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IP-RELAY

Eight Form-C Latching Relays
IndustryPack®

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IP-RELAY

Eight Form-C
Latching Relays
IndustryPack®

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Table of Contents

Product Description 5
VMEbus Addressing 8
AT (ISA) bus Addressing 10
NuBus Addressing 13
I/O Pin Assignments 15
IndustryPack Logic Interface 18
Programming 19
ID PROM 20
User Options 21
Construction and Reliability 22
Repair 23
Pin Group Locations 24
Specifications 25

List of Figures

Figure 1 Simplified Logic Diagram of IP-RELAY 5
Figure 2 Power Supply Filter Circuit 6
Figure 3 Relay Driver Circuit 6
Figure 4 Relay Contact Identification 7
Figure 5 VMEbus Address Map 8
Figure 6 Timer Bit Assignments 9
Figure 7 AT bus Base Addressing 10
Figure 8 AT bus Relay Addressing 11
Figure 9 Timer Bit Assignments 12
Figure 10 NuBus Address Map 13
Figure 11 NuBus Timer Bit Assignments 14
Figure 12 I/O Pin Assignment 16
Figure 13 Logic Interface Pin Assignment 17
Figure 14 ID PROM Data (hex) 20
Figure 15 Location of Pin Groups 24

Product Description

IP-RELAY provides eight Form-C (double-pole, double-through) latching relays. Relays provide complete galvanic isolation between the control side and the contacts. They provide higher on to off resistance ratios than solid state switches can achieve. The gold-over-silver contacts are ideal for accurate switching of low voltage signals, yet the relays are rated to switch one amp per contact continuously.

The gold plated bifurcated contacts have a worst case resistance of 60 mΩ, even after one million operations.

Logic and timing on the IndustryPack automatically controls the latching functions. To set or reset any relay the host software does a single write to a relay-specific address. Each relay switches in three milliseconds. Logic permits only a single relay to switch at one time. This minimizes the impact on power supplies and keeps generated switching noise to a minimum.

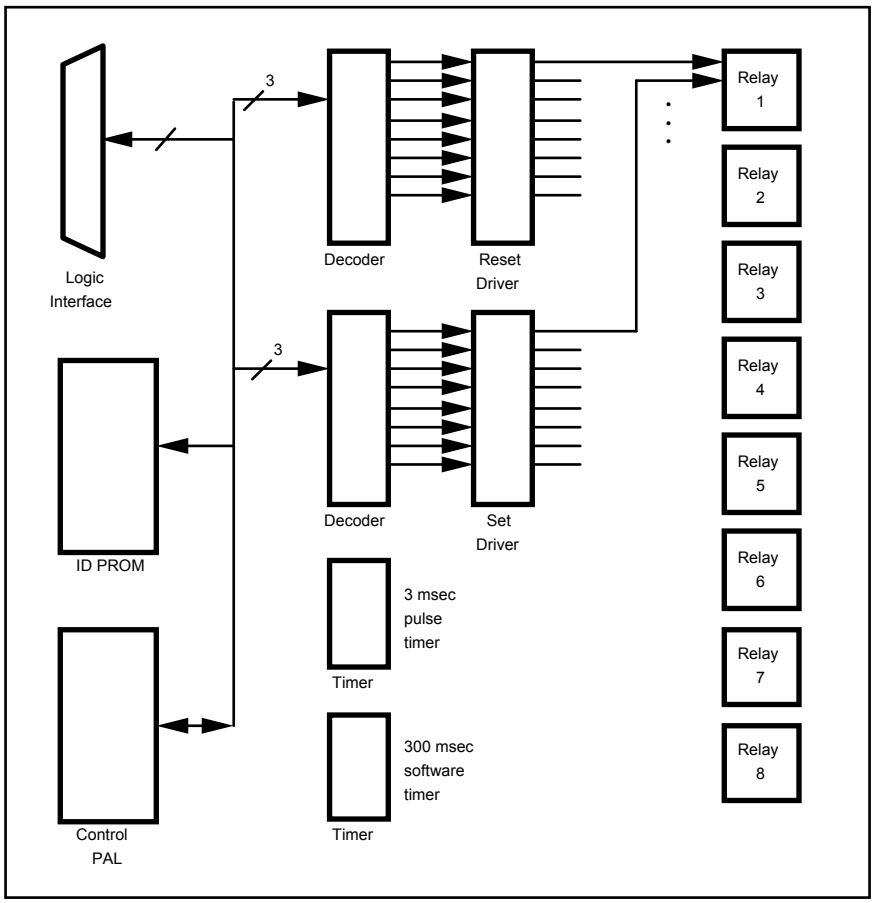


Figure 1 Simplified Logic Diagram of IP-RELAY

Each relay has a mechanical switching time of three milliseconds, nominally. The contacts are rated to switch the specified voltage and currents up to three cycles per second. Two timing circuits on the IndustryPack are provided to aid software in keeping within these limits. Each timer is triggered automatically whenever a relay changes state. The timers may be polled to determine status.

