

Related Products	All KEM GmbH boards with P996 compatible bus (ISA, ISA96, AT96, PISA, PC/104, DIMM-PC, ETX)
Subject	Shareable interrupts
Document Name	ShareIRQ_E111.doc
Usage	Common

1. REVISION HISTORY

Date	Document Name	Subjects added, changed, deleted	Changed by
12-Nov-96	JAP0014.DOC	Initial release of Application Note	H. Bruhn
11-Oct-00	JAP0014.DOC	Change of layout	M. Unverdorben
23-Apr-02	JAP0014.DOC	English proofreading	D. Gunter
23-Aug-02	JAP0014.DOC	Changed to Kontron style	H. Bruhn
21-Nov-02	ShareIRQ_E111.DOC	Changed to new KEM style, added PISA, DIMM-PC, ETX	H. Bruhn

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3. PROBLEM

Systems using the ISA-bus and following the P996 bus specification normally don't support shareable interrupts. Kontron Embedded Modules GmbH boards are nearly all based on the ISA bus (ISA96, AT96, DIMM-PC, ETX, PISA and PC/104 bus only use different pin outs and connectors) and they can't use shareable interrupts as well.

Some devices that support shareable interrupts (i.e. not following the P996 bus specification) have a feature to disable their interrupt-sharing circuit and therefore guarantee compatibility. All devices without this feature will not work properly with Kontron Embedded Modules GmbH boards (later on called Kontron in this document). For a detailed explanation of the problem see the following extraction in section "4. Interrupt-Sharing Option" of the PC/104 specification version 2.3, released by the PC/104 consortium, called APPENDIX C:

This application note has been written because some customers reported problems with several digital I/O boards of REAL TIME DEVICES (DM406, DM5406, DM5810, DM5812), nevertheless these problems may occur with other boards that are using shared interrupts, too. Kontron decided to use REAL TIME DEVICES DM5810 as an explanation example at the end of this application note.

Meanwhile Kontron has been in contact with REAL TIME DEVICES and received information that there is a solution for this problem with the RTD boards. We thank RTD for their quick and uncomplicated support and we have included their solution in this application note.

4. INTERRUPT-SHARING OPTION

4.1. Introduction

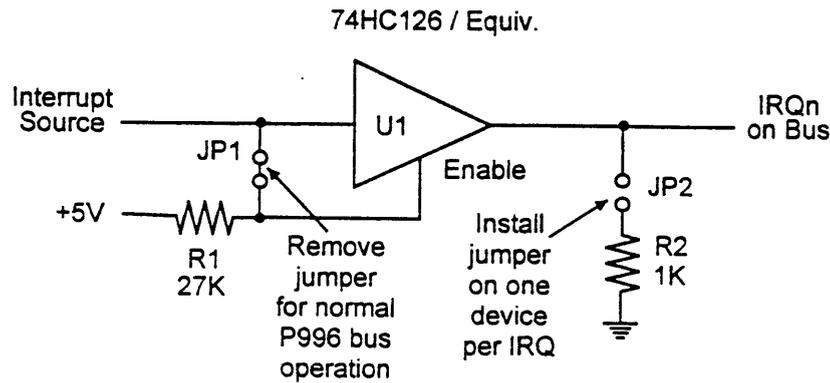
The Interrupt Request lines (IRQn's) on the P996 bus are active high. Consequently, the usual technique of wire-ORing open-collector driving active low bus signals cannot be used for interrupt sharing in the PC bus architecture.

The P996 specification briefly mentions an optional means to share a single bus interrupt line among multiple interrupting devices. This appendix provides design guidelines, which can help assure compatibility of interrupt sharing among PC/104 modules.

4.2. Recommended Circuit

Circuits similar to that shown in the figure below can provide interrupt sharing of the *active high* IRQ signals on the P996 bus, given a few system-level restrictions (see below).

NOTE: *This recommendation does not comply with the P996 specifications.*



4.3. Restrictions

All bus devices sharing a common interrupt must be equipped with a suitable interrupt sharing circuit (see Figure above) and must meet the following two restrictions:

- 1 The interrupt line being shared must not have a pull-up resistance (to +5 volts) less than 15K ohms anywhere in the system. (Typically, the pull-up resistance is located on the CPU module, so this is generally a restriction on the design of the CPU module.) Resistive bus termination will generally violate this restriction; use AC termination instead.
- 2 The interrupt line being shared must have one (and only one) pull-down resistor (1K ohms) connected between the IRQ line and ground. Resistive bus termination will generally violate this restriction; use AC termination instead.

4.4. “P996 Compatibility” Option Jumper

The P996 specification calls for using a 2.2K pull-up resistor on each of the IRQ lines, which violates the 15K minimum pull-up resistance allowed with the recommended interrupt sharing circuit. In systems having this pull-up value, devices with the circuit shown in the above figure can be made compatible by disabling their interrupt sharing circuit. This is accomplished by removing both JP1 and JP2, resulting in a normal P996 (non-shared) interrupt configuration (but with the reduced bus drive common to other PC/104 bus signals).

5. EXAMPLE WITH DM5810

This example will explain why Kontron boards may not work correctly with DM5810 or similar designed boards that don't have the possibility to disable shared interrupts.

REAL TIME DEVICES informed us that they implemented a circuit in the EPLD of all of their DataModules which allows the user to switch the shareable interrupt feature on or off through a software command. This will allow the customer to use the modules with CPU's that support shareable interrupts and with those that do not support shareable interrupts. If a customer has received DataModules from RTD without this feature, or is not sure about it's implementation, he can contact RTD for information and/or an upgrade.

