MSXB 066 & 067 Accessory Board Manual

Bridge Interface Boards

Version 1.00

Microstar Laboratories, Inc.

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MSXB 066 & MSXB 067 - Bridge Interface Boards

The Analog Input Expansion Boards, part number MSXB 066 and MSXB 067, are 8-channel sensor interface boards for strain gauges, load cells, RTDs, and other resistive sensors. They provide flexible interface for quarter-bridge, half-bridge, and full-bridge sensors, with two to eight wires for each sensor, with or without voltage-sense feedback. Figure 1 illustrates the path of the input signal.

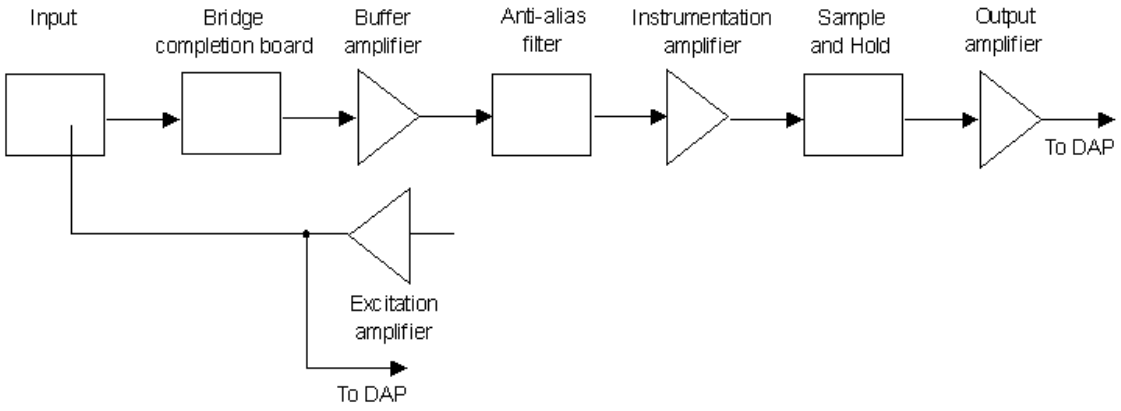

Figure 1. MSXB066/067 Block Diagram.

Features of the Bridge Interface boards include:

- Eight differential inputs
- Bridge completion for various configurations
- Force and sense feedback signals
- Simultaneous sampling
- Anti-alias filtering with one four-pole, low-pass, differential Butterworth filter for each channel
- Three differential excitation voltages – 1.024, 2.048, and 3.072V
- Six gains of 1, 2, 5, 10, 25, and 50 for RTDs and 20, 40, 100, 200, 500, and 1000 for other resistive sensors

The difference between the MSXB 066 and the MSXB 067 is that the MSXB 067 provides anti-alias filtering. The filter module is bypassed on the MSXB 066.

Input signals are connected to the MSXB 066 or the MSXB 067 by means of eight 8-pin mini-DIN connectors. The number of input channels can be expanded to as many as 240 by using up to 15 MSXB 066 or MSXB 067 boards or both.

Microstar Laboratories has several models of MSXB 066 and MSXB 067 expansion boards available. Both expansion boards are compatible with the backplane in the standard industrial enclosures and optionally can be built in a stand-alone or single-board external enclosure configuration. The expansion boards mount directly in a standard Microstar Laboratories industrial enclosure fitted with a 68-line analog backplane.

Basic Models

The MSXB 066 and MSXB 067 expansion boards are currently available in the backplane models. A DAP board is connected to the MSXB 066 and MSXB 067 boards by installing them into an analog backplane mounted in an industrial enclosure.

There is a model of the MSXB 066 and MSXB 067 boards that provides gains of 1 to 50 for applications with RTDs. The model for other resistive configurations has gains between 20 and 1000.

Table 1 shows all MSXB 067 expansion board models. Other cutoff frequencies may be available. Contact your Microstar Laboratories representative to determine all available models.