A wiring option permits IP-RELAY to be used as a two channel by eight line multiplexor or demultiplexor. This mode is convenient for expanding the inputs to IP-PREC-ADC or directing outputs of IP-DAC or IP-16DAC to multiple circuits or equipment.

Theory of Operation

A block diagram of the IP-RELAY's logic is shown above in Figure 1. The three IndustryPack address lines A1, A2 and A3 are used to select one of eight relays. Two three line to eight line decoders are used for this. Address line A4 is used to select the Reset or Set function. Each relay's reset and set coils are driven separately by a high current open collector driver. The driver circuit is shown below in Figure 3. Each coil's current when driven is approximately 40 milliamps. Drive pulse width is controlled by a local 3 millisecond timer. A second timer set to 300 milliseconds nominally is provided to assist software in keeping within the maximum number of relay operations per second if switching maximum rated contact loads.

Filtering is provided to prevent relay coil switching noise from entering the host system. This filter consists of a pi filter and zener diode in the power supply line plus snubber diodes on the relay coils. The simplified circuits for these filters are shown below in Figures 2 and 3.

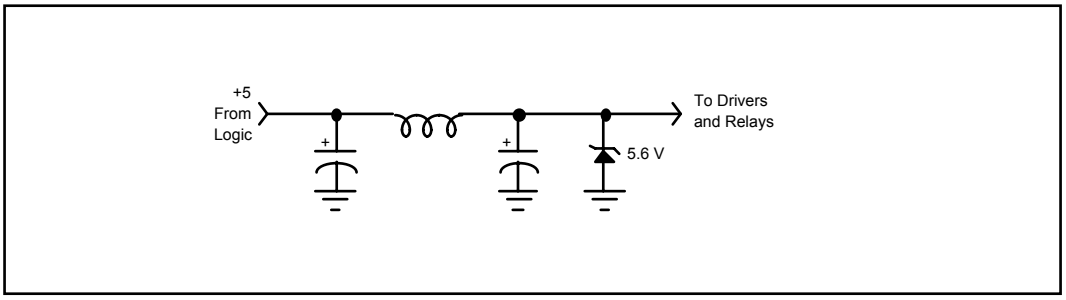


Figure 2 Power Supply Filter Circuit

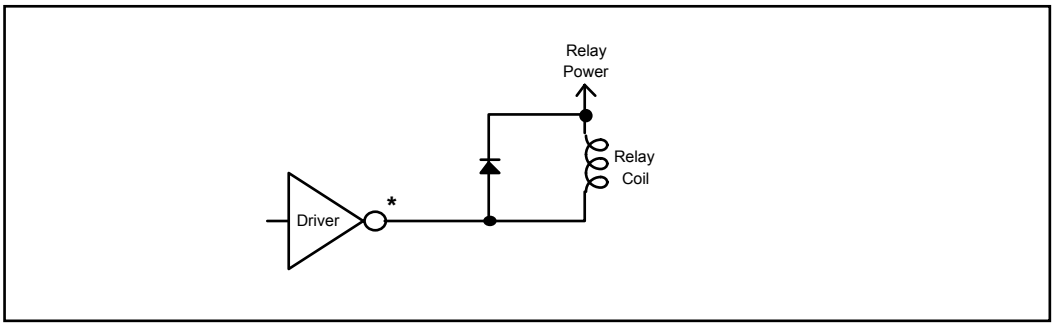


Figure 3 Relay Driver Circuit

Each relay is a latching Form-C, also called double-pole, double-throw. Contact identification is shown below in Figure 4. See also the section below, I/O Pin Assignments.

