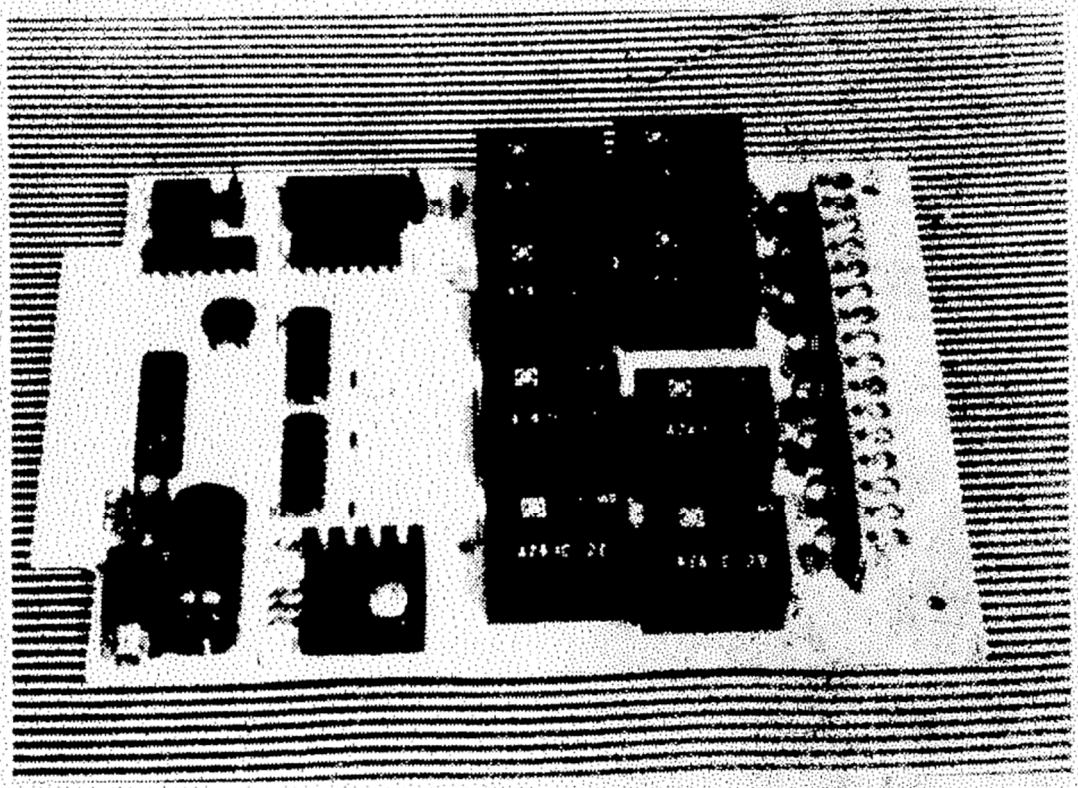
USER'S MANUAL

RE-140
RE-156



RE-140
8 RELAY CARD
RE-156
8 REED RELAY CARD

ALPHA Products

Features

The RE-140 and the RE-156 are very similar. The only noticable difference is the use of fast reed relays on the RE-156 , in place of industrial relays on the RE-140. Address decoding, programming and contact-connection are identical.

With the RE-140, anything that can be controlled electrically can be under computer command. Using the eight on board relay contacts directly, small loads, such as lamps, valves, solenoids and small motors can be turned on or off. With secondary power relay, driven by the RE-140 relay, there is no limit to the power that your computer can control: air conditioners, factory equipment, industrial machines, etc.

With the RE-156, low level signals, such as analog signals in test equipment, can be switched faster than with the RE-140. The RE-156 is also less expensive than the RE-140, and can be used in situations when many low current signals mneed to be switched. It is also used as a low cost multiplexer to expand the AN-146 card from 1 to 8 input channels.

Applications

The general purpose nature of the relay cards, their low cost and the fact that you can add as many cards as you need on the A-BUS Motherboard results in a very large range of applications. Here are a few:

- Test equipment. The relays simulate switches and select inputs and power supplies, or select points to be measured.
- Sequencing: With the proper software, sophisticated sequencing of machines can be performed. Much more powerful and cheaper than dedicated sequencers.
- Control of exposure time in photo lab, control of bath temperature (in conjunction with an analog card).
- General on/off switching of appliances, devices, etc.
- Automation of events and stimuli in experimental psychology.

