

# TDC



## Theater Deployable Communications

Baseline Requirements Document

**Basic Access Module**

**BAM (v3.1)**

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Approved for public release; distribution is unlimited.

## Table of Contents

1.0 SCOPE - - - - -	6
2.0 APPLICABLE DOCUMENTS - - - - -	7
3.0 REQUIREMENTS - - - - -	8
3.1 Module Definition - - - - -	8
3.2 Performance Requirements- - - - -	9
3.2.1 Electrical Interface Requirements (External)- - - - -	9
3.2.1.1 Prime Power - - - - -	10
3.2.1.2 IP 10BaseT/100BaseTX- - - - -	11
3.2.1.3 10BaseFL - - - - -	11
3.2.1.4 100BaseFX- - - - -	11
3.2.1.5 1000BaseSX - - - - -	11
3.2.1.6 Voice Switch Bus- - - - -	11
3.2.1.7 IP and Circuit Admin (DB9, RS-232) - - - - -	11
3.2.1.8 Circuit Admin (10BaseT)- - - - -	12
3.2.1.9 T-1/ISDN-PRI - - - - -	12
3.2.1.10 Clock Sync - - - - -	12
3.2.1.11 Voice Connections- - - - -	12
3.2.1.11.1 Subscriber Interfaces - - - - -	13
3.2.2 Electrical Interface (Internal) - - - - -	13
3.2.3 Functional Requirements - - - - -	13
3.2.3.1 Basic Configuration- - - - -	13
3.2.3.1.1 Datagram Switched Network Functions- - - - -	14
3.2.3.1.2 10BaseT/100BaseTX LAN Access - - - - -	14
3.2.3.1.2.1 IP Backbone Connectivity - - - - -	15
3.2.3.1.2.2 IP Administration - - - - -	15
3.2.3.1.3 SCN Functions - - - - -	15
3.2.3.1.3.1 Local Subscriber Access - - - - -	16
3.2.3.1.3.2 Voice Switch Administration - - - - -	16
3.2.3.1.3.3 Circuit Switch Interconnection - - - - -	17
3.2.3.2 Configuration Options - - - - -	18
3.2.3.2.1 10BaseFL Connectivity - - - - -	18
3.2.3.2.2 Circuit Switch Configuration Options - - - - -	18
3.2.3.2.3 Configuration Kits- - - - -	18
3.2.4 Physical Characteristics - - - - -	19
3.2.4.1 Transit Case - - - - -	19
3.2.4.2 Weight - - - - -	19
3.2.4.3 Storage Space - - - - -	19
3.2.4.4 Marking - - - - -	19
3.2.5 Cables and Accessories- - - - -	20
3.2.6 Reliability - - - - -	20
3.2.7 Maintainability- - - - -	20
3.2.7.1 Mean Time Between Preventive Maintenance - - - - -	21
3.2.8 Environmental Conditions - - - - -	21

3.2.8.1	Temperature	- - - - -	21
3.2.8.2	Relative Humidity	- - - - -	21
3.2.8.3	Altitude	- - - - -	21
3.2.8.4	Sand and Dust	- - - - -	22
3.2.8.5	Shock	- - - - -	22
3.2.8.6	Vibration	- - - - -	22
3.3	Design and Construction	- - - - -	22
3.3.1	Material Parts and Processes	- - - - -	22
3.3.2	Safety	- - - - -	22
3.3.2.1	Electrical Safety	- - - - -	22
3.3.2.2	Mechanical Safety	- - - - -	23
3.4	Logistics	- - - - -	23
4.0	QUALITY ASSURANCE PROVISIONS	- - - - -	24
4.1	General	- - - - -	24
4.2	Responsibility for Inspection	- - - - -	24
4.3	Product Qualification Test (PQT)	- - - - -	24
4.4	Production Acceptance Test (PAT)	- - - - -	24
4.5	Verification Cross Reference Matrix (VCRM)	- - - - -	24
4.5.1	Not Required (N/R)	- - - - -	24
4.5.2	Inspection	- - - - -	24
4.5.3	Analysis	- - - - -	25
4.5.4	Demonstration	- - - - -	25
4.5.5	Test	- - - - -	25
5.0	PREPARATION FOR DELIVERY	- - - - -	27
6.0	Baseline Configuration	- - - - -	28
6.1	Equipment	- - - - -	28
6.2	Elevation Drawings	- - - - -	31
6.3	Cable Diagrams	- - - - -	33
6.4	Interconnection Diagrams	- - - - -	40

List of Tables

Table 1 - Standards and Applicable Documents - - - - - 7  
Table 2 - BAM v3.1 External Interface Characteristics - - - - - 10  
Table 3 - IP 10BaseT/100Base Tx - - - - - 11  
Table 4 - IP Ethernet Switch Admin - - - - - 12  
Table 5 - Circuit Switch Admin COM0 and COM1 - - - - - 12  
Table 6 - Circuit Switch Admin IGX Enet - - - - - 12  
Table 7 - Voice Connections - - - - - 13  
Table 8 - Voice Switch Features - - - - - 17  
Table 9 - Cables and Terminators included with BAM - - - - - 20  
Table 10 - MTBF of Major Components - - - - - 20  
Table 11 - Module Temperature Characteristics - - - - - 21  
Table 12 - Module Humidity Characteristics - - - - - 21  
Table 13 - Module Altitude Characteristics - - - - - 21  
Table 14 - Verification Cross Reference Matrix - - - - - 25  
Table 15 - Equipment Listing - - - - - 28  
Table 16 - Cable Listing - - - - - 33

Figure 1 - Internal Functional Block Diagram - - - - - 9  
Figure 2 - BAM v3.1 Block Diagram - - - - - 14  
Figure 3 - BAM v3.1 Datagram Switched Network Functions Block - - - - - 15  
Figure 4 - Switched Circuit Network Functions and Options - - - - - 16  
Figure 5 - Front Elevation - - - - - 31  
Figure 6 - Rear Elevation - - - - - 32

## **1.0 SCOPE**

This requirements document establishes the performance, manufacture and test requirements for the TDC ICAP Basic Access Module (BAM) v3.1.

## 2.0 APPLICABLE DOCUMENTS

To the extent specified herein, the following documents of latest current issue on the date of this Baseline Requirements Document form part of this BRD.

**Table 1 - Standards and Applicable Documents**

Document Number	Title
	Theater Deployable Communications Standards Document
ANSI Std. T1.102	American National Standard for Telecommunications - Digital Hierarchy - Electrical Interfaces
ANSI Std. T1.107	American National Standard for Telecommunications - Digital Hierarchy-Formats Specifications
ANSI T1.601-1992	American National Standard for Telecommunications - Minimal Set of Bearer Services for the ISDN S Interface
ANSI T1.603-1990	Telephone Instruments with Loop Signaling for Voice Applications
ANSI TIA/EIA-470-B 1997	Telephone Instruments with Loop Signaling for Voice Applications
ATT Pub. 43801	Digital Channel Bank Requirements and Objectives
EIA-232	Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange (Rates to 20 kbps)
ISO/IEC 8802-3 1996 ANSI/IEEE Std. 802.3	Information Technology- Local Metropolitan Area Networks-- Part3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specification. (Documents are one in the same; from IEEE, ANSI, ISO and IEC)
ITU Q.310 -- Q.326	[Signaling System R1, Various Recommendations]
ITU Q.920	ISDN User-Network Interface - Data Link Layer, General Aspect - Digital Subscriber Signaling System No.1
ITU Q.921	ISDN User-Network Interface - Data Link Layer Specification - Digital Subscriber Signaling System No.1
ITU Q.930	ISDN User-Network Interface - Layer 3, General Aspects - Digital Subscriber Signaling System No.1
ITU Q.931	ISDN User-Network Interface -Layer 3 Specification - Digital Subscriber Signaling System No.1
ITU X.25	Interface Between Data Terminal Equipment (DTE) and Data Circuit-Terminating Equipment (DCE) for Terminals Operating in the Packet Mode and Connected to Public Data Networks by Dedicated Circuit
MIL-STD-810F	Environmental Test Methods
*REDCOM Laboratories, Inc. 008421-V60, -EV60	IGX•C ISDN Gateway Exchange User's Manual V6.X
REDCOM Laboratories, Inc. 008836-001, -E001	Feature Addendum, Host Control Interfaces for IGX
REDCOM Laboratories, Inc. 008836-001, -E002	Feature Addendum, Basic for IGX
Various	Cisco Manuals

\* Delivered with module

## **3.0 REQUIREMENTS**

### **3.1 Module Definition**

The Basic Access Module v3.1 (BAM v3.1) is a flexible, scaleable and configurable module that provides both voice and data functions. It has two 10/100 Ethernet switches and a voice circuit switch that provide the following functions:

#### Datagram Switched Network Functions

Access for local 10BaseT/100BaseTX Ethernet users  
Connectivity via 10BaseFL/100BaseFX/1000BaseSX  
Local and remote configuration management  
802.3af POE

#### Switched Circuit Network (SCN) Functions

Access for local phone (POTS and digital) users  
Trunks for SCN backbone  
Local configuration management  
10base-T Ethernet access

#### Configurable Voice Switch Functions

Additional analog and digital subscribers  
Radio wireline interface  
16 party conferencing  
KY-68 interface

Figure 1 shows the Basic Access Module v3.1 internal and external interconnections. Detailed characteristics for each function may be found in Paragraph 3.2.