Table 1. MSXB 067 Basic Models

Product Name	**Cutoff Frequency**
MSXB067-0X-100-E2Q01	100 Hz
MSXB067-0X-1K-E2Q01	1 kHz
MSXB067-0X-10K-E2Q01	10 kHz
MSXB067-0X-25K-E2Q01	25 kHz

Note: X = 1 for a minimum gain of 20; X = 2 for RTD.

Installation

The backplane models of the Bridge Interface board connect directly to the analog backplane via connector **J1**. Each MSXB 066 or MSXB 067 board requires two slots in an industrial enclosure. The board installs into any available slot in the analog backplane.

When installing the expansion board, push the board firmly into the slot and make sure the board is securely connected to the backplane.

Warning: Never connect or disconnect any expansion board from the analog backplane or the Data Acquisition Processor while power is applied to any of them.

Hardware Configuration

Figure 2 shows the component placement outlines of the Bridge Interface board. The connectors and headers are labeled with the letter **J**.

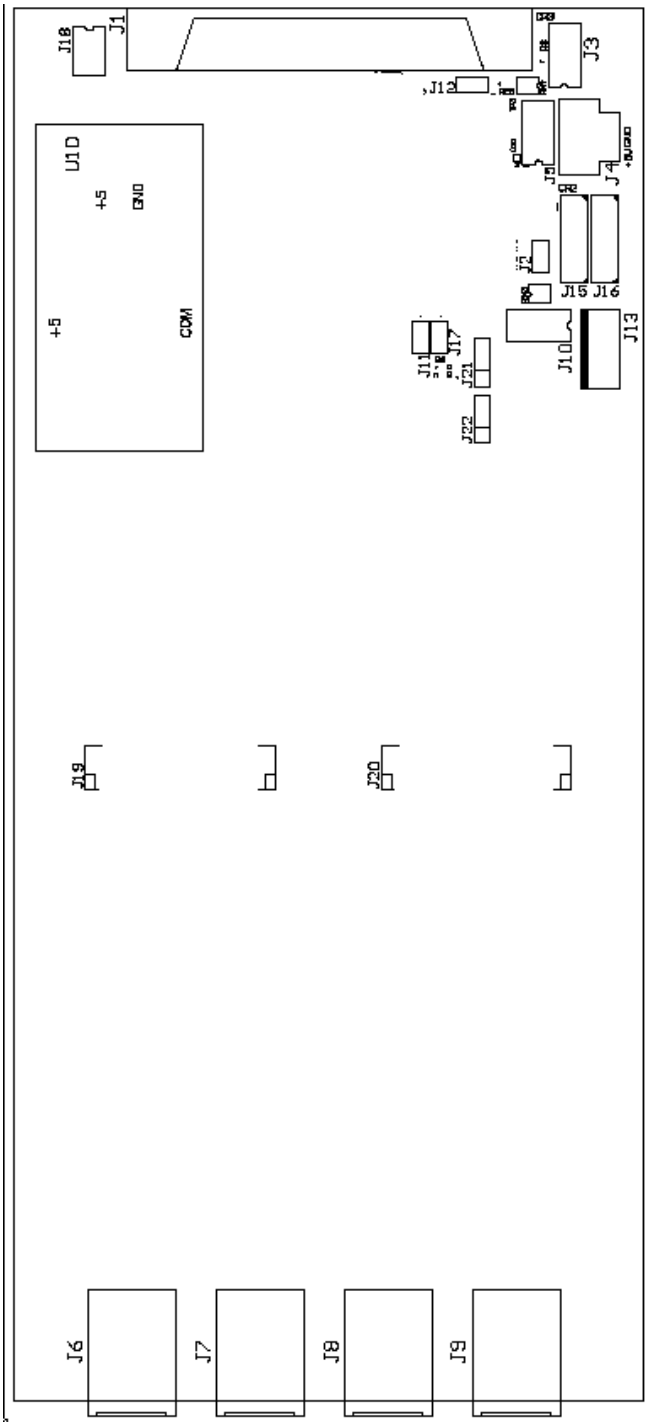

Figure 2. Layout of the Bridge Interface Board.

