KM-488-DD

IEEE-488 Interface Board

☞ **NOTE:** This equipment has been tested and found to comply with the limits for a Class B Digital Device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does not cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.

- Increase the separation between the equipment and receiver.

- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

- Consult the dealer or an experienced radio/tv technician for help.

☞ **NOTE:** Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

☞ **NOTE:** The use of a non-shielded interface cable with the referenced device is prohibited.

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CHAPTER 1
INTRODUCTION

1.1 GENERAL INTRODUCTION

Keithley MetraByte's KM-488-DD is an IEEE-488 interface board which allows programs written on an IBM® PC/XT/AT/386™ or IBM PS2 models 25/30 to communicate with the IEEE-488 bus. The KM-488-DD conforms to the 1978 IEEE-488 (GPIB) standard and thus, is compatible with other IEEE-488 products currently offered by many other manufacturers. Up to fourteen other devices may be connected to the IEEE-488 bus, including instruments, printers, and other computers.

The KM-488-DD's design includes a Wait State Generator to adjust the bus timing. This allows the KM-488-DD to perform within the operating specifications of the GPIB controller chip, even on the fastest 386 or 486-based PC's. The KM-488-DD can also be configured to generate interrupts on any of 6 interrupt request lines and DMA transfers on channels 1, 2, or 3.

Keithley MetraByte's optional software allows the KM-488-DD to be programmed either through the use of the File I/O Commands or from software libraries which allow callable routines to be accessed from programs written in QuickBASIC™, BASICA, Microsoft™ C, TURBO™ PASCAL, and Microsoft™ PASCAL. The KM-488-DD is also compatible with a variety of third-party software packages, such as Keithley Asyst's Asystant GPIB.
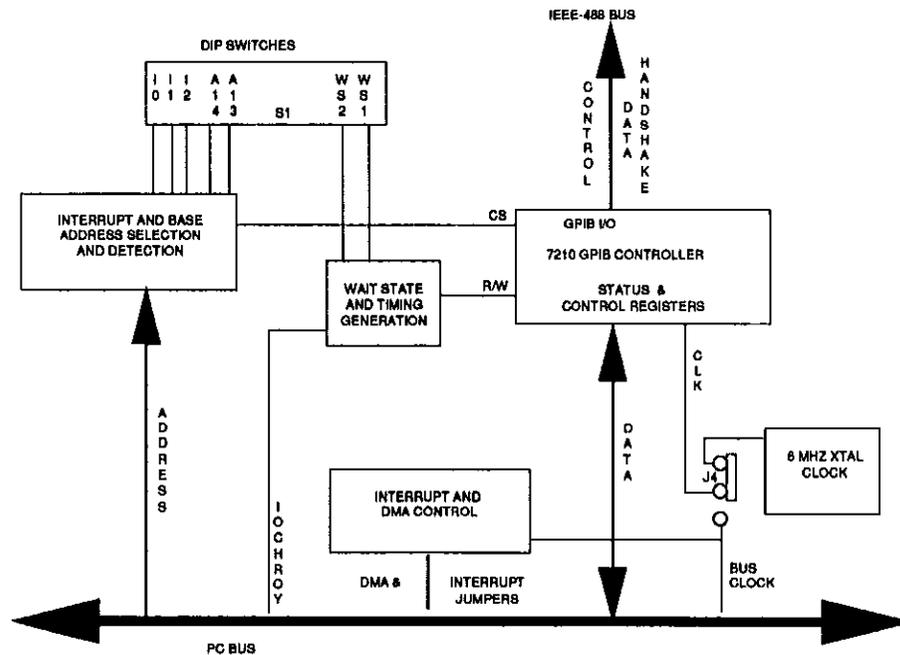
Figure 1-1. KM-488-DD Block Diagram

1.2 SPECIFICATIONS

Specifications for the KM-488-DD are as follows:

Dimensions: One Short PC Slot size

Weight: .29 lb.

Data Transfer Rate: > 300 KB per second

IEEE Controller Chip: NEC µPD7210

Power Consumption: < 650 mAmps

Operating Temperature: 0° to 50° C

Storage Temperature: -20° to +70° C

*Governed by the slowest device

Humidity:	0 to 90% non-condensing
Wait States:	Switch Selectable 1,2,3 or 4
I/O Base Address:	Switch Selectable &H02E1, &H22E1, &H42E1, or &H62E1
DMA Capability:	Switch Selectable Channels 1,2, or 3 shareable
Interrupt (IRQ) Address:	Switch Selectable Levels 2 through 7
Device Interface Capabilities Supported	SH1, AH1, T6, TE0, L4, LE0, SR1, PP0, RL0, DC1, DT1, C0, E1/2, Controller Subsets: C1, C2, C3, C4, and C10 Terminator: Software Selectable characters and/or EOI

1.3 ORDERING INFORMATION

Table 1-1 provides additional ordering information, in the event that you need additional KM-488-DD's or appropriate cables.

