Innovative Integration

TERM Hardware Manual

First Edition

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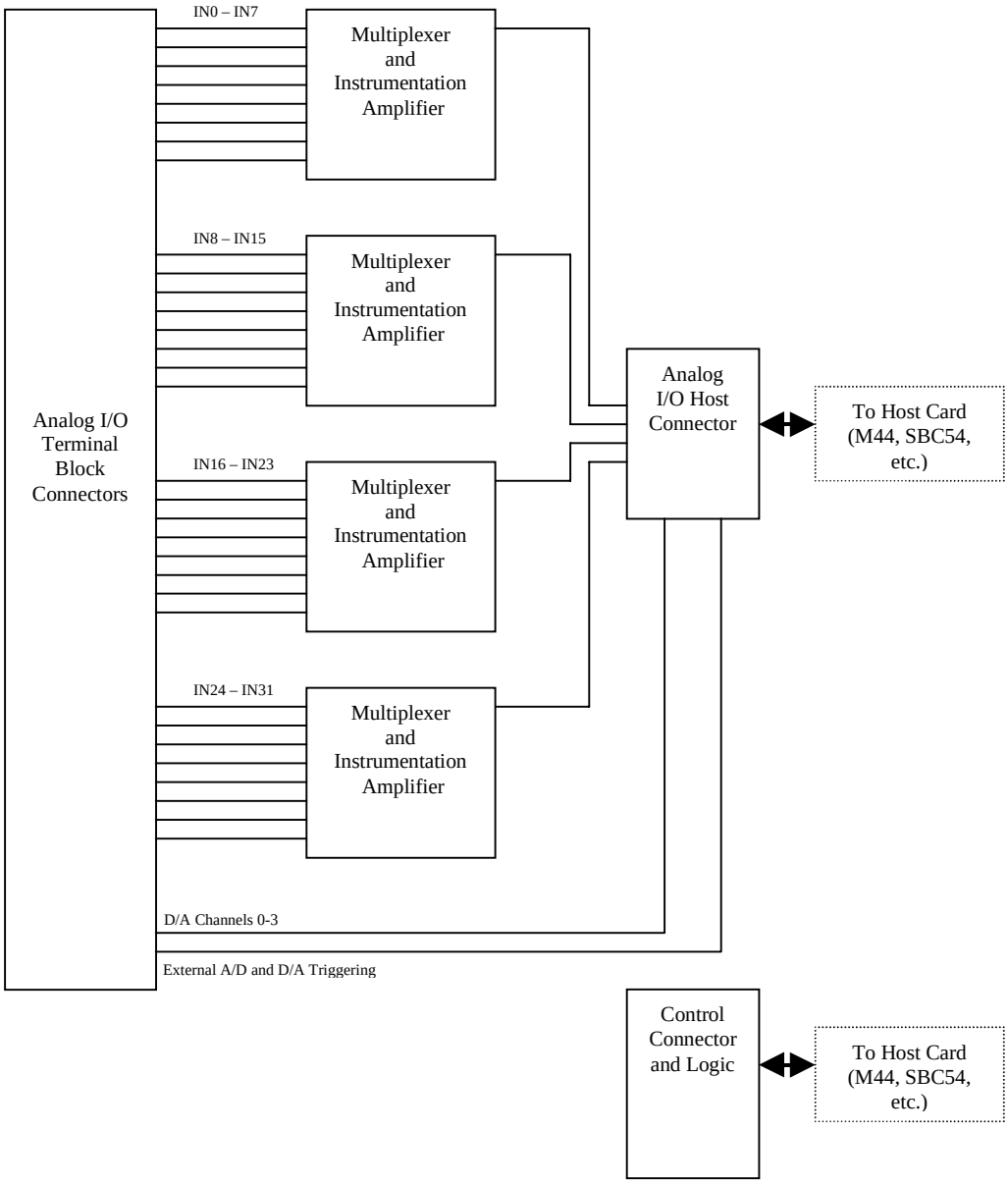
1. TERM Hardware Functions

The TERM module provides external multiplexing capability to Omnibus module-compatible data acquisition boards, such as the M44, SBC54, and M62 cards from Innovative Integration. Designed to be paired with an A4D4 module, the TERM allows up to 32 single ended or 16 differential channels to be sampled by a single A4D4 module. The TERM also provides access to the A4D4 module's D/A outputs and external triggering signals.

