

***Monitoring and Control Network (MCN™)
Comparator Display System***

System Planner

S2-60616-100

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1. Introduction and Manual Overview

The Monitoring and Control Network (MCN™) Comparator Display system provides remote monitoring and control for voting receiver systems. It extends the comparator status indicators for display on a PC and allows an operator or technician to force-vote and disable receivers from a PC. With the MCN system you can control and display multiple comparators from a single point or multiple points. It works with DIGITAC, Spectra-TAC, TAC comparators and Ericsson / GE analog voters.

The MCN system can also be used to provide status and control input/output to a console for ASTRO-TAC systems. ASTRO-TAC systems with 8 or fewer receivers per channel can be monitored and controlled on a PC. This is a major convenience since ASTRO-TAC comparators do not have any indication of active or voted receivers. The AIB ASTRO-TAC Interface Modules are available exclusively through Motorola.

The MCN Comparator Display System is targeted for the following applications:

- Systems which need comparator display for dispatchers
- Systems that need remote comparator display and control for technicians
- Critical comparator systems which require failure logging
- Large comparator systems (wide area or large number of channels)
- Ribbon Systems
- Analog Trunking systems with voting receivers
- ASTRO-TAC systems that require display of comparator status for a dispatcher or technician on a PC or a console
- Any voting system that needs rapid maintenance and diagnostics.

Typical customers are:

- Public Safety Dispatch Centers
- Police and Fire Departments
- State Police systems
- State and Local Governments
- Turnpike systems
- Transit authorities
- Utilities
- Federal Government systems
- Forestry / Conservation

Features:

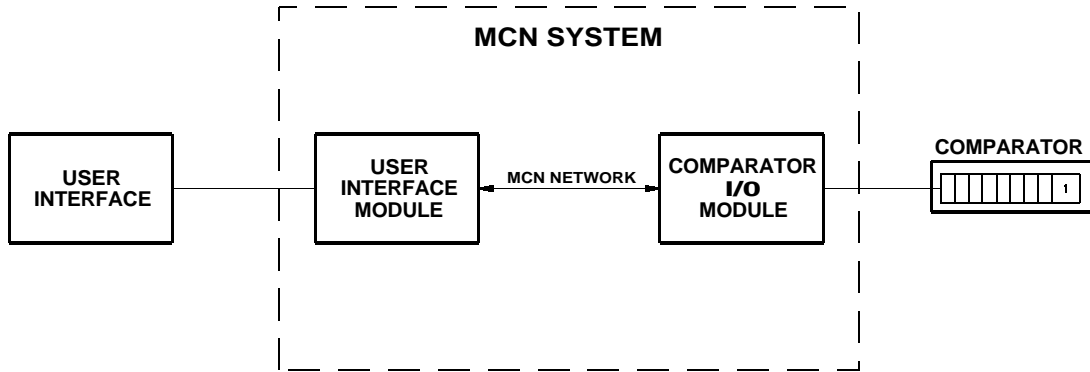
- Remote display of comparator status (Vote, Receive, Disable, Fail)
- Remote control of receivers (Force Vote, Disable)
- Remote Comparator Display and Control on a PC
- Intuitive operation
- PC based system saves space over a comparable button and LED system
- Can provide Input/Output signals for various button and LED or CRT consoles.
- Error Logging for Receiver Failures on PC systems

Benefits:

- Easy RF communications system troubleshooting
- Remote disabling of noise-producing equipment
- Automatic logging of RF system malfunctions
- Quicker system maintenance
- Lower system down time

1.1 MCN System Overview

Figure 1 shows a basic MCN comparator display system. The MCN system is made up of two modules, a Comparator I/O Module and a User Interface Module. The Comparator I/O Module provides the hardware interface to the comparator. The User Interface Module provides the mechanism for the user to monitor and control the comparator.



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Figure 1 - Basic MCN System

The Comparator I/O Module and the User Interface Modules connect with a single cable between the network ports of the modules, simplifying system installation. Standard systems can include up to 20 Comparator I/O Modules in a single network segment. Larger comparator display systems consisting of multiple network segments tied together with routers/repeaters can be custom configured by CTI Products, Inc.

Together, the Comparator I/O Module and the User Interface Module provide a simple, cost effective way to control your comparator system. Because of the MCN system's modular design, your comparator display system can easily expand as your communications system grows.

2. System Operation

This section describes the basic operation of both Comparator I/O Modules and User Interface Modules in a comparator display system. Two systems are described:

- A PC based system connected to three DIGITAC, Spectra-TAC, or Ericsson / GE comparators, and
- A console-based system connected to an ASTRO-TAC comparator.

In an MCN system, the Comparator I/O Module accepts VOTE, RECEIVE, DISABLE, and FAIL receiver status messages from the comparator and sends them to a User Interface Module over the MCN network. User Interface Modules then display the comparator status information on a console or PC.

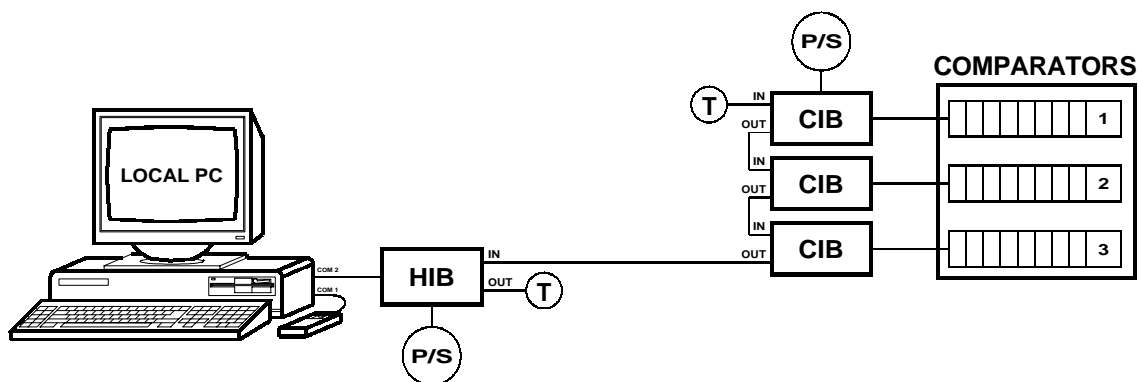
Likewise, when a User Interface Module sends FORCE VOTE or DISABLE commands, the Comparator I/O Module translates the commands and sends them to the comparator.

2.1 PC-Based System for Digitac, Spectra-TAC, or Ericsson Comparators / Voters

2.1.1 System Description

Figure 2 shows a small system made up of three Comparator I/O Modules (the CIBs) and one User Interface Module (the HIB). The PC can monitor and control all three comparators from a single screen. When a receiver is force voted from the PC, a FORCE VOTE message is generated by the MCN RCD software and sent to the CIB that is controlling that particular receiver. When the CIB receives the FORCE VOTE message, it will drive the receiver's VOTE output line to signal the comparator that the receiver is being force voted. A similar process occurs when a receiver is disabled from the PC.

Going the other direction, when the comparator detects that a receiver is active, it will drive the RX input of the CIB. The CIB will then generate a RECEIVE message and send it to the HIB so that the active receiver can be shown on the PC screen. A similar process occurs when the comparator generates a Vote (driving the CIB's VOTE input) or a Fail (driving the CIB's FAIL input) signal.



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Figure 2 - System Operation Example
(P/S = Power Supply, T = Network Terminator)

Section 2. System Operation

2.1.2 MCN Remote Comparator Display PC Software Operation

Two programs make up the MCN RCD software package. They are:

- MCNCFG.EXE - the configuration program
- MCNRCD.EXE - the runtime Remote Comparator Display program.

The MCNCFG program is run by an engineer or technician to build the configuration files when the system is installed or changed. The MCN RCD program is run by a dispatcher or technician to display the status of the voting system.

The MCN RCD software allows the operator to see which receivers are receiving, voted, disabled, failed or in an error condition on the PC. It also allows the operator to monitor and disable receivers with the Force Vote and Disable functions.

2.1.3 System Hardware Requirements

Two components are required for the MCN RCD system.

1. Host Computer Interface Module (HIB)
2. A PC to run the MCN RCD software with the following minimum configuration:
 - 25 MHz 386 PC (for 1-9 Comparator I/O Modules)
 - 50 MHz 486 PC (for 10-20 Comparator I/O Modules)
 - EGA or VGA adapter and monitor
 - 2 MB RAM
 - 10 MB free disk space
 - Microsoft or Logitech mouse
 - one open serial port capable of 38.4k baud
 - MS-DOS 5.0 or higher

2.1.4 PC Display Screen Layout

A typical receiver screen is shown below:

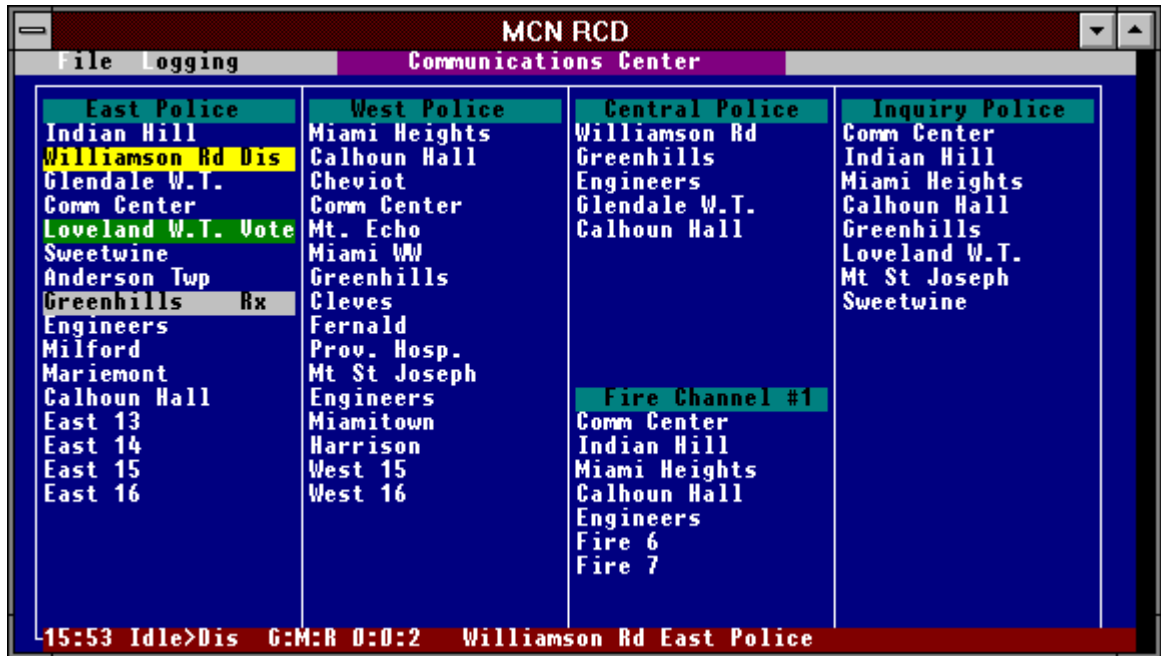


Figure 3 - Receiver Activity on an RCD Screen

The Receiver Display Screen has the following items:

- Menu Bar Located at the top left of the screen
- Screen Name Located at the top center of the screen
- Channel Titles Highlighted areas that extend across the receiver Name column and the Receiver Indicator Column
- Receiver Names Located on the left side of the four columns in the body of the screen
- Receiver Indicators Located to the right of the Receiver Names
- Error Status Line Present on the bottom line of the screen when an error has occurred and the “Show Errors On Screen” option is enabled.

The Receiver Indicators display the status of the receivers. The following status indications can be displayed:

Status	Indicator	Background color	Text Color
No Activity		Blue	
Vote	Vote	Green	White
Receiving	Rx	Lt Gray	Dark Gray
Disabled	Dis	Yellow	Black
Failed	Fail	Red	White
Error	Err	Brown	Yellow

The status text and colors can be custom configured at time of installation.

Section 2. System Operation

2.1.5 Controlling Receivers

You can use the MCN RCD program to control the receiver operation at your remote comparator. You can manually FORCE VOTE a receiver from the PC and listen to its audio quality over your system. You can also DISABLE a receiver that is defective or has a bad phone line. When the receiver or phone line is repaired, you can re-enable the receiver from the PC. Receivers can be controlled with either the mouse or keyboard.

2.1.6 Error Logging

The MCN RCD program can log system errors on a PC. The PC will log whenever a receiver fails or becomes disabled. It will also log when the receiver returns to a normal condition. Logging entries include a time and date stamp, the receiver status, the group, module, and receiver number, the receiver name, and the comments for that receiver. The log entries are stored in an ASCII text format on the disk. The error logging feature is available only when the PC is connected to the MCN system. No error information is logged when the PC is off-line.

2.1.7 MCN RCD Software Configuration

The MCN Remote Comparator Display software includes a configuration program, MCNCFG.EXE, which allows you to custom-configure your system. The configuration is a two-step process:

1. For each Group of 16 comparator I/O modules (CIBs and AIBs), enter the receiver names, channel names, and comments for each receiver.
2. Build the screen by entering channel titles and then by placing the receivers that were previously defined using a “point and shoot” selection method.

