

MSXB 020 Accessory Board Manual

Digital Expansion Board

Version 1.10

Microstar Laboratories, Inc.

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Part Number MSXB020M110

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MSXB 020 Digital Expansion Board

The Microstar Laboratories Digital Input/Output Expansion Board, part number MSXB 020, provides the Data Acquisition Processor with 64 digital inputs and 64 digital outputs with 40-pin connectors. By using multiple Digital Input/Output Expansion Boards the Data Acquisition Processor can be expanded to control up to 128 digital inputs and 1024 digital outputs.

Hardware Configuration

A Digital Input/Output Expansion Board is connected to a Data Acquisition Processor using one cable, MSCBL 036-01. MSCBL 036-01 is a 100 line ribbon cable which connects the digital input/output connector of the Data Acquisition Processor to connector J1 of the Digital Input/Output Expansion Board.

Note: The Digital Input/Output Expansion Board should not be connected to or disconnected from a Data Acquisition Processor while the Data Acquisition Processor is powered.

Each of the connectors J2, J3, J4, and J5 on the Digital Input/Output Expansion Board accept 16 digital inputs and 16 digital outputs. Connectors J2, J3, J4, and J5 have the same 40-pin pinout as the DAP 1200 and DAP 2400 digital input/output connector. The pinout of J2, J3, J4, and J5 is shown on the next page.

| | | |
|----------------|-----------|-------------------------------|
| DOUT 15 | 1 • • 40 | DIN 15 |
| DOUT 14 | 2 • • 39 | DIN 14 |
| DOUT 13 | 3 • • 38 | DIN 13 |
| DOUT 12 | 4 • • 37 | DIN 12 |
| DOUT 11 | 5 • • 36 | DIN 11 |
| DOUT 10 | 6 • • 35 | DIN 10 |
| DOUT 9 | 7 • • 34 | DIN 9 |
| DOUT 8 | 8 • • 33 | DIN 8 |
| DXB | 9 • • 32 | DXC |
| DIGITAL GROUND | 10 • • 31 | DIGITAL GROUND |
| +5 VOLTS | 11 • • 30 | +5 VOLTS |
| DXA | 12 • • 29 | INTERNAL INPUT CLOCK - OUTPUT |
| DOUT 7 | 13 • • 28 | DIN 7 |
| DOUT 6 | 14 • • 27 | DIN 6 |
| DOUT 5 | 15 • • 26 | DIN 5 |
| DOUT 4 | 16 • • 25 | DIN 4 |
| DOUT 3 | 17 • • 24 | DIN 3 |
| DOUT 2 | 18 • • 23 | DIN 2 |
| DOUT 1 | 19 • • 22 | DIN 1 |
| DOUT 0 | 20 • • 21 | DIN 0 |

Connectors J2 - J5 correspond to input ports B0 - B3 and to output ports 0 - 3. The input port name is a parameter of the command SET; the output port number is a parameter of the command DIGITALOUT.

Signals may be connected to a Digital Input/Output Expansion Board using Digital Termination Boards, part number MSTB 004-01 or a 40 wire cable kit, part number MSCBL 004-01K.

At power up and during reset the outputs of the Digital Input/Output Expansion Board's expansion ports will track the digital outputs of the Data Acquisition Processor. After power up or a hardware reset the Digital Input/Output Expansion Board's outputs will come up in a known state of either all high or all low depending on the configuration of the Data Acquisition Processor it is connected to. See the Data Acquisition Processor connector chapters for information on how to configure the digital outputs of the Data Acquisition Processor.

Digital Inputs

For digital input expansion, DAPL automatically generates expansion control signals, as specified by SET commands. The following input procedure reads 16-bit values from the four Digital Input/Output Expansion Board connectors, J2 - J5, and sends the values to the PC:

```
RESET
IDEF A 4
  SET IPIPE0 B0
  SET IPIPE1 B1
  SET IPIPE2 B2
  SET IPIPE3 B3
  TIME 10000
END
PDEF B
  PRINT
END
START A, B
```

Digital Outputs

To use digital output expansion, the DAPL command OUTPORT is required. The output port type of the Digital Input/Output Expansion Board is zero.