Port Selection

Port selection of any A-BUS card is done in two steps.
1) Predecoding (usually a block of 64 ports) is performed by the Adapter Card. Refer to adapter card instructions.
2) Final decoding is done on each A-BUS card. The card selects one (or more, depending on the card) of the 64 ports. A combination of jumpers is used to select the port. The scheme used is similar for most A-BUS cards. It is described in detail in the A-BUS Overview.

Each Relay Card uses only one port. This manual assumes that port 0 is used, but the port you choose may be any within the block defined by the Adapter Card.
If a port other than port 0 is used, be sure to substitute the correct port number in the examples below. i.e. if port 58 is used, a statement such as *OUT 0,255* becomes *OUT 58,255*.
Note: since the port you use might change as you develop your system, it is a good idea to define the port number at the beginning of your program as a variable, and use this variable with all your *OUT* statements. e.g. *OUT P,0*

The Outputs

The 8 relays are controlled by the *OUT* statement in BASIC and in assembly language. Each *OUT* command affects all the 8 relays. In general, the *OUT* statement looks like: *OUT P,X* where P is the port number, and X is the value sent to that port. First let's turn all the relays off. In BASIC, type:
OUT 0,0
TRS-80 Model III: Remember to enable the bus with *OUT 236,16* or *POKE 16912,16*. See adaptor card instructions for details.
All the LED's should be off now, which indicates that all the relay contacts are open. To turn them all on, type:
OUT 0,255
All the LED's should be On and the relay contacts are closed.

The individual relays are controlled by the respective bits of the byte sent. (Bit 0 controls Relay #0, etc.) If the bit is set, the relay will be energized, and the relay contacts will close. If the bit is not set, the relay contacts will open.
For those of you who didn't understand the preceding, simply use the following table:

Relay	Value	
0	1	
1	2	(notice that this is a
2	4	table of powers of 2)
3	8	
4	16	
5	32	
6	64	
7	128	

To activate the relay number on the left of the table, simply use the number on the right. For example, if you want to turn relay #3 on, type:
OUT 0,8
You could also type *OUT 0,2^3*. The advantage of this is having the relay number (3) in the statement. This statement is slower, though. (Note that we use ^ as a symbol for exponentiation. Your computer might use arrows, brackets, etc.)
To turn relay #6 on, type:
OUT 0,64 (or *OUT 0,2^6*)
Notice that relay #3 went off when you turned relay #6 on. If you want to turn more than one relay on at once, ADD the respective numbers in the right column together, and send the sum. For example, if you want to turn relays #1,#3 and #5 on, and leave the rest off, add 2,8, and 32. Type:
OUT 0,42
Relays #1,#3 and #5 should be the only relays on.
As an alternative, you could type
OUT 0,2^1+2^3+2^5. This way you could look at the line and know immediately which relays were turned on. (The relay numbers follow the exponentiation symbol).

If you want to turn relay #1 off, but you want to keep #3 and #5 on, just add up the new total and send that value. Relays #3 and #5 correspond to 8 and 32. 8+32=40, so type:
OUT 0,40
Now, suppose that you want to turn relay #7 on without turning off #3 and #5. If you look back at the table, relays #3,#5 and #7 correspond to 8,32 and 128. 8+32+128=168. So we type:
OUT 0,168

Keeping Track

In your software, it may be helpful to maintain the current relay status in a variable, that way you won't turn off (or on) relays that you don't want to. We use the AND and OR operators to do "bit masking".
Let's assume that in your program, M was the last value sent to the Relay Card, and you want to set the Xth relay on (X is 0,1,2...7) without affecting the states of the other relays. The following statement modifies M by setting only the bit that corresponds to relay X without affecting the others. The *OR* operator accomplishes this. If the Xth relay was already on, these statements would not have any effect on the relays:
M = M OR 2^X : OUT 0,M
(The ^ is the exponentiation symbol. Your basic might use an arrow, or a bracket, etc.)
If you want to turn the Xth relay off, use:
M = M AND (255−2^X) : OUT 0,M
This statement also modifies the value of M by only resetting the bit that corresponds to relay X. The *AND* function accomplishes this. If the relay was already off, the statement would have no effect.
It is a good idea to put the port number at the beginning of your program, (such as P=0) and then use *OUT P,N*. This way, if later you need to change the port number of the card, you can do it quickly, without having to edit each *OUT* statement in your program.

TTL Outputs (Only on the RE-140)

On the relay board, you will notice two lines of holes labelled J5. You could solder a standard header into these holes and use this latched TTL output to directly drive solid state relays or any other device that accepts standard TTL levels.
If you want to disable the mechanical relays on the board (to save power or silence the card), remove jumper J9 (located on the side of the board near a relay). This only cuts the 12V supply to the relays and drivers.

