Analog Output Accessory Board Manual

Analog Output Expansion Boards
MSXB 014, MSXB 022, MSXB 032, and MSXB 056
Version 1.01

Microstar Laboratories, Inc.

Microstar Laboratories, Inc.
2265 116th Avenue N.E.
Bellevue, WA 98004
Tel: (425) 453-2345
Fax: (425) 453-3199
www.mstarlabs.com

Part Number MSXB_AOM101

Contents

Analog Output Expansion Boards

Each Microstar Laboratories Analog Output Expansion Board converts digital outputs from a Data Acquisition Processor into four separate analog outputs. Up to 16 Analog Output Expansion Boards can be connected to a Data Acquisition Processor for a maximum expansion of 64 additional analog output channels. Table 1 below lists available Analog Output Expansion Board models.

Table 1: Analog Output Expansion Board Models

Model Number	Resolution	Stand Alone Eurocard	Eurocard in Single Board Enclosure	Eurocard for Industrial Enclosure
MSXB 014	12-bit	Yes	No	No
MSXB 022	16-bit	Yes	No	No
MSXB 032 *(recommended)*	12-bit	Yes	Yes	Yes
MSXB 056 *(recommended)*	16-bit	Yes	Yes	Yes

Hardware Configuration

Connecting to a Data Acquisition Processor

Each Analog Output Expansion Board connects to the 100-line digital input/output port on the Data Acquisition Processor. The recommended cabling method employs a 100-line cable adapter board. Of particular interest to customers wishing to build CE-compliant systems, this adapter occupies a slot adjacent to the Data Acquisition Processor. The 100-line cable adapter board brings the digital input/output port on the Data Acquisition Processor to the back panel of the host PC, which is then connected to an stand-alone Analog Output Expansion Board, a single board or an industrial enclosure using a 100-line cable.

Table 2: Analog Output Expansion Board Cabling Options

Model Number	J1 Connector Type	100-line Cable Adaptor Board	100-line Cable
MSXB 014	Square	MSCBL 113-01	MSCBL 036
MSXB 022	Square	MSCBL 113-01	MSCBL 036
MSXB 032 *(recommended)*	D	MSCBL 076-01	MSCBL 054
MSXB 056 *(recommended)*	D	MSCBL 076-01	MSCBL 054

For MSXB 032 and MSXB 056, when less stringent requirements apply, an unshielded ribbon cable, part number MSCBL 056-01, can replace the shielded cable, part number MSCBL 054-01.

As described in Table 1 above, each Analog Output Expansion Board has several end panels. The following section describes each end panel in details.

Single-Board External Enclosure Option

The Analog Output Expansion Boards MSXB 032 and MSXB 056 are available with a single-board external enclosure option. The external enclosure provides shielding and is compatible with the European Community directive 89/336/EEC.

The single-board enclosure has several possible front panels that allow for different connection points to the Analog Output Expansion Board. Contact Microstar Laboratories for more information on available end panels for the Analog Output Expansion Board.

Industrial Enclosure Option

The Analog Output Expansion Boards MSXB 032 and MSXB 056 are available with backplane connector option for the industrial enclosure system. The backplane connector is installed in `J1`, which plugs directly into a slot on the Digital Backplane. See the Digital Backplane manual for more information on how to install boards into a Digital Backplane and how to connect the Digital Backplane to the Data Acquisition Processor.

Warning: Never connect or disconnect the Analog Output Expansion Backplane Board while the Digital Backplane is powered.

The Analog Output Expansion Board backplane model has several possible front panels that allow for different connection points to the Analog Output Expansion Board. Contact Microstar Laboratories for more information on available end panels for the Analog Output Expansion Board.

Stand-Alone Option

The Analog Output Expansion Board MSXB 014 and MSXB 022 are available with stand-alone model only. They have cable connectors installed in `J1` instead of the backplane connectors.

If digital input/output is needed in addition to analog output expansion, a Digital Expansion Board is required. If more than one expansion board is to be connected to the digital input/output port of a Data Acquisition Processor, either an unshielded daisy-chain cable must be used, or the expansion boards may reside in an industrial enclosure with Digital Backplane and Interface boards.

Warning: Never connect or disconnect the Analog Output Expansion Board while the Data Acquisition Processor is powered.

Current Requirements and External Power

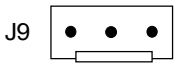
The Analog Output Expansion Board draws power from the PC's 5 volt supply. The following table summarizes the current consumption of each model.