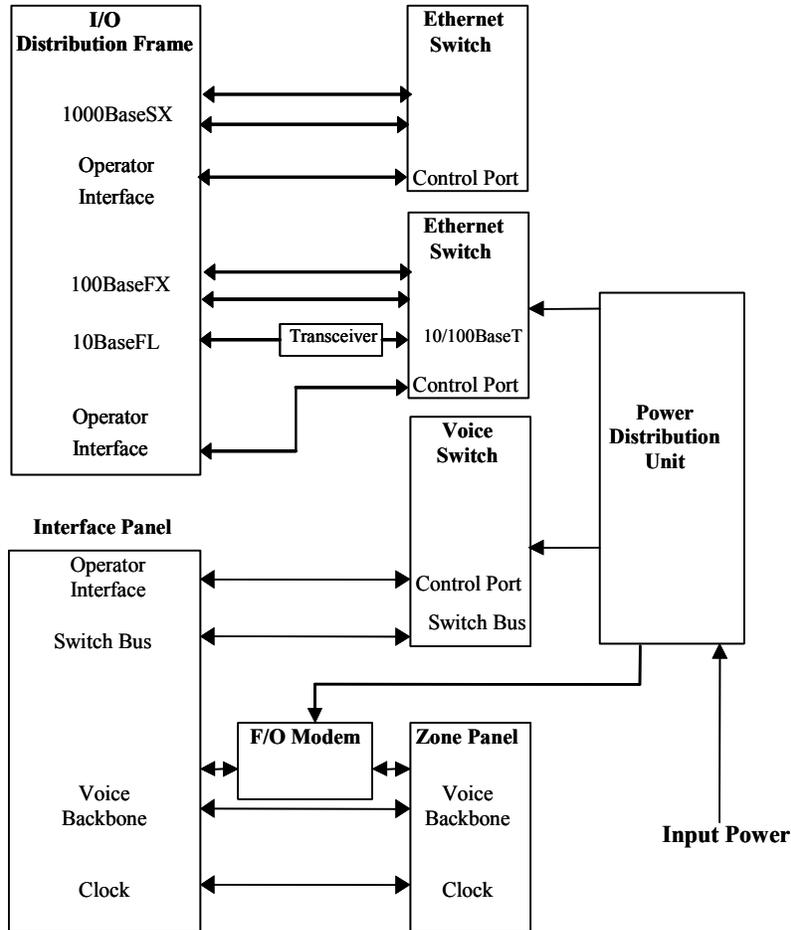


Figure 1 - Internal Functional Block Diagram

### 3.2 Performance Requirements

#### 3.2.1 Electrical Interface Requirements (External)

Access to the BAM v3.1 is through the module's Distribution Frame, Interface Panel and Switch Ports. They are internally wired to provide all the required connections, except the input power. The input power connection is at the power distribution unit. The access ports include the number and type of external interfaces presented in Table 2.

**Table 2 - BAM v3.1 External Interface Characteristics**

<b>Signal Name</b>	<b>Quantity</b>	<b>Connector</b>	<b>Input/Output</b>	<b>Primary Interface</b>	<b>Electrical Characteristics</b>
Prime power	1	IEC 320-C20 Receptacle	I	Local power source	100-127 and 200-240 VAC, 50-60 HZ
10BaseT 100BaseTX	69	RJ 45	I/O	Local users – I/O DF IP	IEEE Std 802.3
10BaseFL Backbone	1	ST (Fiber Optic)	I/O	IP Backbone and/or BAMs	IEEE Std 802.3
100BaseFX Backbone	4	ST (Fiber Optic)	I/O	IP Backbone and/or BAMs	IEEE Std 802.3
1000BaseSX Backbone	2	ST (Fiber Optic)	I/O	IP Backbone and/or BAMs	IEEE Std 802.3
Voice Switch Bus	2	Cannon CIR 020R	I/O	Module inter-connections	REDCOM proprietary
IP Switch Admin	2	DB 9F	I/O	Local administrator – I/O DF	EIA RS-232
Circuit Switch Admin	2	DB 9F	I/O	Local administrator – I/O DF	EIA RS-232
Circuit Switch Admin	1	RJ 45	I/O	Local administrator – I/O DF	IEEE Std 802.3
T-1/ISDN-PRI	2	ST (Fiber Optic)	I/O	Node to node or node to Base Hub connectivity	ANSI T1.603- 1990
T-1/ISDN-PRI	2	RJ 45	I/O	Node to node or node to Base Hub connectivity	ANSI T1.603- 1990
Clock Sync In	1	Cannon CIR 020R	I	Voice Switch	REDCOM proprietary
Clock Sync Out	1	Cannon CIR 020R	O	Voice Switch	REDCOM proprietary
Voice Connections	5	TELCO 50 Pin Receptacle	I/O	Remote and Local Users	ANSI TIA/EIA- 470-B 1997
Voice Connections	24	RJ 11 Pin Receptacle	I/O	Remote & Local Users	RJ 11
MPU Input	1	Cannon CIR 020 R	I	Voiceswitch	REDCOM Proprietary
MPU Output	1	Cannon CIR 020 R	O	Voiceswitch	REDCOM Proprietary

### 3.2.1.1 Prime Power

The Basic Access Module v3.1 is designed to operate from 100 to 127 VAC and 200 to 240 VAC, 50 to 60 Hz, single-phase, three-wire power. The maximum current does not exceed 10.5 amperes at 120 VAC or 5.3 amperes at 230 VAC. The BAM v3.1 includes an internal power distribution unit to minimize line transients and EMI. The prime power connector is an IEC 320-C20 receptacle. Separate switches are provided on the power distribution unit for each prime component, that is Ethernet Switches, voice switch, etc.

### 3.2.1.2 IP 10BaseT/100BaseTX

The 10BaseT/100BaseTX input ports are in accordance with the eight-wire ANSI/IEEE Std 802.3 10BaseT/100BaseTX Standards. The connectors are RJ 45 Modular Jacks. Pin assignments are as shown in the table below. All inactive jacks on the I/O DF shall be physically covered.

**Table 3 - IP 10BaseT/100Base Tx**

Pin	Signal	Pin	Signal	Pin	Signal
1	TPO+	4	TP2+	7	TP3+
2	TPO-	5	TP2-	8	TP3-
3	TP1+	6	TP1-		

### 3.2.1.3 10BaseFL

A 10BaseFL to 10BaseT/100BaseTX Media converter is used to provide connection to legacy 10BaseFL equipped devices. Therefore, the 10BaseFL Datagram Switched Network Backbone connections are fiber optic multi mode. Connectors are ST jacks (transmit and receive).

### 3.2.1.4 100BaseFX

The 100BaseFX Datagram Switched Network Backbone connections are fiber optic multi mode. Connectors are ST jacks (transmit and receive).

### 3.2.1.5 1000BaseSX

The 1000BaseSX Datagram Switched Network Backbone connections are fiber optic multi mode. Connectors are ST jacks (transmit and receive).

