

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

BACKGROUND OF THE INVENTION

The present invention relates to a facsimile remote diagnostic system.

Facsimile is a well known technology which has been experiencing dramatic growth and usage in the business environment. Users recognize the inherent capability of facsimile as an effective means of transmitting many types of documents quickly and efficiently from a transmitting location to one or more remote receiving locations. Facsimile can quickly and efficiently transmit virtually any kind of document from one location to another in a very short transmission time, typically in seconds. This is a dramatic improvement over the sending of documents such as with the postal service and/or utilizing the various express courier services, which typically require overnight delivery of a document.

Users are demanding that the facsimile apparatus be readily available at virtually any time. Facsimile, however, can experience transmission and other types of problems, as with any type of communications equipment. It becomes increasingly important, therefore, to provide a diagnostic capability for the facsimile apparatus for a particular user(s). The facsimile apparatus is typically located at an office, and it becomes very inefficient for a user to have to rely on a diagnostic service to come to the particular office to make necessary repairs to the facsimile apparatus.

In addition, the diagnostic service necessarily increases the cost of the overall equipment, as that service must be paid for in repairing the facsimile equipment.

In other technologies, some approaches have utilized remote diagnostic systems. The first remote diagnostic system was introduced in general by computer makers to provide checks for the current and prior status of the computer system by running diagnostic programs.

The next sophisticated remote diagnostic system introduced a capability using what can be characterized as expert knowledge. However, only one such system or unit is generally not enough to support field-installed equipment. In a facsimile environment, the dramatic expansion can at times demand concurrent diagnostics.

In view of the foregoing, it would be very desirable to provide a remote diagnostic system which can provide remote diagnostics for one or more remotely located facsimile apparatus.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a facsimile remote diagnostic system.

Briefly, the facsimile remote diagnostic system according to the present invention comprises one or more facsimile apparatus connected to a conventional telephone line.

The system further includes remote diagnostic means for communicating with the facsimile apparatus. The remote diagnostic means includes software control means (in one preferred embodiment) for providing remote diagnostics for the facsimile apparatus, and communication adapter means for controlling communications between the software control means and the facsimile apparatus.

The software control means can provide suitable diagnostics for the facsimile apparatus from a remote location, thereby eliminating the need for service personnel to go to the particular location where the facsimile apparatus requires diagnostic services.

Other objects, features and advantages of the present invention will become apparent from the following detailed description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** depicts a block diagram of a remote facsimile diagnostic system according to the present invention.

FIG. **2** depicts a block diagram of a communication control adapter which forms a portion of FIG. **1**.

FIG. **3** depicts a block diagram of a PC expert system utilized with the present invention.

FIG. **4** depicts an illustration of the main function flow of the facsimile diagnostic system.

FIG. **5** depicts a screen display of a B switch setting screen display as utilized with the present invention.

FIG. **6** depicts a RAM accessing screen display according to the present invention.

FIG. **7** depicts a facsimile data base (prestructure) according to the present invention.

FIG. **8** depicts a facsimile registration window image.

FIG. **9** depicts a facsimile model table window image.

FIG. **10** depicts a RAM data definition window image.

FIG. **11** depicts a B switch definition window image.

FIG. **12** depicts a B switch default table window image.

FIG. **13** depicts an error code table window image.

FIG. **14** depicts a customer information window image.

FIG. **15** depicts a service center information window image.

FIG. **16** depicts a general flow of diagnostic according to the present invention.

FIG. **17** depicts a knowledge base representation.

FIG. **18** depicts a representation of data files.

FIG. **19** depicts a representation of model data.

FIG. **20** depicts an illustration of system operation according to the present invention.

FIG. **21** depicts a main menu display according to the present invention.

FIG. **22** depicts a RAM access menu display.

FIG. **23** depicts a set comport command.

FIG. **24** depicts a display of RAM accessing.

FIG. **25** depicts a data type table display.

FIG. **26** depicts a RAM data display.

FIG. **27** depicts a bit switch display.

DETAILED DESCRIPTION OF THE INVENTION

The remote diagnostic system according to the present invention provides remote diagnostics for one or more facsimile apparatus, such as those manufactured by the applicant, Ricoh Corporation. Reference will be made herein to several facsimile models of Ricoh Corporation, although the aspects of the present invention would apply to all types of facsimile.

The system **10** according to the present invention is shown in FIG. **1**.

The system **10** comprises the following units: (1) one or more facsimile (FAX) **12**, communication history of

which is stored in memory accessible by remote way, (2) communication control adapter (CCA) **20** which can communicate with the FAX **12** and computer **50** through serial interface (RS232C) **22**, and (3) personal computer **50** (including an expert system).