Table 1-1. Ordering Information

Part Number	Description
KM-488-DD	Includes the KM-488-DD IEEE-488 Interface Board, Software (on 5.25" disks), and appropriate documentation.
KM-488-DD/3.5	Includes the KM-488-DD IEEE-488 Interface Board, Software (on 3.5" disks), and appropriate documentation.
KM-488-DD-BRD	Includes the KM-488-DD IEEE-488 Interface Board and appropriate documentation.
CGPIB-1	1 meter IEEE-488 cable.
CGPIB-2	2 meter IEEE-488 cable.
CGPIB-4	4 meter IEEE-488 cable.

CHAPTER 2
INSTALLATION

Before you can use your new KM-488-DD board you must unpack and install it correctly. To do this, follow these steps:

- *Unpack and Inspect the KM-488-DD.* This seems like a trivial step; however it is crucial that your board be unpacked correctly. This information is described in section 2.1.

- *Set the Jumpers and Switches on the KM-488-DD.* This step is unnecessary if you elect to use the factory selected defaults shown in Table 2-1. If you want to change any of these settings, consult section 2.2.

- *Install the KM-488-DD.* The KM-488-DD is installed in the same manner as any other peripheral board. If you are unfamiliar with this process, follow the instructions in section 2.3.

If you are installing multiple KM-488-DD's in the same GPIB system, be sure to read Section 2.4, Multiple Board Installation Notes.

2.1 UNPACKING AND INSPECTION

Confirm that each item on the packing list has been shipped. It is a good idea to retain the outer packing material in the event that the board must be returned to the factory for repair.

1. Then, if you haven't already done so, unpack the board down to its anti-static packaging.

2. Hold the board (in its anti-static bag) in one hand. Place the other hand firmly on a metal portion of the system chassis. This procedure eliminates static electricity build-up, thus preventing any possible damage to the board.

3. After allowing a moment for static electricity discharge, carefully unwrap the board from the anti-static material.

4. Inspect the board for any possible shipping damage. If any sign of damage is detected, return the board to the factory as described in section 3.2.

You are now ready to set the jumpers and switches on the KM-488-DD.

2.2 JUMPERS AND SWITCHES

The KM-488-DD contains one DIP switch, two 12-pin jumper banks, and a single 3-pin jumper. The locations of these are shown in Figure 2-1. The Base Address switch controls the base address, interrupt address, and wait states. The jumper banks are used to select the interrupt level and DMA Channel to be used. The single jumper is used to select the source of the master clock signal. The default switch and jumper selections are listed in Table 2-1.
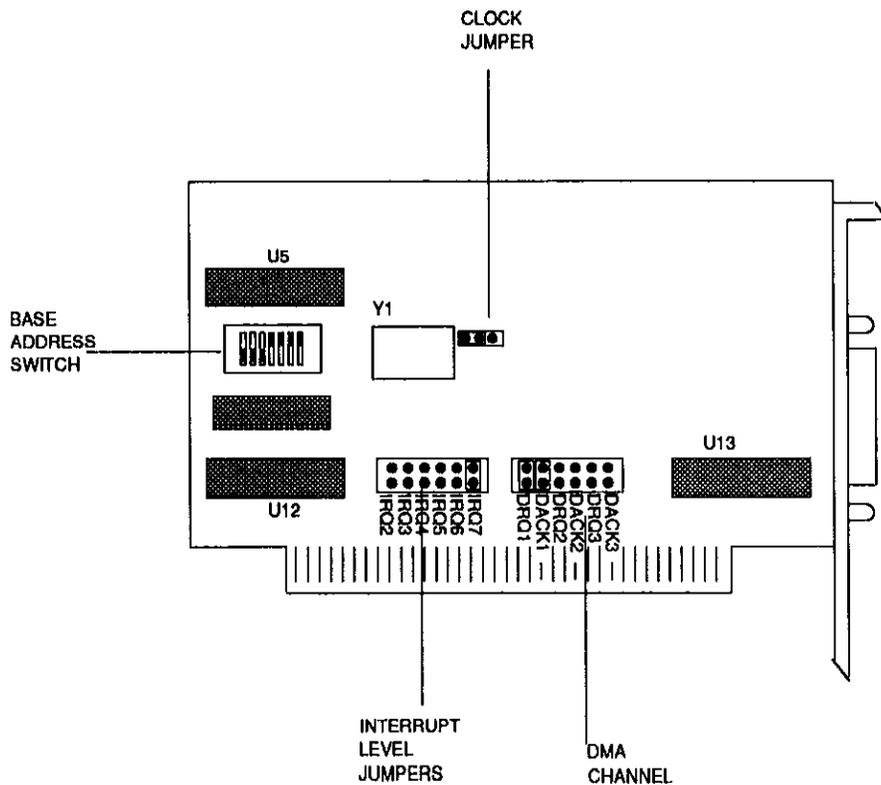

