MICROLINK 301x

Digital Inputs and Outputs

User Manual

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Digital Input and Output Lines

The 301x range provides digital input to the computer and output control by the computer. It features logic level inputs and outputs, and switching functions through relays and transistors. The input and output lines of a 301x are arranged in groups, or ports, of up to 8 lines. Each port can be either input or output. All ports power-up as inputs. In the case of relay modules, this means all relays off.

The range consists of 5 modules. Each module has 2 versions, one having the added advantage of light-emitting diodes to show the state of the input or output lines. Modules with the display lights have the suffix D on the module code, for example 3010D. The light is illuminated when the input or output state is high and corresponds to an input or output state of 1.

The 3010, 3012, 3013 and 3014 modules have 37-way D type sockets. If you prefer to make your connections to screw terminals, you can do so with a 390x module. The 309x modules also provide a range of extra facilities if components such as resistors or filters are added. See Chapter 11 for details. The 3011 has screw terminal connections as standard.

3.1 3010/3010D—32 Digital I/O Lines

The 3010 provides 32 general purpose input and output lines, arranged as 4 ports of 8 lines.

3.1.1 Connection Notes

Input Voltages

All inputs are high impedance CMOS type. They are TTL and 5 V CMOS compatible. Input voltages should be within the range 0 to 5 V. Higher voltages can be dealt with by the addition of resistor networks. This can be conveniently done on a 3900 Screw Terminal module. Input protection can be provided in a similar manner.

Contact Closures

You can interface to contact closures using a resistor to tie the input to either 5 V or 0 V. The contact then switches the line to either 0 or 5 V. The resistor can be fitted to a 3900 module.

Noisy Inputs

Input Filters can be fitted to a 3900 module if required.

Output Drive

The outputs are TTL and 5 V CMOS compatible. They can drive 15 LSTTL loads. The output drive can be increased by using additional transistors. These can be fitted to the 3900 module. Currents of 1 amp can easily be switched.

Power-Up State

The module will power-up as all inputs. If you intend to use the module to produce control outputs then you might want to define logic states at power-up. This can be done by resistors which tie the lines to either 0 V or 5 V. These can be mounted on a 3900 module.

Table 3.1 3010/3010D - 32 Digital I/O Lines
Pin Connections for 37-Way D Plug (Wiring View)

		19	0V
Port 3 Bit 0	37		
		18	Port 3 Bit 1
Port 3 Bit 2	36		
		17	Port 3 Bit 3
Port 3 Bit 4	35		
		16	Port 3 Bit 5
Port 3 Bit 6	34		
		15	Port 3 Bit 7
Port 2 Bit 0	33		
		14	Port 2 Bit 1
Port 2 Bit 2	32		
		13	Port 2 Bit 3
Port 2 Bit 4	31		
		12	Port 2 Bit 5
Port 2 Bit 6	30		
		11	Port 2 Bit 7
Aux Input 0	29		
		10	Aux Input 1
Aux Input 2	28		
		9	Aux Input 3
Port 1 Bit 0	27		
		8	Port 1 Bit 1
Port 1 Bit 2	26		
		7	Port 1 Bit 3
Port 1 Bit 4	25		
		6	Port 1 Bit 5
Port 1 Bit 6	24		
		5	Port 1 Bit 7
Port 0 Bit 0	23		
		4	Port 0 Bit 1
Port 0 Bit 2	22		
		3	Port 0 Bit 3
Port 0 Bit 4	21		
		2	Port 0 Bit 5
Port 0 Bit 6	20		
		1	Port 0 Bit 7

Please read the Connection Notes on the previous page before making your connections.

3.2 3011/3011D—4 Heavy Duty Relays

The 3011 provides 4 independent change-over power relays. There is only one port (of 4 bits) and the port can only be an output. The state of the relays can be read by the computer.

3.2.1 Connection Notes

Relay Type

The relays are the change-over type. When no power is supplied to the Microlink the Pole of each relay will be connected to its Normally Closed contact. The Pole of the relay will only switch to the Normally Open contact when instructed to do so by software.

Inductive Loads

The relay contacts are rated at 10 A 230 V AC for a resistive load. If the load is inductive (for example a motor or a solenoid) then the rating must be reduced, because of the large transients that are produced when inductances are switched. A 0.1 µF capacitor, in series with a 100 Ωresistor, is fitted across each contact. This reduces the size of the transient.

Power-Up State

On power-up each relay will be connected to its Normally Closed contact. The Pole of the relay will switch to the Normally Open contact when instructed to do so by software

Wiring the 3011D

To wire the 3011D remove both the basic 3011 and the display module. Now unplug the display board from the 3011 and wire up the 3011.

