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PB-DIO/DIN

I/O Piggyback Modules

for VMOD2 and IMOD

Manual ID 02923, Rev. Index 0101
Nov 98

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Preface

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Revision History

Revision History				
Manual/Product Title:	**PB-DIO/DIN**			
Manual ID Number:	**02923**			
Rev. Index	**Brief Description of Changes**	**H/W Index PB-DIN**	**PB-DIO**	
0100	Initial Issue	00	02	22 Aug. 89
	Corrections to Issue 1	00	02/1	Feb. 93
	Corrections to Chapters 1 and 3	00	02/1	June 93
	Titlepage updated	00	02/1	Sept. 97
0101	Section 1.3 Specifications Table amended	00	02/1	Sept. 98

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For your safety

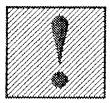
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- It is particularly important to observe standard anti-static precautions when changing piggybacks, ROM devices, jumper settings etc. If the product contains batteries for RTC or memory back-up, ensure that the board is not placed on conductive surfaces, including anti-static plastics or sponges. They can cause short circuits and damage the batteries or tracks on the board.

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- This device should only be installed in or connected to systems that fulfill all necessary technical and specific environmental requirements. This applies also to the operational temperature range of the specific board version, which must not be exceeded. If batteries are present, their temperature restrictions must be taken into account.
- In performing all necessary installation and application operations, please, follow only the instructions supplied by the present manual.
- Keep all the original packaging material for future storage or warranty shipments. If it is necessary to store or ship the board please re-pack it as nearly as possible in the manner in which it was delivered.
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Insertion A Board Layout
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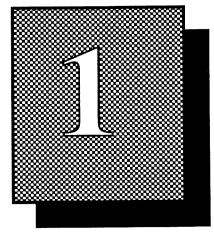
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1. INTRODUCTION

1.1 Product Overview

The PB-DIN is a 20 channel optoisolated input piggyback, with 16 lines for logical level (24V dc or TTL) input and four lines for transition edge detection. The transition edge response (either positive or negative edge) is freely programmable.

The PB-DIO is a 20 channel parallel I/O piggyback with eight inputs, eight outputs, and four handshake lines, all optoisolated.

Both PB-DIN and PB-DIO can be used either with VMOD2 (modular industrial I/O module for use on the VMEbus) or with IMOD (modular industrial I/O motherboard for use on the IUC/CXC).

1.2 Ordering Information

Product	Description	Order Number
PB-DIN	20 channel parallel input piggyback for 24V dc levels on the VMOD2 and IMOD modules. 24V/5mA, optoisolated.	523-14
PB-DIN	20 channel parallel input piggyback for TTL levels on the VMOD2 and IMOD modules. 5V/10mA, optoisolated.	523-14/1
PB-DIO	20 channel digital I/O piggyback for TTL levels on the VMOD2 and IMOD modules. Optoisolated.	523-13/1

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1.3 Specifications

Description	PB-DIN	PB-DIO
Input Channels	16 digital inputs plus 4 handshake lines. All input channels are optoisolated.	8 digital inputs plus 2 handshake lines. All input channels are optoisolated.
Output Channels	None.	8 digital output lines.
Input Voltage	Two versions: 5V dc and 24V dc, typically.	5V dc
Input Current	Two versions: 10mA at 5V and 5mA at 24V, typically.	Two versions: 10mA at 5V and 5mA at 24V, typically.
Output Voltage	Not applicable.	5V
Output Current	Not applicable.	10mA
Switching Level	< 1.5V = low ≥ 3.0V = high	< 1.5V = low ≥ 3.0V = high
Input Frequency	500 KHz maximum	500 KHz maximum
Isolation Voltages	2500V rms input to system, 100V dc between inputs.	2500V rms input to system, 100V dc between inputs.
Timer	24 bit.	24 bit.
Timer Clock	8 MHz.	8 MHz.
Identification Byte	$F3	$F2
Address Range	128 byte blocks.	128 byte blocks.
DTACK Generation	Onboard.	Onboard.
Power Requirements	+5V dc (±5%) 500mA typically.	+5V dc (±5%) 500mA typically.
Temperature Ranges		
Operating	0 to +70°C (Standard)	0 to +70°C (Standard)
Storage	-40 to +85°C (Extended)	-40 to +85°C (Extended)
Operating Humidity	0 to 95% (Noncondensing)	0 to 95% (Noncondensing)
Piggyback Size	Width: 48mm Length: 100mm Depth: 12mm	Width: 48mm Length: 100mm Depth: 12mm
VMOD2/IMOD Interface	Two sets of twin row header pins providing all necessary communication paths and a mechanical mounting method.	Two sets of twin row header pins providing all necessary communication paths and a mechanical mounting method.

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1.4 Advantages of the PB-DIN/DIO Modules

The PB-DIN and PB-DIO were designed to provide an easy-to-use interface for customer applications, resulting in maximum design flexibility. The PB-DIN and PB-DIO provide a cost-effective solution, quick and easy implementation, and full compatibility with existing PEP products.

Both piggybacks can be used with the VMOD2 module and with the IMOD module.

1.5 Related Publications

For more information regarding the VMEbus, please refer to:

* The VMEbus Specification, Revision C.1.

For details regarding the MC68230 parallel interface/timer (PI/T) chip, see section 3.1 of this manual, or the MC68230 datasheet.

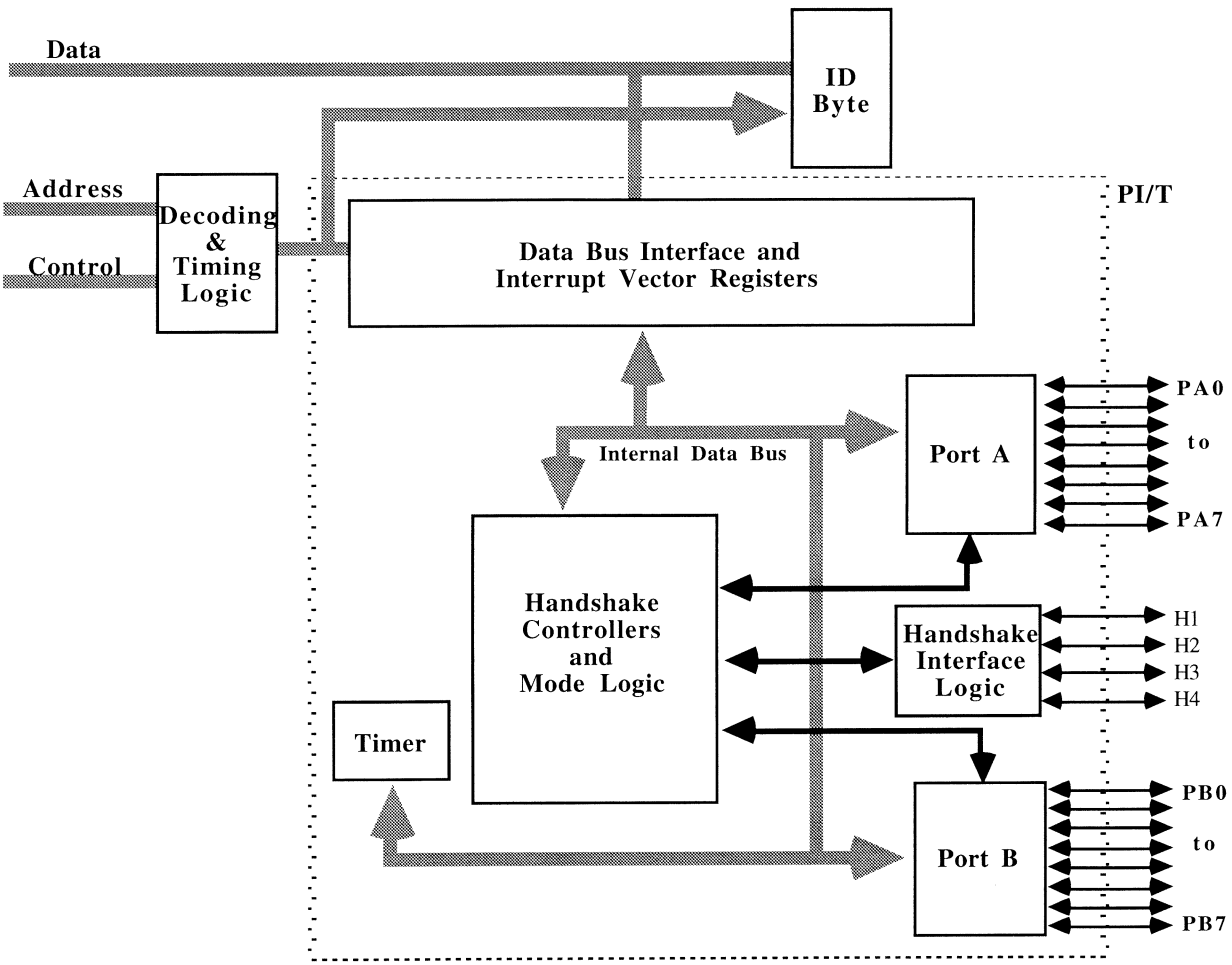
1.6 Common Features of the PB-DIN/DIO Modules

