

***MCN Monitoring and Control Network
Comparator Display System***

***Input/Output Interface Module
IIB
Hardware Reference Manual***

S2-60400-115

CFI Products Inc. 

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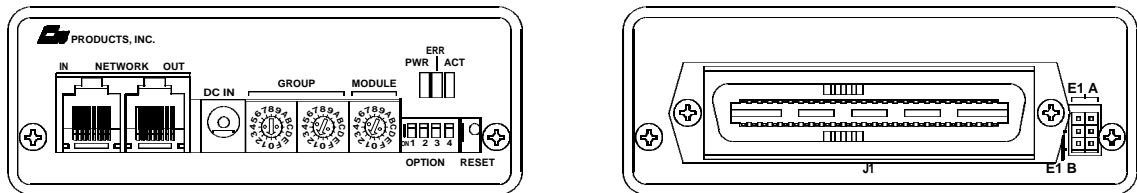
If you have questions about the MCN comparator display system, call us at:
(513) 595-5900. (8:30 to 5:00 Eastern)

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1. Introduction

The Input/Output Interface Module (IIB) is a member of the Monitoring and Control Network (MCN) family of **User Interface Modules**. Hardware specifications, special installation, and configuration information are described in this manual.

The IIB module connects a parallel operator display device (such as a console) to the MCN network. The IIB is used with the operator display device and a Comparator I/O Module (such as a CIB or AIB) to create a comparator display system. The comparator display system provides monitoring and control functions for your communications system. Receiver states monitored by the IIB include VOTE, RECEIVE, DISABLE and FAIL. Receiver functions that can be controlled include FORCE VOTE and DISABLE.



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Figure 1 - IIB Front and Rear View

