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TRAK Microwave Corporation
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TECHNICAL MANUAL

(TM4400013)

MODEL 9100

Modular Frequency/Time System

Revision D

October 2006

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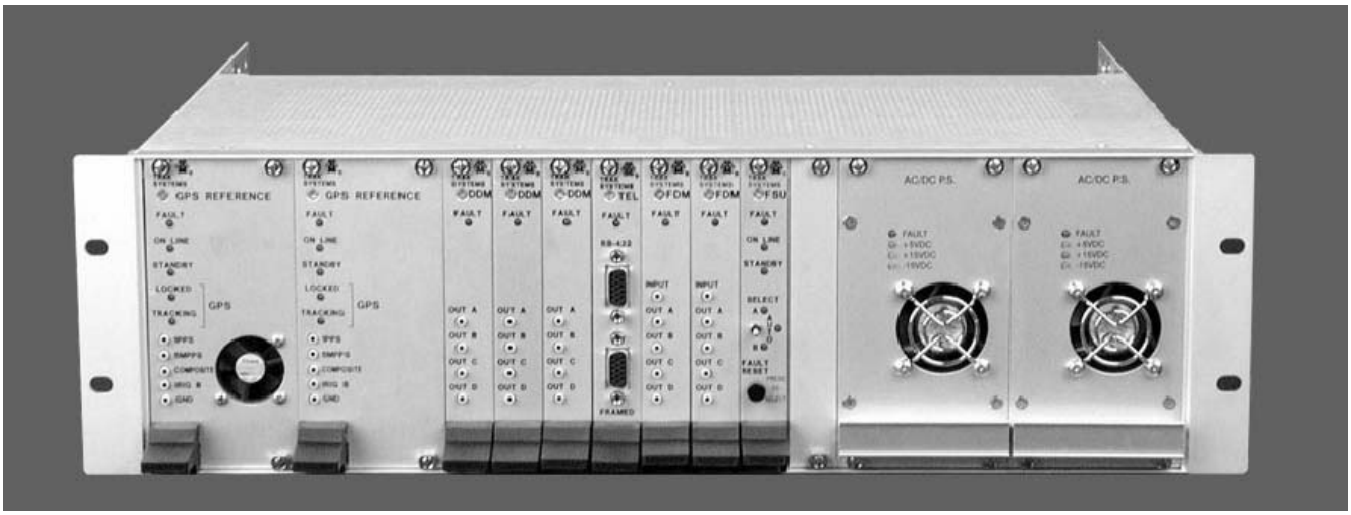
REV	DESCRIPTION	DATE	APPROVED
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STATIC AWARENESS



The 9100-8 Modular System contains CMOS IC's that can be damaged by electrostatic discharge during handling. The following practices minimize the likelihood of CMOS IC damage:

1. Use a static-free work station.
2. Avoid PLASTIC, VINYL, and STYROFOAM in work area.
3. Discharge personal static before handling. *Use a grounded antistatic wrist strap.*
4. Minimize handling. Do **NOT** remove and replace IC's by hand.
5. Use grounded IC removal and insertion tools
6. If required, handle the IC's only by the body - **NOT** by the leads. *Use grounded wrist strap.*
7. Do not slide the IC over any surface.



Frequency & Time Systems Model 9100

TABLE OF CONTENTS

CHAPTER 1
INTRODUCTION

Paragraph		Page
1-1	General	1-1
1-2	Level of Coverage	1-1
1-3	Organization of the Manual	1-1
1-4	Functional Description	1-2
1-5	Physical Description	1-4
1-6	Environmental Characteristics	1-4
1-7	Power Requirements	1-4
1-8	EMC/EMI	1-4
1-9	Input and Output Characteristics	1-5
1-10	Oscillator Options	1-8
1-11	Minor & Major Alarms	1-8

CHAPTER 2
INSTALLATION

2-1	Unpacking Procedure	2-1
2-2	System Mounting Procedure	2-1
2-3	Antenna Mounting	2-1
2-4	Input and Output Signal Connections	2-1
2-5	Input Power	2-2
2-6	Rear Panel Connectors and Fuses	2-2
2-7	Multi-pin Interface Connectors	2-3
2-8	Module Setup	2-5

CHAPTER 3
OPERATION

3-1	General	3-1
3-2	Front-Panel Controls and Indicators	3-1
3-3	Initial Synchronization	3-8
3-4	TOD Output	3-9
3-5	Remote Operation	3-10

CHAPTER 4
MAINTENANCE

4-1	General	4-1
4-2	Maintenance Philosophy	4-1
4-3	Preventive Maintenance	4-1
4-4	Replacement Modules	4-1
4-5	Trouble Shooting Guide	4-1

CHAPTER 5
REPLACEMENT PARTS LIST

5-1	General	5-1

LIST OF ILLUSTRATIONS

Figure		Page
	Model 9100 Modular Frequency/Time System	iii
1-1	Model 9100 Panel Views	1-2
1-2	Model 9100 Functional Block Diagram	1-3
2-1	Model 9100 Rear Panel	2-2
2-2	Model 9106 Digital Distribution (DDM) Switch Locations	2-5
2-3	Model 9107 Frequency Distribution Module (FDM) Jumper Locations	2-6
2-4	Model 9111 Telecommunications Generator (TEL) Switch and Jumper Locations	2-7
3-1	Model 9100 Front Panel	3-1
3-2	Model 9101 GPS Reference Front Panel	3-2
3-3	Model 9106 Digital Distribution DDM Front Panel	3-3
3-4	Model 9111 Telecom Signal Generator Front Panel	3-4
3-5	Model 9107 Frequency Distribution FDM Front Panel	3-5
3-6	Model 9104 Fault Sensing and Switching Unit (FSU) Front Panel	3-6
3-7	Model 9120-2 Power Supply Front Panel	3-7

LIST OF TABLES

Table		Page
1-1	Interface Cables for EMC Compliance	1-4
1-2	Output Characteristics, References	1-5
1-3	Output Characteristics, RS-232 and TOD	1-7
1-4	Output Characteristics, Alarms	1-7
1-5	I/O Characteristics, 10BaseT, NTS	1-7
1-6	Input Characteristics, GPS Antenna	1-7
1-7	Oscillator Characteristics	1-8
1-8	Major and Minor Alarm Conditions	1-10
2-1	Rear Panel Connectors, Fuse, and Switch	2-2
2-2	10Base T Connections	2-3
2-3	Alarms	2-3
2-4	TOD Outputs	2-4
2-5	RS-232 Outputs	2-4
2-6	Reference Outputs	2-4
2-7	DDM Output Signal Switch Positions	2-5
2-8	FDM Input Signal Jumper Positions, T1	2-6
2-9	TEL Framing Format Switch Positions, T1	2-8
2-10	TEL Line Length Compensation Switch Positions, T1	2-8
2-11	TEL Framing Format Switch Positions, E1	2-8
2-12	TEL RS-422 Clock J1 Connections	2-9
2-13	TEL Framed J2 Connections	2-9
3-1	Request Command List	3-12
3-2	Setup Commands List	3-12
5-1	Replacement Modules	5-1