Connecting Analog Input Signals

The MSXB 066 and MSXB 067 boards provide four dual 8-pin mini-DIN connectors, **J6** to **J9**, where each mini-DIN connects to one input. Each dual connector consists of two female connectors stacked vertically. The cable kit MSCBL120-01K contains one mating mini-DIN connector; the MSCBL121-01K includes eight mating connectors. Figure 3 shows the pinout of one of the dual connectors.

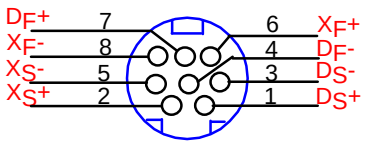

Figure 3. Sensor Input Connector.

Each bridge circuit has a differential voltage excitation (**XF+**, **XF-**) and a differential signal (**DF+**, **DF-**). These signals have corresponding sense signals (**XS+**, **XS-**) and (**DS+**, **DS-**). Each pair of inputs should be connected at the sensor.

Bridge Completion

A small circuit completion module with locations for both force and sense feedback jumpers and bridge completion resistors, part number MSBCM001-01, can be connected to **J14** of the MSXB066/067. One module will be included with each board. Additional modules are sold separately, along with precision resistors for the standard resistance values of 120, 350, and 1000 Ohms. The tech note, TN254, has detail information on bridge completion.

Voltage-Sense Feedback

The MSXB 066 and MSXB 067 boards have an option to enable the sense voltages onto the outputs connected to the DAP board. By default, this option is enabled with a shunt on header **J11**. The upper 8 differential channels in the 16-channel range are the sense voltages, with the lower 8 channels being the input voltages. Refer to the section on Input Address Range for information on configuring the board for a distinct input range.

Excitation Voltage

The Bridge Interface boards support three differential excitation voltages. The nominal voltage difference between the high and low excitation levels **XF+** and **XF-** can be 1.024, 2.048, or 3.072 V. It is selectable at headers **J21** and **J22**.

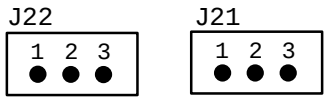

Figure 4. Headers for selecting excitation voltage.

Excitation Voltage (V)	J21	J22
1.024	1-2	2-3
2.048	1-2	1-2
2.048	2-3	2-3
3.072	2-3	1-2

By default, the board is configured for a differential excitation voltage of 3.072V.

Gain Settings

The MSXB066-01 and MSXB067-01 boards provide the gains of 20, 40, 100, 200, 500, and 1000, selectable at the header **J10**. The MSXB066-02 and MSXB067-02 boards have the gains of 1, 2, 5, 10, 25, and 50. The gain settings apply to the bridge differential output signal only, not the excitation sense differential signal. The following tables show the valid settings for each model at header J10.

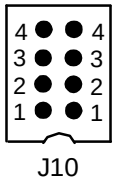

Figure 5. Header J10 for Gain Settings.

For MSXB066-01 and MSXB067-01, the settings are:

Shunt at pin pair(s)	Gain
1, 2, 3	20
1, 2, 4	40
2, 3	100
2, 4	200
1, 3	500
1, 4	1000

For MSXB066-02 and MSXB067-02, the settings are:

Shunt at pin pair(s)	Gain
1, 2, 3, 4	1
1, 2, 3	2
2, 3, 4	5
2, 3	10
1, 3, 4	25
1, 3	50

By default all shunts are installed for a gain of 20 on the –01 model and an unity gain on the –02 model.

Input Address Range

Each MSXB 066 or MSXB 067 Bridge Interface board can support 8 differential inputs. Each analog input expansion board, including the MSXB 066 or MSXB 067 board, must be configured to recognize a unique input address range. By default, the sense voltages are enabled, which are passed to the DAP board as the upper 8 channels of the 16-channel range. The jumper setting on connector **J5** selects the board address ranges.

