DIO-1
I/O Expander Board
Technical Manual

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WARRANTY:

BiPOM Electronics warrants DIO-1 for a period of 90 days. If the board becomes defective during this period, BiPOM Electronics will at its option, replace or repair the board. This warranty is voided if the product is subjected to physical abuse or operated outside stated electrical limits. BiPOM Electronics will not be responsible for damage to any external devices connected to DIO-1. BiPOM Electronics disclaims all warranties express or implied warranties of merchantability and fitness for a particular purpose. In no event shall BiPOM Electronics be liable for any indirect, special, incidental or consequential damages in connection with or arising from the use of this product. BiPOM's liability is limited to the purchase price of this product.

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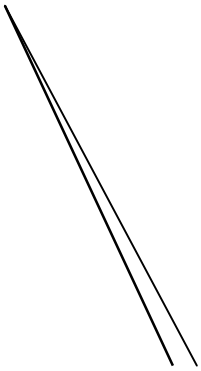


1. Overview

DIO-1 is a Digital Input/Output Expander board for the MINI-MAX/51, MINI-MAX/908 and PRO-MAX series of micro-controller boards.

DIO-1 has 8 open/collector outputs and 12 TTL/CMOS inputs/outputs. DIO-1 has a PIC16C62 microcontroller that appears like an I^2C slave device to the host microcontroller board. DIO-1 can also be used as a standalone microcontroller board.

DIO-1 should be powered from 5 Volts DC of external power source through the 20-pin connector (J1) in slave mode or through VCC and GND terminals in a standalone mode.

2. Specifications

DIO-1 board has the following configuration:

- I^2C interface with a host microcontroller.
- 8 Open/collector outputs. Each channel is rated at 400mA and can with stand peak currents of 500mA. Outputs can be paralleled for higher current. Total Power Dissipation is 1.8 Watts.
  Suppression diodes are used for inductive load driving.
- 12 TTL/CMOS inputs/outputs (each provides upto 25mA Sink/Source Current).
- 80 bytes memory stack with an external access through I^2C
- Operating voltage 5±0.5V

Dimensions are 2.35 X 2.40 inches (5.97 X 6.10 centimeters).

Mounting holes of 0.138 inches (3.5 millimeters) are on four corners.

0° - 70° C operating, -40° - +85° C storage temperature range.

3. Functional Blocks

Figure 1 shows the block diagram of the DIO-1board

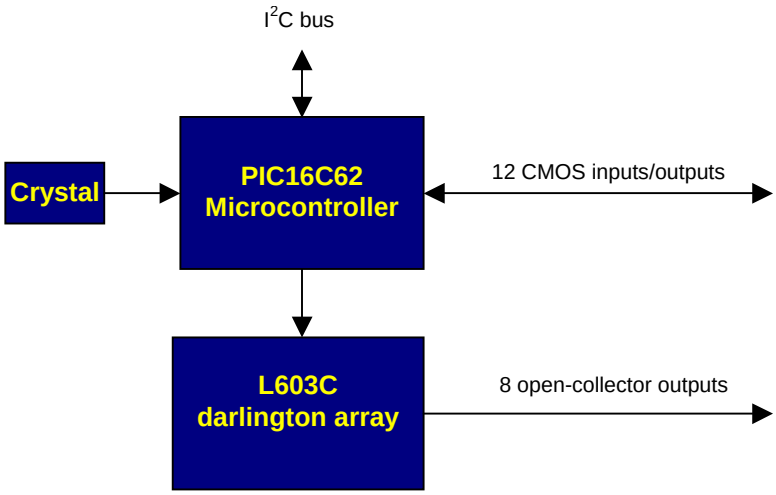


Figure 1

I2C-bus

The I2C-bus pins and power supply are available on the 20-pin connector (J1) for interfacing to existing microcontroller boards. DIO-1 peripheral board can be connected either as a piggyback daughter-board on a host microcontroller board using standoffs or can be placed away from the microcontroller board using a 20-wire ribbon cable. Table 1 shows the pin assignments for J1 connector. Pins 7 … 20 are not connected.

