128-Channel Digital I/O Module

LW-M104-I128 R2 (DX)

User's Manual

(Release 2.0)

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Revision History

Revision	Description	Date
1.0	Initial Release	1/10/2008
1.1	Add Software Programmable Base Address Capability Change Jumper Setting to DIP Switch Setting	10/18/2009
2.0	Add Output Enable Function Save Settings in Flash Memory for DX Version	1/12/2011

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This manual is for the ***LW-M104-I128 R2 (DX) 128-Channel Digital I/O Module***.

P/N: LW-M104-I128-M2

October 10, 2009

Packing List

Before you begin installing your module, please make sure that the following materials have been shipped:

- *LW-M104-I128 R2 (DX) 128-Channel Digital I/O Module*
- *Datasheet*
- *Quick Start Guide*

If any of these items are missing or damaged, contact your distributor or sales representative immediately.

Common Model No. List	Description
LW-M104-I128 R2 (DX)	128-Channel Digital I/O Module

Safety and Static-Electricity

FCC

This device complies with the requirements in part 15 of the FCC rules:

Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

Caution !

Operation of this device in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his/her own expense. The user is advised that any equipment changes or modifications not expressly approved by the party responsible for compliance would void the compliance to FCC regulations and therefore, the user's authority to operate the equipment.

Warning !

There is a danger of a new battery exploding if it is incorrectly installed. Do not attempt to recharge, force open, or heat the battery. Replace the battery only with the same or equivalent type recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions.

Please plug and unplug parts under the condition without power. Make sure power is turned off before setting boards in order to avoid the damage on the sensitive parts caused by power impact.

Acting !

Modern electrical parts are very sensitive to static electricity. Before setting boards, please put them into anti-static pads or bags. It has better to wear anti-static bangle or gloves whenever taking the boards.

Additional Information and Assistance

Visit the LongWin web site at **http://www.LWComputer.com** where you can find the latest information about the product.

Contact your distributor, sales representative, or LongWin's customer service center for technical support if you need additional assistance.

Please have the following information ready before you call:

- *Product name and serial number*
- *Description of your peripheral attachments*
- *Description of your software (operating system, version, application software, etc.)*
- *A complete description of the problem*
- *The exact wording of any error messages*

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Chapter 1

General Information

This chapter gives background information on the LW-M104-I128 128-Channel Digital I/O module.

Information includes:

- *Introduction*
- *Features*
- *Specifications*
- *Physical Dimension*

Chapter 1. General Information

1.1. Introduction

The ***LW-M104-I128 R2 (DX) Digital I/O (DIO) Module*** is designed to meet the size, power consumption, temperature range, quality, and reliability demands of embedded system applications, and satisfies various industrial and consumer applications. This solid, general purpose digital I/O module works on a single +5 Volt power supply at -40°C to +85°C Extended temperature.

The ***LW-M104-I128 R2 (DX) Digital I/O Module*** provides buffered 64-channel digital inputs and 64-channel digital outputs. The digital I/O channels are accessed via eight 20-pin connectors. Each connector provides 16 bits of digital I/O divided into two 8-bit ports. Each I/O line is buffered and output capable of sourcing or sinking up to 35mA.

The board was designed for industrial applications and can be installed in PC/104 bus connector.

