PCI Express-compliant
High-speed Opto-isolated Digital I/O Board

DIO-3232F-PE

Includes API-PAC Driver Library

This PCI Express compliant interface board was designed to extend digital signal I/O functions using a standard PC.

DIO-3232F-PE is a 12 - 24VDC digital I/O board with 32ch opto-coupler isolated inputs and 32ch opto-coupler isolated open-collector outputs with a 5μsec response speed. All input signals can be used as interrupts. It is equipped with a digital filter function and output transistor protection circuit (voltage surge and over-current protection).

Both Windows and Linux drivers are included with this board.

CONTEC provides drivers that enable these boards to be used with LabVIEW.

Packing List

- Board [DIO-3232F-PE]…1
- First step guide … 1
- CD-ROM *1 [API-PAC(W32)] …1
*1 The CD-ROM contains the driver software and User's Guide.

Features

Opto-coupler isolated input (support current sink output) and opto-coupler isolated open-collector output (current sink)
This board has 32ch of opto-coupler isolated input (supporting current sink output) with a 200μsec response speed and 32ch of opto-coupler isolated open-collector output (current sink).

16ch share a common terminal, each capable of supporting different external driver voltages of 12 - 24 VDC for I/O.

Opto-coupler bus isolation
The PCI Express bus (PC) is isolated from both the input and output interfaces by the use of opto-couplers, providing superior noise immunity.

All input signals can be used as interrupts
All input signals can be used as interrupts. Disable or enable interrupts in bit units and select the interrupt edge via software.

Windows and Linux driver libraries are included
The included driver library [API-PAC(W32)] makes it possible to create applications in both Windows and Linux environments. A diagnostic program to check the hardware operation is also provided.

Digital filter prevents input signal errors from noise or chattering.
A digital filter is provided to prevent input signal errors from noise or chattering. This filter can be added to each input terminal, with settings performed via software.

Zener diodes on output circuits provide voltage surge protection with poly-switches for overcurrent protection.
Zener diodes are connected to the output circuits for protection against voltage surges. Similarly, poly-switches are provided for each group of 8ch outputs for over-current protection.
The output rating is 35 VDC (max), 100mA per channel.

Functions and connectors are compatible with PIO-32/32PCI)F series PCI-bus boards
Compatible connector shapes and pin assignments provide easy transition from PCI based to PCI-Express based systems.

LabVIEW support
LabVIEW is supported by using CONTEC's dedicated library VI-DAQ.

Specifications

Item	Specification
Input	
Input format	Opto-coupler isolated input (Compatible with current sink output) (Negative logic *1)
Number of input signal channels	32ch (all available for interrupts) (1 common in 16ch)
Input resistance	2.2kΩ
Input ON current	4.9mA or more
Input OFF current	0.66mA or less
Interrupt	32 interrupt input signals are arranged into a single output of interrupt signal INTA. An interrupt is generated at the rising edge (HIGH-to-LOW transition) or falling edge (LOW-to-HIGH transition).
Response time	Within 5μsec
Output	
Output format	Opto-coupler isolated open collector output (current sink type) (Negative logic *1)
Number of output signal channels	32ch (1 common per 16ch)
Output rating — Output voltage	35VDC (Max.)
Output rating — Output current	50mA (par channel) (Max.)
Surge protector	Zener diode RD47FM(NEC) or equivalent
Response time	Within 5μsec
Common	
Built-in power	None
Allowable distance of signal extension	Approx. 50m (depending on wiring environment)
I/O address	Any 32-byte boundary
Interruption level	1 level use
Max. board count for connection	16 boards including the master board
Isolated Power	500Vrms
External circuit power supply	12 - 24VDC(±10%)
Power consumption (Max.)	3.3VDC 500mA
Operating condition	0 - 50°C, 10 - 90%RH (No condensation)
Bus specification	PCI Express Base Specification Rev. 1.0a x1
Dimension (mm)	169.33(L) x 110.18(H)
Connector	96 pin half pitch connector [F (female) type] PCR-E96LMD+[HONDA TSUSHIN KOGYO CO., LTD.] equivalent to it
Weight	160g

*1 Data "0" and "1" correspond to the High and Low levels, respectively.
*2 When using the internal power supply, the input section consumes up to 80mA and the SW section of output channel consumes up to 60mA, so the output current that can be supplied to the external device is 100mA.