1.1 Reference Documents

1. Monitoring and Control Network System Manual
Part Number S2-60425

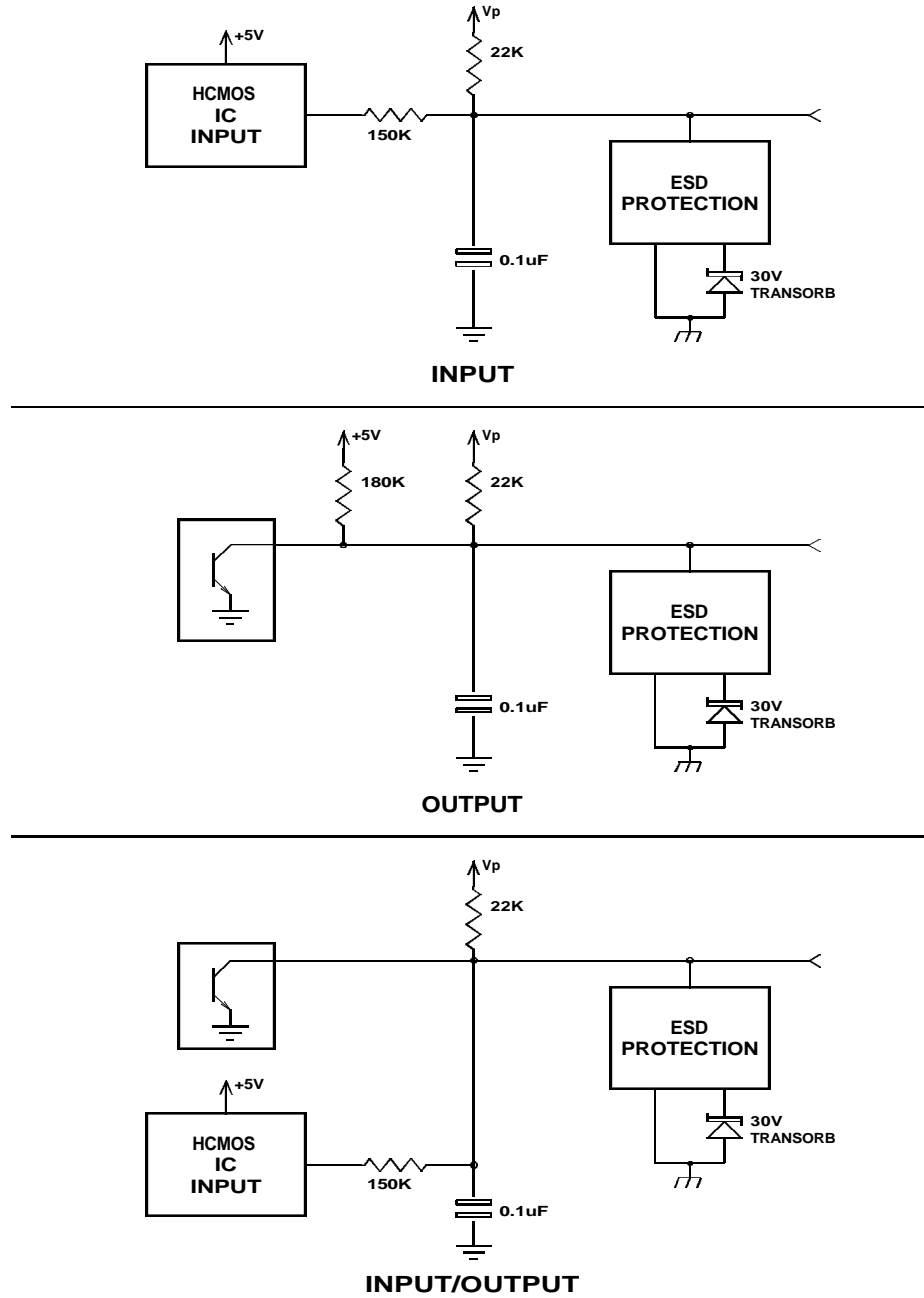
2. Specifications

Size	5.5" x 4.2" x 1.5" (140 x 107 x 38 mm)
Weight	16 oz (455 gm)
Temperature	0 - 50 °C
Humidity	10 - 95% non-condensing
Module Power	10 - 32 Vdc / 2 Watts max.
Number of Receivers Supported	8 (Link Fail feature disabled) 7 (Link Fail feature enabled)
Open Circuit Voltage (all I/O pins) jumper E1B removed jumper E1B installed	+13.8 Vdc nominal +5 Vdc nominal
Inputs per Receiver active low, pull-up to +5 or +13.8 Vdc	Force Vote, Disable
Input Voltage (Input and In/Out pins)	-0.6 to 30 Vdc (max)
Input Current (Input and In/Out pins): jumper E1B removed (Vin = 0 Vdc) jumper E1B installed (Vin = 0 Vdc)	-720 µA max (source) -270 µA max (source)
Outputs per Receiver (active low)	Vote, Receive, Disable, Fail
Output Saturation Voltage (Outputs and In/Out pins) with Iout = 100 mA	550 mV
Output Pin Current (Outputs and In/Out pins)	150 mA max per individual pin (sink) 100 mA max per pin if all outputs are ON.
Maximum Power Dissipation	2 Watts
Input/Output Connection	50 pin Telco style
Network Connector	(2) RJ-45 (1 in, 1 out)
Safety Approvals	UL 1950 CSA 1950 EN 60950-1992
Emissions Compliance	FCC Part 15, Class A DOC Class A EN55022
Susceptibility Compliance	IEC 801-2 IEC 801-3 IEC 801-4 EN50082-1

Table 1 - Module Specifications

Figure 2 shows the equivalent circuits of the IIB I/O pins. The pull-up voltage V_p by jumper E1B, located on the rear of the module.

- $V_p = 13.8$ Vdc with jumper E1B out
- $V_p = 5.0$ Vdc with jumper E1B in



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Figure 2 - I/O Equivalent Circuit

3. Theory of Operation

This section describes the operation of the IIB module in an MCN comparator display system.

3.1 Comparator Status

The Comparator I/O Module (such as an AIB or CIB) accepts the VOTE, RECEIVE, DISABLE, and FAIL receiver status indicators from the comparator. It sends status messages to the IIB module. The IIB module controls the VOTE, RECEIVE, DISABLE, and FAIL parallel lines of the operator interface (such as a console).

3.2 Controlling the Comparator

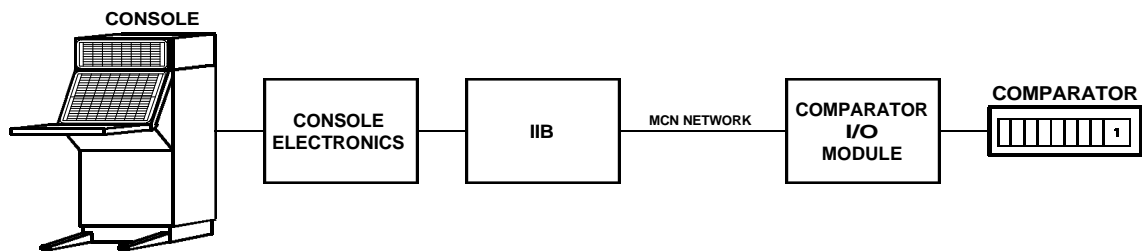
The IIB module monitors the VOTE and DISABLE lines from the console. When the console activates a VOTE or DISABLE line, the IIB module will send a FORCE VOTE or DISABLE command to the comparator. The Comparator I/O Module will then generate the proper FORCE VOTE or DISABLE/ENABLE signal to control the comparator.