APPENDICES

Appendix A	Model 9100 Data Sheet
Appendix B	NTS Option
Appendix C	Commonly Used Time Code Formats
Appendix D	Model 9100 DC Power Input Options
Appendix E	GPS Antenna Installation and Cable Options
Appendix F	Model 9200
G & up	Module Descriptions

CHAPTER 1

INTRODUCTION

1-1 GENERAL

This manual contains the description, installation, operation, and maintenance instructions for the Model 9100 Modular Frequency/Time System (MFTS). It is intended to provide electronics personnel with the information necessary to operate the instrument and to maintain it to the lowest replaceable unit, LRU, or assembly level.

1-2 LEVEL OF COVERAGE

This manual provides coverage to the LRU only. No schematic or logic diagrams of replaceable assemblies are provided. Unlike instruments in use a few decades ago, where it was possible to troubleshoot to the logic gate level, the Model 9100 uses modern technology consisting of CPU's, gate arrays, and imbedded software. Packaging is largely surface-mount technology. Only factory-trained technicians with a high level of training can perform maintenance below the LRU level. Most LRU's have an MTBF in excess of ten years, so frequent replacements are usually not required.

1-3 ORGANIZATION OF THIS MANUAL

The body of this manual describes operation of the basic Model 9100 and its most common synchronization options (plug-in modules). All other plug-in option modules (code generators, signal generators, drivers, I/O, special oscillators, and special power inputs) are described in appendices. The appendix arrangement is as follows:

Appendix A	Model 9100 Data Sheet
Appendix B	Network Time Server
Appendix C	Commonly Used Time Code Formats
Appendix D	Optional Power Input and Output Signals
Appendix E	GPS Antenna Installation and Options
Appendix F	Model 9200 Manual
Appendix G	Module Descriptions
Appendix H	CE Compliance Certification

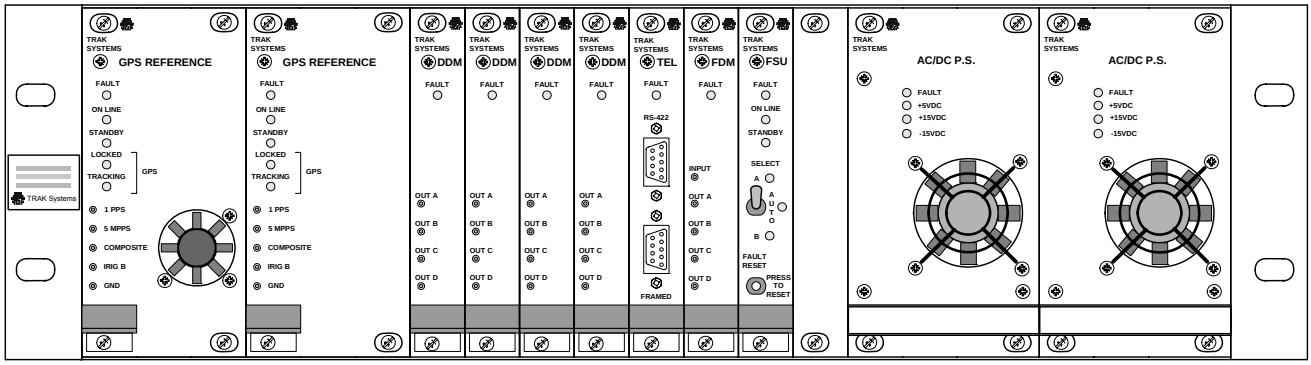


Figure 1-1 Typical Model 9100 Modular Frequency/Time System Front Panel

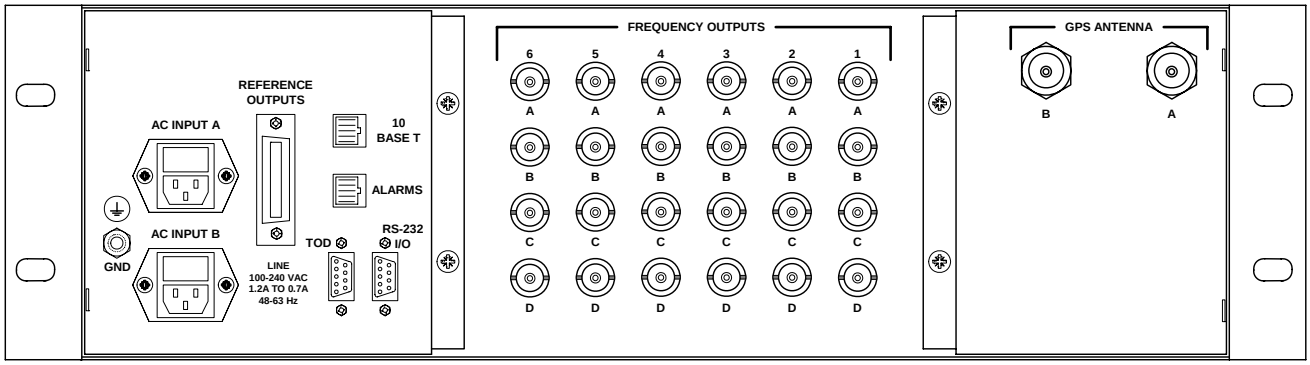


Figure 1-1 Typical Model 9100 Modular Frequency/Time System Rear Panel

1.4 FUNCTIONAL DESCRIPTION

The Model 9100 MFTS is a system providing ultra-stable frequency, time, and reference signals, referenced to the GPS satellite system. By selecting the appropriate functional modules, the system is easily configured for a variety of frequency and timing applications. Features include the following:

- Single or dual redundant operation
- GPS Disciplined single, double oven crystal oscillator, and/or rubidium oscillators.
- Standard references include 10 MHz, 5 MPPS, 1 PPS, Composite and IRIG B time code. Optional references include T1 or E1 Telecom outputs. Consult factory for other available reference frequencies.
- Off-line A/B switching in each distribution module, no signal point of switch failure
- Six, four-channel output module positions available, optional expansion chassis available for additional digital signal distribution.
- RS-232 I/O
- Ethernet Interface with Network Time Server (NTS) and Telnet capability

The Model 9100 is a system partitioned into four sections: (1) Signal Generation, (2) Signal Distribution, (3) Control/Status, and (4) Power Supply.