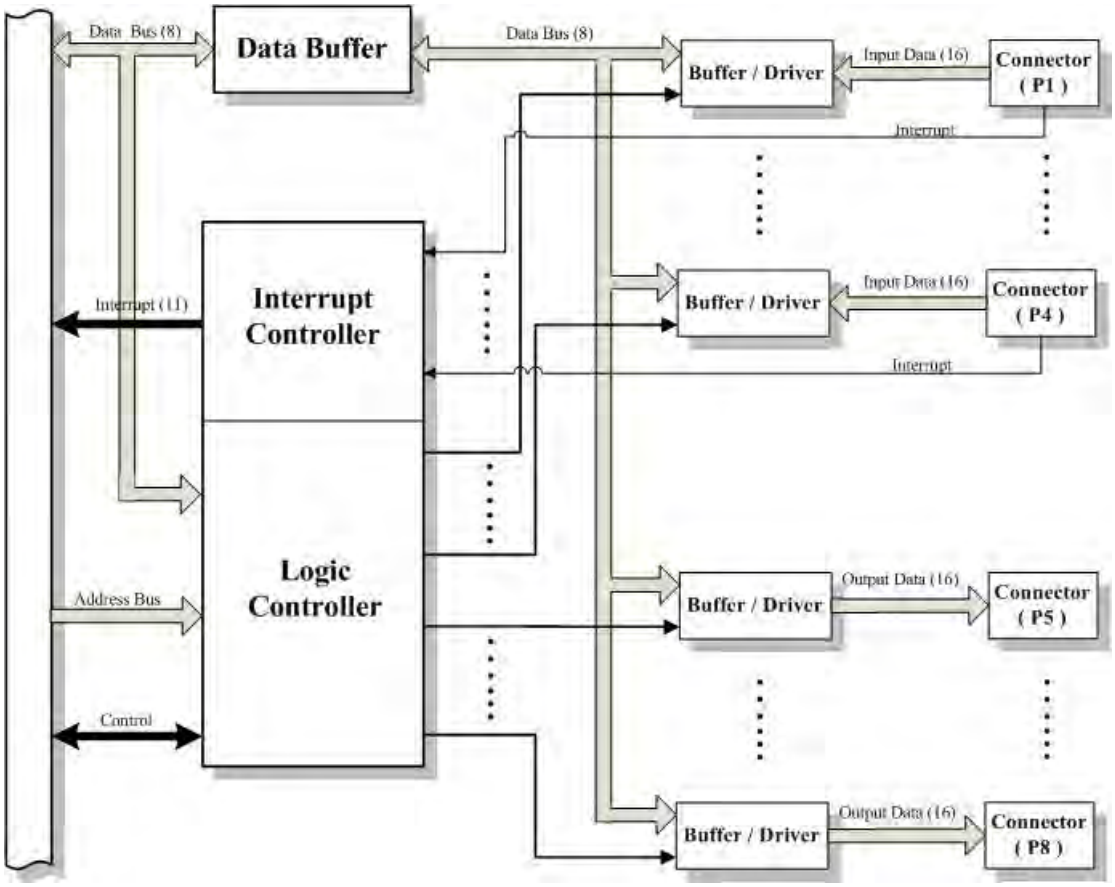

Figure 1. LW-M104-I128 R2 (DX) Block Diagram

The ***LW-M104-I128 R2 (DX) Digital I/O Module*** occupies 11-Byte consecutive I/O locations. The base address is selectable via jumpers.

The module provides access to interrupt levels IRQ3-7, 9-12, 14 and 15 on the PC bus for real-time background applications. Using interrupts allows "background" operation, where I/O can be performed while the PC is executing another task, such as running an unrelated applications program. This feature is useful for performing I/O at a controlled rate. Since a counter output can be used to drive the interrupt request pin on the input connector at a periodic rate for a user supplied interrupt service routine that performs whatever function is necessary in response to the interrupt.

The interrupt is enabled and set by software setting the relative register.

1.2. Features

- *64-Channel Digital Input with Build-in Pull-up*
- *64-Channel Digital Output*
- *Software Programmable Base Address*
- *Software Programmable Interrupt*
- *Flexible Sharing Interrupt*
- *Settings Saved in Flash Memory (DX Version Only)*
- *TTL Level Input and Output*
- *16 Power-Up I/O Base Address Options*
- *All I/O Lines Buffered on the Board.*
- *Software Setting and Clear for Output Port*
- *Software Control Output Enable*
- *Build-In Pull-Up Resistor for Input Port*
- *-40 ~ 85° C Extended Operating Temperature*
- *+5V Supply Available to the User.*
- *Single Power Supply*

1.3. Specifications

The following section provides technical specifications for the ***LW-M104-I128 R2 (DX) Digital I/O Module***.

Bus Types:

- PC/104 (IEEE-996) (ISA Compatible)

I/O Channel

- 64 Channel Digital Inputs with Build-In Pull-Up
- 64 Channel Digital Outputs
- TTL Level Compatible

I/O Address Space and Base Address

- Software Programmable Base Address

- 16-Byte Consecutive Series I/O Addresses Space
- 16 Base Addresses Option on Power Up (Can be customized)
  0x100, 0x180, 0x200, 0x220, 0x280, 0x2C0, 0x300, 0x310, 0x320, 0x600, 0x800, 0xC00, 0x1500, 0x1800, 0x3200, 0x3800 (Hexadecimal)

Interrupt

- Software Programmable Interrupts
- Sharing Interrupt
- Independent Interrupt Setting for Each 16-bit Input Port
- 11 Interrupt Sources of IRQ3 to IRQ7, IRQ9 to IRQ12, IRQ14 and IRQ15

Digital I/O Interface

- Eight 20-Pin 0.100" Pitch IDC Connector

Mechanical and Environmental

- Dimensions: 3.6 x 3.8 inch (90 x 96 mm)
- Operating Temperature: -40 ~ 85° C Extended Temperature
- Storage Temperature: -55° to +120° C
- Operating Humidity: 0% ~ 95% Relative Humidity, No Condensing
- Weight: 60 gm
- Shock and Vibration: Tested to MIL-STD 202F, Method 213B, Table 213-I, Condition A (three 50G shocks in each axis) and MIL-STD 202F, Method 214A, Table 214-I, Condition D (11.95B random vibration, 100 Hz to 1000 Hz for 5 minutes per axis).
- PC/104 Expansion Bus: 104-Pin 0.1 Inch Pitch Stackthrough Connector. Electrical Specifications Equivalent to ISA Bus Specification

Power Requirement

- Voltage: +5V +/- 5%
- Current: 0.1A @ 5V (Typical)