### 3.2.1.6 Voice Switch Bus

The Voice Switch Bus connectors are Cannon CIR 020R jacks with the pin-outs being proprietary. A 3.3-foot cable suitable to interconnect two BAMs is supplied with each BAM. Up to 8 BAMs may be interconnected.

### 3.2.1.7 IP and Circuit Admin (DB9, RS-232)

The IP Ethernet Switches and Circuit Switch Administration ports are in accordance with the DB 9, RS-232 standards using the VT100 Emulators (9600 bps, No Parity, 8 Data Bits, 1 Stop Bit). Each Admin connector is a DB-9F with pin assignments as shown in the following tables:

**Table 4 - IP Ethernet Switch Admin**

Pin	Signal	Pin	Signal	Pin	Signal
1	Data Carrier Detect	4	Data Terminal Ready	7	Request to Send
2	Received Data	5	Signal Ground	8	Clear to Send
3	Transmitted Data	6	Data Set Ready	9	Ring Indicator

**Table 5 - Circuit Switch Admin COM0 and COM1**

Pin	Signal	Pin	Signal	Pin	Signal
1	not used *	4	not used *	7	Request to Send
2	Received Data	5	Signal Ground	8	Clear to Send
3	Transmitted Data	6	not used *	9	not used

Note: Pins 1,4 and 6 are tied together at the Interface Panel

### **3.2.1.8 Circuit Admin (10BaseT)**

The 10BaseT Circuit Admin is in accordance with the eight-wire ANSI/IEEE Std. 802.3 10BaseT Standards. The connector is an RJ 45 Modular Jack. Pin assignments are as shown in the table below.

**Table 6 - Circuit Switch Admin IGX Enet**

Pin	Signal	Pin	Signal	Pin	Signal
1	TPO+	4	TP2+	7	TP3+
2	TPO-	5	TP2-	8	TP3-
3	TP1+	6	TP1-		

### **3.2.1.9 T-1/ISDN-PRI**

The SCN Backbone signals are 1.544 Mbps serial data formatted as T-1 or ISDN-PRI trunks. The SCN Backbone can be accessed via fiber optic multi-mode ST jacks or RJ 45 connections.

#### **3.2.1.10 Clock Sync**

A clock synchronization cable shall be attached to the Clock Sync out port.

#### **3.2.1.11 Voice Connections**

The connector is a 50-pin TELCO plug that provides up to 24 each 2-wire phone connections. Pin assignments are as shown in the following table:

**Table 7 - Voice Connections**

<b>Pin</b>	<b>Signal</b>	<b>Pin</b>	<b>Signal</b>	<b>Pin</b>	<b>Signal</b>	<b>Pin</b>	<b>Signal</b>
1	Ring	26	Tip	13	Ring	38	Tip
2	Ring	27	Tip	14	Ring	39	Tip
3	Ring	28	Tip	15	Ring	40	Tip
4	Ring	29	Tip	16	Ring	41	Tip
5	Ring	30	Tip	17	Ring	42	Tip
6	Ring	31	Tip	18	Ring	43	Tip
7	Ring	32	Tip	19	Ring	44	Tip
8	Ring	33	Tip	20	Ring	45	Tip
9	Ring	34	Tip	21	Ring	46	Tip
10	Ring	35	Tip	22	Ring	47	Tip
11	Ring	36	Tip	23	Ring	48	Tip
12	Ring	37	Tip	24	Ring	49	Tip
				25	N/C	50	N/C

### **3.2.1.11.1 Subscriber Interfaces**

The BAM v3.1 provides 24 subscriber voice interfaces on the rear RJ-11 Jack panel and additional interfaces (16 active without additional line cards) via the 10 ft Telco 50 cables and two 25-position RJ-11 harmonicas. Four ISDN BRI-S interfaces are provided via the included 6 position RJ-45 Harmonica.

### **3.2.2 Electrical Interface (Internal)**

This documentation shows the internal wiring of the major module components and the details of each major cable assembly internal to the module distribution frame. This information is found in Paragraph 6.4.

### **3.2.3 Functional Requirements**

#### **3.2.3.1 Basic Configuration**

The BAM v3.1 is a flexible, scaleable and configurable module, which performs both Datagram Switched Network and Switched Circuit Network (SCN) functions (Figure 2). It includes both an internal circuit switch that implements a Private Branch eXchange (PBX) and IP Ethernet switchable ports to permit users to create a local area IP datagram network. The BAM v3.1 provides two SCN and five datagram network backbone connections, which can be interconnected to the network hub or to another network node.

External circuit switch backplane bus and Ethernet switch connections are provided so that multiple BAMs may be connected together to form a single voice circuit switch and large LANs.

These connections permit additional SCN subscribers and LAN users to be added as a mission grows.

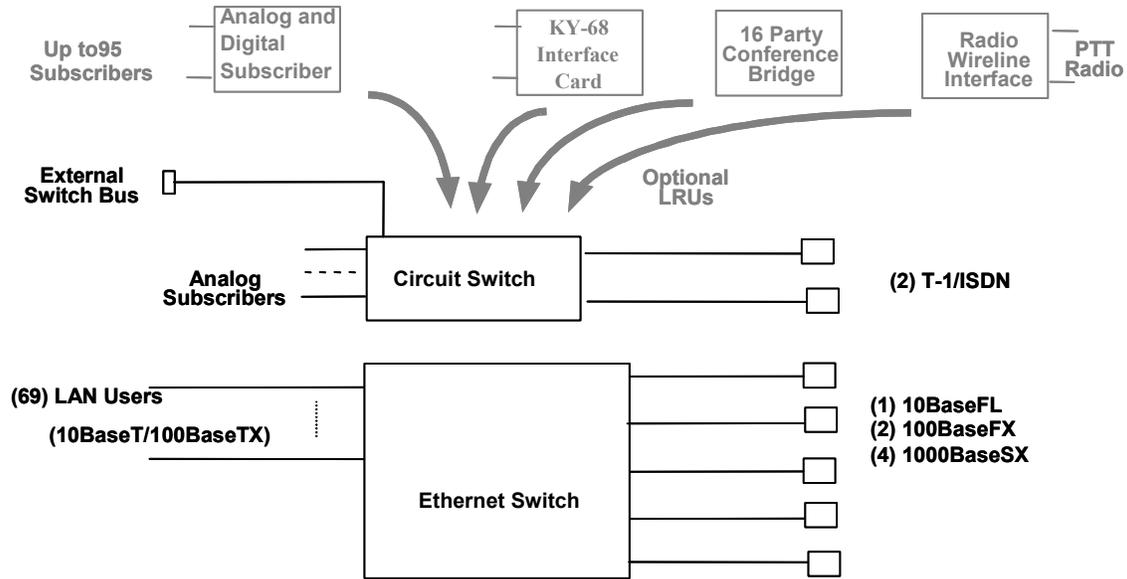


Figure 2 - BAM v3.1 Block Diagram

### 3.2.3.1.1 Datagram Switched Network Functions

The BAM v3.1 provides local LAN users access to the Datagram Switched Network, Ethernet switching, connectivity to the TDC ICAP Datagram Switched Network backbone and administration and control (Figure 3).

### 3.2.3.1.2 10BaseT/100BaseTX LAN Access

The BAM v3.1 provides Ethernet access for local data users to the TDC ICAP Datagram Switched Network. Access is provided for up to 69 10BaseT/100BaseTX users. All 10BaseT/100BaseTX accesses are Ethernet switch ports.

