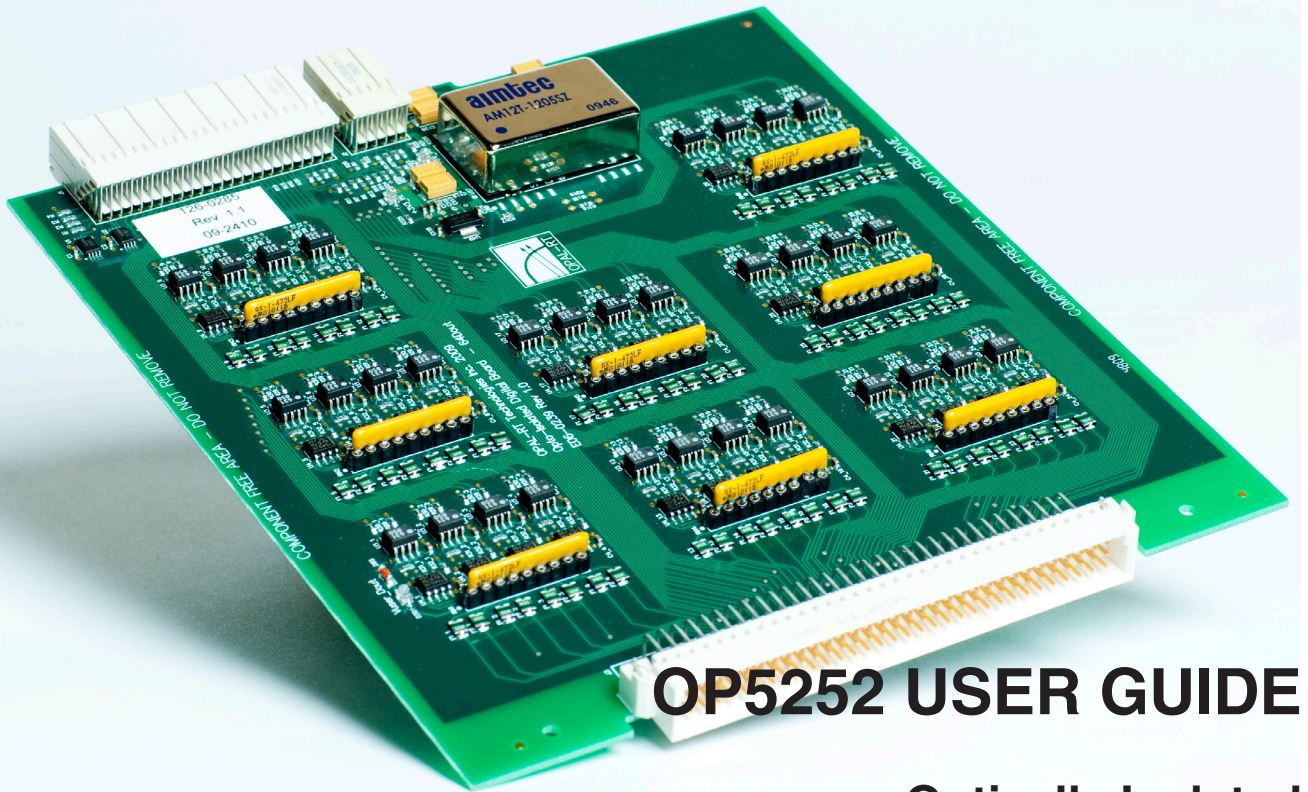




OPAL-RT



## OP5252 USER GUIDE

Optically Isolated  
64 Digital Output Module

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## GETTING STARTED

Before you begin, verify that your system meets the requirements of the OP5252 card:

### SOFTWARE REQUIREMENTS

- RT-LAB 8.4.0 and higher
- MATLAB 32 bits 6.5 and higher
- Windows XP and higher
- RT-XSG 1.3

### HARDWARE REQUIREMENTS

- Opal-RT simulator:
  - OP5000 series hardware-in-the-loop simulator
  - Opal-RT I/O expansion box (only for use with Opal-RT simulators)

### FEATURES

- 64 optically isolated output channels
- All outputs are outputted simultaneously for better simulation accuracy. They refresh output rate is up to 5 MHz
- Outputs can be grouped in parallel for any size bus simulation
- All outputs accept voltage up to 30V and the output current is up to 100mA.