3.3 Associating an IIB with a Comparator I/O Module

When an IIB is installed into a system, you need to configure the IIB with the address of the Comparator I/O Module it will be operating with. Section 6.1 describes how to enter this extra address. By having the address of the Comparator I/O Module, the IIB knows how to route its control messages for FORCE VOTE and DISABLE over the MCN network.

3.4 System Example

Figure 3 shows an example comparator display system using the IIB module with a console for the operator station.



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Figure 3 - IIB System Example

When the comparator detects that a receiver is active, it sends a RECEIVE command followed by a VOTE command (if that receiver becomes voted). The Comparator I/O Module processes these commands and sends them to the IIB. The IIB then activates the VOTE and RX outputs for that receiver.

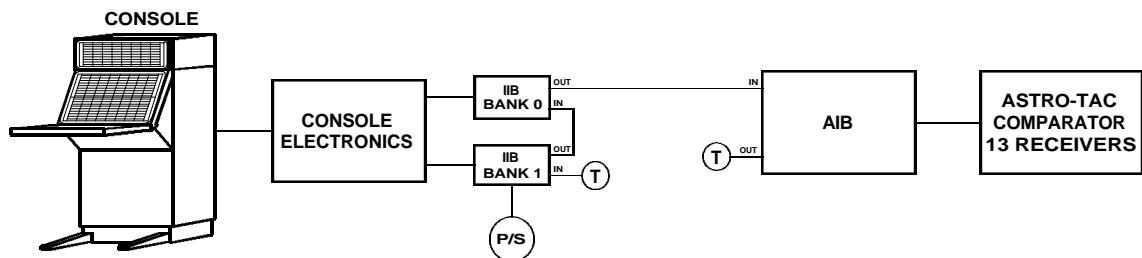
If the comparator detects that a receiver has failed, it sends a FAIL command to the Comparator I/O Module. Again, the Comparator I/O Module sends this FAIL command to the IIB so that the user can see that the receiver has failed.

From the console, the user can generate FORCE VOTE or DISABLE commands for each receiver in the system. The IIB detects these active signals and sends them to the Comparator I/O Module, which then controls the comparator.

3.5 Receiver Banks

The IIB module is designed to operate with a maximum of 8 receivers. This group of 8 receivers is called a **bank**. If the Comparator I/O Module supports more than 8 receivers (more than 1 bank of receivers), then multiple IIBs are required to monitor and control these additional banks. Section 4 describes how the IIB is configured to select the bank of receivers being monitored.

For example, the system shown in Figure 4 shows an ASTRO-TAC[™] Comparator that supports a total of 13 receivers. The AIB Comparator I/O Module separates the 13 receivers into two banks of 8 receivers.



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Figure 4 - Multiple IIB System Example

Two IIBs provide support for the 13 receivers of the ASTRO-TAC[™] Comparator. The AIB module divides the 13 receivers into bank 0 (receivers 1 through 8) and bank 1 (receivers 9 through 13). Each IIB has to be configured to operate with one of the banks of the AIB. The first IIB would be configured to operate with bank 0 of the AIB. The other IIB would be configured to operate bank 1 of the AIB. This configuration is done using the option switches on the front of the IIB. Refer to section 4 for details. With this configuration, the console will be able to monitor and control receivers 1 through 13 of the comparator. The Link Fail feature of the second IIB (configured for bank 1) can be enabled to monitor the status of the AIB to ASTRO-TAC[™] Comparator communication link as well as the MCN network communications link. Refer to section 7.1. Because the second IIB only monitors and controls receivers 9 through 13 (a total of 5 receivers) of the ASTRO-TAC[™] Comparator, its highest receiver is unused and therefore available to display Link Fail status.

3.6 Parallel I/O Signals

The IIB provides two input/output lines per receiver (VOTE and DISABLE) that allow both monitoring and control of the signal. Two output only lines per receiver (FAIL and RECEIVE) are also provided. None of these I/O lines are latched in the IIB. In the console, the VOTE switch or button should be momentary, and the DISABLE switch or button should be latched.

Because the VOTE and DISABLE lines are input/output lines, when the VOTE or DISABLE input is driven by the console, any device tied to that line will also be driven (an LED for example).

3.7 Bi-directional Lines

Because the console VOTE and DISABLE lines are bi-directional, the console's LEDs will be lit if the console outputs are active. Because of this, the console could still indicate a DISABLE or VOTE on a receiver even if there is a problem in the network cabling or the Comparator I/O Module.