The following DAPL listing outputs the 16-bit values in pipes P0 - P3 to the four Digital Input/Output Expansion Board connectors J2 - J5:

```
OUTPORT 0..3 TYPE=0

RESET
PIPES P0,P1,P2,P3
PDEF B
  DIGITALOUT(P0, 0)
  DIGITALOUT(P1, 1)
  DIGITALOUT(P2, 2)
  DIGITALOUT(P3, 3)
END
START B
```

Synchronous Digital Output Expansion

Synchronous digital expansion uses a special protocol which is implemented by the DAPL command DEXPAND. For each word of output, the data and address are encoded into four words that are sent to

the digital output port. If `DEXPAND` is used, all digital outputs are synchronous on all Digital Input/Output Expansion Boards. See the description of `DEXPAND` in the DAPL manual for more information.

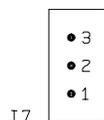
More Than One Digital Input/Output Expansion Board

Several Digital Input/Output Expansion Boards can be connected together to provide additional digital expansion. When more than one Digital Input/Output Expansion Board is used, the J1 connectors of all Digital Input/Output Expansion Boards are tied together. Contact Microstar Laboratories for information about special cables which provide this feature.

The Digital Input/Output Expansion Board has three socketed termination resistor networks, RN10, RN11 and RN12, adjacent to J1. The resistors are installed in the sockets when the boards are shipped from the factory. For single board systems, the resistors should remain installed. For multiple board systems, only one board may have the resistors installed. The board farthest from the Data Acquisition Processor should have the resistors installed. If more than one board in a system has the resistors installed, the system may fail.

Input Range

Each Digital Input/Output Expansion Board must be configured to recognize a specific input address range. Connector J7 selects this range.



Pin 1 of connector J7 is toward the right edge of the Digital Input/Output Expansion Board. The input range is selected according to the following table:

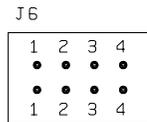
| Input Range | Jumper J7 |
|--------------------|------------------|
| B0-B3 | 1 to 2 |
| B4-B7 | 2 to 3 |
| disabled | removed |

Each port has 16 binary inputs.

Note: Only two Digital Input/Output Expansion Boards can be used for digital input expansion. If more than two Digital Input/Output Expansion Boards are connected to the Data Acquisition Processor then the Digital Input/Output Expansion Boards not being used for input expansion must have their input expansion disabled by removing the shunt from J7.

Output Range

Each Digital Input/Output Expansion Board must be configured to recognize a specific range of output addresses. Valid address ranges are 0-3, 4-7, ..., 60-63. Connector J6 of the Digital Input/Output Expansion Board selects this range.



Pin 1 of connector J6 is closest to the left edge of the Digital Input/Output Expansion Board. The output range is selected according to the following table:

| Output Address | Jumpers |
|----------------|------------|
| 0 - 3 | 1, 2, 3, 4 |
| 4 - 7 | 1, 2, 3 |
| 8 - 11 | 1, 2, 4 |
| 12 - 15 | 1, 2, |
| 16 - 19 | 1, 3, 4 |
| 20 - 23 | 1, 3 |
| 24 - 27 | 1, 4 |
| 28 - 31 | 1 |
| 32 - 35 | 2, 3, 4 |
| 36 - 39 | 2, 3 |
| 40 - 43 | 2, 4 |
| 44 - 47 | 2 |
| 48 - 51 | 3, 4 |
| 52 - 55 | 3 |
| 56 - 59 | 4 |
| 60 - 63 | none |

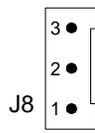
Digital output can be expanded past the maximum limit for digital input. For Digital Input/Output Expansion Boards that expand digital

output beyond the maximum digital input range, the digital inputs must be disabled by removing the shunt on J7.

External Power

The Digital Input/Output Expansion Board typically requires 0.66 Amp. The total power consumption of all expansion boards must not exceed the availability of the Data Acquisition Processor. Please refer to the hardware documentation of the Data Acquisition Processor for more specific power availability information. If the total power consumption of the exceeds the power availability of the Data Acquisition Processor, then external power must be used.

The Digital Input/Output Expansion Board allows an external 5-volt power supply to be connected through connector J8. Connector J8 is a male Molex connector part number 26-60-4030 and mates with the Molex connector part number 09-50-3031. Both mating connectors are included with the Microstar Laboratories cable kit MSCBL 027-01K.



| Pin | Signal |
|-----|------------|
| 1 | +5 Volts |
| 2 | Ground |
| 3 | No connect |

When an external +5 Volts power supply is connected to the board, all shunts on jumper header J9 must be removed. Jumper header J9 is located to the right of J1. Removing all the shunts from J9 disconnects the Data Acquisition Processor's +5V power supply from the board's +5V power supply.

Warning: When using an external power supply, all shunts on J9 must be removed. Otherwise the external power supply or the host PC power supply could be damaged.