### MODULE INSTALLATION

The OP5252 Digital Output Signal Conditioning Module must be inserted into the Opal-RT simulator. Make sure that the card is properly aligned, using the guide tracks, before pressing into place.

## INTRODUCTION

The OP5252 is a part of the OP5000 series of optional, versatile Signal Conditioning Modules for Opal-RT's state of the art HIL (hardware-in-the-loop) systems. Designed for Opal-RT's simulation systems, the OP5252 provides digital output signals with specific voltage conditioning. The optical isolation of the OP5252 outputs make it ideal for environments where voltage isolation is required.

## DESCRIPTION

The OP5252 features 64 optically isolated output channels and all are outputted simultaneously. It is perfectly suited to interface TTL or differential signals to real-life environment signals, providing perfect electrical isolation with full short-circuit protection.

## CIRCUIT LAYOUT DIAGRAMS

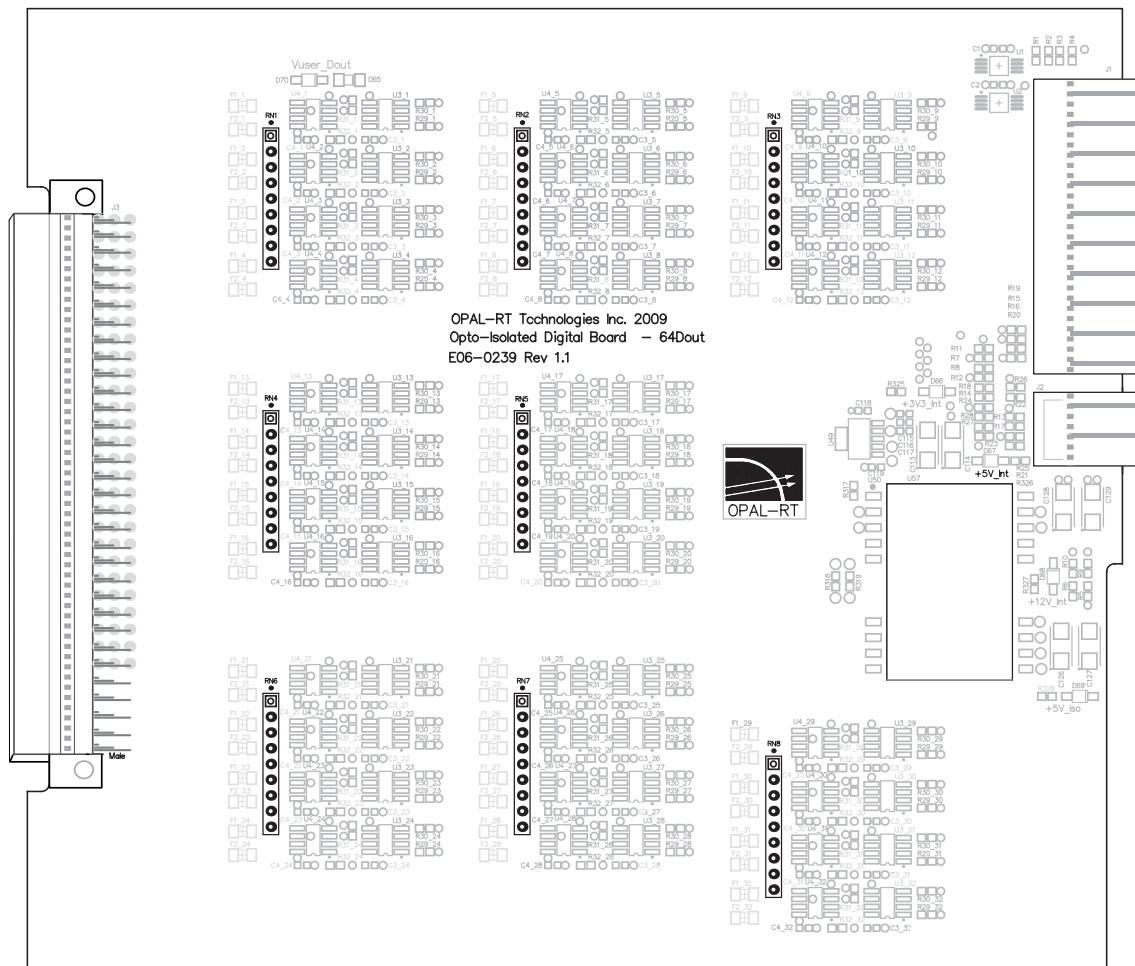


Figure 1: OP5252 Digital Signal Conditioning Module

## INTRODUCTION

### Circuit Layout Diagrams

## Outputs

Each optically isolated output has an open collector transistor. It can sink up to 100 mA continuous, and up to +30V according to user requirements. It is current protected by resettable 150 mA fuse (PTC). The optical isolation circuitry is powered by an internal isolated DC supply.