This is one reason for using the Link Failure Reporting of the IIB (see section 7.1, *Link Failure Reporting*). Using this feature, the operator can be warned when the comparator is not communicating with the Comparator I/O Module (provided the Comparator I/O Module supports Link Fail reporting) or when the IIB is not communicating with the Comparator I/O Module.

3.8 Example Connections to a Console

Figure 5 shows how an IIB may be connected to a console. Notice that the VOTE and DISABLE lines between the IIB and the console are bi-directional.

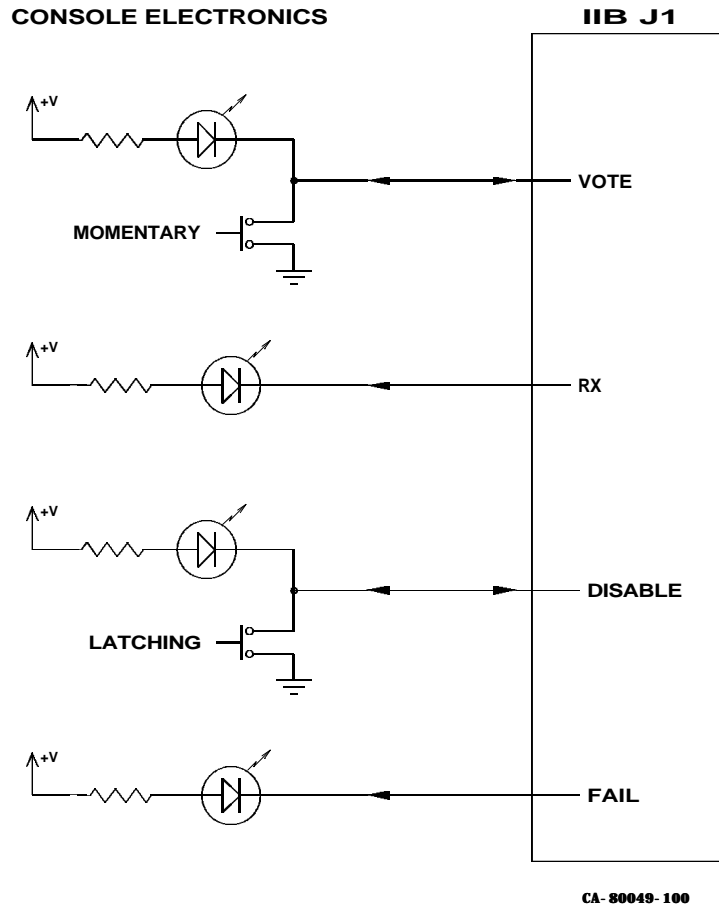


Figure 5 - IIB Connections to a Console

4. Option Switches

Three sets of option switches are provided for module configuration. The module must be power cycled or reset after these switches are set so that the options will take effect. Table 2 describes the option switches and shows the factory defaults.

SWITCH	DESCRIPTION	DEFAULT
GROUP	unit address setting refer to the MCN System Manual	00
MODULE	unit address setting refer to the MCN System Manual	0
OPTION position 1	receiver bank selector 1 (see Table 3)	DOWN
position 2	receiver bank selector 2 (see Table 3)	DOWN
position 3	receiver bank selector 3 (see Table 3)	DOWN
position 4	unit address selector	DOWN

Table 2 - IIB Option Switches

The Group and Module selector switches are used to set the unit address during module installation.

The unit address selector switch (OPTION switch position 4) is only used at installation time. Refer to section 6, *Special Installation Instructions*, for a description of this switch. For normal operation, this switch must be in the DOWN position.

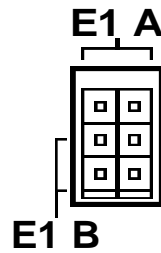
An IIB can monitor 8 receivers when the Link Fail feature is disabled or 7 receivers when the Link Fail feature is enabled (one receiver bank). Option switches 1 through 3 allow the IIB to monitor any receiver bank supported by the Comparator I/O Module. The settings for these switches is shown in Table 3. If the Link Fail feature is enabled, the last receiver on an IIB is unusable. The IIB will not provide monitoring and control functions for that receiver.

Bank	Option Switch Position			Receiver Numbers
	1	2	3	
0	DOWN	DOWN	DOWN	1 through 8
1	UP	DOWN	DOWN	9 through 16
2	DOWN	UP	DOWN	17 through 24
3	UP	UP	DOWN	25 through 32
4	DOWN	DOWN	UP	33 through 40
5	UP	DOWN	UP	41 through 48
6	DOWN	UP	UP	49 through 56
7	UP	UP	UP	57 through 64

Table 3 - Receiver Bank Selectors

When the IIB is used with a Comparator I/O Module that supports only 8 receivers, such as a CIB, bank 0 will always be used.