The following is a block diagram of the TERM board.



Input signal flow though the TERM board circuitry is as follows: single ended or differential signals attached to the screw terminal connectors are presented to the inputs of the multiplexers. If single-ended muxes (DG408 devices) are populated on the board, the mux's control inputs cause it to switch one of the eight inputs to its output. If differential muxes (DG409 devices) are populated on the board, then the control inputs cause the mux to switch one of the four differential pairs to its output. The mux output(s) are in turn connected to an instrumentation amplifier which serves to buffer the signal (in single ended installations) or convert the signal to single ended format (in differential installations). The signal is then passed through a gain and offset trim amplifier stage before being passed to the analog I/O connector for connection to the host board.

2. Analog I/O and Control Host Connections

Connection to the host board (M44, SBC54, etc) is made with two cables: one for the analog connection and one for the control connection. The analog connection is made via a straight through 15 pin ribbon cable with DB15 connectors on each end. One end is connected to the TERM module at the analog I/O host connector, and the other is connected to the host board's I/O module bus I/O connector. If the host board in use does not supply a 15 pin I/O connector (i.e. the SBC54), then the connection is made to the highest 15 pins of the 50 pin header connector on the host card (see the host card's hardware manual for details on I/O module bus I/O connector pinouts). Since there are two or more I/O module sites on each host board, be sure to connect the TERM analog cable to the correct I/O connector for the site in which the A4D4 module is installed.

The control connection is made via a 14 pin ribbon cable with IDC type connectors on each end. One end connects to the TERM's control connector, and the other end connects with the host board's mux control connector. As with the analog cable, be sure to use the correct mux control connector on the host board for the module site where the A4D4 is installed.

3. Using the TERM Board

The TERM board is easy to control from host software via the host's mux control connector. The host's hardware manual documents the mux control bus implemented on the TERM module, and gives a memory map showing the appropriate addresses to access to drive the mux control signals.

Multiplexing functions are controlled via a "bus" implemented through the mux control connector. The TERM's onboard logic responds to accesses over the control bus and in turn generates various control signals to the multiplexers to control channel selection. The following operations can be performed:

1) Multiplexer 0 channel select
2) Multiplexer 1 channel select
3) Multiplexer 2 channel select
4) Multiplexer 3 channel select
5) All muxes channel select

The individual multiplexer channel select functions allow software to set the channel number of each multiplexer to select a particular sample and hold output (and therefore a particular TERM input channel) to pass on to the A4D4 module. For example, writing the value 0x1 to the multiplexed zero channel select address causes multiplexer zero to switch to its input channel 1, which causes the value present on input pin IN1 (through the sample and hold) to be connected to the A4D4 modules A/D channel 0. The following tables give the relationships between the input connectors and the mux control values necessary to drive the signals out to a particular output for both single-ended and differential installations.

Multiplexer Number	Multiplexer Control Value	Selected Input Signal
0	0	IN0
	1	IN1
	2	IN2
	3	IN3
	4	IN4
	5	IN5
	6	IN6
	7	IN7
1	0	IN8
	1	IN9
	2	IN10
	3	IN11
	4	IN12
	5	IN13
	6	IN14
	7	IN15
2	0	IN16
	1	IN17
	2	IN18
	3	IN19
	4	IN20
	5	IN21
	6	IN22
	7	IN23
3	0	IN24
	1	IN25
	2	IN26
	3	IN27
	4	IN28
	5	IN29
	6	IN30
	7	IN31