Board Dimensions

169.33(L)
110.18(H)
[mm]
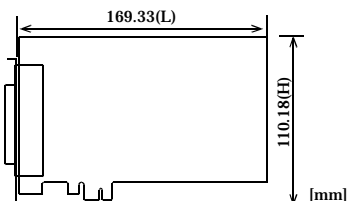
The standard outside dimension (L) is the distance from the end of the board to the outer surface of the slot cover.

Support Software

API-DIO(WDM)/API-DIO(98/PC)
Digital I/O driver for Windows

[Found on the included CD-ROM driver library API-PAC(W32)]

For use in Windows environments, API-DIO(98/PC) is driver library software that provides basic Win32 API functions (DLL).

Various sample programs using Visual Basic and Visual C++ and a diagnostic program used to check the hardware operation are also provided.

< Operating Environments >

Operating Systems: Windows Vista, Windows XP, Server 2003, 2000

Programming languages: Visual Basic, Visual C++, Visual C#, Delphi, C++ Builder

Upgraded software versions can be downloaded from CONTEC's document site (http://www.contec.com/apipac/).

For more details on supported OS, programming languages and for updated information, please visit CONTEC's Web site.

API-DIO(LNX)
Digital I/O driver for Linux

[Found on the included CD-ROM driver library API-PAC(W32)]

API-DIO(LNX) is driver software for Linux which provides device drivers (modules) by shared library and kernel versions. Various sample gcc programs are provided.

< Operating Environments >

Operating Systems: RedHatLinux, TurboLinux
(For details on supported distributions, refer to Help files that are available after installation.)

Programming language: gcc

Upgraded software versions can be downloaded from CONTEC's document site (http://www.contec.com/apipac/).

For more details on supported OS, programming languages and for updated information, please visit CONTEC's Web site.

VI-DAQ
Data acquisition VI library for LabVIEW

[Available for free download from CONTEC's web site]

CONTEC's VI library is for use with National Instruments' LabVIEW.
VI-DAQ is designed with functions similar to that of LabVIEW's Data Acquisition VI, allowing various devices to be used without complicated settings.
For more details and to download VI-DAQ go to http://www.contec.com/vidaq/.

Optional Cables and Connectors

Shield Cable with 96-Pin Half-Pitch Connectors at Both Ends
:PCB96PS-0.5P (0.5m)
:PCB96PS-1.5P (1.5m)
:PCB96PS-3P (3m)
:PCB96PS-5P (5m)

Flat Cable with 96-Pin Half-Pitch Connectors at Both Ends
:PCB96P-1.5 (1.5m)
: PCB96P-3 (3m)
: PCB96P-5 (5m)

Shield Cable with 96-Pin Half-Pitch Connectors at One End
: PCA96PS-0.5P (0.5m)
: PCA96PS-1.5P (1.5m)
: PCA96PS-3P (3m)
: PCA96PS-5P (5m)

Flat Cable with 96-Pin Half-Pitch Connectors at One End
:PCA96P-1.5 (1.5m)
: PCA96P-3 (3m)
: PCA96P-5 (5m)

Distribution shield cable with 96-Pin Half-Pitch Connectors (96P→37P x 2)
:PCB96WS-1.5P (1.5m)
: PCB96WS-3P (3m)
: PCB96WS-5P (5m)