An internal  $R_L$  resistor is provided to obtain a high level when the output thermistor is open. The user may select this  $R_L$  in accordance with the pull-up resistor used in their own circuit.



**CAUTION:** If  $V_{user}$  is connected to the simulator, the output voltage  $DOUT$  would be the same as  $V_{user}$  as long as no RT-LAB model is running (output transistor is open).

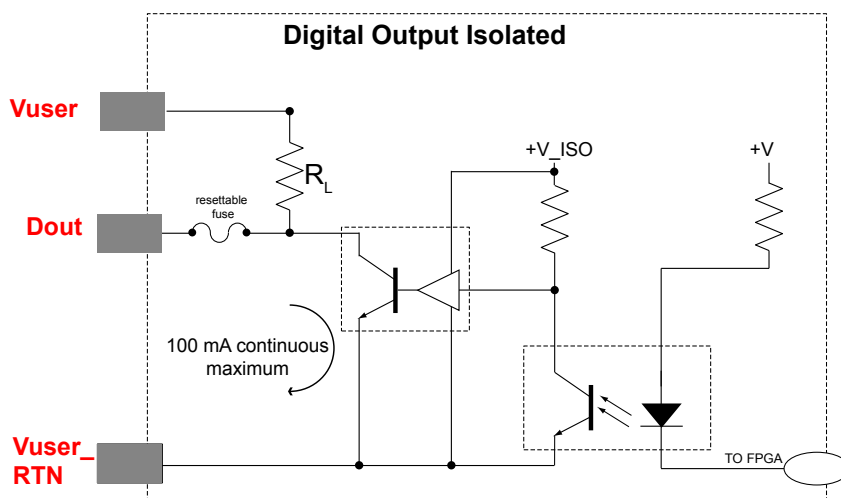


Figure 2: Isolated Digital Output Drawing



NOTE:  $V_{user\_RTN}$  is normally the  $V_{user\_GND}$ .

## Interconnections

The OP5252 is a carrierless module. It fits directly into the OP5000 series of hardware-in-the-Loop simulators without carriers. Up to four OP5252 modules can be positioned in a Wanda 4U and up to eight in an OPAL-RT Expansion Box.

## POWER CONFIGURATION

The digital outputs use an isolated DC-DC converter to power onboard circuitry.

If the pull-up resistor on the user's circuit is too high, it may be necessary to change the on-board  $R_L$  resistor to achieve better rise times. If the rise time is unimportant, there is no need to change the  $R_L$  resistor.

