

Karel MS48

Telephone System

*Installation
&
Maintenance
Guide*



Edition 3.2

KAREL

CONTENTS

<u>SECTION</u>		<u>PAGE</u>
	INTRODUCTION	1
	TECHNICAL REFERENCE	
I.	SYSTEM	3
I.1.	MB48 MOTHERBOARD & EXP48 EXPANSION MODULES	5
I.2.	POWER TO THE SYSTEM	8
I.2.A.	SPS48 POWER SUPPLY MODULE	8
I.2.B.	POWER FAILURE TRANSFER STATIONS	10
I.3.	EXTERNAL MUSIC CONNECTOR	10
I.4.	EXTERNAL RELAY	10
II.	ACCESSORIES	11
II.1.	CONSOLES, FEATURE PHONES, DIRECT STATION SELECT MODULES – OP48(-H), LT48(-H), DSS80, DSS40	11
II.1.A.	OP48(-H) CONSOLE	12
II.1.B.	LT48(-H) FEATURE PHONE	13
II.1.C.	DSS80 DIRECT STATION SELECT MODULE	13
II.1.D.	DSS40 DIRECT STATION SELECT MODULE	14
II.2.	MINI PRINTER - KY16	15
II.3.	CALL RECORD LISTING INTERFACE – CM48	17
II.4.	PC-CONSOLE INTERFACE – PK48	19
II.5.	CALL RECORD LISTING & PC-CONSOLE INTERFACE - CM48 + PK48	20
II.6.	SERIAL PRINTER INTERFACE - RS232	20
II.7.	DOORPHONE - DY26	21
II.8.	EXTERNAL ANNOUNCEMENT SYSTEM	21
II.9.	AUTO ATTENDANT & VOICE MAIL – EVM48	22
II.10.	ISDN ADAPTOR - IA12, EXP-IA12	23
II.11.	LOCAL PAGER – PG100	26
II.12.	STANDARD TELEPHONE SETS	27
II.13.	FILTER & PROTECTION UNIT – FPBASE, FPEXP	28
III.	SOFTWARE	29
IV.	TECHNICAL SPECIFICATIONS	31

SECTION**PAGE****INSTALLATION**

I.	PRELIMINARY NOTICE	33
I.1.	DELIVERY CHECK	33
I.2.	INSPECTION	33
I.3.	ENVIRONMENTAL REQUIREMENTS	33
II.	SYSTEM INSTALLATION	35
II.1.	GROUNDING	36
II.2.	SPS48 POWER SUPPLY MODULE	37
II.3.	MB48 MOTHERBOARD & EXP48 EXPANSION MODULES	38
III.	ACCESSORY INSTALLATION	41
III.1.	CONSOLES, FEATURE PHONES, DIRECT STATION SELECT MODULES	41
III.2.	MINI PRINTER	45
III.3.	PC INTERFACE	49
III.4.	SERIAL PRINTER INTERFACE	50
III.5.	DOORPHONE	51
III.6.	EXTERNAL ANNOUNCEMENT SYSTEM	53
III.7.	AUTO ATTENDANT & VOICE MAIL	54
III.8.	ISDN ADAPTOR	55
III.9.	LOCAL PAGER	58
III.10.	STANDARD TELEPHONE SETS, EXTERNAL LINES	61
III.11.	FILTER & PROTECTION UNIT	62
III.12.	EXTERNAL MUSIC SOURCE	63
III.13.	EXTERNAL RELAY	64

MAINTENANCE

I.	MAINTAINING THE SYSTEM	67
----	------------------------	----

INTRODUCTION

This Installation and Maintenance Guide provides an overall technical reference on the KAREL MS48 system and its accessories and includes descriptions, structures and capabilities as well as the installation and maintenance information.

This guide is formed up of three main chapters:

- 1) Technical Reference: The system outline is given and all the accessories are described. Brief information about the software structure of the system is presented and finally the technical specifications of the system are listed.*
- 2) Installation Guide: The basic system installation and wiring instructions are presented. Following the system installation part, the installation and the wiring of the accessories are explained.*
- 3) Maintenance Guide: The basic steps to solve the problems faced after the installation of the system are given.*

I. SYSTEM

At minimum capacity, MS48 has 4 lines and 12 extensions, which can be further upgraded to support the following configurations :

Lines	Extensions
4	28
6	18
	34
8	24
	40
10	30
12	36

At minimum capacity, the MS48 system consists of the following parts :

- CBN48 Cabinet made of metal,
- SPS48 Power Supply Module including a power card and cables,
- PWT48 Power Transformer,
- RNT48 Ring Transformer,
- MB48 Motherboard that can support the minimum capacity of 4/12.

The EXP48 Expansion Modules may be used to increase the system capacity.

See the following figures to have a general idea about the outlook as well as the structure of the system.

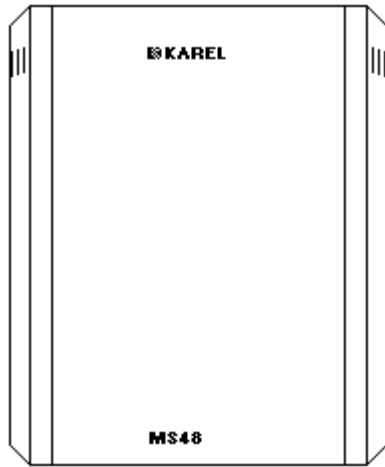


Figure A-1

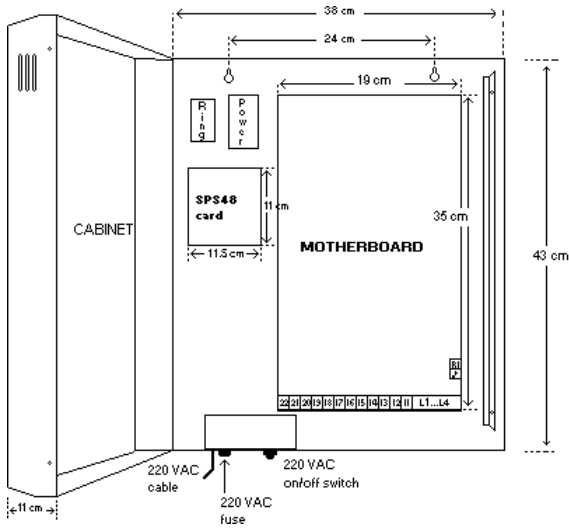


Figure A-2

The CBN48 metal cabinet provides a strong shell and a natural electromagnetic shield for the system.

I.1.

MB48 MOTHERBOARD & EXP48 EXPANSION MODULES

The MB48 motherboard consists of the microprocessor, utility, DTMF, switching, line and extension circuitries. See the following figures for the location of these circuitries and the operational flow diagram of MB48 motherboard.

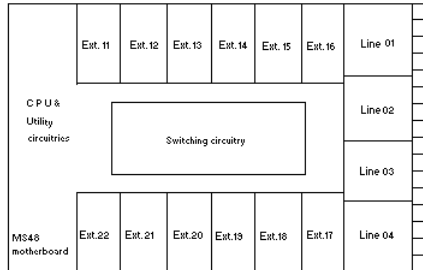


Figure A-3

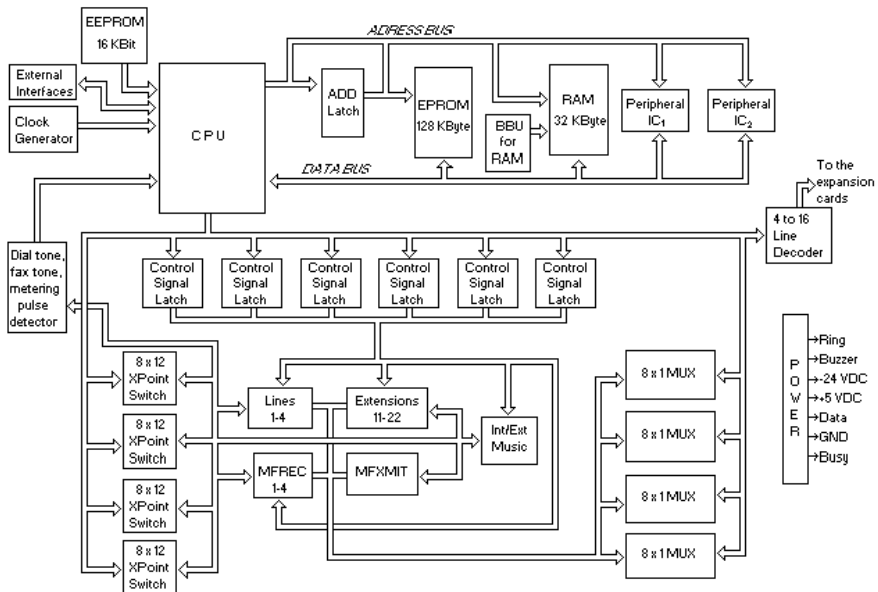


Figure A-4

The MB48 motherboard has 4 lines and 12 extensions, constructing the basic capacity of the system. However, this capacity may be further increased by means of EXP48 Expansion Modules.

There are 3 types of EXP48 Expansion Modules :

- EXP48 (4/12) Expansion Module with a capacity of 4/12.
- EXP48 (0/16) Expansion Module with a capacity of 0/16.
- EXP48 (2/6) Expansion Module with a capacity of 2/6.

At most two EXP48 Expansion Modules of any type can be installed on top of the MB48 motherboard except for both being EXP48 (0/16) or EXP48 (2/6), so that MS48 system supports the following capacities :

Lines	Extensions
4	28
6	18
	34
8	24
	40
10	30
12	36

The default numbering plan of MS48 system depends on the system capacity as follows :

- For capacities (4/12) and (6/18), the extensions have numbers 11 to 22 and 11 to 28, whereas the lines have numbers 01 to 04 and 01 to 06, respectively.
- For higher capacities, the extensions have three digit numbers, and the numbering of the lines is similar to the lower capacities. So, the extensions have numbers from 111 to 150 (max.) and the lines have numbers from 01 to 12 (max.).

When all the modules are installed and the system is powered on, the system checks and recognizes all the cards automatically and arranges the numbering plan accordingly.

Other than the extension circuitries that exist on all EXP48 modules and the line circuitries that exist on all EXP48 modules except for EXP48 (0/16), there are also utility and switching circuitries on EXP48 Expansion Modules. See the following figures for the location of these circuitries, noting that the extension and line numbers are assigned with the assumption that the related EXP48 module is the first card installed on top of the MB48 motherboard.

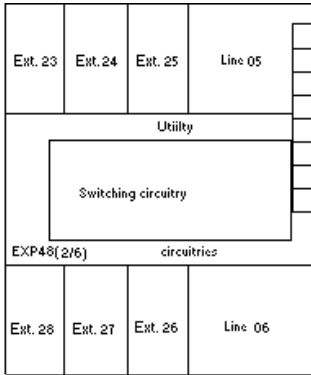


Figure A-5.I

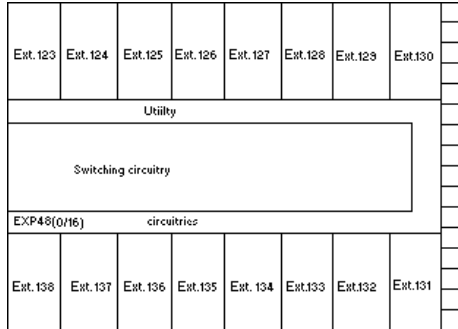


Figure A-5.II

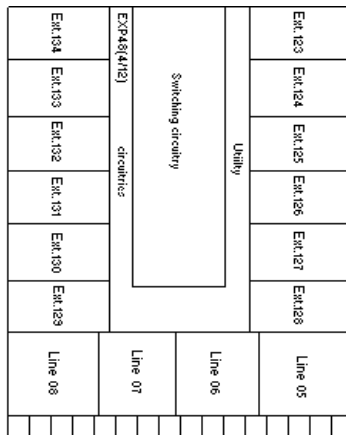


Figure A-5.III

As explained above, the DTMF circuitries exist on the MB48 motherboard, but not on the EXP48 modules. However, when the system capacity is increased beyond 6/18, the MF receiver capacity of the MB48 motherboard - that can serve 8 ports at a time - may be insufficient especially under heavy traffic. The MFR48 MF-Receiver Card that comes with each EXP48 (0/16) and EXP48 (4/12) module is designed to avoid such cases. MFR48 is to be installed on top of the MB48 motherboard when at least one of the two expansion modules is to be used. The MFR48 card has 2 MF receiver chips and thus increments the MF receiver capacity of the system by serving 4 extra ports at a time.

The dimensions of MB48 are 19 cm x 35 cm and the weight is 0.75 kg.

The dimensions of EXP48 (4/12) are 18.5 cm x 26 cm and the weight is 0.6 kg.

The dimensions of EXP48 (0/16) are 18.5 cm x 23 cm and the weight is 0.4 kg.

The dimensions of EXP48 (2/6) are 14.5 cm x 16.5 cm and the weight is 0.3 kg.

I.2. POWER TO THE SYSTEM

MS48 system receives 220 VAC from the mains. Inside the fuse slot next to the system ON/OFF switch, there exists a F-type fuse of 1 A / 250 VAC for the first step protection.

The system can operate for the mains input of 180 - 260 VAC 50/60 Hz. The PWT48 Power Transformer generates 2x15 VAC from the mains voltage, which is processed by the SPS48 Power Supply Module.

The PWT48 Power Transformer is located inside a metal cage at the up left corner of the CBN48 cabinet, together with the RNT48 Ring Transformer which generates 64 Vrms ring signal.

I.2.A. SPS48 POWER SUPPLY MODULE

SPS48 Power Supply Module is simply a card that resides below the metal cage surrounding the RNT48 and PWT48 transformers.

SPS48 is a Switched Mode Power Supply (SMPS). Receiving 2x15 VAC from the PWT48 Power Transformer, SPS48 generates +5 VDC, +12 VDC and -24 VDC for the system operation, for the accessories and for the RNT48 Ring Transformer. The output of the RNT48 transformer is the 64Vrms ring signal, which is transferred to the MB48 motherboard directly.

SPS48 also has connectors for KY16 Mini Printer and OP48(-H) Consoles / LT48(-H) Feature Phones / PG100 Local Pager / IA12 ISDN Adaptor. The Busy and Data signals on these connectors are not processed by SPS48, they are just received from the MB48 motherboard so as to be transmitted to the accessories.

See the following figure for the location of the connectors on SPS48.

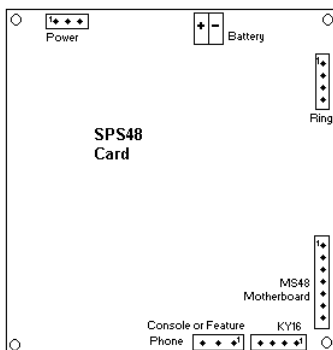


Figure A-6

The pin-out of the connectors on SPS48 module are illustrated in the following table:

SPS48 – MB48 Connector	
Pin	Signal
1	Ring Control
2	Buzzer Control
3	- 24 VDC
4	+ 5 VDC
5	Data
6	GND
7	Busy

SPS48 – RNT48 Connector	
Pin	Voltage
1	-
2	GND
3	-24 VDC
4	+24 VDC

SPS48 – PWT48 Connector	
Between Pins	Voltage
1 & 3	15.5 VAC
2 & 3	15.5 VAC

SPS48 - KY16 Connector	
Pin	Signal
1	GND
2	Data
3	Busy
4	-

SPS48 - Console/Feature Phone/Pager/ ISDN Adaptor Connector	
Pin	Signal
1	Data
2	+12 VDC
3	GND

MS48 system can be backed up with a battery of 12 VDC in order to provide the continuity of the operation in case of mains failure, by the help of the battery backup circuitries of SPS48. For the cases where a battery is to be connected to the system, it is strongly recommended to choose a dry battery for the proper operation.

The MS48 system that is equipped with a 12 V – 7 Ah battery can continue to run for 5 hours under an average traffic of 35 %.