- Optoisolated or TTL level input.
- Software selectable channels; the ports can work in a variety of different ways.
- Each channel is fully and independently programmable to work as either simple bit I/O lines, or as a fully handshake controlled port.
- 24 bit programmable timer.
- Interrupt request line. Interrupt vector generated by piggybacks.
- Onboard DTACK generator for all necessary DTACK signals.

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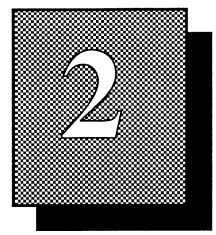
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Figure 1.1 Block Diagram of the PB-DIN and PB-DIO



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2. FUNCTIONAL DESCRIPTION

This chapter describes PB-DIN and PB-DIO in terms of function and system applications. In addition, this chapter provides an address map, connector pinouts, and information regarding the various modes of operation.

2.1 The MC68230 Parallel Interface and Timer Chip (PI/T)

The MC68230 parallel interface and timer (PI/T), provides versatile double buffered interfaces and a system-oriented timer for MC68000 systems. The parallel interfaces operate at either 8 or 16 bits wide in unidirectional mode. An associated data direction register determines whether each port pin is an input or an output. The programmable handshake pins provide an interface flexible enough for connection to a variety of low, medium or high speed peripheral devices, or to other computer systems.

The PI/T timer contains a 24 bit counter and a 5 bit prescaler. The timer is clocked by the system clock (PI/T CLK pin) and the 5 bit prescaler may be used. It can generate periodic interrupts, a square wave, or a single interrupt after a programmed time period. It can also be used for elapsed time measurement or as a device watchdog.

2.1.1 Features of the PI/T

- MC68000 bus compatible
- Port modes: Bit I/O
  Unidirectional 8 and 16 bit
- Programmable handshaking options
- 24 bit programmable timing modes
- 5 separate interrupt vectors
- Separate port and timer interrupt service requests
- Registers are Read/Write and directly addressable

The PI/T consists of two logically independent sections: the ports and the timer. The port section consists of port A (PA0 to PA7), port B (PB0 to PB7), and four handshake pins (H1, H2, H3 and H4). The four programmable handshake pins, depending on the mode, can control data to and from the ports, or can be used as interrupt generating inputs or I/O pins.

The timer consists of a 24 bit counter, optionally clocked by a 5 bit prescaler.

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2.2 Port General Information and Conventions

This section introduces concepts that are generally applicable to the PI/T ports independent of the chosen mode and submode. For this reason, no particular port or handshake pins are mentioned; the notation H1(H3) indicates that, depending on the chosen mode and submode, the statement given may refer to either H1 or H3.

2.2.1 Unidirectional vs. Bidirectional

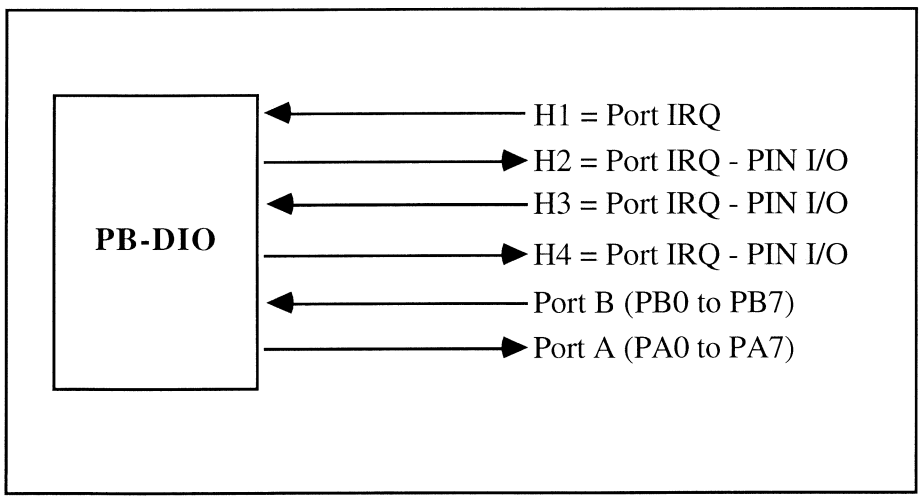
The PB-DIN module requires all channels to be set to Input.

The PB-DIO module requires to be set to either 10 IN or 10 OUT. These conditions are set by the optocouplers.

2.3 The I/O Ports

The two I/O ports consist of eight bidirectional lines and two multifunction handshake lines. This is illustrated in the figure below.

Figure 2.1 The PB-DIO Input/Output Ports



Above all, the TTL I/O port enables realization of simple bit I/O for industrial applications such as switch operation or polling for the control of user-defined peripherals. Implementation of the individual bits is left completely up to the user.

Note

Simple output is easily programmed on Port A pins PA0 to PA7, or on Port B Pins PB0 to PB7. This is also true of simple input which does not require constant monitoring. In this case, the handshake pins should be used for 'change of state' IRQ input, avoiding the need for continuous polling.

The program examples in chapter 4 illustrate the necessary initialization procedures for the applications discussed above.

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2.4 The Handshake Pins H1, H2, H3 and H4

Table 2.1 Use of the Handshake Pins

Description	Handshake Pins
Input Pin	H1, H2, H3, H4
Output Pin	H2, H4
Change of State IRQ Pin	H1, H2, H3, H4
Port A Handshake Pin	H1, H2
Port B Handshake Pin	H3, H4

These pins can be controlled by several of the PI/T registers. The registers associated with the handshake pins are described as follows.