The signal generation section consists of the 9101 GPS Reference. This module contains a GPS receiver, precision oscillator, signal generators, and microprocessor. Standard signals from this module include 10 MHz, 1 PPS, 5 MPPS, Composite, and IRIG B time code. Optional signals can be provided in place of standard signals, refer to appendix D for options.

In a redundant configuration, two GPS Reference modules are installed. In normal operation the outputs from the primary GPS Reference (A1) provide reference signals through the distribution modules. In case of a failure in the primary GPS Reference, the backup GPS Reference (A2) is automatically switched online.

A switch on the FSU front panel allows override of automatic switchover. This allows manual selection of primary or backup GPS Reference regardless of the operating condition of the module. When one GPS Reference module is installed the front panel switch is inoperable.

The signal distribution section consists of up to six plug-in modules in chassis locations A3 through A8. Three types of distribution modules are available: DDM, FDM, and TEL. The DDM is used for digital signal distribution, FDM is used for reference frequency and IRIG B time code distribution, and the TEL is used for T1 or E1 signal generation and distribution.

The FSU module, A9 provides status and control of the system through an RS-232 and optional Ethernet interface. With the Ethernet option installed, the Network Time Server (NTS) feature is available. The FSU also provides an ASCII Time of Day (TOD) output and major and minor alarm relay contacts.

Power supply section can be configured for single or dual redundant operation. The standard power supply operates from AC power. DC power input is available as an option.

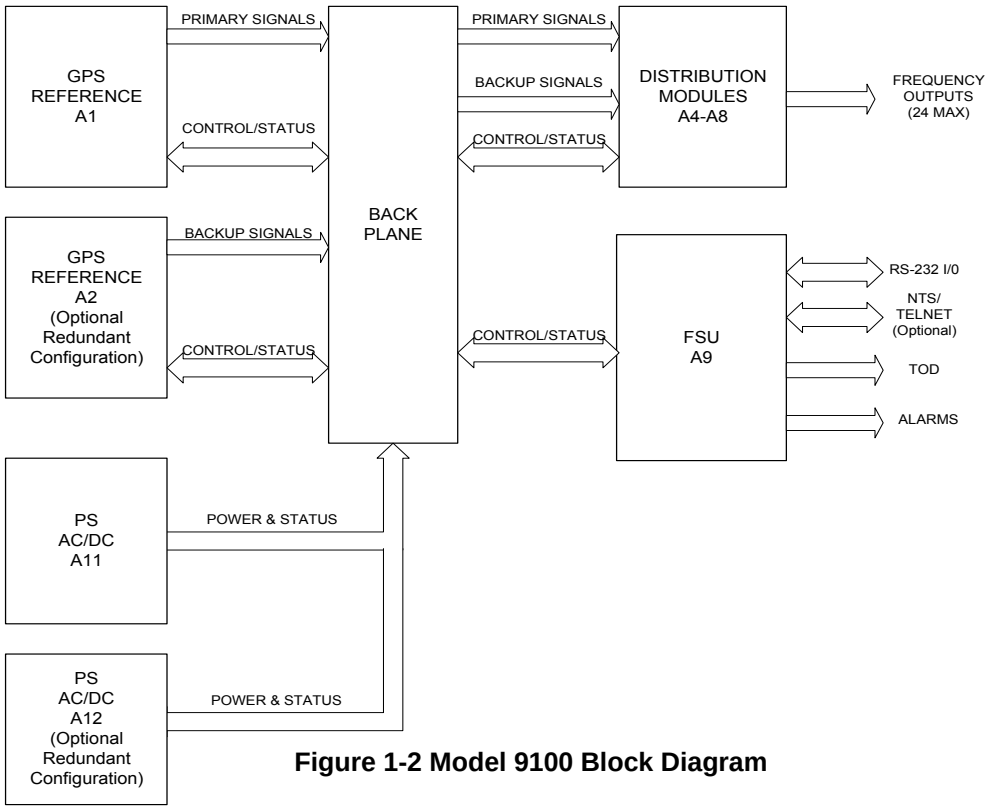


Figure 1-2 Model 9100 Block Diagram

1-5 PHYSICAL DESCRIPTION

The Model 9100 is a single chassis designed for mounting in a standard EIA 19-inch wide rack. Front panel height is 5.22 inches (3U) and overall depth is 15.0 inches exclusive of front panel handles and rear panel connectors.

There are 12 front panel plug-in modules locations, A1 and A2 are reserved for the GPS Reference Modules, A3 through A8 are reserved for distribution modules, A9 and A10 are reserved for FSU modules and A11 and A12 are reserved for Power Supply modules. Weight is approximately 25 pounds with all modules installed. System status indicators and test points are located on module front panels. All connections to the unit are via rear panel connectors with exception of the Telecom module, which contains two front panel high-density 15-pin DD-sub connectors for Framed and EIA-RS-422 output signals.

1-6 ENVIRONMENTAL CHARACTERISTICS

Unless otherwise specified, Model 9100 meets all published specifications when operated over the temperature range of –30°C to +60°C with a rate of change <2°C/minute. Maximum operating humidity is 95%, non-condensing. The unit withstands normal shock and vibration found in all forms of common-carrier shipment.

1-7 POWER REQUIREMENTS

The Model 9100 operates from 100 to 240 VAC ± 10%, 48-63 Hz single-phase power. Power consumption with all modules installed is approximately 120 watts at power-up and tapers to approximately 80 watts within fifteen minutes of power-up at 25°C.

As an option, the system can be ordered with DC power supply in place of the AC power supply. Input voltage is 20-60 VDC. Refer to Appendix D for further details.

1-8 EMC/EMI

The Model 9100 meets the requirements of FCC Part 15 Class B for North America and Product Family harmonized standards EN55022 and EN55024 for emissions and immunity compliance of the EMC Directive 89/335/EEC and its amendments.

Note: In order to comply with the standards above, the following interface cables or equivalent listed in Table 1-1 must be used.