There exists a connector on the SPS48 card for battery connection (see Figure A-6). The F-Type fuse of 8 A / 12 VDC for battery is also available on SPS48 card, residing at the down right corner of the power connector.

SPS48 is also capable of charging the battery while the system power is on and the system is running under low traffic. Besides, there exists a low voltage battery cut-off circuitry, which turns itself off when the battery voltage goes below 8.5 VDC and does not start until the battery voltage is above 11.5 VDC. So, preventing full discharge of the battery SPS48 makes the lifetime of the battery longer.

The SPS48 card also has the system buzzer that may be used as an external ringer for the incoming external calls.

The dimensions of the SPS48 card are 11 cm x 11.5 cm and the weight is 0.3 kg.

I.2.B. POWER FAILURE TRANSFER STATIONS

In case of power failure the stand-by battery backup allows the system resume operation without any interrupt.

In case there is no battery connected to the system when the power goes off, the lines on the MB48 motherboard and EXP48 (4/12) module are automatically connected to first 4 extensions of the same board. The same also applies to EXP48 (2/6), such that the lines on EXP48 (2/6) module are connected to the first 2 extensions of the same board, in case of power failure.

See the following figure illustrating the power failure transfer stations of MS48 (10/30) system.

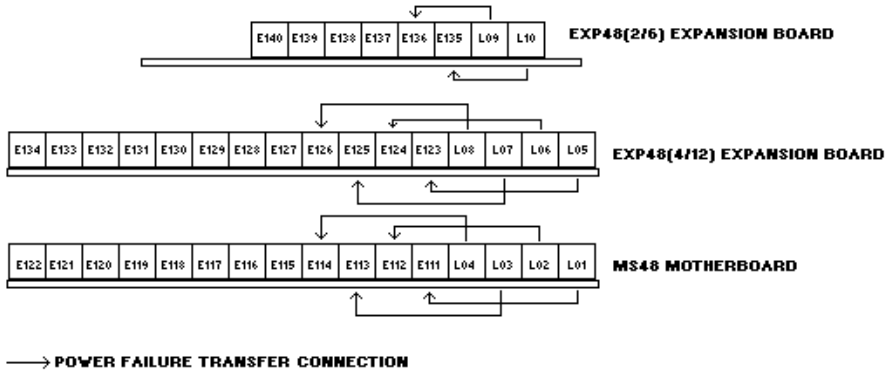


Figure A-7

I.3. EXTERNAL MUSIC CONNECTOR

Any external music source (tape recorder, radio or CD player) can be connected to the system to be used for background music facility and to be transmitted to the external parties parked or put on hold. This connection is established via the 2-pin music connector on the MB48 motherboard.

I.4. EXTERNAL RELAY

An external relay which is rated for 250 VAC - 24 VDC at a maximum current of 2 A exists on the MB48 motherboard to be used to activate either a door opener, an external ringer, an external music source or an external announcement system. The connection to the external relay is established through the 2-pin relay connector on the MB48 motherboard. The selection among these devices is made by programming.

II. ACCESSORIES

To offer you a full telecommunication system, MS48 is equipped with many accessories. These accessories are shown in the following figure and explained one by one in the following sections.

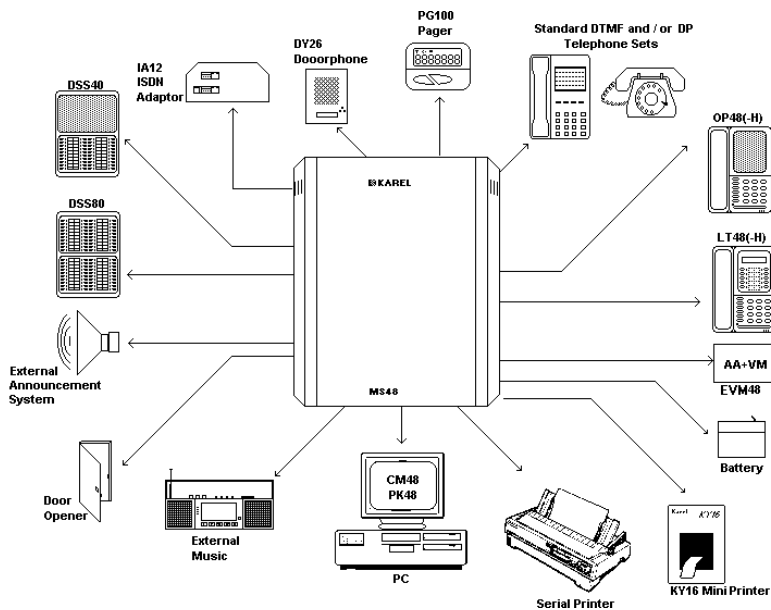


Figure A-8

II.1. CONSOLES, FEATURE PHONES, DIRECT STATION SELECT MODULES – OP48(-H), LT48(-H), DSS80, DSS40

OP48(-H) Consoles, LT48(-H) Feature Phones, DSS80 / DSS40 Direct Station Select Modules are the members of the same telephone family, hence they have similar cases.

The data cabling of these sets is made via the 3-pin CONSOLE connector on the SPS48 Power Supply Module. The signaling between the system and consoles, feature phones or DSS modules is illustrated in the following table.

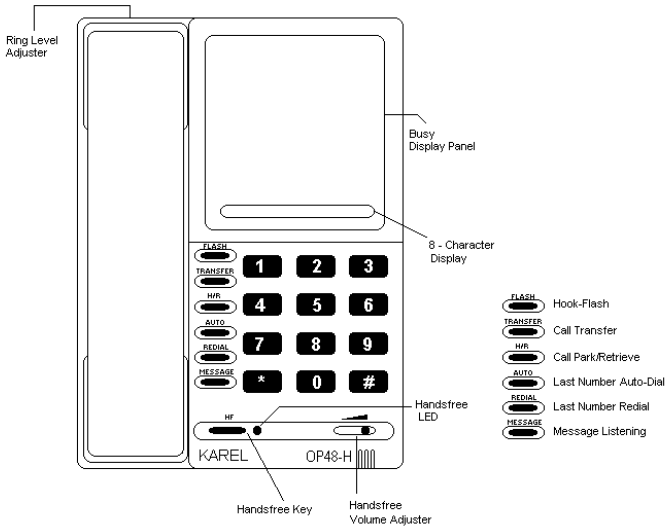
SPS48 Card CONSOLE Connector Pin No	Signal	Telephone / DSS Card RJ Socket Pin No
1	Data	1
2	+ 12 VDC	6
3	GND	2

The input of +12 VDC is regulated to +5 VDC by telephone / DSS cards.

II.1.A. OP48(-H) CONSOLE

There are two types of OP48 Consoles, OP48 Console and OP48-H Handsfree Console, the second one being half-duplex. The OP48(-H) Console has a BDP (Busy Display Panel) that shows the states of all the extensions and lines as well as some system features. There is also an 8-Character Display that keeps the user informed about the calling / called extension and dialed numbers as well as some system features.

The outlook and BDP of OP48-H are illustrated in the following figures.



Handsfree Key, Handsfree Volume Adjuster and Handsfree LED are available only on the handsfree versions.

Figure A-9

11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
01	02	03	04	C	J	»	C1	C2	S
05	06	07	08	P	⊞	★	Lo	Pa	Er
09	10	11	12	†	⊞	⊞	Pr	Ro	Di

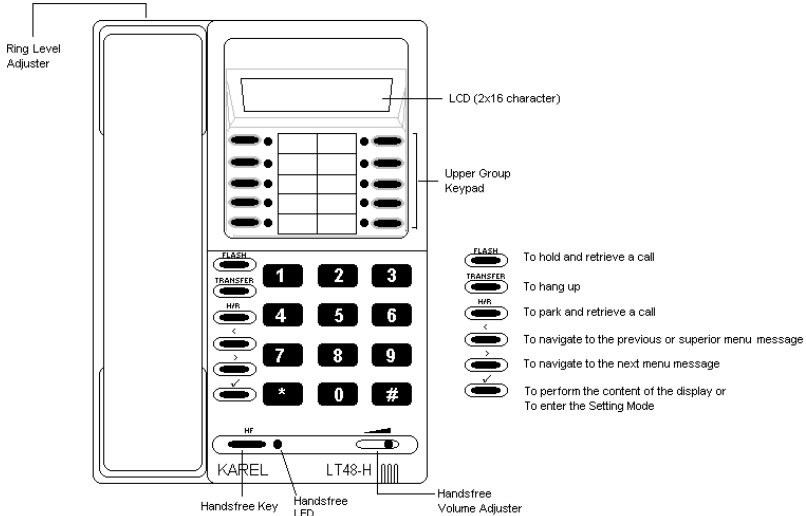
Figure A-10

The dimensions of OP48(-H) are 22 cm x 6.5 cm x 16 cm and the weight is 0.9 kg.

II.1.B. LT48(-H) FEATURE PHONE

There are two types of LT48 Feature Phones, LT48 Feature Phone and LT48-H Handsfree Feature Phone, the second one being half-duplex. The LT48(-H) Feature Phone is equipped with a 2 x 16 menu driven LCD, which offers self explanatory messages for the user to monitor the state of the operation and access many system features. Also, it is possible to make one touch dialing for accessing any extension / line or activating most system features, by the help of the 10 programmable keys in the upper keypad.

The outlook of LT48-H is illustrated in the following figure.



Handsfree Key, Handsfree Volume Adjuster and Handsfree LED are available only on the handsfree versions.

Figure A-11

The dimensions of LT48(-H) are 22 cm x 6.5 cm x 16 cm and the weight is 0.9 kg.

II.1.C. DSS80 DIRECT STATION SELECT MODULE

The DSS80 Direct Station Select Module, which is used as an add-on module for OP48(-H) Consoles and LT48(-H) Feature Phones, is a programmable keypad, including 80 multipurpose keys and 80 corresponding LEDs.

Each key may be programmed to activate two facilities, which may be calling an extension, accessing a line or activating a system feature. The corresponding LED of each key shows the status of the facility assigned to the primary function of the key.

The outlook of DSS80 is illustrated in the following figure.

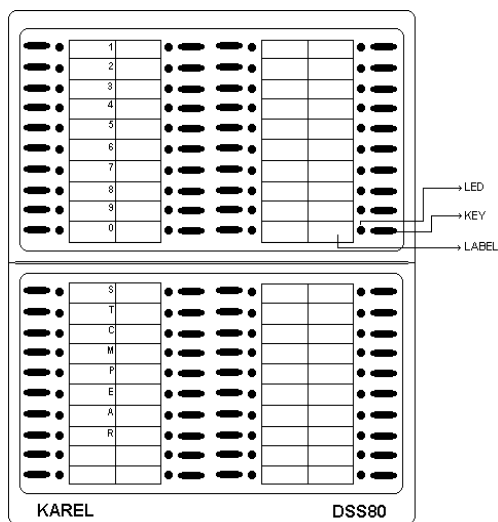


Figure A-12

The dimensions of DSS80 are 16 cm x 22 cm x 6.5 cm and the weight is 0.7 kg.

II.1.D. DSS40 DIRECT STATION SELECT MODULE

The DSS40 Direct Station Select Module, which is used as an add-on module for OP48(-H) Consoles and LT48(-H) Feature Phones, consists of a BDP (Busy Display Panel), a 2-Character Display and a programmable keypad including 40 multipurpose keys and 40 corresponding LEDs.

Each key may be programmed to activate two facilities, which may be calling an extension, accessing a line or activating a system feature. The corresponding LED of each key shows the status of the facility assigned to the primary function of the key.

The BDP (Busy Display Panel) together with the 2-Character Display shows the states of 40 extensions and 12 lines as well as some system features.

DSS40 can be used not only with the MS48 system, but also with the other KAREL systems of bigger capacities. That is why DSS40 handles 4-digit physical numbers for extensions, such that the 2-Character Display is used to show the most significant two digits whereas the LEDs on the BDP are used to indicate the least significant two digits. In this way, the two digits in the 2-Character Display may be interpreted as “page numbers”, and there are 3 pages with numbers 11 to 13 that covers all the extensions in the KAREL systems to which DSS40 can be connected. It is also possible to navigate forward and backward among the pages, via the “+” and “-” keys on DSS40 keypad. However, when DSS40 is connected to MS48 system, it is enough to observe the first page (page 11) covering the extensions 1111 to 1150. The states of 12 lines as well as system features are displayed on all pages.

The outlook and BDP of DSS40 are illustrated in the following figures.

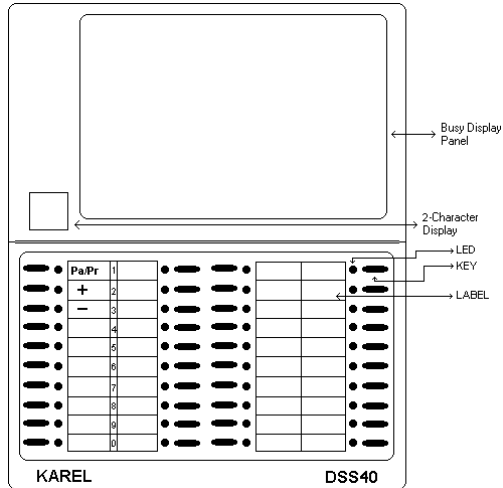


Figure A-13

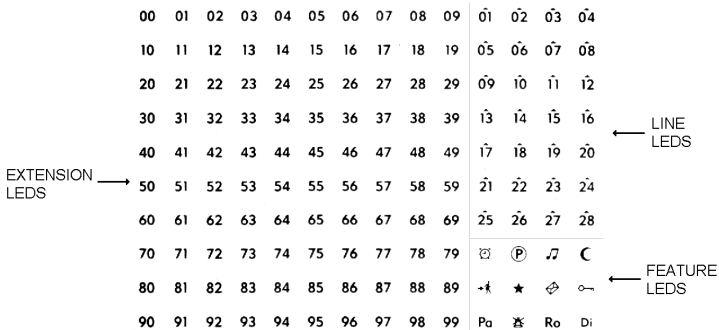


Figure A-14

The dimensions of the DSS40 are 16 cm x 22 cm x 6.5 cm and the weight is 0.7 kg.

II.2. MINI PRINTER - KY16

MS48 system offers *Call Record Listing (CRL)* facilities, by keeping the records of the external calls and storing them in its non-volatile memory against any power failure. You may obtain these records by way of some external devices.

One of these external devices is KY16 Mini Printer, which gives 16-column printout using an Epson type print head.

The following figure illustrates the outlook of KY16 Mini Printer.

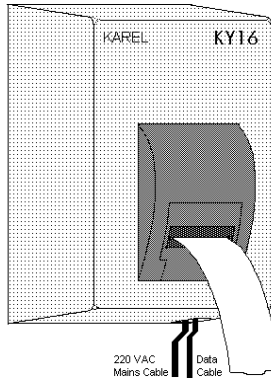


Figure A-15

The data cabling of KY16 Mini Printer is made via the 4-pin PRINTER connector on SPS48 Power Supply Module. The signaling between the system and KY16 is illustrated in the following table.

SPS48 Card PRINTER Connector Pin No	Signal	KY16 Card Connector Pin No
1	-	-
2	Busy	2
3	Data	3
4	GND	1

Below is a sample printout of a call record obtained from a KY16.

Counter ← #0006	LDIS	→ Call Type
Date (Day/Month) ← 25/01	19:33:19	→ Starting Time (Hour/Minute/Second)
Duration (Minute/Second) ← 01:29	12 15 03	→ Trunk → Ending extension → Starting extension
Pulse number ← 0002	000200	→ Cost
Number dialed ← 0212543123		

Figure A-16

The dimensions of KY16 are 15 cm x 20.5 cm x 9 cm and the weight is 1.3 kg.

● **NOTE**

Only one of the three CRL accessories - namely KY16 Mini Printer, CM48 CRL Interface and/or PK48 PC-Console Interface, RS232 Serial Printer Interface - can be connected to the system at a time. The selection among these devices is made by programming.