I2C-bus connector (J1)

Signal	Pin	Pin	Signal
SCLK	6	5	SDA
VCC	4	3	GND
VCC	2	1	GND

Table 1

Input/Output Terminals

8 open collector outputs and 12 input/output connections are available on the terminal blocks X1, X2 and X3. X3 also has power supply terminals. **GND** is a Ground reference for logic and I/O pins. **VCC** is Positive supply (5 Volts) for logic and digital Input/Output pins. **AGND** is a Ground Reference point for the open collector outputs. **VS** is the common point for Suppression diodes at the outputs.

VCC and GND terminals should be used for the power supply of the board in a standalone mode.
VS and AGND should be used for powering external loads connected to the open-collector outputs.

Table 2 shows the pin assignments for Terminal blocks.

Open Collector Outputs Terminal (X1)

Name	Signal	Pin
B0	OUTPUT 0	1
B1	OUTPUT 1	2
B2	OUTPUT 2	3
B3	OUTPUT 3	4
B4	OUTPUT 4	5
B5	OUTPUT 5	6
B6	OUTPUT 6	7
B7	OUTPUT 7	8

Input/Output Terminal (X2)

Name	Signal	Pin
RA0	RA0	1
RA1	RA1	2
RA2	RA2	3
RA3	RA3	4
RA4	RA4 (output is open drain type)	5
RA5	RA5	6
RC0	RC0	7
RC1	RC1	8

Input/Output Terminal (X3)

Name	Signal	Pin
RC2	RC2	1
RC7	RC7	2
RC6	RC6	3
RC5	RC5	4
GND	GND	5
5V	VCC (5 Volt DC)	6
GND	AGND	7
VS	VS (5…90 Volt DC)	8

Table 2

4. Board Layout

Figure 2 shows positions of major components, connectors and terminals on the DIO-1 board.