1.4. Physical Dimension

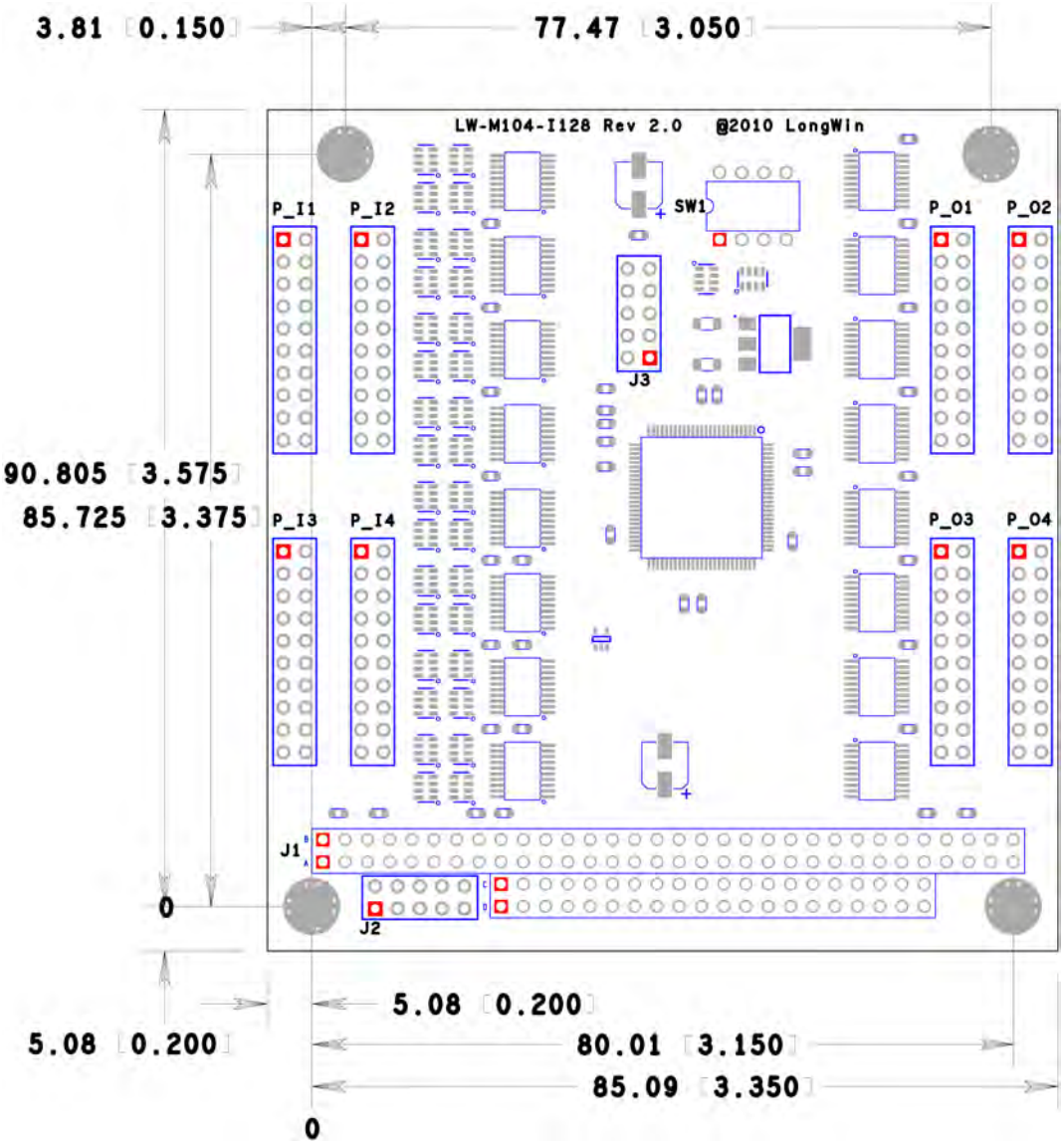

Figure 2. LW-M104-I128 R2 (DX) Board Dimension (Millimeter)

Chapter 2

Installation

This chapter explains the setup procedures of LW-M104-P4I1 digital I/O module, including instructions on setting jumpers and wiring connectors. Be sure to read all safety precautions before you begin the installation procedure.

Information includes:

- *DIP-Switch*
- *Connectors*
- *Power Connector (J2 Option)*
- *Digital Input Connectors*
- *Digital Output Connectors*
- *PC/104 Expansion Bus (J1)*

Chapter 2. Installation

2.1. DIP-Switch of Power-Up Base Address

The ***LW-M104-I128 R2 (DX) Digital I/O Module*** has a 4-bit DIP Switch that allows you to configure your digital I/O module power-up base address to suit your application. The figures and table below list the functions of the various settings.