II.3. CALL RECORD LISTING INTERFACE – CM48

MS48 system offers the alternative of using a PC for *Call Record Listing (CRL)* facilities, so that you can process the records of the external calls stored in the system memory over PC.

CM48 Call Record Listing Interface serves this purpose. By way of CM48, call records can be processed, filtered and statistically ordered or a phone directory can be created. CM48 consists of the add-on card called PKCR, a 5-meter cable for PC-PKCR connection, a security plug and a 3.5" diskette with the necessary software that operates under Windows. The cable has a 25-pin D-type plug at the PC end and a 5-pin connector at the PKCR end.

● **PC REQUIREMENTS:**

The PC to be used with MS48 should have the following specifications:

- a) 640 KB RAM (at least)
- b) Windows (not older than 3.1)
- c) A harddisk
- d) A serial port

● **SIGNALING AND COMMUNICATION PARAMETERS:**

The signaling between PKCR card and the PC is illustrated in the following table. Since the PC-PKCR cable has a 25-pin plug at the PC end, it is necessary to employ a 25-pin to 9-pin converter plug, in order to use the 9-pin connector of the PC:

PKCR Card		PC	
Connector Pin No	Signal	25-pin Connector Pin No	9-pin Connector Pin No
1	+ 10 VDC	4	7
2	- 10 VDC	20	4
3	TXD	3	2
4	RXD	2	3
5	PC GND	7	5

The signal names above are given with respect to CM48 and these pin assignments are valid only for IBM compatible devices. If your device is not IBM compatible, then you must provide the requested pin connections to match the signaling parameters of CM48.

The communication protocol for PC-Exchange connection is illustrated in the following table.

For PC	
Data Bits	8
Stop Bit	1
Parity	None
Baud Rate	4800 Bps

CM48 is able to set the communication protocol to the appropriate values automatically.

- **DATA FORMAT OF CM48:**

A call record consists of two lines, each followed by Carriage return (0Dh) and Line Feed (0Ah) characters.

Structure of the first line:

Starting Character Position	Field Width	Information
1	1	#; indicates start of record
2	4	4 digit counter value
6	1	Space
7	4 or 2	Call type
11	1	Space
12	1	Common Pool information

- Call type:

LDIS	Long Distance
INTL	International
IC	Incoming

Call type field and the preceding space are not sent to PC for local calls.

- Common pool information field contains the character C to indicate calls made from the common pool. If the call was not made from the common pool then this field and the preceding space are not sent to PC.

Structure of the second line:

Starting Character Position	Field Width	Information
1	8	Date in the format dd/mm/yy
9	1	Space
10	8	Starting time of the call in the format hh:mm:ss
18	1	Space
19	8	Ending time of the call in the format hh:mm:ss
27	1	Space
28	5	Call duration in the format mm:ss
33	1	Space
34	4	Starting extension number, OPE for the operator and Dtt for the incoming calls coming from a DISA line where tt is the line number.
38	1	Space
39	4	Ending extension number, OPE for the operator.
43	1	Space
44	3	Call Info
47	1	Space
48	2	Line number
50	1	Space

51	4	Metering Pulse count
55	1	Space
56	7	Call Cost
63	1	Space
64	Variable	Number dialed

- **NOTES**

- Only one of the three CRL accessories - namely KY16 Mini Printer, CM48 CRL Interface and/or PK48 PC-Console Interface, RS232 Serial Printer Interface - can be connected to the system at a time. The selection among these devices is made by programming.
- PKCR and RS232 cards have the same PCB, with some different components. It is possible to distinguish the cards by component U4, which exists on RS232 card only.

The dimensions of PKCR card are 5.5 cm x 6 cm.

The weight of the CM48 is 0.3 kg (including cable).

II.4. PC-CONSOLE INTERFACE – PK48

MS48 system offers the alternative of using a PC as a console, for you to supervise your system via your personal computer, by monitoring the states of extensions / lines or checking and editing system parameters or backing up the parameters in the PC to avoid parameter loss.

PK48 PC-Console Interface serves this purpose. PK48 consists of an add-on card called PKCR (the same card of CM48 CRL Interface), a 5-meter cable for PC-PKCR connection, a security plug and a 3.5" diskette with the necessary software that operates under DOS. The cable has a 25-pin D-type plug at the PC end and a 5-pin connector at the PKCR end.

The PC requirements as well as the signaling and communication parameters are the same as the ones for CM48 CRL Interface.

- **NOTES**

- Only one of the three CRL accessories - namely KY16 Mini Printer, CM48 CRL Interface and/or PK48 PC-Console Interface, RS232 Serial Printer Interface - can be connected to the system at a time. The selection among these devices is made by programming.
- PKCR and RS232 cards have the same PCB, with some different components. It is possible to distinguish the cards by component U4, which exists on RS232 card only.

II.5. CALL RECORD LISTING & PC-CONSOLE INTERFACE - CM48 + PK48

CM48+PK48 is the combined unit of CM48 and PK48 interfaces, the programs of which can run independently but cooperatively.

CM48+PK48 consists of an add-on card called PKCR (the same card of CM48 CRL Interface), a 5-meter cable for PC-PKCR connection, a security plug and two 3.5" diskettes one with CM224-W and the other with PK224-D software. The cable has a 25-pin D-type plug at the PC end and a 5-pin connector at the PKCR end.

See sections II.3. and II.4. for detailed information about CM48 and PK48, respectively.

II.6. SERIAL PRINTER INTERFACE - RS232

MS48 system offers the alternative of using a serial printer for *Call Record Listing (CRL)* facilities, for you to access the call records in the system memory through the serial printer.

RS232 Serial Printer Interface serves this purpose. RS232 consists of an add-on card and a 5-meter cable for PC-Exchange connection. The cable has a 25-pin D-type plug at the PC end and a 3-pin connector at the RS232 end.

● **SIGNALING AND COMMUNICATION PARAMETERS:**

The signaling between RS232 and the serial printer is illustrated in the following table. Since the printer-RS232 cable has a 25-pin plug at the printer end, it is necessary to employ a 25-pin to 9-pin converter plug, in order to use the 9-pin connector of the printer :

RS232 Card		Printer	
Connector Pin No	Signal	25-pin Connector Pin No	9-pin Connector Pin No
1	TXD	3	3
2	RXD	20	6
3	Printer GND	7	5

The parameters of RS232 DSR/DTR protocol for the data flow between the system and the printer is illustrated in the following table :

For Printer	
Data Bits:	8
Stop Bit:	1
Parity:	Even
Baud rate:	2400 bps

You may need to configure the printer for these parameters by selecting the appropriate settings on the printer.

The data format of RS232 is identical to the data format of CM48 CRL Interface.

The dimensions of RS232 card are 5.5 cm x 6 cm.

The weight of RS232 interface (including cable) is 0.25 kg.

• **NOTES**

- Only one of the three CRL accessories - namely KY16 Mini Printer, CM48 CRL Interface and/or PK48 PC-Console Interface, RS232 Serial Printer Interface - can be connected to the system at a time. The selection among these devices is made by programming.
- PKCR (used by PK48 and CM48) and RS232 cards have the same PCB, with some different components. It is possible to distinguish the cards by component U4, which exists on RS232 card only.

II.7. DOORPHONE – DY26

MS48 system has a built in circuitry, which can drive DY26 Doorphone. Any user of the system can access the doorphone and make a conversation with the party near the doorphone. The voice path is full-duplex. The doorphone has a ring button on it. This ring button can be utilized to ring an external ringer or an extension telephone. DY26 Doorphone has a speech processor card inside the metal box.

The outlook and structure of DY26 is illustrated in the following figure.

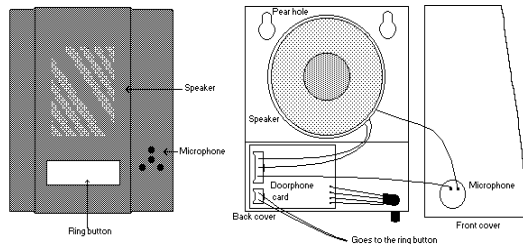


Figure A-17

The pin-out of the 4-pin doorphone connector on the MB48 motherboard is illustrated in the following table:

MB48 Motherboard	
Doorphone Connector	
Pin no	Signal
1	SPEECH
2	GND
3	+ 5 VDC
4	RINGGEN

The dimensions of DY26 are 12 cm x 14 cm x 3 cm and the weight is 0.5 kg.

II.8. EXTERNAL ANNOUNCEMENT SYSTEM

Any external announcement system can be connected to MS48 system through the 4-pin doorphone connector on MS48 motherboard.

II.9. AUTO ATTENDANT & VOICE MAIL - EVM48

EVM48 Auto Attendant guides the external callers throughout their calls with pre-recorded messages, and hence enables the operator to work more efficiently, especially under high traffic. Optionally, Voice Mail facilities may be employed, and then the extensions can have private voice mail boxes to be used to leave / receive messages to / from other users.

EVM48 has 2 minutes Auto Attendant memory on board. Besides, EVM48 has two 36-pin connectors on the component side, which are used to install the optional EVM-FE (Auto Attendant Expansion) and three 24-pin connectors, which are used to install the optional EVM-DE (Voice Mail Expansion) cards.

The EVM-FE card with a Flash ROM memory chip preserves the special messages for Auto Attendant purposes. At most two EVM-FE cards can be installed on the EVM48 card in addition to the onboard one. Each EVM-FE card has a message capacity of 2 minutes. Thus, EVM48 can have a maximum Auto Attendant message capacity of 6 minutes. 24 different messages to be used during different states of call handling of Auto Attendant can be entered. These messages are retained even when the system power is off.

The EVM-DE card with two Dynamic RAM chips stores messages for the Voice Mail purposes. At most three EVM-DE cards can be installed on the EVM48 card. Each EVM-DE card can provide a total message capacity of 15 minutes. Thus, EVM48 can have a maximum Voice Mail message capacity of 45 minutes. The capacity per EVM-DE card may be also increased to 20 minutes by programming, in which case the voice quality is impaired to a certain extent, but the difference cannot be recognized by human ear. The Voice Mail messages are lost when the system power is off.

EVM48 supports two voice channels, used by both Auto Attendant and Voice Mail facilities. That is, EVM48 can serve two users at a time, to record and listen to the messages. The two LEDs on the card are used to show the states of these voice channels. At start up, these LEDs blink till the system recognizes EVM48. Then, each LED stays on while the corresponding channel is idle and stays off when the corresponding channel is in use.

The external callers can make use of the EVM48 facilities, only if they have DTMF telephone sets in order to be able to key in numbers whenever required by EVM48.

The outlook of EVM48, EVM-FE and EVM-DE cards is illustrated in the following figure.

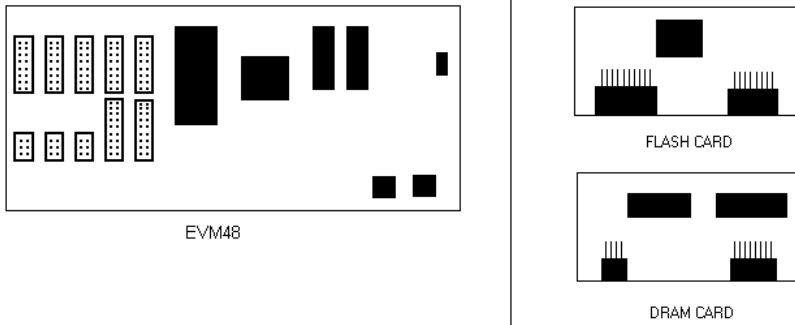


Figure A-18

EVM48 is an add-on card that is to be located on the MB48 motherboard.

The dimensions of EVM48 are 9 cm x 18 cm and the weight is 0.1 kg.

The dimensions of EVM-FE and EVM-DE are 6.5 cm x 3.5 cm.

II.10. ISDN ADAPTOR – IA12, EXP-IA12

The IA12 ISDN Adaptor is an ETSI compatible terminal adaptor that serves as an interface between the ISDN BRA-S0 lines coming through the network terminator (NT1) of PTT and the analog lines of the MS48 system. The adaptor also supports many EURO-ISDN facilities for Basic Rate Access.

The function of IA12 ISDN Adaptor is to support the ISDN BRA protocol of the network in order to make bi-directional conversions between the ISDN BRA lines of PTT and the analog lines of the MS48 system.

At basic capacity, IA12 ISDN Adaptor is capable of handling one S0 line coming from NT1 of the PTT. This capacity can be further increased by means of an EXP-IA12 Expansion Board which can also support one S0 line. Since each S0 line offers two separate channels, the IA12 alone can convert two analog lines of the MS48 system to one ISDN BRA-S0 line whereas the IA12 with EXP-IA12 can convert four analog lines to two ISDN BRA-S0 lines.

The IA12 ISDN Adaptor communicates with the MS48 system through the data line of KAREL telephones. Due to the current limitation on this data line which also feeds the adaptor, it is not possible to connect more than three adaptors to the same system, and the third adaptor cannot have the EXP-IA12 Expansion Board. As a result, the available ISDN line capacities of MS48 system are illustrated as follows:

1 st IA12 ISDN Adaptor	With motherboard only	1 S0 (2 analog lines)
	With expansion board	2 S0 (4 analog lines)
2 nd IA12 ISDN Adaptor	With motherboard only	3 S0 (6 analog lines)
	With expansion board	4 S0 (8 analog lines)
3 rd IA12 ISDN Adaptor	With motherboard	5 S0 (10 analog lines)

The IA12 motherboard has one 8-pin RJ45 socket for connection to the S0 line coming from NT1, two 623K4 type connectors for connection to the A / B terminals of the analog line on the MS48 system and one 6-pin RJ jack for connection to the data line of KAREL telephones. The data cable having a connection box at one end and a RJ45 plug at the other end also comes with the adaptor.

The EXP-IA12 Expansion Board has one 8-pin RJ45 socket for connection to the S0 line coming from NT1 and two 623K4 type connectors for connection to the A / B terminals of the analog line on the MS48 system. The EXP-IA12 Expansion Board also comes with a flat cable for IA12 connection, which is to be attached to the corresponding 20 pin connectors on the IA12 motherboard and EXP-IA12 card.

The IA12 motherboard also has three LEDs to display the status of S0 lines as well as the data line. The rightmost LED turns on when the adaptor is synchronized with the S0 line connected to the IA12 motherboard. The middle LED turns on when the adaptor is synchronized with the S0 line connected to the EXP-IA12 card. And the leftmost LED turns on when the adaptor is synchronized with the data line.

The outlook of IA12 motherboard and EXP-IA12 card are illustrated in the following figures.

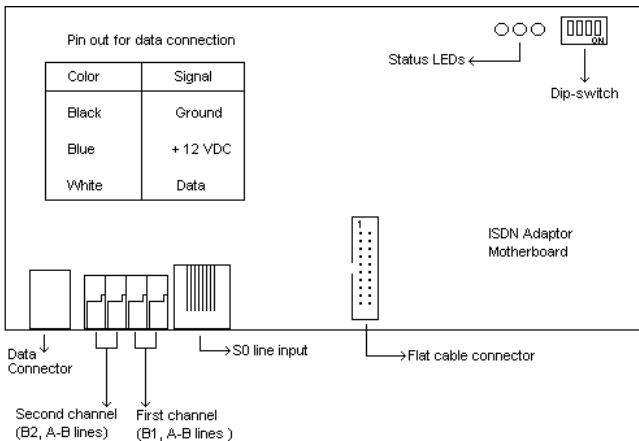


Figure A-19

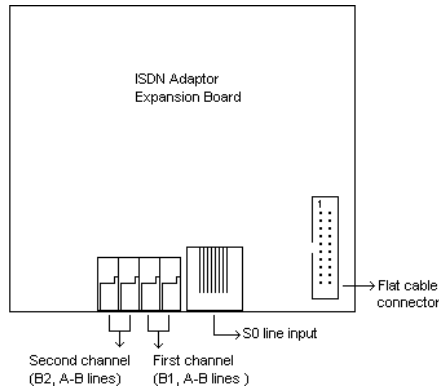


Figure A-20

The S0 lines connected to the IA12 adaptor may be Point to Point (that supports the connection of 1 device only) or Point to Multi-Point (that supports the connection of upto 8 distinct devices). Furthermore, as far as the numbering scheme is concerned, DDI (Direct Dialing In) may be active on Point to Point lines, or MSN (Multiple Subscriber Numbering) may be active on Point to Multi-Point lines. These settings are simply managed by the system software.