An MCN Group Configuration file (.GCF extension) contains all of the receiver information for a particular set of MCN Comparator I/O Modules, all addressed into a single MCN Group.

MCN Screen Files (.MSF extension) contain a list of receivers to be displayed on the current CRT screen and where they will appear on the screen. One MCN Screen File supports four different Group Configuration Files so that receivers from four different MCN Groups can be monitored and controlled from the same screen.

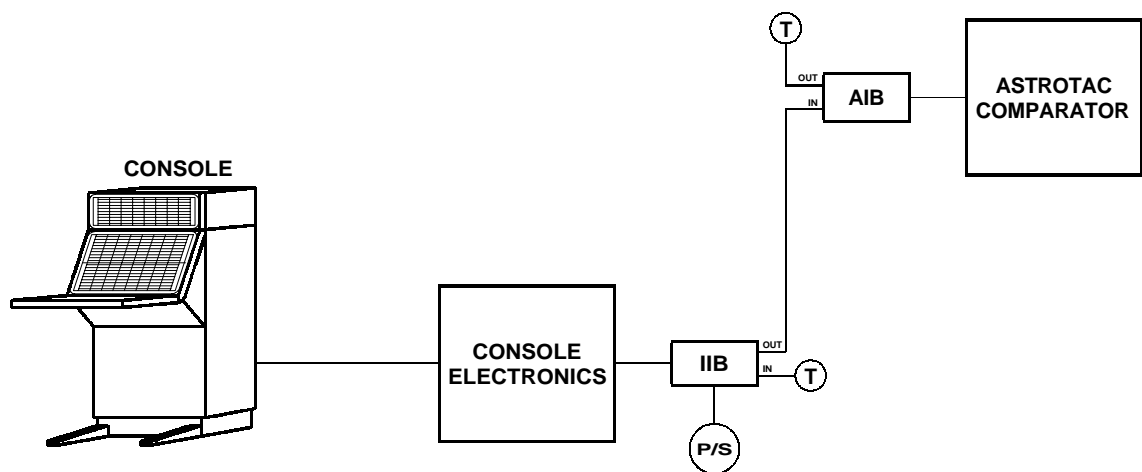
Up to 88 receivers can appear on the PC display. For many systems this will allow an operator to view all of the receivers in a voting receiver system. On larger systems as many as 50 screens can be created to display a system's receivers.

2.2 Console-Based System with ASTRO-TAC Comparator

2.2.1 System Description

The following diagram shows a simple system for ASTRO-TAC comparator display and control on a console. The AIB ASTRO-TAC Interface Module is connected to the comparator via a serial cable. The IIB I/O Interface Module is connected to 16-I/O boards in a Central Electronics Bank (CEB).

The status can be displayed on a console with parallel I/O lines for Vote, Receive, Disable, and Fail indicators and switches. The console is configured just as if it is connected to a standard analog comparator such as a DIGITAC or Spectra-TAC comparator. In this configuration, the comparator display and control will be running through the console electronics.



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Figure 4 - 8 ASTRO-TAC Receivers with Console Display
(P/S = Power Supply, T = Network Terminator)

Section 2. System Operation

2.2.2 IIB Module Connections to a Console

In a console-based system, the VOTE and DISABLE control lines that connect to the I/O lines of the console are actually bi-directional signals. Figure 5 shows the interface between the console electronics and the IIB's J1 connector.

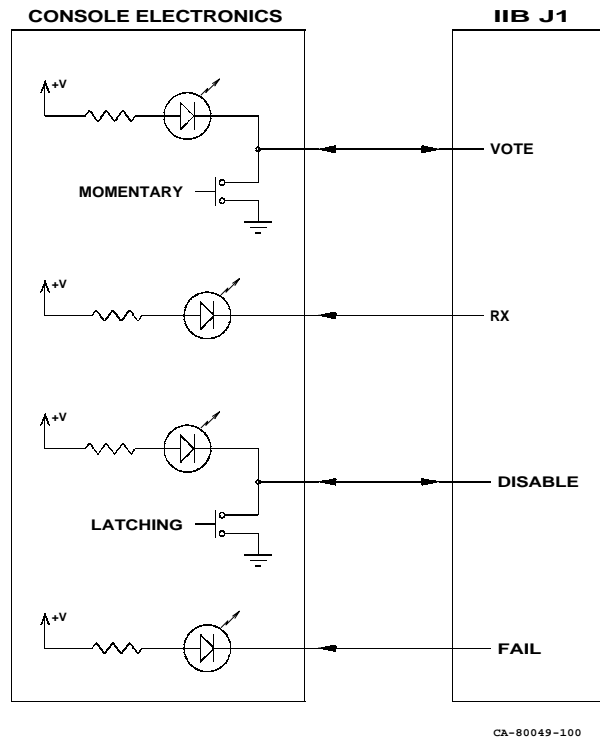


Figure 5 - Console Electronics Interface

3. System Components and Specifications

3.1 Module Types

The MCN Module types consist of five classes or types of modules:

- Comparator Input/Output Modules
- User Interface Modules.
- Transmitter Steering Interface Modules
- System Extender Modules
- Router and Repeater Modules

3.1.1 Comparator Input Output Modules (CIBs and AIBs)

Comparator I/O Modules provide the physical connection between the comparator and the MCN network. Depending on the features provided by the comparator, the connection to the comparator may be discrete I/O points that are hard wired to the comparator, or a simple RS-232 cable connected to a communications port on the comparator.

The following are the MCN Comparator I/O Modules:

- Comparator Interface Module (CIB)
- ASTRO-TAC Comparator Interface Module (AIB) (available exclusively through Motorola)

Each module is briefly described in its own section. For more information about features specific to an individual module, refer to its hardware reference manual.

3.1.2 User Interface Modules (HIBs and IIBs)

An MCN User Interface Module connects the MCN network to various User Interface devices. The user interface may be simple lights and push buttons, such as a console, or the user interface may be a program running on a PC to monitor and control the comparator.

The following are CTI Products' MCN User Interface Modules:

- Host Computer Interface Module (HIB) for PC interface (serial)
- Input/Output Interface Module (IIB) for console interface (parallel)

Each module is briefly described in its own section. For more information about features specific to an individual module, refer to its hardware reference manual.

Section 3 System Components and Specifications

3.1.3 Transmitter Steering Interface Modules (TIBs)

The Transmitter Steering Interface Modules (TIBs) work in conjunction with the CIB comparator Interface Modules and external Transmitter Steering equipment, such as the TSAM Transmitter Steering Unit from CTI Products. This interface provides monitor and control of transmitter sites from a PC with a HIB as the Operator Interface Module. The CIB is the only Comparator I/O Module that operates with the TIB and the HIB is the only User Interface Module that operates with a TIB.

The TIB is used in systems that have multiple transmitters, with each transmitter associated with one or more receivers and that use the TSAM to provide steering for the transmitter sites. The TIB will translate a FORCE VOTE command for a particular receiver into a FORCE TX command that commands the TSAM to steer to the transmitter associated with the receiver being FORCE VOTED. The TIB can also monitor the TSAM for the active transmitter site for display on a PC.

3.1.4 System Extension Modules (EXBs)

The EXB modules are used in pairs to connect two MCN networks together or to extend the length of an MCN network beyond 4000 feet. Typical applications include:

- Extending MCN Networks over phone lines
- Display and control multiple remote comparator locations at a central location
- Connects multiple local PC displays to a remote MCN network using 1 phone line
- Zone Comparators
- Master/Slave Comparators (Sub-Comparators)
- State-Wide / Regional / City-Wide voting systems

The EXB System Extender Modules use any analog or digitized analog channel (including standard 2-wire or 4-wire leased lines, or microwave channels) which is capable of carrying V.32 terbo standard modem signaling,. Data transfer between distant networks is "live", delayed only by the transit time through the EXB modules and the data rate across the modem link.

3.1.5 Router and Repeater Modules

Router and repeater modules are available on special order to extend the MCN network in the same building. They can also extend the network capacity to greater than 64 modules or 20 Comparator Interface Modules. The implementation of systems with these modules is customer-specific. CTI Products applications engineers will be happy to assist you in designing a custom system that extends past the normal limits of the MCN network.

3.2 Common Specifications for Modules

All modules are housed in similar metal enclosures. They all have similar environmental and power requirements. The common specifications are listed in Table 1. Specifications for features specific to a module or specifications that differ from these common specifications are listed in that module's section of this manual.

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 nominal
Network Connector	(2) RJ-45 (1 in, 1 out) Includes network connections and power distribution
Safety Approvals	UL 1950 CSA 1950 EN 60950-1992
Emissions Compliance	FCC Part 15, Class A DOC Class A EN55022 Class A
Susceptibility Compliance	IEC 801-2 IEC 801-3 IEC 801-4 EN50082-1

Table 1 - Common Module Specifications

3.3 ASTRO-TAC Comparator Interface Module (AIB)

The AIB connects Motorola's ASTRO-TAC comparator to the MCN network. Features of the AIB module include:

- Serial communication cable connects the AIB to the ASTRO-TAC comparator.
- Support for up to 16 receivers per AIB.
- Provides VOTE, RECEIVE, DISABLE, and FAIL status for each receiver to an MCN User Interface Module.
- Allows a User Interface Module to FORCE VOTE or DISABLE any receiver.

Number of Receivers Supported	16
Comparator Connector	9 pin D-SUB, female
ASTRO-TAC Interface	HDLC Synchronous Serial 9600 Baud
ASTRO-TAC Firmware Version	System Release 1.7 or later

Table 2 - AIB Module Specifications

3.4 Comparator Interface Module (CIB)

The CIB connects various types of comparators with parallel I/O facilities to the MCN network.

Features of the CIB module include:

- Parallel bi-directional I/O line connections between the CIB and a parallel I/O comparator, including Motorola DIGITAC, Spectra TAC, TAC, and Ericsson / GE analog comparators.
- Support for up to 8 receivers per module.
- Provides VOTE, RECEIVE, DISABLE, and FAIL status for each receiver to an MCN User Interface Module.
- Allows a User Interface Module to FORCE VOTE or DISABLE any receiver.
- The CIB can be connected to more than one comparator (with total support for 8 receivers) as long as the comparators are of the same type.

Option switches on the front panel of the CIB configure the type of comparator being used. Refer to the CIB hardware reference manual for a description of the CIB's option switches.

Number of Receivers Supported	8
Open Circuit Voltage (all I/O pins) jumper E1B removed jumper E1B installed	+13.8 Vdc nominal (Standard) +5 Vdc nominal (Logic Levels)
Inputs per Receiver active low, pull-up to +5 or +13.8 Vdc	Vote, Receive, Disable and Fail
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)	Force Vote and Disable
Output Saturation Voltage (Outputs and In/Out pins) with Output Current = 100 mA	550 mV max.
Output Pin Current (Outputs and In/Out pins)	150 mA max. per pin (sink) 100 mA max. per pin if all outputs are ON
Input/Output Connection	50 pin Telco style

Table 3 - CIB Module Specifications

3.5 Host Computer Interface Module (HIB) and MCN RCD Software

The HIB provides a serial interface to a PC and works with the Monitoring and Control Network Remote Comparator Display (MCN RCD) software to provide comparator monitoring and control.

Features of the HIB module / MCN RCD software combination include:

- Easy to use software for visual indication of voting system status
- Monitors up to 4 groups of 16 comparator I/O modules simultaneously (512 receivers).
- Displays up to 88 receivers viewable on a single screen.
- Configurable receiver names and screen positions.
- Displays VOTE, RECEIVE, DISABLE and FAIL information for each receiver on the screen.

- FORCE VOTE and DISABLE switch functions are controlled with either a mouse or keyboard.
- Allows logging (to the screen and/or to a disk file) of receivers that fail or become disabled. Logging may be enabled or disabled by the operator.
- Modem support allows remote monitoring and control.

Because the module can be used with modems for remote operation, a technician no longer has to travel to the comparator site to diagnose system problems since he can monitor and control the comparator from a properly equipped PC in their shop.

PC Connector	9 pin D-SUB, female, DCE
Baud Rates Supported	9600, 14.4K, 19.2K, 38.4K (38.4K Default)

Table 4 - IIB Module Specifications

3.6 Input/Output Interface Module (IIB)

The IIB provides discrete, parallel Input/Output points for monitoring and control of comparators. IIB outputs can be connected to LEDs for viewing comparator status and inputs can be connected to switches for control of comparator functions. Features of the IIB include:

- Support for up to 8 receivers.
- Status Outputs for each receiver which includes VOTE, RECEIVE, DISABLE, and FAIL.
- Control Inputs for each receiver include FORCE VOTE and DISABLE.
- Link Fail output which indicates a failed serial link with the ASTROTAC comparator. This output takes up one receiver output.