Table 1-1 Interface Cables for EMC Compliance

Reference Designator	Connector	Interface cable type
J1 & J2	“N” Type	RG-58
J5 through J28	BNC	RG-400
J29 & J30	RJ-45	Shielded twisted pair
J31 & J32	9-Pin D-SUB	Shielded twisted pair
J33	24 pin	TRAK supplied cable
FL1 & FL2	IEC-320	TRAK supplied power cords
Telecom Module J1 & J2	HD 15-pin DD-SUB	Shielded twisted pair

1-9 INPUT and OUTPUT CHARACTERISTICS

The Model 9100 input and output characteristics are listed in Tables 1-2 through 1-6.

Table 1-2. Output Characteristics, References

OUTPUTS	CHARACTERISTICS	
10 MHz (FDM)	Type:	Sinusoidal
		Selection by jumpers on FDM
	Level:	13 dBm, ± 2 dBm (1 Vrms)
	Impedance:	50 Ω
	Connector:	BNC
	Quantity	4
IRIG B (FDM)	Type:	1 kHz amplitude modulated (IRIG B122)
		Selection by jumper in FDM
	On Time:	Positive going edge of frame reference marker
	Level:	2.8 ± 0.2 VPP, exalted carrier cycles, IRIG-B
	Modulation Ratio:	3.3:1 typical
	Drive:	50 Ω
	Connector:	BNC
	Quantity	4
1 PPS (DDM)	Type:	TTL level pulse
	On Time:	Positive going edge
	Pulse Width:	400 ± 1 μs
	Rise/Fall Times:	<15 ns
	Drive:	50 Ω
	Connector:	BNC
	Quantity:	4

Table 1-2. Output Characteristics, References (continued)

OUTPUTS	CHARACTERISTICS	
5 MPPS (DDM)	Type:	TTL level square wave
	On Time:	Positive going edge
	Pulse width:	50 ns, ± 10 %
	Rise/Fall Times	< 15 ns
	Drive:	50 Ω
	Connector:	BNC
	Quantity:	4
Composite, 1 PPS + 5 MPPS (DDM)	Type:	TTL level pulse
	On Time:	Positive going edge of 1 PPS insertion point
	Pulse width	50 ns, ± 5 ns, changing to 150ns, ± 5 ns, at 1 PPS epoch
	Rise/Fall Times	< 15 ns
	Drive:	50 Ω
	Connector:	BNC
	Quantity:	4
Telecommunications, T1 or E1 (TEL)	Type:	Clock, TTL, and RS-422 (1.544 MPPS for T1 or 2.048 MPPS for E1), square wave
	Type	Framed, all ONEs, T1 or E1
	Connectors	TTL clock, rear panel BNC. 15 pin “DD” for RS-422 clock and framed signals
	Quantity	4 each of TTL, RS-422 clocks, and framed signals

Table 1-3. Output Characteristics, RS-232 I/O and TOD

OUTPUT	CHARACTERISTICS	
RS-232 I/O and TOD	Type:	Single ended RS-232
Common Characteristics	Character format:	8 data bits, 1stop bit, no parity
	Message Format	Two types, refer to paragraph 3-4 for detailed description
	Baud rate:	9600, Fixed
	Connectors:	9 pin “D” type

Table 1-4. Output Characteristics, Alarms

OUTPUT	CHARACTERISTICS	
Alarms	Type:	Relay contacts, one set major and one set minor alarm. Refer to Paragraph 1-11 for detailed description.
	Sense:	Contacts closed for no alarm condition
	Connector:	RJ-45 Type

Table 1-5. I/O Characteristics, 10 BaseT, Network Time Server

I/O	CHARACTERISTICS	
10 BaseT Ethernet	Network Time Protocol	NTP Version 3 (RFC 1305)
	Telnet	Status
	Connector:	RJ-45 Type

Table 1-6. Input Characteristics, GPS Antenna

INPUT	CHARACTERISTICS	
GPS Antenna	Supply voltage	+ 4.5 to 5.25 VDC, 5 – 80 ma
	Connector:	“N” type female

1-10 OSCILLATOR OPTIONS

Table 1-7. Oscillator Characteristics

The 9101 modules can be configured with three oscillator options. Characteristics of each oscillator are listed below.

Oscillator Type	10 MHz Output Phase Noise	Accuracy to UTC	Holdover Phase & Frequency Drift	Note
OCXO SC cut Single Oven	<-105 dBc @ 10Hz offset <-125 dBc @ 100 Hz offset <-140 dBc @ 1 KHz offset <-145 dBc @ 10 KHz offset	<100 nsec	<10 µsec/day <$5X10^{-10}$/day	Holdover @ constant temp ± 5ºC
OCXO SC cut Double Oven	<-115 dBc @ 10 Hz offset <-135 dBc @ 100 Hz offset <-145 dBc @ 1 KHz offset <-150 dBc @ 10 KHz offset	<100 nsec	<10 µsec/day <$5X10^{-10}$/day	Holdover @ operating temp of –30ºC to +60ºC
Rubidium	<-100 dBc @ 10 Hz offset <-125 dBc @ 100 Hz offset <-140 dBc @ 1 KHz offset <-145 dBc @ 10 KHz offset	<100 nsec	<10 µsec/week <$1X10^{-11}$/day	Holdover @ operating temp of –30ºC to +60ºC

Notes: Holdover specification is based on oscillator disciplined to GPS for a minimum of 72 hours.

1-11 MINOR & MAJOR ALARMS

Two sets of relay contacts provide Minor and Major Alarm indications. A closed contact indicates normal operation; an open contact indicates alarm condition. A Minor Alarm is reported if the system fault is detected, but is still supplying reliable reference frequencies. A Major Alarm is reported if the system is no longer supplying reliable reference signals or if a power supply failure occurs. The following conditions report Minor and Major Alarms.

Table 1-8 provides details of all the fault conditions and when the when a Minor and Major Alarm is reported including when the system will switch from GPS REF A to GPS REF B.

Minor Alarms

- Primary GPS Reference Module failure and operation is switched over to backup GPS Reference Module. Module failure includes any of the following: Loss of 1 PPS, 5 MPPS, Composite, 10 MHz IRIG B outputs, or Rubidium oscillator unlocked. Antenna failure and time out set by remote STI command is exceeded. GPS receiver unlocked and time out set by remote STI command is exceeded. Oscillator calibration required.

- Backup GPS Reference module failure and system is operating from Primary GPS Reference. Module failure includes any of the following: Loss of 1 PPS, 5 MPPS, Composite, and IRIG B outputs. Rubidium oscillator unlocked. Antenna failure and time out set by remote STI command is exceeded. GPS receiver unlocked and time out set by remote STI command is exceeded. Oscillator calibration required.

- Power Supply failure, if system contains dual power supplies and the second power supply is operational.