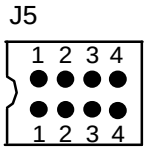

Figure 6. Input Range Selection Header

Signal Channels	Sense Channels	Board Number	Shunts
D0 – D7	D8 – D15	0	1, 2, 3, 4
D16 – D23	D24 – D31	1	1, 2, 3
D32 – D39	D40 – D47	2	1, 2, 4
D48 – D55	D56 – D63	3	1, 2
D64 – D71	D72 – D79	4	1, 3, 4
D80 – D87	D88 – D95	5	1, 3
D96 – D103	D104 – D111	6	1, 4
D112 – D119	D120 – D127	7	1
D128 – D135	D136 – D143	8	2, 3, 4
D144 – D151	D152 – D159	9	2, 3
D160 – D167	D168 – D175	10	2, 4
D176 – D183	D184 – D191	11	2
D192 – D199	D200 – D207	12	3, 4
D208 – D215	D216 – D223	13	3
D224 – D231	D232 – D239	14	4

With the sense voltages enabled, each jumper setting on connector **J5** selects an address range of 8 input channels and 8 voltage-sense feedback channels. Up to 15 boards can connect to a single DAP, providing 120 differential analog inputs. When using multiple MSXB 066 or MSXB 067 or both, every input expansion board in the system must have a unique address range.

If the voltage-sense feedback is not necessary or if an application requires more than 120 bridge inputs, the feedback option can be disabled to allow for additional channel ranges. Header **J12** selects the low- or high-order half of the 16-channel address range determined by **J5**. By default, a shunt is installed on **J12** to configure for the low-order, i.e. the first 8 channels, of the input address range. If it is removed, the board is configured for the higher order of the address range. In this case, two Bridge Interface boards can have the same jumper setting at **J5** but with only one board having shunt installed on **J12**. A system can have a combination of boards with voltage-sense feedback enabled and some disabled.

There are two special expansion address ranges, **D240** to **D247** and **D248** to **D255**. The first expansion address is reserved and must not be used. The second address range, **D248** to **D255**, puts the sample-and-hold amplifiers into track mode.

The input addressing is enabled by installing a shunt on header **J17**. If the shunt is removed, the board is always on; it passes outputs to the DAP board as long as it is powered.

Power Requirements

Each MSXB 066 or MSXB 067 filter board requires less than 2 Amps at +5 Volts DC. It draws power from the 68-line connector on the analog backplane. A DAP board can typically supply a total of 2 Amps at its +5V connection. If the total current required by the expansion boards in the system exceeds 2 Amps, an external power supply should be connected to the backplane of the industrial enclosure. An external power is needed with more than one MSXB 066 or 067 in the system. One model of the industrial enclosure contains a built-in power supply that connects to an AC power outlet.

External Power Option

On the external-power model of the Bridge Interface board, connector **J4** provides connection for a +5V external power. Connector **J4** is a single-row header on 0.156-inch centers located by the DC-to-DC converter. **J4** is Molex part number 26-60-4030, which mates with the Molex part number 09-50-3031. Microstar can provide a cable, part number MSCBL033, that connects the 5VDC power of a PC to **J4**. The pin-out of connector **J4** is shown below.

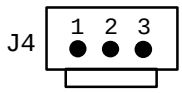

Figure 7. External Power Connector.

Pin	Signal
1	+5V
2	Ground
3	Not Used

To turn an internal-power model of the expansion board into using an external power, the traces at **J3** need to be cut. **J3** is located next to **J4**.

Simultaneous Sample and Hold Option

The sample-and-hold feature is enabled by default by installing a shunt on header **J2**. Removing the shunt bypasses the sample-and-hold feature and thus disables the simultaneous sampling. When simultaneous sampling is disabled, the board reads the most recent value from a channel per input clock and moves on to the next channel.

When the sample-and-hold amplifiers are enabled, reading from any pin in the address range of **D248** to **D255** places all the channels on all connected Bridge Interface board(s) into track mode, which provides settling time between samples. This is a dummy reading and the value from this input channel pipe should be ignored. Reading from any pin in the lower address range of **D0** to **D239**, which places the board into hold mode, gives a value corresponding to an input signal as held on the last transition from track mode to hold mode.

The Bridge Interface board(s) should be held in track mode for a minimum of 4 microseconds before switching to hold mode, which means the DAP board should sample any pin within **D248** to **D255** for at least 4 μs before sampling an input signal. This is to provide adequate settling time for large voltage wings.