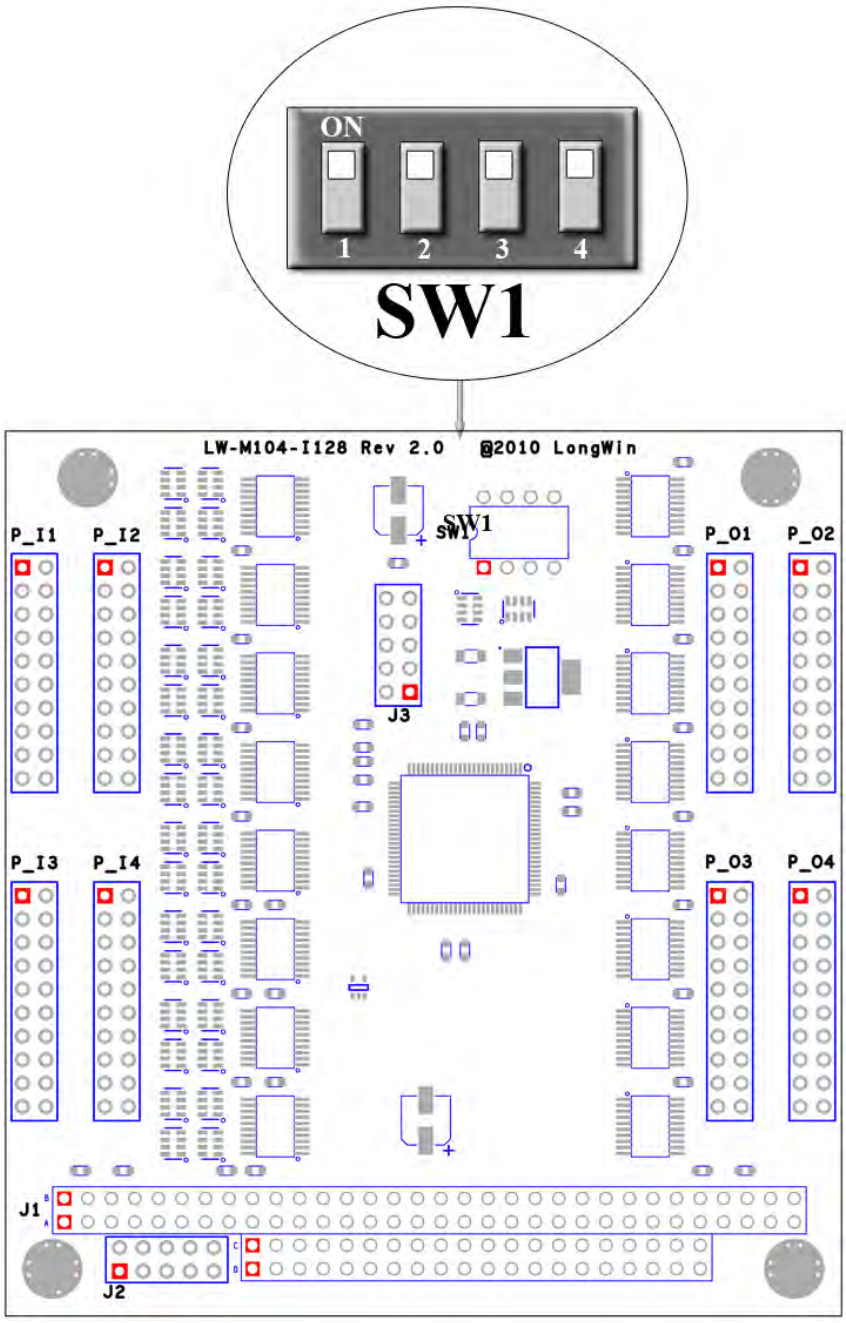

Figure 3. SW1DIP-Switch Location

The module has DIP Switch in default positions so that in most cases it requires no special setting for normal operation. You can connect the power and peripherals to operate immediately.

The ***LW-M104-I128 R2 (DX) Digital I/O Module*** occupies 16 consecutive I/O locations. To set desired I/O port power-up base address, DIP Switch must be correctly set on the board. These switches are marked as 1 to 4. Be careful when selecting the base address as some selections conflict with existing PC ports.

IMPORTANT: Carefully review the *Table 1. I/O Base Address DIP-Switch Setting Table* before selecting the I/O base address. If the addresses of two circuits overlap you will experience unpredictable computer behavior.

Table 1. Power-Up Base Address DIP-Switch Setting

DIP-Switch Reference				Base Address
4	3	2	1 *	
OFF	OFF	OFF	OFF	0x100
OFF	OFF	OFF	ON	0x180 **
OFF	OFF	ON	OFF	0x200
OFF	OFF	ON	ON	0x220 **
OFF	ON	OFF	OFF	0x280
OFF	ON	OFF	ON	0x2C0 **
OFF	ON	ON	OFF	0x300 (Default)
OFF	ON	ON	ON	0x310 **
ON	OFF	OFF	OFF	0x320
ON	OFF	OFF	ON	0x600 **
ON	OFF	ON	OFF	0x800
ON	OFF	ON	ON	0xC00 **
ON	ON	OFF	OFF	0x1500
ON	ON	OFF	ON	0x1800 **
ON	ON	ON	OFF	0x3200
ON	ON	ON	ON	0x3800 **

For DX Version Only:

* When Bit 1 of SW1 is set to "OFF", the system will power up with one of 8 power-up base address options.

When Bit 1 of SW1 is set to "ON", the system will power up with the last saved base address in flash memory. After setting the base address by software, it will be saved automatically in flash memory.

** Useless for DX version.

You may configure your module to match the needs of your application by setting switches.

Switches are designated with 1 to 4. *Table 1. I/O Base Address DIP-Switch Setting Table* is a summary of switch use. Factory settings are shown in the "Default".

A pair of needle-nose pliers (or a ball pen) may be helpful when working with switches. If you have any doubts about the best hardware configuration for your application, contact LongWin before you make any changes.

2.2. Connectors

On board connectors link the ***LW-M104-I128 R2 (DX) Digital I/O Module*** to external devices. Generally, you simply need a cable to make connections. Refer to *Figure 4. LW-M104-I128 R2 (DX) Connectors Location* for the locations of the connectors J1, J2 and P1 to P8. *Table 2. LW-M104-I128 R2 (DX) Connector List* summarizes the use of the connectors. The interface is described in following section, showing pin assignments, signal definitions. Please refer to relative section for detail.