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 (Standard) +5 Vdc nominal (Logic Levels)
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 μ A max. (source) -270 μ A max. (source)
Outputs per Receiver (active low)	Vote, Receive, Disable, Fail
Output Saturation Voltage (Outputs and In/Out pins) with Output Current = 100 mA	550 mV
Output Pin Current (Outputs and In/Out pins)	150 mA max. per pin (sink) 100 mA max. per pin if all outputs are ON.
Input/Output Connection	50 pin Telco style

Table 5 - IIB Module Specifications

3.7 Transmitter Steering Interface Module (TIB)

The Transmitter Steering Interface Modules (TIBs) work in conjunction with the CIB comparator Interface Modules and external Transmitter Steering equipment, such as the TSAM Transmitter Steering Unit from CTI Products.

When a receiver is FORCE VOTED from the PC, the HIB sends a FORCE VOTE command to the CIB, the TIB that is associated with that CIB also receives the command and activates the TX Select line for the specified receiver/transmitter. The TIB then activates the Force Select output line for approximately 100 milliseconds. After this 100 milliseconds, the TX Select lines and the Force Select line are deactivated so that the TIB can resume monitoring the transmitter status.

The TIB monitors the TSAM's 8 TX Select lines to determine which transmitter is currently active. Whenever the TSAM steers to a transmitter, the TSAM updates the TX Select lines to indicate the currently active transmitter. The TIB sends the status information to a HIB over the MCN network so that the transmitter status can be displayed on the PC.

Number of Transmitters Supported	8
Open Circuit Voltage (all I/O pins) jumper E1B removed jumper E1B installed	+13.8 Vdc nominal +5 Vdc nominal
Inputs per Transmitter active low, pull-up to +5 or +13.8 Vdc	TX Select In
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 μ A max (source) -270 μ A max (source)
Outputs per Transmitter (active low)	TX Select Out
Control Outputs (active low)	Force Select
Output Saturation Voltage (Outputs and In/Out pins) with Iout = 100 mA	550 mV max.
Output Pin Current (Outputs and In/Out pins)	150 mA max per pin (sink) 100 mA max per pin if all output are ON
Maximum Power Dissipation	2 Watts
Input/Output Connection	50 pin Telco style

Table 6 - TIB Module Specifications

3.8 EXB System Extender Module

The EXB modules are used in pairs to connect two MCN networks together or to extend the length of an MCN network beyond 4000 feet. One side of each EXB module connects to the MCN network. The other side connects to a 2-wire or 4-wire leased telephone line or analog microwave channel.

Power:	10 to 30 VDC 5 watts max. (Counts as 2 MCN standard loads)
Size:	7.5" D x 5.6" W x 1.6" H (MCN "B" size module)
Mounting:	Desktop with integral non-slip feet Optional Wall Mount Bracket Optional 19" rack mounts (1 Rack Unit high)
Temperature:	0-60°C
Humidity:	10-95% non-condensing
Safety Listings:	UL1459, CSA C22.2, EC EN60950
Telco Approvals	FCC Part 68 (U.S.) IC CS02 & CS03 (Canada)
Telephone Line Levels:	TX: -10 or -16 dBm (Switch selectable) RX: -45 to -16 dBm
EMI: Complies with	FCC part 15 Class A Industry Canada (IC) Class A EN55022 Class A (European Union)
EMC:	EN50082-1 (European Union)
European:	Carries the CE Mark
Modem:	Internal V.32 terbo 19.2 Kbps, 2/4 wire leased line (Switch selectable) Simultaneous Voice plus Data
MCN Network	Standard 78 Kb or High-speed 1.25 Mb network models available

Table 7 - EXB Module Specifications

4. System Installation Options

4.1 Mounting Options

EIA 19" rack mount, DIGITAC bracket and cable rear mount, and Wall mount kits are available for MCN modules. These kits are described below.

4.1.1 Rack Mounting

The quad rack mount option provides a 19" rack mounting bracket that supports four MCN size A modules. It requires 1 Rack Unit (1.75") of rack space. Similar rack mounts are available for (3) B size modules (3B rack) and (2) A size plus (1) Size B module (2A+B rack).

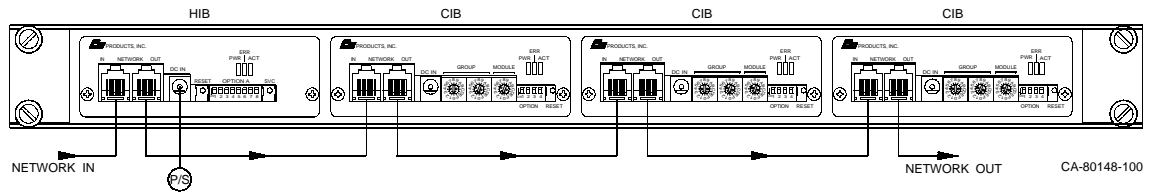


Figure 6 - MCN Quad Rack Mount

Figure 7 shows an exploded view of the rack mount installation. The top diagram shows the front view of the bracket with one module installed. The bottom two diagrams show a side view of the module installation and bracket installation respectively.

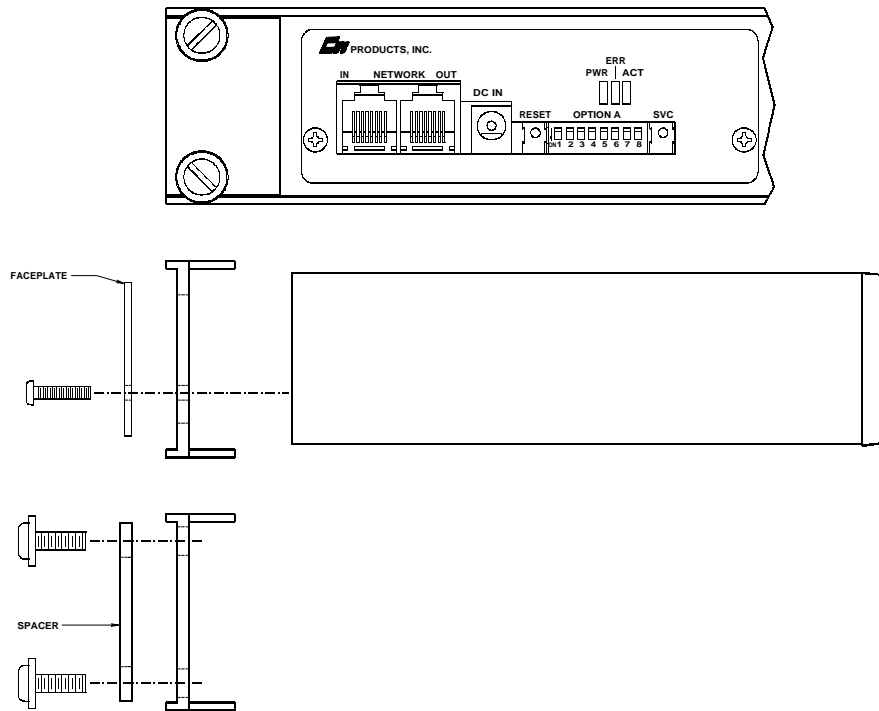


Figure 7 - Rack Mounting - Front and Side View

4.1.2 DIGITAC Bracket and Cable Rear Mount

The DIGITAC rear mount bracket and cable provides a quick and easy way to mount the CIB and connect it to the DIGITAC without extra cables and punch blocks. The CIB module I/O connector has a pinout that matches the DIGITAC P805 connector. The rear mount includes a ribbon “T” connector. One connector plugs into P805, another connects to the CIB module, and a third is a female 50-pin connector for external comparator I/O connections. The DIGITAC rear mount kit is shown below:

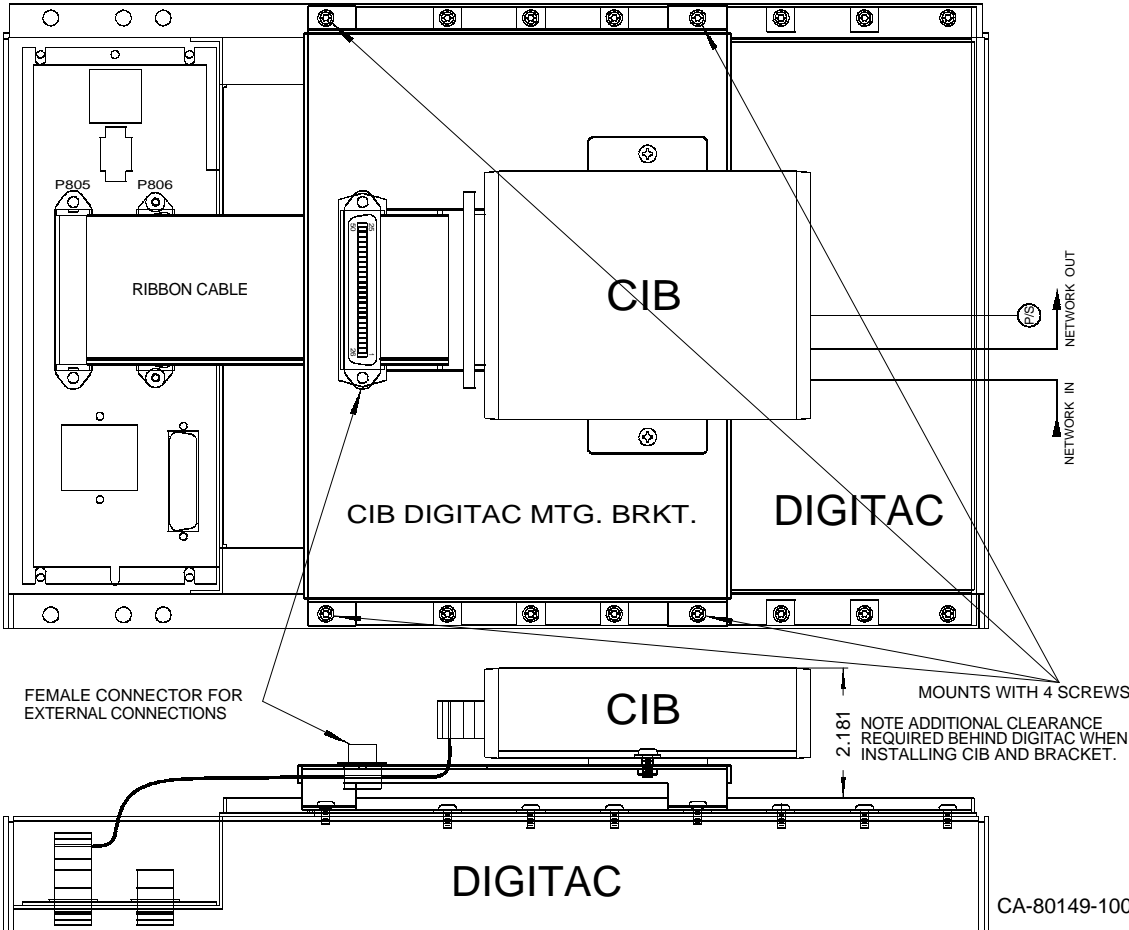


Figure 8 - Digitac Bracket and Ribbon Cable

Section 4. System Installation Options

4.1.3 Wall Mounting

The wall mount option allows a module to be mounted to a flat surface. Each MCN module has two screw holes located on the bottom of the module. Simply attach the mounting plate to the bottom of the module using these two screw holes and then screw this assembly to the wall. The module can be mounted in any orientation. Figure 9 shows an exploded view of the wall mount installation.

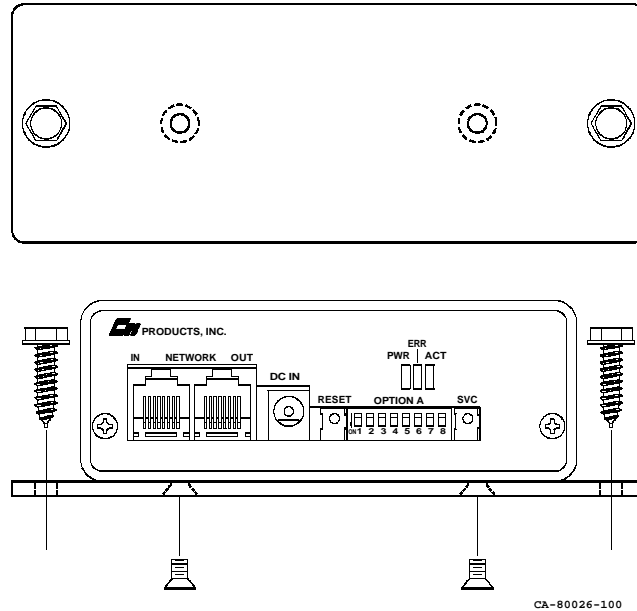


Figure 9 - Wall Mounting

4.2 Parallel I/O Cabling

Parallel I/O cables are standard 25-pair cables and are used with CIB Comparator Interface Modules and IIB I/O Interface Modules. Three versions are available, a 10 and 25 foot male to male cable for connection to punch blocks, and a 25 foot male to blunt end cable for wiring directly to the back of a Spectra-TAC comparator or Ericsson / GE Analog Voter.