Figure 1: Multiplexer control values for single-ended installations

Multiplexer Number	Multiplexer Control Value	Selected Positive Input Signal	Selected Negative Input Signal
0	0	IN0	IN1
	1	IN2	IN3
	2	IN4	IN5
	3	IN6	IN7
1	0	IN8	IN9
	1	IN10	IN11
	2	IN12	IN13
	3	IN14	IN15
2	0	IN16	IN17
	1	IN18	IN19
	2	IN20	IN21
	3	IN22	IN23
3	0	IN24	IN25
	1	IN26	IN27
	2	IN28	IN29
	3	IN30	IN31

Figure 2: Multiplexer control values for differential installations

For example, with a single-ended TERM board connected with the standard cable to an M44 with A4D4 module, writing the value two to the control address for multiplexer zero would cause the device to switch to input channel two, thus causing the signal on input pin IN2 to be connected to output zero on the analog connector through the instrumentation and trim amplifiers. This in turn allows the A4D4 module's A/D device zero to sample the IN2 signal.

Similarly, with a differential TERM board and A4D4 module, writing the value one to the control address for multiplexer three would cause the device to switch input signals IN26 and IN27 to the instrumentation amplifier, which would in turn drive the voltage difference between the two signals through the trim amp to output three on the analog connector. This signal would then be digitizable by the A4D4's A/D device three.

The all muxes channels select function causes all multiplexers to switch to the same mux input channel number. For example, writing the value 0x0 to all muxes channel select address causes all four muxes to switch to their input channel 0. This causes the signals on input connector pins IN0, IN8, IN16, and IN24 to be switched to the A4D4 A/D input channels 0, 1, 2 and 3 respectively.

The TERM board also provides offset and gain trim potentiometers for each of the four instrumentation amplifiers. The following table gives the reference designators for the trim pots for each channel.

Output Channel	Gain Trim Potentiometer	Offset Trim Potentiometer
0	R19	R23
1	R26	R30
2	R2	R6
3	R9	R13

4. Connector Pinouts

4.1 P1 – Analog I/O Host Connector

Connector types: DB15 right angle
Number of pins: 15
Mating connector:

The following table gives the pin numbers and functions for the P1 connector.

Pin Number	Function
1	Analog Mux 0 Output
2	Analog Mux 1 Output
3	Analog Mux 2 Output
4	Analog Mux 3 Output
7, 9-12	Ground
5	D/A Channel 0 Input
6	D/A Channel 2 Input
8	External A/D Trigger Output
13	D/A Channel 1 Input
14	D/A Channel 3 Input
15	External D/A Trigger Output

Figure 3: Analog I/O Host Connector

4.2 JP1, JP2, JP3 – Analog I/O Terminal Block Connectors

Connector types: Screw terminal block
Number of pins: 80 total
Mating connector:

The following table gives the pin numbers and functions for the JP1 connector.

Pin Number	Function
1, 3, 5, …31	Analog Input 0-15
2, 4, 6, …32	Ground

Figure 4: Analog I/O Terminal Block Connector JP1

The following table gives the pin numbers and functions for the JP2 connector.

Pin Number	Function
1, 3, 5, …31	Analog Input 16-31
2, 4, 6, …32	Ground

Figure 5: Analog I/O Terminal Block Connector JP2

The following table gives the pin numbers and functions for the JP3 connector.

Pin Number	Function
1	External A/D Trigger Input
2, 4, 6, …16	Ground
3	External D/A Trigger Input
5	External Sample and Hold Input
9	D/A Channel 0 Output
11	D/A Channel 1 Output
13	D/A Channel 2 Output
15	D/A Channel 3 Output

Figure 6: Analog I/O Terminal Block Connector JP3

4.3 JP4 – TERM Control Connector

Connector types: Shrouded header
Number of pins: 14
Mating connector:

The following table gives the pin numbers and functions for the JP4 connector.

Pin Number	Function
1, 3, 5	Data Bits 0..2
2, 4, 6	Address Bits 0..2
7	Strobe (active low)
9	Digital 5V (from host)
10	Digital Ground (from host)
14	Analog Ground
8, 11, 12, 13	Reserved

Figure 7: TERM Control Connector