All the I/O connectors are dual-row male headers with 0.1 inch pitch for use with flat ribbon IDC female connectors and ribbon cable. Shrouded with center-bump polarized headers are manufacturing options upon required. It will prevent accidentally installing cables backwards.

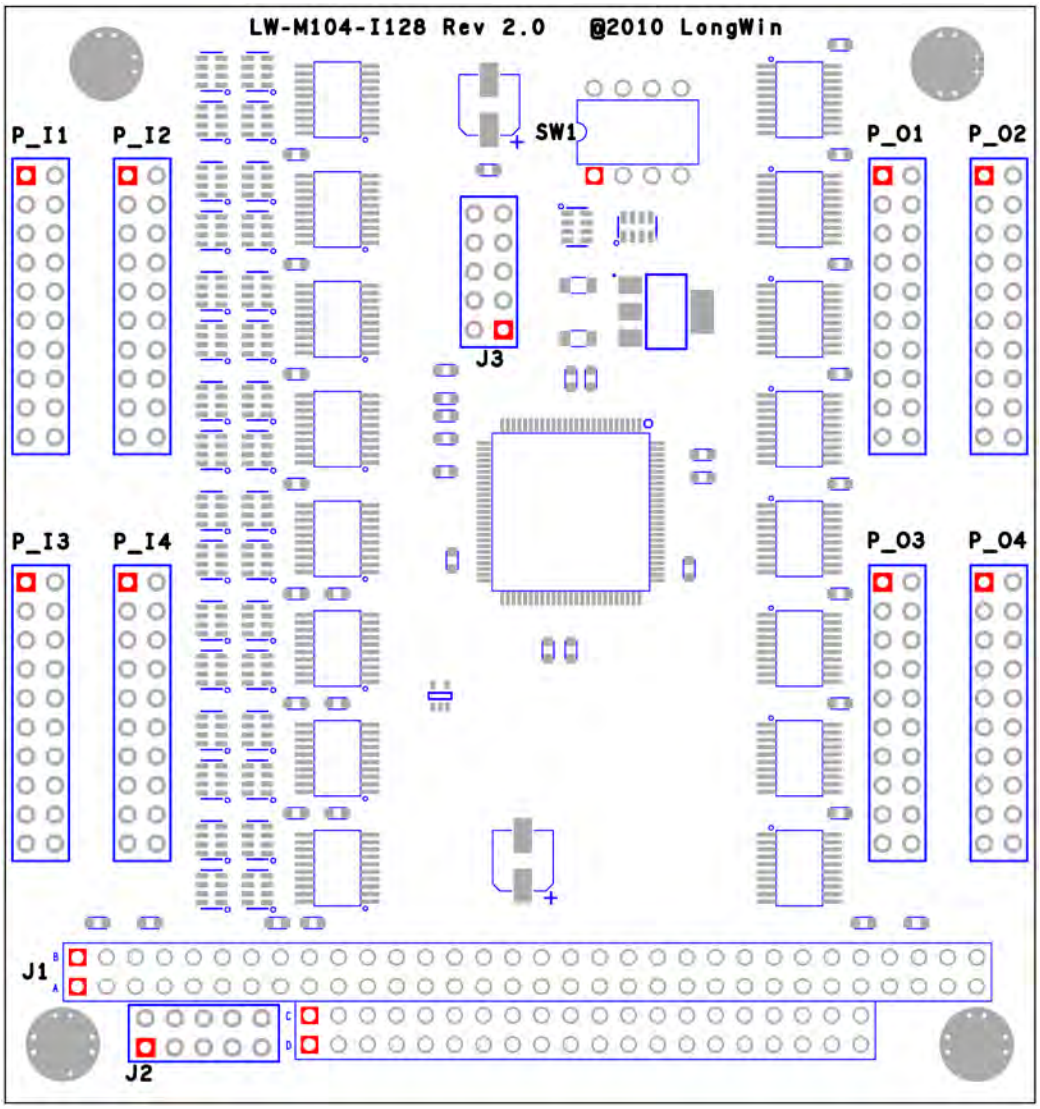

Figure 4. LW-M104-I128 R2 (DX) Connectors Location

You can design a PCB board assembly, made with female connectors in the same relative positions as the LW-M104-I128 R2 (DX)'s headers, to eliminate cables requirements. Precise dimensions for locating connectors are provided upon required.

Table 2. LW-M104-I128 R2 (DX) Connector List

Reference	Description	Pitch
J1	PC/104 Expansion Connector	0.1 Inch
J2	Power Connector	0.1 Inch
P_I1 – 4	Digital Input Connector	0.1 Inch
P_O1 – 4	Digital Output Connector	0.1 Inch

The PC/104 expansion bus appears on connector J1. It uses a 0.1 Inch 4-row connector called out in the PC/104 specification. J1 has both male and female connections on top and bottom sides, allowing for "Stackthrough" assembly. You can expand the system with other PC/104 compliant expansion modules. These modules stack directly on the connectors.

2.3. Power Connector (J2 Option)

A standard 5x2-pin 0.1 inch pitch connector may be used to supply main power to the ***LW-M104-I128 R2 (DX) Digital I/O Module*** and to devices that require. The +5V power supply is used to provide power for stacked external 5V PC/104 module if needed.

Be sure the power plug is wired correctly before applying power to the board! See *Table 3. Power Connector Pin Assignment*.