The DM5810 is using an interrupt sharing circuit similar to the one described in the chapters above. It doesn't have the possibility to disable this circuit via jumpers for P996 compatibility. If a customer is using a RTD board without the disabling feature, or a board from any other manufacturer only supporting sharable interrupts, the following problems will occur.

The drawing below (part of the DM5810 User's Manual by RTD) shows the interrupt sharing circuit with one interrupt line that can be jumpered from IRQ2 to IRQ7. This line is pulled down via a 1K ohms resistor and a jumper "G" to ground. Whenever an interrupt request is made, the line is forced high to generate an interrupt. After the tri-state buffer is disabled, the line is pulled to ground again. If this circuit is connected to a board complying to P996 specs, which pulls the IRQ line high via 2K2 resistor, the result will be a toggling signal level which may either produce lot's of interrupts or no interrupts at all, depending on the number and kind of devices sharing the interrupt.

Because the interrupt sharing circuit described above is not following the typical interrupt sharing circuit described in the appendix C of the PC/104 specification, there is no chance to get proper functionality between both boards, except there is another solution like that found by REAL TIME DEVICES (software command).

If one of your additional boards in a Kontron system causes problems with the interrupt lines and has an interrupt sharing circuit onboard, check the possibility of disabling interrupt sharing by jumpers or software first. If there is no disabling feature available, contact the board manufacturer for further support.

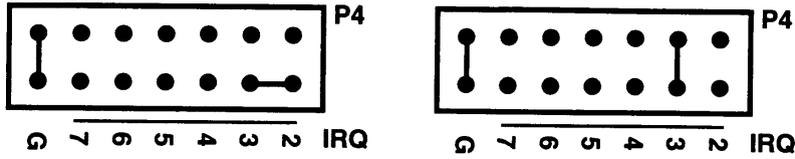


Fig. 1-2a:
Factory Setting

Fig. 1-2b:
IRQ3 Selected

Fig. 1-2 — Interrupt Channel Select Jumper, P4

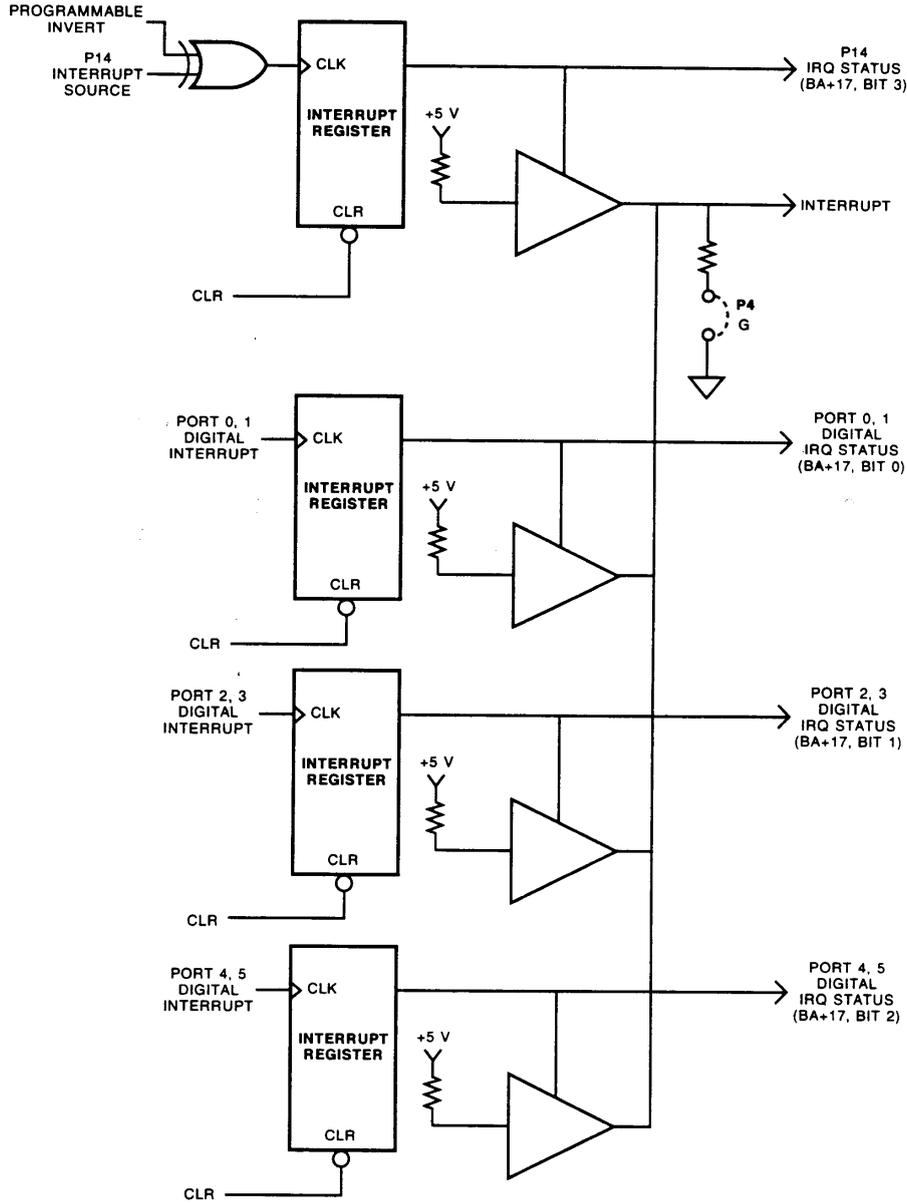


Fig. 1-3 — Pulling Down the Interrupt Request Lines