



**NC-940
PC/104 Module
8 Channel Relay Actuator**

Reference Manual

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General Description

1

The NC-940 relay actuator PC/104 module is designed for control applications. It features 8 channels of electromechanical single-pole double-throw relays which can be set or reset directly by I/O write instructions. Each relay is rated at 1.5A and 125 VAC. The normal open, normal close, and common contacts of each relay are reached through 50-pin mating connectors. Relay activation is indicated by an adjacent LED. The relays are activated when a logic high is written to the controlling bit.

1.1 Features

- 8 single-pole, double-throw relays
- 125VAC/1.5A maximum contact rating
- Isolation up to 1KVrms
- NC, NO, and COM contacts output
- LED indicators show activated relays



1.2 Specifications

Relay Output

| | |
|---------------------------|---|
| Number of channels | 8 |
| Type | Electromechanical DIP Relay, Normal Open |
| Form | DPDT (wired as SPDT) |
| Contact rating | |
| Maximum Switching Power | 30W/60VA |
| Maximum Switching Voltage | 125VDC/125VAC |
| Maximum Switching Current | 1.5ADC/1.5AAC |
| Contact Resistance | 100m Ω maximum |
| Indication Mode | Logic "1" = LED on and relay set Logic "0" = LED off and relay reset |
| Life Expectancy | 10 X 10 ⁶ operations (rated) |
| Operate/Release | 8/8ms |
| Breakdown Voltage | |
| Coil to contact | 1500Vrms |
| Across contact | 1000Vrms |

Power Requirements

| | |
|--------|---------------|
| +5VDC | 200mA typical |
| +12VDC | 100mA typical |