Table 3. Power Connector Pin Assignment

Signal	Pin		Pin	Signal
Ground	1		2	Key
Ground	3		4	+5V
Ground	5		6	+5V
Ground	7		8	+5V
Ground	9		10	+5V

The ***LW-M104-I128 R2 (DX) Digital I/O Module*** requires only single +5VDC (±5%) for operation. The exact power requirement of the ***LW-M104-I128 R2 (DX) Digital I/O Module*** depends on several factors, including the installed digital I/O devices, the peripheral connections.

2.4. Digital Input Connectors

The 64 digital input channels are accessed via four 20-pin IDC connectors of P_I1 to P_I4. Each connector provides 16 bits of digital input divided into two 8-bit ports. Pin assignments for digital input connectors are detailed as followings.

Table 4. Digital Input Connector Pin Assignment (P_I1/I2/I3/I4)

Description	Signal	Pin		Pin	Signal	Description
+5V Power Supply	+5V	1		2	+5V	+5V Power Supply

Data 7 of Channel B	ID7B	3		4	ID6B	Data 6 of Channel B
Data 5 of Channel B	ID5B	5		6	ID4B	Data 4 of Channel B
Data 3 of Channel B	ID3B	7		8	ID2B	Data 2 of Channel B
Data 1 of Channel B	ID1B	9		10	ID0B	Data 0 of Channel B
Data 7 of Channel A	ID7A	11		12	ID6A	Data 6 of Channel A
Data 5 of Channel A	ID5A	13		14	ID4A	Data 4 of Channel A
Data 3 of Channel A	ID3A	15		16	ID2A	Data 2 of Channel A
Data 1 of Channel A	ID1A	17		18	ID0A	Data 0 of Channel A
Ground	Gnd	19		20	Gnd	Ground

The +5V power supply can supply power to an external device through the connectors.

2.5. Digital Output Connectors

The 64 digital output channels are accessed via four 20-pin IDC connectors of P_O1 to P_O4. Each connector provides 16 bits of digital output divided into two 8-bit ports. Pin assignments for digital output connectors are detailed as followings.

Table 5. Digital Output Connector Pin Assignment (P_O1/O2/O3/O4)

Description	Signal	Pin		Pin	Signal	Description
Ground	Gnd	1		2	Gnd	Ground
Data 0 of Channel A	OD0B	3		4	OD1B	Data 1 of Channel A
Data 2 of Channel A	OD2B	5		6	OD3B	Data 3 of Channel A
Data 4 of Channel A	OD4B	7		8	OD5B	Data 5 of Channel A
Data 6 of Channel A	OD6B	9		10	OD7B	Data 7 of Channel A
Data 0 of Channel B	OD0A	11		12	OD1A	Data 1 of Channel B
Data 2 of Channel B	OD2A	13		14	OD3A	Data 3 of Channel B
Data 4 of Channel B	OD4A	15		16	OD5A	Data 5 of Channel B
Data 6 of Channel B	OD6A	17		18	OD7A	Data 7 of Channel B
+5V Power Supply	+5V	19		20	+5V	+5V Power Supply

The +5V power supply can supply power to an external device through the connectors.

2.6. PC/104 Expansion Bus (J1)

The ***LW-M104-I128 R2 (DX) Digital I/O Module*** provides a PC/104 expansion bus for additional system functions. This bus offers compact, self-stacking, modular expandability. The PC/104 expansion bus signals are implementing an ISA bus, available on a 104-pin ISA bus connector.

The growing list of PC/104 modules available from LongWin and hundreds of other PC/104 vendors includes such functions as communications interfaces, video frame grabbers, field bus interfaces, digital signal processors (DSPs), data acquisition and control functions, and many specialized interfaces and controllers. In addition, custom application-specific logic boards can also be stacked directly on top of the LW-M104-I128 R2 (DX) using its PC/104 expansion bus interface as a rugged and reliable interconnect.

The PC/104 expansion bus appears on a 104-pin 0.1 Inch pitch female quad-row header (32 x 2 + 20 x 2). An implementation of the ISA bus appears on J1.

Table 6. PC/104 Expansion Bus Pin Assignment (J1)

Pin	Row A	Row B	Row C	Row D	Pin
1	IOCHK*	GND	GND	GND	0
2	SD7	RESET	SBHE*	MEMCS16*	1
3	SD6	+5V	LA23	IOCS16*	2
4	SD5	IRQ9	LA22	IRQ10	3
5	SD4	-5V	LS21	IRQ11	4
6	SD3	DRQ2	LA20	IRQ12	5
7	SD2	-12V	LA19	IRQ15	6
8	SD1	SRDY*	LA18	IRQ14	7
9	SD0	+12V	LA17	DACK0*	8
10	IOCHRDY	KEY	MEMR*	DRQ0	9
11	AEN	SMEMW*	MEMW*	DACK5*	10
12	SA19	SMEMR*	SD8	DRQ5	11
13	SA18	IOW*	SD9	DACK6*	12
14	SA17	IOR*	SD10	DRQ6	13
15	SA16	DACK3*	SD11	DACK7*	14
16	SA15	DRQ3	SD12	DRQ7	15
17	SA14	DACK1*	SD13	+5V	16
18	SA13	DRQ1	SD14	MASTER*	17
19	SA12	REFRESH*	SD15	GND	18
20	SA11	BCLK	KEY	GND	19
21	SA10	IRQ7			
22	SA9	IRQ6			
23	SA8	IRQ5			
24	SA7	IRQ4			
25	SA6	IRQ3			
26	SA5	DACK2*			
27	SA4	TC			
28	SA3	BALE			
29	SA2	+5V			
30	SA1	OSC			
31	SA0	GND			
32	GND	GND			

Chapter 3

Technical Reference

This chapter explains contains information that permits users to create an embedded system customized to specific requirements.