The IA12 ISDN Adaptor also supports the following Euro-ISDN features, provided that the user has the subscription to the network, if necessary :

- Calling Line Identification Presentation (CLIP)
- Calling Line Identification Restriction (CLIR)
- Connected Line Identification Presentation (COLP)
- Connected Line Identification Restriction (COLR)
- Advice of Charge at Call Setup (AOC_S)
- Advice of Charge During Call (AOC_D)
- Advice of Charge at the End of Call (AOC_E)

The IA12 ISDN Adaptor is capable of matching either "Speech" or "3.1 KHz Audio" bearer capabilities for outgoing calls as well.

By way of the OP48(-H) or LT48(-H) telephones, several ISDN network messages including the number of the calling party and call charge information can be monitored. These network messages are also transferred to the CRL accessories.

Neither MS48 system nor IA12 ISDN Adaptor has internal S0 ports, so it is not possible to connect an ISDN terminal to the extensions of MS48 system. However, it is possible to connect another ISDN terminal in parallel with the IA12 ISDN Adaptor in the Point to Multi-Point lines with MSN facility.

The dimensions of IA12 are 10 cm x 21 cm x 7 cm and the weight is 0.9 kg.

The dimensions of EXP-IA12 are 9 cm x 8 cm.

II.11. LOCAL PAGER – PG100

PG100 Local Pager lets you page extensions that are equipped with receivers (beepers) so that they can pick up their calls or attend later. The outlook of PG100 is illustrated in the following figure.

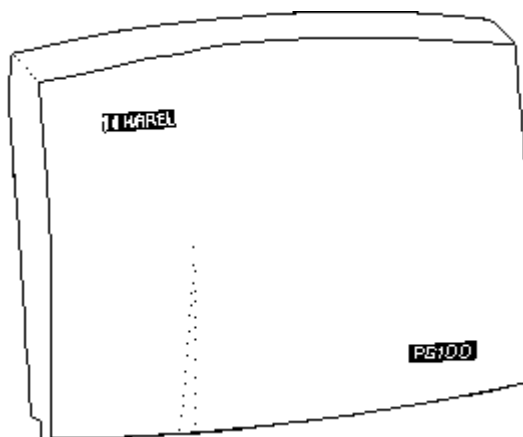


Figure A-21

KAREL also has its own beepers (receivers), which are adjusted to operate at the same frequency of PG100 and which are also programmable for the desired extension number as well as the PG100 Local Pager.

IMPORTANT

The operating frequency of PG100 Local Pager is 167.050 MHz. with a 25 KHz. Bandwidth.

The coverage area of PG100 is 200 m indoor and 2 km open air.

The Data cabling of PG100 Local Pager is made via the 3-pin CONSOLE connector on the SPS48 card. The signaling between the SPS48 and PG100 is illustrated in the following table:

SPS48 Card		PG100 Card
CONSOLE Connector Pin No	Signal	RJ Plug Pin No
1	Data	1
2	+12 VDC	6
3	GND	2

The input of +8 VDC is regulated to +5 VDC by PG100.

PG100 can be also directly connected to mains voltage through a 12 VDC power adaptor. Normally, PG100 receives power over the data cable. However, if the data line of the system is overloaded due to the existence of many OP48(-H) and LT48(-H) telephones or DSS40 and DSS80 modules connected to the system, it is preferable to feed PG100 over the power adaptor that is to be procured locally.

The dimensions of PG100 are 24 cm x 19 cm x 4.5 cm and the weight is 0.5 kg.

II.12. STANDARD TELEPHONE SETS

Any ordinary telephone set, may be DP or DTMF, can be connected to MS48 system including KAREL's own Ladin and Fulya telephone sets, which are both DP/DTMF switchable.

The following figure illustrates the outlook of Ladin.

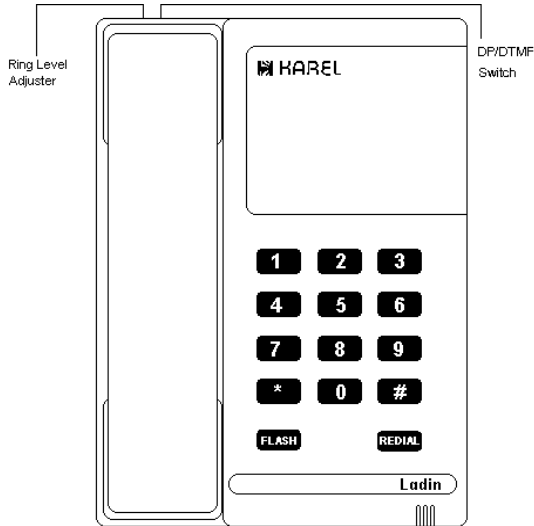


Figure A-22

The following figure illustrates the outlook of Fulya.



Figure A-23

The dimensions of the Ladin are 22 cm x 6.5 cm x 15.5 cm and the weight is 0.6 kg.

The dimensions of the Fulya are 16 cm x 8 cm x 22 cm and the weight is 0.5 kg.

II.13. FILTER & PROTECTION UNIT – FPBASE, FPEXP

The external lines that are connected to the system and the extension lines coming from other buildings are open to environmental effects like lightning or AM radio interference.

In order to protect the system against lightning and radio interference, KAREL has external modules that can be connected to both extensions and lines. These modules are presented in two different models:

- a) FPBASE Filter & Protection Base Unit,
- b) FPEXP Filter & Protection Expansion Unit.

Both units are capable of handling four lines. The difference between FPBASE and FPEXP is the base cover, which exists only on FPBASE unit. FPEXP units are installed on top of an FPBASE unit. So, if a Filter and Protection Unit is required for a system then an FPBASE unit must be used and depending on the capacity of the ports that must be filtered and protected, FPEXP units can be added.

The outlook and structure of FPBASE and FPEXP units are illustrated in the following figure.

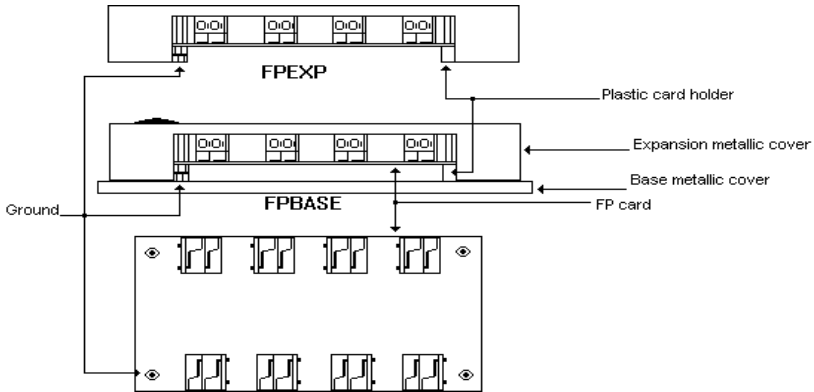


Figure A-24

The dimensions of the FPBASE are 18 cm x 12 cm x 3 cm and the weight is 0.4 kg.

The dimensions of the FPEXP are 17 cm x 12 cm x 2.5 cm and the weight is 0.3 kg.

III. SOFTWARE

MS48 system is a *Stored Program Controlled* (SPC) system. It has a microprocessor, which controls the operation of the system; and an eprom that stores the software of the system. All the default system and extension / line parameters are stored in the EPROM.

Though MS48 is a small capacity system, the software is designed to provide a full feature system. There are three categories for the features of the system:

- 1) User features,
- 2) Operator features,
- 3) Programs.

User features are the software facilities, which may be activated by any user of the system.

Operator features are the software facilities, which may be activated only by the operator of the system. The operator is the first extension of the system, i.e. the extension who has the physical access code "11" or "111" depending on the capacity of the system.

Programs are the codes that may be entered only either by the system supervisor or the operator after the system is put in programming mode by the system supervisor. By default, the operator is the system supervisor. By programming, most of the parameters, which control the operation of the system, can be changed.

The software facilities are given in the relevant guides together with their details.

IV. TECHNICAL SPECIFICATIONS

GENERAL SPECIFICATIONS		
1.	Capacity	Total: 48 ports + 1 doorphone channel Lines: Min 4 / Max 12 Extensions : Min 12 / Max 40
2.	Control	SPC 80C88 Processor EPROM (1 Mbit) EEPROM (16 Kbit) 256 Kbit Static RAM With NiCd Battery Backup
3.	Switching	Space Division CMOS Crosspoint Switch
4.	Power	180 - 260 VAC - 50/60 Hz. MS48 (4/12) stand-by power consumption: 11W EXP48 (2/6) stand-by power consumption: 2 W EXP48 (4/12) stand-by power consumption: 3 W EXP48 (0/16) stand-by power consumption: 3 W Maximum power consumption: 40W Power failure: <ul style="list-style-type: none"> • Power failure transfer stations for MB48 (4/12), EXP48 (4/12) and EXP48 (2/6) • Battery backup with 12 VDC
5.	Dialing	Dial Pulse (DP) 10 pps Dual Tone Multi-Frequency (DTMF) 140 msec
6.	Dialing conversions	DP – DTMF, DTMF – DP
7.	Speech paths	12 (2 paths are reserved for incoming external calls)
8.	MF Receivers	8 (4 x 2) (plus 4 (2 x 2) with MFR48 card)
9.	Connectors	Lines and extensions: 623K4 type External relay and external music: 623K4 type Power and external interfaces: Pin connectors (Tunik)
10.	External Connections	Standard Telephones: 2 wires KAREL Feature Phone (LT48(-H)) : 5 wires KAREL Console (OP48(-H)) : 5 wires KAREL DSS Module (DSS80, DSS40): 3 wires KAREL Local Pager (PG100): 3 wires KAREL Mini Printer (KY16): 3 wires KAREL Doorphone (DY26): 4 wires PC: 5 wires Serial Printer: 3 wires
11.	CRL (Call Record Listing)	KAREL KY16 Mini Printer PC Interface Serial Printer Interface
12.	CRL Capacity	Approximately 700 calls

CHARACTERISTICS		
1.	Extension Interface	Station Loop: Max. 1200 Ohms Including the Telephone Set
2.	Max. Line Loop Resistance	2.2 Kohms
3.	Line Interface	Loop Start With DP and DTMF Signaling 12/16 KHz Metering Pulse Detection Polarity Reversal Detection

4.	Extension Feed Voltage	-24 VDC
5.	Make-Break Ratio	33 msec make / 67 msec break
6.	Interdigit Pause for Automatic Dialer	720 ± 20 msec for DP 175 ± 5 msec for DTMF
7.	Cross-talk Attenuation	Better than 70 dB
8.	Maximum Number of Telephone Sets per Line	2 telephone sets
9.	Ring Voltage Generated	64 Vrms, 25-30 Hz
10.	Minimum Ring Detected	30 Vrms, 25-30 Hz
11.	Environmental Requirements	0 C ⁰ to +45 C ⁰ , 20% - 80% Humidity
12.	Hook-Flash Duration Range	100 - 600 msec
13.	Dimensions	38 cm x 11 cm (h) x 43 cm
14.	Weight	8.25 kg
15.	Maintenance	Built-in Self-Diagnosis On Site / Remote Programming PC Console

TONE CADENCES & FREQUENCIES		
1.	Dial tone (500 Hz.)	Continuous
2.	Ring-back tone (500 Hz.)	1500 msec on, 3500 msec off
3.	Busy tone (500 Hz.)	500 msec on, 500 msec off
4.	DISA dial tone (500 Hz.)	300 msec on, 300 msec off, 300 msec on, 300 msec off, 300 msec on, 2000 msec off
5.	Message waiting dial tone (500 Hz.)	300 msec on, 300 msec off, 300 msec on, 300 msec off, 300 msec on, 2000 msec off
6.	Error tone (500 Hz.)	300 msec on, 300 msec off, 300 msec on, 300 msec off, 300 msec on, 300 msec off, 700 msec on, 300 msec off
7.	Reminder dial tone	1000 msec 500 Hz, 1000 msec 250 Hz
8.	Special dial tone (250 Hz.)	Continuous
9.	Overflow tone (2000 Hz.)	700 msec on, 200 msec off
10.	Warning tone (250 Hz)	20 msec on, 1500 msec off

RING CADENCES		
1.	External Call, Call Back Call, Reminder Call, Wake Up Call	1500 msec on, 3500 msec off
2.	Internal Call	400 msec on, 350 msec off, 400 msec on, 3500 msec off
3.	Doorphone Call	800 msec on, 350 msec off, 800 msec on, 3500 msec off

DTMF TONES:

		High frequency group (- 7 dBm)		
		1209 Hz	1336 Hz	1477 Hz
Low Frequency Group (- 9 dBm)	697 Hz	1	2	3
	770 Hz	4	5	6
	852 Hz	7	8	9
	941 Hz	*	0	#

Nominal frequencies of MS48 may deviate ± 2.5 % from the values above.

I. PRELIMINARY NOTICE

I.1. DELIVERY CHECK

On the arrival at the stock or installation site, the first thing that should be done is to check all the items against the packing list. It is essential to report any missing elements immediately.

I.2. INSPECTION

Before starting installation, it is necessary to make a visual inspection to ensure that:

- 1) The cabinets of the system as well as the covers of the accessories are not dented or scratched during the shipment.
- 2) The cards are not cracked.
- 3) There are no loose ends, damaged or loose components on the cards.
- 4) All connections to the power supply are tight.

Existing damages should be reported immediately.

I.3. ENVIRONMENTAL REQUIREMENTS

Before the installation, the system should be stocked in a place where the temperature is in-between -40 C° and $+80\text{ C}^{\circ}$.

At start up, you should make sure that the room where the system is to be installed is clean, well ventilated and well lit. In fact the following places must be avoided for installation:

- 1) Places exposed to direct sunlight,
- 2) Extremely hot and cold places,
Temperature must be in the range of 0 C° and $+45\text{ C}^{\circ}$ and the relative humidity must be in the range of 20% and 80%,
- 3) Places where vibrations or shocks are frequent or strong,
- 4) Places near radio broadcast antennas,
- 5) Dusty places, places where the system may be in contact with water or oil,
- 6) Sulfuric gases produced in areas where there are thermal springs, etc. that may damage the system,
- 7) Near high frequency sewing machines or electric welders.

II. SYSTEM INSTALLATION

The MS48 system is designed to be mounted on the wall. Hence, the system comes with a template and a pair of anchor plugs with screws. Another pair of screws that are used to fasten the front cover are also available.

The template has the same dimensions with the MS48 system, so that it can be used to choose the location of the system and to determine the points of the holes on the wall. The template also has the necessary information to hang the system on a proper location on the wall, which is illustrated in the following figure.

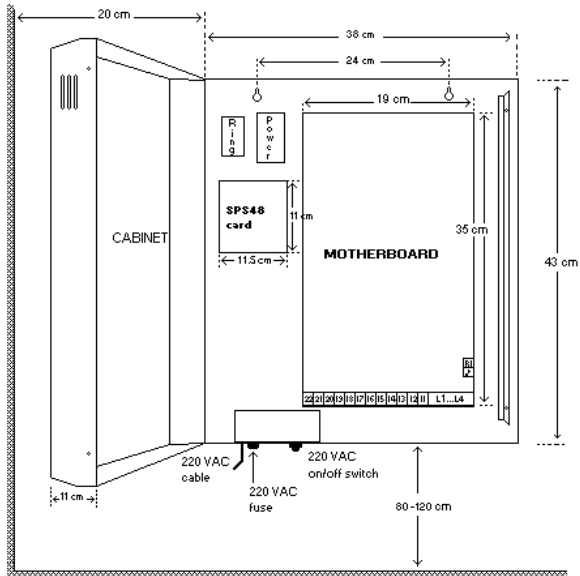


Figure B-1

To install the system (see Figure B-2) :

- 1) Place the template on the wall.
- 2) Drill two holes at the points marked as X1 and X2 on the template.
- 3) Drive the anchor plugs into the holes.
- 4) Insert the screws into the anchor plugs and fix the screws.
- 5) Hang the cabinet on the wall by placing the two pear holes at the back of the cabinet over the screws.