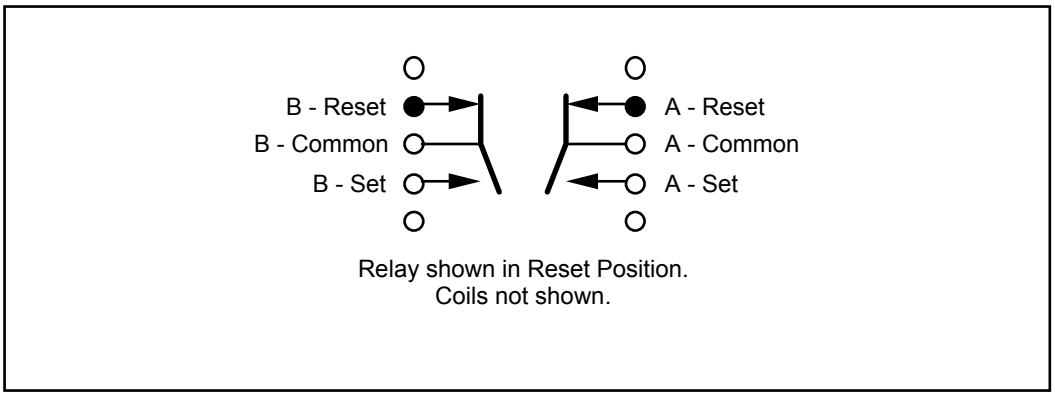


Figure 4 Relay Contact Identification

VMEbus Addressing

Relays are set or reset by writing to specific addresses. The data written is ignored. The write may be a byte or word write. If it is a byte write, it may be to an even address or to the odd address following.

Once a relay is set (or reset), it stays in that position, even if power is removed. The IndustryPack RESET signal, generated by the IP carrier, is true if the power supply is below specifications. This RESET signal inhibits new set or reset pulses, but does not halt a pulse in progress. Power-up, power-down, and VMEbus Reset do not cause the relays to change state.

The address map for the VMEbus for setting and resetting the relays is shown in Figure 5. For NuBus applications see the section following, NuBus Addressing.

Address	Function	Relay
base + $00	Reset	Relay 8
base + $02	Reset	Relay 7
base + $04	Reset	Relay 6
base + $06	Reset	Relay 5
base + $08	Reset	Relay 4
base + $0A	Reset	Relay 3
base + $0C	Reset	Relay 2
base + $0E	Reset	Relay 1
base + $10	Set	Relay 8
base + $12	Set	Relay 7
base + $14	Set	Relay 6
base + $16	Set	Relay 5
base + $18	Set	Relay 4
base + $1A	Set	Relay 3
base + $1C	Set	Relay 2
base + $1E	Set	Relay 1

Note: A byte or word write must be executed to the listed address. Data is ignored. See text for timing limitations.

Figure 5 VMEbus Address Map

Only one relay may switch at a time. The switching current is approximately 40 milliamps, which is drawn from the +5 volt supply through a filter. By limiting switching to a single relay the impact on the power supply and the noise generated into the host system is kept to a minimum. In normal cases, even with sensitive analog IPs installed, the impact on the system from relays switching will be negligible.

A local timer on IP-RELAY is used to time the set and reset pulses. The length of these pulses is nominally three milliseconds. No other relay may be set or reset during this time. Should the host software attempt a set or reset operation, the IP will block the attempt and will not respond with ACK. This will cause a bus timeout to occur. The state of the on-board timer must be tested prior to any write that may overlap a previous relay set or reset operation.

This timer bit is accessed by reading any odd byte within the I/O space of the IP, typically base + $01. The bit is the LSB (bit 0). If the bit is a one, then an operation is in progress and any pending writes must be postponed. If the bit is a zero, then the IP is idle and a write operation is permitted. Thus the bit may be interpreted as a logic true BUSY flag. This is shown in Figure 6. Writes to IP-RELAY should not be attempted if bit 0 is set.

Address	Bit	Function
base + $01	Bit 0 (LSB)	BUSY (3 msec)
base + $01	Bit 1	TIMER (300 msec)

Note: All accesses are odd byte reads. A 1 indicates busy, a 0 indicates idle.

Figure 6 Timer Bit Assignments

A second timer is provided to assist software is meeting a recommended maximum relay switching rate of 20 cycles per minute at maximum rated contact loads. This timer is started every time a relay changes state. The timer period is 300 milliseconds, nominally. The timer state may be read in bit 1 in any odd byte in the IP's I/O space. This is shown in Figure 7. A logic 1 (set) means the timer is still running. A logic 0 (reset) means the timer has expired, and the IP is idle. Note that this timer does not block accesses.

The 300 millisecond timeout is approximately one fifth the recommended waiting time between changes to any one relay, for continuous cycling. This timer may thus be used to assist in sequencing through all eight relays, for example, with a conservative margin.

AT (ISA) bus Addressing

SBS' ATC4 AT bus carrier permits up to four IndustryPacks to be installed into one PC bus slot.

The ATC4 has a one-time set up program called ATCSETUP (previously called SPSETUP) that is provided on floppy disk with each ATC4. This program has a "fill in the blank" menu that the AT systems integrator uses to select the address location and mode for the ATC hardware. When the ATCSETUP program terminates it creates and installs a device driver called SOLUPACK.SYS in the CONFIG.SYS. This device driver programs the control registers on the ATC4 for proper operation each time the system is booted.