Clocking and Triggering Connections

Clocking and triggering signals can be connected to the Bridge Interface board. External clock and trigger signals connected to the MSXB 066 or the MSXB 067 board must be in the standard TTL range of 0 to 5 volts. See the DAP hardware manual for more information about hardware clocking and triggering.

Connectors **J15** and **J16** on MSXB 066 (or MSXB 067) provide access to the external clock and trigger signals from the Data Acquisition Processor. **J15 and J16** are Molex part number 53014-0610. The mating connector consists of a shell and discrete crimp pins; the shell is Molex part number 51004-0600 and the crimp pins are Molex part number 50011-8100. The schematic diagrams for connectors **J15 and J16** are shown below:

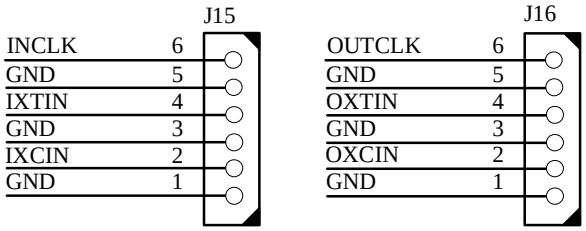

Figure 8. External Clock and Trigger Signals

Pin	Signal
INCLK	Internal Input Clock – Output
IXTIN	External Input Trigger – Input
IXCIN	External Input Clock – Input
OUTCLK	Internal Output Clock – Output
OXTIN	External Output Trigger – Input
OXCIN	External Output Clock – Input

Filter Modules

For the MSXB 067 board, two filter modules are installed at connectors **J19** and **J20**. It is compatible with filter module MSFM002, which has various cutoff frequencies. Please contact Microstar Laboratories for the available filter frequencies.

Software Configuration

The following is a typical input procedure definition. The input procedure **MslInput** acquires the signals on **D0**, **D1**, **D2**, …, and **D7** sequentially. The **TIME** command sets the sampling time to 4.0 microseconds. Since the input configuration samples nine pins, including one pin in the range of **D248** to **D255** for the track mode, each pin is sampled every 36 microseconds or at approximately 27.8 kS/s. The **MERGE** command sends the input data from input channels to the binary communications pipe **$BINOUT**:

```
RESET
IDEF MslInput 9
  SET IP0  D248
  SET IP1  D0
  SET IP2  D1
  SET IP3  D2
  SET IP4  D3
  SET IP5  D4
  SET IP6  D5
  SET IP7  D6
  SET IP8  D7
  TIME 4.0
  END
PDEF MslProc
  MERGE (IP(1 .. 8), $BINOUT)
  END
START MslInput, MslProc
```

Note that data from input channel pipe 0 are ignored. The only function of the **SET IP0 D248** command is to place the sample-and-hold amplifiers into track mode. An unity gain is used on the DAP board because the amplifiers on the Bridge Interface board provide sufficient gain and no additional gain is needed.

As described in the section on Simultaneous Sample and Hold Option, the board must be held in track mode for a minimum of 4 microseconds. That does not mean the value for the **TIME** command has to be at least 4. A pin between **D248** and **D255** can be sampled more than once to achieve a higher sample rate per channel. For the example above, the pin **D248** (or any channel in **D248**-**D255**) can be sampled twice to reduce the sample time to 2.0 microseconds to fulfill the minimum time for track mode. In that case, the input definition becomes the following:

```
IDEF MslInput 10
  SET IP0  D248
  SET IP1  D248
  SET IP2  D0
  SET IP3  D1
  SET IP4  D2
  SET IP5  D3
  SET IP6  D4
  SET IP7  D5
  SET IP8  D6
  SET IP9  D7
  TIME 2.0
  END
```

The number of inputs is increased from 9 to 10. The sample time interval per channel is now 20 microseconds, which translates to a sample rate of 50 kS/s, compared to the 27.8 kS/s from the first input definition with **D248** sampled once.