Half Pitch 96P Female Connector Set (5 Pieces)
:CN5-H96F

Accessories

PCB3

Screw Terminal (M3 x 96)
:EPD-96A *1

Screw Terminal (M3.5 x 96)
:EPD-96 *1

Digital I/O 64CH Series Terminal Panel
:DTP-64(PC) *1

Signal Monitor for Digital I/O(64Bits)
:CM-64(PC)E *1

Screw Terminal (M3 x 37P)
:EPD-37A *2

Screw Terminal (M3.5 x 37P)
:EPD-37 *2

General Purpose Terminal
:DTP-3A *2

Screw Terminal
: DTP-4A *2

Signal Monitor for Digital I/O
:CM-32(PC)E *2

Connection Conversion Board (96-Pin → 37-Pin x 2)
:CCB-96 *3

*1 A PCB96P or PCB96PS optional cable is required separately.
*2 A PCB96WS optional cable is required separately.
*3 Option cable PCB96P or PCB96PS, and the cable for 37-pin D-SUB are required separately.
*Check the CONTEC's Web site for more information on these options.

On-board connector wiring

Connector shape
The on-board interface connector (CN1) is used when connecting this product and the external devices.

Interface connector (CN1)

B48
B47   A48
       A47

B02   A02
B01   A01
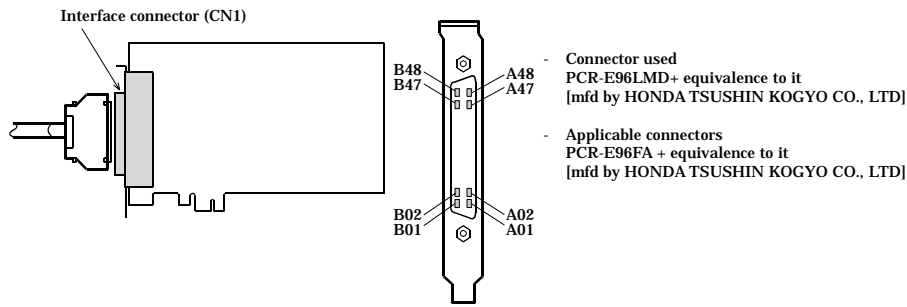
- Connector used
  PCR-E96LMD+ equivalence to it
  [mfd by HONDA TSUSHIN KOGYO CO., LTD]

- Applicable connectors
  PCR-E96FA + equivalence to it
  [mfd by HONDA TSUSHIN KOGYO CO., LTD]

Connector Pin Assignment
Pin Assignments of Interface Connector (CN1)