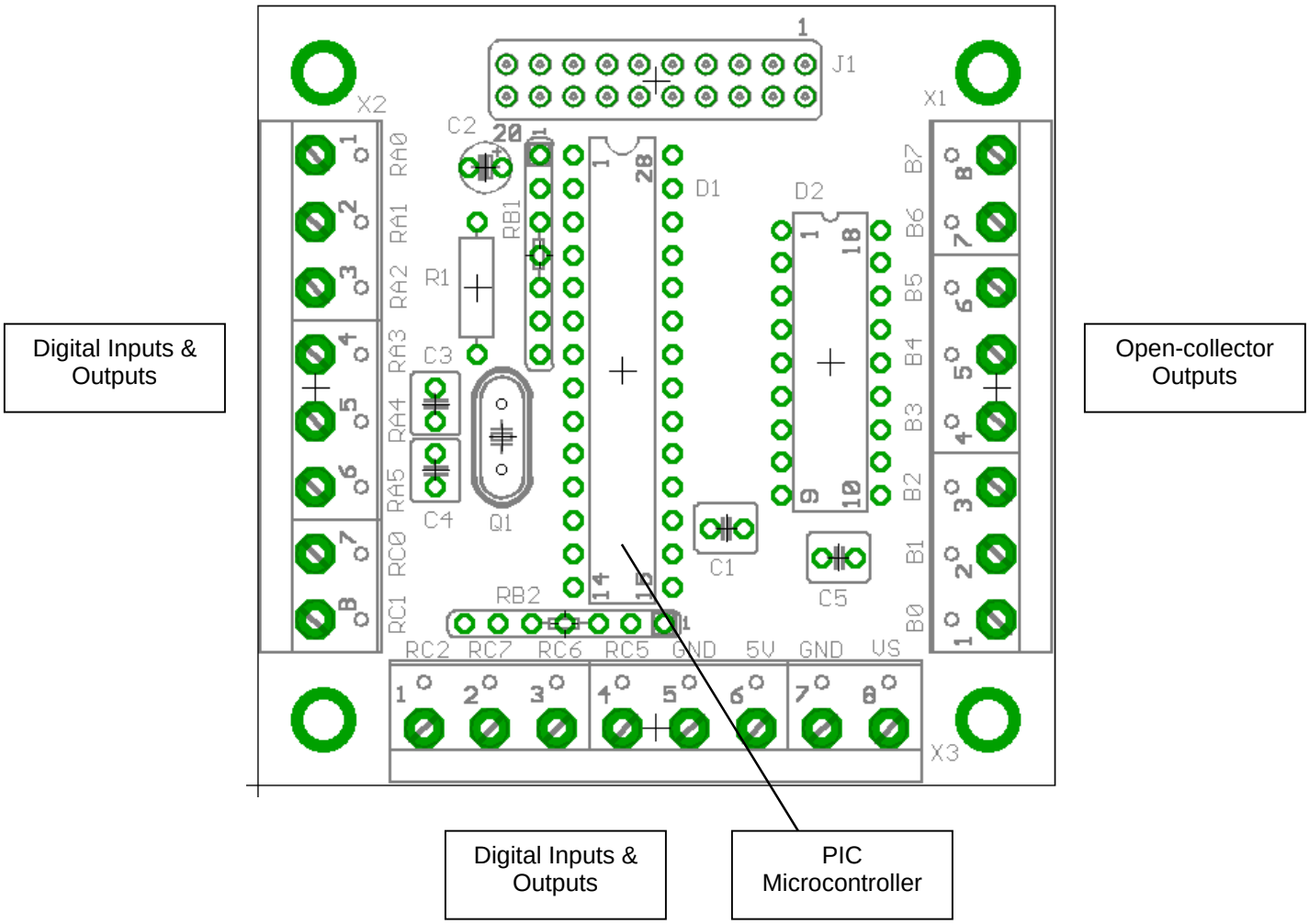


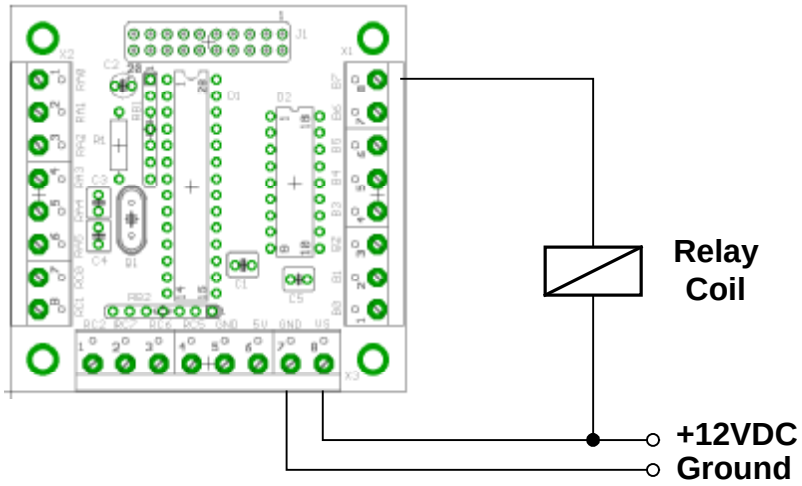
Figure 2

5. Wiring diagram

Example 1: Driving a 12 Volt relay with DIO-1

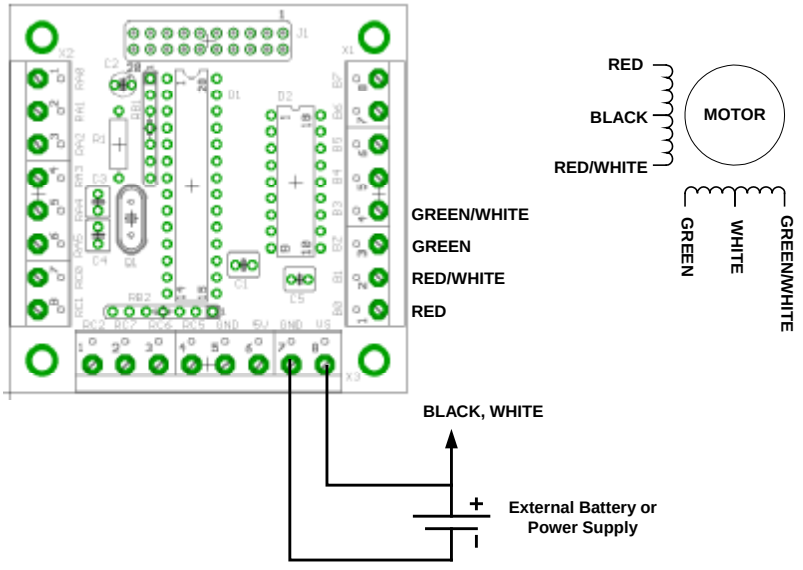
- Connect one side of the relay coil to one of the open-collector outputs (B7 in this example).
- Connect the other side of the relay coil to external supply for the relay (12 Volts in this example)
- When B7 is activated (set to low level), relay is energized.

