NOTE: This module must be configured before being installed in your system. Refer to section 4 for information about the module configuration.
FCC Statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Warning: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.

DOC Statement

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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)
1. INTRODUCTION

1.1 REFERENCE DOCUMENTS

2. THEORY OF OPERATION

2.1 COMPARATOR STATUS
2.2 CONTROLLING THE COMPARATOR
2.3 LOSS OF COMMUNICATIONS
2.4 SYSTEM EXAMPLE

3. SPECIFICATIONS

4. OPTION SWITCHES

5. CONNECTORS

6. MOUNTING

7. SETTING GROUP/MODULE SWITCHES

8. SPECIAL FEATURES

8.1 LINK FAILURE REPORTING

9. TROUBLESHOOTING
1. **Introduction**

The ASTRO-TAC™ Comparator Interface Module (AIB) is a member of the Monitoring and Control Network (MCN™) family of Comparator I/O Modules. Hardware specifications, special installation, and configuration information are described in this manual.

The AIB module connects a Motorola ASTRO-TAC™ (VSELP signaling) or ASTRO-TAC™ 3000 (APCO Project 25 IMBE signaling) Comparator to the MCN network. An AIB is used with an MCN User Interface Module, Motorola’s ASTRO-TAC™ or ASTRO-TAC™ 3000 Comparator and a user interface device, such as a console or PC, to create a comparator display system. The comparator display system provides monitoring and control functions for your communications system. Receiver states monitored by the AIB include VOTE, RECEIVE, DISABLE and FAIL. Receiver functions that can be controlled include FORCE VOTE and DISABLE.

![AIB Front and Rear View](image-url)

Figure 1 - AIB Front and Rear View

This manual applies only to AIB modules with model number S2-60331-nnn, where ‘nnn’ is the number 110 or greater (this is the module’s version number). This model number can be found on the rear panel of the module.

If the module’s version number is greater than 110, there may be additional features supported by the module that are not covered in this manual. Refer to the AIB module backward compatibility cross reference sheet supplied with this manual to find out if the module has features not discussed in this manual.

New features added to version 110 include the following:

- support for the ASTRO-TAC™ 3000

For the remainder of this manual, all references to the ASTRO-TAC™ Comparator include the ASTRO-TAC™ 3000 as well, unless stated otherwise.

1.1 **Reference Documents**

1. Monitoring and Control Network Comparator Display System Manual  
   Part Number S2-60425
2. **Theory of Operation**

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

The AIB module must be configured for the comparator it is operating with, either an ASTRO-TAC™ or an ASTRO-TAC™ 3000 Comparator. Section 4 describes the ASTRO-TAC™ select option switch used for this configuration.

When used with an ASTRO-TAC™ 3000 Comparator, the AIB provides monitoring and control for up to 64 receivers. The AIB divides the receivers into eight **banks** for compatibility with the MCN network. The defined receiver banks are:

- bank 0 supports receivers 1 through 8
- bank 1 supports receivers 9 through 16
- bank 2 supports receivers 17 through 24
- bank 3 supports receivers 25 through 32
- bank 4 supports receivers 33 through 40
- bank 5 supports receivers 41 through 48
- bank 6 supports receivers 49 through 56
- bank 7 supports receivers 57 through 64

When used with an ASTRO-TAC™ Comparator, the AIB provides monitoring and control for up to 13 receivers, dividing the receivers into two banks (banks 0 and 1).

When installing a system, make sure that the User Interface Module is configured for the correct bank for the receivers being monitored and controlled by the User Interface Module. Refer to the hardware reference manual of the User Interface Module for details about bank configuration.

2.1 **Comparator Status**

The AIB accepts VOTE, RECEIVE, DISABLE, and FAIL receiver status messages from the ASTRO-TAC™ Comparator and sends them to a User Interface Module over the MCN network. User Interface Modules, such as the IIB (I/O Interface Module) or HIB (Host Computer Interface Module) then display the comparator status information on a console or PC.

2.2 **Controlling the Comparator**

When a User Interface Module sends FORCE VOTE or DISABLE commands, the AIB translates the commands for the ASTRO-TAC™ Comparator and sends them to the comparator.
The AIB updates the ASTRO-TAC™ Comparator with the latest control information every second and whenever a FORCE VOTE or DISABLE command is received from a User Interface Module.