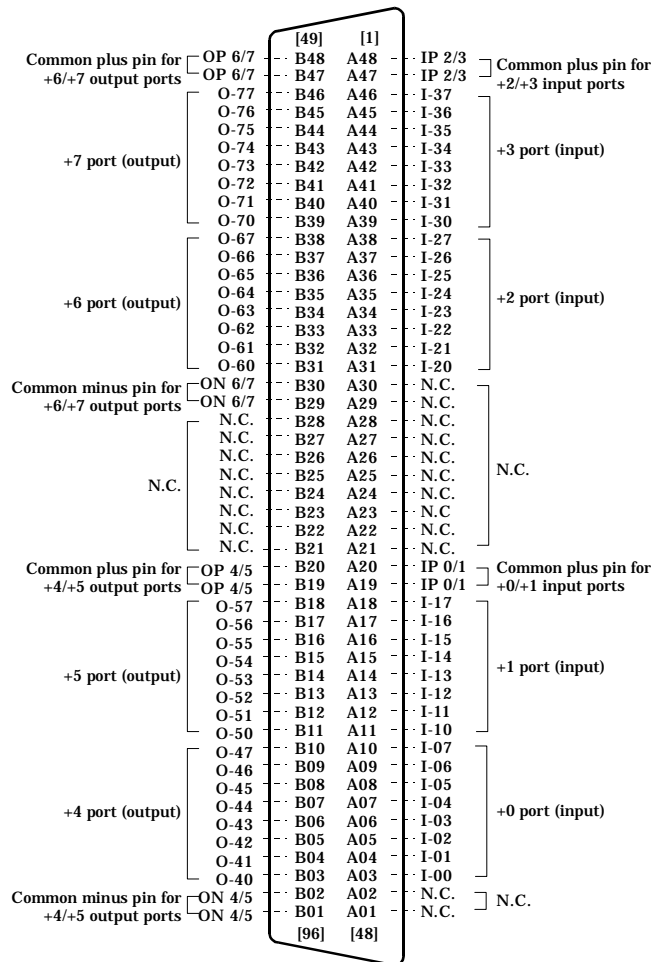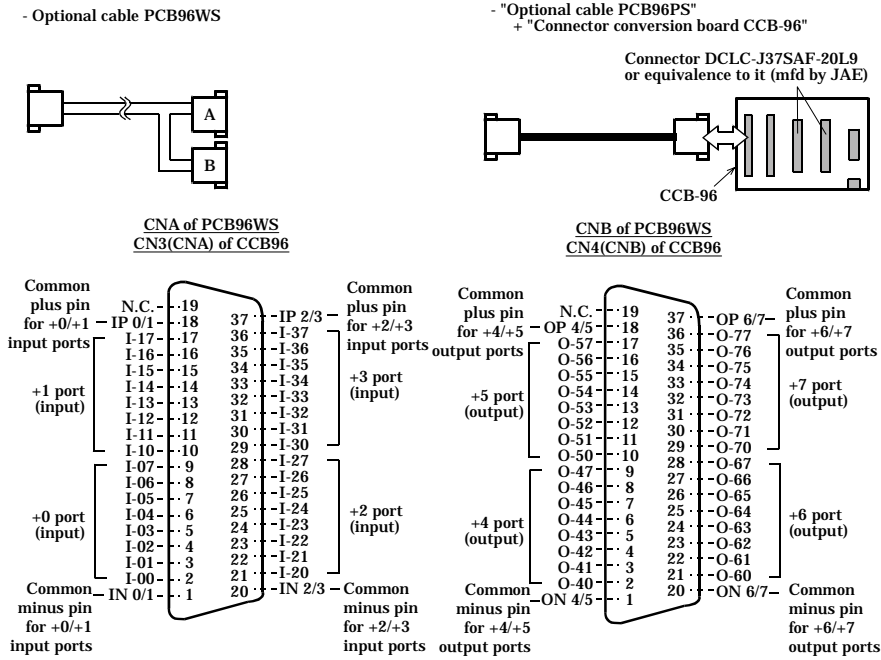|	[49]	[1]		
Common plus pin for OP 6/7	B48	A48	IP 2/3	Common plus pin for
+6/+7 output ports OP 6/7	B47	A47	IP 2/3	+2/+3 input ports
O-77	B46	A46	I-37	
O-76	B45	A45	I-36	
O-75	B44	A44	I-35	
O-74	B43	A43	I-34	
+7 port (output) O-73	B42	A42	I-33	+3 port (input)
O-72	B41	A41	I-32	
O-71	B40	A40	I-31	
O-70	B39	A39	I-30	
O-67	B38	A38	I-27	
O-66	B37	A37	I-26	
O-65	B36	A36	I-25	
+6 port (output) O-64	B35	A35	I-24	+2 port (input)
O-63	B34	A34	I-23	
O-62	B33	A33	I-22	
O-61	B32	A32	I-21	
O-60	B31	A31	I-20	
Common minus pin for ON 6/7	B30	A30	N.C.	
+6/+7 output ports ON 6/7	B29	A29	N.C.	
N.C.	B28	A28	N.C.	
N.C.	B27	A27	N.C.	
N.C.	B26	A26	N.C.	
N.C.	B25	A25	N.C.	N.C.
N.C.	B24	A24	N.C.	
N.C.	B23	A23	N.C	
N.C.	B22	A22	N.C.	
N.C.	B21	A21	N.C.	
Common plus pin for OP 4/5	B20	A20	IP 0/1	Common plus pin for
+4/+5 output ports OP 4/5	B19	A19	IP 0/1	+0/+1 input ports
O-57	B18	A18	I-17	
O-56	B17	A17	I-16	
O-55	B16	A16	I-15	
O-54	B15	A15	I-14	
+5 port (output) O-53	B14	A14	I-13	+1 port (input)
O-52	B13	A13	I-12	
O-51	B12	A12	I-11	
O-50	B11	A11	I-10	
O-47	B10	A10	I-07	
O-46	B09	A09	I-06	
O-45	B08	A08	I-05	
+4 port (output) O-44	B07	A07	I-04	+0 port (input)
O-43	B06	A06	I-03	
O-42	B05	A05	I-02	
O-41	B04	A04	I-01	
O-40	B03	A03	I-00	
Common minus pin for ON 4/5	B02	A02	N.C.	N.C.
+4/+5 output ports ON 4/5	B01	A01	N.C.	
	[96]	[48]		