4.2.1 DIGITAC Comparators Cabling with DIGITAC Bracket and Cabling

For CIBs connected to DIGITAC comparators using the DIGITAC Bracket and Cable, the CIB connects to the DIGITAC through a ribbon cable and no extra parallel I/O cable is required. The cable and punch block that are normally ordered to connect to P805 on the DIGITAC comparator will instead be connected to the third connector on the ribbon cable.

If a cable and punch block weren't ordered for the DIGITAC, you can order a male to male cable and punch block.

4.2.2 DIGITAC Comparators Cabling with DIGITAC Rack or Wall Mount

For CIB modules which mount using a rack mount or wall mount, you will need a parallel I/O cable.

You can order either:

- Male to male 25-pair cable for use with a dedicated punch block
- Male to blunt end 25-pair cable to punch down to an existing punch block.

4.2.3 Spectra-TAC and TAC Comparators and Ericsson Analog Voters

There are 3 general ways to connect to these types of comparators:

1. Male to male 25-pair cable to punch block with field wiring to back of comparator. This option provides the most flexibility, but it requires a punch block and a place to mount it.
2. Male to blunt end 25-pair cable wired directly to the back of the comparator card cage. This method eliminates the need for a punch block and works well if the CIB modules and comparators are mounted close in the same rack so that you can disconnect the cable from the CIB module if the comparator card cage must be removed.
3. A short 25-pair pigtail cable with a female connector wired directly to the comparator card cage. A male to male 25-pair cable then connects the CIB to the pigtail. This method eliminates the need for a punch block, but still allows the comparator card cage to be removed from the rack for service, especially if the CIB module is mounted in a different equipment rack. Note that the female pigtail cable is field fabricated.

4.2.4 IIB I/O Modules:

There are two parallel cabling options for IIB modules:

- Male to Male 25-pair cable and punch block with cross-connect to the comparator interface punch block(s) for the console module. This is the most flexible option, but it does require extra punch blocks and mounting space.
- Male to blunt end 25-pair cable, punched down to the existing punch block(s) for the console I/O module. This option is less expensive and takes up less space. In the case of the Motorola Centracom series II consoles, one IIB module can connect to two comparator interfaces in the CEB. With this option, you will have to split the cable apart and connect to two punch blocks, or to both sides of a split punch block.

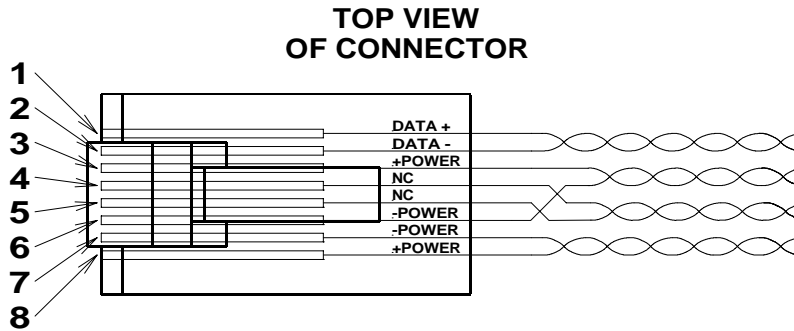
4.3 Network Cabling

MCN modules communicate over a network cable. Specifications for network cabling are the following:

- 4 pair level IV or V unshielded, 24 AWG, twisted pair cable (EIA/TIA 568B).
- Maximum of 64 modules can be connected together, with a limit of 20 Comparator I/O Modules per network segment.
- Maximum cable length is 4000 feet.
- Straight through connections.

Section 4. System Installation Options

One side of the network cable is shown below. This diagram details the pinout and twisted pair configuration of the cable.



CA-80042-100

Figure 10 - MCN Cable Pinout

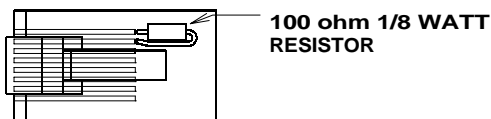
When cabling your system, daisy-chain the modules together and insert a network terminator into the unused port of the first module and the unused port of the last module in the chain. An example of what the terminator looks like is shown in Figure 11.

Use of standard length cables from CTI Products is highly recommended to provide best system performance. Standard lengths are available up to 1000 feet. Standard lengths can be combined with cable couplers to create desired length cables. Custom lengths can also be ordered.

If you do provide your own cable, be sure it meets the specifications above. The system will not work with ordinary telephone cable.

The MCN network cable is not rated for outdoor use. The MCN system is not rated for cabling running exposed outdoors, for example with overhead lines, due to possible lightning surges.

If you are providing your own cable for a run longer than 100 feet, a new power supply will be required at the far end. You may use 2-pair Level IV or Level V cable instead of 4-pair. In this instance, connect just the data pair (Pins 1 and 2).



CA-80025-100

Figure 11 - MCN Network Terminator

4.4 Power Requirements / Power Supply Specifications

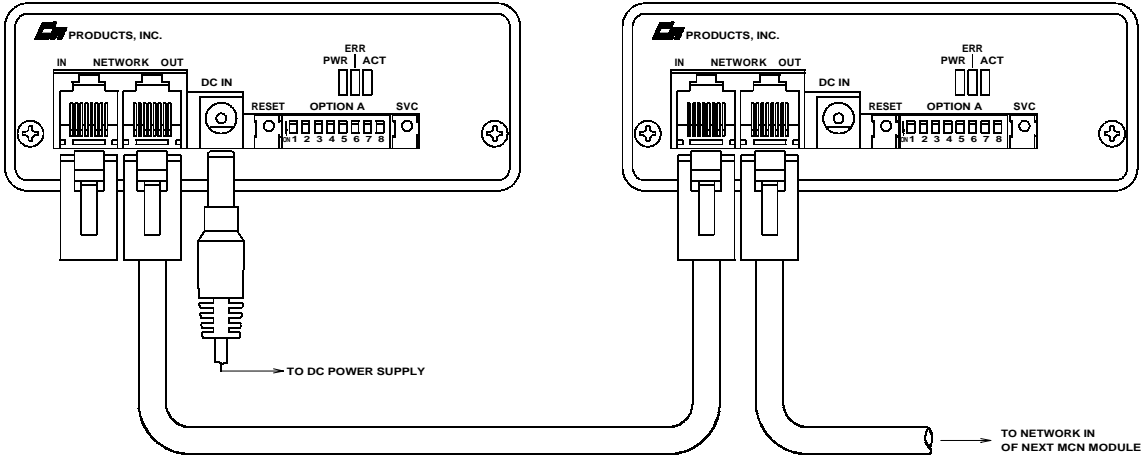
Power input for all MCN modules is 10 to 32 VDC, with most modules requiring 2 W nominal. AC power supplies are available that provide 18 VDC at 800 mA. MCN systems have been fully tested for appropriate immunity to harmful electrical noise and electrical impulses when assembled with these power supplies. Operation with other, non-qualified power supplies could yield lower system performance and may void US, Canadian, or European emissions and susceptibility approvals.

The DC IN receptacle of all MCN modules can accept either polarity configuration from the input power plug.

The MCN system provides a unique way to distribute power to multiple modules from a single power supply. The network cable used for module communication also contains power lines so that the power from a power supply can be distributed along with the communication lines. The limits of this power distribution are the following:

- A maximum of four modules can be powered from a single power supply.
- The maximum cable length between the modules that share a power supply is 100 feet.

To create this power distribution (refer to Figure 12), simply connect the power supply into your first module. Then, connect the NETWORK OUT port of that module to the NETWORK IN port of the next module. Continue connecting NETWORK OUT ports to NETWORK IN ports until all modules are connected. If you need to add more power supplies to the system due to power distribution limits, simply connect another power supply into the DC IN port of a module. This new power supply then provides power for the module it is connected to as well as all modules from that module's NETWORK OUT port or until another power supply is encountered.



CA-80027-100

Figure 12 - DC Power Chaining

Section 4. System Installation Options

In the example shown in Figure 13, two power supplies are required, even though there are only four modules in the system. The second supply is required because the network cable between the third and fourth modules is greater than the 100 foot cable length maximum for power distribution.

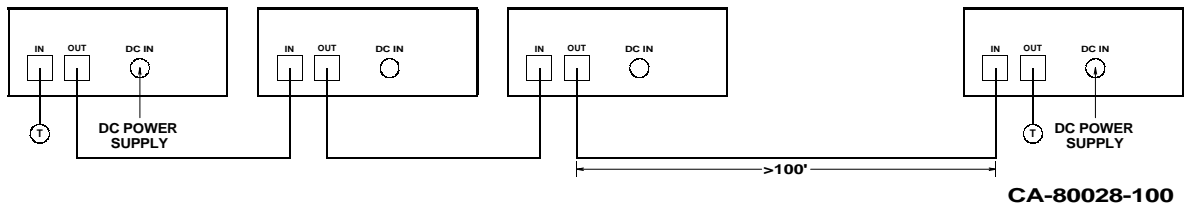


Figure 13 - Power Distribution Example

The following specifications apply to the AC power supplies:

120 VAC U.S. / Canada Power Supply (81-10398)

This module is a plug-in type Class-2 power supply with integral 120VAC power prongs. It includes a mounting tab for use with the grounding screw in a standard 15A outlet.

AC Voltage:	120 VAC 60 Hz 15W
Basic Dimensions when plugged into a wall outlet	2.85" Wide x 3.5" High x 2.25" Deep (73 x 89 x 57 mm)
Overall dimensions with mounting tab and clearance for DC cable	2.85" Wide x 5.5" High x 2.25" Deep (73 x 140 x 57 mm)
DC Cable Length (Approximate)	6' (1.8m)
Weight	1.75 Lbs

When planning the number of outlet strips needed for your system, please note that the 120 V Power Supply will use one outlet and will cover up two additional outlets on close-spaced outlet strips. Plan for three outlets for every 120V Power Supply.

230 VAC European Power Supply (81-10728)

This module is a desk-top type Class-2 power supply unit with an IEC connector for the 230VAC power input. The customer shall furnish the appropriate line cord for the destination country.

AC Voltage	230 VAC 50/ 60 Hz 15W
Basic Dimensions	4.75" Long x 3.2" Wide x 2.65" High (121 x 81 x 67 mm)
Overall dimensions with clearance for AC cord and DC cable	9" Long x 3.2" Wide x 2.65" High (229 x 81 x 67 mm)
DC Cable Length (Approximate)	6' (1.8m)

5. Designing and Ordering a System

The following procedures should be followed when designing and ordering an MCN system.

Step	Operation
1	Determine the type of comparator in the system: Spectra-TAC, DIGITAC TAC, or ASTRO-TAC comparator or Ericsson / GE analog voters.
2	Determine the total quantity of comparators in the system.
3	Determine how many receivers are connected to each comparator.
4	Determine the type and quantity of operator interface required (PC or console based).
5	<p>For console-based systems, determine the number of I/O cards, operator interface modules, and I/O programming options required. Order these items from your console vendor.</p> <p>For instance, in Motorola Centracom Series II consoles, B1426 Modules are required in the Central Electronics Bank (CEB) for every 4 receivers and B1439 Comparator Display Modules are required for button and LED consoles for every 4 receivers.</p>
6	Follow the instructions in the <i>Designing an MCN system</i> section.

5.1 Designing an MCN system

Before designing an MCN system, follow steps 1-6 on page 23.

5.1.1 Network Planning / Equipment Location

Typically, comparator interfaces (CIBs and AIBs) will be mounted near the comparators, either in rack mounts or in DIGITAC Bracket and Cable Rear Mount.

For DIGITAC comparators, the DIGITAC Rear Mount is the preferred method to mount the CIB because it includes a ribbon cable for quick and easy connection. It also conserves rack space. For other comparators, the Quad Rack Mount is preferred. It can mount (4) modules.

For Console Logic I/O, the IIBs will mount near the console electronics (CEB). This may be local to the comparator and AIBs, in which case they can mount to the same rack mounts as the AIBs. They may also be located at an extended distance from the comparators. In which case, they can be rack mounted near the CEB and connected to the comparator interfaces via an extended length network cable. These are called Extended IIBs in the ordering worksheet.

HIBs connected to modems will normally be mounted locally to the CIBs.

HIBs connected directly to PCs will mount close to their PCs and will connect to the comparator interfaces through an extended length network cable. Extended HIBs can be mounted with their own rack mount, a wall mount, or placed in the bottom of a console enclosure without a mount.

5.1.2 AIB Considerations

AIB modules are ordered per ASTRO-TAC RF channel. Only one AIB module is used per ASTRO-TAC comparator, up to 13 receivers. Each channel will need its own AIB module. Remember that PC display systems can only display and control the first 8 ports on an ASTRO-TAC comparator. AIB modules are available exclusively through Motorola.

5.1.3 IIB Considerations

IIBs monitor and control ASTRO-TAC receiver ports in banks of 8. You will need 1 or 2 IIBs per AIB. Note that consoles and transmit-only base stations each take up a port. If you use the Link Fail indicator option on the IIB, it will take up the highest receiver in the system (#8 or #16).