Figure 6 shows the configuration of the two jumper options available on the rear of the IIB. These jumpers should be installed at system installation time with power removed from the IIB.



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Figure 6 - Jumper Options

Jumper E1A is located across the top 2 terminals of the 6 pin terminal block. This jumper must normally be installed. It is only removed for factory test.

Jumper E1B is located across the left side middle and bottom terminals of the 6 pin terminal block. Set this jumper to match the needs of your operator interface station.

The remaining 2 terminals of the block are unused.

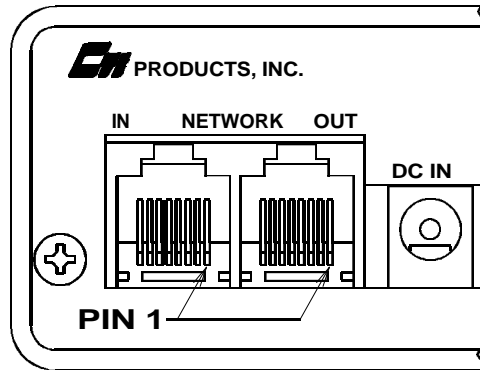
Jumper	Function	Default
E1A	In to enable output RX 7. Out to disable output RX 7.	IN
E1B Vp Set	In for inputs pulled up to +5 Vdc. Out for inputs pulled up to +13.8 Vdc.	OUT

Figure 7 - Jumper Options Description

Because most installations require the pullup voltage to be +13.8 Vdc, no jumper is provided with the unit for the E1B jumper terminals. If you have an application that requires the pullup voltage to be set to +5 Vdc, you can order an additional jumper by calling CTI Products Inc. and ordering part number 27-10351.

5. Connectors

The **NETWORK IN/OUT** ports on the front of the IIB are used to connect the IIB with other MCN modules. These ports carry both the network data signals as well as DC power for power distribution with other modules. . Table 4 gives the pinout for these connectors. Figure 8 shows the location of pin 1 for each port.



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Figure 8 - Network IN/OUT Ports

Pin	Function
1	DATA +
2	DATA -
3	+ POWER
4	No Connect
5	No Connect
6	- POWER
7	- POWER
8	+ POWER

Table 4 - Network Connector Pinout

The **DC IN** port provides the primary power connection to the module. Power is distributed through the **NETWORK OUT** connector to provide power to the **NETWORK IN** connector of the MCN unit it is connected to. Each power supply can power up to four units total. See reference 1 for complete details of connections to the network and DC IN connectors.

Connector J1 provides the discrete I/O for the user interface signals. Table 5 gives the pinout for this connector. Figure 9 describes the functions of the I/O signals. All inputs and outputs are active low.

Signal	Direction	Description
VOTE	Input/Output	Output activated when comparator votes that receiver. Ground input to force vote a receiver.
RX	Output	Activated when comparator detects a valid signal on the receiver.
DIS	Input/Output	Output activated when receiver is disabled by comparator. Ground input to disable the receiver.
FAIL	Output	Activated when receiver failure is detected by the comparator.

Figure 9 - I/O signal descriptions

IIB J1	Function	Direction	Wire Color
21	Vote 1	Input/Output	Blu/Vio
19	Rx 1	Output	Brn/Yel
20	Dis 1	Input/Output	SlT/Yel
23	Fail 1	Output	Grn/Vio
46	Vote 2	Input/Output	Vio/Blu
44	Rx 2	Output	Yel/Brn
45	Dis 2	Input/Output	Yel/SlT
48	Fail 2	Output	Vio/Grn
15	Vote 3	Input/Output	SlT/Blk
12	Rx 3	Output	Org/Blk
14	Dis 3	Input/Output	Brn/Blk
17	Fail 3	Output	Org/Yel
40	Vote 4	Input/Output	Blk/SlT
37	Rx 4	Output	Blk/Org
39	Dis 4	Input/Output	Blk/Brn
42	Fail 4	Output	Yel/Org
9	Vote 5	Input/Output	Brn/Red
6	Rx 5	Output	Blu/Red
8	Dis 5	Input/Output	Grn/Red
11	Fail 5	Output	Blu/Blk
34	Vote 6	Input/Output	Red/Brn
31	Rx 6	Output	Red/Blu
33	Dis 6	Input/Output	Red/Grn
36	Fail 6	Output	Blk/Blu
3	Vote 7	Input/Output	Grn/Wht
18	Rx 7	Output	Grn/Yel
2	Dis 7	Input/Output	Org/Wht
5	Fail 7	Output	SlT/Wht
28	Vote 8	Input/Output	Wht/Grn
26	Rx 8	Output	Wht/Blu
27	Dis 8	Input/Output	Wht/Org
30	Fail 8 / Link Fail	Output	Wht/SlT
4	Link Fail Enable	Input	Brn/Wht
1	Ground		Blu/Wht
10	unused	Input	SlT/Red
16	unused	Input	Blu/Yel
22	unused	Input	Org/Vio
29	unused	Input	Wht/Brn
35	unused	Input	Red/SlT
41	unused	Input	Yel/Blu
47	unused	Input	Vio/Org
7	unused	No Connect	Org/Red
13	unused	No Connect	Grn/Blk
24	unused	No Connect	Brn/Vio
25	unused	No Connect	SlT/Vio
32	unused	No Connect	Red/Org
38	unused	No Connect	Blk/Grn
43	unused	No Connect	Yel/Grn
49	unused	No Connect	Vio/Brn
50	unused	No Connect	Vio/SlT