*I-00 - I-17 can be used as interrupt signal.
* The numbers in square brackets [ ] are pin numbers designated by HONDA TSUSHIN KOGYO CO., LTD.

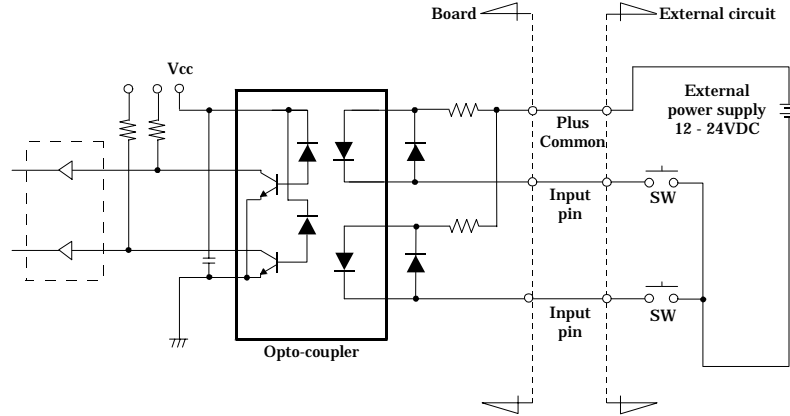| I-00 - I-37	32 input signal pins. Connect output signals from the external device to these pins.
O-40 - O-77	32 output signal pins. Connect these pins to the input signal pins of the external device.
IP 0/1 - IP 2/3	Its positive side is connected to these pins. These pins are common to 16 input signal pins.
OP 4/5 - OP 6/7	Its positive side is connected to these pins. These pins are common to 16 output signal pins.
ON 4/5 - ON 6/7	Its negative side is connected to these pins. These pins are common to 16 output signal pins.
N.C.	This pin is left unconnected.

Pin Assignments of Optional Connector PCB96WS and CCB-96

The figure below shows the correspondence between the option cable pins and signals.

- Optional cable PCB96WS

- "Optional cable PCB96PS"
  + "Connector conversion board CCB-96"

Connector DCLC-J37SAF-20L9
or equivalence to it (mfd by JAE)