The following resistors are used for the OP5252 to achieve faster rise times. The part numbers provided are for reference purposes only. Part numbers may differ according to supplier or country:

	Voltage range (Volts - continuous)	Resistor value ( $\Omega$ ) (R)	Resistor Network Bourns Part Number
Digital Output	0-8	270	4609H-101-271 LF / 4309H-101-271 LF
	0-15	1000	4609H-101-102 LF / 4309H-101-102 LF
	0-30	4700 (default)	4609H-101-472 LF / 4309H-101-472 LF

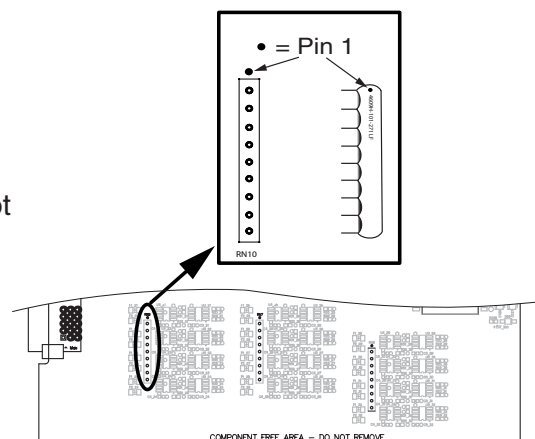
Table 1: Digital Output Voltage and Resistor Values



**WARNING:** ensure that the proper resistor is installed to obtain desired rise time. Failure to do so may result in damage to the OP5252 board or host setup.

### Outputs:

Changing the value of resistor network RN1 to RN8 (on the pcb) will configure the output voltage range in groups of 8. Using a SIP-9 isolated resistor network, make sure you match the pin 1 indicator with pin 1 on the module. As previously mentioned, an additional resistor in parallel with the output circuit will increase the current, as long as the current does not exceed 100 A per output.



Each output resistor network affects 8 digital output channels. Refer to the Resistor Network table below for the relationship between the resistor network and output channels. Use the following formula to ensure safe power dissipation:  $V_{user} (V) / \text{Resistor} (\Omega) = \text{current} (A)$ .

Resistor network	Channel bank
RN1	00-07
RN2	08-15
RN3	16-23
RN4	24-31
RN5	32-39
RN6	40-47
RN7	48-55
RN8	56-63

Table 2: Dout Resistor Network by Channel Bank

All digital outputs are accessible via a 96 pin, 3 x 32, DIN96 male connector.

Pay careful attention to the position diagram and Pin Assignment table to ensure proper and safe function.

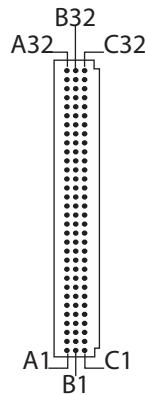


Figure 3: OP5252 DIN96 Pin Assignment (male)