Table 2.2 PI/T Register Description Overview

Register Name	Address	Register Function	Status after RESET
Port General Control Register	PI/T $01	Sets PI/T operating mode, controls handshake pins H1 - H4.	All bits to zero.
Port Service Request Register	PI/T $03	Sets internal PI/T interrupt priorities.	All bits to zero.
Port A Data Direction Register	PI/T $05	Describes the bit in port A as either input or output.	All bits to zero.
Port B Data Direction Register	PI/T $07	Describes the bit in port B as either input or output.	All bits to zero.
Port Interrupt Vector Register	PI/T $0B	Contains the interrupt vector numbers of the interrupt handler.	Register = $0F
Port A Control Register	PI/T $0D	Steers the functions of the I/O port A. Contains the enable flag for port IRQ (H1 and H2).	All bits to zero.
Port B Control Register	PI/T $0F	Steers the function of I/O port B. Contains the enable flag for port IRQ (H3 and H4).	All bits to zero.
Port A Data Register	PI/T $11	Holds data for PI/T port A.	All bits to zero.
Port B Data Register	PI/T $13	Holds data for PI/T port B.	All bits to zero.
Port Status Register	PI/T $1B	Internal flip-flops occur in this register, designated by status bits H1S - H4S. Flip-flops returned to original state by writing a 1 to the appropriate status bit.	All bits to zero.
Timer Control Register	PI/T $21	Controls all timer operations.	All bits to zero.
Timer Interrupt Vector Register	PI/T $23	Contains the timer interrupt vector number.	Register = $0F

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2.5 PI/T Register description

2.5.1 Port General Control Register (PI/T $01)

This register sets the operating mode of the PI/T and controls the handshake pins H1 - H4 (port IRQ or I/O).

Table 2.3 Bit Map of the Handshake Pins H1 - H4.

Bits	Setting	Function
7 6	0 0 0 1 1 0 1 1	Mode 0 Unidirectional 8 Bit Mode Mode 1 Unidirectional 16 Bit Mode Mode 2 Bidirectional 8 Bit Mode Mode 3 Bidirectional 16 Bit Mode
5	0 1	H3 and H4 disabled H3 and H4 enabled
4	0 1	H1 and H2 disabled H1 and H2 enabled
3 2 1 0	x x x x	H4 H3 Bit = 1: Rising Edge active H2 Bit = 0: Falling Edge active H1

After RESET, all bits are returned to zero.

Note

Since the RESET returns all bits to 0, it also puts the PI/T into an input device mode on all ports. This results in active outputs due to the pull-up resistor after the opto-coupler.

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Table 2.4 Port Mode Control Summary

Mode 0 - Unidirectional 8 Bit Mode

Port A

Submode 00	Pin Definable Double Buffered Input or Single Buffered Output
H1	Latches input data
H2	Status interrupt generating input, general purpose output, or operation with H1 in the interlocked or pulsed handshake protocols
Submode 01	Pin Definable Double Buffered Output or Nonlatched Input
H1	Indicates data received by peripheral
H2	Status/interrupt generating input, general purpose output, or operating with H1 in the interlocked or pulsed handshake protocols
Submode 1X	Pin Definable Single Buffered Output or Nonlatched Input
H1	Status/interrupt generating input
H2	Status/interrupt generating input or general purpose output

Port B

H3 and H4	Identical to port A, H1 and H2

Mode 1 - Unidirectional 16 Bit Mode

Port A Most significant data byte or nonlatched input or single buffered output

Submode XX	(Not used)
H1	Status/interrupt generating input
H2	Status/interrupt generating input or general purpose output

Port B Least significant data byte

Submode X0	Pin Definable Double Buffered Input or Single Buffered Output
H3	Latches input data
H4	Status/interrupt generating input, general purpose output, or operation with H3 in the interlocked or pulsed handshake protocols

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2.5.2 Port Services Request Register (PI/T $03)

This register controls the double functions on some of the PI/T pins, and sets internal PI/T interrupt priorities.

Table 2.5 Setting Interrupt Priorities via the Port Service Request Register

Bits 7 6 5 4 3 2 1 0	Function
0 0 0 1 1	Fixed when port EOC IRQs are used.
0 0 0	Interrupt priority:- H1>H2>H3>H4 (Default)
0 0 1	H2>H1>H3>H4
0 1 0	H1>H2>H4>H3
0 1 1	H2>H1>H4>H3
1 0 0	H3>H4>H1>H2
1 0 1	H3>H4>H2>H1
1 1 0	H4>H3>H1>H2
1 1 1	H4>H3>H2>H1

After RESET, all bits are returned to zero.

2.5.3 Port A and B Data Direction Registers (PI/T $05 / PI/T $07)

For simple bit I/O, the following is applied:

Table 2.6 Bit Map of the Port B Data Direction Register

Bits 7 6 5 4 3 2 1 0	Function
	Each bit represents an input line.
0 x x x 0 x x x	Bits 7 and 3 in the Port Data Registers are inputs. The rest are outputs.
1 x x x 1 x x x	Bits 7 and 3 in the Port Data Registers are outputs. The rest are inputs.

After RESET, all bits are returned to zero.

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2.5.4 Port Interrupt Vector register (PI/T $0B)

This register contains the interrupt vector numbers of the VMOD2/IMOD interrupt handler. The upper six bits are programmable, the lower two bits are self-modifying.

Table 2.7 Bit Map of the Port Interrupt Vector Register

Bits 7 6 5 4 3 2 1 0	Function	
	Interrupt Vectors	
1 1 1 1 0 0	Example: $F0 - $F3	
0 0	H1 IRQ	Internal
0 1	H2 IRQ	External to user functions
1 0	H3 IRQ	External to user functions
1 1	H4 IRQ	External to user functions

After RESET, this register contains $0F.

2.5.5 Port A and B Control Registers (PI/T $0D / PI/T $0F)

These registers control the functions of ports A and B, and contain enable flags for port IRQ inputs H3 and H4.

Table 2.8 Bit Map of the Port Control Registers

Bits 7 6 5 4 3 2 1 0	Function
1 x	Fixed, VMOD2/IMOD-specific for bit I/O
	Bits 5 - 3 provide H4 control
0 x x	Transition operated input, H4S set by appropriate edge.
1 x 0	Output low.
1 x 1	Output high.
	Bit 2 is the H4 interrupt enable/disable
0	Disabled
1	Enabled
	Bit 1 is the H3 interrupt enable/disable
0	Disabled
1	Enabled
x	Bit 0 is "don't care"

After RESET, all bits are returned to zero.

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2.5.6 Port A and B Data registers (PI/T $11 / PI/T $13)

These registers hold the data for the PI/T ports A and B.

2.5.7 Port Status Register (PI/T $1B)

With the appropriate edge on pins H1 through H4 of the PI/T, internal flip-flops are set in the port status register. These flip-flops are identified by status bits H1S through H4S. The flip-flops can be returned to their original state by writing a "1" to the status bit. Use of the EOC and port IRQs requires that, at the end of the IRQ service routine, bits H1S through H4S be erased in the port status register, allowing for new interrupts.

Table 2.9 Bit Map of the Port Status register

Bits 7 6 5 4 3 2 1 0	Function
x x x x x x x x	Current levels at H1 - H4 pins. H4S, H3S, H2S status pins. EOC status bit.

After RESET, all bits are returned to zero.

2.6 Timer Operation and Applications Summary

This section describes the programmable options available, capabilities and restrictions that apply to the timer. Programming the timer control register is outlined in the several examples given.

2.6.1 Timer Operation

The MC68230 timer can provide several facilities required by the MC68000 operating systems. It can generate periodic interrupts, or a single interrupt after a programmed time period. Also, it can be used for elapsed time measurement or as a device watchdog.

The PI/T timer contains a 24 bit synchronous down counter that is loaded from three 8 bit counter preload registers. The 24 bit counter may be clocked by the output of a 5 bit prescaler. If the prescaler is used, it may be clocked by the system clock (CLK pin). The counter signals the occurrence of an event primarily through zero detection (a zero is detected when the counter of the 24 bit timer is equal to zero). This sets the Zero Detection Status (ZDS) bit in the timer status register. It may be checked by the processor or may be used to generate a timer interrupt. The ZDS bit can be reset by writing a one (1) to the timer status register in that bit position, independent of timer operation.

The general operation of the timer is flexible and easily programmable. The timer is fully configured and controlled by programming the 8 bit timer control regisster. It controls:-

1. the choice between the port C operation and timer operation of three timer pins;
2. whether the counter is loaded from the counter preload register, or rolls over when zero detect is reached;
3. the clock input;
4. whether the prescaler is used, and
5. whether the timer is enabled.