(1) Facsimile **12**

The target facsimile is the G3 standard facsimile with the following additional functions: (a) buffer memory which can store communication histories including some image pattern, (b) bit switches which control the functions and mode by remote means, and (c) sensor status stored in the buffer memory.

(2) Communication Control Adapter **20**

This unit has the same function as facsimile, network control unit (NCU), MODEM and protocol processor. Image communication with other FAX is possible. A block diagram of the CCA is shown in FIG. **2**. FIG. **2** depicts a block diagram of the communication control adapter (CCA) **20**. The CCA **20** includes a network control unit (NCU) **26** which controls data communication through a public telephone line **14**. The main functions of the NCU **26** are startup of the unit, resetting or sendout of selected signals, calling signal detection and loop status maintenance (keep loop mode).

The CCA **20** also includes a modem **30** which provides data signal conversion to the transmission of analog signals and also provides the reverse inversions in a known fashion.

The CCA **20** further includes a multiple page signal controller (MPSC) **32** which detects the end of the page in image signal.

The CCA **20** also includes an operation port unit (OPU) **44** which controls the operation panel and keyboard.

Finally, the CCA **20** includes a power supply unit (PSU) **46** which provides suitable power as necessary.

CCA **20** has all the necessary functions of facsimile and digital interfaces to the PC **50** of FIG. **1**. It can communicate with both current G3 facsimiles and computers and includes enough memory (RAM) **40** to store two-page document images.

(3) PC (Expert System) **40** This part is newly developed with architecture as seen in

FIG. **3**. Details of the flow are shown in the accompanying Figures.

The main function flow of the FAX diagnostic system is shown in FIG. **4**.

B Switch Setting

This function will allow the user to read all Bit Switch values from a remote FAX machine and then, if necessary, rewrite the new data back to the remote FAX machine. The Key is the customer name or customer FAX number. The screen will display as in FIG. **5**.

B Switch Resetting

If Bit Switch values read from a remote FAX are not clear, this function will reset Bit Switch values for the remote FAX, based on the default values of the particular FAX model. After default values have been displayed on the screen, the user can modify any Bit Switch value and then rewrite all Bit Switch values back to remote FAX. The screen will display as FIG. **5**. The only difference between these two functions is the former read data from remote FAX and the latter read data from Bit Switch default data base instead.

RAM Accessing

This function will allow the user to read a specific portion of RAM data from a remote FAX, and also

easily modify those data on the screen and then rewrite the new data back to the remote FAX. The screen will display as in FIG. **6**.

The RAM Definition window can have two displayed options:

(i) priority—display information on the screen started from the specified priority

(ii) address—display information on the screen started from the specified address

The user selects "Start Address" and "End Address" directly from the RAM Definition Table.

If the specified addresses are correct, the user clicks the "OK" button on the RAM Data Setting window. Then the system will start to access the remote RAM, and then display the retrieved data on the remote RAM Display window.

Users will be allowed to modify the data displayed on the remote RAM Display window (except for the Address column) and then, if necessary, the new data will be rewritten back to the remote FAX.

Reports

This function will supply various reports output, and allow the user to examine the important information through the screen display. The names of reports are:

TCR
Service Report
Transmission Report
Transfer Report
Error Report
System Report
Polling File List
Program List
Telephone List

Data Base

The FAX Data Base (tree structure) is shown in FIG. **7**.

Data Base Entry

FAX Registration window image is shown in FIG. **8**.

FAX Model Table window image is shown in FIG. **9**.

RAM Data Definition window image is shown in FIG. **10**.

B Switch Definition window image is shown in FIG. **11**.

B Switch Default Table window image is shown in FIG. **12**.

Error Code Table window image is shown in FIG. **13**.

Customer Information window image is shown in FIG. **14**.

Service Center Information window image is shown in FIG. **15**.

Diagnosis

General Flow of Diagnosis is shown in FIG. **16**.
Knowledge Base Representation is shown in FIG. **17**.
Data Files are shown in FIG. **18**.
Model Data is shown in FIG. **19**.

How the System Works

FAX model is sometimes important to diagnose, because most knowledge is related to the model. In this example, FX3300 is stored in user's data base for initial communication setup. The customer's name is used as a key to connect the remote FAX. Another telephone number is necessary in case of FAX malfunctions.

Analyses results are reserved for future data analysis. The result of statistical analysis will be represented here.