If you have any receivers on ports 9-13, you will need (2) IIBs per AIB.. Also, if you have a receiver active on Port 8 and you need the Link Fail Indication option, you will need (2) IIBs per AIB. Otherwise, you will need (1) IIB per AIB.

If you will be using both logic I/O (IIBs) and PC display (HIBs), please note that the console display can get out of sync since it has a bi-directional Disable line. See the *Appendix E System Limitations when using HIB and IIB Modules Together* section of this system planner for more details.

5.1.4 CIB Considerations

Normally, you will order one CIB for each comparator card cage. This corresponds to 8 receivers on Motorola comparators. Even if not all the receivers are used, configuring the system for the maximum number of receiver slots allows for easy system expansion when receivers are added. This is especially true in the case of DIGITAC comparators. When you use the DIGITAC Bracket and Cable, you must dedicate a CIB to each DIGITAC cage.

Typically, divide the number of receivers per channel by 8 and round up to the next whole number. For example, a 20 channel DIGITAC system will have 3 card cages and would require 3 CIBs.

Can you connect multiple channels (card cages) to a single CIB to save cost? Yes, so long as you are connecting only one type of comparator to one CIB. For example, in a system that had 6 Spectra-TAC channels each with only 4 receivers, one CIB could be connected to 2 channels, and only 3 CIBs would be required, but there would be no pre-wired expansion. When you control multiple channels or comparator card cages, be sure to use the punch block wiring option to make the field wiring easier. If you control multiple DIGITAC cages from one CIB, you can't use the DIGITAC bracket and ribbon cable mount.

A standard configured system can have a maximum of 20 comparator modules (CIBs and AIBs) on a network segment. Larger systems can be custom-configured by CTI Products, Inc. If you need more than 20 CIBs and AIBs on one network, call a system engineer at CTI Products, Inc.

5.2 MCN System Components

Below is a list of MCN modules and accessories available to build your comparator display system.

COMPONENT	CTI Products PART NUMBER
Comparator I/O Modules	
Comparator Interface Module (CIB) For DIGITAC, Spectra-TAC and other parallel I/O comparators.	S2-60442
ASTRO-TAC Interface Module (AIB) (Available only through Motorola as a CDN6119)	
Operator Interface Modules	
Input/Output Interface Module (IIB) For connection to CEBs	S2-60433
Host Computer Interface Module (HIB) and MCN Remote Comparator Display DOS Software	S1-60424
Transmitter Steering Interface Modules	
Transmitter Steering Interface Module (TIB) (Works with CIB and HIB modules) (Contact CTI Products for system design)	S2-60451
System Extender Modules	
MCN System Extender Module (EXB) 78K (Contact CTI Products for system design)	S1-60602
MCN System Extender Module (EXB) 1.25 M (Contact CTI Products for availability and system design)	S1-60603
Router and Repeater Modules	
Routers & Repeaters (Configurations vary depending on application. Contact CTI Products, Inc for system design.)	
Modems	
Modem V.34 28.8 Kb Dial-Up	99-10962
Standard Length Network Cables, Terminators, Couplers	
9 inch cable	S2-60438
3 ft. cable	89-10732
10 ft. cable	89-10712
25 ft. cable	89-10835
100 ft. cable	89-10836
100 ft. Plenum cable	S2-60439
200 ft. cable	S2-60534
200 ft. Plenum cable	S2-60535
400 ft. cable	S2-60536
400 ft. Plenum cable	S2-60537
1000 ft. cable	S2-60538
1000 ft. Plenum cable	S2-60539
Terminator (1 each)	S2-60318
Cable Coupler	27-10841

Custom Length Network Cables	
Cable Assy Network Base	S1-60197
Order 1 base and X feet of one of the following:	
Cable Network Custom Length (per foot)	30-10947
Cable Network Custom Length Plenum (per foot)	30-10957
Power Supplies	
120 VAC U.S. / Canada	81-10398
230 VAC Europe (terminates with an IEC connector)	81-10728
Mounting Kits	
Quad Rack Mount Size A (1 Rack Unit high)	S2-60435
Wall Mount Size A	S2-60436
DIGITAC Bracket and Ribbon Cable	S2-60437
Serial I/O Cables	
AIB to ASTRO-TAC 10' serial cable (Available through Motorola as a CDN6119)	
HIB - PC (9 or 25 Pin) 6' Serial Cable	S2-60441
HIB - Modem 3' Serial Cable	S2-60445
PC (9 or 25 pin) - Modem 6' Serial Cable	S2-60450
25 Pair I/O Cables and Punch Blocks	
Punch block 50 Pair	31-10354
25-Pair Male-Male Cable to Punch block (10 ft.)	89-10711
25-Pair Male-Male Cable to Punch block (25 ft.)	89-10837
25-Pair Male-Blunt end Cable (25 ft.)	89-10843
Modems	
Modem V.34 28.8 Kb Dial-Up	99-10962
Modem	99-
Manuals	
MCN System Installation Manual	S2-60425
AIB ASTRO-TAC Interface Module Manual (Available through Motorola as a CDN6107)	S2-60399
IIB I/O Interface Module Manual	S2-60400
CIB Comparator Interface Module Manual	S2-60426
HIB Host Computer Interface Module Manual	S2-60427
MCN Remote Comparator Display Software Manual	S2-60428
TIB Transmitter Steering Interface Module Manual	S2-60469
EXB MCN System Extender Module Manual	S2-60596

5.3 Custom System Configuration Worksheet

Step	Operation
1	<p>Determine the number of networks required. With PC Display, typically only 1 network will be used, so that the PC can see all the comparators.</p> <p>If you are using ASTRO-TAC comparators and Logic I/O (AIBs and IIBs) exclusively, they can be configured as multiple stand-alone networks.</p> <p>Contact a systems engineer from CTI Products, Inc. at (513) 595-5900 if you have any of the following systems:</p> <ul style="list-style-type: none"> • Remotely located (> 4000 ft.) comparators • Multiple PC Displays and one or more remotely located comparators • Sub-Comparators • Greater than 20 total CIBs plus AIBs • Greater than 64 total modules (CIBs, AIBs, HIBs, IIBs) • Transmitter Steering (TSAM) Units and TIB modules <p>For each network, do the steps 2 through 20.</p>
2	<p>AIB ASTRO-TAC Interface Modules and cables: Count the number of AIB ASTRO-TAC Interface Modules to order. If you do not have ASTRO-TAC comparators, skip to step 3:</p> <p>CDN6119 AIB ASTRO-TAC Interface Module Qty: _____</p> <p>Order the same quantity of AIB to ASTRO-TAC serial cables: CDN6131 AIB to ASTRO-TAC cable (10 ft.) Qty: _____</p> <p>Order these items from Motorola.</p>
3	<p>IIB Logic I/O Interface Modules: If you need logic I/O to connect to the I/O lines of a console, calculate the number of IIB Input/Output Modules required. If you want to use only PC display, skip ahead to step 4.</p> <p>IIBs monitor and control ASTRO-TAC ports in banks of 8. You will need 1 or 2 IIBs per AIB. An IIB can also monitor one CIB module. See <i>IIB Considerations</i> section for more details.</p> <p>Count the number of IIBs required for all channels and order that quantity of IIBs: S2-60433 Input/Output Interface Module (IIB) Qty: _____</p>
4	<p>CIB Comparator Interface Modules: Calculate the number of CIB Modules to order. You will need CIB modules for DIGITAC, Spectra-TAC, and TAC comparators and Ericsson / GE analog voters. If you do not have these type of comparators, skip to step 5.</p> <p>Enter the number of CIBs required for each comparator type and order the total quantity:</p> <p>CIBs for DIGITAC _____ CIB for Spectra-TAC _____ CIBs for TAC _____ CIBs for Ericsson / GE analog voters _____</p> <p>S2-60442 Comparator Interface Module (CIB) Total Qty: _____</p>

Continued

5	Check for maximum number of comparator modules: Calculate the total number of required comparator modules:		
	AIB Modules from Step 2		_____
	CIB Modules from Step 4		_____
	Total		_____
	(Maximum 20)		
	If you need more than 20 CIBs and AIBs on one network, call a system engineer at CTI Products, Inc.		
6	Order the number of Local PC User Interfaces required. Local PCs are connected to the MCN network (maximum 4000' total).		
	S1-60424	Host Computer Interface Module (HIB) with MCN Remote Comparator Display DOS Software::	Qty _____
	Order the same quantity of serial cables (HIB to PC).		
	S2-60441	Serial Cable Kit (includes cable and adapter for 9 pin or 25 pin communication ports):	Qty: _____
	Order PCs separately. See the <i>System Hardware Requirements</i> section for details.		
7	Order the number of Remote (Dial-Up or Leased Line) PC User Interfaces, modems, and serial cables required. Remote PCs are connected to the MCN network through a HIB Host Computer Interface located at the network and a pair of modems.		
	S1-60424	Host Computer Interface Module (HIB) with MCN Remote Comparator Display DOS Software:	Qty _____
	99-10962	Modem V.34 28.8Kb Dial-Up (For small systems with 1-3 CIB modules, 14.4K modems can also be used.) (Contact CTI Products, Inc. for leased line modems.)	Qty _____
	Order the same quantity of serial cables (HIB to Modem).		
	S2-60445	Serial Cable HIB-Modem (9 pin male to 25 pin female):	Qty: _____
	Order PC to Modem Cables:		
	S2-60450	PC (9 or 25 Pin) to Modem Cable	Qty: _____
	Order PCs separately. See the <i>System Hardware Requirements</i> section for details.		
8	Calculate the number of mounts required for Local Modules (Local to Comparators):		
		DIGITAC	Quad
		Rear Mount	Rack Mount
	Local Modules		Single
			Wall Mount
a	DIGITAC CIBs	_____	_____
b	Other CIBs	N/A	_____
c	AIBs	N/A	_____
d	Local IIBs	N/A	_____
e	HIBs (for Modem)	N/A	_____
f	Totals Modules	_____	_____
	Modules per Mount	1	4
	Divide Total Modules by Modules per Mount and round up to the next whole number to calculate Subtotal Mounts:		
9	Subtotal Local Module Mounts	_____	_____

Continued

Designing an MCN system

9	Calculate the number of mounts required for Extended IIBs (IIBs mounted near the CEB but not in the same rack as the comparator interfaces.):			
		Quad Rack Mount	Single Wall Mount	
a	Extended IIBs	_____	_____	
	Modules per Mount	4	1	
	Divide Extended IIBs by Modules per Mount and round up to the next whole number to calculate Subtotal Mounts:			
b	Subtotal Extended IIB Module Mounts	_____	_____	
10	Calculate the number of mounts required for Extended HIBs (HIBs mounted near the PC and not in the same rack as the comparator interfaces.)			
		Quad Rack Mount	Single Wall Mount	
a	Extended HIB mounts	_____**	_____	
	** Normally, the PCs will be physically separated from each other and you will use one mount per HIB module. You can rack HIBs together if they are all within 6 cable-feet of their PCs.			
11	Total the number of mounts required based upon the subtotals in the last 3 steps:			
		DIGITAC Rear Mount	Quad Rack Mount	Single Wall Mount
a	Local Modules			
	Local Mounts (8g)	_____	_____	_____
b	Ext. IIB Mounts (9b)	N/A	_____	_____
c	Ext. HIB Mounts (10a)	N/A	_____	_____
d	Totals Mounts	_____	_____	_____
	Enter the totals below and order the appropriate quantity of mounts:			
e	S2-60437 DIGITAC Bracket and Cable Kit			Qty: _____
f	S2-60435 Quad Rack Mount Kit			Qty: _____
g	S2-60436 Wall Mount Kit			Qty: _____
12	Parallel I/O Cabling (25-Pair Cables) Enter the required number of cables for your system. See the <i>Parallel I/O Cabling</i> section for more details.			
		Male to Male 25' Cable	Male to Male 10' Cable	Male to Blunt 25' Cable
a	CIB Modules			
	DIGITAC Bracket/Cable ** _____	_____	N/A	_____
b	DIGITAC Rack/Wall	_____	_____	_____
c	Spectra-TAC, TAC, EGE	_____	_____	_____
d	IIB Modules	_____	_____	_____
e	Totals	_____	_____	_____
	** Order cables only if cables were not ordered with DIGITAC comparator.			
	Enter the totals below and order the appropriate quantity of items:			
f	89-10837 Male to Male Cable 25'			Qty: _____
g	89-10711 Male to Male Cable 10'			Qty: _____
h	89-10843 Male to Blunt Cable 25'			Qty: _____