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2.6.2 Run/Halt Definition

The overall operation of the timer is described in terms of the run or halt states. The control of the current state is determined by programming the timer control register. When in the halt state, all of the following occur:

1. The prior content of the counter is not altered and is reliably readable via the count registers.
2. The prescaler is forced to $1F, whether or not it is used.
3. The ZDS status bit is forced to zero, regardless of the possible zero contents of the 24 bit counter.

The run state is characterised by:

1. The counter is clocked by the source programmmed in the timer control register.
2. The counter is not readily readable.
3. The prescaler is allowed to decrement if programmed for use.
4. The ZDS status bit is set when the 24 bit counter changes from $000001 to $000000.

Note

The counter pins cannot be used on the PB-DIN and PB-DIO. The PI/T is clocked at 8 MHz.

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2.6.3 Timer Control Register (PI/T $21)

This register controls all timer operations.

Table 2.10 Bit Map of the Timer Control Register

Bits 7 6 5 4 3 2 1 0	Function
0 1 x	Timer Output (TOUT) Control The TOUT pin is a square wave output in run state, and moves the counter once for the passage of all zeros. In halt state, the TOUT pin is set low.
0	Zero Detect Control After the passage of all zeros in the first clock cycle, the contents of the Counter Preload Register are placed in thge counter and decrementation begins.
x	"Don't care"
0 0	Clock Control The timer's internal 8 bit prescaler is enabled. The 8 MHz onboard clock decrements the prescaler, and the prescaler decrements the counter from $00 to $1F.
0 1	The TIN pin serves as a timer enable input for the timer enable flag (active high). The internal clock is used and the prescaler is enabled.
1 0	The counter is timed with the falling edge on the TIN pin. The prescaler is enabled.
1 1	The counter is timed with the falling edge on the TIN pin. The prescaler is disabled.
0 1	Timer Enable Disabled. Timer in halt state. Enabled. Timer in run state.

After RESET, all bits are returned to zero.

2.6.4 Timer Interrupt Vector Register (PI/T $23)

This register contains the timer interrupt vector number.

After RESET, this register contains $0F.

2.6.5 Counter Preload Registers; High, Middle, Low (PI/T $27, $29, $2B)

This group of three 8 bit registers contains the original timer value which is carried over to the timer count register after timer enable or zero detect impulse.

After RESET, all bits remain unaffected.

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2.6.6 Timer Count Registers; High, Middle, Low (PI/T $2F, $31, $33)

The current timer count is contained in this group of registers (see section 2.6.5).

After RESET, all bits remain unaffected.

2.6.7 Timer Status Register (PI/T $35)

Bit 0 of this register contains information regarding zero detect status. This bit is set when the counter moves from $000001 to $000000, and is reset through a direct reset, or when the timer is placed in halt state.

After RESET, all bits are returned to zero.

2.7 Address Map

Address Offset		Read/Write Access	Byte/Word Access
$40	ADC Read/Convert Address	R/W	W
$7F	Identification Byte	R	B
	-- Reserved. Do not access --		
$35	Timer Status Register	R/W	B
$33	Timer Count Register - Low	R	B
$31	Timer Count Register - Middle	R	B
$2F	Timer Count Register - High	R	B
$2D	-- Reserved. Accessible --		
$2B	Counter Preload Register - Low	R/W	B
$29	Counter Preload Register - Middle	R/W	B
$27	Counter Preload Register - High	R/W	B
$25	-- Reserved. Accessible --		
$23	Timer Interrupt Vector Register	R/W	B
$21	Timer Control Register	R/W	B
	-- Reserved. Do not access --		
$1B	Port Status Register	R/W	B
	-- Reserved. Do not access --		
$13	Port B Data Register	R/W	B
$11	Port A Data Register	R/W	B
$0F	Port B Control Register	R/W	B
$0D	Port A Control Register	R/W	B
$0B	Port Interrupt Vector Register	R/W	B
$09	-- Reserved. Do not access --		
$07	Port B Data Direction Register	R/W	B
$05	Port A Data Direction Register	R/W	B
$03	Port Service Request Register	R/W	B
$01	Port General Control Register	R/W	B
$00			

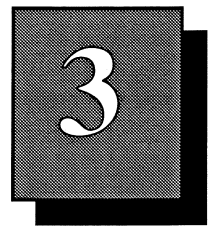
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3. CONFIGURING AND INSTALLING THE PB-DIN AND PB-DIO

This chapter explains how to install the PB-DIN and PB-DIO modules for system operation. Before making any connections, please ensure that all system devices are turned off.

Caution!

1.) Before installing or removing any boards, always turn off the power to the bus and external power supplies. Inserting or removing modules while the power is on could result in damage to the modules.

2.) Please ensure that all jumpers are configured before installing the PB-DIN/DIO. For further details on jumper configuration, please refer to the IMOD or VMOD2 User's manual.

3.1 Changing the Input Voltage

The input voltage on PB-DIN can be altered by changing resisttor networks 6, 7, 8 and 9. Input voltages and their corresponding resistor values are shown below.

Input Voltage	Resistor Value
5 V	390 Ω
12 V	1.8 KΩ
24 V	4.7 KΩ

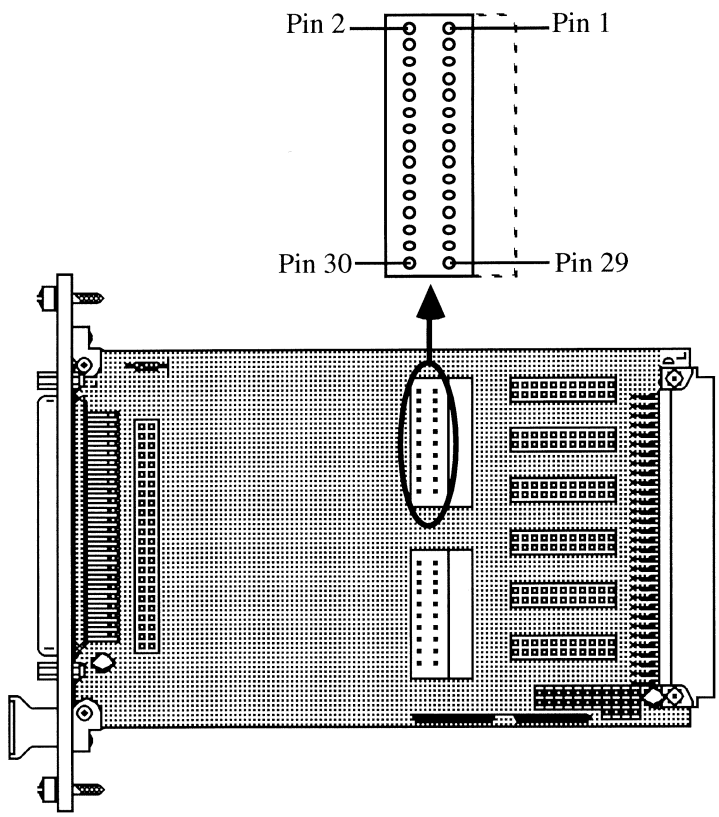
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3.2 Connector to the 8 Bit Data Bus (ST1)

Pin No.	Signal	Pin No.	Signal
1	GND	2	+5V (VCC)
3	+12V	4	-12V
5	R/W	6	CLK
7	RESET*	8	DTACK*
9	INTA*	10	CS*
11	INT	12	NC
13	ID7	14	IDS0*
15	ID6	16	IAS*
17	ID5	18	IA6
19	ID4	20	IA5
21	ID3	22	IA4
23	ID2	24	IA3
25	ID1	26	IA2
27	ID0	28	IA1
29	GND	30	+5V (VCC)

NOTE: * is Active Low.