Major Alarms

- Primary and backup GPS Reference Module failure. Module failures include any of the following: Loss of 1 PPS, 5 MPPS, Composite, and IRIG B outputs. Rubidium oscillator unlocked. Antenna failure and time out set by remote STI command is exceeded. GPS receiver unlocked and time out set by remote STI command is exceeded.

- Double failure of both GPS Reference modules. In this condition the standby GPS Reference module (B) is placed on line. The FSU SELECT switch may be used to manually select either A, the primary or B, the secondary.

- Primary and backup Power Supply failure

- Distribution Module failure

Table 1-8. Major and Minor Alarm Conditions

Signal Name	GPS Module A	GPS Module B	Switch to B	DDU	Major Alarm	Minor Alarm
GPS Status(1)	F	G	Y	-	N	Y
GPS Status(1)	F	F	N	-	Y	Y
Rub/10Mhz	F	G	Y	-	N	Y
Rub/10Mhz	F	F	N	-	Y	Y
5MHZ	F	G	Y	-	N	Y
5MHZ	F	F	N	-	Y	Y
Composite	F	G	Y	-	N	Y
Composite	F	F	N	-	Y	Y
IRIG B	F	G	Y	-	N	Y
IRIG B	F	F	N	-	Y	Y
1PPS	F	G	Y	-	N	Y
1PPS	F	F	N	-	Y	Y
CPU	F	G	Y	-	N	Y
CPU	F	F	N	-	Y	Y
Antenna (1)	F	G	Y	-	N	Y
Antenna (1)	F	F	N	-	Y	Y
OSC Cal	F	G	N	-	N	Y
OSC Cal	F	F	N	-	N	Y
DAC Fail	F	N	Y	-	N	Y
DAC Fail	F	F	N	-	Y	Y
*	PSA	PSB	*	*	*	*
9100 Supply A	F	G	-	-	Y	Y
9100 Supply B	G	F	-	-	Y	Y
9200 Supply A	F	G	-	-	Y	N
9200 Supply B	F	F	-	-	Y	N
Dist Freq	-	-	-	F	Y	Y
Dist TEL	-	-	-	F	Y	Y
Dist TTL	-	-	-	F	Y	Y
Dist TFL	-	-	-	F	Y	Y

(1) Alarm Condition occurs after user set timeout elapses. Refer to the STI command in Chapter 3 for details of the user set timeout.

CHAPTER 2

INSTALLATION

2-1 UNPACKING PROCEDURE

The Model 9100 is packed for shipment in molded foam end-caps. Accessories, such as manual, antennas, cables, power cords, and mating connectors are contained in the same box as the Model 9100. Unpack the system as follows:

a. Examine shipping container for any signs of damage and rough handling. Record any damage observed and report to carrier.

b. Remove and retain shipping list from outside of carton.

c. Open shipping carton top and lift out the Model 9100 system.

d. Examine contents for any sign of damage and record any damage noted.

e. Remove accessories from the carton.

f. Check to ensure that all items listed on the packing list have been removed from the shipping carton.

g. Retain shipping carton and packing material for future use.

2-2 SYSTEM MOUNTING PROCEDURE

The Model 9100 is designed for mounting in an EIA standard 19-inch rack. Unit height is 5.22 inches and the depth is 15.00 inches. Allow at least four inches behind the unit for cable clearance. Free flow of circulating air should be available to assure an ambient temperature does not exceed +60^{o}C.

2-3 ANTENNA MOUNTING

A GPS antenna and coaxial cable is supplied with the Model 9100. For redundant configurations, two antennas and coaxial cables are typically supplied. In-line amplifiers and lightning suppressors are provided as options. For installation instructions of antenna and options, refer Appendix E of this manual.

2-4 INPUT and OUTPUT SIGNAL CONNECTIONS

Refer to Figure 2-1 and Table 2-1 for input and output connector location and description. Connect all cables as required for system operation. Frequency output connections have front panel distribution modules that share the same relative position. For example, Output 1, A through D corresponds with front panel module location A3.

Each distribution module has switches or configuration headers for selection of output signals. Refer to paragraph 2-6 for these module configuration instructions. Adhesive labels with signal names are provided and can be affixed to the rear panel. This provides a visual indication of the signal selected on the corresponding distribution module. For example if A3 is a DDM and the module is configured for 1 PPS distribution, place the 1 PPS label below BNC connector J8.

2-5 INPUT POWER

The standard Model 9100 is equipped with two input AC power outlets. The system operates from 100 to 240 VAC ± 10%, with no voltage selection required. If system is configured with redundant power supplies, connect both AC power cords. If system is configured with a single power supply, connect AC power cord to AC INPUT A. for DC power input options refer to Appendix D.

2-6 REAR PANEL CONNECTORS and FUSES

The Model 9100 rear panel is shown in Figure 2-1. All connectors, fuses, and indicators are described in Table 2-1. Multi-pin connector pin connections are provided in paragraph 2-7