Table 5 - IIB Connector J1 Pinout in 'Logic' Order

IIB J1	Function	Direction	Wire Color
26	Rx 8	Output	Wht/Blu
1	Ground		Blu/Wht
27	Dis 8	Input/Output	Wht/Org
2	Dis 7	Input/Output	Org/Wht
28	Vote 8	Input/Output	Wht/Grn
3	Vote 7	Input/Output	Grn/Wht
29	unused	Input	Wht/Brn
4	Link Fail Enable	Input	Brn/Wht
30	Fail 8 / Link Fail	Output	Wht/Slt
5	Fail 7	Output	Slt/Wht
31	Rx 6	Output	Red/Blu
6	Rx 5	Output	Blu/Red
32	unused	No Connect	Red/Org
7	unused	No Connect	Org/Red
33	Dis 6	Input/Output	Red/Grn
8	Dis 5	Input/Output	Grn/Red
34	Vote 6	Input/Output	Red/Brn
9	Vote 5	Input/Output	Brn/Red
35	unused	Input	Red/Slt
10	unused	Input	Slt/Red
36	Fail 6	Output	Blk/Blu
11	Fail 5	Output	Blu/Blk
37	Rx 4	Output	Blk/Org
12	Rx 3	Output	Org/Blk
38	unused	No Connect	Blk/Grn
13	unused	No Connect	Grn/Blk
39	Dis 4	Input/Output	Blk/Brn
14	Dis 3	Input/Output	Brn/Blk
40	Vote 4	Input/Output	Blk/Slt
15	Vote 3	Input/Output	Slt/Blk
41	unused	Input	Yel/Blu
16	unused	Input	Blu/Yel
42	Fail 4	Output	Yel/Org
17	Fail 3	Output	Org/Yel
43	unused	No Connect	Yel/Grn
18	Rx 7	Output	Grn/Yel
44	Rx 2	Output	Yel/Brn
19	Rx 1	Output	Brn/Yel
45	Dis 2	Input/Output	Yel/Slt
20	Dis 1	Input/Output	Slt/Yel
46	Vote 2	Input/Output	Vio/Blu
21	Vote 1	Input/Output	Blu/Vio
47	unused	Input	Vio/Org
22	unused	Input	Org/Vio
48	Fail 2	Output	Vio/Grn
23	Fail 1	Output	Grn/Vio
49	unused	No Connect	Vio/Brn
24	unused	No Connect	Brn/Vio
50	unused	No Connect	Vio/Slt
25	unused	No Connect	Slt/Vio

Table 6 - IIB Connector J1 Pinout in 'Punch Block' Order

6. Special Installation Instructions

6.1 Unit Address Setting

An IIB must be programmed with two unit addresses:

1. the address of the Comparator I/O Module it will operate with
2. the IIB's own address

You only need to perform this programming once, at installation time. These addresses are stored in non-volatile memory so the only reason that you would have to repeat this step is if you changed the unit address of the Comparator I/O Module or if you replaced the IIB module.

Before programming the address information into the IIB, determine the unit addresses of all the MCN modules in the system, following the guidelines in the *Address Planning* planning section of the Monitoring and Control Network System Manual (reference 1).

Valid ranges for the Group and Module switches are:

- Group number = 00 through FE
- Module number = 0 through F

The steps for programming the unit address of the Comparator I/O Module are:

Step	Action
1	Determine the unit addresses of all the MCN modules in the system.
2	Apply power to the IIB.
3	Place OPTION switch 4 in the UP position.
4	Set the Group and Module switches to the unit address of the Comparator I/O Module (from step 1) that this IIB will operate with.
5	Press the RESET button on the IIB.
6	The ERR LED will turn on and remain on.
7	Place OPTION switch 4 in the DOWN position.
8	Set the Group and Module switches to the unit address of this IIB (its own address from step 1).
9	Press the RESET button on the IIB.
10	The ERR LED will turn on momentarily and then turn off.