Table 3: Current Consumption

Model Number	Current (Amps)
MSXB 014	0.9
MSXB 022	1
MSXB 032	0.9
MSXB 056	1

The total power consumption of all expansion boards must not exceed the power available from 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 is more than the power available from the Data Acquisition Processor, external power must be used.

The Analog Output Expansion Board allows an external 5-volt power supply to be connected through connector J9. Connector J9 is a male Molex connector, part number 26-60-4030 and mates with the female Molex connector, part number 09-50-3031. A mating connector is available as the Microstar Laboratories cable kit, part number MSCBL 035-01K.



Pin	Signal
1	+5 volts
2	Ground
3	Not Connected

Figure 1. External Power Selection Header

When an external +5 Volts power supply is connected to the board, all shunts on the external power jumper header must be removed. The

following table summarizes the external power jumper header on each Analog Output Expansion Board model.

Table 4: External Power Jumper Header

Model Number	Jumper Header
MSXB 014	J12-J17
MSXB 022	J12
MSXB 032	J15
MSXB 056	J12

The external power jumper header is located to the right of J1. Removing all the shunts from J15 or J12 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 J15 must be removed. Otherwise the external power supply or the host PC power supply could be damaged.

Note: When using external power, it is best to power the Analog Output Expansion Board from the host PC's power supply so that both the Analog Output Expansion Board and the Data Acquisition Processor are powered on and off at the same time. If this is not practical, then external power to the Analog Output Expansion Board should be applied before powering on the DAP and should be disconnected after powering off the DAP.

Multiple Analog Output Expansion Boards

Address Range Selection

Digital outputs from a Data Acquisition Processor may be expanded into 64 ports, shared among Analog Output Expansion Boards, Digital Output Expansion Boards, Counter-Timer Boards, etc. The Analog Output Expansion Board divides this digital port address space into 16 contiguous ranges of 4 ports each. Address jumpers located on the Analog Output Expansion Board's J2 header provide the means to

select the address range. Figure 2 shows the pin numbering of header J2.

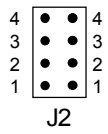


Figure 2. Address Range Selection Header

The address range is selected by installing jumpers on header J2 as shown in the following table:

Table 5. Address range configuration

Output Address	Jumpers	DACOUT Port Address
0 - 3	1, 2, 3, 4	2 - 5
4 - 7	1, 2, 3	6 - 9
8 - 11	1, 2, 4	10 - 13
12 - 15	1, 2	14 - 17
16 - 19	1, 3, 4	18 - 21
20 - 23	1, 3	22 - 25
24 - 27	1, 4	26 - 29
28 - 31	1	30 - 33
32 - 35	2, 3, 4	34 - 37
36 - 39	2, 3	38 - 41
40 - 43	2, 4	42 - 45
44 - 47	2	46 - 49
48 - 51	3, 4	50 - 53
52 - 55	3	54 - 57
56 - 59	4	58 - 61
60 - 63	none	62 - 65

Notice that corresponding “Output Addresses” (digital port numbers) and “DACOUT Port Addresses” differ numerically by 2. Analog output ports 0 and 1 are driven by DACs on the Data Acquisition Processor. Digital output expansion maps the single 16-bit digital output port onto 64 additional ports. Analog output expansion merely piggybacks on the digital expansion scheme, augmenting rather than consuming the analog output capability on the Data Acquisition Processor.

Analog Outputs

Connections

There are four digital-to-analog converters on the Analog Output Expansion Board. These digital-to-analog converters are identical to those on most Data Acquisition Processors. The digital-to-analog converters have voltage outputs with typical output impedance of 0.2 Ω and maximum output current of 5 mA. It is recommended, however, that the output current not exceed 1 mA.

The DAC outputs are available on several connectors on the Analog Output Expansion Board. The following table summarizes the available connectors on each model.

Table 6: Connectors for DAC Outputs

Model Number	8-Point Quick Connector	10-Pin Shrouded Header	DB-9 Connector
MSXB 014	J7	J8	-
MSXB 022	J7	J8	-
MSXB 032	J7	J8	-
MSXB 056	J7	J8	J13

There is a ground return for each output. It is recommended that these grounds be paired with their respective outputs to minimize noise. The connections on the 8-point terminal block are clearly labeled on the circuit board. The connections on the 10-pin shrouded header and DB-9 connector are shown in Figures 3 and 4 respectively.