Important: There is no need for suppression diode on the relay coil as this is built into DIO-1. However, to use this built-in protection, the relay supply should also be connected to the VS terminal.

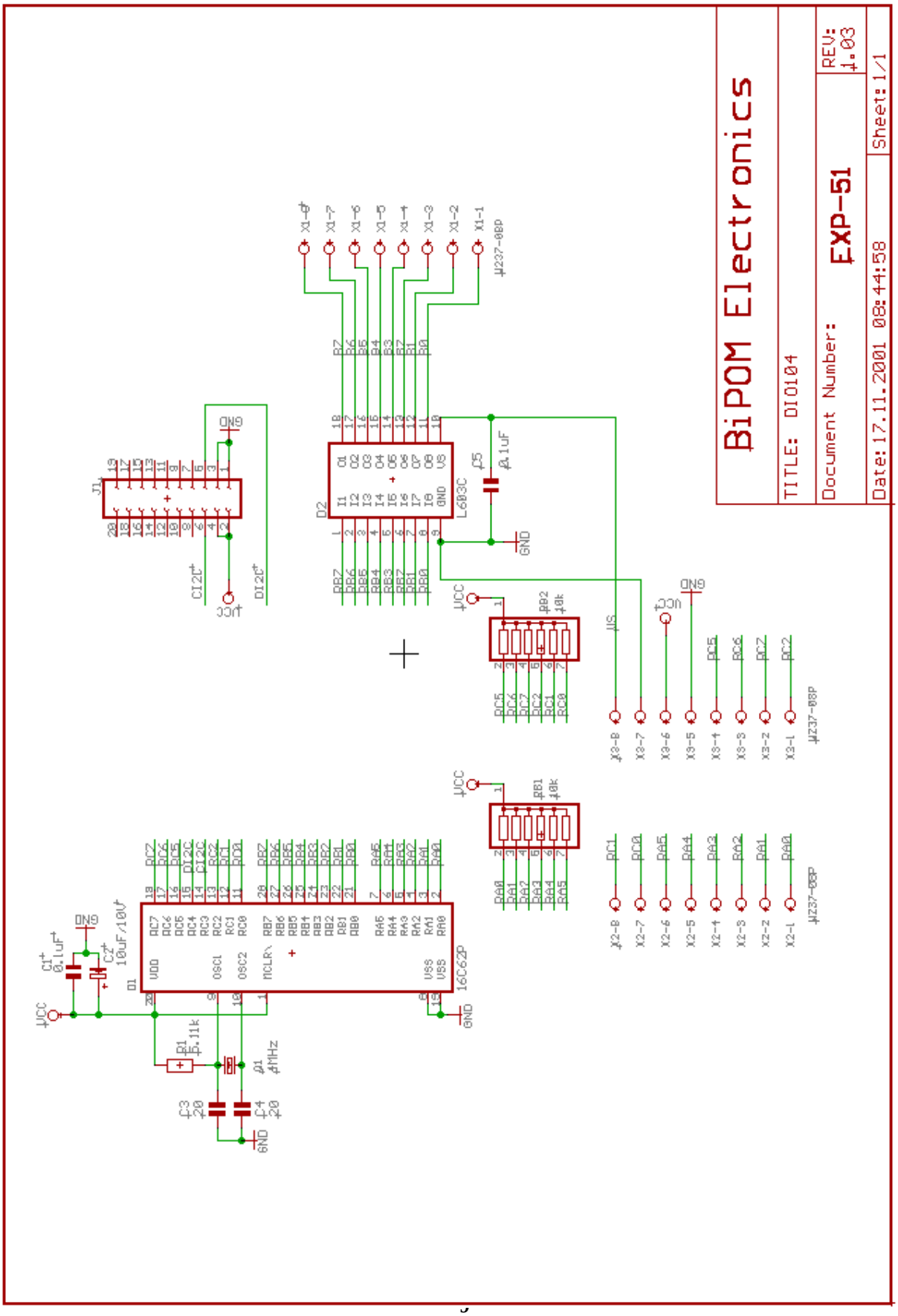


Example 2: Driving a stepper motor with DIO-1

- Connect one side of each of the motor coils to one of the open-collector outputs (B4-B7 in this example).
- Connect the other side of each motor coil together and to external supply (12 Volts in this example).
- Activate each of the outputs in sequence under software control to create motor turning action.