"Line Fail," "CED Not Detected" and "DIS . . . " are the part of the stored expert knowledge listed in the manual. Tables 3 and 4 are the example already stored in Ricoh. The result of this diagnosis is service "ACTION." This should be connected to the small data base of service engineers. The result of the diagnosis will be sent to the customer or service center via FAX or phone (if FAX doesn't work).

Another window "DATA for FX3300" is connected to the specific data concerning FX3300. Tables 1 and 2 are the example.

A description of the operation of the facsimile diagnostic system according to the present invention will now be provided. In order to run the system, a user will need a configuration such as depicted in FIG. 1, which includes a control system such as a PC/AT,XT or IBM PS2 which runs DOS operating systems. In addition, a hard disk and a double sided disk drive is recommended. However, two double sided disk drives can be utilized. The user will need a serial cable, a communication control adapter (CCA), a mouse, an analog telephone line and two serial ports or a serial and a mouse port. The software is typically one such as Microsoft Windows version 2.0 or later version, and DOS 2.0 or later version.

The hardware interconnection is as depicted in FIG. 1, in which a telephone line is connected to the CCA socket, which indicates line side. The user connects a serial cable to both the CCA and computer serial port, and connects the mouse to the serial port or to a mouse port.

The "DTE/DCE" switch is set to "DCE". In starting up, the operation is as follows:

(1) Copy "*.*" to the windows' working directory.

(2) When in DOS, enter "WIN FAXSET" and then press <Return>, or

(3) Select and run FAXSET.EXE in the MS-DOS Executive window. Starting FAXSET automatically creates an empty window where the user can select various commands. Before running the program, Microsoft Windows are usually already installed.

The main menu on the display of PC of FIG. 1 is depicted in FIG. 21. In order to choose a Command from a Menu,

(1) if using the mouse, the user chooses a command from a menu:

(i) Click the menu name on the menu bar,

(ii) Click the command name.

(2) if using the keyboard, then follow these steps:

(i) press the ALT key,

(ii) press the underlined letter in the menu name,

(iii) press the underlined letter in the command name.

In order to cancel a menu,

(1) if using the mouse and decide after selecting the menu that the user doesn't want to choose a command, the menu can be cancelled by pressing ESCAPE.

2) if using the keyboard and decide after selecting the menu that the user doesn't want to choose a command, cancel the menu by clicking anywhere outside the menu. Clicking in a blank area of the window is best, so that the user doesn't select something else in the window without meaning to.

FIG. 22 depicts a RAM access menu on the display of the PC of FIG. 1.

In order to set up a communications port, the Set Comport command provides this function, as seen in FIG. 23. The user does this only if the port connection to CCA is different than default —COM1.

The user should use the mouse to select the right serial port which will communicate with CCA.

(i) Click "OK" to make some changes.

(ii) Click "CANCEL" if no changes or discard those changes.

FIG. 24 depicts the display of RAM accessing.

(1) If the user receives a message "Error in opening Com Port" after selecting RAM accessing command, then reset communications port.

(2) Input target fax telephone number to telephone number blank field.

(3) Input the starting and ending address of RAM where the user is going to retrieve data from target facsimile. If the command menu selected is "Read/-Write BS" then input the starting and ending address of whole bit-switch-table basing on target machines' models For example, if target machine is R50 series, then

enter "0080" for starting address field, and

enter "009F" for ending address field.

(4) Click "OK" if input information is correct.

Then the application program will automatically dial the telephone number entered and retrieve the remote fax information which store in the RAM just entered above. If the RAM address specified is larger than 256 bytes, the application program will need to dial another call to get the rest of the data from remote target facsimile. But, the RAM accessing will not success if the telephone number entered is incorrect, the target facsimile is busy, the target facsimile does not power on, or CCA does not power on.

For each of these causes, the application program will pop up a related message on the screen. Here are some actions which should be followed:

(i) Reexamine the information entered on the screen.

(ii) Check the target facsimile's current status—power is off or machine is still busy.

(iii) Check CCA's connection and power switch.

(5) Click "CANCEL" if it is decided not to continue the program.

After data has been retrieved successfully from the target facsimile, the user needs to input data type for each address group. The window will display as seen in FIG. 25. For example, if retrieving the remote RAM from 70b0 to 70fa out of R50 series machines, the corresponding information will be TTI counter, TTI, CSI counter, CSI, RTI counter and RTI.