## OP5252 PIN ASSIGNMENTS

OP5252 126-0285	Screw terminal 126-0274	Module pin assignment	OP5252 126-0285	Screw terminal 126-0274	Module pin assignment
A32	A32	NC	A16	A16	OUT 32
B32	B32	NC	B16	B16	OUT 33
C32	C32	NC	C16	C16	OUT 34
A31	A31	NC	A15	A15	OUT 35
B31	B31	NC	B15	B15	OUT 36
C31	C31	NC	C15	C15	OUT 37
A30	A30	NC	A14	A14	OUT 38
B30	B30	NC	B14	B14	OUT 39
C30	C30	NC	C14	C14	OUT 40
A29	A29	NC	A13	A13	OUT 41
B29	B29	NC	B13	B13	OUT 42
C29	C29	NC	C13	C13	OUT 43
A28	A28	NC	A12	A12	OUT 44
B28	B28	NC	B12	B12	OUT 45
C28	C28	NC	C12	C12	OUT 46
A27	A27	NC	A11	A11	OUT 47
B27	B27	OUT 00	B11	B11	Vuser-DOUT
C27	C27	OUT 01	C11	C11	Vuser-DOUT
A26	A26	OUT 02	A10	A10	Vuser-DOUT
B26	B26	OUT 03	B10	B10	Vuser-DOUT
C26	C26	OUT 04	C10	C10	Vuser_RTN
A25	A25	OUT 05	A09	A09	Vuser_RTN
B25	B25	OUT 06	B09	B09	Vuser_RTN
C25	C25	OUT 07	C09	C09	Vuser_RTN
A24	A24	OUT 08	A08	A08	Vuser_RTN
B24	B24	OUT 09	B08	B08	Vuser_RTN
C24	C24	OUT 10	C08	C08	Vuser_RTN
A23	A23	OUT 11	A07	A07	Vuser_RTN
B23	B23	OUT 12	B07	B07	Vuser_RTN
C23	C23	OUT 13	C07	C07	Vuser_RTN
A22	A22	OUT 14	A06	A06	NC
B22	B22	OUT 15	B06	B06	NC
C22	C22	OUT 16	C06	C06	OUT 48
A21	A21	OUT 17	A05	A05	OUT 49
B21	B21	OUT 18	B05	B05	OUT 50
C21	C21	OUT 19	C05	C05	OUT 51
A20	A20	OUT 20	A04	A04	OUT 52
B20	B20	OUT 21	B04	B04	OUT 53
C20	C20	OUT 22	C04	C04	OUT 54
A19	A19	OUT 23	A03	A03	OUT 55
B19	B19	OUT 24	B03	B03	OUT 56
C19	C19	OUT 25	C03	C03	OUT 57
A18	A18	OUT 26	A02	A02	OUT 58
B18	B18	OUT 27	B02	B02	OUT 59
C18	C18	OUT 28	C02	C02	OUT 60
A17	A17	OUT 29	A01	A01	OUT 61
B17	B17	OUT 30	B01	B01	OUT 62
C17	C17	OUT 31	C01	C01	OUT 63

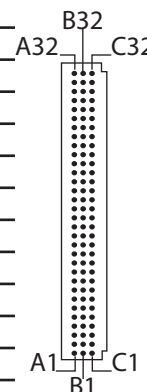


Table 3: Pin Assignments

**Pin Assignments for 126-0292 64 D I/O DIN96 4 x 50 adapter**

		OP5252	126-0292 (64 DI/O DIN96 4x50)	
I/O Type	Module pin assignment	Din 96 IO	Connector	Pin #
Dout	OUT00	B27	P1	1
Dout	OUT01	C27	P1	3
Dout	OUT02	A26	P1	5
Dout	OUT03	B26	P1	7
Dout	OUT04	C26	P1	9
Dout	OUT05	A25	P1	11
Dout	OUT06	B25	P1	13
Dout	OUT07	C25	P1	15
Dout	OUT08	A24	P1	17
Dout	OUT09	B24	P1	19
Dout	OUT10	C24	P1	21
Dout	OUT11	A23	P1	23
Dout	OUT12	B23	P1	25
Dout	OUT13	C23	P1	27
Dout	OUT14	A22	P1	29
Dout	OUT15	B22	P1	31
Dout	OUT16	C22	P2	1
Dout	OUT17	A21	P2	3
Dout	OUT18	B21	P2	5
Dout	OUT19	C21	P2	7
Dout	OUT20	A20	P2	9
Dout	OUT21	B20	P2	11
Dout	OUT22	C20	P2	13
Dout	OUT23	A19	P2	15
Dout	OUT24	B19	P2	17
Dout	OUT25	C19	P2	19
Dout	OUT26	A18	P2	21
Dout	OUT27	B18	P2	23
Dout	OUT28	C18	P2	25
Dout	OUT29	A17	P2	27
Dout	OUT30	B17	P2	29
Dout	OUT31	C17	P2	31
Digital Power	Vuser_DOUT	B11	P1-P2	41
Digital Power	Vuser_DOUT	C11	P1-P2	42
Digital Power	Vuser_DOUT	A10	P1-P2	45
Digital Power	Vuser_DOUT	A09	P1-P2	46
Digital Power	Vuser_RTN	C10	P1-P2	43
Digital Power	Vuser_RTN	A09	P1-P2	44
Digital Power	Vuser_RTN	B09	P1-P2	47
Digital Power	Vuser_RTN	C09	P1-P2	48
Digital Power	Vuser_RTN	A08	P1-P2	49
Digital Power	Vuser_RTN	B08	P1-P2	50
Dout	OUT32	A16	P3	1
Dout	OUT33	B16	P3	3
Dout	OUT34	C16	P3	5
Dout	OUT35	A15	P3	7
Dout	OUT36	B15	P3	9
Dout	OUT37	C15	P3	11
Dout	OUT38	A14	P3	13
Dout	OUT39	B14	P3	15
Dout	OUT40	C14	P3	17
Dout	OUT41	A13	P3	19