Relay Contacts

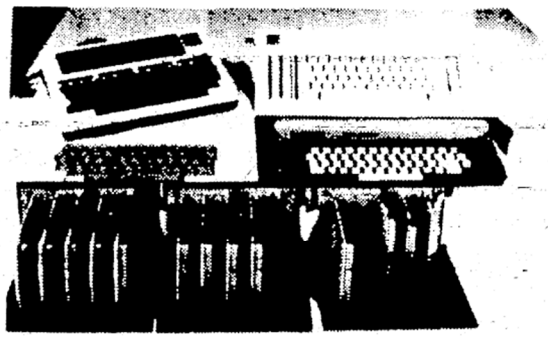
Each relay controls one set of contacts. Each contact is only connected to two screw terminals. These contacts behave like a simple switch which can be open or closed. No power of any kind is supplied to these terminals. They are intended to switch on or off external devices powered by their own supplies. The LEDs are located near the terminal strip for convenience, so you can tell at a glance which relays are energized. There is no electrical connection between the relay contacts and the LEDs (or any other part of the circuit).
Do not exceed the contact rating of the relays (see specifiaction table at the end). Although the relays will operate at several times the rated values, the life of the contacts will be severely shortened. If you need to switch loads that exceed the rating, use a secondary power relay driven by the on-board relay. Better yet, use a solid state relay driven by the TTL outputs. The contacts are "normally open" which means that when the relay is not energized, (LED off), the contact is open. This is similar to a switch being "OFF". The relays used also have a "normally closed" contact which is not used. If you need it, you can "tack solder" a wire in the board. On the RE-140, the relay terminal corresponding to the normally closed contact is easily identified, since it is the only pad under the relay not connected to any lines.

Alternate Connectors

In addition to the terminal strip, the relay contacts have been brought out to to two rows of holes that will accept a 50 pin header. The first 8 pins on each side are the contacts, and the middle 9 are unused, so you could use two smaller (16 pin) connectors instead of the 50 pin header.

Interrupts

If you need to use it, the interrupt line back to the computer is accessible on the board. Three holes, labelled J6 on the RE-140 or J4 on the RE-156, near the power jack are the ground, the regulated 5V and the interrupt. Check your adapter card instructions to see if the INT signal is wired with your particular system.



Control up to 200 relays

Electrical Noise Considerations

Interference from electrically noisy devices may cause program errors or erratic operation. Noise from external relays, motors, or switched transformers can couple into the data bus and cause operational problems. Here is a list of suggestions which will help eliminate these problems.

1) On the RE-140, if you use relay contacts to switch a 115V load, install a "snubber" network (.1uF/250V in series with 100ohm resistor across the contacts) to protect the contacts and to prevent electrical noise from coupling back to the computer.

2) When switching DC inductive loads from relay outputs, connect a diode across the load in a reverse bias fashion to absorb coil kick-back spikes. This may be necessary when driving secondary DC relays, solenoids, or motors.

3) For AC inductive loads, such as motors, use a .1 microfarad capacitor and/or an MOV with a rating of 1.6 times the AC voltage. (Radio Shack part number 276-570. Digi-Key number 7062.) Connect across the load.

4) For switching heavy loads, use a second relay driven by the relay on the board.

5) Keep output lines as short as possible.

6) The length of the cable from the A-BUS to the computer is limited by the drive capability of the computer and by its sensitivity to electrical noise. In most cases 3 to 4 feet is a maximum, although with experimentation, you may go further. Remember that the cable acts as an antenna that can pick up electrical interference (EMI/RFI) and couple it to your system.