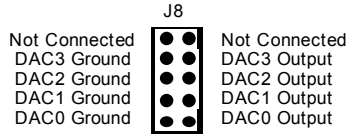


Figure 3. DAC Output 10-Pin Connector at J8

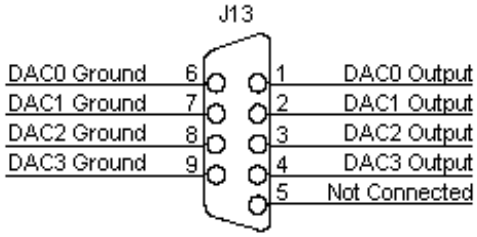


Figure 4: DB-9 Connector at J13

Voltage Range Selection

Connectors J3 to J6 select the voltage range. Connectors J3 to J6 on MSXB 014 and MSXB 032 are different from those on MSXB 022 and MSXB 056.

For MSXB 014 and MSXB 032, each digital-to-analog converter has an eight-pin header with three jumpers to select the output voltage range. Connector J3 controls DAC0, J4 controls DAC1, J5 controls DAC2, and J6 controls DAC3. The pin numbering of the headers is shown in Figure 5, and the jumper is placed on each header as shown in Table 7. Pin 1 is closest to the J1 end of the board and to the header label.

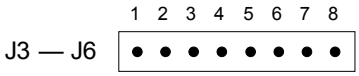


Figure 5. Voltage Range Selection Header on MSXB 014 and MSXB 032

Table 7: Voltage Range Configuration for MSXB 014 and MSXB 032

Jumpers	Range
3 to 4, 5 to 6, 7 to 8	0 volts to +10 volts
1 to 2, 4 to 5, 7 to 8	-5 volts to +5 volts
1 to 2, 4 to 5, 6 to 7	-10 volts to +10 volts

For MSXB 022 and MSXB 056, each digital-to-analog converter has a three-pin header with a jumper to select the output voltage range. Connector J3 controls DAC0, J4 controls DAC1, J5 controls DAC2, and J6 controls DAC3. The pin numbering of the headers is shown in

Figure 6, and the jumper is placed on each header as shown in Table 8.

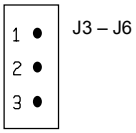


Figure 6. Voltage Range Selection Header on MSXB 022 and MSXB 056

Table 8. Voltage Range Configuration for MSXB 022 and MSXB 056

Jumpers	**Range**
1 to 2	-5 volts to +5 volts
2 to 3	-10 volts to +10 volts

The Analog Output Expansion Board is shipped with the -5 volts to +5 volts range selected.

Note: If the voltage range of the Analog Output Expansion Board is changed, the board should be recalibrated. Recalibration can be performed by Microstar Laboratories.

Software Configuration

The Analog Output Expansion Board is controlled through DAPL in the same way as output expansion is controlled with the Digital Expansion Board. To use the Analog Output Expansion Board, the DAPL `OUTPORT` command is required. The output port type of the Analog Output Expansion Board is "1".

The command `DACOUT` uses "0" and "1" for the Data Acquisition Processor onboard analog outputs. For the Analog Output Expansion Board, `DACOUT` uses "2" for analog output expansion port 0, "3" for output expansion port 1, and so on.

The following DAPL listing generates +5 volts DC on `DAC0`, 0 volts DC on `DAC1`, -2.5 volts DC on `DAC2`, and +2.5 volts DC on `DAC3`, provided that the DAC output control jumpers are in the ± 5 volt range as shipped from the factory:

```
OUTPORT 0..3 TYPE=1

RESET
PIPES P0, P1, P2, P3
PDEF A
DACOUT(P0,2)
DACOUT(P1,3)
DACOUT(P2,4)
DACOUT(P3,5)
END
START A
FILL P0 32767
FILL P1 0
FILL P2 -16384
FILL P3 16384
```

In real applications, the values in pipes `P0`, `P1`, `P2` and `P3` typically come from other procedures instead of from `FILL` commands.

Synchronous Analog Output Expansion

Synchronous analog output expansion uses a special protocol that 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, DAC outputs occur one-

after-the-other, synchronously with the Data Acquisition Processor's Internal Output Clock. See the description of DEXPAND in the DAPL manual for more information. Also see the Applications Manual for an example of synchronous analog output expansion.