After the driver is run at boot time, the ATC4 board is normally "transparent" to the user's software. Application software directly addresses the I/O registers on each IndustryPack.

The base address of the four IPs on the ATC4 is specified in the ATCSETUP menu. Offsets from this base address are shown in hex in Figure 7. The additional offsets for resetting or setting each relay are shown below in Figure 8. Note that the physical address to change the state of each relay is the sum of three numbers: the IP_Base_Address (from the ATCSETUP), the IP Offset (from Figure 7), and the relay offset (from Figure 8).

IP Module	**IP I/O Offset Addresses**
IP A	IP_Base_Address + 0
IP B	IP_Base_Address + $80
IP C	IP_Base_Address + $100
IP D	IP_Base_Address + $180

Note: IP_Base_Address is set in the ATSETUP menu.

Figure 7 AT Bus Base Addressing

Relay Address	Function	Relay
IP Offset + $00	Reset	Relay 8
IP Offset + $02	Reset	Relay 7
IP Offset + $04	Reset	Relay 6
IP Offset + $06	Reset	Relay 5
IP Offset + $08	Reset	Relay 4
IP Offset + $0A	Reset	Relay 3
IP Offset + $0C	Reset	Relay 2
IP Offset + $0E	Reset	Relay 1
IP Offset + $10	Set	Relay 8
IP Offset + $12	Set	Relay 7
IP Offset + $14	Set	Relay 6
IP Offset + $16	Set	Relay 5
IP Offset + $18	Set	Relay 4
IP Offset + $1A	Set	Relay 3
IP Offset + $1C	Set	Relay 2
IP Offset + $1E	Set	Relay 1

Note: A byte or word write must be executed to the listed address. Data is ignored. See text for timing limitations. See Figure 7 for IP Offset addresses.

Figure 8 AT Bus Relay Addressing

Software wishing to access the ID PROM must first access the ATC4 control register, switching the mode from I/O read/write to ID read. (D4, D3 of Carrier_Base_Address changes from 00 to 01). See the ATC4 User Manual for more information. Software which accesses the ID PROM should restore the ATC4 control register when it completes.

The use of latching relays is preferred in PC environments to keep system heat as low as possible.

Relays are set or reset by writing to specific addresses. The data written is ignored. The write may be a byte or word write. If it is a byte write, it may be to an even address or to the odd address following.

Once a relay is set (or reset), it stays in that position, even if power is removed. Power-up, power-down, and system re-boot do not cause the relays to change state.

Only one relay may switch at a time. The switching current is approximately 40 milliamps, which is drawn from the +5 volt supply through a filter. By limiting switching to a single relay the impact on the power supply and the noise generated into the host system is kept to a minimum. In normal cases, even with sensitive analog IPs installed, the impact on the system from relays switching will be negligible.

A local timer on IP-RELAY is used to time the set and reset pulses. The length of these pulses is nominally three milliseconds. No other relay may be set or reset during this time. Should the host software attempt a set or reset operation, the IP will block the attempt and will not respond with ACK. This will cause a bus timeout to occur. The state

of the on-board timer must be tested prior to any write that may overlap a previous relay set or reset operation.

This timer bit is accessed by reading any odd byte within the I/O space of the IP, typically IP Offset + $01. The bit is the LSB (bit 0). If the bit is a one, then an operation is in progress and any pending writes must be postponed. If the bit is a zero, then the IP is idle and a write operation is permitted. Thus the bit may be interpreted as a logic true BUSY flag. This is shown in Figure 9. Writes to IP-RELAY should not be attempted if bit 0 is set.

Address	Bit	Function
IP Offset + $01	Bit 0 (LSB)	BUSY (3 msec)
IP Offset + $01	Bit 1	TIMER (300 msec)

Note: All accesses are odd byte reads. A 1 indicates busy, a 0 indicates idle.

Figure 9 Timer Bit Assignments

A second timer is provided to assist software is meeting a recommended maximum relay switching rate of 20 cycles per minute (3.3 times per second) at maximum rated contact loads. This timer is started every time a relay changes state. The timer period is 300 milliseconds, nominally. The timer state may be read in bit 1 in any odd byte in the IP's I/O space. This is shown in Figure 9. A logic 1 (set) means the timer is still running. A logic 0 (reset) means the timer has expired, and the IP is idle. Note that this timer does not block accesses.

It is common that the software sequences through the timers, accessing the IP more than 3.3 timer per second, but not exceeding the switching rate for any one relay of 3.3 cycles per second. In this case the 300 millisecond timer may still be helpful. It may be tested by the software only once per sequence (associated with relay 1, for example). Alternatively the timer may still be tested and used as a hold off flag prior to all IP-RELAY accesses, providing a conservative access rate limit.