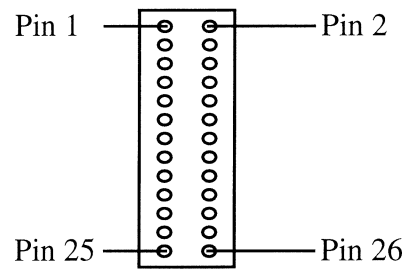


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3.3 Output Connector (ST2)

Pin No.	Signal	Pin No.	Signal
1	Vcc	2	Vcc
3	PA0	4	PB0
5	PA1	6	PB1
7	PA2	8	PB2
9	PA3	10	PB3
11	PA4	12	PB4
13	PA5	14	PB5
15	PA6	16	PB6
17	PA7	18	PB7
19	H1	20	H3
21	H2	22	H4
23	GND	24	GND
25	GND	26	GND



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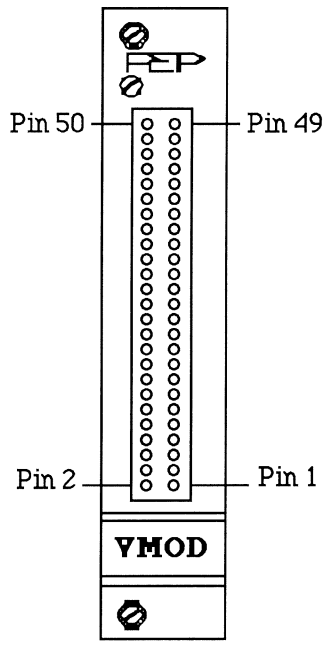
3.4 PB-DIN/DIO Pinouts

VMOD Front Panel ST3	VMOD Bu2A			VMOD Bu2B		
	PB-DIN ST2 Signals	Pins	PB-DIO ST2 Signals	PB-DIN ST2 Signals	Pins	PB-DIO ST2 Signals
1				VCCEB	24	GND Ext
2				VCCEB	23	GND Ext
3				H4E	22	H4
4				H2E	21	H2
5				H3E	20	H3
6				H1E	19	H1
7				PB7E	18	PB7
8				PA7E	17	PA7
9				PB6E	16	PB6
10				PA6E	15	PA6
11				PB5E	14	PB5
12				PA5E	13	PA5
13				PB4E	12	PB4
14				PA4E	11	PA4
15				PB3E	10	PB3
16				PA3E	9	PA3
17				PB2E	8	PB2
18				PA2E	7	PA2
19				PB1E	6	PB1
20				PA1E	5	PA1
21				PB0E	4	PB0
22				PA0E	3	PA0
23				NC	25, 26	GND Ext
24				VCCEA	1, 2	Vcc Ext
25	NC	- -	NC	NC	- -	NC
26	NC	- -	NC	NC	- -	NC
27	VCCEB	24	GND Ext			
28	VCCEB	23	GND Ext			
29	H4E	22	H4			
30	H2E	21	H2			
31	H3E	20	H3			
32	H1E	19	H1			
33	PB7E	18	PB7			
34	PA7E	17	PA7			
35	PB6E	16	PB6			
36	PA6E	15	PA6			
37	PB5E	14	PB5			
38	PA5E	13	PA5			
39	PB4E	12	PB4			
40	PA4E	11	PA4			
41	PB3E	10	PB3			
42	PA3E	9	PA3			
43	PB2E	8	PB2			
44	PA2E	7	PA2			
45	PB1E	6	PB1			
46	PA1E	5	PA1			
47	PB0E	4	PB0			
48	PA0E	3	PA0			
49	NC	25, 26	GND Ext			
50	VCCEA	1, 2	Vcc Ext			

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Figure 3.1 Illustration of VMOD2/IMOD Front Panel



In this example, a VMOD front panel is shown. This figure is also relevant to VMOD2 and IMOD.

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3.5 Using PB-DIN as a 20 Bit Input Module

This application note is for customers who want to use the PB-DIN as a 20 bit input module only, without interrupt requests. (Port A + Port B + H1 - H4)

To implement the PB-DIN in this way, the following bytes must be written to the PI/T 68230:

Bytes Written	PI/T Address	Description
$00	PI/T $01	Port General Control Register
$00	PI/T $03	Port Service Request Registere
$00	PI/T $05	Port A Data Direction Register
$00	PI/T $07	Port B Data Direction Register
$C0	PI/T $0D	Port A Control Register
$C0	PI/T $0F	Port B Control Register

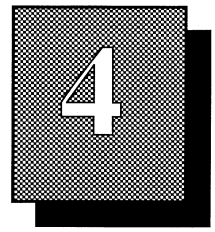
The input levels of Port A, Port B, and the handshake lines H1 through H4 can be read from the following PI/T addresses:

$11	Port A Data Register
$13	Port B Data Register
$1B	Port Status Register

With open inputs, Port A and Port B Data Registers will read $FF and the Port Status Register will read $F0.

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4. PROGRAM EXAMPLES

WARNING!

The programs found in this chapter are **only examples!** They may or may not run on your system, depending on the system configuration.

4.1 Counter

```
*************************************************************************
* This routine initializes the timer registers for counter applications.  The TIN pin is used to
* provide the input pulses.  The timer IRQ is not used (*B18 & B19:  1-3).
*
*


*                       VDAD Address

Bas_Ad                  EQU$FE0400Base Address

*                       VDAD Register Offsets

TCR                     EQU$21Timer Control Register
CPRH                    EQU$27Counter Preload Register (high)
CPRM                    EQU$29Counter Preload Register (middle)
CPRL                    EQU$2BCounter Preload Register (low)
CRH                     EQU$2FCounter Register (high)
CRM                     EQU$31Counter Register (middle)
CRL                     EQU$33Counter Register (low)


*                       Example Definitions

S_Val                   EQU$FFFFFFCounter value at start
TCtrl1                  EQU$07Control byte (TIN = Clk, prescaler off)
TCtrl2                  EQU$13Control byte (TIN = Enable, prescaler on)

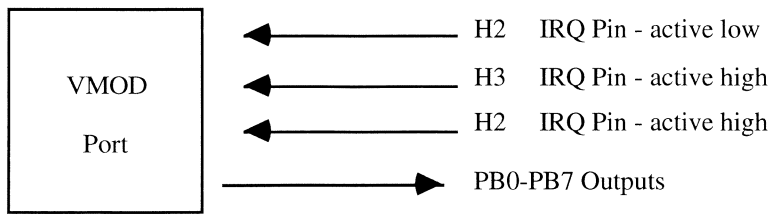
Init:           move.1  #Bas_Ad,a0          Load Base Address
                movep.1 #S_Val,CPRH(a0)     Load Counter Preload Register
                move.b  #TCtrl1,TCR(a0)     Enable counter
                  :
read_Counter    movep.1 CRH(a0),d0          Read actual counter value
```