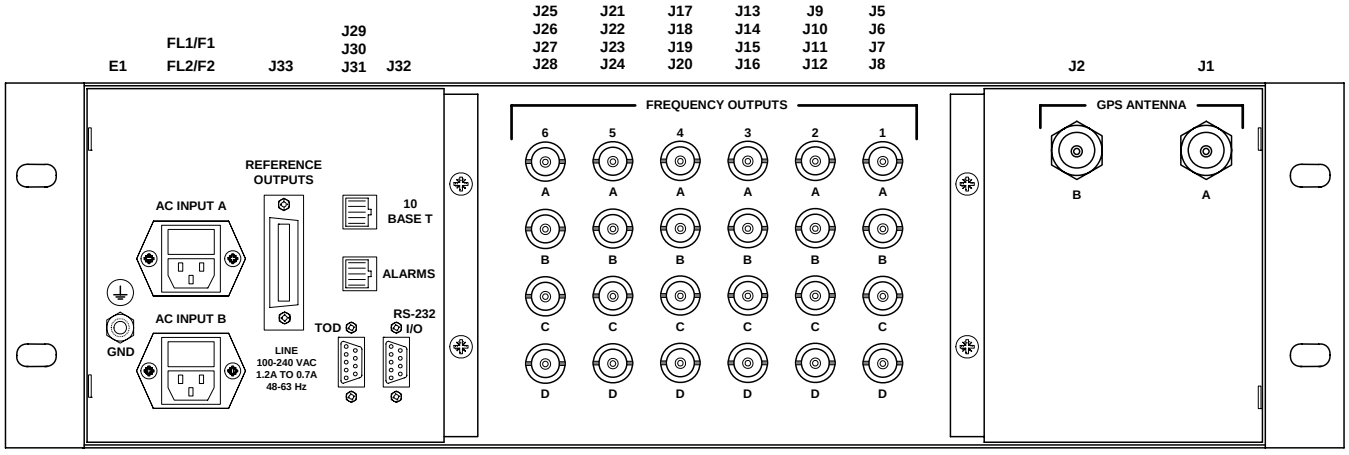


Figure 2-1. Model 9100 Rear Panel

Table 2-1. Rear Panel Connectors and Fuses

REF DES	FUNCTION	CHASSIS CONNECTOR	MATING CONNECTOR
J1 & J2	Connection to GPS antenna. J1 connects antenna to GPS Reference Module A1and J2 connects antenna to GPS Reference Module A2.	N female (2)	Antenna Lead- in cable
J3 & J4	(NOT USED)		
J5 – J28	Reference Outputs	BNC female (24)	BNC male
J29	10 BaseT Ethernet (NTS/NTP)	RJ45 female	RJ45 male
J30	Alarms, Major and Minor	RJ45 female	RJ45 male
J31	TOD (Time of Day)	DB-9 female (2)	DB-9 male
J32	RS-232 I/O	DB-9 female (2)	DB-9 male
J33	Reference Outputs (to Digital Distribution Unit)	AMP 554088-1	IEEE-488 Interface Cable, with metal shell and shielded cable, 1 meter. Cable supplied with Model 9200
FL1	100 to 240 Vac, power to PS A (A11)	IEC-320 type	Power Cord
F1	3 amp slow-blow fuse for PS A (A11) and spare fuse	Installed in FL1	
FL2	100 to 240 Vac power to PSB (A12)	IEC-320 type	Power Cord
F2	3 amp slow-blow fuse for PSB (A12) and spare fuse	Installed in FL2	

2-7 MULTI-PIN INTERFACE CONNECTOR

Table 2-2 through 2-5 provide the multi-pin connector pin assignments.

Table 2-2 10 BASE T (J29)

Pin No	FUNCTION
1	TXD+ (Transmit Data)
2	TXD- (Transmit Data)
3	RXD+ (Receive Data)
4	N/C
5	N/C
6	RXD- (Receive Data)
7	N/C
8	N/C

Table 2-3 Alarms (J30)

Pin No	FUNCTION
1	N/C
2	N/C
3	N/C
4	Minor Alarm Common
5	Minor Alarm N.C.
6	N/C
7	Major Alarm Common
8	Major Alarm N.C.

Table 2-4 TOD (J31)

Pin No	FUNCTION
1	N/C
2	TXD (Transmit Data)
3	N/C
4	N/C
5	Ground
6	N/C
7	N/C
8	N/C
9	N/C

Table 2-5 RS-232 I/O (J32)

Pin No	FUNCTION
1	N/C
2	TXD (Transmit Data)
3	RXD (Receive Data)
4	N/C
5	Ground
6	N/C
7	N/C
8	N/C
9	N/C

Table 2-6, Reference Outputs, (J33)

Pin No	FUNCTION	Pin No	FUNCTION
1	RS-232 B	13	Ground
2	RS-232 A	14	Ground
3	1 PPS B	15	Ground
4	1 PPS A	16	Ground
5	5 MPPS B	17	Ground
6	5 MPPS A	18	Ground
7	Composite B	19	Ground
8	Composite A	20	Ground
9	GPS Status A	21	GPS Status B
10	I^2C Interface Data	22	Ground
11	I^2C Interface Clock	23	Ground
12	N/C	24	Ground

2-8 MODULE SET UP

Distribution modules have switches or configuration headers for selection of output signals. If known in advance, each system is factory configured for a specific customer application. Otherwise, the modules are set to factory default.

Adhesive labels with signal names are provided with each system to attach to the rear panel. This provides a visual indication of the signal selected on the corresponding distribution module. For example if A3 is a DDM and the module is configured for 1 PPS distribution, place the 1 PPS label below BNC connector J8.

2-8.1 DIGITAL DISTRIBUTION MODULE (DDM), (A3-A8)

The DDM provide four outputs of the selected reference signal. Each DDM can be set with an internal switch to output four outputs each of the three references. The DDM requires no user adjustments or configuration set-up other than selection of the required reference. Refer to Figure 2-2 for rotary switch location and Table 2-4 for DDM output selector switch settings.

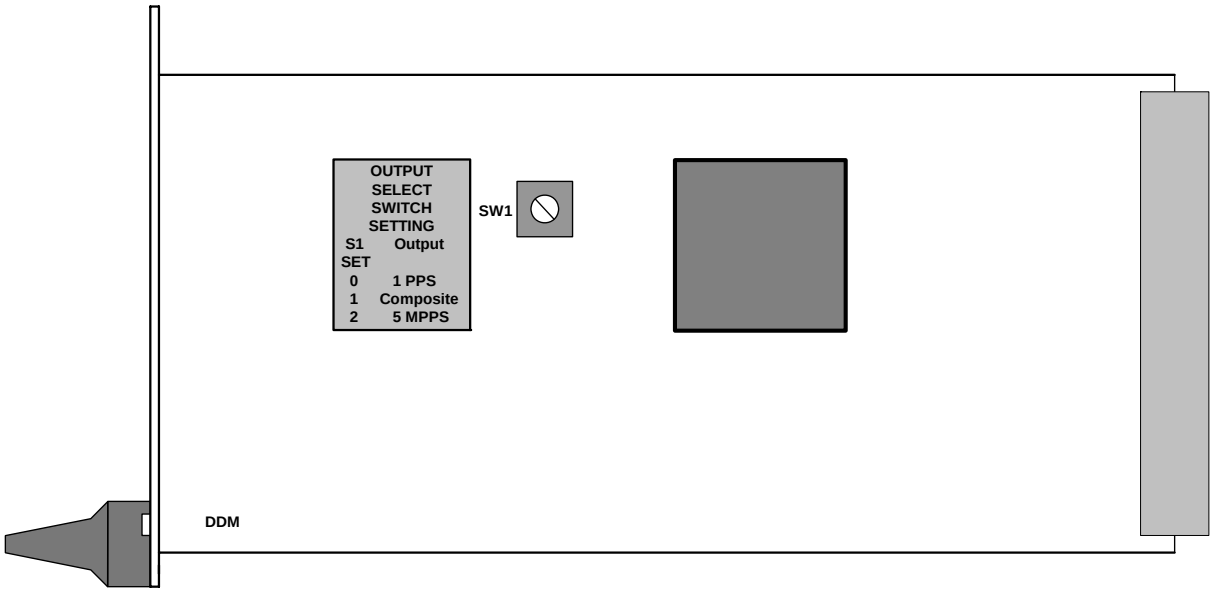


Figure 2-2, DDM Output Selector Switch Location

Table 2-7, DDM Output Signal Switch Positions

SW1 Setting	Ref. Output
0	1 PPS
1	Composite
2	5 MPPS

NOTE: Factory default setting for the DDM is 1 PPS.