NuBus Addressing

Relays are set or reset by writing to specific addresses. The data written is ignored. The write may be a byte or word write. If it is a byte write it may be to an even address or to the odd address following. Since the NuBus uses only 32-bit wide accesses, 16-bit wide peripherals such as the IP-RELAY appear in the host address space every other (16-bit) word.

Once a relay is set (or reset), it stays in that position, even if power is removed. Power-up, power-down, and NuBus Reset do not cause the relays to change state.

The address map for the NuBus for setting and resetting the relays is shown in Figure 10.

RM1260 Address	RM1270 Address	Function	Relay
base + $01	base + $03	Reset	Relay 8
base + $05	base + $07	Reset	Relay 7
base + $09	base + $0B	Reset	Relay 6
base + $0D	base + $0F	Reset	Relay 5
base + $11	base + $13	Reset	Relay 4
base + $15	base + $17	Reset	Relay 3
base + $19	base + $1B	Reset	Relay 2
base + $1D	base + $1F	Reset	Relay 1
base + $21	base + $23	Set	Relay 8
base + $25	base + $27	Set	Relay 7
base + $29	base + $2B	Set	Relay 6
base + $2D	base + $2F	Set	Relay 5
base + $31	base + $33	Set	Relay 4
base + $35	base + $37	Set	Relay 3
base + $39	base + $3B	Set	Relay 2
base + $3D	base + $3F	Set	Relay 1

Note: A byte write must be executed to the listed address. Data is ignored. See text for timing limitations.

Figure 10 NuBus Address Map

Only one relay may switch at a time. The switching current is approximately 40 milliamps, which is drawn from the +5 volt supply through a filter. By limiting switching to a single relay the impact on the power supply and the noise generated into the host system is kept to a minimum. In normal cases, even with sensitive analog IPs installed, the impact on the system from relays switching will be negligible.

A local timer on IP-RELAY is used to time the set and reset pulses. The length of these pulses is nominally three milliseconds. No other relay may be set or reset during this time. Should the host software attempt a set or reset operation, the IP will block the attempt and will not respond with ACK. This will cause a bus timeout to occur. The state of the on-board timer must be tested prior to any write that may overlap a previous relay set or reset operation.

This timer bit is accessed by reading the first odd byte within the I/O space of the IP. The bit is the LSB (bit 0). If the bit is a one, then an operation is in progress and any pending writes must be postponed. If the bit is a zero, then the IP is idle and a write operation is permitted. Thus the bit may be interpreted as a logic true BUSY flag. This is shown in Figure 11. Writes to IP-RELAY should not be attempted if bit 0 is set.

RM1260 Address	**RM1270 Address**	**Bit**	**Function**
base + $01	base + $03	Bit 0 (LSB)	BUSY (3 msec)
base + $01	base + $03	Bit 1	TIMER (300 msec)

Note: All accesses are odd byte reads. A 1 indicates busy, a 0 indicates idle.

Figure 11 NuBus Timer Bit Assignments

A second timer is provided to assist software is meeting a recommended maximum relay switching rate of 20 cycles per minute (3.3 times per second) at maximum rated contact loads. This timer is started every time a relay changes state. The timer period is 300 milliseconds, nominally. The timer state may be read in bit 1 in any odd byte in the IP's I/O space. This is shown in Figure 11. A logic 1 (set) means the timer is still running. A logic 0 (reset) means the timer has expired, and the IP is idle. Note that this timer does not block accesses.

It is common that the software sequences through the timers, accessing the IP more than 3.3 timer per second, but not exceeding the switching rate for any one relay of 3.3 cycles per second. In this case, the 300 millisecond timer may still be helpful. It may be tested by the software only once per sequence (associated with relay 1, for example). Alternatively, the timer may still be tested and used as a hold off flag prior to all IP-RELAY accesses, providing a conservative access rate limit.

I/O Pin Assignments

This section gives the pin assignments for IP-RELAY contacts.

The pin numbers given in Figure 12 below correspond to numbers on the 50-pin IndustryPack I/O connector, to the wires on a 50-pin flat cable plugged into a standard IP carrier board, and to the screw terminal numbers on the IP-Terminal block.