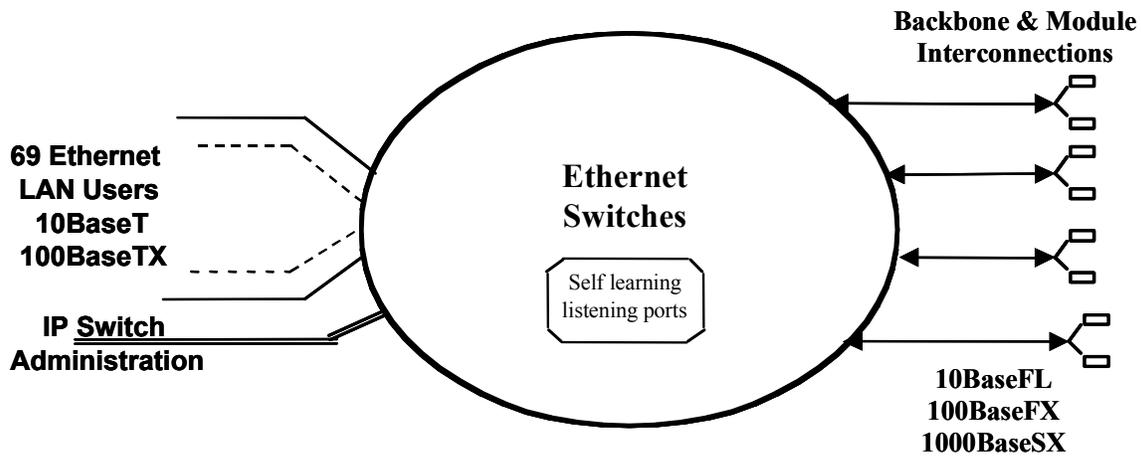


Figure 3 - BAM v3.1 Datagram Switched Network Functions Block

### 3.2.3.1.2.1 IP Backbone Connectivity

Five fiber optic multi mode output ports are provided at the I/O Distribution Frame. These ports provide connectivity to the Datagram Switched Network backbone and interconnections to other BAMs that are collocated.

### 3.2.3.1.2.2 IP Administration

The IP functions of the BAM v3.1 are manageable via an external PC computer interconnected to the IP Switch Admin connector at the module's I/O DF. Management of the following functions is provided:

- Configuration
- Status
- Control

### 3.2.3.1.3 SCN Functions

In the basic circuit switch configuration (i.e., no optional circuit cards), the BAM v3.1 provides local phone access for up to 40 analog, 4 digital users to the Switched Circuit Network, and 2 T-1/ISDN-PRI trunk connections to the TDC ICAP SCN backbone (Figure 4). The circuit switch is a REDCOM IGX•C Exchange, configured with the following cards:

- 2 ea. DS-1 trunk cards
- 1 ea. MTI card
- 1 ea. Clock synchronizer card

- 5 ea. Line Circuit card
- 1 ea. ISDN-Basic Rate “S” Interface card

The circuit switch provides the features in Table 8.

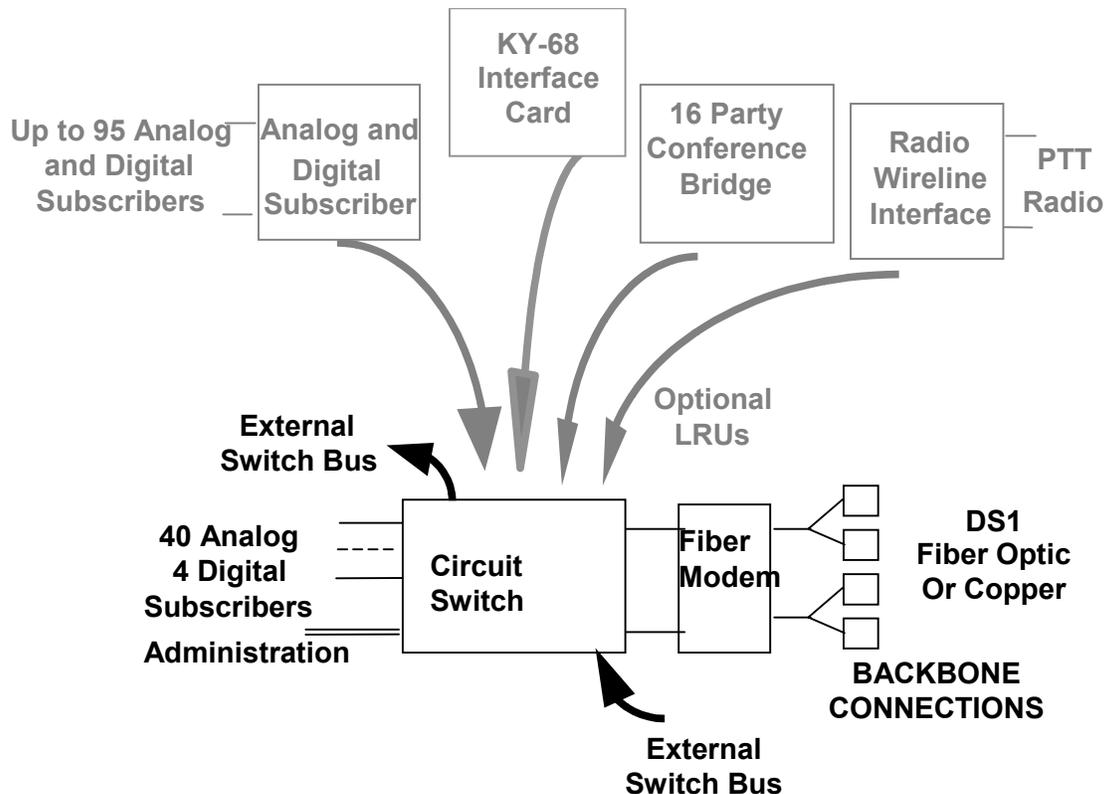


Figure 4 - Switched Circuit Network Functions and Options

### 3.2.3.1.3.1 Local Subscriber Access

The BAM v3.1, in its basic configuration, provides access to the Circuit Switch for 40 local telephone subscribers via 2-wire analog circuits. Additionally, the switch can support POTS (WECO 2500), faxes, modems, STU IIIs, and 4 ISDN-BRI “S” digital subscribers, i.e. digital phones and video teleconference units.

### 3.2.3.1.3.2 Voice Switch Administration

The BAM v3.1 provides the capability for the management of the voice switch through a local laptop computer via the Voice Switch Admin connector at the module’s Interface Panel, a remote location with an external modem or from 10BaseT Ethernet port. Management of the following functions is provided:

- a) Configuration
- b) Health and Status
- c) Control
- d) Downloading statistical data

**Table 8 - Voice Switch Features**

AUTOVON	Multi Level Precedence and Preemption (MLPP) & PRIORITY FEATURES- provides for processing emergency calls. There are six levels of emergency override.
SITE DOCS/PSR	SITE DOCS/V-LIST-provides the ability to execute the Site Office Records program available on a PCMCIA card. This program will automatically generate IGX system information including details on the following: Hardware Configuration, Dialing Plan, Trunks, Lines, and System Tables.
TOLL RESTRICTION	TOLL RESTRICTION FEATURE- provides the capability to restrict originating lines and trunks from accessing specified trunks, and to restrict the digits that they may dial on those trunks.
CO MF	MF SIGNALLING FEATURE-provides the ability for the switch to interpret Central Office Multi-Frequency signaling. The MF Sender/Receiver card is needed for this feature to work.
CUSTOM	ROSMI CUSTOM FEATURE- provides the ability for the switch to interface to the KY-68 Interface card.
HOST	HOST COMPUTER CONTROL (CTI) FEATURE- provides user access to the IGX Host Control Interface. This allows control of switching functions through an external host computer.
BOOK	Creates a phonebook (i.e. a database) of PBX users.
BASIC	Basic Program Language
CHAIN	Conference Chaining
LAW CONVERSION	IGATE
CLUSTER	Multi Cluster Feature
International	International Feature
ISDN	ISDN Features
EXP-ANN	Expanded Announcer Support
VOIP	Voice Over IP Support
619A	619A-PRI MLPP Support
MET	Multi E1/T1 Support
EISDN	Euro ISDN Support
CLASS	CO Class Features

### 3.2.3.1.3.3 Circuit Switch Interconnection

The Circuit Switch is configured with external backplane connections to enable multiple switches (up to a maximum of 8) to be interconnected to form a larger switch with “single switch” functionality. When a “single switch” is formed, only one administration connection is required.

### 3.2.3.2 Configuration Options

#### 3.2.3.2.1 10BaseFL Connectivity

A 10BaseT/100BaseTX to 10BaseFL Media converter is provided with the BAM v3.1 that allows connection to legacy 10BaseFL equipped devices.