Information includes:

- *I/O Address*
- *Digital I/O Channel*
- *Base Address*
- *Interrupt*
- *Programming Example*
- *PC/104 Stack Expansion*

Chapter 3. Technical Reference

3.1. I/O Address

The board occupies 11-Byte consecutive I/O locations... The module base address can be selected by jumper. If in doubt of where to assign the base address, refer to the *Table 1. I/O Base Address DIP-Switch* Setting Table for your reference.

The 11 consecutive series I/O addresses space is shown as following *Table 7. Digital I/O Address Map*.

Table 7. Digital I/O Address Map

Address	Read	Write
Base Address	P1 Channel A Input	Output Register for Channel A on P5
Base Address + 1	P1 Channel B Input	Output Register for Channel B on P5
Base Address + 2	P2 Channel A Input	Output Register for Channel A on P6
Base Address + 3	P2 Channel B Input	Output Register for Channel B on P6
Base Address + 4	P3 Channel A Input	Output Register for Channel A on P7
Base Address + 5	P3 Channel B Input	Output Register for Channel B on P7
Base Address + 6	P4 Channel A Input	Output Register for Channel A on P8
Base Address + 7	P4 Channel B Input	Output Register for Channel B on P8
Base Address + 8	**Interrupt Register for P1/P2** D[3:0]: IRQ Number for P1 D[7:4]: IRQ Number for P2 (0: The Interrupt was Disabled)	**Interrupt Register for P1/P2** D[3:0]: IRQ Number for P1 D[7:4]: IRQ Number for P2 (0: Disable The Interrupt)
Base Address + 9	**Interrupt Register for P3/P4** D[3:0]: IRQ Number of P3 D[7:4]: IRQ Number of P4 (0: The Interrupt was Disabled)	**Interrupt Register for P3/P4** D[3:0]: IRQ Number for P3 D[7:4]: IRQ Number for P4 (0: Disable The Interrupt)
Base Address + 10	Base Address (Low Byte)	Base Address (Low Byte) ***Important:*** *Must write the 2-Byte Base Address in Sequence, Low Byte first, then High Byte.*
Base Address + 11	Base Address (High Byte)	Base Address (High Byte) ***Important:*** *Must write the 2-Byte Base Address in Sequence, Low Byte first, then High Byte.*
Base Address + 14	`[0]=1: Output Enabled` `[0]=0: Output Disabled`	`0xFF`: Output Port Enable `Others`: Hi-Impendence Output Port
Base Address + 15		**Set all output port at same time with the data pattern D[7"0]** `D[7:0]=0x00:` Clear All Output to "0" `D[7:0]=0xFF:` Set All Output to "1"

The module is an I/O-mapped device that is easily configured from any language and can easily perform digital I/O access through the module's I/O ports. This is especially true if the form of the data is byte or word wide. All references to the I/O ports would be in absolute port addressing. However, a table could be used to convert the byte or word data ports to a logical reference.

3.2. Digital I/O Channel

The 64 digital input channels are accessed via four 20-pin IDC connectors of P1 to P4. Each connector provides 16 bits of digital input divided into two 8-bit ports. Pin assignments for digital input connectors are detailed as followings.

The 64 digital output channels are accessed via four 20-pin IDC connectors of P5 to P8. Each connector provides 16 bits of digital output divided into two 8-bit ports. Pin assignments for digital output connectors are detailed as followings.

The outputs are active high. Writing a one ("1") corresponds to +5V while writing a zero ("0") corresponds to 0V at the output.

Each output port has an output register associated with it. This register may be written and retains its value. To preset a value to all of the output ports at same time, the application program should write to the port address of "Base Address + 15". It is useful to set/clear all port, e.g.

To set all port to "1", write "0xFF" to port address of "Base Address + 15";

To clear all port to "0", write "0x00" to port address of "Base Address + 15";

3.3. Base Address

The ***LW-M104-I128 R2 (DX) Digital I/O Module*** provides software programmable base address capability, as well as 16 pre-set base addresses as shown in *Table 1. I/O Base Address DIP-Switch Setting Table*.

You can set the base address to any consecutive 16-Byte available I/O space with automatic 16-Byte alignment. E.g. If setting the base address to 0x365, you will actually get a base address of 0x360.

To set the base address using software, you ***MUST*** write the 2-Byte Base Address in Sequence, Low Byte first, then High Byte. E.g.: Change the base address to I/O space 0x680 at current base address 0x300.

```
main()
{
    unsigned char ch;
    outportb(0x30A, 0x80)   ; Set Low-Byte base address 0x80
    outportb(0x30B, 0x06)   ; Set High-Byte base address 0x06
    …
}
```

For DX Version, the base address that you set will be automatically saved in flash memory. If the Bit 1 of SW1 is set to "ON", the system will power up to last saved base address.