Pin Number	Relay	Function
1	Relay 1	A - reset
2	Relay 1	A - common
3	Relay 1	A - set
4	Relay 1	B - reset
5	Relay 1	B - common
6	Relay 1	B - set
7	Relay 2	A - reset
8	Relay 2	A - common
9	Relay 2	A - set
10	Relay 2	B - reset
11	Relay 2	B - common
12	Relay 2	B - set
13	Relay 3	A - reset
14	Relay 3	A - common
15	Relay 3	A - set
16	Relay 3	B - reset
17	Relay 3	B - common
18	Relay 3	B - set
19	Relay 4	A - reset
20	Relay 4	A - common
21	Relay 4	A - set
22	Relay 4	B - reset
23	Relay 4	B - common
24	Relay 4	B - set
25	Relay 5	A - reset
26	Relay 5	A - common
27	Relay 5	A - set
28	Relay 5	B - reset
29	Relay 5	B - common
30	Relay 5	B - set
31	Relay 6	A - reset
32	Relay 6	A - common
33	Relay 6	A - set
34	Relay 6	B - reset
35	Relay 6	B - common
36	Relay 6	B - set
37	Relay 7	A - reset
38	Relay 7	A - common
39	Relay 7	A - set
40	Relay 7	B - reset
41	Relay 7	B - common
42	Relay 7	B - set
43	Relay 8	A - reset
44	Relay 8	A - common
45	Relay 8	A - set
46	Relay 8	B - reset
47	Relay 8	B - common
48	Relay 8	B - set
49	--	B side MUX common
50	--	A side MUX common

Figure 12 I/O Pin Assignment

A user wiring option permits connecting the eight common A terminals of the relays together, and the eight common B terminals together, to make a two channel eight line multiplexor. See section User Options below for wiring details. For convenience in this mode, two I/O pins are provided for the two MUX common lines. These are shown

above in Figure 12 as A side MUX and B side MUX on pins 50 and 49 respectively. In this mode the A and B common terminals are connected together on the IP. I/O wiring would normally not connect to these, but would connect the A-set terminal of relay **n** to line **n.** All relays except **n** would be in the reset position, and relay **n** would be in the set position. The B side would be connected similarly.

IndustryPack Logic Interface Pin Assignment

Figure 13 below gives the pin assignments for the IndustryPack Logic Interface on the IP-RELAY. Pins marked n/c below are defined by the specification, but not used on IP-RELAY.

GND	GND	1	26
CLK	+5V	2	27
Reset*	R/W*	3	28
D0	IDSel*	4	29
D1	n/c	5	30
D2	MEMSel*	6	31
D3	n/c	7	32
D4	INTSel*	8	33
D5	n/c	9	34
D6	IOSel*	10	35
D7	n/c	11	36
n/c	A1	12	37
n/c	n/c	13	38
n/c	A2	14	39
n/c	n/c	15	40
n/c	A3	16	41
n/c	n/c	17	42
n/c	A4	18	43
n/c	n/c	19	44
BS0*	A5	20	45
BS1*	n/c	21	46
n/c (–12V)	n/c	22	47
n/c (+12V)	Ack*	23	48
+5V	n/c	24	49
GND	GND	25	50

Note 1: The no-connect (n/c) signals above are defined by the IndustryPack Logic Interface Specification, but not used by this IP. See the Specification for more information.

Note 2: The layout of the pin numbers in this table corresponds to the physical placement of pins on the IP connector. Thus this table may be used to easily locate the physical pin corresponding to a desired signal. Pin 1 is marked with a square pad on the IndustryPack.

Figure 13 Logic Interface Pin Assignment

Programming

Programming the IP-RELAY consists of performing a write operation to the assigned address for each relay. Relay selection is controlled by the address. Data on writes is ignored. See previous sections VMEbus Addressing, AT bus Addressing and NuBus Addressing for address maps.

IP-RELAY uses latching relays to conserve power is a static state. These relays do not change state during power-up, power-down, or bus reset. See the “Product Description” section of this manual for more information.

Only one relay is set or reset at one time. This operation takes roughly three milliseconds. A timer is provided that the software must poll if the software has no other mechanism of assuring that no attempt will be made to set or reset a relay while a relay state change is in progress.

ID PROM

Every IP contains an IP PROM that has a size of at least 32 x 8 bits. The ID PROM aids in software auto configuration and configuration management. The user's software, or a supplied driver, may verify that the device it expects is actually installed at the location it expects, and is nominally functional. The ID PROM contains the manufacturing revision level of the IP. If a driver requires that a particular revision be present, it may check for it directly.

Standard data in the ID PROM on the IP-RELAY is shown in Figure 14.
For more information on IP ID PROMs, refer to the IndustryPack Logic Interface Specification.

The location of the ID PROM in the host's address space is dependent on which carrier is used. Normally for VMEbus carriers the ID PROM space is directly above the IP's I/O space, or at IP-base + $80. Macintosh drivers use the ID PROM automatically. RM1260 address may be derived from Figure 14 by multiplying the addresses given by two, then subtracting one. RM1270 addresses may be derived by multiplying the addresses given by two, then adding one.