#### 3.2.3.2.2 Circuit Switch Configuration Options

In addition to the basic functions and features, the installer may customize the switch by modifying the card complement to provide the additional features. Some of them are listed below:

- In conjunction with the KY-68 Interface Card access to 4 each KY-68s per card
- Up to 95 phone users – 2-wire analog and digital BRI “S”
- Push to Talk (PTT) – Radio wireline Interface
- 16 party conferencing
- E&M – 4 wire Type 1
- T1, E1 Trunks
- Etc.\*

\* See REDCOM Manual for a more complete listing of the interface and feature options.

The configuration cannot violate the basic configuration rules of the REDCOM IGX•C for the 96 time slots.

#### 3.2.3.2.3 Configuration Kits

The following kits are available to provide additional capabilities to the BAM:

- **Local Base Interface Kit** – provides for interconnectivity with local PBX systems via LSRD/GSRD trunk and E&M trunk 4-wire boards.
- **Radio Interface Kit** – provides LST-5 UHF radio interface cards for the switch.
- **Subscriber Extension Kit** – provides the capability to remotely distribute voice circuits from the voice modules.
- **Subscriber Loop Kit** – provides additional 2-wire POTS analog and ISDN-BRI S digital interface cards.
- **T1 Trunk - Including International and Echo Cancellation** – provides increased T1/ISDN-PRI and E1 trunk capability with echo cancellation
- **TRI-TAC Interface Kit** – provides SF Trunk circuits to interface with TRI-TAC services, such as TTC-39, SB-3865 circuit switches.
- **DSVT Kit** – provides the capability for 2 each KY-68's per card.
- **Lightning Protection Kit**

Many of the system level and maintenance kits can be used for BAM module troubleshooting and cable repair. These kits include:

- **Fireberd Analyzer Kit** – Contains the Fireberd 6000 and interfaces for circuit testing.
- **Cable Maintenance Kit** – Contains Fiber Optic Time Domain Reflectometer, HP Digital Average Power Meter, Cable Tester, Digital Multimeter, Oscilloscope, RS530 and Breakout Box.
- **Voice/Data Cable Kit** – Contains Category 5 Twisted Pair materials to make 10/100 BaseT cables (RJ11 and RJ45) with label package.
- **Fiber Cable Kit** – Contains tactical 1.5 K m of fiber cable, SC/ST connectors and fiber termination tool kit.
- **Circuit Extension Kit** – Contains Campus Rex T1/E1, T1/E1 Fiber line driver and CV-2048 Modem or CV-8448F Modem.
- **Laptop Computer Kit** – Contains Laptop Computer w/ CD-ROM, Portable Ethernet Sniffer w/ software.
- **Small UPS Kit** – Provides protection and backup (650VA) of prime power circuits.
- **Large UPS Kit** – Provides protection and backup (1500VA) of prime power circuits.

### **3.2.4 Physical Characteristics**

#### **3.2.4.1 Transit Case**

The Basic Access Module v3.1 is housed in a 13 U transportable container (transit case), approximately 22.5”W. x34.5”D. x27.3”H. The transit cases are designed to stack on top of and mechanically interlock to like cases; interior equipment frame slides out for access. The transit cases with their covers in place are designed to protect the electronic equipment inside from direct exposure to environmental conditions; e.g., rain, snow, ice, dust, etc., likely to be encountered during world wide military transit.

#### **3.2.4.2 Weight**

The Basic Access Module v3.1, including all internally carried cables, does not exceed 96kg/ 210lb.

#### **3.2.4.3 Storage Space**

The Basic Access Module v3.1 transit case include storage pouches within its covers to contain cables, manuals, etc. that must be transported and used with the module.

#### **3.2.4.4 Marking**

See TDC Standards Document for required markings.

### 3.2.5 Cables and Accessories

The BAM v3.1 includes the cables and terminators listed in Table 9. Strain relief and cable management hardware are provided with the module.

**Table 9 - Cables and Terminators included with BAM**

Function	Color Code	Quantity	Description
Power	N/R	1	IEC-320 C20 Jack to NEMA 5-15P
Cable Assembly F	N/R	1	CLK to BUS IN
Cable Assembly E1	N/R	1	Bus Terminator
Cable Assembly E2	N/R	1	Bus Terminator
Cable Terminator G2	N/R	1	(5PIN) Clock Sync
Cable Assembly	N/R	1	CLK IN to CLK OUT
Cable Assembly	N/R	1	Bus In to Bus Out
SCN & IP Backbone	N/R	2	Fiber optic ST Plug to ST Plug (2 fibers)
Configuration Port	N/R	1	DB 9 Plug to DB 9 Jack pin-to- pin
Ethernet Switch Jumper	N/R	1	RJ-45 to RJ-45 10BaseT/100BaseTX
6 Position RJ45 - Harmonica	N/R	1	ISDN Harmonica RJ45
Modular Y Adapters	N/R	4	1 RJ45 to 2 RJ45 Y Cable
Telco 50 Pin	N/R	1	Telco (M-F) 50 Pin Cable

Note: This does not include Zone Cables provided with the cards.

### 3.2.6 Reliability

The module with its standard complement of LRUs, have a mean time between failure (MTBF) commensurate with similar commercial equipment in its class. The actual MTBF for the major system components are shown in Table 10. Where Reliability data is not readily available from the vendor, this is indicated.

**Table 10 - MTBF of Major Components**

Component	MTBF
Catalyst 2950C	268,292 hours
Catalyst 3560-48PS	173,500 hours
IGX*C configured for BAM v3.1	25,000 hours (estimated)

### 3.2.7 Maintainability

Maintainability characteristics will be part of the selection criteria for all hardware. Ease of maintenance, such as accessibility to Line Replaceable Units, fault detection/isolation software capability, and fault annunciation will be considered.

### 3.2.7.1 Mean Time Between Preventive Maintenance

The Mean Time Between Preventive Maintenance, during operation, is 30 days. The duration of preventive maintenance actions such as corrosion control, cleaning filters, etc., does not exceed 30 minutes.

### 3.2.8 Environmental Conditions

During storage, transport and operation the modules can withstand exposure to temperatures as shown in Table 11.

#### 3.2.8.1 Temperature

Temperature characteristics for the major equipment components are shown in Table 11.

**Table 11 - Module Temperature Characteristics**

Equipment	Temperature (degrees C)	
	Operating	Non-Operating
Catalyst 2950C	-5 to 45	-25 to 70
Catalyst 3560-48PS	0 to 45	-25 to 70
IGX*C configured for BAM v3.1	0 to 50	Not Available

#### 3.2.8.2 Relative Humidity

Relative humidity characteristics for the major equipment components are shown in Table 12.

**Table 12 - Module Humidity Characteristics**

Equipment	Humidity
	Non-condensing
Catalyst 2950C	10-95%
Catalyst 3560-48PS	10-85%
IGX*C configured for BAM v3.1	5 to 95%

#### 3.2.8.3 Altitude

Altitude characteristics for the major equipment components are shown in Table 13.

**Table 13 - Module Altitude Characteristics**

Equipment	Altitude (feet)	
	Operating	Non-Operating
Catalyst 2950C	Up to 10,000	Up to 15,000
Catalyst 3560-48PS	Up to 10,000	Up to 15,000

**Table 13 - Module Altitude Characteristics**

<b>Equipment</b>	<b>Altitude (feet)</b>	
	<b>Operating</b>	<b>Non-Operating</b>
IGX*C configured for BAM v3.1	Not Available	Not Available

**3.2.8.4 Sand and Dust**

During storage and transport, the modules are protected when exposed to sand and dust in accordance with the best commercial practices for close proximity to operating aircraft. During operation with covers removed, the modules can withstand sand and dust in accordance with the best commercial practices for natural conditions.

**3.2.8.5 Shock**

Module equipment racks are equipped with rubber shock isolation mounts and is protected from shocks induced during handling, setup and tear down. Modules and components can operate without degradation following exposure to the non-operating shock environment described by Method 516.5, Procedure VI (Bench Handling) of MIL STD 810F.

**3.2.8.6 Vibration**

The modules are equipped with rubber shock isolation mounts so that the modules can withstand the vibration encountered while being transported by commercial and military airlift, sealift and vehicular (over unimproved roads) systems; MIL-STD-810F, Method 514.5, Procedure I, Categories 4, 7 and 8; alternative procedures may be substituted after TDC Program Office approval.