2.3 Loss of Communications
In the unlikely event that the MCN network link between the AIB and all of its User Interface Modules is broken (the AIB is no longer communicating with any User Interface Module, therefore its ACT LED will turn off), the AIB will send a message to the ASTRO-TAC™ Comparator clearing any active FORCE VOTES.

Active DISABLE inputs from the User Interface Module(s) are not changed if MCN network communications is lost.
2.4 System Example

Figure 2 shows an example comparator display system using the AIB module and ASTRO-TACTM Comparator.

![Diagram of AIB System Example]

**Figure 2 - AIB System Example**

When the ASTRO-TACTM Comparator detects that a receiver is active, it sends a RECEIVE command followed by a VOTE command (if that receiver becomes voted). The AIB processes these commands and sends them to the User Interface Module. The User Interface Module then indicates that the receiver is active and voted. If the User Interface Module is an IIB, the IIB activates the VOTE and RX outputs for that receiver’s status display.

If the comparator detects that a receiver has failed, then it will send a FAIL command to the AIB. Again, the AIB sends this FAIL command to the User Interface Module so that the user can see that the receiver has failed.

One issue to note, however, is that if Motorola’s RSS (Radio Service Software) is used to disable a receiver, the comparator does not send the DISABLE information to the AIB. The MCN comparator display system will not show that receiver as being disabled, even though it truly is disabled in the comparator.

From the operator station, the user can generate FORCE VOTE or DISABLE commands for each receiver in the system. The User Interface Module detects these commands and sends them to the AIB. The AIB then sends a command to the ASTRO-TACTM Comparator, telling it which receivers were force voted or disabled.

In this example, if the User Interface Module is an IIB, the IIB has to be configured for bank 0 to operate with receivers 1 through 8 of the ASTRO-TACTM Comparator or configured for bank 1 to operate with receiver 9 through 13. If the User Interface Module is a HIB with the MCN Remote Comparator Display software running on a PC, only bank 0 (receivers 1 through 8) can be monitored and controlled. Refer to the hardware reference manual of the User Interface Module for details about bank configuration.
3. Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>5.5” x 4.2” x 1.5” (140 x 107 x 38 mm)</td>
</tr>
<tr>
<td>Weight</td>
<td>16 oz (455 gm)</td>
</tr>
<tr>
<td>Temperature</td>
<td>0 - 50 ºC</td>
</tr>
<tr>
<td>Humidity</td>
<td>10 - 95% non-condensing</td>
</tr>
<tr>
<td>Module Power</td>
<td>10 - 32 Vdc / 2 Watts max.</td>
</tr>
</tbody>
</table>
| Number of Receivers Supported | 13 when configured for ASTRO-TAC™ mode  
                             | 64 when configured for ASTRO-TAC™ 3000 mode                          |
| Comparator Connector       | 9 pin D-SUB, female                                                   |
| 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                                                                |
| ASTRO-TAC™ Comparator      | 1.7 or later                                                          |
| Firmware Version           |                                                                      |
| ASTRO-TAC™ 3000 Comparator| Any version is compatible with the AIB module.                        |

Table 1 - Module Specifications
4. Option Switches

Five 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.

<table>
<thead>
<tr>
<th>SWITCH</th>
<th>MODULE DESCRIPTION</th>
<th>DEFAULT</th>
</tr>
</thead>
<tbody>
<tr>
<td>GROUP</td>
<td>unit address setting (refer to the MCN System Manual)</td>
<td>00</td>
</tr>
<tr>
<td>MODULE</td>
<td>unit address setting (refer to the MCN System Manual)</td>
<td>0</td>
</tr>
<tr>
<td>OPTION A</td>
<td>position 1 not used</td>
<td>UP</td>
</tr>
<tr>
<td></td>
<td>position 2 not used</td>
<td>UP</td>
</tr>
<tr>
<td></td>
<td>position 3 not used</td>
<td>UP</td>
</tr>
<tr>
<td></td>
<td>position 4 not used</td>
<td>UP</td>
</tr>
<tr>
<td></td>
<td>position 5 not used</td>
<td>UP</td>
</tr>
<tr>
<td></td>
<td>position 6 not used</td>
<td>UP</td>
</tr>
<tr>
<td></td>
<td>position 7 not used</td>
<td>UP</td>
</tr>
<tr>
<td></td>
<td>position 8 ASTRO-TAC™ select</td>
<td>DOWN</td>
</tr>
<tr>
<td>OPTION B</td>
<td>position 1 not used</td>
<td>UP</td>
</tr>
<tr>
<td></td>
<td>position 2 not used</td>
<td>UP</td>
</tr>
<tr>
<td></td>
<td>position 3 synchronous clock selection, see Table 4</td>
<td>UP</td>
</tr>
<tr>
<td></td>
<td>position 4 synchronous clock selection, see Table 5</td>
<td>UP</td>
</tr>
<tr>
<td>SER MODE</td>
<td>position 1 synchronous clock selection, see Table 4</td>
<td>DOWN</td>
</tr>
<tr>
<td></td>
<td>position 2 synchronous clock selection, see Table 5</td>
<td>DOWN</td>
</tr>
</tbody>
</table>