Accessing the ID PROM on ATC4 (AT bus) carrier requires writing to the control register on the carrier board to select the ID PROM space of its IndustryPacks. See the ATC4 manual for more information.

The ID PROM used is an AMD 27LS19A or equivalent.

3F 19	(available for user)	
17	CRC	(88)
15	No of bytes used	(0C)
13	Driver ID, high byte	(00)
11	Driver ID, low byte	(00)
0F	reserved	(00)
0D	Revision	(B2)
0B	Model No IP-RELAY	(1A)
09	Manufacturer ID SBS	(F0)
07	ASCII "C"	(43)
05	ASCII "A"	(41)
03	ASCII "P"	(50)
01	ASCII "I"	(49)

Figure 14 ID PROM Data (hex)

User Options

The only user option is to connect the eight A common contacts and the eight B common contacts to a pair of common lines to convert the IP-RELAY into a two channel, eight line multiplexor or demultiplexor. The advantage of performing this connection on the IndustryPack is that it may be more convenient that performing the same wiring externally. Also, if low level signals are being switched, the on-board wiring should produce a lower differential thermocouple error than external wiring due to the close proximity (and therefore smaller temperature gradient) of the on-board connections.

To make this conversion, connect the eight pins of E1 together, and to E4. Also connect the eight pins of E3 together and to E1. The locations of these four pin groups are shown in Figure 15, near the end of this manual. Wire-wrap® is recommended.

Normally the A-set and B-set terminals of the relays would be used for the multiplexed signals. The A side MUX common (I/O pin 50) and the B side MUX common (I/O pin 49) become the most convenient common lines. No connection would be made to the A-reset and B-reset terminals. Only one relay would be in the set position. The other relays would be in the reset state. The user must program the proper relay sequencing.

The user may select either “make before break” or “break before make” operation of the multiplexor by coding the appropriate relay sequence.

Construction and Reliability

IndustryPacks were conceived and engineered for rugged industrial environments. The IP-RELAY is constructed out of 0.062 inch thick FR4 material. The six copper layers consist of a ground plane, a power plane and four signal planes. Heavy traces are used to permit a 1 Amp rating of all contact pins.

Through-hole and surface mounting of components is used. IC sockets are screw-machined pins, gold plated. High insertion and removal forces are required, which assists in keeping components in place. If the application requires unusually high reliability or is in an environment subject to high vibration, the user may solder the four corner pins of each socketed IC into the socket, using a grounded soldering iron.

The IndustryPack connectors are keyed, shrouded and gold plated on both contacts and receptacles. They are rated at 1 Amp per pin, 200 insertion cycles minimum. These connectors make consistent, correct insertion easy and reliable.

The IP is secured to the carrier with four metric M2 stainless steel screws. The heads of the screws are countersunk into the IP. The four screws provide significant protection against shock, vibration, and incomplete insertion. They are not required for most applications.

The IndustryPack provides a low temperature coefficient of 0.89 W/°C for uniform heat. This is based on the temperature coefficient of the base FR4 material of .31 W/m-°C, and taking into account the thickness and area of the IP. This coefficient means that if 0.89 Watts is applied uniformly on the component side, that the temperature difference between the component and the solder side is one degree Celsius.

Repair

Service Policy

Before returning a product for repair, verify as well as possible that the suspected unit is at fault. Then call the Customer Service Department for a RETURN MATERIAL AUTHORIZATION (RMA) number. Carefully package the unit, in the original shipping carton if this is available, and ship prepaid and insured with the RMA number clearly written on the outside of the package. Include a return address and the telephone number of a technical contact. For out-of-warranty repairs, a purchase order for repair charges must accompany the return. SBS will not be responsible for damages due to improper packaging of returned items. For service on SBS products not purchased directly from SBS, contact your reseller. Products returned to SBS for repair by other than the original customer will be treated as out-of-warranty.