**3.3 Design and Construction**

**3.3.1 Material Parts and Processes**

This module is built to good commercial practices. Mechanical and electrical interchangeability exists between like systems, subsystems, assemblies, subassemblies and replaceable parts.

**3.3.2 Safety**

This module shall not present a safety, fire or health hazard to personnel.

**3.3.2.1 Electrical Safety**

This module is designed to eliminate the hazard to personnel of inadvertent lethal voltage contact. All electrical conductors carrying voltages in excess of 70 volts shall be insulated to prevent contact or covered by a protective barrier. All removable protective barriers shall be interlocked to automatically disconnect power behind the barrier upon removal or clearly marked with a warning label that indicates the voltage potential that will be encountered behind the barrier. All warning labels shall remain visible after the cover has been removed.

### **3.3.2.2 Mechanical Safety**

Sharp surfaces shall have protective covers or other suitable features to minimize injury where personnel are likely to be exposed to such surfaces.

### **3.4 Logistics**

This module accommodates a two level maintenance concept: organizational (Air Force personnel) and depot (contractor personnel). Removal and replacement of an LRU is defined at the organizational level and any needed repair of the LRU is defined at the depot level. Any special test or support equipment required to effect removal or replacement of an LRU at the organizational level can be provided as part of the module. No more than two persons shall be required to remove or replace an LRU.

An LRU is defined as the lowest element of the module which can be isolated to be faulty through inspection; built-in test; technical manuals; TDC-ICAP system performance; spares substitution; or other diagnostic aid approved by the Government for organizational level maintenance, exclusive of expendables such as fuses, lamps and LEDs. An LRU is defined at the card/module level or higher.

## **4.0 QUALITY ASSURANCE PROVISIONS**

### **4.1 General**

The quality assurance program includes tests and other evaluations to the extent specified herein. The quality assurance program is designed to verify the electrical, mechanical and functional characteristics of each module. The purpose is to ensure that each module complies with or performs better than the requirements specified herein.

### **4.2 Responsibility for Inspection**

Unless otherwise specified in the contract, the contractor shall be responsible for the performance of all inspection requirements and may use his own or any other facilities suitable for the performance of the inspection requirements. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to the prescribed requirements.

### **4.3 Product Qualification Test (PQT)**

Inspections, analyses, demonstrations and tests verify compliance of Section 3 of this specification on the first production unit.

### **4.4 Production Acceptance Test (PAT)**

Each module delivered to the Government undergoes an Acceptance Test Process as identified in Table 14. The acceptance test verifies that the module interfaces are operating properly prior to delivery to the Government.

### **4.5 Verification Cross Reference Matrix (VCRM)**

Table 14 provides a list of each Section 3 requirement and the verification method to be used. The following paragraphs define the codes employed in the VCRM. Unless otherwise noted, where more than more one verification method is shown, one method or a combination of methods may be used to show compliance.

#### **4.5.1 Not Required (N/R)**

This method indicates that verification is not required because the paragraph is a title, heading, general introductory paragraph or statement of a goal and contains no “shall” or “must” statements.

#### **4.5.2 Inspection**

Inspection is a method of verification of the module performance or characteristics by examination of the equipment or associated documentation. Inspections are conducted with the use of inspection tools, measurement devices, visual means and comparison. Most inspections apply to verification of requirements associated with physical characteristics such as size, weight,

appearance, adherence to specified standards and engineering practices, quality design, and construction supported with quality documentation. Inspections also include the auditing of manufacturer’s data that verifies the performance of non-developmental items that comprise the TDC ICAP module. Inspections may occur during any assembly stage of the unit under test.

#### 4.5.3 Analysis

Analysis is a method of verification through technical evaluation of calculations, computations, models, analytical solutions, use of studies, reduced data, and/or representative data to determine that the item conforms to the specified requirements.

#### 4.5.4 Demonstration

Demonstration is a method of verification whereby the properties, characteristics and parameters of the item are determined by observation alone and without the use of instrumentation for quantitative measurements. This method is used when a requirement does not contain a specific numerical parameter that must be measured. Demonstrations may occur during verification of a unit under test at any assembly stage. Pass/fail criteria are simple yes/no indications of functional performance since no quantitative values are specified.

#### 4.5.5 Test

Test is a method to verify that a specified requirement is met by thoroughly exercising the applicable item under specified conditions and by using the appropriate instrumentation in accordance with test procedures. This method requires the use of laboratory equipment, simulators, or services to verify compliance to the specified requirements. This method is used when it is practicable to make direct or indirect measurement of a specified numerical parameter to verify compliance with a requirement. Tests may occur during verification of a unit at any assembly stage. Actual measured values are recorded, and pass/fail is determined by comparing the measured value with the specified value. Measurement accuracy is precise enough to ensure that the measured value is within the specified tolerance.

**Table 14 - Verification Cross Reference Matrix**

Paragraph	Title	Verification Method					
		N/R	PQT				ATP
			Inspect	Analysis	Demo	Test	
3.	Requirements	X					
3.1	Functional Requirements	X					
3.2	Performance Requirements	X					
3.2.1	Electrical Interface Requirements (External)	X					
3.2.1.1	Prime Power					X	X
3.2.1.2 – 10	Connectors				X		X
3.2.2	Electrical Interface (Internal)	X					
3.2.3	Functional Requirements	X					
3.2.3.1	Basic Configuration	X					

**Table 14 - Verification Cross Reference Matrix**

Paragraph	Title	Verification Method					
		N/R	PQT				ATP
			Inspect	Analysis	Demo	Test	
3.2.3.1.1	Datagram Switched Network Functions				X		X
3.2.3.1.1.1	10BaseT/10BaseTX LAN Access				X		X
3.2.3.1.1.2	IP Backbone Connectivity				X		X
3.2.3.1.1.3	IP Administration				X		X
3.2.3.1.2	SCN Functions	X					
3.2.3.1.2.1	Local Subscriber Access				X		X
3.2.3.1.2.2	Voice switch Administration				X		X
3.2.3.1.2.3	Circuit Switch Interconnection				X		X
3.2.3.2	Configuration Options				X		X
3.2.3.2.1	10BaseFL Connectivity				X		X
3.2.3.2.2	Circuit Switch Configuration Options	X					
3.2.3.2.3	Configuration Kits	X					
3.2.4	Physical Characteristics	X					
3.2.4.1	Transit Case		X				
3.2.4.2	Weight					X	
3.2.4.3	Storage Space		X				
3.2.4.4	Marking		X				X
3.2.5	Cables and Accessories				X		X
3.2.6	Reliability			X			
3.2.7	Maintainability			X			
3.2.7.1	Mean Time Between Preventive Maintenance			X			
3.2.8	Environmental Conditions	X					
3.2.8.1	Temperature					X	
3.2.8.2	Humidity			X			
3.2.8.3	Altitude			X			
3.2.8.4	Sand and Dust			X			
3.2.8.5	Shock					X	
3.2.8.6	Vibration					X	
3.3	Design and Construction	X					
3.3.1	Materials Parts and Processes			X			
3.3.2	Safety	X					
3.3.2.1	Electrical Safety			X		X	
3.3.2.2	Mechanical Safety		X	X			
3.4	Logistics			X			

## **5.0 PREPARATION FOR DELIVERY**

Each module is packaged for shipment and the package marked in accordance with the requirements of the contract under which the module is ordered.