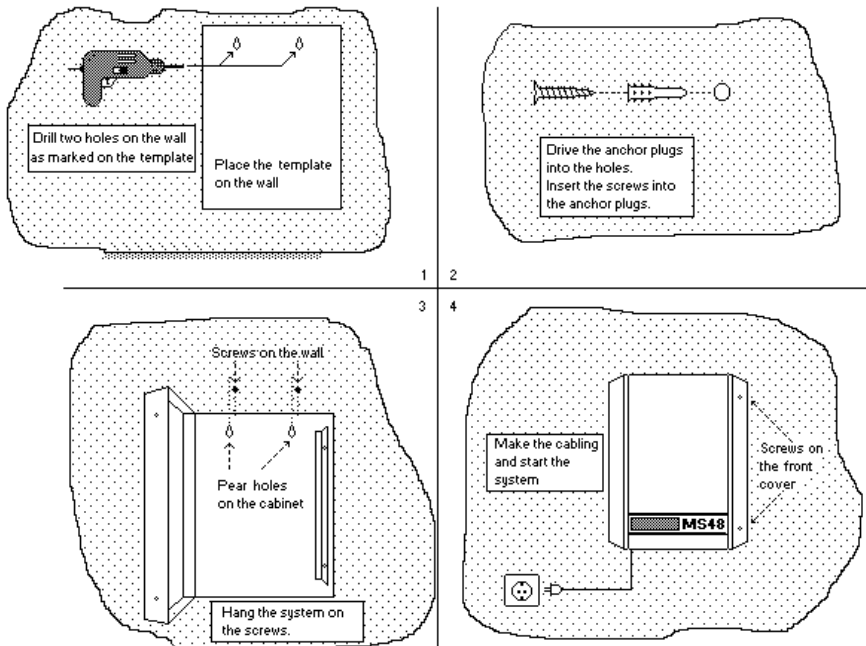


Figure B-2

It is recommended to close the front cover after the cabling of extensions / lines and accessories is completed, by inserting the two screws into the holes on the right side of the front cover (see Figure B-2).

IMPORTANT

1. The equipment can be installed only by the service personnel.
2. The area behind the front cover is not for operator access, hence the front cover can be opened only by the service personnel.
3. The mains socket should be installed near the equipment or should be easily accessible.

II.1. GROUNDING

There are two different ground terms in MS48 system.


- a) One is the signal ground, which takes place on the MB48 motherboard as well as the add-on cards. It serves as a reference for the signals on the cards.
- b) Second is the chassis ground.

The subject of this section is chassis ground, which has an utmost importance for the protection of the system against any lightning, or any high voltage coming through external lines, extensions or mains.

The chassis ground is established through the mains cable of the system, which is equipped with the ground wire. Therefore, if the mains outlet has a proper ground, there is no need to make any extra connections for the chassis ground. Due to this reason, it is recommended to operate the system over a mains plug that is properly grounded.

Checking whether the mains ground is proper or not requires special devices. But it is possible to have a rough idea about the mains ground simply by measuring the voltage across:

- The phase and the neutral; it must be in range of 180 VAC and 260 VAC.
- The ground and the neutral; it must be 1-2 VAC.

If mains ground is not satisfactory, the system chassis can be connected to a hot or cold water pipe, which may serve as the ground surface of your system, through the ground screw (labeled with ) at the down left corner of the system cabinet, to which the ground wire of the mains cable is connected. For such cases, it is of course better to construct an ideal ground, simply by inserting a metal bar (of at least 1.5 m length and 1.5 cm radius, copper is preferable) into the earth, as illustrated in the following figure.

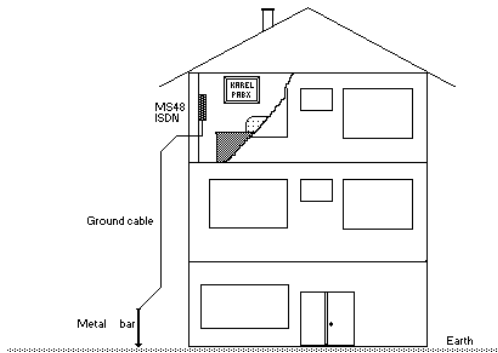


Figure B-3

II.2. SPS48 POWER SUPPLY MODULE

The SPS48 Power Supply Module, including the power card with cables, comes already installed in the system cabinet, below the metal cage surrounding the RNT48 and PWT48 transformers.

The SPS48 card is connected to MB48 motherboard via the 7-pin flat cable. Also, the 3-pin connector at the end of the cable coming from PWT48 power transformer as well as the 4-pin connector at the end of the cable coming from RNT48 ring transformer are attached to the corresponding connectors on SPS48 card.

The output of the RNT48 ring transformer, which is in fact the ring signal itself, is directly transferred to the MB48 motherboard. For this, the 2-pin connector at the end of the cable coming from RNT48 is attached to the corresponding connector on MB48.

These connections are illustrated in the following figure.

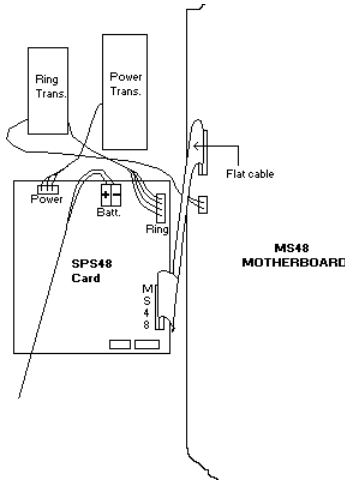


Figure B-4

The free space inside the system cabinet, below the SPS48 card, is reserved for the battery, which can be attached to the system cabinet via the metal bars that can be supplied on demand.

IMPORTANT

The ventilation holes on the front cover of the system cabinet must not be closed for any reason, since it may cause SPS48 to overheat and get damaged.

II.3. MB48 MOTHERBOARD & EXP48 EXPANSION MODULES

The MB48 motherboard comes installed in the cabinet. It stays on the brass card holders that are attached to itself by screws. One of the brass card holders together with its screw – the one passing through the M4 hole at the right side of the motherboard – is used to carry the chassis ground to the motherboard and add-on cards.

The MS48 system can have at most two EXP48 Expansion Modules, that are add-on cards to be installed on the MB48 motherboard. In such a case, the first EXP48 card is located on the motherboard and the second one is placed on the first one. In such a situation, the EXP48 (2/6) card cannot be the first card located on the motherboard. Rather, it must be placed on the other EXP48 card, due to its smaller dimensions.

Such an installation can be established simply as follows: There exist several male connectors on the solder side of each EXP48 card. The female correspondents of these connectors are also available on each EXP48 card together with the MB48 motherboard. The following figure illustrates the location of these connectors on the EXP48 cards as well as the MB48 motherboard.

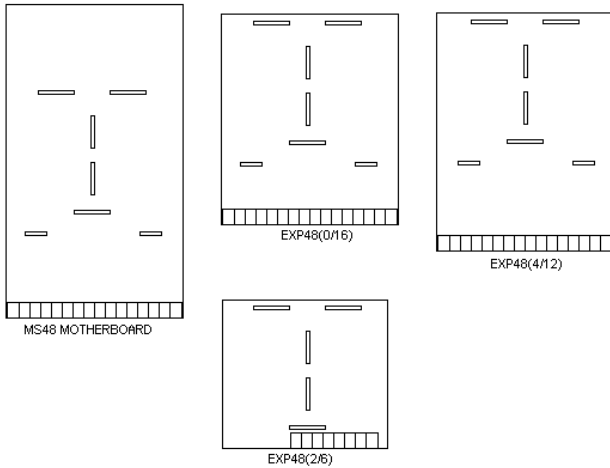


Figure B-5

For the installation of each EXP48 card, the male connectors on the card itself must be attached to the female correspondents on the card underneath, which may be either the MB48 motherboard or another EXP48 card.

After that, it is necessary to fix the EXP48 cards by way of brass card holders and screws. One of the brass card holders together with its screw – the one corresponding to the M4 hole of the motherboard – is used to carry the chassis ground to the EXP48 card.

The following figure is to demonstrate the installation of EXP48 cards briefly.

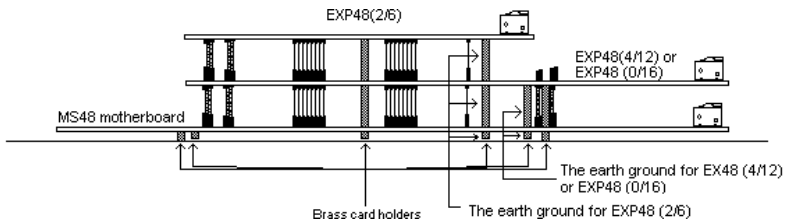


Figure B-6

IMPORTANT

Make sure that :

- 1) All the pins of male connectors on the EXP48 cards are matched to the corresponding pins of the female correspondents on the card underneath properly.
- 2) All the brass card holders of each EXP48 card, especially the ones that carry the chassis ground, are fixed properly.

As the last step in the installation of EXP48 modules, the MFR48 MF-Receiver Card that comes with EXP48 (4/12) or EXP48 (0/16) must be installed on the MB48 motherboard.

For this, the two male connectors on the solder side of MFR48 card must be attached to the female correspondents on the up left corner of the MS48 motherboard. After that, it is necessary to fix the MFR48 card to the MB48 motherboard using one brass card holder with its screw and washer.

The following figure illustrates the installation of MFR48 card.

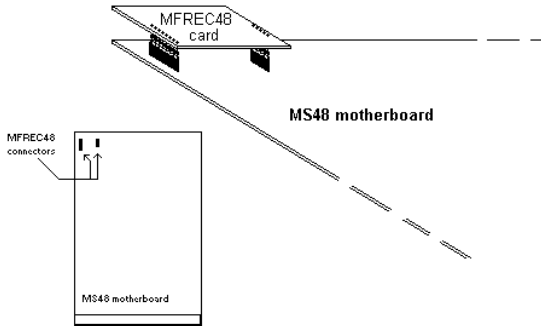


Figure B-7

III. ACCESSORY INSTALLATION

III.1. CONSOLES, FEATURE PHONES, DIRECT STATION SELECT MODULES

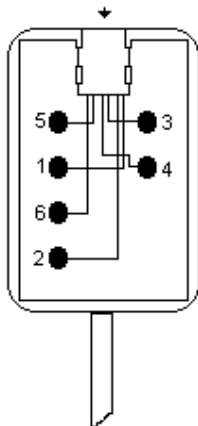
- **CABLING**

Each LT48(-H) Feature Phone, OP48(-H) Console and DSS40 / DSS80 Direct Station Select Module comes with a telephone data cable, which is a 2.5-meter long cable formed up of two parts. One is a cable with a 6-pin RJ plug at both ends and the other one is a connection box. The connection box has a 6-pin RJ socket at one side so that one of the free ends of the cable can be fixed to the connection box easily. The other free end of the cable has also the corresponding RJ socket at the backside of the telephone or DSS module.

The system itself also comes with the system data cable, which is similar to telephone data cable. One end of the cable is fixed to the connection box. The other free end of the cable has a 3-pin connector, which is to be inserted to the CONSOLE connector on the SPS48 card, in order to carry data signals for the telephones and DSS modules.

The following signals are present on the connection box of system data cable:

Cable to the connection box of
the telephone data cable



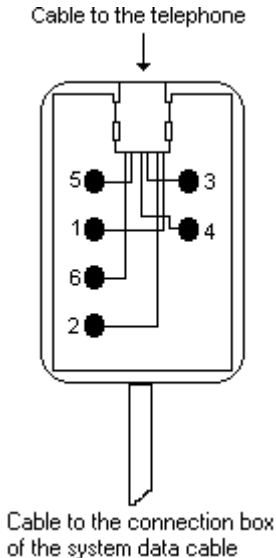
- 1- Data signal
- 2- Ground (GND)
- 3- No connect
- 4- No connect
- 5- Busy
- 6- + 12 VDC

Note : Busy signal is for KY16 Mini Printer.

Cable from the system

Figure B-8

The following signals are present on the connection box of telephone data cable:



- 1- Data Signal
- 2- Ground (GND)
- 3- A (ring) signal from the connector of the relevant extension port.
- 4- B (tip) signal from the connector of the relevant extension port.
- 5- No Connect
- 6- + 12 VDC

Note : On the connection boxes of DSS40 and DSS80 modules items "3" and "4" are "No Connect".

Figure B-9

To make the cabling of each LT48(-H) Feature Phone, OP48(-H) Console and DSS40 / DSS80 Direct Station Select Module :

- 1) The free end of the system data cable must be passed through the hole on the panel at the down left corner of the system cabinet (the panel on which the system ON/OFF switch resides) and then attached to the CONSOLE connector on SPS48 card.
- 2) The Data / + 12 VDC / GND signals on the connection box of the system data cable must be wired in parallel to the corresponding pins of the connection box of the telephone data cable.
- 3) The RJ plug at the free end of the telephone data cable must be inserted into the female correspondant on the telephone or DSS module.
- 4) At this point, the cabling of DSS40 and DSS80 modules is completed, as there are no A / B terminals for these modules. However, for each OP48(-H) and LT48(-H) telephone, the wiring of the A / B terminals must be made separately, by connecting the wires of the cable coming from the corresponding extension connector on MB48 motherboard or EXP48 card to the A / B terminals (the terminals with red and green wires) in the connection box of the telephone data cable.

The following figure illustrate the cabling of OP48(-H) Consoles, LT48(-H) Feature Phones and DSS40 / DSS80 Direct Station Select Modules.

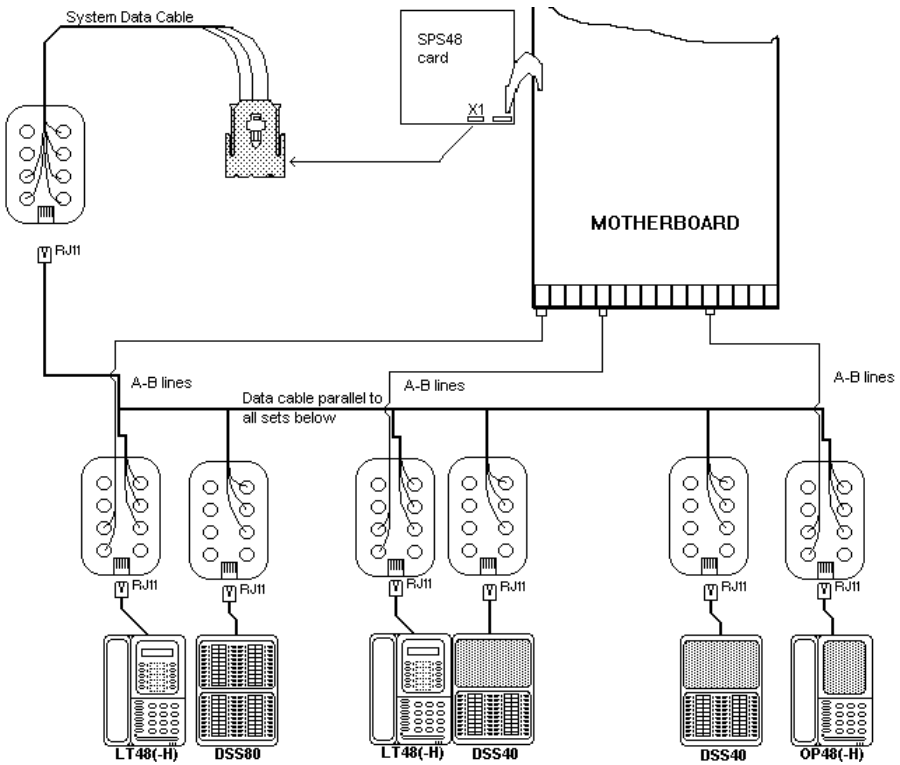


Figure B-10

In case there is a LT48(-H) Feature Phone or OP48(-H) Console located near the system, the method of Data / +12 VDC / GND cabling for this telephone may be simplified by connecting one of the RJ plugs on the telephone data cable to the RJ socket on the connection box of the system data cable.