Specifications

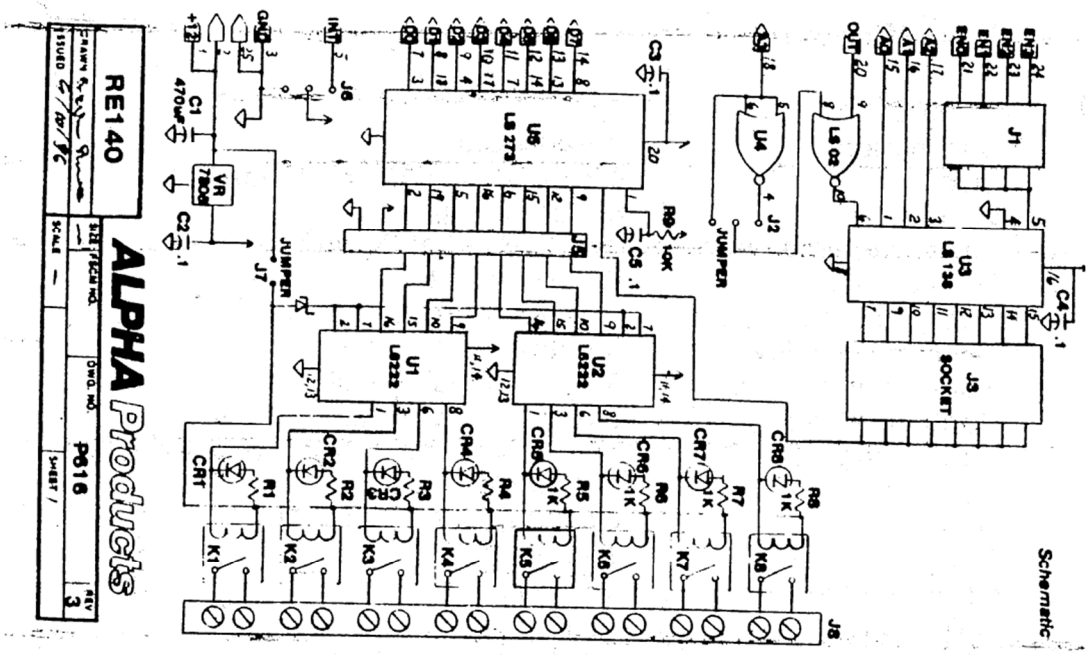
RE-140

Description:	8 Relay Card
Size:	4.15 x 5.8 in (106 x 149 mm)
Weight:	6.4 oz (181g)
Power requirements:	8 to 12V DC at 300mA
Device address:	jumper selectable
Operating temperature:	0 to 50 degrees C
Relative humidity:	0 to 90%
Number of outputs:	8 electromechanical relays
Contact rating:	3 Amps at 125V AC
U.L. Rating:	3A at 30V DC or 120V AC resistive. 1.2A at 120VAC inductive
UL File:	E43203; CSA File LR 36664
Contact isolation:	1000V RMS
Operate time:	6 ms typical
Release time:	2 ms typical
Life expectancy:	10 million operations
Connector:	Screw type terminal
Status indicator:	8 LED (On = energized)

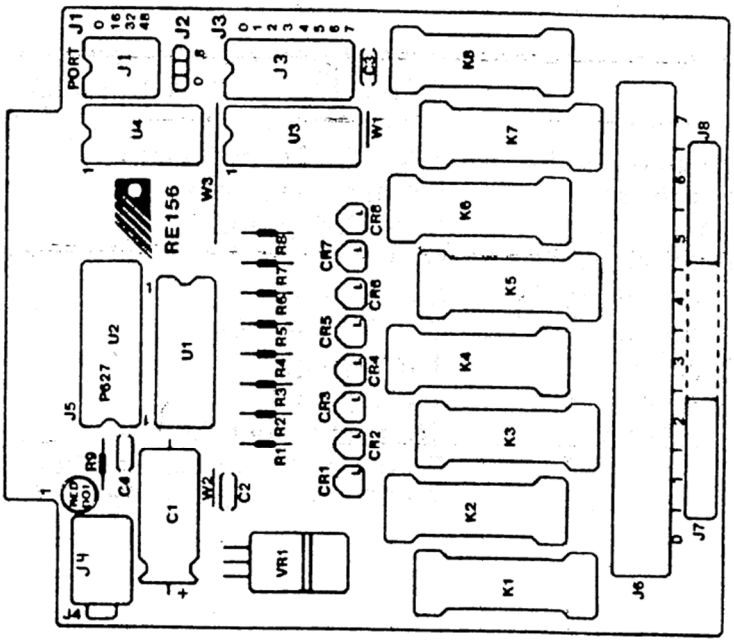
RE-156

Description:	8 Reed Relay Card
Size:	4.15 x 4.8 in (106 x 122 mm)
Weight:	4.3 oz (121g)
Power requirements:	8 to 12V DC at 250mA
Device address:	jumper selectable
Operating temperature:	0 to 50 degrees C
Relative humidity:	0 to 90%
Number of outputs:	8 reed relays
Contact rating:	20mA at 60V DC
Operate time:	1 ms typical
Release time:	1 ms typical
Life expectancy:	10 million operations
Connector:	Screw type terminal and header
Status indicator:	8 LED (On = energized)

Schematic



RE-156



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