2-8.2 Model 9107 Frequency Distribution Module (FDM) Module Jumper Settings

The FDM provides four outputs of the selected reference signal. Each FDM can be set with internal jumpers on E1 and E2 to output 10 MHz or IRIG B. Refer to Figure 2-3 for jumper location and Table 2-8 for FDM selector output jumper settings.

The FDM also has a potentiometer (R2) for adjusting the output signal level of the four outputs. The potentiometer is factory set to 2.8 VPP into 50 ohms.

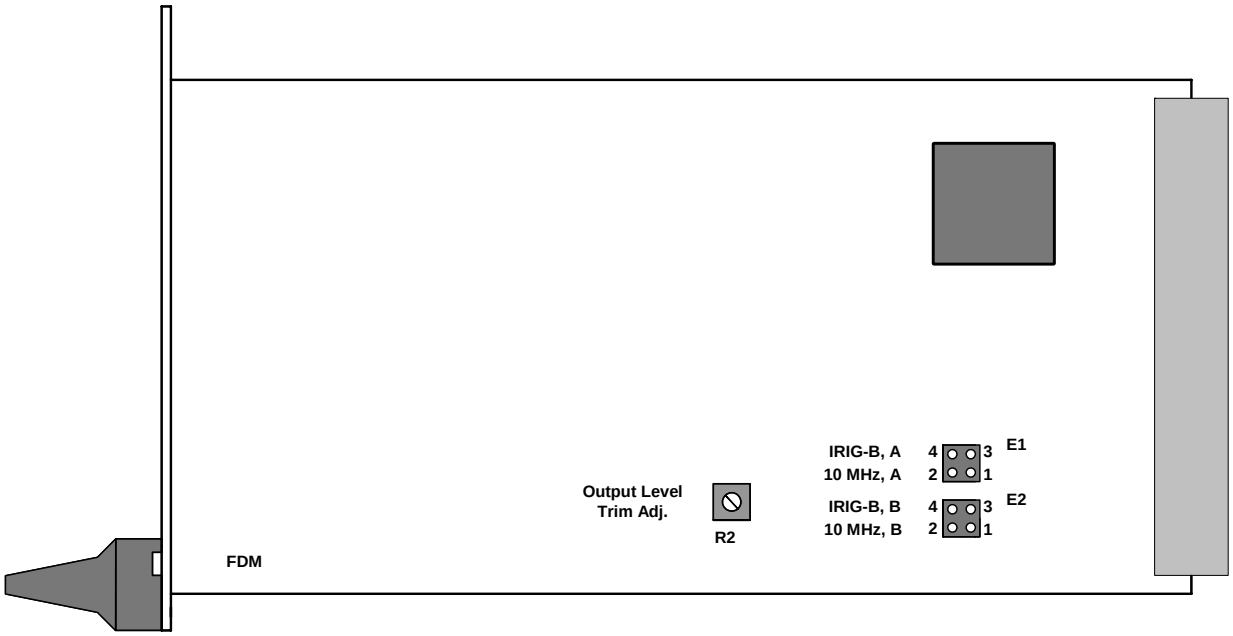


Figure 2-3, FDM Output Jumper Locations

Table 2-8, FDM Output Signal Jumper Positions

Output	Jumper Positions
10 MHz	E1, Jumper 1 and 2 E2, Jumper 1 and 2
IRIG-B	E1, Jumper 3 and 4 E2, Jumper 3 and 4

2-8.3 Model 9111 TEL Module Switch and Jumper Settings

The Model 9111 is factory configured for either T1 or E1 telecommunications outputs and cannot be field changed. This includes both clock and framed signals. Refer to Figure 2-4 for selector switch location and Tables 2-9, 2-10, and 2-11 for TEL selector switch settings. Refer to Tables 2-12 and 2-13 for RS-422 Clock and Framed outputs.

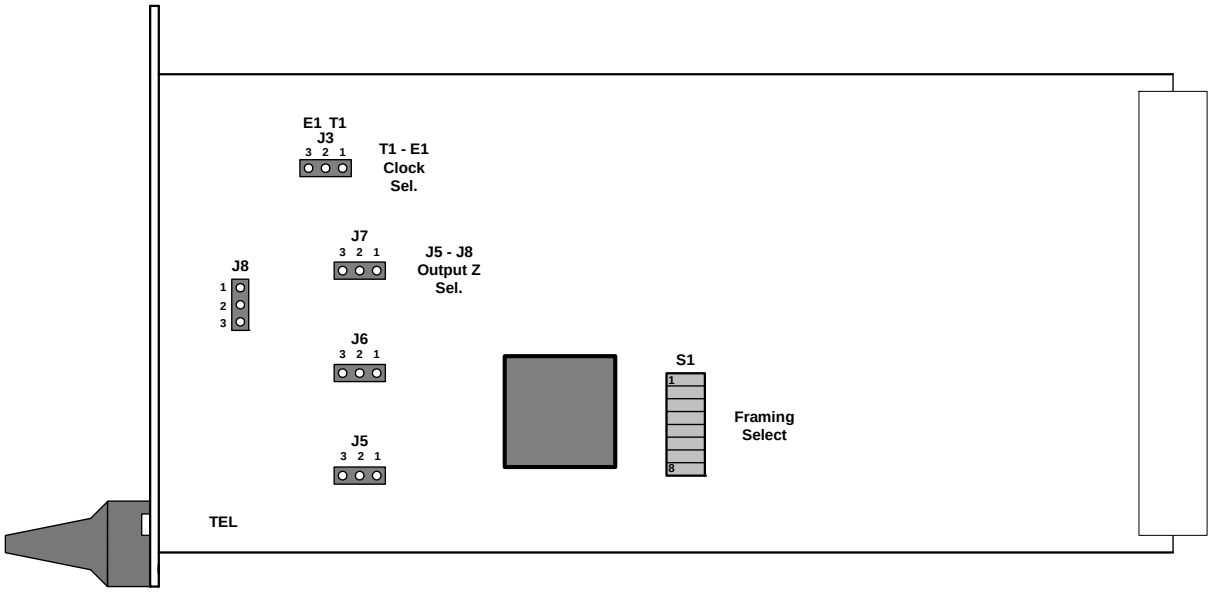


Figure 2-4, TEL Selector Switch and Jumper Location

Model 9111-1 TEL Module Switch and Jumper Settings for T1

Output Ground Isolation (Factory configured)
R33 – R36 Zero Ohm resistors not installed (Isolated)