- **FIXING DSS40 / DSS80 MODULES TO OP48(-H) / LT48(-H):**

Each DSS40 or DSS80 module comes with a plastic telephone connection part, used to fix the module to the LT48(-H) or OP48(-H) telephone of the relevant extension.

To fix the DSS40 or DSS80 module to the LT48(-H) or OP48(-H) telephone (see Figure B-11) :

- 1) Remove the screw at the bottom of the telephone.
- 2) Remove the two screws at the bottom corners of the DSS module.
- 3) Place the plastic telephone connection part in-between the telephone and the DSS module.
- 4) Insert the screws to the telephone and DSS module.

If there are several DSS modules connected to the same extension, each extra DSS module can be connected to the previous one as explained above.

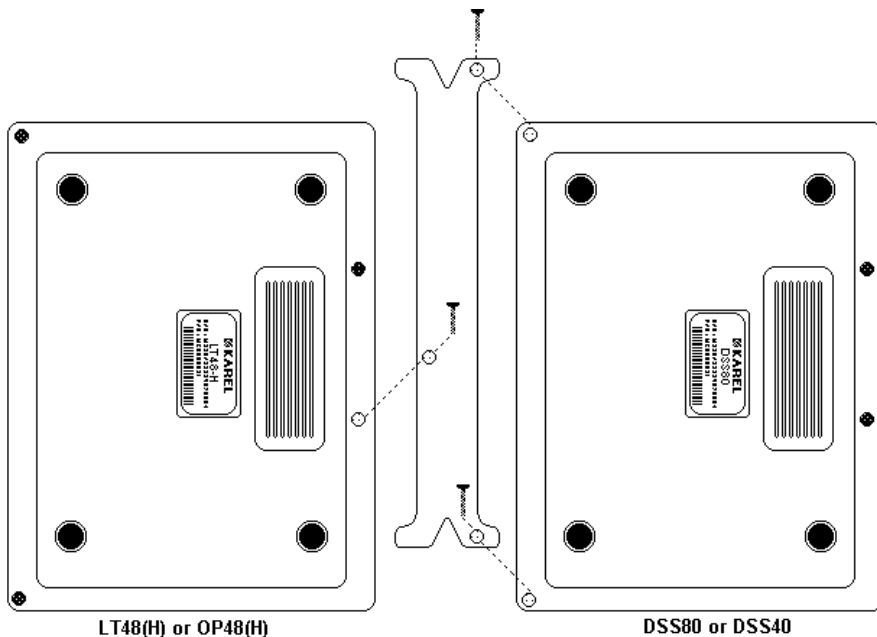


Figure B-11

• **NUMBER OF TELEPHONES & DISTANCE TO THE SYSTEM:**

Please also note that :

- 1) OP48(-H) Consoles, LT48(-H) Feature Phones and DSS80 / DSS40 Direct Station Select Modules can be connected to the first 16 extensions of the system.
- 2) The total number of OP48(-H) Consoles, LT48(-H) Feature Phones and DSS80 / DSS40 Direct Station Select Modules connected to the system must not exceed 10.

If the Data / 12 VDC / GND and A / B (ring / tip) wires of a console or a feature phone are carried separately as described in the "Cabling" part above, the console or feature phone can be installed more than 5 meters away from the system.

In such a case, the maximum distance between a single feature phone, console or DSS module and the system can be 250 meters, if the wiring is made with ordinary wires.

However, if more than one set will be installed to the system and if the Data / 12 VDC / GND wires of the sets are wired in parallel as described in the "Cabling"

part above, the maximum distance of 250 meters decreases proportionally. For example, if 10 LT48 Feature Phones are connected to the system in this way, the distance between the system and the LT48 Feature Phones cannot exceed 25 meters.

In such a case, the performance can be further improved by connecting +12 VDC power supply, if the data voltage of the ultimate console is below +8.5 VDC, between 12 VDC and GND terminals.

- **EXTENSION NUMBER SETTING :**

After the wiring of the OP48(-H) Consoles, LT48(-H) Feature Phones and DSS40 / DSS80 Direct Station Select Modules, the extension setting of these sets should be made as follows :

- a) OP48(-H): The setting is made by the "Message" key. Keep the key pressed till the extension number starts blinking on the display and "A" appears next to it. Then, press the same key several times till the correct extension number appears on the display.
- b) LT48(-H): The setting is made by the "H/R" key. Keep the key pressed till an extension number is shown on the display. Then, press the same key several times till the correct extension number appears on the display.
- c) DSS80: The setting is made by the "A" key. Press the key till the 3rd beep and then, enter the extension number.
- d) DSS40: The setting is made by the "Pa/Pr" key. Press the key till the 2nd beep. Then, press the same key several times till the correct extension number appears on the display.

III.2. MINI PRINTER

The KY16 Mini Printer has the built-in mains and data cables. Also it has a paper roll and a printer ribbon installed. A pair of anchor plugs with screws for the printer to be mounted on the wall as well as two spare paper rolls and a spare printer ribbon are also provided.

- **INSTALLATION:**

- 1) Drill two holes 12.5 cm apart at a height of 150 cm.
- 2) Drive the anchor plugs into the holes.
- 3) Insert the screws into the anchor plugs.
- 4) Hang the printer on the screws.

The following figure illustrates the installation.

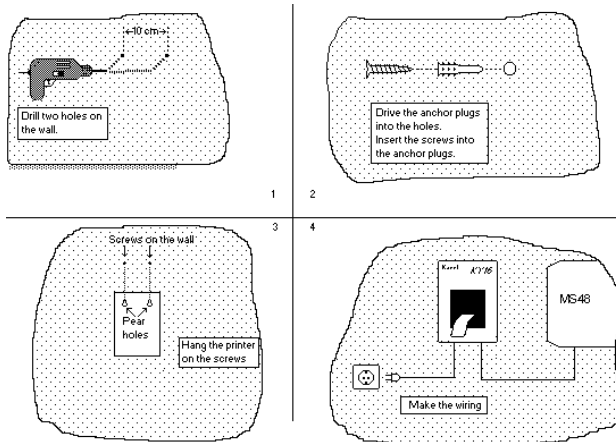


Figure B-12

• **CABLING**

The power cabling can be established via the built-in mains cable.

The printer data cable that emerges from the bottom of the KY16 Mini Printer has a connection box (with a cable) at its free end. The cable of the connection box is attached to the box itself through a 6-pin RJ plug and has a 4-pin connector at the other end.

The following signals are present on the connection box of printer data cable :

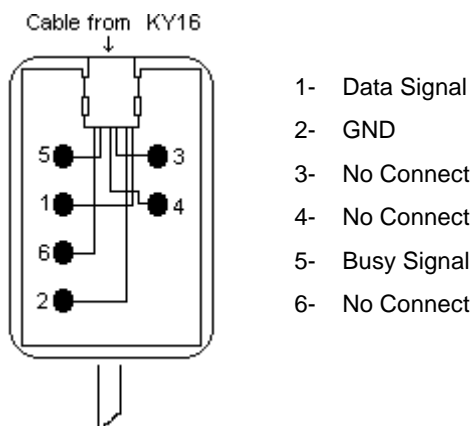


Figure B-13

For connecting KY16 to the system:

- 1) The free end of the data cable should be passed through the hole on the panel at the down left corner of the system cabinet (the panel on which the system ON/OFF switch resides).
- 2) The 4-pin connector at the end of the cable should be attached to the corresponding PRINTER connector on the SPS48 card.

The data cabling of KY16 is illustrated in the following figure.

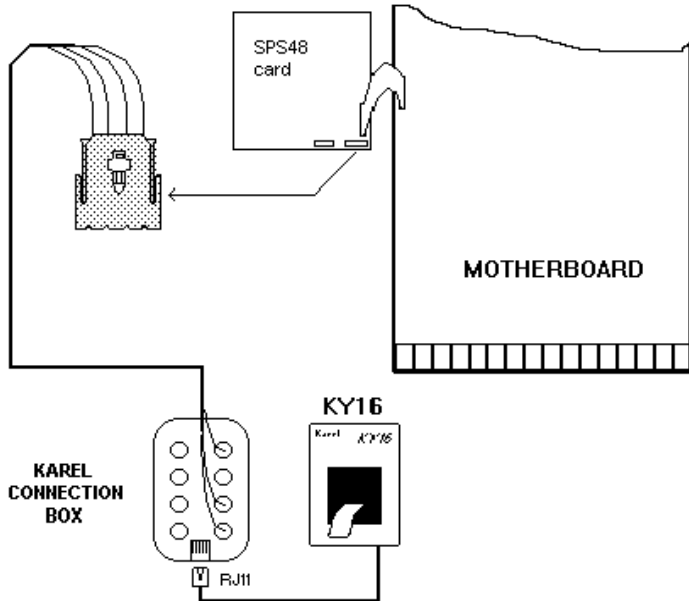


Figure B-14

After the installation and cabling of KY16 is completed, it is also necessary to enter the related programming code for selecting KY16 as the CRL (Call Record Listing) media, as explained in the MS48 Programming Guide.

• **DIP-SWITCH SETTING**

For KY16 to operate with MS48 system, the dip-switches that exist on the printer card inside the KY16 cabinet must be set as follows:

Dip-switch	Position
1	OFF
2	OFF
3	ON
4	ON

- **PAPER ROLL & PRINTER RIBBON**

Replacing the paper roll or the printer ribbon is very easy by way of the mobile front cover of the cabinet.

To replace the paper roll:

- 1) Pull out the black front cover from the upper side.
- 2) Take out the old paper roll with the cylindrical bar fixing it in the slot.
- 3) Place the new roll on the bar.
- 4) Place the bar into its slot.
- 5) Fix the free end of the paper to the print head.
- 6) Close the front cover.

Placing a new paper roll in KY16 is illustrated in the following figure.

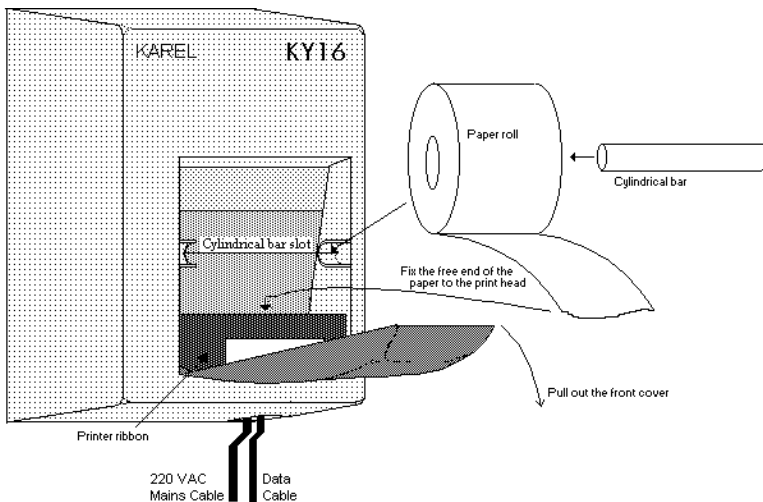


Figure B-15

To replace the printer ribbon:

- 1) Pull out the black front cover from the upper side.
- 2) Take out the old ribbon.
- 3) Place the new ribbon inside the print head.
- 4) Close the front cover.

III.3. PC INTERFACE

• INSTALLATION

The PKCR card has three male connectors on the solder side, which must be attached to the female correspondents on the MB48 motherboard.

The installation of PKCR card is illustrated in Figure B-16.

• CABLING

- 1) The 5-pin connector end of the PC-PKCR cable should be passed through the cable hole on the panel at the down left corner of the system cabinet (the panel on which the system ON/OFF switch resides).
- 2) This connector must be plugged into the corresponding connector on the PKCR card.
- 3) The 25-pin D-type plug at the other end of the PC-PKCR cable must be attached to the security plug first and then the security plug should be connected to the 25-pin serial port of the PC. (It is necessary to employ a 25-pin to 9-pin converter plug, in order to use the 9-pin connector of the PC.)

The cabling of PKCR card is illustrated in the following figure.

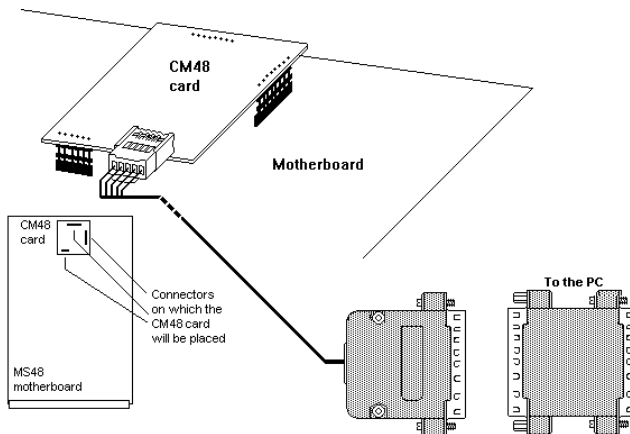


Figure B-16

After the installation and cabling of PKCR card is completed, the necessary CM48 and / or PK48 software must be installed on the PC, as described in the CM48 and PK48 Owner's Guides, respectively.

It is also necessary to enter the related programming code for selecting the PC as the CRL (Call Record Listing) media, as explained in the MS48 Programming Guide.

III.4. SERIAL PRINTER INTERFACE

• INSTALLATION

The RS232 card has three male connectors on the solder side, which must be attached to the female correspondents on the MB48 motherboard.

The installation of RS232 card is illustrated in Figure B-17.

• CABLING

- 1) The 3-pin connector end of the PC-RS232 cable should be passed through the cable hole on the panel at the down left corner of the system cabinet (the panel on which the system ON/OFF switch resides).
- 2) This connector must be plugged into the corresponding connector on RS232 card.
- 3) The 25-pin D-type plug at the other end of the PC-RS232 cable must be attached to the serial port of the printer. (It is necessary to employ a 25-pin to 9-pin converter plug, in order to use the 9-pin connector of the printer.)

The cabling of RS232 card is illustrated in the following figure.

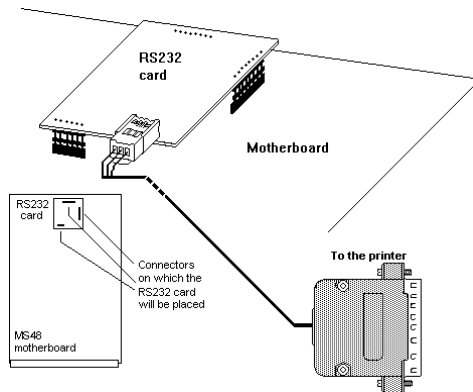


Figure B-17

After the installation and cabling of RS232 card is completed, it is also necessary to enter the related programming code for selecting the serial printer as the CRL (Call Record Listing) media, as explained in the MS48 Programming Guide.

III.5. DOORPHONE

• INSTALLATION

DY26 Doorphone is designed to be mounted on the wall with a couple of anchor plugs and screws. For this:

- 1) Drill two holes, which are 7.5 cm apart.
- 2) Drive the anchor plugs into the holes.
- 3) Insert the screws into the anchor plugs.
- 4) Hang the doorphone on the screws.

The following figure illustrates the installation.