## 6.0 BASELINE CONFIGURATION

### 6.1 Equipment

**Table 15 - Equipment Listing**

Device	Manufacturer	Part Number	Description	Quantity
Circuit Switch	REDCOM	IGX•C Standard Shelf	Circuit switch single shelf	1
Software	REDCOM	6.X-TDC	Version B06XARXPX	1
Software	REDCOM	AUTOVON	MLPP & Priority Feature	1
Software	REDCOM	619A	PRI MLPP	2
Software	REDCOM	Toll Restriction	Toll Restriction Feature	1
Software	REDCOM	CO MF	MF Signaling Feature	1
Software	REDCOM	CUSTOM	ROSMI Custom Feature	1
Software	REDCOM	HOST	Host Computer Control (CTI) Feature	1
Software	REDCOM	PSR	Print Site Records Feature	1
Software	REDCOM	BOOK	Phonebook	1
Software	REDCOM	Basic	BASIC Program Language	1
Software	REDCOM	Chain	Conference Chaining	1
Software	REDCOM	Law Conversion	IGATE	1
Software	REDCOM	Cluster	Multi Cluster Feature	1
Software	REDCOM	International	International Feature	1
Software	REDCOM	ISDN	ISDN Features	1
Software	REDCOM	EXP-ANN	Expanded Announcer Support	1
Software	REDCOM	VOIP	Voice Over IP Support	1
Software	REDCOM	MET	Multi E1/T1 Support	1
Software	REDCOM	EISDN	Euro ISDN Support	1
Software	REDCOM	CLASS	CO Class Features	1
Timeslot Interchange	REDCOM	MA0689-001	Voice matrix	1
MSU Controller	REDCOM	TK0640-017	Supervisor and Control Board Set/10 Base-T	1
BRI Card	REDCOM	TK0531-322	Basic Rate "S" Interface	1
Trunk Card	REDCOM	TK0292-003	DS-1 or T-1 Trunk card	2
Message Transceiver Interface	REDCOM	TK0463-101	ISDN-PRI implemented in conjunction with DS-1 Trunk	1
Clock Synchronizer	REDCOM	TK0473-163	T-1 Clock Synchronizer and Master Clock Synchronizer	1
Line Circuit	REDCOM	TK0653-113	2-wire analog circuits	5
Ring Generator	REDCOM	TK0060-005	Switch Ring Generator	1

**Table 15 - Equipment Listing**

Device	Manufacturer	Part Number	Description	Quantity
Transit Case	ECS Composites	11978	Transit Case-13U case with slide-out inner frame	1
Ethernet Switch	Cisco Systems	WS-C3560-48PS-S	Catalyst 3560 48 10/100Base T Ports 4 1000Base SX Ports	1
Ethernet 1000BaseSx	Cisco Systems	GBIC-SX=	GBIC 1000BaseST Interface Adapter	4
Ethernet Switch	Cisco Systems	WS-C2950C-24	Catalyst 2950C 24-10BaseT / 100BaseTX & 2-100BaseFX Ports	1
Software	Cisco Systems	Version 12.0	Enterprise IOS	2
Power Distribution Unit	Marway	411355	Multiple Power switch Power Supply	1
Media Converter	Transition Networks	E-TBT-FRL-04 or E-TBT-FRL-05	Media Converter 10BASET to 10BASEFL	1
Cable Mgmt	Ortronics	OR60400199	Bend Limiting Strain Relief Bar	2
Fiber Optic Modem	S.I. Tech	2890-2R-ASP-1	Dual T1 Fiber Optic Modem	1
6 position 568 Harmonica with Telco connector	SIEMON	H50M-6MJ8-TIA	ISDN Harmonica with RJ-45 stored in module lids or drawer	1
Modular Y-adapter	SIEMON	YT4-U2-U2	4-pair T568A jack into two 4-pair T568A	4
Telco 50pin to 50 pin Telco cable	REDCOM	CA0467-010	10 foot Telco cable for module to harmonica connections stored in module lids or drawer (Male to Female)	1
RJ-45 Zone/Patch Panel	REDCOM	MA9079-023	RJ-45 Zone/Patch Panel	1
Rear Panel			Rear Panel	1
W1 Cable	TBD	TBD	Power Cable	1
W3, W4 Cable	TBD	TBD	Fiber Optic Cable (ST to ST)	2
W5, W6 Cable	TBD	TBD	Cable Assembly	2
W2 Cable	TBD	TBD	Power Cable Assembly for Media Conv	1
W7, W8 Cable	TBD	TBD	Power Cable for Ethernet Switches	2
W29, W30 Cable	TBD	TBD	Fiber Optic Cable (SC to ST)	2
W31, W32 Cable	TBD	TBD	Fiber Optic Cable (MT-RJ to ST)	2
W33 Cable	TBD	TBD	Fiber Optic Cable (ST to ST)	1
W27, W28 Cable	TBD	TBD	Cable Assembly, 10/100 BASET Internal crossover	2
Connector	TBD	TBD	Bulkhead Coupler (ST-ST)	14

**Table 15 - Equipment Listing**

<b>Device</b>	<b>Manufacturer</b>	<b>Part Number</b>	<b>Description</b>	<b>Quantity</b>
P1 Cable (In Pouch)	TBD	TBD	Admin cable, Laptop to DF	1
P2, P3 Cable (In Pouch)	TBD	TBD	Cable Assembly Fiber Optic (ST-ST)	2
P4 Cable	TBD	TBD	Cable Assembly F CLK to Bus In (stored in pouch)	1
Terminator	TBD	TBD	Cable Assembly E1 Bus Terminator (stored in pouch)	1
Terminator	TBD	TBD	Cable Assembly E2 Bus Terminator (stored in pouch)	1
Terminator	TBD	TBD	Cable Terminator G2 (5 Pin) Clock Sync (stored in pouch)	1
P5 Cable	TBD	TBD	Cable Assembly Bus In to Bus Out (stored in pouch)	1
P6 Cable	TBD	TBD	Cable Assembly CLK In to CLK Out (stored in pouch)	1
W9 Cable	TBD	TBD	REDCOM proprietary MPU Output cable	1
W10 Cable	TBD	TBD	REDCOM proprietary MPU Input cable	1

Note: Zone Cables are considered part of the associated card assembly.