Figure 2-1. Location of Jumpers and Switches

Table 2-1. Default Jumper and Switch Settings

Switch/Jumper	Default

Base Address Switch (S1)
    Base Address
    Interrupt Address
    I/O Wait States
	
	02E1 hex
	02F7 hex
	1

Interrupt Level (J2)	7
DMA Channel (J3)	1
Clock (J4)	8 MHz.

Switches

There is only one switch on the KM-488-DD board. This is the **Base Address Switch**.

The **Base Address Switch** (S1) is a 7-slide, DIP switch. When a rocker is moved to the ON position, this sends the signal low (logical 0). The 7 slide switches are used to select the **Base Address, Interrupt Address,** and **I/O Wait States**.
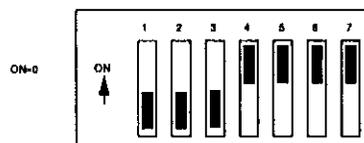
Figure 2-2. Base Address Switch

Interrupt Address. Switches 1, 2, and 3 (I0, I1, and I2) are used to select the Interrupt Response Level Address. This is the address to which the interrupting device must be written in order to be reset. The address is **02F***x*, where *x* is the interrupt level, from 2 to 7. The default selection is 7. To make another choice, configure the slide switches as shown in Figure 2-3.
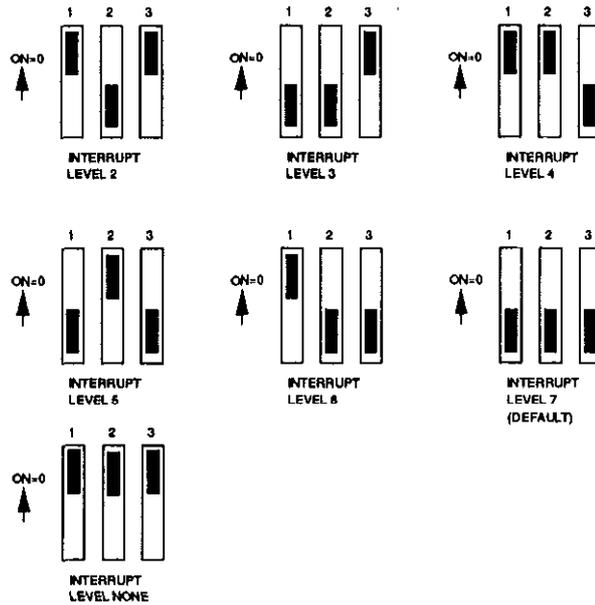
*Figure 2-3. Interrupt Selection*

Base Address. Switches 4 and 5 (A14 and A13) set the address used by the computer to communicate with the IEEE Controller Chip on the board. Available base addresses (in hex) are: 02E1,22E1,42E1,and 62E1. The default base address is 02E1. To select another base address, move the switches to the positions shown in Figure 2-4.
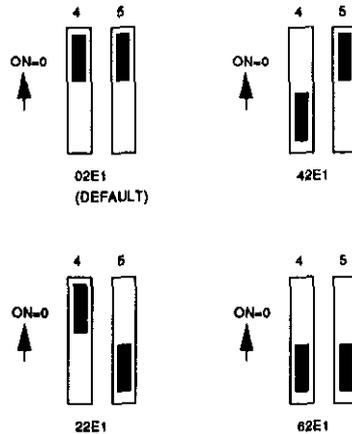