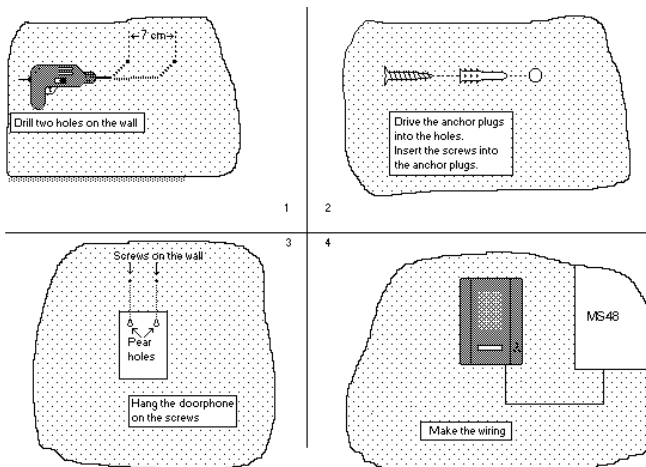


Figure B-18

• CABLING

The cable that emerges from the bottom of the DY26 doorphone has a 4-pin connector at its free end. For connecting the doorphone to the system, the free end of this cable should be passed through the cable hole on the panel at the down left corner of the system cabinet (the panel on which the system ON/OFF switch resides) and then attached to the corresponding socket on the MB48 motherboard, as illustrated in the following figure.

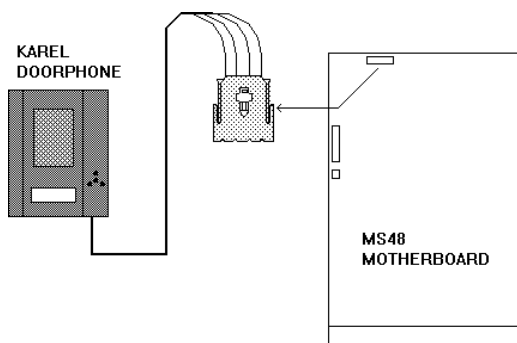


Figure B-19

DY26 doorphone has a ring button on it. When a doorphone user presses this button the telephone of the operator or the ringing extension rings. But if desired this facility may be canceled and an external ringer can be connected to the ring button. For this:

1. Loose the screws at the top and the bottom of the doorphone and open the front cover.
2. Loose the screws at the back of the ring button and disconnect the two-wire cable between the doorphone card and the ring button.
3. Pass the power cables of the ringer through the data cable hole at the back cover of the doorphone box.
4. Connect the power of the external ringer through the ring button.
5. Close the cover of the doorphone.

The following figure illustrates this connection.

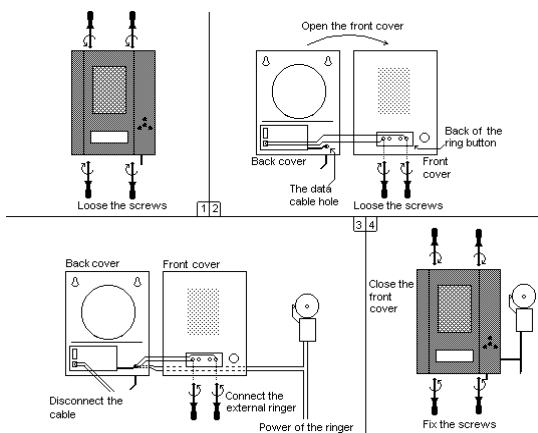


Figure B-20

III.6. EXTERNAL ANNOUNCEMENT SYSTEM

- **CABLING :**

Any external announcement system can be connected to MS48 system through the doorphone socket on MB48 motherboard. For making this connection, the free end of the cable (with 4-pin connector) should be passed through the cable hole on the panel at the down left corner of the system cabinet (the panel on which the system ON/OFF switch resides) and then attached to the doorphone socket on the MB48 motherboard. The following figure illustrates the installation.

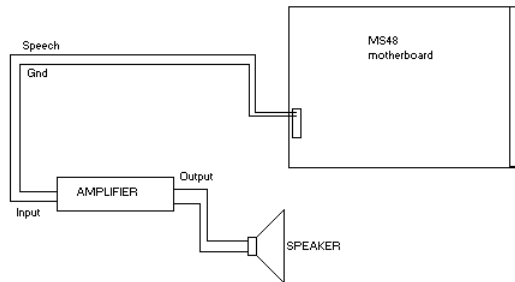


Figure B-21

MS48 system is enhanced with a facility, which provides the efficient use of your amplifier by way of its external relay (see section III.13). The external relay of MS48 system can be used to switch the power of the amplifier of the announcement system. For this, the power of the amplifier must be connected through the external relay on MB48 motherboard and the system must be programmed accordingly.

The following figure is to give an idea about these connections.

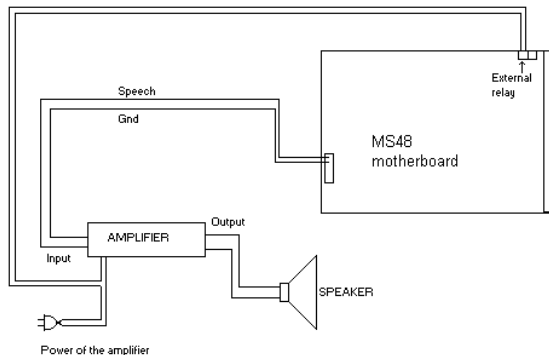


Figure B-22

III.7. AUTO ATTENDANT & VOICE MAIL

- **REMARK**

If one of the PC Interface accessories – namely CM48, PK48 and CM48+PK48 – or the RS232 Serial Printer Interface is to be connected to the system as well, the installation and wiring of this accessory must be made before the installation and wiring of EVM48 Auto Attendant.

- **INSTALLATION :**

The EVM48 card has three male connectors on the solder side, which must be attached to the female correspondents on the MB48 motherboard.

The installation of EVM48 card is illustrated in the following figure.

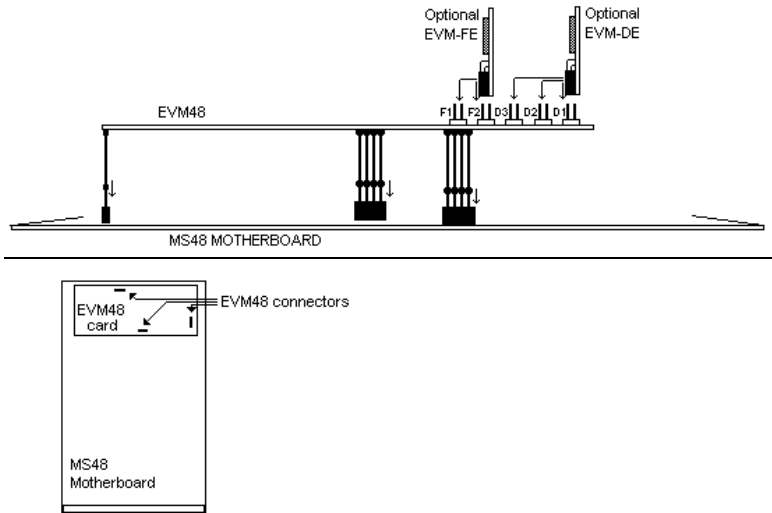


Figure B-23

Additional EVM-FE (Auto Attendant Expansion) and EVM-DE (Voice Mail Expansion) cards – if there exist any - must be installed on the EVM48 card through 36-pin F1/F2 and 24-pin D1/D2/D3 connectors, respectively. The first EVM-FE card must be installed to the Flash socket marked as F1, whereas the second EVM-FE card must be installed to the socket marked as F2. The first EVM-DE card must be installed on the DRAM socket marked as D1 and the second EVM-DE card must be installed to the socket marked as D2, whereas the third EVM-DE card must be installed to the socket marked as D3. See the following figure for the location of these sockets.

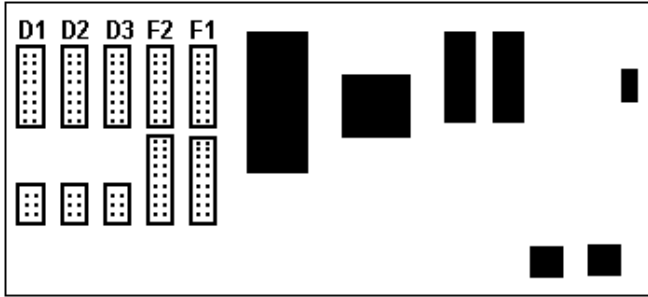


Figure B-24

III.8. ISDN ADAPTOR

- **INSTALLATION**

IA12 ISDN Adaptor is designed to be mounted on the wall with a couple of anchor plugs and screws. For this:

- 1) Drill two holes, which are 17.5 cm apart.
- 2) Drive the anchor plugs into the holes.
- 3) Insert the screws into the anchor plugs.
- 4) Hang the adaptor on the screws.

- **MOUNTING**

The IA12 motherboard comes installed in the cabinet. It stays on the brass card holders that are attached to itself by screws.

The EXP-IA12 Expansion Board is mounted on the motherboard with brass card holders and screws. The communication between the IA12 motherboard and EXP-IA12 card is established by a 20-pin flat cable. The following figure illustrates this connection .

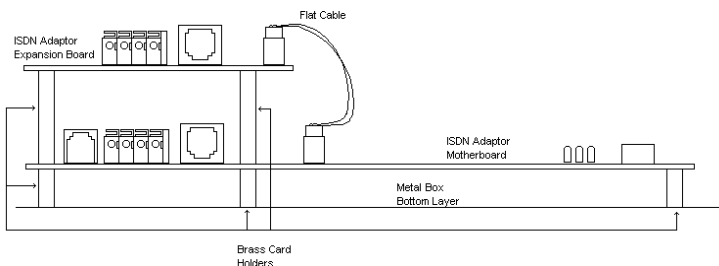


Figure B-25

- **CABLING**

For the data line :

The IA12 ISDN Adaptor with the ISDN data cable. Like the telephone data cable of the consoles and feature phones, the ISDN data cable is formed up of two parts. One is a cable with a 6-pin RJ plug at both ends and the other one is a connection box. The connection box has a 6-pin RJ socket at one side so that one of the free ends of the cable can be fixed to the connection box easily. The other free end of the cable has also the corresponding RJ socket at the bottom part of the IA12 motherboard.

The signals on the connection box of ISDN data cable are the same as the signals on the connection box of telephone data cable.

For making the data connection of the IA12 ISDN Adaptor :

- 1) The Data / + 12 VDC / GND signals on the connection box of the system data cable must be wired in parallel to the corresponding pins of the connection box of the ISDN data cable.
- 2) The RJ plug at the free end of the ISDN data cable must be attached to the corresponding RJ socket at the bottom part of the IA12 motherboard.

For the S0 line :

By the help of a cable having 8-pin RJ45 plugs at both ends, the S0 line coming through NT1 must be attached to the corresponding RJ45 socket at the bottom part of the IA12 motherboard or EXP-IA12 card.

For the analog lines :

An S0 line is converted to two analog external lines.

For connecting a pair of analog external lines corresponding to the S0 line on the IA12 motherboard, the wires of the cable coming from the related line connectors on MB48 motherboard or EXP48 card and passing through the hole on the front panel at the down left corner of the system cabinet (the panel on which system ON/OFF switch resides) must be attached to the two 2-pin connectors at the bottom part of the IA12 motherboard.

The same also applies to the analog line connection of EXP-IA12 Expansion Board. However, before such a cabling is made, the sticker covering the empty hole at the bottom of the IA12 cabinet must be removed, so as to access the analog line connectors on the EXP-IA12 card.

IMPORTANT

The first channel of the IA12 motherboard or EXP-IA12 card must be connected to an odd numbered line (i.e. 01, 03, 05, ..., 19) and the second channel must be connected to the succeeding even numbered line.

As illustrated in the figure below, while making the analog line connection as explained above, the first channel on the IA12 motherboard or EXP-IA12 card must be connected to line 01 or line 03 or so on. Then, if the first channel is connected to line 01, the second channel must be connected to line 02 or if the first channel is connected to line 03, the second channel must be connected to line 04 or so on.

The following figure illustrates the wiring between MS48 system and IA12 motherboard:

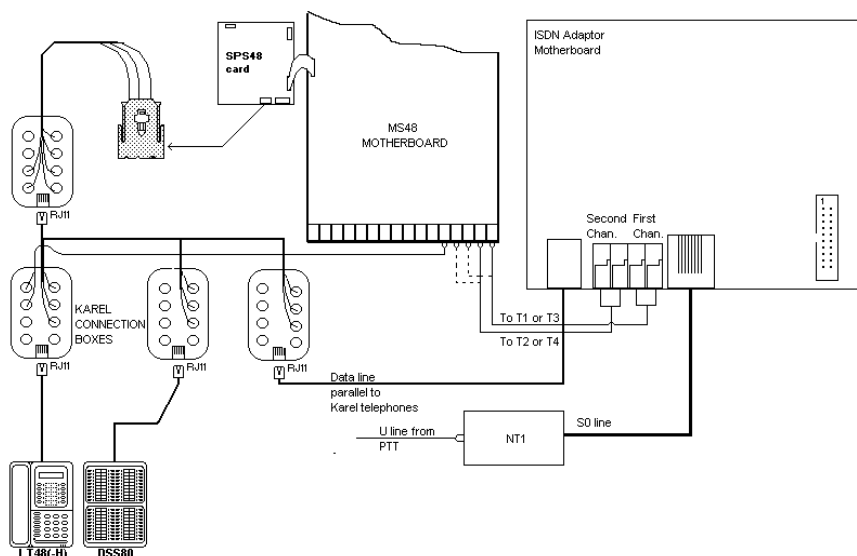


Figure B-26

● **DIP-SWITCH SETTING :**

There exists four dip-switches on the IA12 motherboard, that can be accessed upon opening the top cover. These dip-switches are used to distinguish the IA12 ISDN Adaptors connected to the system. For the first adaptor all the dip-switches must be OFF. For the second one the dip-switch "3" must ON and the others must be OFF and for the third one (which can have only the IA12 motherboard) the dip-switch "2" must be ON and the others must be OFF. To make it clear the following table is given:

	Dip-switch 1	Dip-switch 2	Dip-switch 3	Dip-switch 4
First Adaptor	OFF	OFF	OFF	OFF
Second Adaptor	OFF	OFF	ON	OFF
Third Adaptor	OFF	ON	OFF	OFF

III.9. LOCAL PAGER

• **INSTALLATION :**

The PG100 Local Pager is designed to be mounted on the wall. Hence, PG100 comes with a template and 2 anchor plugs with screws.

To install PG100 :

- 1) Place the template on the wall.
- 2) Drill 2 holes at the points on the template.
- 3) Drive the anchor plugs into the holes.
- 4) Insert the screws into the anchor plugs.
- 5) Hang the pager on the screws.

The following figure illustrates this installation.

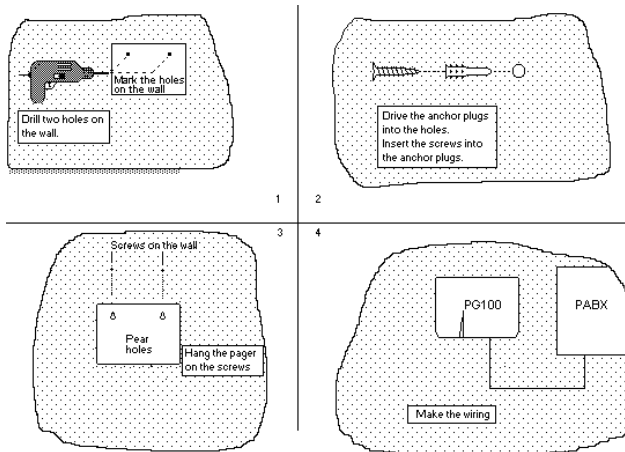


Figure B-27

• **CABLING :**

The PG100 Local Pager comes with the pager data cable. Like the telephone data cable of the consoles and feature phones, the pager data cable is formed up of two parts. One is a cable with a 6-pin RJ plug at both ends and the other one is a connection box. The connection box has a 6-pin RJ socket at one side so that one of the free ends of the cable can be fixed to the connection box easily. The other free end of the cable has also the corresponding RJ socket at the bottom part of the PG100 cabinet.