Appendix A. Connectors at a Glance

Header	*Description*
J1	68-pin connector to the DAP
J2	Enables sample-and-hold amplifiers
J3	Determines whether the board is externally powered
J4	3-pin Molex Connector for external power
J5	Determines the input address range
J6 – J9	8-pin mini-DIN input connectors
J10	Determines gain setting
J11	Enables voltage-sense feedback
J12	Selects the low- or high-order of the address range
J13	Internal use – for programming EEPROM
J14	Connects to bridge completion daughter board
J15	Input clock and trigger
J16	Output clock and trigger
J17	Enables addressing
J18	Internal use
J19	Connects to filter module for MSXB 067
J20	Connects to filter module for MSXB 067
J21, J22	Selects the excitation voltage

Appendix B. Mechanical Layout

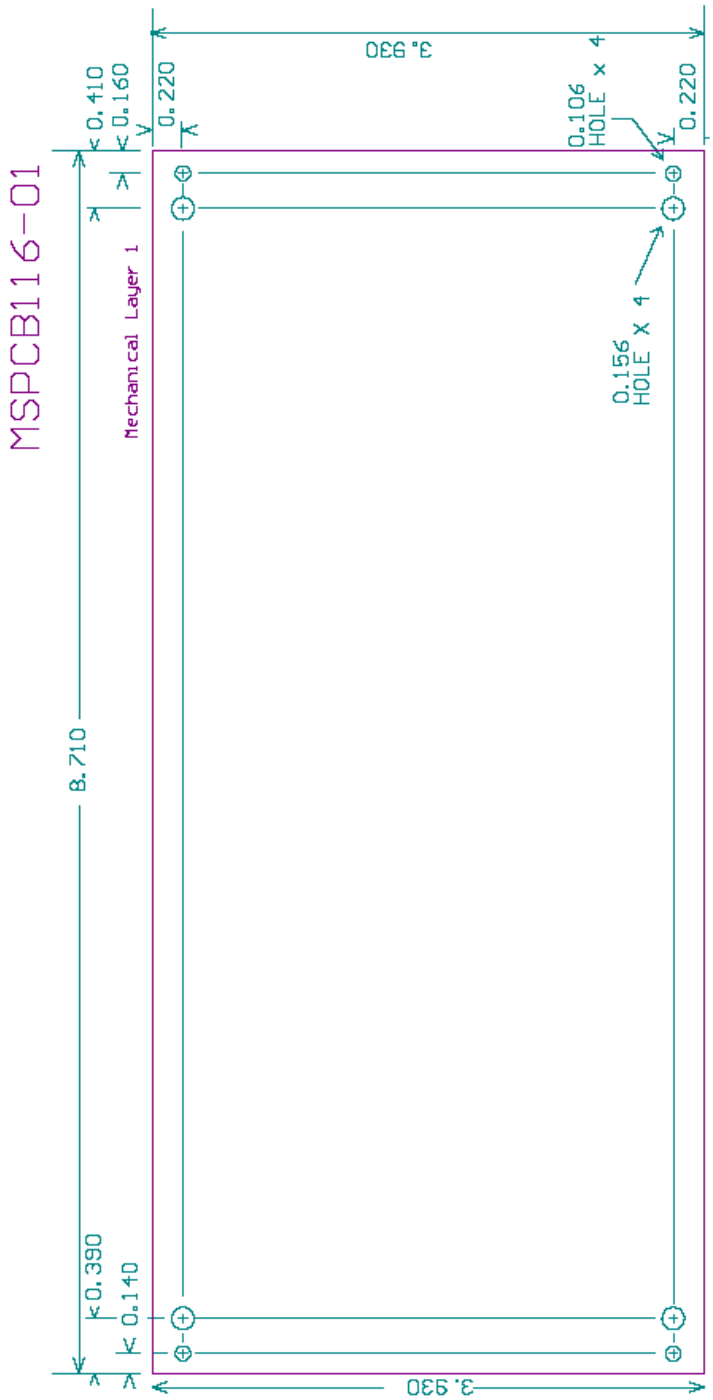

Figure 9. Dimensions of the Board.