		OP5252	126-0292 (64 DI/O DIN96 4x50)	
I/O Type	Module pin assignment	Din 96 IO	Connector	Pin #
Dout	OUT42	B13	P3	21
Dout	OUT43	C13	P3	23
Dout	OUT44	A12	P3	25
Dout	OUT45	B12	P3	27
Dout	OUT46	C12	P3	29
Dout	OUT47	A11	P3	31
Dout	OUT48	C06	P4	1
Dout	OUT49	A05	P4	3
Dout	OUT50	B05	P4	5
Dout	OUT51	C05	P4	7
Dout	OUT52	A04	P4	9
Dout	OUT53	B04	P4	11
Dout	OUT54	C04	P4	13
Dout	OUT55	A03	P4	15
Dout	OUT56	B03	P4	17
Dout	OUT57	C03	P4	19
Dout	OUT58	A02	P4	21
Dout	OUT59	B02	P4	23
Dout	OUT60	C02	P4	25
Dout	OUT61	A01	P4	27
Dout	OUT62	B01	P4	29
Dout	OUT63	C01	P4	31
Digital Power	Vuser_RTN	C08	P3-P4	43
Digital Power	Vuser_RTN	A07	P3-P4	44
Digital Power	Vuser_RTN	B07	P3-P4	47
Digital Power	Vuser_RTN	C07	P3-P4	48

Table 4: Pin assignments for 126-0292



NOTE: Even numbered pins (2, 4, 6, 8, 10, 12, ...32) on connectors P1 to P4 are all tied to Vuser\_RTN

## SPECIFICATIONS

Product name	OP5252
Part Number	126-0285
Number of Outputs:	64
Isolation:	Optical isolator
Output Drive:	Open Collector Transistor
Output Current max:	100 mA continuous
Output Protection :	150 mA Resettable Fuse
Output Voltage range:	4 to 30 Vdc
Pull-Up Load resistor network:	Socket mounted
Delay Low-to-High:	100 ns with 1 kΩ R <sub>L</sub>
Delay High-to-Low:	50 ns
Rise/Fall times:	R <sub>L</sub> dependant / 6 ns
Power Isolation:	On-board DC to DC isolated converter