CCB-96

CNA of PCB96WS
CN3(CNA) of CCB96

CNB of PCB96WS
CN4(CNB) of CCB96

	CNA		
Common plus pin for +0/+1 input ports	N.C. – ·19	37· – IP 2/3	Common plus pin for +2/+3 input ports
	IP 0/1 – ·18	36· – I-37	
+1 port (input)	I-17 – ·17	35· – I-36	
	I-16 – ·16	34· – I-35	
	I-15 – ·15	33· – I-34	+3 port (input)
	I-14 – ·14	32· – I-33	
	I-13 – ·13	31· – I-32	
	I-12 – ·12	30· – I-31	
	I-11 – ·11	29· – I-30	
	I-10 – ·10	28· – I-27	
+0 port (input)	I-07 – ·9	27· – I-26	
	I-06 – ·8	26· – I-25	
	I-05 – ·7	25· – I-24	
	I-04 – ·6	24· – I-23	+2 port (input)
	I-03 – ·5	23· – I-22	
	I-02 – ·4	22· – I-21	
	I-01 – ·3	21· – I-20	
	I-00 – ·2	20· – IN 2/3	Common minus pin for +2/+3 input ports
Common minus pin for +0/+1 input ports	IN 0/1 – ·1		

	CNB		
Common plus pin for +4/+5 output ports	N.C. – ·19	37· – OP 6/7	Common plus pin for +6/+7 output ports
	OP 4/5 – ·18	36· – O-77	
+5 port (output)	O-57 – ·17	35· – O-76	
	O-56 – ·16	34· – O-75	
	O-55 – ·15	33· – O-74	+7 port (output)
	O-54 – ·14	32· – O-73	
	O-53 – ·13	31· – O-72	
	O-52 – ·12	30· – O-71	
	O-51 – ·11	29· – O-70	
	O-50 – ·10	28· – O-67	
+4 port (output)	O-47 – ·9	27· – O-66	
	O-46 – ·8	26· – O-65	
	O-45 – ·7	25· – O-64	
	O-44 – ·6	24· – O-63	+6 port (output)
	O-43 – ·5	23· – O-62	
	O-42 – ·4	22· – O-61	
	O-41 – ·3	21· – O-60	
	O-40 – ·2	20· – ON 6/7	Common minus pin for +6/+7 output ports
Common minus pin for +4/+5 output ports	ON 4/5 – ·1		

Connection of Input Signals

Connect the input signals to a device which can be current-driven, such as a switch or transistor output device.
The board inputs the ON/OFF state of the current-driven device as a digital value.

Input Circuit

Board / External circuit

Vcc

Opto-coupler

Plus Common

Input pin

Input pin
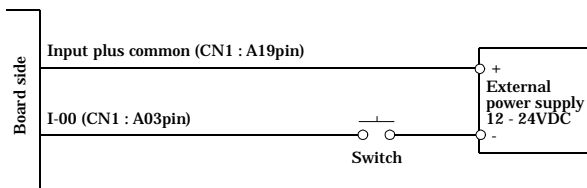
SW

SW

External power supply 12 - 24VDC

* Input pin represents I-xx.

The input circuits of interface blocks of this product are illustrated above. Connect the input signals to a device which can be current-driven, such as a switch or transistor output device.
This product inputs the ON/OFF state of the current-driven device as a digital value. The signal inputs are isolated by opto-couplers (ready to accept current sinking output signals). This product therefore requires the external power supply to drive the input section of this product. In this case, 11mA current is requested each channel on 24VDC (5.5mA on 12VDC).

⚠ **CAUTION** Please refer to Selecting Power Supply, and choose the proper supply by jumps.

Connecting a Switch

Board side

Input plus common (CN1 : A19pin)

I-00 (CN1 : A03pin)

Switch

+ External power supply 12 - 24VDC -

When the switch is ON, the corresponding bit contains 1.
When the switch is OFF, by contrast, the bit contains 0.

Connection of Output Signals

Connect the output signals to a current-driven controlled device such as a relay or LED.
The board controls turning ON/OFF the current-driven controlled device using a digital value.