Figure 2-4. Base Address Selection

I/O Wait States. The KM-488-DD is designed with a switch-selectable wait state generator. Selectable wait states are provided to insure optimum performance and reliable operation at the differing bus clocks found in personal computers. The default number of wait states (1) should be correct for most personal computers. However, if you get garbled data or your program crashes, you may need to adjust the number of wait states. Some general guidelines are presented in Table 2-2. The number of wait states is selected by setting switches 6 and 7 (marked WS1 and WS2) on the DIP switch. You can program the KM-488-DD to generate one, two, three, or four wait states during I/O. The default number of wait states is 1. To select a different number, set the switches to one of the positions shown in Figure 2-5.
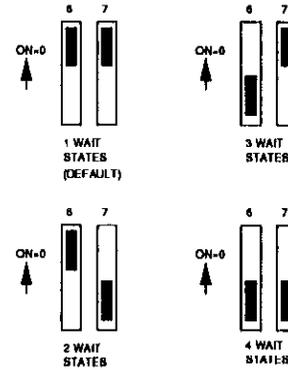

Figure 2-5. I/O Wait State Selections

Table 2-2. Wait States

Bus Clock Frequency	Number of Wait States
≤ 5 MHz.	1 *(default)*
5 MHz < freq ≤ 8 MHz.	2
8 MHz < freq ≤ 10 MHz.	3
10 MHz < freq.	4

Jumpers

There are two jumper blocks and a single jumper on the KM-488-DD. These are used to pro-
gram the **Interrupt Level, DMA Level,** and the **Clock Source.**

Interrupt Level. The KM-488-DD is capable of generating the interrupts required by third
party software packages. The interrupt level jumper (J2) defines the interrupt level to be
used. Valid interrupt levels (2 through 7) and the jumper positions used are shown in Fig-
ure 2-6. Be certain that the same Interrupt Level and the Interrupt Response Level (See Base
Address Switch.) are selected. Note that the KM-488-DD driver software does not use
interrupts. Thus, you should place the interrupt level jumper in the disabled position.
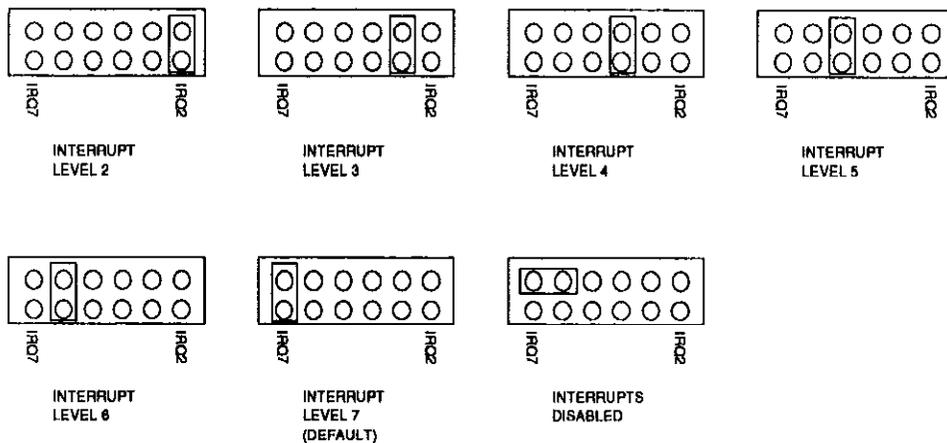

Figure 2-6. Interrupt Level Jumpers

DMA Level. DMA (Direct Memory Access) can be used to transfer data quickly from a
peripheral to the computer. The PC has four DMA channels one of which is reserved.
Based on your system configuration others may be available. Select an appropriate DMA
level using the DMA Level Jumpers. Refer to Figure 2-7 for jumper positions.

DMA
CHANNEL 1
(DEFAULT)

DMA
CHANNEL 2

DMA
CHANNEL 3

DMA
DISABLED
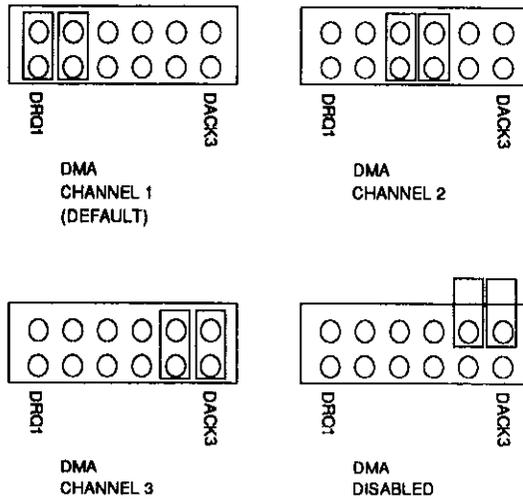
Figure 2-7. DMA Level Jumpers

Clock Source. The IEEE bus interface circuitry on the KM-488-DD board requires a master clock signal. This clock is normally connected to an on-board 8 MHz clock oscillator. You can, however, elect to drive this circuitry from the PC's clock. Be aware that the clock speed will vary according to the model of computer used. To select the clock source, place the jumper block between the appropriate pins. See Figure 2-8.