Continued

13	Order Punch Blocks		
a	Total 25-pair cables connected to Punch Blocks (from above): Divide the total of 25-pair cables by 2 and round up to the next whole number. Order the proper quantity of punch blocks.		_____
b	31-10354	50-Pair Punch Block	Qty: _____
14	Order Standard Network Cables Total the number of network cables required and order them:		
a	S2-60438	9" Network Cable Used between Modules in a Quad Rack Mount	Qty: _____
b	89-10732	3' Network Cable Used between adjacent CIBs mounted to DIGITAC Brackets Used between Quad Rack Mount Units May be used between wall mount units	Qty: _____
c	89-10712	10' Network Cable Used between adjacent equipment racks May be used between wall mount units	Qty: _____
d	89-10835	25' Network Cable General purpose extended length	Qty: _____
e	89-10836	100' Network Cable General purpose extended length	Qty: _____
f	S2-60439	100' Network Plenum Cable Plenum rated extended length.	Qty: _____
g	S2-60534	200' Network Cable General purpose extended length	Qty: _____
h	S2-60535	200' Network Plenum Cable Plenum rated extended length.	Qty: _____
l	S2-60536	400' Network Cable General purpose extended length	Qty: _____
j	S2-60537	400' Network Plenum Cable Plenum rated extended length.	Qty: _____
k	S2-60538	1000' Network Cable General purpose extended length	Qty: _____
l	S2-60539	1000' Network Plenum Cable Plenum rated extended length.	Qty: _____
	Don't forget to order the network cable to the operator display positions (HIBs).		
15	Order Custom Length Network Cables If your Operator Interface (PC or Console) is located at a distance from your comparators, you will need to order extended network cables. See the <i>Network Cabling</i> section of this planner for details. For custom length cables, order a Base Cable Assembly and then a cable length in feet. Base Cable Assy: S1-60197 Cable Assy Network Base Qty: _____ Cable Length: 30-10947 Cable Network Custom Length Qty: _____ ft 30-10957 Cable Network Custom Length Plenum Qty: _____ ft Order each Base cable assembly on one line, followed by the Cable Length on the next line.		
16	Order Network Terminators Each network needs (2) terminators: S2-60318 Terminator, Network		Qty: <u> 2 </u>

Continued

Designing an MCN system

<p>17</p> <p>a</p> <p>b</p> <p>c</p> <p>d</p> <p>e</p> <p>f</p>	<p>Order power supplies: Each power supply can power up to (4) modules at a total cable length of up to 100 feet. See the <i>Power Requirements</i> section for more details.</p> <p>Total number of modules: (CIBs, AIBs, IIBs, HIBs) _____</p> <p>Divide by 4 and round up to next whole number This is the basic number of power supplies needed. _____</p> <p>Add power supplies to keep network cable lengths from power supplies to their furthest modules to 100 feet or less: _____</p> <p>Total Power Supplies (add 17b and 17c) _____</p> <p>Order:</p> <table border="0"> <tr> <td>81-10398</td> <td>120 VAC US/ Canadian Power Supply</td> <td>Qty _____</td> </tr> <tr> <td>81-10728</td> <td>230 VAC European Power Supply</td> <td>Qty _____</td> </tr> </table> <p>The 230 VAC power supply has an IEC power connector. Customer must furnish line cord for local power connections.</p>	81-10398	120 VAC US/ Canadian Power Supply	Qty _____	81-10728	230 VAC European Power Supply	Qty _____
81-10398	120 VAC US/ Canadian Power Supply	Qty _____					
81-10728	230 VAC European Power Supply	Qty _____					
<p>18</p>	<p>Order the appropriate spare modules. See the <i>MCN System Components</i> section for spare part numbers.</p>						
<p>19</p>	<p>Order the appropriate manuals. See the <i>MCN System Components</i> section for spare part numbers.</p>						
<p>20</p>	<p>If this is a Logic I/O system connected to a console, order the required number of Input/Output cards and comparator display modules (if needed) for the console.</p>						

6. Appendix B Available Documents

The following manuals are available for the MCN Remote Comparator Display system:

	CIB Catalog Sheet
	IIB Catalog Sheet
	HIB Catalog Sheet
	MCN Remote Comparator Display Catalog Sheet
	MCN System Extender Module Catalog Sheet
S2-60425	MCN System Installation Manual
S2-60399	AIB ASTRO-TAC Interface Module Manual
S2-60400	IIB I/O Interface Module Manual
S2-60426	CIB Comparator Interface Module Manual
S2-60427	HIB Host Computer Interface Module Manual
S2-60469	TIB Transmitter Steering Interface Module Manual
S2-60596	EXB MCN System Extender Module Manual
S2-60428	MCN Remote Comparator Display Software Manual

7. Appendix C System Examples

The following examples show how MCN modules are combined to form various systems, as well as the capabilities of those systems.

7.1 Example 1 - PC Based System for DIGITAC Comparator-- 8 Receivers

Figure 14 shows a system that provides local monitoring and control of up to 8 receivers utilizing a PC as the operator interface. This system assumes the following:

- DIGITAC Comparator, 8 Receivers
- PC Display
- CIB will be mounted on the rear of the Digitac Comparator
- North American power supply is required.
- 100 feet between PC and comparator
- HIB will be rack-mounted in the operator console.

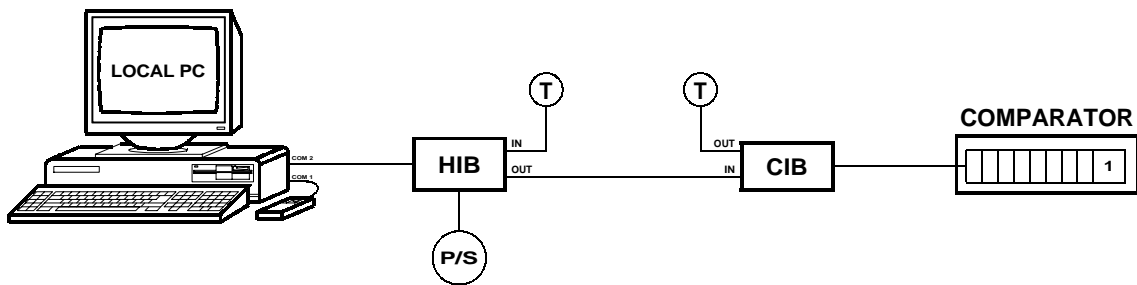


Figure 14 - 8 Digitac Receivers with PC Display
(P/S = Power Supply, T = Network Terminator)

This is an easy system to order since there is a packaged model for an 8-receiver DIGITAC comparator with PC display: Order the following items:

Equipment List for Example System 1

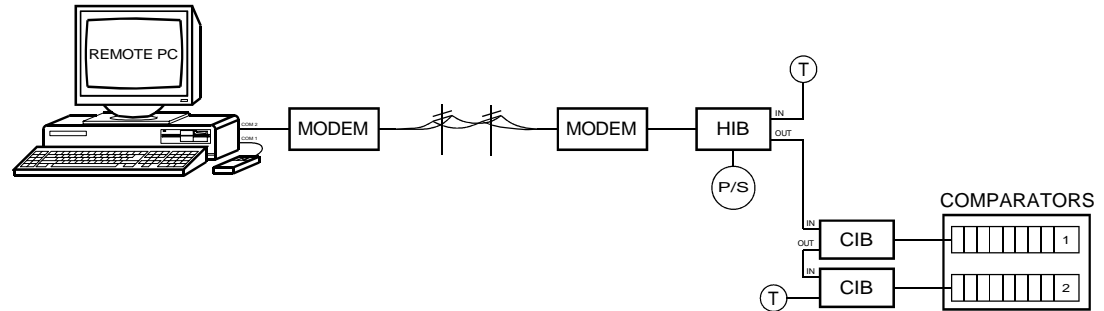
Item	Part Namber	Description	Qty
1	S2-60442	Comparator Interface Module (CIB)	1
2	S1-60424	Host Computer Interface Module (HIB) and MCN Remote Comparator Display DOS Software	1
3	S2-60441	HIB - PC (9 or 25 Pin) 6' Serial Cable	1
4	S2-60437	DIGITAC Bracket and Ribbon Cable (for CIB)	1
5	S2-60435	Quad Rack Mount Size A (1 Rack Unit high) (for HIB)	1
6	89-10836	100 Ft Network Cable	1
7	S2-60318	Terminator (1 each)	2
8	81-10398	Power Supply N. American	1

Order the PC separately. See the *System Hardware Requirements* section for details.

7.2 Example 2 - PC Based dial-up System for Spectra-TAC or Ericsson Comparator-- 12 Receivers

Figure 15 shows a simple dial-up system to monitor and control 12 or 16 receivers. This system assumes the following:

- Spectra-TAC or Ericsson / GE Comparator, 16 (or 12) Receivers maximum,
- Dial-Up PC Display
- CIBs & HIB will be rack mounted
- Wiring will be directly to the back of the comparator backplanes with no punch blocks.



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Figure 15 Dial-Up Display for up to 16 Receivers

Equipment List for Example System 2

Item	Part Nmber	Description	Qty
1	S2-60442	Comparator Interface Module (CIB)	2
2	S1-60424	Host Computer Interface Module (HIB) and MCN Remote Comparator Display DOS Software	1
3	89-10843	Male to Blunt Cable 25'	2
4	S2-60445	HIB - Modem 3' Serial Cable	1
5	S2-60450	PC (9 or 25 pin) to Modem Cable	1
6	99-10962	Modem V.34 28.8 Kb Dial-up	2
7	S2-60435	Quad Rack Mount Size A (1 Rack Unit high)	1
8	S2-60438	9" Network Cable	2
9	S2-60318	Terminator (1 each)	2
10	81-10398	Power Supply N. American	1

Order the PC separately. See the *System Hardware Requirements* section for details.

7.3 Example 3 - Extended Distance Spectra-TAC or Ericsson Comparator Connected to a Console -- 16 Receivers

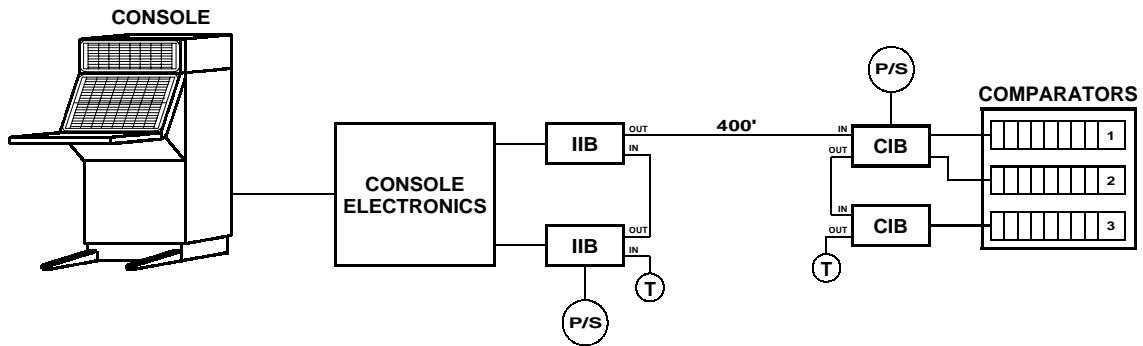
A multiple comparator system is shown in Figure 17. This system implements monitoring and control of 3 different comparators from one console.

This system assumes the following:

- Spectra-TAC or Ericsson / GE Comparator, 16 Receivers maximum
- Console Display
- CIBs will be rack mounted
- IIBs will be rack mounted
- 400 feet between comparators and console electronics
- Punch blocks are used for connection to comparators and to the consoles (Note that the punch blocks are not shown on the diagram.)

Why in the world would we use an MCN system to connect the comparators to the console electronics? Can't they be connected directly? Normally, they can. In this case, the console electronics enclosure is located 400 feet from the comparators. For the logic signals involved, there is a typical limit of about 200 cable feet between the comparator and the console electronics. We are using the MCN system as wire extenders to get rid of the 200 ft limitation. Only a single network cable for the MCN system has to be run the 400 ft. The MCN system can function to 4000 feet. If more than 4000 feet are required, CTI Products can furnish MCN EXB System extender Modules which can extend the network over telephone lines.

Notice that in this system, one CIB module is being used to control receivers from two comparators (comparators 1 and 2). The only requirement for this setup is that both comparators 1 and 2 are the same type (in this case they are both Spectra TAC or both Ericsson / GE). Comparator 3 does not have to be the same type as comparators 1 and 2 since it connects to a different CIB. We are using punch blocks in this system so we can easily connect comparators 1 and 2 to CIB module 1.