Table 2 - AIB Option Switches

Table 3 shows the setting for the ASTRO-TAC™ select switch. This switch configures the AIB to operate with either the ASTRO-TAC™ comparator (supporting up to 13 receivers) or the ASTRO-TAC™ 3000 comparator (supporting up to 64 receivers). If this switch is not set properly, the AIB will not communicate with the comparator.

<table>
<thead>
<tr>
<th>Comparator Type</th>
<th>Option A Switch position 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTRO-TAC™ 3000</td>
<td>DOWN</td>
</tr>
<tr>
<td>ASTRO-TAC™</td>
<td>UP</td>
</tr>
</tbody>
</table>

Table 3 - ASTRO-TAC Select Switch

Table 4 and Table 5 show the configurations for the synchronous clock selection switches found on the rear of the module. The default positions (internal TX...
Clock and RX Clock) are used for direct connection between the AIB and ASTRO-TAC™ Comparator.

<table>
<thead>
<tr>
<th>TX Clock Source</th>
<th>SER MODE position 1</th>
<th>OPTION B position 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal (default)</td>
<td>DOWN</td>
<td>UP</td>
</tr>
<tr>
<td>External</td>
<td>UP</td>
<td>DOWN</td>
</tr>
</tbody>
</table>

**Table 4 - Transmit Clock Selection**

<table>
<thead>
<tr>
<th>RX Clock Source</th>
<th>SER MODE position 2</th>
<th>OPTION B position 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal (default)</td>
<td>DOWN</td>
<td>UP</td>
</tr>
<tr>
<td>External</td>
<td>UP</td>
<td>DOWN</td>
</tr>
</tbody>
</table>

**Table 5 - Receive Clock Selection**
5. Connectors

The NETWORK IN/OUT ports on the front of the AIB are used to connect the AIB with other MCN modules. These ports carry both the network data signals and the DC power for power distribution with other modules. Table 6 gives the pinout for these connectors. Figure 3 shows the location of pin 1 for each port.

![Network IN/OUT Ports Diagram](image_url)

#### Table 6 - Network Connector Pinout

<table>
<thead>
<tr>
<th>Pin</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DATA +</td>
</tr>
<tr>
<td>2</td>
<td>DATA -</td>
</tr>
<tr>
<td>3</td>
<td>+ POWER</td>
</tr>
<tr>
<td>4</td>
<td>No Connect</td>
</tr>
<tr>
<td>5</td>
<td>No Connect</td>
</tr>
<tr>
<td>6</td>
<td>- POWER</td>
</tr>
<tr>
<td>7</td>
<td>- POWER</td>
</tr>
<tr>
<td>8</td>
<td>+ POWER</td>
</tr>
</tbody>
</table>

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.
**Table 7 - AIB <-> Comparator Communication Cable**

The **HOST** connector (9 pin D-SUB female) on the rear of the AIB is used to connect the module to connector J15 (25 pin D-SUB female) on the back of the ASTRO-TAC™ Comparator. This port is a synchronous RS-232 port operating at 9600 baud. Table 7 gives the pinout of the AIB to ASTRO-TAC™ Comparator communications cable.

This cable is available as an accessory to the AIB. The part number for ordering this cable is S2-60440.
6. **Mounting**

   Please refer to reference 1, *Mounting Options*, for details of mounting the AIB 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.

7. **Setting Group/Module Switches**

   Please refer to the MCN System Manual, reference 1, *Setting the Unit Address*, for details about the Group and Module switches on the AIB module.
8. Special Features
The AIB module was designed with specific features/functions that help make the system easier to use and maintain.