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4.2 Initialisation of Bit I/O and Change of State IRQ

```
*******************************************************************************
* This routine shows how to initialize an I/O port with 8 outputs and 3 IRQ inputs, using the
* following configuration:
*
*
*
```




```
*
```

```
                        VMOD Address

Bas_Ad                  EQU     $FE0400         VMOD Base Address


                        Register Offsets

PGCR                    EQU     $01             Port General Control Register
PSRR                    EQU     $03             Port Service Request Register
PBDDR           EQU     $07             Port B Data Direction Register
PIVR                    EQU     $0B             Port Interrupt Vector Register
PACR                    EQU     $0D             Port A Control Register
PBCR                    EQU     $0F             Port B Control Register
PSR                     EQU     $1B             Port Status Register
Lev_Ad                  EQU     $FF             VDAD Interrupt Level Register


*                       Example Definitions

IRQL                    EQU     $1              Interrupt Level (example)
IRQV                    EQU     $F2             Interrupt Vector Number (example)

Init:           movea.l #Bas_Ad,a0              Load base address
                move.w  #IRQL,Lev_Ad(a0)        Set interrupt level
                move.b  #IRQV,PIVR(a0)          Load interrupt vector number
                move.b  #$18,PSRR(a0) Initialize PI/T IRQ pins
                move.b  #$3C,PGCR(a0)Define H pin sense, enable H2-H4
                move.b  #$FF,PBDDR(a0)          Set PB0-PB7 data direction
                  :
                  :
IRQ_Enable:     move.b  #0F,PSR(a0)             Reset H2S, H3S, H4S status bits
                move.b  #$84,PACR(a0) Enable H2 interrupt
                move.b  #$86,PBCR(a0) H3, H4 interrupts
                  :
                  :
```

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4.3 Timer

```
*******************************************************************************
*  This routine initializes the timer for a time measurement example.  The Tin pin is used as an enable,
*  so that the start and stop counter functions are controlled externally.  The timer is in the run state
*  when the timer enable bit in the Timer Control Register is 1 and the Tin pin is low.
*
Init:       move.l   #Bas_Ad,a0          Load base Address
            movep.l  #S_Val,CPRH(a0)     Load Counter Preload Registers
            move.b   #TCtrl2,TCR(a0)     Enable counter if Tin is low
              :
            movep.l  CRH(a0),d0          Read actual counter value
            move.l   #S_Val,d1           Calculate multiplicator for
            sub.l    d0,d1               internal clock (8 MHz)
```


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Using PB-DIN as a 20 Bit Input Module

This application note is for customers who want to use the PB-DIN as a 20 bit input module only, without interrupt requests. (Port A + Port B + H1 - H4)

To implement the PB-DIN in this way, the following bytes must be written to the PI/T 68230:

Bytes Written	PI/T Address	Description
$00	PI/T $01	Port General Control Register
$00	PI/T $03	Port Service Request Register
$00	PI/T $05	Port A Data Direction Register
$00	PI/T $07	Port B Data Direction Register
$C0	PI/T $0D	Port A Control Register
$C0	PI/T $0F	Port B Control Register

Now the input levels of Port A, Port B, and the handshake lines H1 through H4 can be read from the following PI/T addresses.

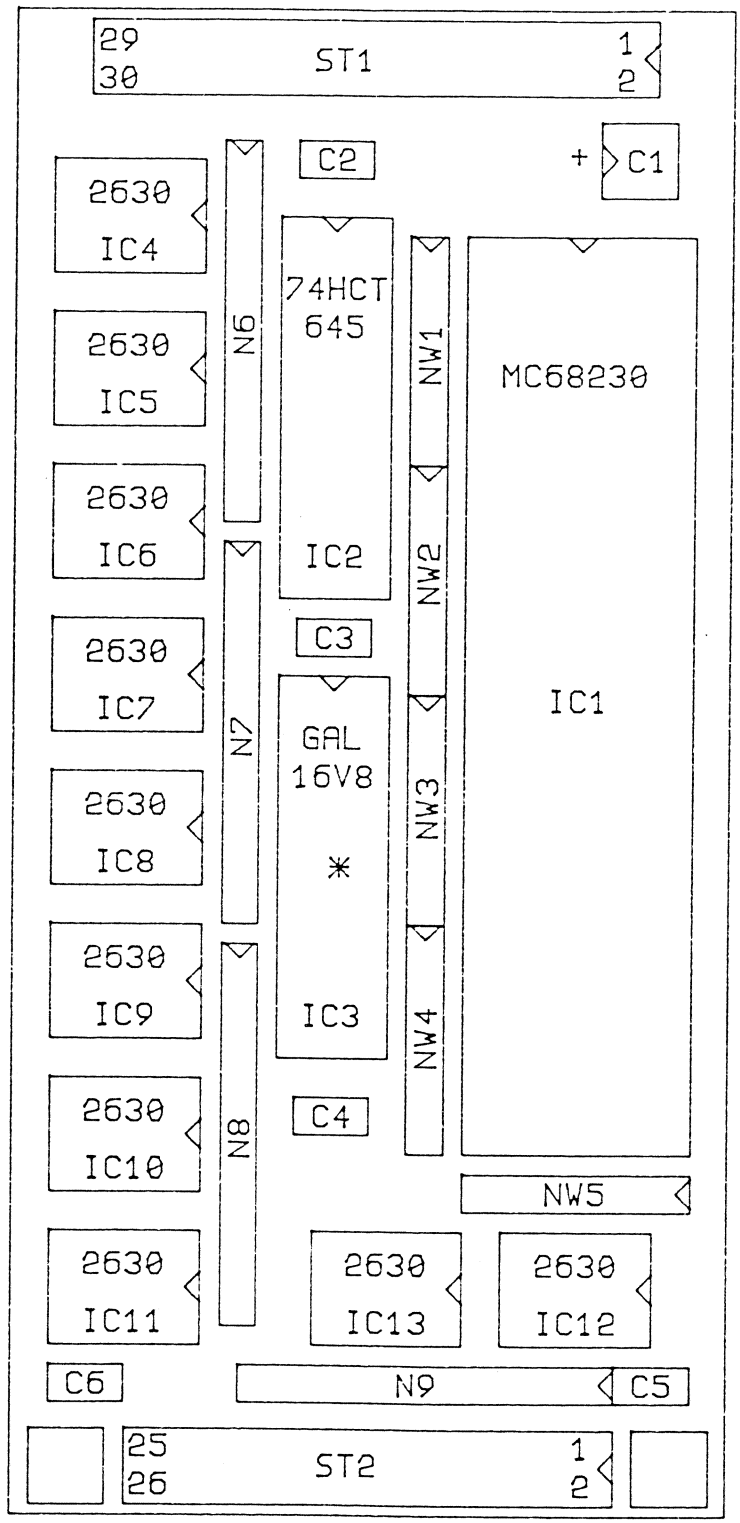
$11 Port A Data Register
$13 Port B Data Register
$1B Port Status Register

With open inputs, you will read $FF from the Port A and Port B Data Registers and $F0 from the Port Status Register