1.3

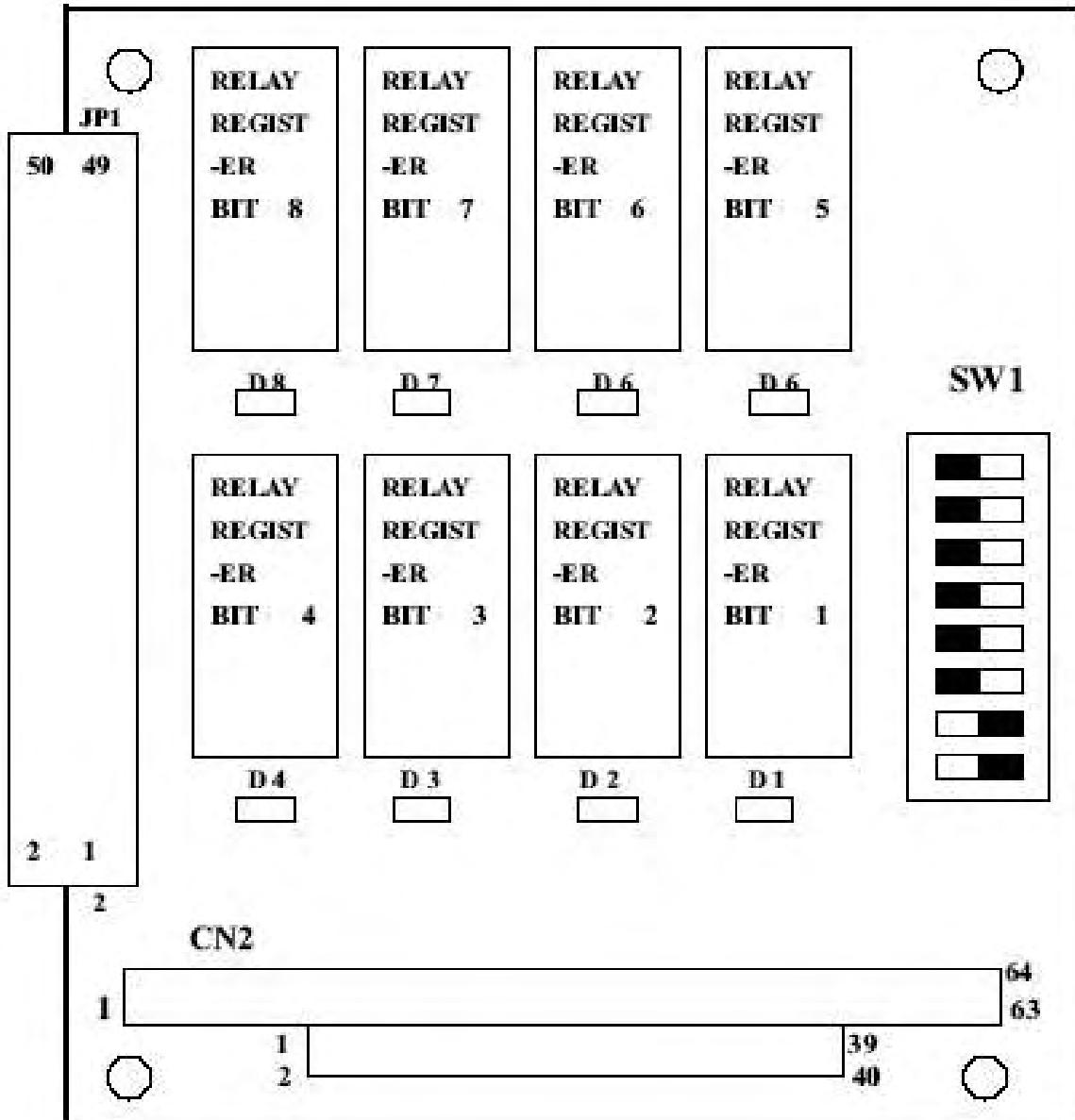
Physical/Environmental

| | |
|-----------------------------|--------------------------|
| Dimensions | 95mm X 90mm |
| Weight | 230g |
| Operating Temperature Range | 0 to 50°C |
| Storage Temperature Range | -20 to 70°C |
| Relative Humidity | 0 to 90%, non-condensing |

Module Configuration and Installation

2.1 Location Diagram

Refer to the following diagram for help in locating components needed during installation.



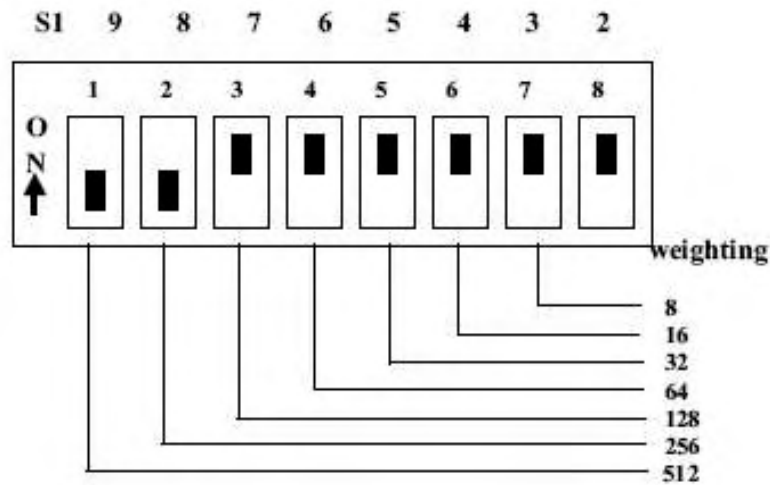
and configuration of the NC-940 module.



2.2 DIP Switch Setting

The NC-940 occupies four consecutive I/O port spaces. The first address or base address is set via a DIP switch labeled SW 1. If more than one module is to be installed in a PC, each module must be given a unique base address. When selecting the base address, refer to Appendix A to aid in preventing device conflicts. Valid addresses are from 200Hex to 3F8Hex. The following figure shows the default setting of 300Hex.

Base Address Switch Setting



**Base address = 512+256 = 768 (Decimal)
300 (Hexadecimal)**



| I/O Port Range | DIP Switch Position | | | | | | | |
|----------------|---------------------|----|----|----|----|----|----|----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| | A9 | A8 | A7 | A6 | A5 | A4 | A3 | A2 |
| 200 - 203 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 204 - 207 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 208 - 20B | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 20C - 20F | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| 220 - 223 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| *300 - 303 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3F8 - 3FB | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| 3FC - 3FF | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

0 = ON, 1 = OFF

* = FACTORY DEFAULT SETTING



2.3 Connector Pin Assignments

All outputs of the NC-940 are reached through 50-pin connectors labeled JP1. The following figure and descriptions give the necessary data for wiring.

JP1

| NAME | PIN | PIN | NAME |
|-------|-----|-----|-------|
| R1COM | 1 | 2 | R1COM |
| R1NC | 3 | 4 | R1NC |
| R1NO | 5 | 6 | R1NO |
| R2COM | 7 | 8 | R2COM |
| R2NC | 9 | 10 | R2NC |
| R2NO | 11 | 12 | R2NO |
| R3COM | 13 | 14 | R3COM |
| R3NC | 15 | 16 | R3NC |
| R3NO | 17 | 18 | R3NO |
| R4COM | 19 | 20 | R4COM |
| R4NC | 21 | 22 | R4NC |
| R4NO | 23 | 24 | R4NO |
| R5COM | 25 | 26 | R5COM |
| R5NC | 27 | 28 | R5NC |
| R5NO | 29 | 30 | R5NO |
| R6COM | 31 | 32 | R6COM |
| R6NC | 33 | 34 | R6NC |
| R6NO | 35 | 36 | R6NO |
| R7COM | 37 | 38 | R7COM |
| R7NC | 39 | 40 | R7NC |
| R7NO | 41 | 42 | R7NO |
| R8COM | 43 | 44 | R8COM |
| R8NC | 45 | 46 | R8NC |
| R8NO | 47 | 48 | R8NO |
| N/C | 49 | 50 | N/C |
| | | | |