8.1 Link Failure Reporting
During normal operation, the AIB and the ASTRO-TAC™ Comparator communicate by exchanging data and status information. If the communications between the two devices stop (the comparator is turned off or the communications cable is removed), the AIB will generate a special message onto the MCN network, telling all User Interface Modules assigned to that AIB that the comparator communication link has failed.

Some User Interface Modules have the ability to report this link failure. How this link failure is shown depends on the type of User Interface Module being used. Refer to the User Interface Module’s hardware reference manual to find out if it supports this link failure reporting.
9. Troubleshooting

This table is a list of troubleshooting tips specific to the AIB 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 AIB is treated as a field replaceable unit. If any system problems are the result of a malfunctioning AIB unit, the entire unit must be replaced and returned for repair.

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>CAUSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>User Interface Module is not showing a disabled receiver when the</td>
<td>This is normal. If Motorola’s RSS (Radio Service Software) is used to disable a receiver, the ASTRO-TACT™ Comparator does not send that information to the AIB. The MCN comparator display system will not show that receiver as being disabled, even though it truly is disabled in the comparator.</td>
</tr>
<tr>
<td>receiver is disabled at the ASTRO-TACT™ Comparator</td>
<td></td>
</tr>
<tr>
<td>User Interface Module reports a link fail error for the AIB</td>
<td>Verify that the AIB is properly connected to the comparator. Verify that the AIB’s OPTION A, switch 8 is set for the proper comparator type. If not, change the switch and reset the AIB.</td>
</tr>
<tr>
<td>PROBLEM</td>
<td>CAUSE</td>
</tr>
<tr>
<td>---------</td>
<td>-------</td>
</tr>
<tr>
<td>User interface is not showing correct status OR Operator cannot FORCE VOTE or DISABLE the receivers</td>
<td>Verify that the AIB’s OPTION A, switch 8 is set for the proper comparator type. If not, change the switch and reset the AIB. Connect the cable between the AIB and the ASTRO-TAC™ Comparator.</td>
</tr>
<tr>
<td>TX and RX Clocks</td>
<td>Using an oscilloscope or breakout box, verify that a 9600 KHz signal (50% duty cycle) is present on the ASTRO-TAC™ Comparator J15 connector, pins 15 (Tx Clk) and 17 (Rx Clk) (± 3 to ± 12 Vdc swing). If not, verify that the AIB OPTION B switches 3 and 4 are in the UP position and the AIB SER MODE switches 1 and 2 are in the DOWN position. If the switches are correct, verify the continuity of the cable: DE9 pin 9 to DB25 pin 15 DE9 pin 6 to DB25 pin 17 If the cable is ok, the AIB is not functioning properly. Replace the AIB.</td>
</tr>
<tr>
<td>AIB to ASTRO-TAC™ Comparator Data</td>
<td>Verify that every 1 to 5 seconds, a short burst of data occurs on the ASTRO-TAC™ Comparator J15 connector, pin 3, RXD (± 3 to ± 12 Vdc swing). If not, verify the continuity of the cable: DE9 pin 3 to DB25 pin 3 If the wire is ok, the AIB is not functioning properly. Replace the AIB.</td>
</tr>
<tr>
<td>ASTRO-TAC™ Comparator to AIB Data</td>
<td>Verify that at least every few seconds, a short burst of data occurs on the AIB HOST connector, pin 2, RXD (± 3 to ± 12 Vdc swing). If not, verify the continuity of the cable: DE9 pin 2 to DB25 pin 2 If the wire is ok, the ASTRO-TAC™ Comparator is not functioning properly. Repair the ASTRO-TAC™ Comparator.</td>
</tr>
<tr>
<td>Control Signals</td>
<td>Verify that AIB HOST connector pins 4 (DCD) and 7 (CTS) are active (+6 to +12 Vdc). If not, verify the continuity of the cable: DE9 pin 4 to DB25 pin 20 DE9 pin 7 to DB25 pin 4 If the wires are ok, the ASTRO-TAC™ Comparator is not functioning properly. Verify that ASTRO-TAC™ Comparator J115 connector pins 5, 7, 9, and 11 are active (+6 to +12 Vdc). If not, replace the ASTRO-TAC™ Comparator.</td>
</tr>
</tbody>
</table>