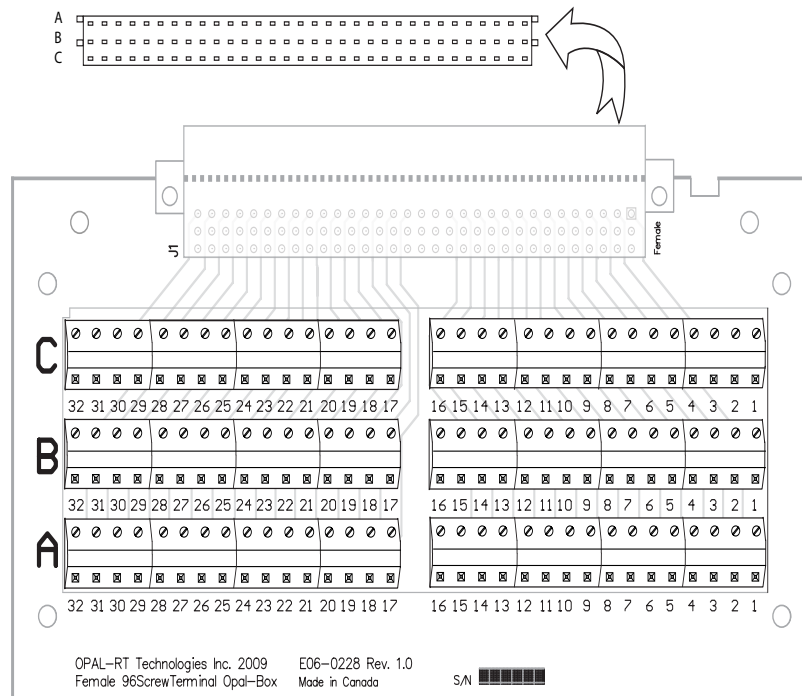
## ACCESSORIES

The following accessories are available for use with the OP5252:

- 126-0274: Female 96DIN screw terminal
- 126-0292: 64 D I/O DIN96 4 x 50 adapter
- 113-0374L (optional) 2 x 50-pins IDC50

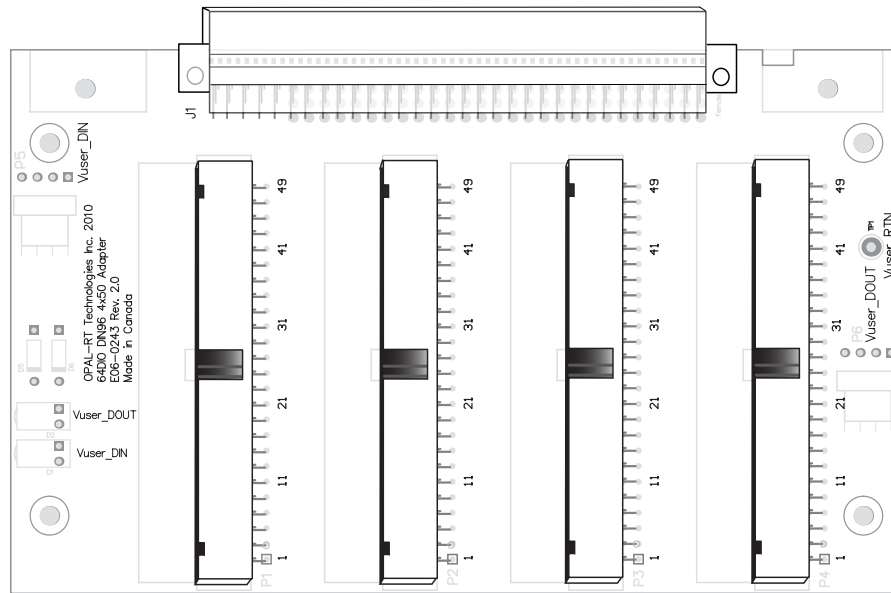
### 126-0274: Female 96DIN screw terminal

Connecting directly into the OP5252, the 96DIN screw terminals allow quick and precise customized connections to specific pins (listed in “Table 3: Pin Assignments”).