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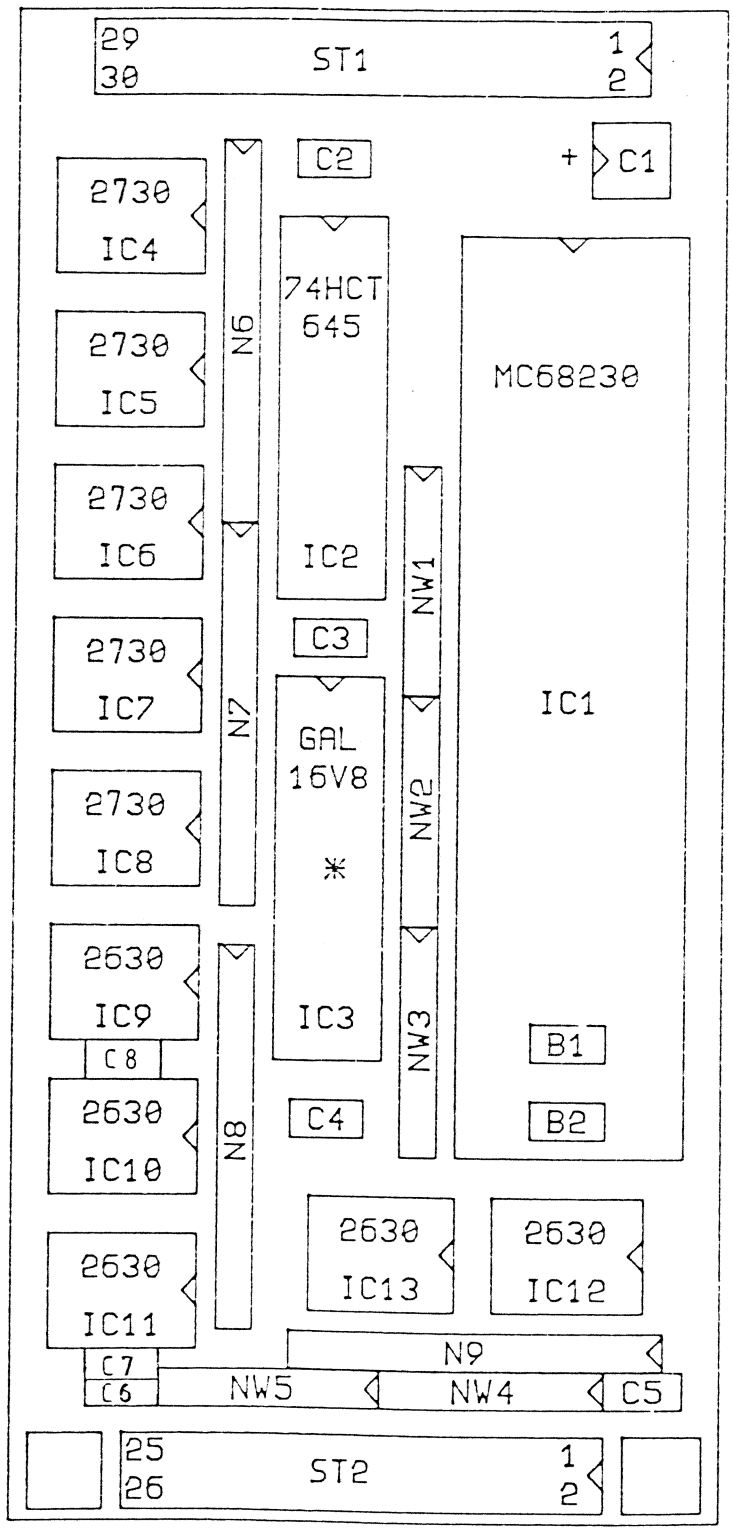


* entspr. Bestell-Nr / according to order-no 523-14

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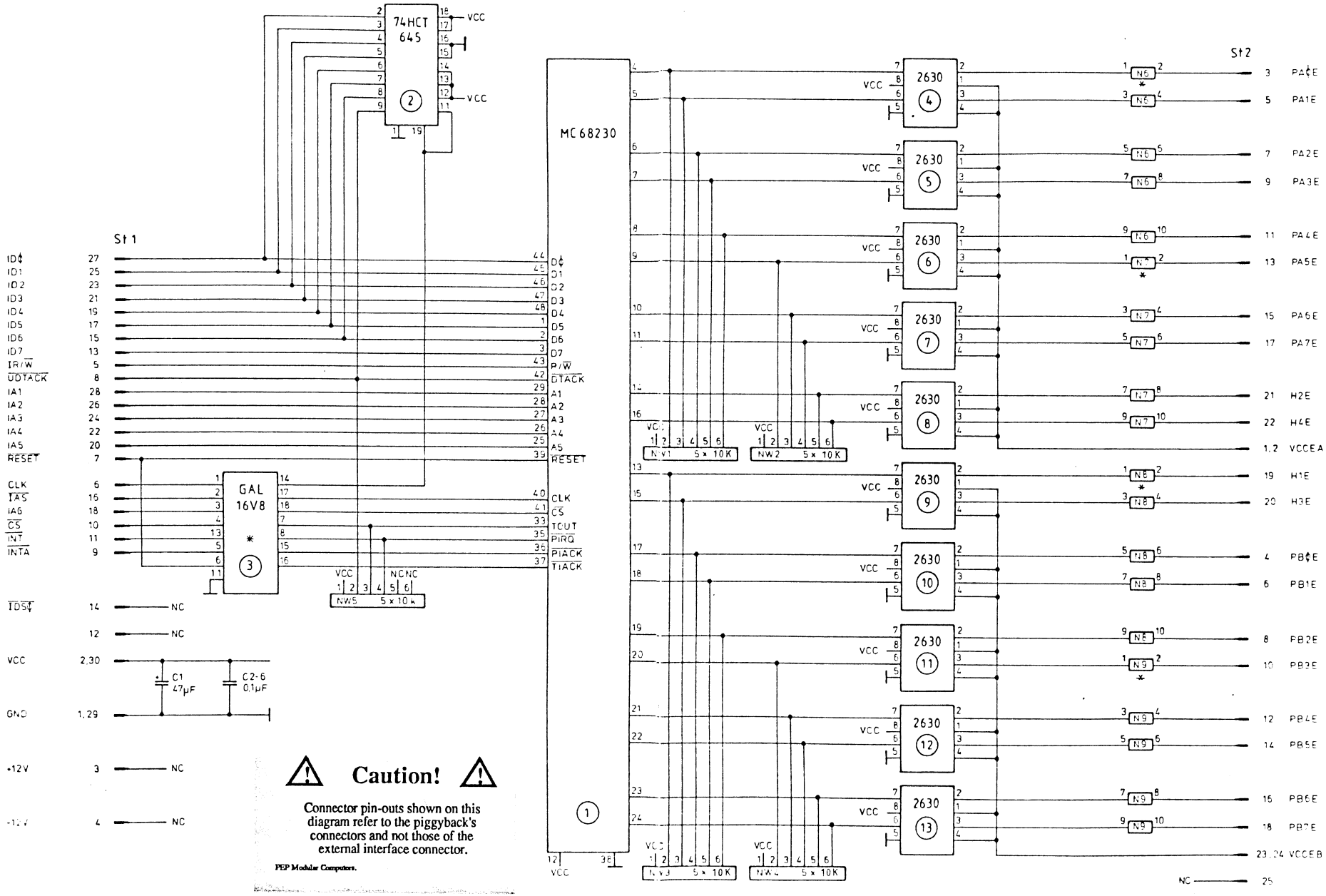


* entspr. Bestell-Nr / according to order-no 523-13

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Caution!

Connector pin-outs shown on this diagram refer to the piggyback's connectors and not those of the external interface connector.