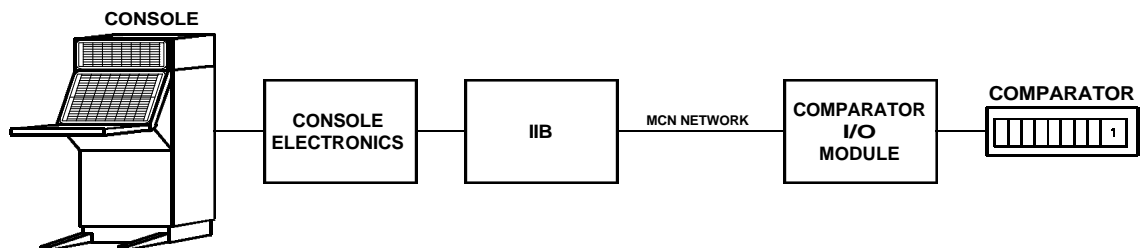
After you complete these steps, connect the IIB to the Comparator I/O Module. Apply power to the Comparator I/O Module and within approximately three seconds, the ACT LED of the IIB should turn on and the ACT LED of the Comparator I/O Module should turn on or blink. If the ACT LEDs turn on, the IIB has been correctly programmed with the unit address of the Comparator I/O Module. If the ACT LEDs remain off, verify your unit switch settings and repeat

the unit address programming steps.

For example, Figure 10 shows a system with a single IIB and Comparator I/O Module. The following steps show how the system might be setup, using the following address assignments:

- IIB address is Group 80, Module 0
- Comparator I/O Module is Group 00, Module 0

Step	Action
1	Connect the network cable between the IIB NETWORK OUT port and the Comparator I/O Module's NETWORK IN port.
2	Power on both the Comparator I/O Module and the IIB.
3	On the Comparator I/O Module, set the Group switch to 00 and the Module switch to 0.
4	Reset the Comparator I/O Module.
5	On the IIB, place OPTION switch 4 in the UP position.
6	On the IIB, set the Group switch to 00 and the Module switch to 0. This is the address of the Comparator I/O Module it will work with.
7	On the IIB, set the receiver bank selector switches.
7	Press the RESET button on the IIB.
8	The IIB's ERR LED will turn on and remain on.
9	On the IIB, place OPTION switch 4 in the DOWN position.
10	On the IIB, set the Group switch to 80 and the Module switch to 0. This is the IIB's own address.
11	Press the RESET button on the IIB.
12	The ERR LED will turn on momentarily and then turn off.
13	After a couple of seconds, the ACT LED on the IIB should turn ON and the ACT LED of the Comparator I/O Module should turn ON or begin blinking.
	If this does not occur, repeat the process or consult the troubleshooting guide in section 10.



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Figure 10 - Unit Address Programming Example

7. Special Features

7.1 Link Failure Reporting

The IIB has a selectable option to show communication link failures between the IIB and its Comparator I/O Module (network link failures) or between the Comparator I/O Module and the comparator (comparator link failures). With this option enabled, the IIB will always report network link failures. Comparator link failures will only be reported if the Comparator I/O Module implements Link Failure Reporting. Refer to the hardware reference manual of the Comparator I/O Module being used to see if it supports this feature (for example, Link Failure Reporting is supported in the AIB module, but not in the CIB module).

This option is enabled by grounding connector J1 pin 4, the **Link Fail Enable** input, and then resetting the IIB. When this input is grounded, the IIB no longer provides monitor and control of its receiver 8 I/O lines (J1 pins 26, 27, 28 and 30). Instead, the **Link Fail** output (connector J1 pin 30) is used to show the status of communication links. If this output is HIGH, all communications are OK between the IIB and its Comparator I/O Module and between the Comparator I/O Module and the comparator. If either of these communication links break (a cable is disconnected or a module is turned off), then this output will be driven LOW by the IIB to indicate the link failure.

8. Mounting

Refer the reference 1, section *Mounting Options*, for details about mounting the IIB module.