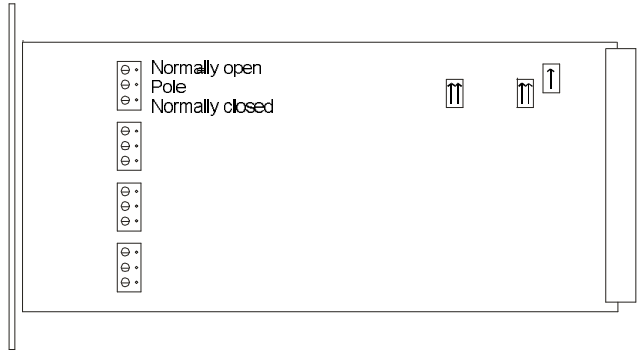

Figure 3.1 3011 Module

3.3 3012/3012D—8 Reed Relays

The 3012 provides 8 independent change-over reed relays. There is only one port (of 8 bits) and the port can only be an output, although the state of the relays can be read by the computer.

3.3.1 Connection Notes

Relay Type

The relays are the change-over type. When no power is supplied to the Microlink the Pole of each relay will be connected to its Normally Closed contact. This will continue to be the case after power-up. The Pole of the relay will only switch to the Normally Open contact when instructed to do so by software.

Inductive Loads

The relay contacts can switch 200 V DC and 250 mA for a resistive load. If the load is inductive (for example a motor or a solenoid), then the rating must be reduced because of the large transients that are produced when inductances are switched. Transient suppression components can be fitted to the 3900 Screw Terminal mode if required.

Capacitive Loads

A situation that often causes trouble is the switching of capacitive loads. A high current rushes into the capacitance when it is switched, often sufficient to weld the relay contacts. (If a relay stops working, but recovers after being given a sharp tap, then the contact has been welded.) People often don't realise when they have a capacitive load. For instance an open circuit screened cable can present a considerable capacitance. If you suspect that you have this problem then series resistors can be used to limit the peak current. These can conveniently be fitted to the 3900 Screw Terminal module.

Power-Up State

Each relay will power-up connected to its Normally Closed contact.

Table 3.2 3012/3012D - 8 Reed Relays
Pin Connections for 37-Way D Plug (Wiring View)

		19	unused
unused	37		
		18	unused
unused	36		
		17	unused
N.O. Relay 1	35		
		16	Pole Relay 1
N.C. Relay 1	34		
		15	unused
N.O. Relay 2	33		
		14	Pole Relay 2
N.C. Relay 2	32		
		13	unused
N.O. Relay 3	31		
		12	Pole Relay 3
N.C. Relay 3	30		
		11	unused
N.O. Relay 4	29		
		10	Pole Relay 4
N.C. Relay 4	28		
		9	unused
N.O. Relay 5	27		
		8	Pole Relay 5
N.C. Relay 5	26		
		7	unused
N.O. Relay 6	25		
		6	Pole Relay 6
N.C. Relay 6	24		
		5	unused
N.O. Relay 7	23		
		4	Pole Relay 7
N.C. Relay 7	22		
		3	unused
N.O. Relay 8	21		
		2	Pole Relay 8
N.C. Relay 8	20		
		1	unused

N.O. = Normally Open, N.C. = Normally Closed
Please read the Connection Notes before making your connections.

3.4 3013/3013D—16 Isolated Inputs

The 3013 module provides 16 isolated digital input lines arranged in 2 ports of 8.

3.4.1 Connection Notes

Input Current

Voltages between 5 and 50 Volts can be directly connected across the + and – inputs of an isolator. Remember that the input is a LED with a series 4K7 resistor. This means that with 50 V applied about 10 mA will flow from the signal source. You can reduce this, if you wish, by adding series resistance to produce an optimum current of about 1 mA.

Higher Voltages

Adding series resistance also allows larger voltages to be handled. When doing this you should consider the power dissipation in the added resistor. The 50 volt limit given above is dictated by the 0.5 Watts that this produces in the 4K7 input resistor. Such resistors can be conveniently mounted on the 3900 Screw Terminal module.

Reverse Voltages

The inputs are protected against reverse voltages up to 50 V. This limit is imposed by power dissipation as above.

Input to Input Isolation

Each of the 16 inputs is isolated not only from the main Microlink circuits but also from the other 15 inputs. This means that the module can accept signals from several sources which have large standing voltages between them.

TTL Signals

Logic signals produced by TTL circuits need special consideration. This is because TTL outputs are poor current sources. This means that if you connect the + input of an isolator to the TTL signal and the – input to the signal 0 V, the TTL output will not be able to drive much current through the LED. TTL outputs are however good current sinks. The correct way is to connect the isolator + input to +5 V and the isolator – input to the TTL output. This works well, although it produces a logic

inversion. This means that a low at the TTL output switches the isolator on and produces a “1” at the module output.

These remarks apply only to actual TTL outputs. Many outputs described as TTL compatible are produced by 74HC or HCT circuits and are good current sources.

AC Signals

AC signals can be handled by the addition of rectifiers and capacitors. These can be conveniently fitted to the 3900 Screw Terminal module.