2.4

JP1 Connector Pin Description

| Signal Name | Description |
|---------------|--|
| R1COM - R8COM | Common contact pins of relays 1 - 8 |
| R1NC - R8NC | Normally closed contacts of relays 1 - 8 |
| R1NO - R8NO | Normally open contacts of relays 1 - 8 |
| N/C | No connect |



2.5

Module Installation

The NC-940 PC/104 module is shipped with an electrostatically protective cover. When unpacking, touch the electrostatically shielded packaging to a metal surface to discharge any accumulated static electricity prior to touching the module.

The following description summarizes the procedure for installing the NC-940.

WARNING

TURN OFF the PC and all accessories connected to the PC whenever installing or removing any peripheral board including the NC-940 module.

Installation procedures:

1. Turn off the system power.
2. Unplug all power cords.
3. Remove the case cover if necessary.
4. Remove the top module if it is a non-stackthrough module.
5. Put the NC-940 module in line with top present module as described in Appendix B.
6. Install four spacers if necessary.
7. Connect cable if necessary.
8. Press the modules together until the inside distance is SPACER'S height (0.6"). Replace all the screws.
9. Repeat steps 6-8 until all modules are set into position.
10. Connect cable to NC-940 if necessary.
11. Replace the case cover and reconnect all necessary cables.
12. Turn on the system power.



Register Description

The NC-940 occupies 4 consecutive addresses in I/O address space, but only one address is used. During installation, set the SW 1 switch to the correct base address. The following table shows the register configuration.

Base Address + 0

| | | | | | | | | |
|------------|----|----|----|----|----|----|----|----|
| Bit Number | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Bit Name | R8 | R7 | R6 | R5 | R4 | R3 | R2 | R1 |

Only base address + 0 is used for 8-bit wide relay output register. This register is a read/write register for controlling relays. The controlling bits R1 through R8 correspond to onboard Relay 1 through Relay 8. To activate a relay, set the corresponding controlling bit to "1". To turn off a relay, set the corresponding bit to "0". The data written to the register can be read back as data for comparison and confirmation purposes. Base addresses +1, +2, and +3 are all reserved.