CA-80020-100

Figure 16 - 16 Receivers with Console Display

(P/S = Power Supply, T = Network Terminator)

Equipment List for Example System 3

Item	Model/Option	Description	Qty
1	S2-60433	IIB Input/Output Interface Module	2
2	S2-60442	CIB Comparator Interface Module	2
3	S2-60435	Quad Rack Mount Size A (1) for CIBs, (1) for extended IIBs	2
4	89-10837	Cable Assy 25 pr M-M 25' (2) for CIBs, (2) for IIBs	4
5	31-10354	Punch Block, 50-Pair (1) for CIBs, (1) for IIBs	2
6	S2-60438	Cable Assy Network 9"	2
7	S2-60536	400 Ft Network Cable	1
8	S2-60318	Network Terminator	2
9	81-10398	Power Supply N. American (2) needed because of cable length.	2

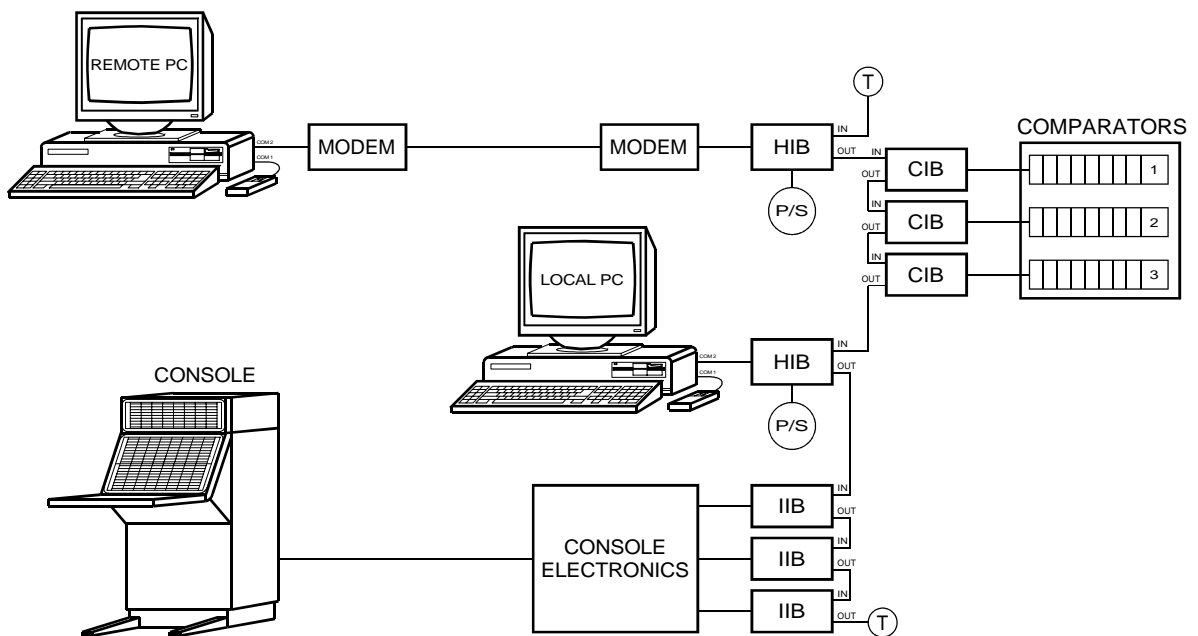
Be sure that the console has console has enough I/O boards and points available. For button and LED consoles, be sure that the operator positions have the proper number of Comparator Status Display Modules. The console may also require re-programming to implement the comparator display. Electronics has (4) B1426 Comparator Interface Modules.

7.4 Example 4 - 24 Receivers with Multiple Operator Positions

The example in Figure 17 shows a much larger system than the previous examples. Three CIB modules are used to control a total of 24 receivers. The three IIB modules can be used to provide control of all receivers from the main console. Each PC in the system can control all receivers as well. The HIB modules provide both local and remote control of all receivers. With the HIB connected directly to the modem, the comparators can be accessed from anywhere that has a dial-up phone line.

This system assumes the following:

- (2) Spectra-TAC Comparator (comparators 1 & 2), 8 receivers each
- (1) DIGITAC Comparator (comparator 3), 8 receivers
- 1000 feet between comparators room and the CEB room
- Local PC display in the console electronics room
- Dial-up PC for remote monitoring
- Console Display using Extended IIBs
- All comparators are mounted in the same rack.
- The Dial-up HIB and the CIBs for the Spectra-TAC comparators will be rack mounted in same cabinet as the comparators
- CIBs will be connected to Spectra-TAC comparators with blunt-end cables wired directly to the back of the comparators.
- The CIB for the DIGITAC comparator will mount to the rear of the comparator with a Digitac Bracket and Cabling kit.
- IIBs will be rack mounted in the CEB room
- The HIB in the CEB room will be mounted under a desk-top using a wall-mount kit.
- Punch blocks are used for connection between the IIBs and the consoles CEB (punch blocks are not shown on the diagram.)



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Figure 17 - 24 Receivers with Multiple Operator Console and PC Positions

(P/S = Power Supply, T = Network Terminator)

Power is provided to this MCN system from two power supplies. One supply power one HIB module and all three CIB modules. Another supply power the second HIB module and the three IIB modules.

This system allows parallel status and control of three comparators from three operator locations. If an operator at one location force votes a receiver, the other two operator stations will show that receiver as voted. Or, if an operator disables a receiver, all other operator stations will also show that receiver as disabled. If one of the comparators signals that a receiver is voted, all three stations will show the receiver being voted.

Equipment List for Example System 4

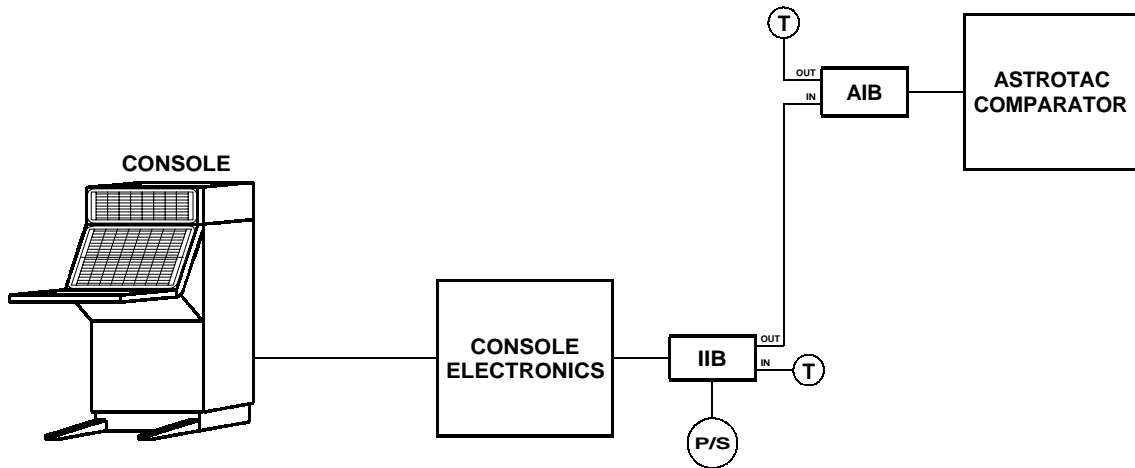
Item	Model/Option	Description	Qty
1	S2-60433	IIB I/O Interface Module	3
2	S2-60442	CIB Comparator Interface Module	3
3	S1-60424	Host Computer Interface Module (HIB) with MCN Remote Comparator Display DOS Software for Local and Dial-Up PC	2
	Order Separately	PCs for Local and Dial-Up display **	2
4	S2-60441	Serial Cable Kit (includes cable and adapter for 9 pin or 25 pin communication ports) for local HIB	1
5	S2-60445	Serial Cable for HIB to Modem for Dial-Up HIB	1
6	99-10962	V.34 Dial-Up Modems	2
7	S2-60450	PC (9 or 25 pin) - Modem 6' Serial Cable	1
8	S2-60437	DIGITAC Bracket and Cable Kit	1
9	S2-60435	Quad Rack Mount Size A (1) for Spectra-TAC CIBs, (1) for extended IIBs	2
10	S2-60436	Wall Mount Kit (For mounting HIB in console electronics room)	1
11	89-10837	Cable Assy 25 pr M-M 25' for IIBs	3
12	89-10843	Male to Blunt Cable 25' for Spectra-TAC Comparators	2
13	31-10354	Punch Block, 50-Pair (for IIBs)	2
14	S2-60438	Cable Assy Network 9" (1) Dial-up HIB to Spectra-TAC CIB (1) Spectra-TAC CIB to Spectra-TAC CIB (2) IIB to IIB	4
15	89-10732	3' Network Cable Quad rack mount to Digitac CIB	1
16	89-10835	25' Network Cable HIB in CEB room to IIB Quad rack mount	1
17	S2-60538	1000 Ft Network Cable DIGITAC Comparator CIB Module to HIB in console electronics room	1
18	S2-60318	Network Terminator	2
19	81-10398	Power Supply N. American (2) needed to power (8) modules	2

There is one limitation of a system which uses both HIBs and IIBs together to control the same comparator. The console Disable LED can get out of sync if the PC re-enables a receiver. See the *Appendix E System Limitations when using HIB and IIB Modules Together* section for details.

7.5 Example 5 - ASTRO-TAC Comparator with 8 Receivers Displayed on a Console

Figure 18 shows an MCN system that provides monitoring and control of up to 8 receivers connected to a Motorola ASTRO-TAC comparator. Since the system has only 8 receivers, only one IIB module is required. This system assumes the following:

- ASTRO-TAC Comparator, 8 Receivers
- Console Interface
- Comparators and console electronics are located within 25 feet of each other
- The AIB and IIB modules will be rack mounted
- North American power supply is required.



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Figure 18 - 8 ASTRO-TAC Receivers with Console Display

(P/S = Power Supply, T = Network Terminator)

This is an easy system to order since there is a packaged model for an 8-receiver ASTRO-TAC comparator with console display: Order the following items:

Equipment List for Example System 5

Item	Model/Option	Description	Qty
1	CDN6119	ASTRO-TAC AIB Module (Order from Motorola)	1
2	CDN6131	AIB to ASTRO-TAC cable (10 ft.) (Order from Motorola)	1
3	S2-60433	IIB Input/Output Interface Module (8 Rx)	1
4	S2-60435	Quad Rack Mount Size A (1 Rack Unit high)	1
5	89-10837	Cable Assy 25 pr M-M 25' (for IIB)	1
6	31-10354	Punch Block, 50-Pair (for IIB)	1
7	S2-60438	9" Network Cable	1
8	S2-60318	Terminator (1 each)	2
8	81-10398	Power Supply N. American	1

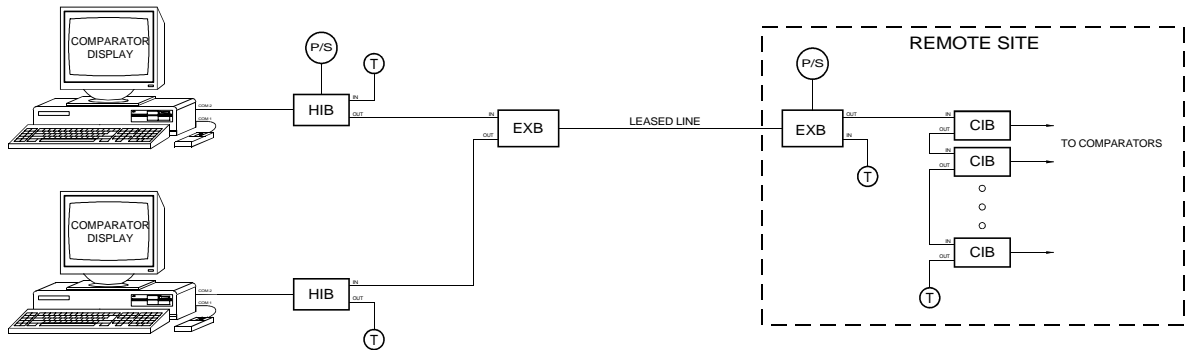
Be sure that the console CEB has (2) B1426 Comparator Interface Modules.

For button and LED consoles, be sure that the operator positions have the proper number of B1439 Comparator Status Display Modules.

7.6 Example 6 - Multiple Remote PCs using EXB System Extenders

When only one remote PC is needed to monitor remote comparators, a HIB Host Computer Interface Module and a pair of modems are used. If multiple PCs are required, that method would require multiple telephone lines, one for each PC.

Figure 19 shows a way to connect multiple PCs to remote comparators using only one phone line. The pair of EXB System Extender Modules extend the MCN network at the remote site to the local site. The remote network of CIB Comparator Interface Modules is essentially re-created at the local site. Multiple PCs are then connected to the local MCN network through standard HIB Host Computer Interface Modules. The number of PCs at the local site is limited only by standard MCN system limitations.



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Figure 19 Multiple Local PC Displays with Remote Comparators using EXB Modules

Systems using EXB System Extender Modules are considered custom designed systems. Please contact a CTI Products application engineer for help in designing a system.