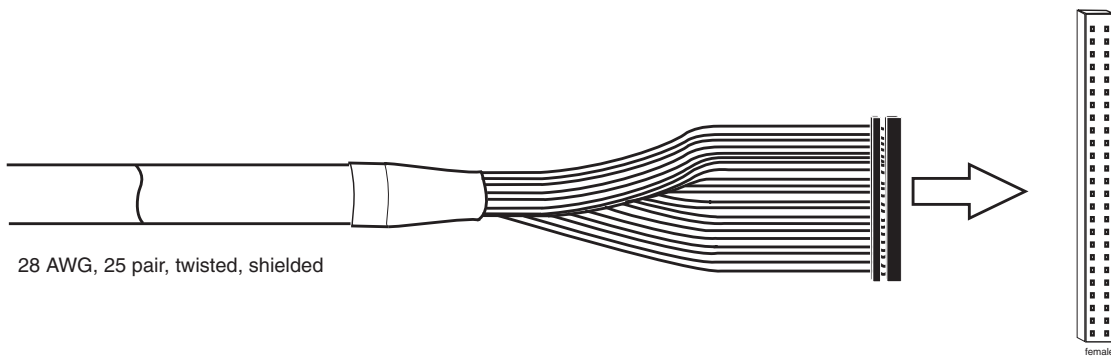
### 126-0292: 64 D I/O DIN96 4 x 50 adapter

This adapter is used to connect twisted pair flat cables and allows for quick connections to digital Input/ Output boards (patch panel) using four 50-pin (2x25) connectors. (See Table 4 for pin assignments.)



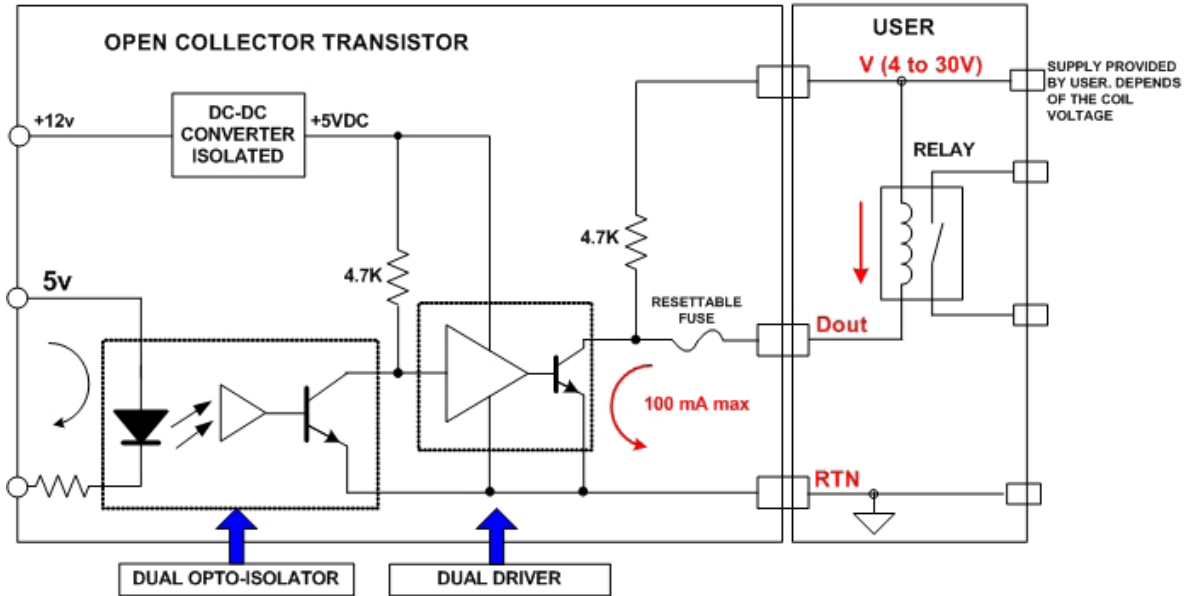
### 113-0374L 2 x 50-pins IDC50 cable

Round shielded cable, 25 twisted pair (for use with part number 126-0292, 64 D I/O DIN96 4 x 50 adapter)



## TYPICAL APPLICATION

The diagram below illustrates one typical application example.





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