The following signals are present on the connection box of PG100 data cable:

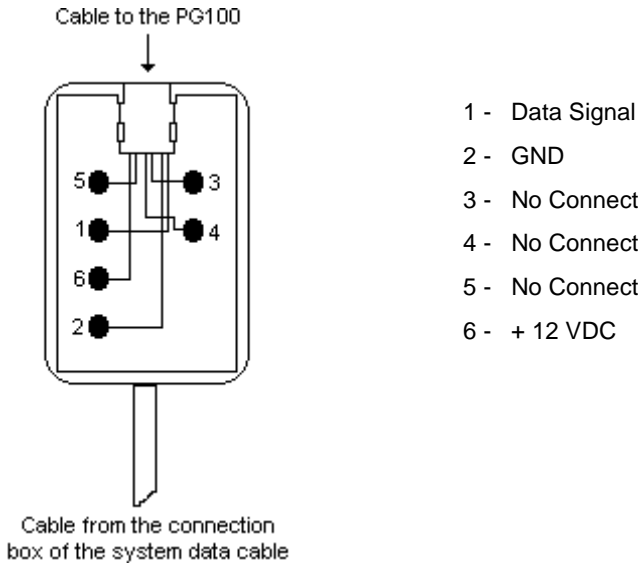


Figure B-28

PG100 shares the system data cable with OP48(-H) Consoles, LT48(-H) Feature Phones and DSS80 / DSS40 Direct Station Select Modules.

For connecting the PG100 pager to the system:

- 1) The Data / + 12 VDC / GND signals on the connection box of the system data cable must be wired in parallel to the corresponding pins of the connection box of the pager data cable.
- 2) The RJ plug at the free end of the pager data cable must be attached to the corresponding RJ socket at the bottom part of the PG100 cabinet.

The following figure illustrates the cabling of PG100 Local Pager.

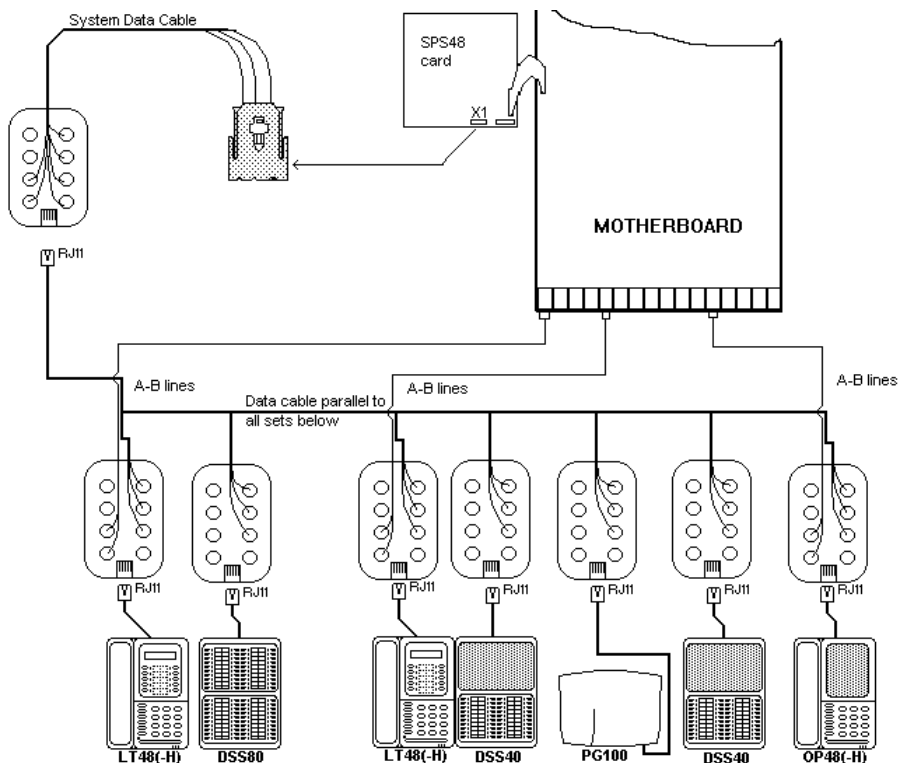


Figure B-29

The maximum distance between the PG100 Local Pager and the system can be 300 meters, if the wiring is made with ordinary wires.

However, the maximum distance of 300 meters decreases proportionally if there are KAREL telephones connected to the system. For example, if 2 LT48 Feature Phones are connected to the system in this way, the distance between the system and the PG100 Local Pager cannot exceed 100 meters.

- **POWER CONNECTION :**

PG100 can be also directly connected to mains voltage through a 12 VDC power adaptor. Normally, PG100 receives power over the system data cable. However, if the data line of the system is overloaded due to the existence of many OP48(-H) and LT48(-H) telephones or DSS40 and DSS80 modules connected to the system, it is preferable to feed PG100 over the power adaptor that is to be procured locally.

The power adaptor can be connected to the PG100 pager via the power socket at the bottom part of the PG100 cabinet.

III.10. STANDARD TELEPHONE SETS, EXTERNAL LINES

- **CABLING :**

For connecting a standard telephone set to the system the wires of the cable coming from the corresponding extension connector on MB48 motherboard or EXP48 card and passing through the hole on the panel at the down left corner of the system cabinet (the panel on which the system ON/OFF switch resides) must be attached to the A / B terminals of the telephone.

For connecting an external line to the system the wires of the cable coming from the corresponding line connector on MB48 motherboard or EXP48 card and passing through the hole on the panel at the down left corner of the system cabinet (the panel on which the system ON/OFF switch resides) must be attached to the external line.

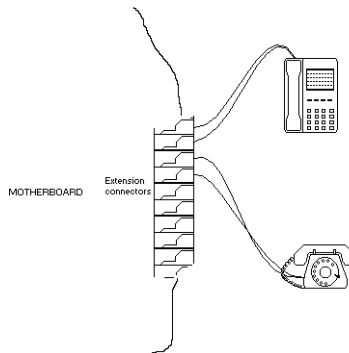


Figure B-30

Normally a standard telephone set can be connected as much as 2 kms away from the system by using ordinary copper wires. Depending on the quality of the wires the distance changes proportionally.

III.11. FILTER & PROTECTION UNIT

- **INSTALLATION :**

The FPBASE module has a metal base part, which has two pear holes. Through these pear holes the FPBASE module can be mounted on the wall.

On the top covers of FPBASE and FPEXP modules there are four holes, one at each corner. These holes are used to fix the modules to the ones underneath. Three holes on FPEXP are connected to FPBASE unit with plastic holders whereas the fourth one has brass card holder with two washers to carry the chassis ground to the upper modules.

The following figure illustrates the installation of FPEXP on top of an FPBASE.

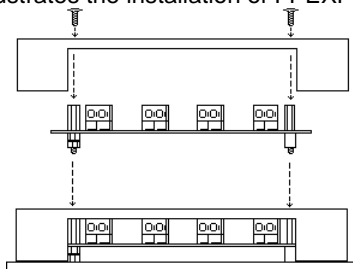


Figure B-31

- **CABLING :**

During the installation of FPBASE and FPEXP units, it is very important to connect the ground of all the units to the chassis ground of the system. For that there is a special connector on the metal base of FPBASE, which is to be attached to the chassis ground of the system through the ground pin at the down left corner of the system cabinet, to which the ground wire of the mains cable is connected. This ground is carried to the FPEXP units by way of the two washers and a brass card holder (see Figure B-32).

It should be noted that the directions of the line / extension connections are also important. The system side of the card is marked with "PABX" and the external line (or far extensions) side is marked with "PTT" on the card (see the following figure).

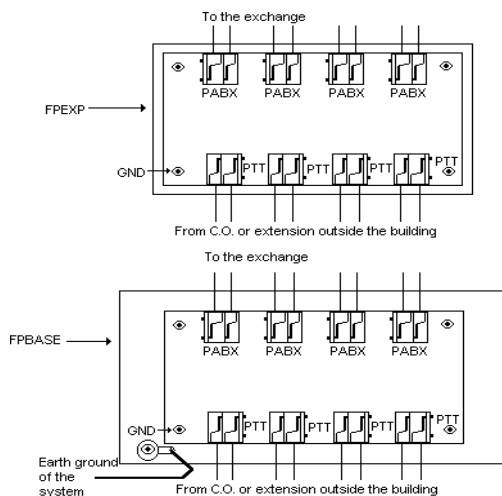


Figure B-32

To get the utmost benefit from FPBASE and FPEXP units against lightning, the modules should be installed 20 meters away from the system. This need not be the physical distance but the length of the cables between the system and the modules.

III.12. EXTERNAL MUSIC SOURCE

- **CABLING :**

A music source (tape recorder, radio or CD player) can be connected to the system to be used for "Background Music" and "Music On Hold" facilities. For connection, the wires coming from the speaker outlet of the music source should be inserted into the 2-pin music connector at the down right corner of the MB48 motherboard, as illustrated in the following figure.

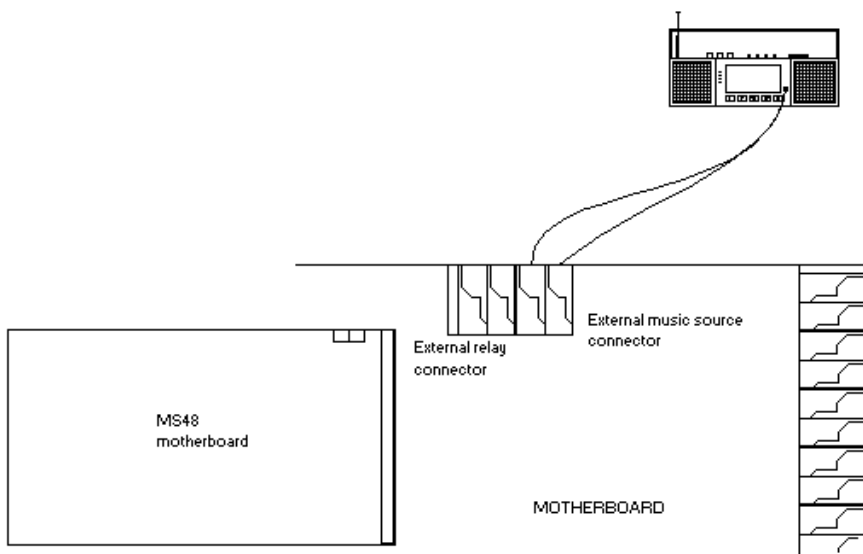


Figure B-33

MS48 is enhanced with a facility to provide the efficient use of the music source by way of its external relay (see sec.III.13.). When the power switch of the music source is connected to the relay on the MB48 motherboard and the necessary programming is carried on, then the music source is automatically activated when an external party is parked or put on hold or when an extension activates the Background Music facility. Hence, the music source remains on only while a call is parked or put on hold or when a user is listening to music on the handsfree telephone.

III.13. EXTERNAL RELAY

The external relay at the down right corner of the MB48 motherboard can be used to switch one of the following equipments provided that the relay is programmed accordingly:

- 1) Door Opener
- 2) External Ringer (to ring for the incoming external calls)
- 3) External Announcement System (see sec.III.6)
- 4) External Music Source (see sec.III.12)

- **CABLING :**

The connection to the external relay should be made through the 2-pin relay connector at down right corner of the MB48 motherboard. The following figure illustrates the connection of the relay to an external device.

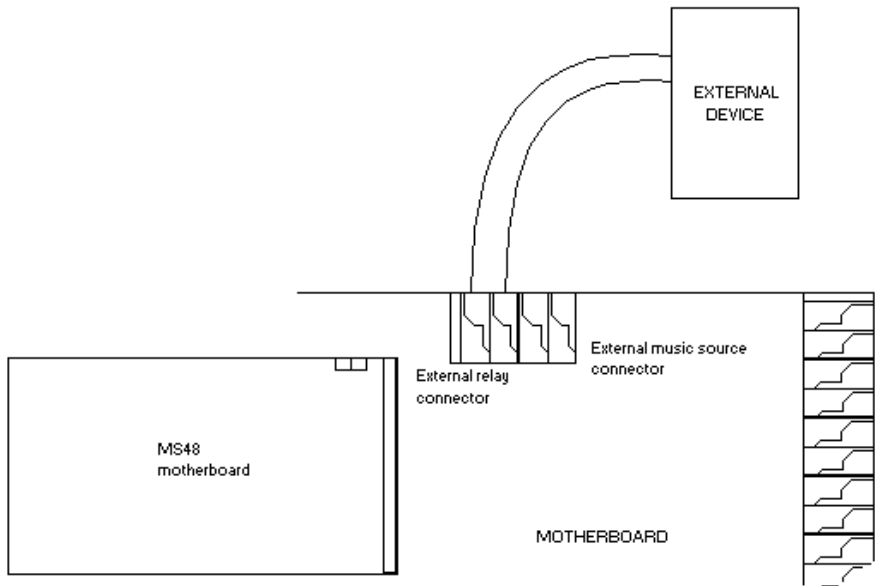


Figure B-34

WARNING

When the mains power goes off and on, if no battery backup is available for the system, the external relay may be activated for a very short while which may cause an undesired activation of the device that is connected to the relay.

This may be especially important for the security of the building if a door opener is connected to the relay. Therefore during the installation please make sure that no undesired operations occur.

I. MAINTAINING THE SYSTEM

After powering on the system, all the extensions, external lines and the accessories must be tested.

To help the installer and to ease his job, some basic problems and most probable solutions are listed below:

1) One or more ports on the MB48 motherboard do not operate properly:

- a) Check the pin connections of the EXP48 modules to the MB48 motherboard,
- b) Remove all the EXP48 modules from the system and try again,
- c) Replace the MB48 motherboard.

2) One or more ports on one of the EXP48 modules do not operate properly:

- a) Check the pin connections of the EXP48 modules to the MB48 motherboard,
- b) Remove the other EXP48 modules from the system and try again,
- c) Replace the EXP48 module,
- d) Replace the MB48 motherboard.

3) No Auto Attendant message can be recorded:

- a) Check the pin connections of the EVM48 card to the MB48 motherboard,
- b) Check if the EVM-FE card, if any, is inserted to the correct connector properly,
- c) Replace the EVM-FE card, if any.
- d) Replace the EVM48 card.
- e) Replace the MB48 motherboard.

4) No Voice Mail message can be recorded:

- a) Check the pin connections of the EVM48 card to the MB48 motherboard,
- b) Check if the EVM-DE card is inserted to the correct connector properly,
- c) Replace the EVM-DE card,
- d) Replace the EVM48 card,
- e) Replace the MB48 motherboard.

5) The recorded Auto Attendant messages are very noisy:

- a) Replace the EVM-FE cards, if any.

6) The recorded Voice Mail messages are very noisy:

- a) Replace the EVM-DE cards.

7) CM48 or PK48 cannot communicate with the PC:

- a) Remove KY16 Mini Printer if it is already installed on the system,
- b) Make sure that you are using the correct security plug,
- c) Check the cable connections at both sides,
- d) Check the pin connections of the PKCR card,
- e) Check if the communication port of the PC is working properly,
- f) Replace the cable,
- g) Replace the PKCR card,
- h) Reinstall the software,
- i) Replace the MB48 motherboard.

8) RS232 cannot communicate with the printer:

- a) Remove KY16 Mini Printer if it is already installed on the system.
- b) Check the cable connections at both sides,
- c) Check the pin connections of the RS232 card,
- d) Check whether the communication parameters of the printer match to these of the system,
- e) Replace the cable,
- f) Replace the RS232 card,
- g) Replace the MB48 motherboard.

9) The DY26 doorphone does not function:

- a) Check the cabling of the doorphone,
- b) Replace the doorphone,
- c) Replace the MB48 motherboard.

10) LB or TE is displayed on the consoles and feature phones:

- a) Check the cabling of all the consoles, feature phones and direct station select modules,
- b) Replace the MB48 motherboard.

11) One of the telephones have no dial tone:

- a) Check the cabling of the telephone,
- b) Replace the telephone,
- c) Check the related extension circuitry of the MB48 motherboard (or EXP48 module), and replace the motherboard (or expansion card) if no dial tone is received.