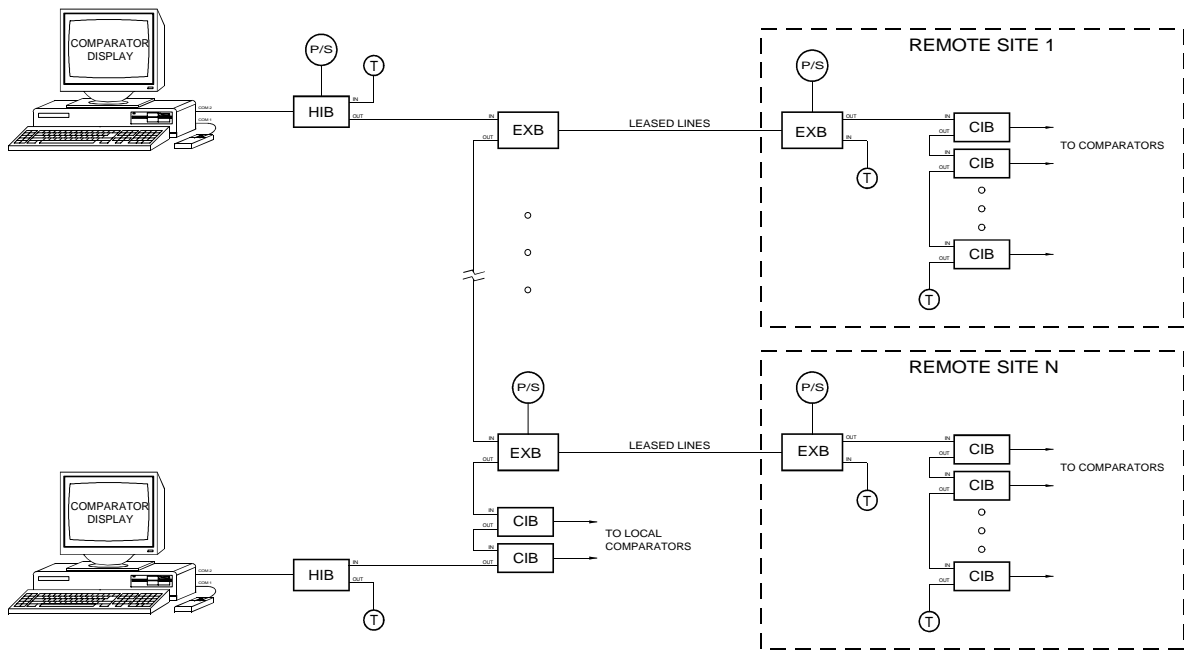
7.7 Example 7 - Multi-Site Comparator Networks Zone & Master/Slave (Sub) Comparators

Many voting systems covering a large geographic area will have comparators located at multiple sites. In this way, comparators for particular zones are located close to their receivers, with the voted audio brought back to the dispatch center on a single phone line for each zone. This greatly reduces the length and cost of the associated telephone lines.

Some state-wide or city-wide systems use Master-Slave (or Sub-Comparator) systems. In these systems, the City-Wide or State-Wide channel is broken into zones, each with its own comparator, called Slave or Sub-Comparators. The voted audio from the Sub-comparators is brought back to a Master comparator at the dispatch location. The Master comparator then picks the best signal from the sub-comparators.

Figure 20 shows a way to monitor and control the comparators in a Zone or Master/Slave (Sub) Comparator system. Each of the remote sites has its comparators connected to CIB modules on its own MCN network. Each remote site is connected back to the central (master) site through a pair of EXB System Extender modules. The master site has its Master Comparator connected to CIB Comparator Interface Modules.

Since all the MCN networks are connected together at the master site, the PCs there can monitor comparators at multiple sites simultaneously. If, for instance, a wide-area channel has 3 sub-comparators, the PCs can monitor all 3 sub-comparators and the master comparator simultaneously.



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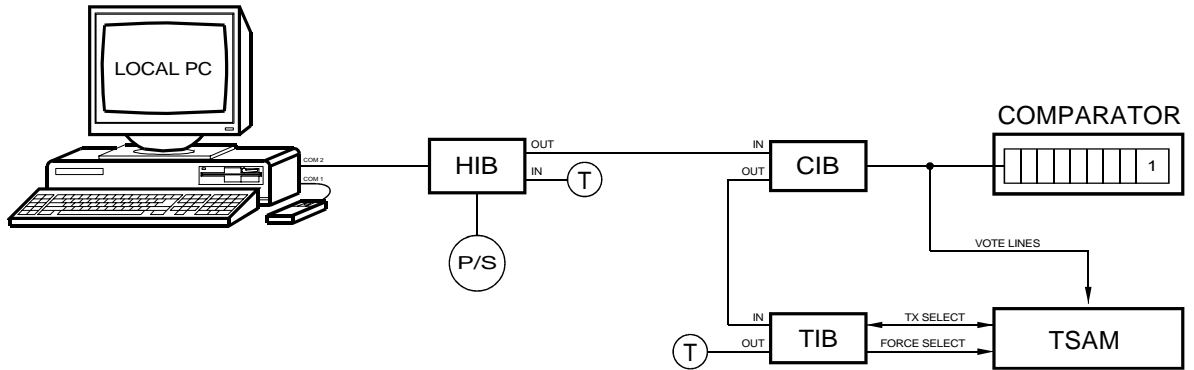
Figure 20 Multiple Remote Comparator Sites combined with EXB Modules

Systems using EXB System Extender Modules are considered custom designed systems. Please contact a CTI Products application engineer for help in designing a system.

7.8 Example 8 - Controlling Transmitter Steering Systems using TIB Modules

Figure 21 shows a single-channel 8-receiver comparator system, a TSAM Transmitter Steering Unit, and a TIB Transmitter Steering Interface Module.

Systems using TIB Transmitter Steering Interface Modules and TSAM Transmitter Steering Units are considered custom designed systems. Please contact a CTI Products application engineer for help in designing a system.



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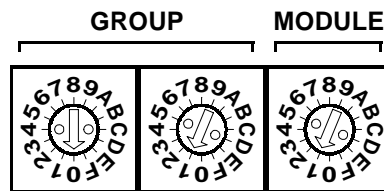
Figure 21 Controlling a Transmitter Steering System with a TIB Module

Systems using EXB System Extender Modules are considered custom designed systems. Please contact a CTI Products application engineer for help in designing a system.

8. Appendix D Module Addressing and Receiver Banks

8.1 Module Addressing

Each MCN module is identified by a unique address that must be set at installation time. This address is specified by the combination of a Group number and a Module number. The Group and Module numbers are assigned with the rotary switches on either the front or back of the module. Whenever the Group or Module number is changed, the module must be reset or power cycled for the change to occur.



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Figure 22 - Group and Module Switches

Figure 22 shows a view of the Group and Module switches. Valid ranges of these switches are:

- Group number = 00 through FE
- Module number = 0 through F (16 modules per group)

Group number FF is reserved and should not be used for any module in the system. If Group number FF is assigned to a module, the module, when reset, will lock on its ERR LED and halt. All modules in a system must have unique addresses. If two or more modules are set to the same address, your system will not work properly and you could have unintended operation. Other than those restrictions, any Group/Module combination can be used for any module.

Certain MCN modules must have two addresses specified. One is for the MCN module that it will operate with and the other is for the module itself. The IIB module requires this dual address information. Refer to the IIB's hardware reference manual for details about setting the two addresses.

Assign all Comparator I/O Modules to the same Group or set of Groups (if you have more than 16 modules), typically beginning with Group 00, Module 0 and progressing sequentially. Although modules can be added at higher addresses later, if you have plans to expand a channel, you may want to leave module addresses open for the expansion.

Assign all User Interface Modules to the same Group or set of Groups (if you have more than 16 modules), beginning with Group 80, Module 0.

When using the HIB User Interface Module with the MCN Remote Comparator Display software, only four Groups can be monitored and controlled at a time on one PC. If you are going to be using this User Interface Module, plan the addresses of your Comparator I/O modules so that you use as few different Groups as possible.

In a large system, you can monitor and control more than 4 Groups on a PC using the HIB; you are just limited to 4 groups simultaneously. For these types of large systems, group your modules so that all the receivers you may want to watch simultaneously are within the same 4 groups. Large systems (over 20 CIB and AIB modules) will be custom designed by CTI Products.

8.2 Receiver Banks

The CIB parallel Comparator Interface Module controls and monitors 8 receivers. The AIB supports all 16 receivers of an ASTRO-TAC comparator.

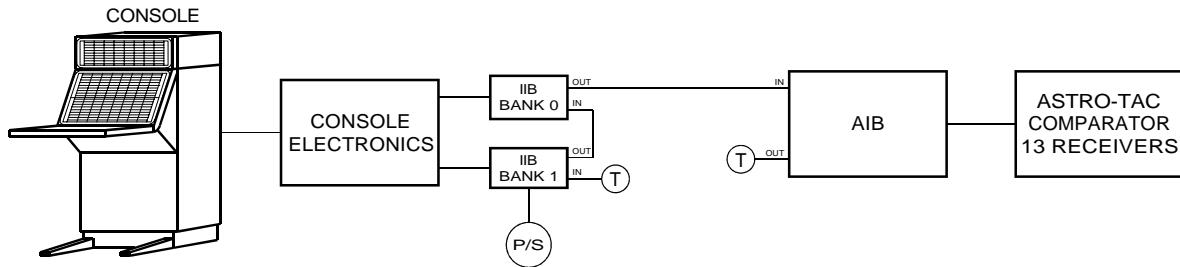
For Comparator I/O Modules such as the AIB module that support more than 8 receivers, the receivers are grouped into **banks** of 8 receivers. Some User Interface Modules, such as HIBs operating with the MCN Remote Comparator Display software support only bank 0. Other User Interface Modules, such as the IIB, can be configured to control any one of the 8 banks.

Below is a list of the MCN banks and the receivers contained in those banks.

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

Table 8 - MCN Receiver Banks

In the example shown in Figure 23, the ASTRO-TAC comparator supports 16 receivers. The AIB divides the receivers into two banks (receiver banks 0 and 1) for its communications with the User Interface Modules (the IIB modules). Two IIBs are installed in the example system to support these 16 receivers. When the IIBs were installed, each had to be configured (through front panel option switches) for the bank of receivers that each will be monitoring. The first IIB is configured to monitor receivers 1 through 8 (bank 0). The second IIB is configured to monitor receivers 9 through 16 (bank 1). With this configuration, the console can monitor and control receivers 1 through 16.



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Figure 23 - MCN Bank Configuration Example

9. Appendix E System Limitations when using HIB and IIB Modules Together

Because the console VOTE and DISABLE lines are bi-directional, the console's LEDs will be lit if the console's 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. Take for example the system shown in Figure 4.

When the DISABLE button on the console is pressed, the DISABLE LED on the console will immediately turn on and stay on after the DISABLE button is released since it is a latched output. The console will show a Disable condition, even if there was a problem with the network or the AIB.

Likewise, in a mixed system with HIBs and IIBs, if a receiver is disabled through the console (with its latching output) and then a PC user re-enables the receiver, the receiver will actually be enabled, but the console will show it as disabled. In this case, the console operator must press the disable button again to release the latch in the console.

10. Appendix F Warranty

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 installation, up to a maximum of 14 months from shipment from CTI Products, Inc. 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.

11. Appendix G Customer Support

**For Pre- and Post-sale support,
large systems, custom system design, or special applications contact:**

**CTI Products, Inc.
1211 West Sharon Road
Cincinnati, Oh 45240
Phone: (513) 595-5900 Fax: (513)595-5983.
8:30 to 5:00 Eastern time**

12. Appendix H Glossary

16 I/O Module	This is a generic term for the B1426 Comparator Interface Module in the CEB of a Centracom Series II console.
AIB Module	ASTRO-TAC Comparator Interface Module. The AIB Module connects Motorola's ASTRO-TAC comparator to the MCN network.
CEB	Central Electronics Bank for a Centracom Series II (or later) console.
CIB Module	Comparator Interface Module. The CIB module connects various types of parallel I/O comparators (such as DIGITAC, Spectra-TAC and TAC comparators) to the MCN network. A CIB module controls 8 receivers. Do not confuse this with the B1426 Comparator Interface Module which plugs into the CEB of a Centracom Series II console
Comparator I/O Module	This is a generic term used to describe the modules that connect a comparator to the MCN network. Comparator I/O Modules include the AIB ASTRO-TAC Interface Module and the CIB Comparator Interface Module.
EXB Module	The EXB System Extender Modules are used in pairs to extend the MCN network to distances greater than 4000 feet. These operate over leased telephone lines or microwave channels.
HIB Module	Host Computer Interface Module. The HIB module provides a connection to the MCN network for a PC. It uses a serial interface on the PC and works with CTI Products' MCN Remote Comparator Display (MCN RCD) software to provide comparator monitoring and control.
IIB Module	Input/Output Interface Module. The IIB module is a User Interface Module that connects to the MCN network. It provides discrete, parallel I/O points for connection to a console system. It is typically connected to B1426 Comparator I/O Modules in the CEB.
MCN System	This is the name for CTI Products' Monitoring and Control Network system. Modules in the MCN System product line include the AIB, IIB, CIB, and HIB modules.
MCNCFG	This is the configuration software that is included in a PC-based MCN system. This software allows the user to custom-configure the comparator display screens used with the MCN Remote Comparator Display System program.
MCN RCD	This is the MCN Remote Comparator Display software. It is used in PC-based comparator display system.
RCD	Remote Comparator Display
TIB Module	Transmitter Steering Interface Module. The TIB module works with a CIB module and an external Transmitter Steering Unit. The TIB module sends Selected TX indications back to the HIB module (through the CIB module). It also accepts Force Vote signals from the CIB module to force-steer a transmitter site.
User Interface Module	This is a generic term used to describe the modules that connect a user interface (console or PC) to the MCN network. User Interface Modules include the IIB Input/Output Interface Module for use with consoles and the HIB Host Computer Interface Module for use with PCs.