8 MHz.
(DEFAULT)

BUS
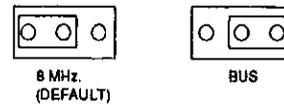
Figure 2-8. Clock Source Jumper

NOTE: The BUS position may be required by certain third party software packages.

2.3 BOARD INSTALLATION

This section provides general instructions for installing the KM-488-DD Board in an IBM PC/XT/AT/286/386 or compatible. Some things, such as removing the computer's cover, are machine-dependent. Consult the documentation provided with your computer, if necessary.

WARNING

DO NOT ATTEMPT TO INSERT OR REMOVE ANY ADAPTER BOARD WITH THE COMPUTER POWER ON! THIS COULD CAUSE DAMAGE TO THE COMPUTER!

To install the KM-488-DD Board:

1.   Turn the power to the PC and to all attached options OFF.

2.   Unplug the power cords of all attached options from the electrical outlets. Then, make a note of where all the device cables are attached to the rear of the system unit. Disconnect the cables.

3.   Remove the cover of the PC. To do this, first remove the cover mounting screws on the rear panel of the computer.   Then, slide the cover of the computer about 3/4 of the way forward. Tilt the cover upwards to remove.

4.   Choose an available option slot. Loosen and remove the screw at the top of the blank adapter plate. Then slide the plate up and out to remove.

5.   Hold the KM-488-DD (in its anti-static bag) in one hand. With the other hand, touch any metallic part of the PC/AT cabinet. This will safely discharge any static electricity which has built-up in your body. Unwrap the KM-488-DD from the anti-static bag.

6.   If you haven't already done so, set the switches and jumpers as described in section 2.4.

7. Align the gold edge connector with the edge socket and the back adapter plate with the adapter plate screw opening. Gently press the board downward into the socket. Re-install the adapter plate screw.

8. Replace the computer's cover. Tilt the front of the cover up and slide it onto the system's base, making sure the sides of the cover are under the rail along the sides of the frame. Install the mounting screws.

9. Plug in all cords and cables. Turn the power to the computer back on.

2.4   MULTIPLE BOARD INSTALLATION NOTES

When installing multiple KM-488-DD in the same GPIB system, be sure to:

•   Assign a different Base Address to each KM-488-DD

•   Assign a different Interrupt Level to each KM-488-DD, if required by your software

•   Assign a different DMA Level to each KM-488-DD, if required by your software

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CHAPTER 3
WARRANTY INFORMATION

3.1 WARRANTY

All products manufactured by Keithley MetraByte are warranted against defective materials and workmanship for a period of **one year** from the date of delivery to the original purchaser. Any product that is found to be defective within the warranty period will, at the option of Keithley MetraByte, be repaired or replaced. This warranty does not apply to products damaged by improper use.

CAUTION

Keithley MetraByte Corporation assumes no liability for damages consequent to the use of this product. This product is not designed with components of a level of reliability suitable for use in life support or critical applications.

3.2   RETURN TO FACTORY INFORMATION

Before returning any equipment to the factory for repair, you must first call the Technical Support Department at (508) 880-3000. They will try to diagnose and solve your problem over the phone. If they ascertain that the unit has to be returned to the factory for repair, they will issue a Return Material Authorization (RMA) number. Note that if the board is to be repaired under warranty, the Technical Support Department will need your invoice number and the date the board was purchased. Please reference the RMA number on any correspondence regarding the board.

When returning the Board for repair, please include the following information:

1.   A brief description of the problem.

2.   Your name, address, and telephone number.

3.   The invoice number and the date when the board was purchased.

4.   Repackage the board in its original anti-static wrapping (Handle it with ground protection.) and ship it back to:

Repair Department
Keithley MetraByte Corporation
440 Myles Standish Boulevard
Taunton, Massachusetts 02780

Telephone:(508)880-3000
Telex:503989
FAX:(508)880-0179

Be sure to reference your RMA number on the outside of the package!

APPENDIX A
REGISTER MAP

Address	Read Register	Write Register
Base + 0	Data In	Data Out
Base + 400 hex	Interrupt Status 1	Interrupt Mask 1
Base + 800 hex	Interrupt Status 2	Interrupt Mask 2
Base + C00 hex	Serial Poll Status	Serial Poll Mode
Base + 1000 hex	Address Status	Address Mode
Base + 1400 hex	CMD Pass Through	Auxiliary Mode
Base + 1800 hex	Address 0	Address 0/1
Base + 1C00 hex	Address 1	End of String