Pin Group Locations

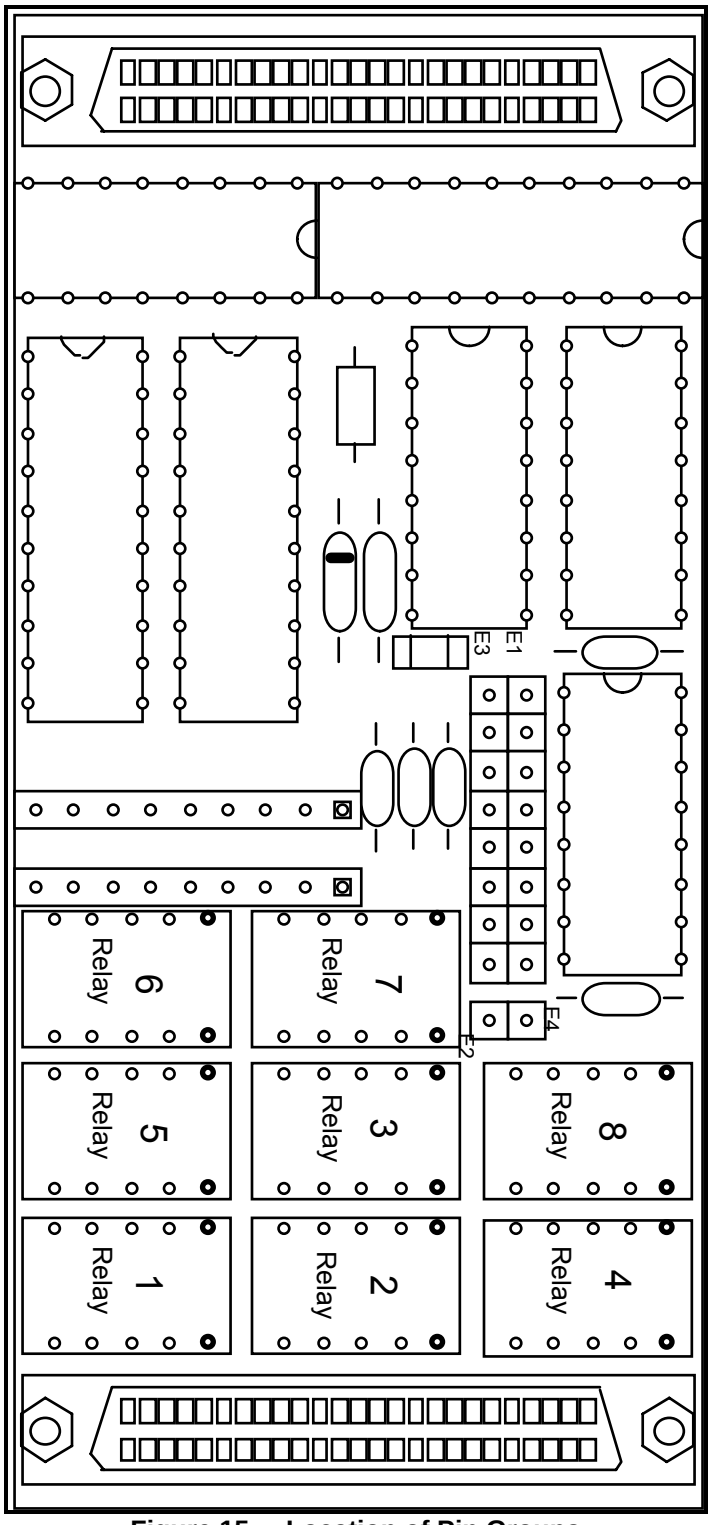


Figure 15 Location of Pin Groups

Specifications

Logic Interface	IndustryPack logic Interface
Wait States	Zero, all accesses
Number of Relays	Eight
Type of Relay	Form C latching (double pole, double through)
Operating Power	500 mW typical
Switching Power	700 mW typical
Switching Time	3 msec maximum
Switching Function	On-board timers and logic
Switching Rate	180 cpm continuous no load 20 cpm continuous rated load
Switching Rate Function	On-board timer readable by software fixed at 180 cpm
Timers	Two timers readable by software, Timer one fixed at 3 msec, Timer two fixed at 300 msec. Timer one blocks additional write accesses. Both timers always readable.
Initial Contact Resistance	50 mΩ max, 30 mΩ typical
Contact Material	Gold-clad silver
Switching Power	30 W, 62.5 VA maximum per relay
Switching Current	1 Amp maximum
IP Switching Voltage	60 V maximum
Relay UL/CSA Rating	1 A 30 VDC, 0.3 A 110VDC, 0.5 A 125 VAC
Relay breakdown voltage	750 Vrms
Expected Life	mechanical : 10^8 (@ 180 cpm) contact: 2 x 10^5 at 1A 30VDC
Relay Shock Resistance	Functional: 50 G Destructive: 100 G
Relay Vibration Resistance	Functional: 18G,10 to 55 Hz
Power Requirements	+5 VDC, 100 mA typical 140 mA switching
Dimensions	1.800 by 3.900 by 0.340 inches maximum
Environmental	Operating temperature: +10° to +50°C Humidity: 5% to 95% non-condensing Storage: –10° to +85°C

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