As defined, all three counters are HEX types and all three identifications are ASCII (upper case) types. Therefore, the input sequence will be as above table, which means:

Address 70b0 stores a HEX data	(TTI counter)
Address from 70b1 to 70d0 stores ASCII (upper) data.	{TTI}
Address 70d1 stores a Hex data	(CSI counter)
Address from 70d2 to 70e5 stores ASCII (upper) data.	(CSI)
Address 70e6 stores a HEX data	(RTI counter)
Address from 70e7 to 70fa stores ASCII (upper) data.	(RTI)

Click "OK" if input information is correct, and click "CANCEL" if it is decided not to continue the application program.

RAM Data Display

After clicking "OK" on the "Data Type Table" window, the user can check the target facsimile information on the "Remote RAM Display" window as seen in FIG. 26. In this case,

TTI counter	is 20 (HEX)
TTI	is RICOH SAN JOSE ATD DEPARTMENT
CSI counter	is 14 (HEX)
CSI	is 94520637
RTI counter	is 14 (HEX)
RTI	is RICOH SAN JOSE BULD2

If the user needs to rewrite the information displayed on the screen, follow these steps:

(1) Use mouse and click on that particular position

(2) Type in new data

(3) Click "WRITE" if the user wants to write the new data back to target facsimile

(4) Click "DONE" if all data has been examined

Since the maximum digits which can be entered for TTI is 20 (HEX), which is 32 (decimal), the user should not overtype new data to the next field, which will be a counter of CSI; also, the same as CSI, RTI, and some other similar cases.

If the size of retrieved data is larger than the size of the display window, the window will offer a vertical scroll bar on the right margin of the window. Then the user can use the scroll bar to review all of the data.

If the user needs to modify some data and rewrite back to target facsimile, then the application program will only rewrite those data which shows on the current window.

After data has been retrieved successfully from the target facsimile, the user can check the target facsimile Bit Switch information on the "Bit Switch Display" window in FIG. 27. If the user needs to rewrite the information displayed on the screen, follow these steps:

(1) Use mouse and click on that particular position.

(2) Type in new data.

(3) Click "WRITE" if the user wants to write the new data back to target facsimile.

(4) Click "DONE" if all the data has been examined.

What is claimed is:

1. A remote facsimile diagnostic system comprising one or more facsimile apparatus,

remote diagnostic means for remotely communicating with each of said facsimile apparatus including communication,

adapter means for controlling communications with said facsimile apparatus,

a telephone line connected between each of said facsimile apparatus and said remote diagnostic means, and

remote control means for providing remote diagnostics of each of said facsimile apparatus through said communication adapter means over said telephone line wherein said control means is a programmed personal computer, including means for storing programmed control instructions for providing diagnostics to said facsimile apparatus.

2. A system as in claim 1 wherein each of said facsimile apparatus includes memory means for storing communication histories, bit switches for controlling functions and modes through said remote diagnostic means, and sensor status means.

3. A system as in claim 2 wherein said remote control means includes means for retrieving the memory contents of each of said facsimile memory means.

4. A system as in claim 3 wherein said remote control means includes means for displaying the retrieved facsimile memory contents, including means for distinguishing the memory content values which are different from their respective default values.

5. A system as in claim 4 wherein said remote control means includes means for repairing a defective one of said facsimile apparatus, including means for writing new memory content values to the defective facsimile memory means.

6. A system as in claim 5 wherein said remote control means includes means for providing repair instructions to each of said facsimile apparatus.

7. A remote diagnostic system for image reproducing apparatuses comprising:

at least one image reproducing apparatus;

means for controlling communications with each of said image reproducing apparatus;

a transmission line connected between each of said image reproducing apparatus and said means for controlling communications;

remote diagnostic means for remotely communicating with each of said image reproducing apparatus through said means for controlling communication and over said transmission line, wherein said remote diagnostic means is a programmed computer, including means for storing control instructions for providing diagnostics to said image reproducing apparatus.

8. A system as in claim 7 wherein each of said image reproducing apparatus includes memory means for storing use histories, bit switches for controlling functions and mode through said remote diagnostic means, and sensor status means.

9. A system as in claim 8 wherein said remote diagnostic means includes means for retrieving the memory contents of said memory means of each of said image reproducing apparatus.

10. A system as in claim 9 wherein said remote diagnostic means includes means for displaying the retrieved memory contents of said image reproducing apparatus, including means for distinguishing the memory content values which are different from their respective default values.

11. A system as in claim 10 wherein said remote diagnostic means includes means for repairing a defective one of said image reproducing apparatus, including means for writing new memory content values to said memory means of said defective image reproducing apparatus.

12. A system as in claim 7 wherein said remote diagnostic means includes means for providing repair instructions to each of said image reproducing apparatus.

* * * * *