MCN Monitoring and Control Network
Comparator Display System

ASTRO-TAC™ Comparator Interface
Module
AIB
Hardware Reference Manual

S2-60399-115

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

CTi Products Inc.

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

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Computer Software Copyrights

CE

Standard Limited Hardware Warranty

LIMITED WARRANTY. Equipment manufactured by CTI Products, Inc. is warranted to be free from defects in material and workmanship for a period of ONE (1) YEAR from date of shipment to original purchaser. Under this warranty, our obligation is limited to repairing or replacing any equipment proved to be defective by our inspection within one year of sale to the original purchaser. This warranty shall not apply to equipment which has been repaired outside our plant in any way, so as to, in the judgment of CTI Products, Inc. affect its stability or reliability, nor which has been operated in a manner exceeding its specifications, nor which has been altered, defaced, or damaged by lightning.

CUSTOMER REMEDIES. In the event of a defect, malfunction, or failure to conform to specifications established by the seller during the period shown, the customer shall call CTI Products, Inc. to obtain a Return Authorization Number and return the product or module, shipping and insurance prepaid. CTI Products, Inc., will then at its option, either repair or replace the product or module and return it, shipping prepaid, or refund the purchase price thereof. On-site labor at the purchaser's location is not included in this warranty.

EQUIPMENT NOT MANUFACTURED BY CTI Products, Inc. Equipment not manufactured by CTI Products, Inc. is excluded from this warranty, but is subject to the warranty provided by its manufacturer, a copy of which will be supplied to you upon specific written request.

NO OTHER WARRANTIES. The foregoing constitutes the sole and exclusive remedy of the buyer and exclusive liability of CTI Products, Inc., AND IS IN LIEU OF ANY AND ALL OTHER WARRANTIES EXPRESSED OR IMPLIED OR STATUTORY AS TO MERCHANTABILITY, FITNESS FOR PURPOSE SOLD, DESCRIPTION, QUALITY, PRODUCTIVENESS OR ANY OTHER MATTER.

NO LIABILITY FOR CONSEQUENTIAL DAMAGES. WITHOUT LIMITING THE FOREGOING, IN NO EVENT SHALL CTI PRODUCTS, INC. OR ITS SUPPLIERS BE LIABLE FOR ANY DAMAGES WHATSOEVER (INCLUDING, WITHOUT LIMITATION, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR FOR LOSS OF BUSINESS PROFITS, BUSINESS INTERRUPTION, LOSS OF BUSINESS INFORMATION, OR OTHER PECUNIARY LOSS) ARISING OUT OF THE USE OF OR INABILITY TO USE CTI PRODUCTS, INC. EQUIPMENT BY PURCHASER OR OTHER THIRD PARTY, WHETHER UNDER THEORY OF CONTRACT, TORT (INCLUDING NEGLIGENCE), INDEMNITY, PRODUCT LIABILITY OR OTHERWISE, EVEN IF CTI PRODUCTS, INC. HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES OR LOSSES. IN NO EVENT SHALL CTI PRODUCTS, INC.'S, LIABILITY EXCEED THE TOTAL AMOUNT PAID BY PURCHASER FOR THE EQUIPMENT GIVING RISE TO SUCH LIABILITY.

CTI Products, Inc.
1211 W. Sharon Rd.
Cincinnati, OH 45240

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

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.
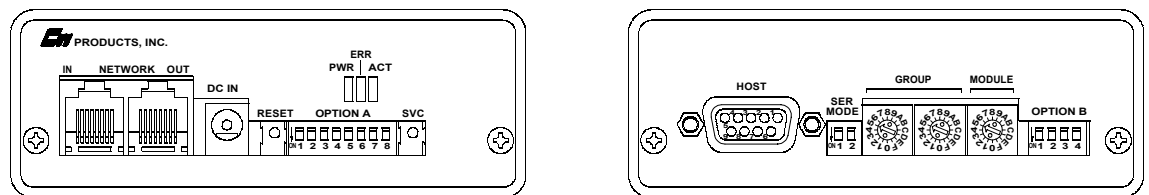
CA-80022-100