Output Circuit
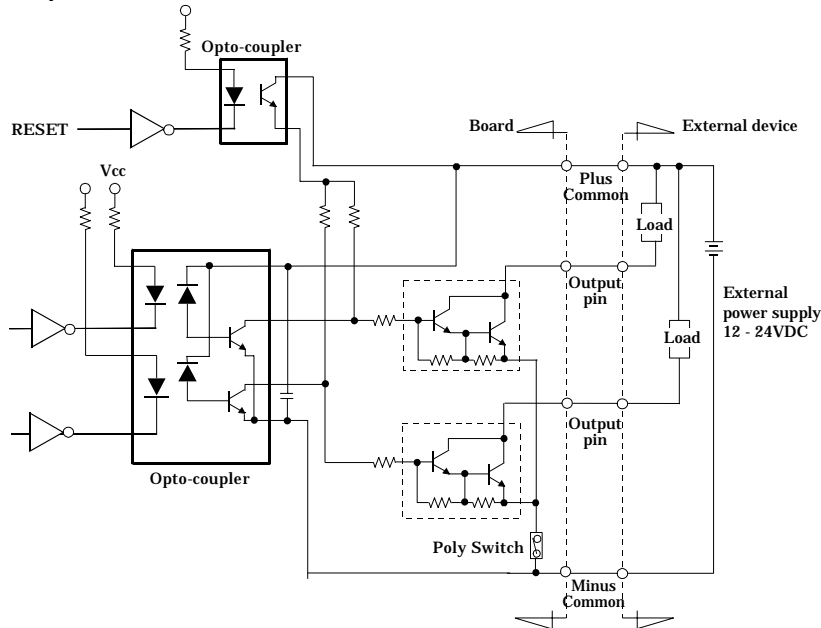
* Output pin represents O-xx.

The output circuits of interface blocks of this product are illustrated above. The signal output section is an opto-coupler isolated, open-collector output (current sink type). Driving the output section requires an external power supply. The rated output current per 1ch is 50mA at maximum.
A zener diode is connected to the output transistor for protection from surge voltages.
Similarly, polyswitches are fitted to each group of 8ch outputs for over-current protection.
When the overcurrent protector works, the output section of this product is temporarily disabled. If this is the case, turn of the power to the PC and the external power supply and wait for a few minutes, then turn them on back.

⚠ **CAUTION**
When the PC is turned on, all outputs are reset to OFF.
Please refer to "Selecting Power Supply" and then connect to the jumper in accordance with the power supply to be used.
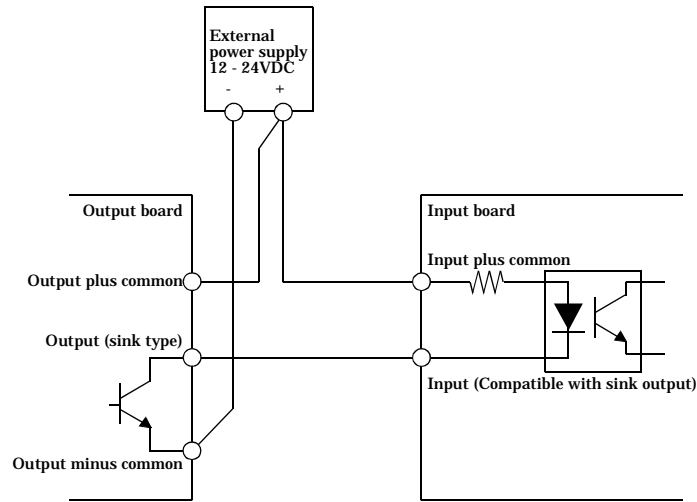
Connection to the LED
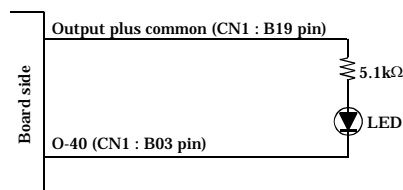
When "1" is output to a relevant bit, the corresponding LED comes on.
When "0" is output to the bit, in contrast, the LED goes out.

Connecting a Current Sink Output and Current Sink Output-Supported Input

The following example shows a connection between a sink type output (output board) and a sink output support input (input board). Refer to this connection example when you connect such boards to each other.

Block Diagrams