6. Schematics



7. I²C communication protocol

I²C bus is used to control over the DIO-1 Expander board.

DIO-1 board uses 7-bit address format with a R/W bit.
B' 0001 0000' - Slave Address with R/W=0 //A write operation
B' 0001 0001' - Slave Address with R/W=1 //A read operation

Figure 4 shows the Data transfer sequence for a WRITE to DIO-1. Figures 5 and 6 show the Data transfer sequences for READ operations. Table 3 has access addresses (Units) of the DIO-1.

For additional information on I²C interface specification, refer to Philips www.semiconductors.philips.com

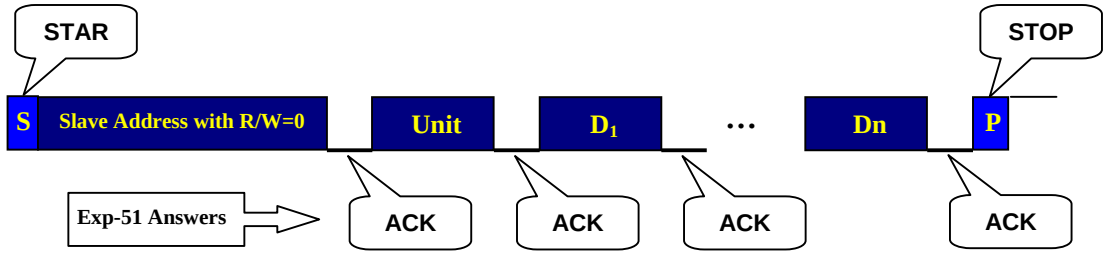


Figure 4

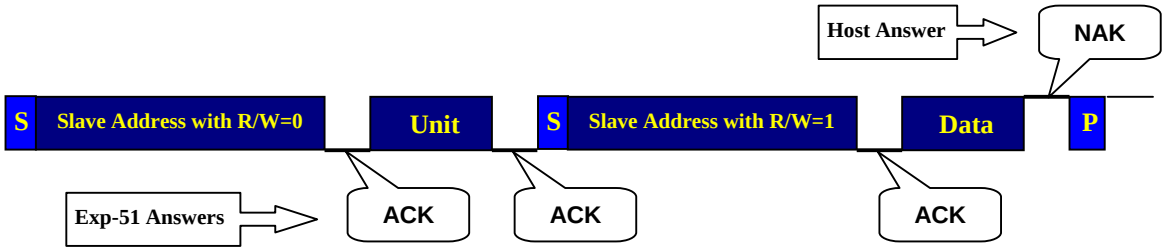


Figure 5

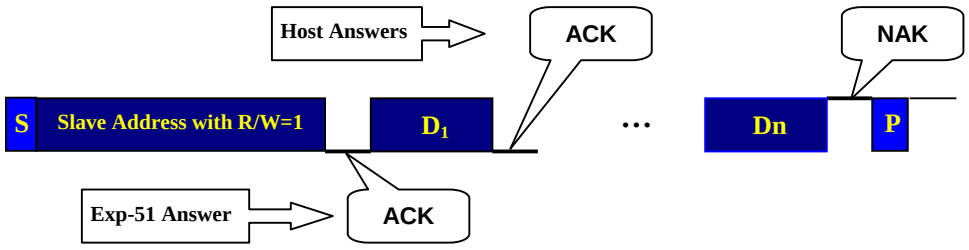


Figure 6

Unit Addresses

Address	UNIT	Access
0	PORTA	read/write
1	TRISA	read/write
2	PORTB	read/write
3	TRISB	read only
4	PORTC	read/write
5	TRISC	read/write
6	5 Byte Device Identifier	read only
7	80 Byte Memory buffer	read/write

Table 3

The Device Identifier is a sequence of 5 Bytes:

- TYPE - Type of the DIO-1 Expander board Controller
- VERS - Version of the Controller
- YEAR - The Date of the Controller's Code development
- MONTH
- DAY

8. Software

Software project examples for interfacing with DIO-1 board are available with our program development packages:

Development Tools	Language	Web link	Project
8051 Development System	C or Assembly	www.bipom.com/8051dev.htm	Examples/dio1
BASCOM51 Compiler	BASIC	www.bipom.com/bascom51.htm	Examples/dio1
MINI-MAX Sets	BASIC	www.bipom.com/minimaxset.htm	Examples/dio1