3.4. Interrupt

The ***LW-M104-I128 R2 (DX) Digital I/O Module*** provides 11 interrupt sources of IRQ3 to IRQ7, IRQ9 to IRQ12, IRQ14 and IRQ15. Every 16-Channel port has one interrupt pin on Data 7 of Channel B. It can be directed to any one of the 11 interrupt sources by software.

Table 8. Interrupt Register

Interrupt Register	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Base Address + 9	Interrupt Channel Number for P2				Interrupt Channel Number for P1			
Base Address + 10	Interrupt Channel Number for P4				Interrupt Channel Number for P3			
	Interrupt Channel Number: 0x0 : Disable Interrupt for the Input Port 0x1 : Disable Interrupt for the Input Port 0x2 : Disable Interrupt for the Input Port 0x3 : Set IRQ3 to the Input Port 0x4 : Set IRQ4 to the Input Port 0x5 : Set IRQ5 to the Input Port 0x6 : Set IRQ6 to the Input Port 0x7 : Set IRQ7 to the Input Port 0x8 : Disable Interrupt for the Input Port 0x9 : Set IRQ9 to the Input Port 0xA : Set IRQ10 to the Input Port 0xB : Set IRQ11 to the Input Port 0xC : Set IRQ12 to the Input Port 0xD : Disable Interrupt for the Input Port 0xE : Set IRQ14 to the Input Port 0xF : Set IRQ15 to the Input Port							

On occasion, a system application will require more interrupt levels than are available interrupt sources. You can simply share the same interrupt source by setting to same interrupt channel to relative input ports. You can also disable the interrupt for the input connectors by simply writing a "0" to the relative interrupt register.

Interrupt should be set prior to use, if an interrupt is required by your application software. Consult the user manual for the application software being used to determine the proper setting.

For DX Version, the interrupt setting will be automatically saved in flash memory. If the Bit 1 of SW1 is set to "ON", the system will restore the interrupt settings during power up.

3.5. Programming Example

The following example in C Language is provided as a guide to assist you in developing your working software.

In this example, the module base address is 0x300 (Hexadecimal). First, set interrupt source of IRQ6 to input connector P1, clear all output ports, read input Port A on input connector P1, then write it to output Port B on output connector P6 as follows:

```
main()
{
    unsigned char ch;
    outportb(0x309, 0x06)   ; Set IRQ6 to P1, and disable P2
    outportb(0x308, 0x00)   ; Clear all output ports to "0"
    ch = inportb(0x300)     ; Read Port A on input connector P1
    outportb(0x303, ch)     ; write Port B on output connector P6
}
```

3.6. PC/104 Stack Expansion

PC/104 compatible expansion modules can be installed on the LW-M104-I128 R2 (DX) expansion bus. The buffered output signals to the expansion bus are standard TTL level signals. All inputs to the LW-M104-I128 R2 (DX) operate at TTL levels and present a typical CMOS load to the expansion bus.

You can install one or more PC/104 compatible modules on the LW-M104-I128 R2 (DX) expansion connectors. You can stack several modules on the ***LW-M104-I128 R2 (DX) Digital I/O Module***. Each additional module increases the thickness of the package by 0.66 inches (15 mm). See Following Figure for details.

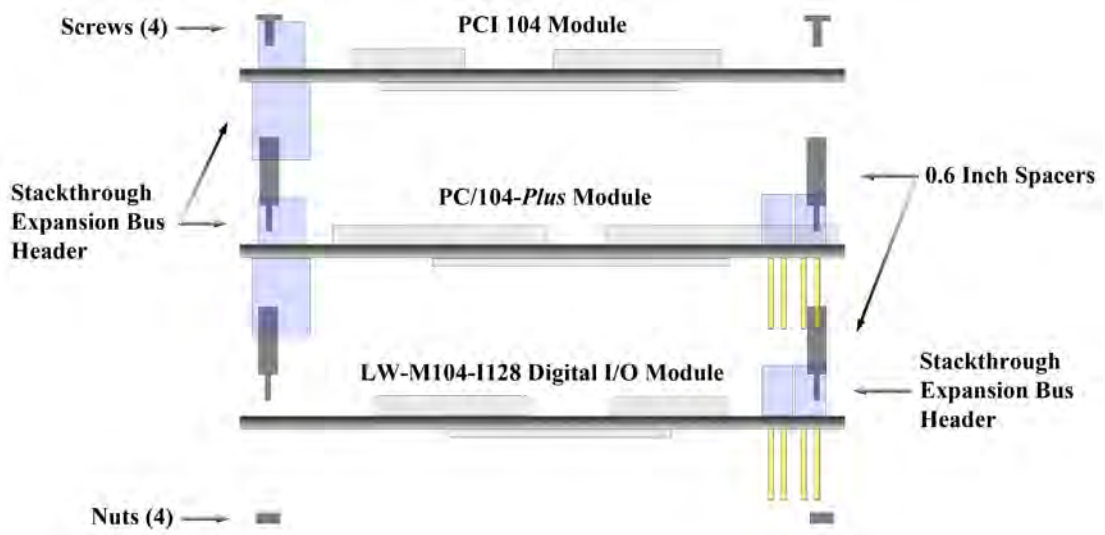

Figure 5. PC/104 Module Stack

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