Table 3.3 3013/3013D - 16 Isolated Inputs
Pin Connections for 37-Way D Plug (Wiring View)

		19	unused
unused	37		
		18	unused
unused	36		
		17	unused
Port 1 Input 0 +	35		
		16	– Port 1 Input 0
Port 1 Input 1 +	34		
		15	– Port 1 Input 1
Port 1 Input 2 +	33		
		14	– Port 1 Input 2
Port 1 Input 3 +	32		
		13	– Port 1 Input 3
Port 1 Input 4 +	31		
		12	– Port 1 Input 4
Port 1 Input 5 +	30		
		11	– Port 1 Input 5
Port 1 Input 6 +	29		
		10	– Port 1 Input 6
Port 1 Input 7 +	28		
		9	– Port 1 Input 7
Port 0 Input 0 +	27		
		8	– Port 0 Input 0
Port 0 Input 1 +	26		
		7	– Port 0 Input 1
Port 0 Input 2 +	25		
		6	– Port 0 Input 2
Port 0 Input 3 +	24		
		5	– Port 0 Input 3
Port 0 Input 4 +	23		
		4	– Port 0 Input 4
Port 0 Input 5 +	22		
		3	– Port 0 Input 5
Port 0 Input 6 +	21		
		2	– Port 0 Input 6
Port 0 Input 7 +	20		
		1	– Port 0 Input 7

Please read the Connection Notes on the previous page before making your connections.

3.5 3014/3014D—16 Isolated Outputs

The 3014 provides 16 isolated digital output lines arranged in 2 ports of 8.

3.5.1 Connection Notes

Switch Capability

Each output is a transistor capable of switching voltages up to 30 V and currents up to 1.5 mA. Higher voltages will damage the device. If the combination of load resistance and supply voltage demands more than 1.5 mA for a complete switching action, then the output will not be able to supply it and an incomplete switching action will result.

Increased Switch Capability

An additional transistor circuit is required to switch more current or more voltage. This can be conveniently mounted on the 3901 Screw Terminal module.

Logic Signal

A frequent need is to convert the isolated output to a 5 V logic signal. This can be done by connecting the – output to the logic 0 V. The output + now becomes the signal line and should be tied to 5 V via a 4K7 resistor. Note that this produces a signal inversion, ie switching the output on produces a low logic signal. This arrangement is essential if you wish to drive true TTL inputs. If however the input only takes a very small current (as in CMOS units), then the resistor can be placed between – output and 0 V, with the + output connected to 5 V. This arrangement avoids the inversion.

Reverse Voltage

The outputs are not protected against the application of reverse voltages.

Table 3.4 3014/3014D - 16 Isolated Outputs
Pin Connections for 37-Way D Plug (Wiring View)

		19	unused
unused	37		
		18	unused
unused	36		
		17	unused
Port 1 Output 0 +	35		
		16	– Port 1 Output 0
Port 1 Output 1 +	34		
		15	– Port 1 Output 1
Port 1 Output 2 +	33		
		14	– Port 1 Output 2
Port 1 Output 3 +	32		
		13	– Port 1 Output 3
Port 1 Output 4 +	31		
		12	– Port 1 Output 4
Port 1 Output 5 +	30		
		11	– Port 1 Output 5
Port 1 Output 6 +	29		
		10	– Port 1 Output 6
Port 1 Output 7 +	28		
		9	– Port 1 Output 7
Port 0 Output 0 +	27		
		8	– Port 0 Output 0
Port 0 Output 1 +	26		
		7	– Port 0 Output 1
Port 0 Output 2 +	25		
		6	– Port 0 Output 2
Port 0 Output 3 +	24		
		5	– Port 0 Output 3
Port 0 Output 4 +	23		
		4	– Port 0 Output 4
Port 0 Output 5 +	22		
		3	– Port 0 Output 5
Port 0 Output 6 +	21		
		2	– Port 0 Output 6
Port 0 Output 7 +	20		
		1	– Port 0 Output 7

Please read the Connection Notes on the previous pages before making your connections.

3.6 301x Specifications

3.6.1 3010 Specifications

Maximum number of inputs	32
Maximum number of outputs	32
Power-up state	all inputs
Voltage Inputs	
Compatibility	TTL and 5 V CMOS
Range	0 to 5 V
Voltage Outputs	
Compatibility	TTL and 5 V CMOS
Drive	15 LSTTL loads
Current switching	1 A

3.6.2 3011 Specifications

Maximum number of inputs	0
Maximum number of outputs	4
Power-up state	normally closed
Relay type	change-over
Operating time	8 msec
Release time	2.5 msec
Contact rating	10 A at 30 V DC or 230 V AC

3.6.3 3012 Specifications

Maximum number of inputs	0
Maximum number of outputs	8
Power-up state	normally closed
Relay type	change-over
Operating time	1 msec
Release time	1 msec
Contact rating	250 mA at 200 V DC, 3 W non-reactive

3.6.4 3013 Specifications

Maximum number of inputs	16
Maximum number of outputs	0
Range	0 to 50 V
Isolation	240 V AC
Reverse voltage protection	50 V

3.6.5 3014 Specifications

Maximum number of inputs	0
Maximum number of outputs	16
Current switching	1.5 mA
Voltage switching	30 V
Reverse voltage protection	None