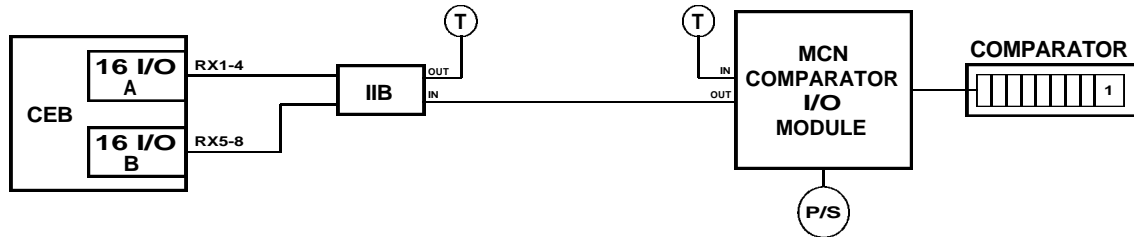
CAUTION

Make sure that any mounting screws used to secure unit to a bracket do not protrude into the unit's enclosure more than 1/8 inches from the bottom surface of the unit.

Using a larger screw that touches the pc board inside the unit may damage the unit when it is powered. Doing so will void the unit's warranty.

9. Connecting an IIB to a CEB

The following example shows how you would connect an IIB to Motorola's CEB (Central Electronics Bank) in a comparator display system. Figure 11 shows what this system looks like.



CA-80029-100

Figure 11 - IIB / CEB Connection Example

The IIB connects to the CEB through two 16 I/O cards (cards A and B). Each 16 I/O card can handle only 4 receivers. The CEB must be configured so that the 16 I/O cards operate as comparator display boards. Table 7 shows the cross connections needed between the IIB and the 16 I/O cards. Once these connections are made, you need to install jumper JU6 through JU33 on each 16 I/O card.

IIB J1	Function	Connect to 16 I/O Bd (A or B) - Pin
21	Vote 1	A - 26
19	Rx 1	A - 27
20	Dis 1	A - 28
23	Fail 1	A - 29
46	Vote 2	A - 30
44	Rx 2	A - 31
45	Dis 2	A - 32
48	Fail 2	A - 33
15	Vote 3	A - 34
12	Rx 3	A - 35
14	Dis 3	A - 36
17	Fail 3	A - 37
40	Vote 4	A - 38
37	Rx 4	A - 39
39	Dis 4	A - 40
42	Fail 4	A - 41
9	Vote 5	B - 26
6	Rx 5	B - 27
8	Dis 5	B - 28
11	Fail 5	B - 29
34	Vote 6	B - 30
31	Rx 6	B - 31
33	Dis 6	B - 32
36	Fail 6	B - 33
3	Vote 7	B - 34
18	Rx 7	B - 35
2	Dis 7	B - 36
5	Fail 7	B - 37
28	Vote 8	B - 38 *
26	Rx 8	B - 39 *
27	Dis 8	B - 40 *
30	Fail 8 / Link Fail	B - 41 *
4	Link Fail Enable	tie to IIB J1 pin 1 to enable the Link Fail feature
1	Ground	A & B 1 through 16

Table 7 - IIB to CEB Connections

* Signals for receiver 8 are active only if the Link Fail Enable (J1 pin 4) is open (Link Fail feature is disabled). If J1 pin 4 is grounded, J1 pin 30 becomes a Link Fail output and J1 pins 26, 27 and 28 become unused pins.

10. Troubleshooting

This table is a list of troubleshooting tips specific to the IIB module. For additional troubleshooting tips, refer to the troubleshooting section found in the *Monitoring and Control Network System Manual*, reference 1.

Due to the high percentage of surface-mount components the IIB is treated as a field replaceable unit. If any system problems are the result of a malfunctioning IIB unit, the entire unit must be replaced and returned for repair.

PROBLEM	CAUSE
ERR LED is ON	<p>Verify that the module's Group and Module numbers are valid.</p> <p>Reprogram the unit address of the Comparator I/O Module that the IIB is connected to. Also, verify that this is a valid unit address. Refer to section 6.1 for a description of this procedure.</p> <p>Verify that option switch 4 is in the DOWN position.</p>
Receiver 8 is not working properly	<p>Verify that the Link Fail Enable pin (J1, pin 4) is not tied to ground when the module is reset.</p>
Link Failure Reporting is not working properly	<p>Verify that the Link Fail Enable pin (J1, pin 4) is tied to ground when the module is reset.</p> <p>If comparator link failures are not being reported, verify that the Comparator I/O Module supports the Link Fail reporting feature.</p>
Link Fail Enable (J1 pin 4) is grounded and the Link Fail output (J1 pin 30) is active.	<p>Verify that the network cable between the IIB and the Comparator I/O module is properly connected and that both modules are communicating (their ACT LEDs are on).</p> <p>Verify that the cable between the Comparator I/O Module and the comparator is properly installed and that the Comparator I/O Module is communicating with the comparator (refer to the troubleshooting section of the Comparator I/O Module).</p>