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-TAC™ Comparator.
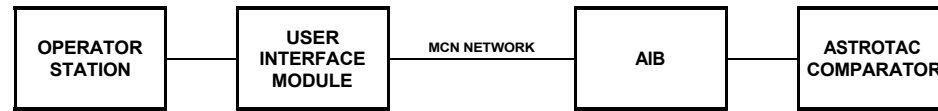
CA-80040-100

Figure 2 - AIB System Example

When the ASTRO-TAC™ 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-TAC™ 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-TAC™ 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

Size	5.5" x 4.2" x 1.5" (140 x 107 x 38 mm)
Weight	16 oz (455 gm)
Temperature	0 - 50 ºC
Humidity	10 - 95% non-condensing
Module Power	10 - 32 Vdc / 2 Watts max.
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 Firmware Version	1.7 or later
ASTRO-TAC™ 3000 Comparator Firmware Version	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.

SWITCH	MODULE 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 A position 1	not used	UP
position 2	not used	UP
position 3	not used	UP
position 4	not used	UP
position 5	not used	UP
position 6	not used	UP
position 7	not used	UP
position 8	ASTRO-TAC™ select	DOWN
OPTION B position 1	not used	UP
position 2	not used	UP
position 3	synchronous clock selection, see Table 4	UP
position 4	synchronous clock selection, see Table 5	UP
SER MODE position 1	synchronous clock selection, see Table 4	DOWN
position 2	synchronous clock selection, see Table 5	DOWN

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.

Comparator Type	Option A Switch position 8
ASTRO-TAC™ 3000	DOWN
ASTRO-TAC™	UP

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.

TX Clock Source	SER MODE position 1	OPTION B position 3
Internal (default)	DOWN	UP
External	UP	DOWN

Table 4 - Transmit Clock Selection

RX Clock Source	SER MODE position 2	OPTION B position 4
Internal (default)	DOWN	UP
External	UP	DOWN

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.
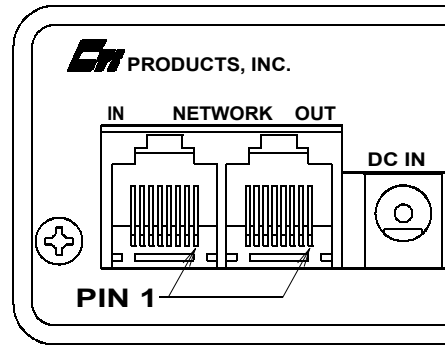
CA-80068-100

Figure 3 - 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 6 - 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.

AIB HOST Connector DE9-female Signal Name	Cable Connector DE9-male	Direction	Cable Connector DB25-male	ASTRO-TAC™ Comparator J15 DB25-female Signal Name
RXD	2	<	2	TxD3
TXD	3	>	3	RxD3
CTS	7	<	4	RTS3
RTS	8	>	5	CTS3
DTR	1	>	6, 8	DSR3, DCD3
Ground	5		7	Signal Ground
RCLK	9	>	15	TCLK3
TCLK	6	>	17	RCLK3
DCD	4	<	20	DTR3
Chassis Gnd	shell		1	Shield Gnd

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.

PROBLEM	CAUSE
User Interface Module is not showing a disabled receiver when the receiver is disabled at the ASTRO-TAC™ Comparator	This is normal. If Motorola's RSS (Radio Service Software) is used to disable a receiver, the ASTRO-TAC™ 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.
User Interface Module reports a link fail error for the AIB	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.

PROBLEM	CAUSE

User interface is not showing correct status
 	
OR
 	
Operator cannot FORCE VOTE or DISABLE the receivers
	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.
	
	TX and RX Clocks
	 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.
	
	AIB to ASTRO-TAC™ Comparator Data
	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.
	
	ASTRO-TAC™ Comparator to AIB Data
	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.
	
	Control Signals
	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 J15 connector pins 5

68-10842-115

13