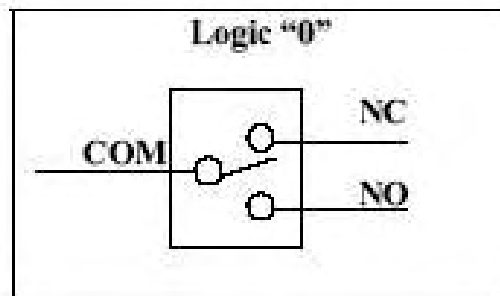


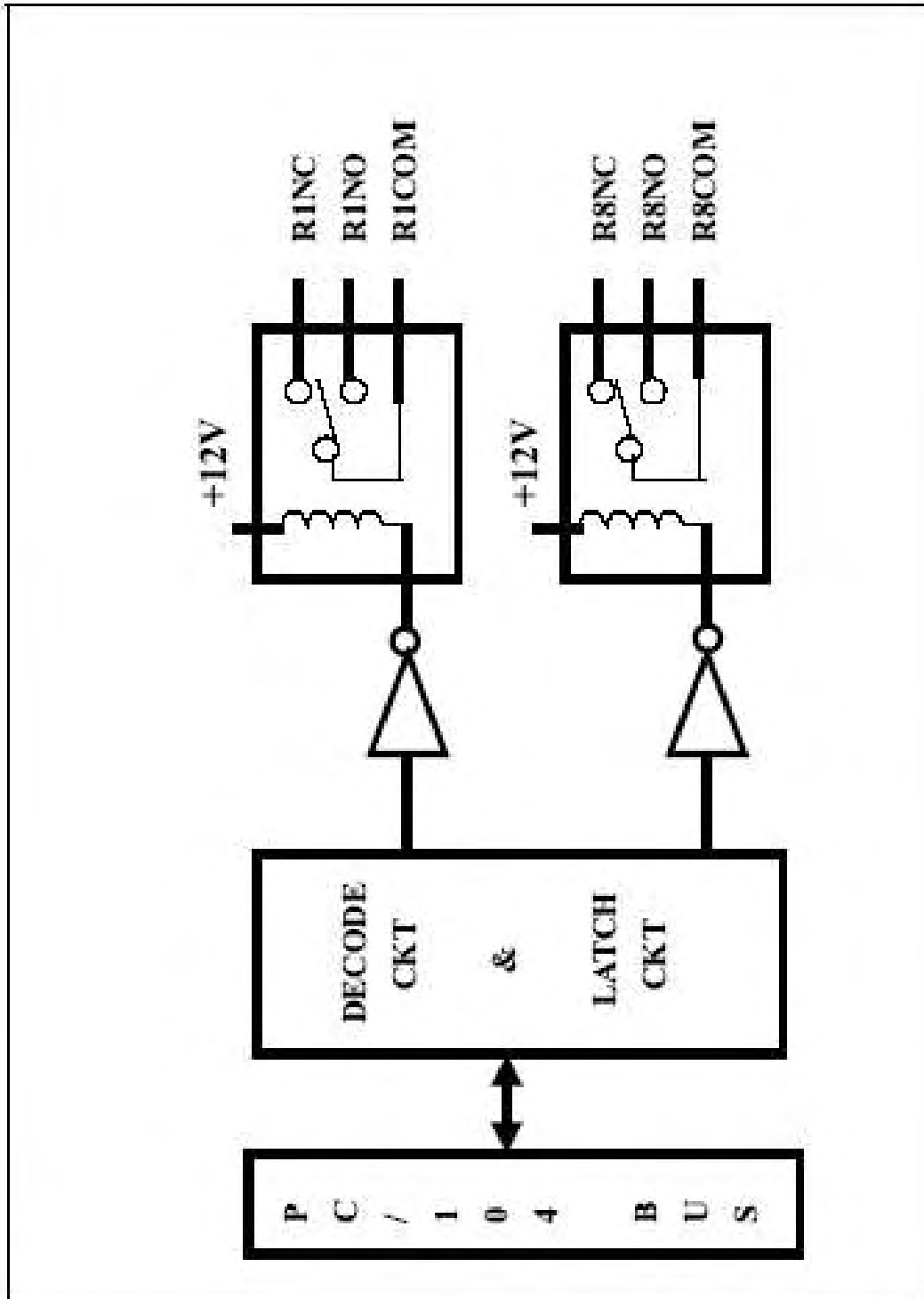
Programming the NC-940 is straightforward. It can be easily accomplished using direct I/O instructions from a variety of application languages. In this section an example in BASIC is given. This example shows how to control the eight relays on the module, assuming the base address as 300Hex.

```
BASE = &H300
out  BASE, 0           'All relays are off
out  BASE, 1           'Only Relay 1 is activated
out  BASE, &H80        'Only Relay 8 is activated
out  BASE, &H55        'Relays 1, 3, 5, 7 are activated
inp  (BASE)            'Read back relay status: 55Hex
```

Relay Output

Each of the electromechanical delays has three contacts: COM (Common), NO (Normally Open), and NC (Normally Closed). When a 0 is written to the associated controlling bit, the COM and NC posts make contact. When a 1 is written to the controlling bit, the COM and NO posts make contact. Refer also to the Register Description and Programming sections regarding controlling the relays.







Appendix A: PC I/O Mapping

| I/O Port Address Range | Function |
|------------------------|---------------------------------------|
| 000 - 1FF | PC reserved |
| 200 - 20F | Game controller (joystick) |
| 278 - 27F | Second parallel printer port (LPT 2) |
| 2E1 | GPIB controller |
| 2F8 - 2FF | Second serial port (COM 2) |
| 320 - 32F | Fixed disk (XT) |
| 378 - 37F | Primary parallel printer port (LPT 1) |
| 380 - 38F | SDLC communication port |
| 3B0 - 3BF | Monochrome adapter/printer |
| 3C0 - 3CF | EGA, reserved |
| 3D0 - 3DF | Color/graphics adapter |
| 3F0 - 3F7 | Floppy disk controller |
| 3F8 - 3FF | Primary Serial port (COM 1) |



Appendix B: PC/104 Mechanical Specifications

PC/104 General Description

While the PC and PC/AT architectures have become extremely popular in both general purpose (desktop) and dedicated (non-desktop) applications, their use in embedded microcomputer applications have been limited due to the large sizes of standard PC and PC/AT motherboards and expansion cards. PC/104 modules can be of two bus types, 8 bit and 16 bit, which correspond to the PC and PC/AT buses respectively.

Besides bus options, there are stackthrough and non-stackthrough differences. The stackthrough version provides a self-stacking PC bus. It can be placed anywhere in a multi-module stack. The non-stackthrough version offers minimum thickness by omitting bus stackthrough pins. It must be positioned at one end of a stack.

For convenience, the NC-940 is equipped as a stackthrough version only.