## 6.2 Elevation Drawings

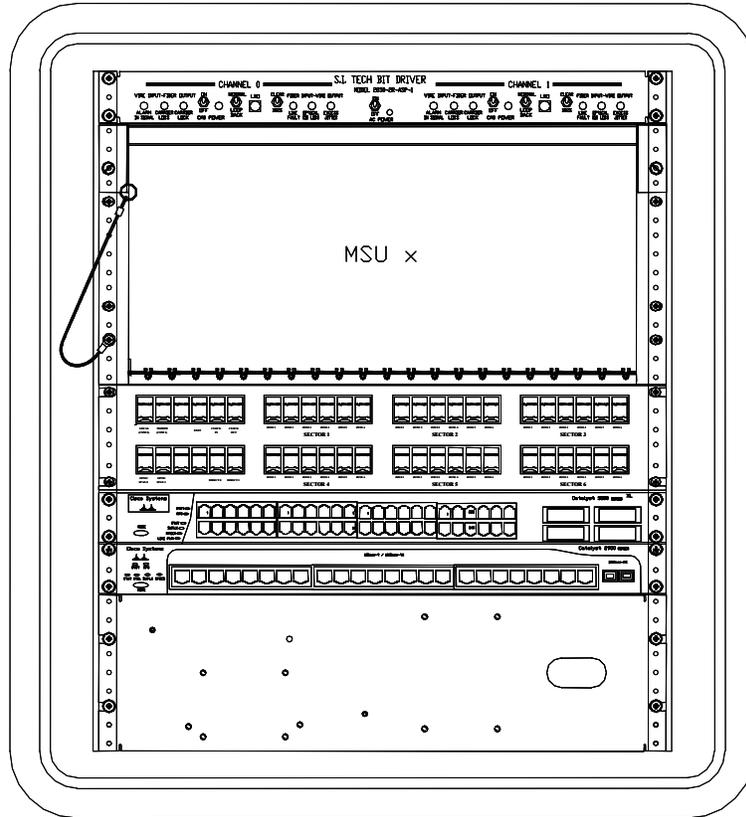


Figure 5 - Front Elevation

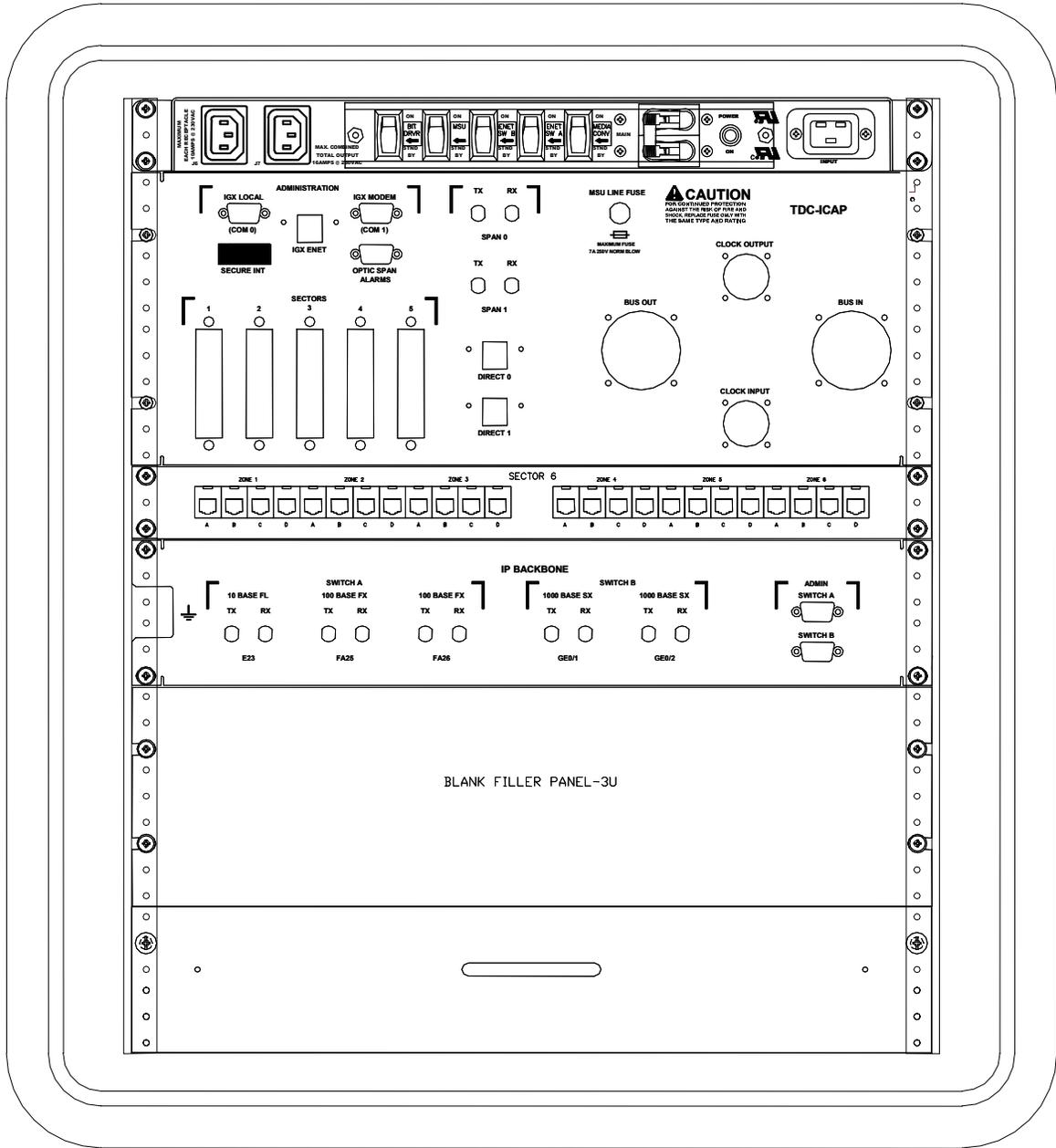


Figure 6 - Rear Elevation

### 6.3 Cable Diagrams

**Table 16 - Cable Listing**

Wire Number	Part Number	Manufacturer	Description
W1	CH9079-P36	Panel Components	Power Cable A5 Switch
W3, W4	90FB020101	REDCOM	T1 Voice Backbone
W5, W6	SC9079-L24	REDCOM	Ethernet Switch Admin Cables A2/A3
W2	90GX0AX222	REDCOM	Media Converter
W7, W8	(2x) 90GX0AX501	REDCOM	Power Cable Ethernet Switches-A2, A3
W29, W30	90FB120102	REDCOM	Ethernet Data Backbone
W31, W32	90FB120103	REDCOM	Ethernet Data Backbone
W33	90FB020101	REDCOM	Media Converter FO Cable
W27, W28	CA9079-R10		Ethernet Crossver Cable
P1	90DB9FMX10		Admin cable, Laptop to DF (stored in Pouch)
P2, P3	90FB640101	REDCOM	Inter-module fiber optic cable (stored in pouch)

Cable W1  
 Switch- Power Cable  
 Pin Assignments  
 IEC-320      IEC-320  
 Receptacle    Plug  
 Switch-A5    Power Conditioner-  
                   A1  
 Power        Power

	Signal	Direction	
1	Line	-----	1
2	Neutral	-----	2
3	GND	-----	3

Cable W3, W4  
Voice Backbone Fiber Optic Cable

Pin Assignments

ST	ST
Plug	Plug
Dual T1	Optical Scan 0 & 1
FO Modem A4	Interface Panel A7

	Signal	Direction	
1	Tx	→	1
2	Rx	←	2

Cable W5, W6

Ethernet Switch A2/A3 Admin Cable

Pin Assignments

RJ45 (solid)	DB09F
Plug	Receptacle
	AMP 745491-2

REDCOM  
1RMPMCRS8X  
Switch A2/A3 I/O DF  
Console  
Console Port I/O DF

	Signal	Direction	
1	RTS	→	8 (CTS)
2	DTR	→	6 (DSR)
3	TxD	→	2 (RxD)
4	GND		5
5	GND		5
6	RxD	←	3 (TxD)
7	DSR	←	4 (DTR)
8	CTS	←	7 (RTS)

Cable W2  
Media Converter – A8 Power Cable

Pin Assignments

IEC-320 Receptacle	IEC-320 Plug
Media Converter – A8 Power	Conditioner-A1 Power

	<b>Signal</b>	<b>Direction</b>	
1	Line	-----	1
2	Neutral	-----	2
3	GND	-----	3

Cable W7, W8  
Ethernet Switch – A2/A3 Power Cable

Pin Assignments

IEC-320 Receptacle	IEC-320 Plug
Ethernet Switch- A2/A3 Power	Power Conditioner- A1 Power

	<b>Signal</b>	<b>Direction</b>	
1	Line	-----	1
2	Neutral	-----	2
3	GND	-----	3

Cable W29, W30  
Data Backbone Fiber Optic Cable

Pin Assignments

SC	ST
Plug	Plug
Ethernet	I/O DF
Switch A2	I/O DF
	Tx/Rx 0

1000BaseSx

	Signal	Direction	
1	Tx	→	1
2	Rx	←	2

Cable W31, W32  
Data Backbone Fiber Optic Cable

Pin Assignments

MT-RJ	ST
Plug	Plug
Ethernet	I/O DF
Switch A3	I/O DF
100BaseFx	Tx/Rx 0

	Signal	Direction	
1	Tx/Rx	→	1
		←	2

Fiber Ethernet Multimode Cable Spec

The fiber Ethernet interface operates at a wavelength of 1300 nanometers.

Multimode fiber Ethernet cables should conform to the following:

- Standard: ISO/IEC 9314-3
- Maximum path length (all cables in a connection from end to end): 2 km
- Cabling: 62.5-micron or 50-micron core with an optical loss of 0 to 9 dB

Cable W33  
Media Converter Fiber Optic Cable  
Pin Assignments

ST Plug Media Converter A10	ST Plug 10 BASE FL Interface Panel A7
-----------------------------------	--

	<b>Signal</b>	<b>Direction</b>	
1	Tx	→	1
2	Rx	←	2

Cable W27, W28  
Ethernet Crossover Cable  
Pin Assignments

RJ45 (SOLID)  
Plug

REDCOM  
Switch A2  
Switch A3

RJ45 (SOLID)  
Plug

REDCOM  
Switch A3  
Media Conv.



Cable P1

Module Admin Cable (stored in pouch)

Pin Assignments

DB09F	DB09M
Receptacle	Plug
AMP 745491-2	AMP 745906-1
Laptop COM port	I/O DF
Terminal	Various Admin

	Signal	Direction	
2	RD	←	2
3	TD	→	3
4	DTR	→	4
5	GND	----	5
6	DSR	←	6
7	RTS	→	7
8	CTS	←	8

Cable P2, P3

Fiber Optic Backbone Cable (stored in pouch)

Length: 6 Meters (20 feet)

Pin Assignments

ST	ST
Plug	Plug

	Signal	Direction	
1	Tx	→	1
2	Rx	←	2