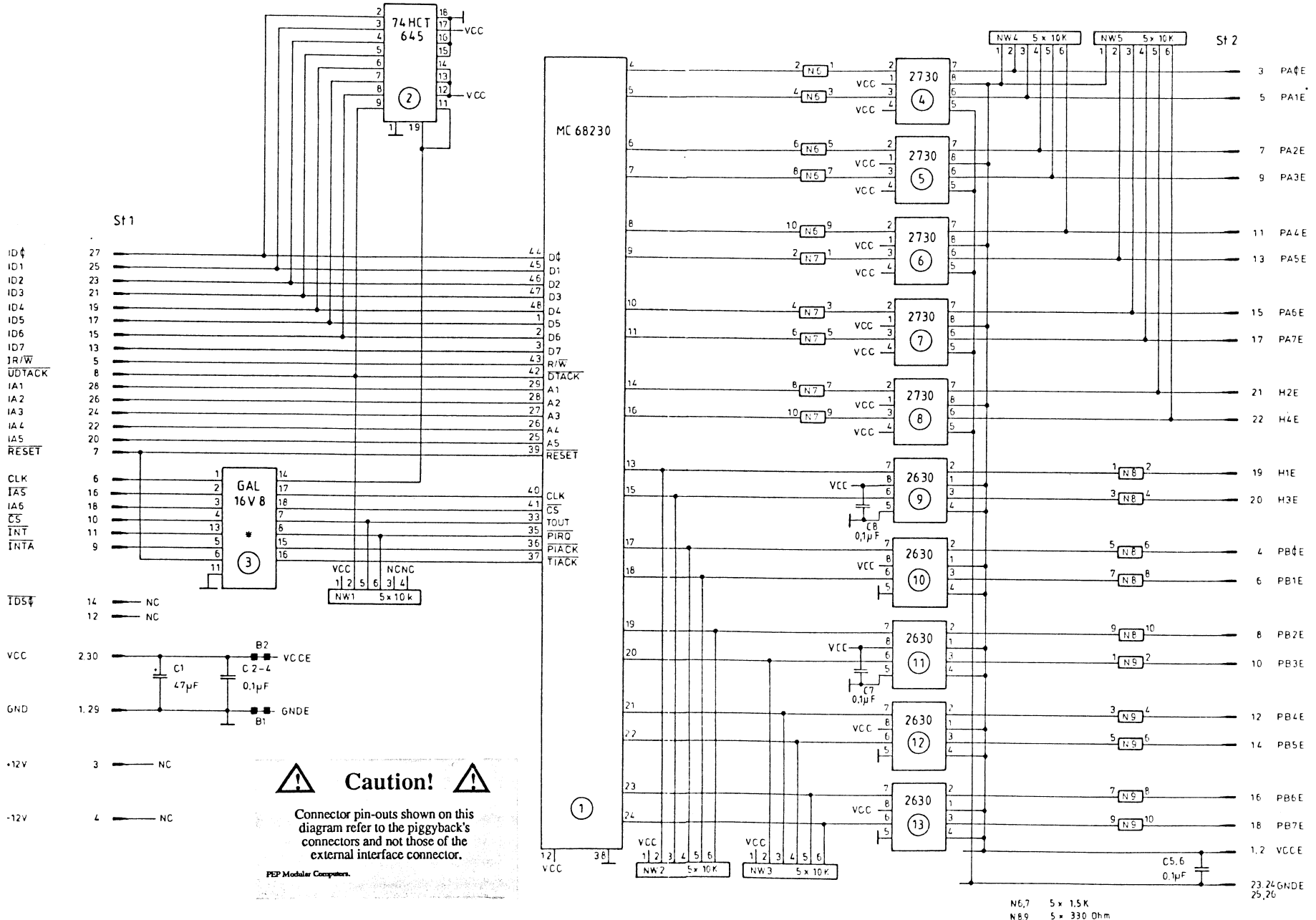
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Errata 1

Manual: 02923

Manual Index: 0101

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1. Reference: Page: 1-2, Chapter 1.3, Table

The referenced information (table) is superceded by the following table.

Description	PB-DIN	PB-DIO
Input Channels	16 digital inputs plus 4 additional input lines. All input channels are opto-isolated.	8 digital inputs plus 2 handshake lines. All input channels are opto-isolated.
Output Channels	None.	8 digital output lines plus 2 hand-shake lines.
Input Voltage	Two versions: 5V DC and 24V DC typically.	5V DC
Input Current	Two versions:10mA per channel at 5V and 5mA per channel at 24V typ-ically.	10mA per channel at 5V VCCE max =6.5V
Output Voltage	Not applicable.	5V
Output Current	Not applicable.	10mA
Switching Level	<1.5V = low > or = 3.0V = high	<1.5V = low > or = 3.0V = high
Input Frequency	500 KHz maximum	500 KHz maximum
Isolation Voltages	2500 V rms input to system, 100V DC btween inputs.	2500 V rms input to system, 100V DC btween inputs.
Timer	24 bit.	24 bit.
Timer Clock	8 MHz.	8 MHz.
Identification Byte	$F3	$F2
Address Range	128 byte blocks.	128 byte blocks.
DTACK Generation	Onboard.	Onboard.
Power Requirements	+5V DC (+ or - 5%) 500mA typically.	+5V DC (+ or - 5%) 500mA typically.
Temperature Ranges		
Operating	0°C to +70°C (Standard)	0°C to +70°C (Standard)
Storage	-40°C to +85°C (Extended)	-40°C to +85°C (Extended)
Operating Humidity	0 to 95% (Non-condensing)	0 to 95% (Non-condensing)
Piggyback Size	Width: 48mm Length: 100mm Depth: 12mm	Width: 48mm Length: 100mm Depth: 12mm

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Description	PB-DIN	PB-DIO
VMOD2/IMOD Interface	Two sets of twin row header pins providing all necessary communication paths and a mechanical mounting method.	Two sets of twin row header pins providing all necessary communication paths and a mechanical mounting method.

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Errata 2

Manual: 02923

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1. Reference: Page: 3-4, Chapter 3.4, Table 3.4

The referenced information (table) is supplemented by the following table. This table provides pinout cross-referencing between the ST2 connector of the piggyback module and the carrier board connector(s). Not all connector types are available on a single carrier board, therefore the table is to be read in context with the carrier board used.

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Table 1-1: PB-DIO-DIN to Carrier Board Pinout Table (Both Positions)

POS.	PB-DIN	PB-DIO	ST2	Carrier Board	
	Signal	Signal		MFO	DSUB
U P P E R	VCCEA	Vcc Ext	1, 2	50	50
	NC	GND Ext	25, 26	49	17
	PA0E	PA0	3	48	33
	PB0E	PB0	4	47	49
	PA1E	PA1	5	46	16
	PB1E	PB1	6	45	32
	PA2E	PA2	7	44	48
	PB2E	PB2	8	43	15
	PA3E	PA3	9	42	31
	PB3E	PB3	10	41	47
	PA4E	PA4	11	40	14
	PB4E	PB4	12	39	30
	PA5E	PA5	13	38	46
	PB5E	PB5	14	37	13
	PA6E	PA6	15	36	29
	PB6E	PB6	16	35	45
	PA7E	PA7	17	34	12
	PB7E	PB7	18	33	28
	H1E	H1	19	32	44
	H3E	H3	20	31	11
	H2E	H2	21	30	27
	H4E	H4	22	29	43
	VCCEB	GND Ext	23	28	10
	VCCEB	GND Ext	24	27	26
Not Used				26	42
Not Used				25	9

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POS.	PB-DIN	PB-DIO	ST2	Carrier Board	
	Signal	Signal		MFO	DSUB
L O W E R	VCCEA	Vcc Ext	1, 2	24	25
	NC	GND Ext	25, 26	23	41
	PA0E	PA0	3	22	8
	PB0E	PB0	4	21	24
	PA1E	PA1	5	20	40
	PB1E	PB1	6	19	7
	PA2E	PA2	7	18	23
	PB2E	PB2	8	17	39
	PA3E	PA3	9	16	6
	PB3E	PB3	10	15	22
	PA4E	PA4	11	14	38
	PB4E	PB4	12	13	5
	PA5E	PA5	13	12	21
	PB5E	PB5	14	11	37
	PA6E	PA6	15	10	4
	PB6E	PB6	16	9	20
	PA7E	PA7	17	8	36
	PB7E	PB7	18	7	3
	H1E	H1	19	6	19
	H3E	H3	20	5	35
	H2E	H2	21	4	2
	H4E	H4	22	3	18
	VCCEB	GND Ext	23	2	34
	VCCEB	GND Ext	24	1	1

Legend: Carrier Board, MFO, DSUB

where: MFO = 50-Pin, **M**ale, dual row header connector, **F**ront panel or **O**n-board
DSUB = 50-Pin, female Dsub front panel connector

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Errata 3

Manual: 02923

Manual Index: 0101

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1. Reference: Page: 3-1, Chapter 3.1

The referenced information (table showing input voltages and resistor values) is superceded by the following table. The replacement table revises the resistor values.

Input Voltage	Resistor Value
5 V	330 Ohms
12 V	1 KOhm
24 V	2.2 KOhm

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