Clock Select (Factory configured)
J3, jumper pins 1 and 2 (1.555 MPPS)

Output Transformer Impedance Select (Factory configured)
J5 – J8, jumper 1 and 2 (120Ω)

Table 2-9, TEL Framing Format Switch Positions for T1

S1 Settings	On	Off
S1-4	B8ZS Disabled	B8ZS Enabled
S1-5	Transparent Zero Suppression	Bit 7 Stuffing Zero Suppression
S1-6	Yellow Alarm Transmit Disabled	Yellow Alarm Transmit Enabled
S1-7	193S Select	193E Select
S1-8	Internal 193S Bit Selection	External 193S Bit Selection

Table 2-10, TEL Line Length Compensation Switch Positions for T1

S1-1 Settings	S1-2 Settings	S1-3 Settings	Line Length
On	Off	Off	1 – 133 Feet
Off	On	On	133 – 266 Feet
Off	On	Off	266 - 399 Feet
Off	Off	Off	399 – 533 Feet
Off	Off	Off	533 – 655 Feet

Model 9111 TEL Module Switch and Jumper Settings for E1

Output Ground Isolation (Factory configured)

R33 – R36 Zero Ohm resistors not installed (Isolated), for balanced 120Ω output
R33 – R36 Zero Ohm resistors installed (non-Isolated), for unbalanced 75Ω output

Clock Select (Factory configured)

J3, jumper pins 2 and 3 (2.048 MPPS)

Output Transformer Impedance Select (Factory configured)

J5 – J8, jumper 1 and 2 (120Ω)
J5 – J8, jumper 2 and 3 (75Ω)

Table 2-11, TEL Framing Format Switch Positions for E1

S1 Settings	On	Off
S1-4	Transmit CAS M frame enabled	Transmit CAS M frame disabled
S1-5	Transmit CRC4 M frame disabled	Transmit CRC4 M frame enabled
S1-6	Data AMI encoded	Data HDB3 encoded
S1-7	TDMA normal	TDMA alarm enable
S1-8	TRA normal	TRA alarm enable

Table 2-12, Model 9111 TEL RS-422 Clock Outputs, J1

Pin No	FUNCTION	Pin No	FUNCTION
1	Output A, +	6	Output A, -
2	Output B, +	7	Output B, -
3	Output C, +	8	Output C, -
4	Output D, +	9	Output D, -
11- 15	Ground	5-10	No Connection

Table 2-13 Model 9111 TEL Framed Outputs, J2

Pin No	FUNCTION	Pin No	FUNCTION
1	Output A, +	6	Output A, -
2	Output B, +	7	Output B, -
3	Output C, +	8	Output C, -
4	Output D, +	9	Output D, -
11- 15	Ground	5-10	No Connection

CHAPTER 3

OPERATION

3-1 GENERAL

This chapter covers the operation of the Model 9100 including a description of front and rear panel controls and indicators, initial synchronization, fault detection and remote interfaces.

3-2 FRONT PANEL CONTROLS and INDICATORS

A typical Model 9100 front panel view is shown in Figure 3-1. This view depicts a typical system configured for redundant operation.

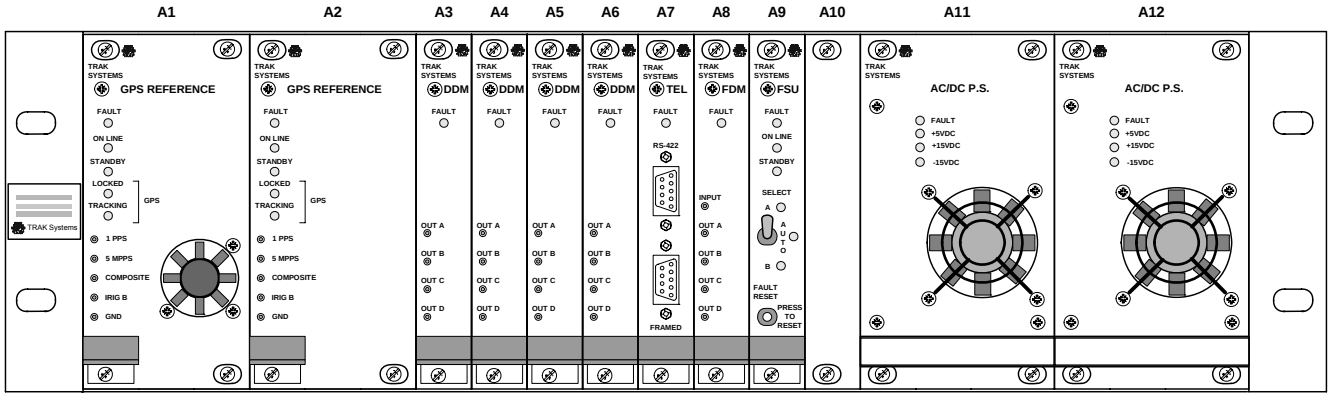


Figure 3-1. Typical Model 9100- Front Panel View

The Model 9100 has 12 front panel plug-in module locations. A1 and A2 are reserved for the GPS Reference Modules, A3 through A8 are reserved for distribution modules, A9 and A10 are reserved for FSU modules and A11 and A12 are reserved for Power Supply modules. In non-redundant configurations, GPS Reference module A2 and Power Supply module A12 are omitted. The type and number of distribution modules installed in module locations A3 through A8 vary based on system application. A view of each module front panel along with a description of controls and indicators are provided below.

3-2.1. GPS Reference Modules, A1 and A2

The Model 9101 GPS Reference Module front panel is shown in Figure 3-2. Descriptions of the indicators and test points are given below.

FAULT Red, module fault summation

ON LINE Green, indicates module is the on line reference

STANDBY Green, indicates module is in standby

LOCKED Green, indicates internal oscillator is within ± 400 ns of GPS. At power up and until the module is locked the indicator flashes, during this time the 1 PPS, 5 MPPS and Composite signal outputs are muted.

TRACKING Green, indicates GPS is tracking satellites

The Model 9101 GPS Reference Module front panels shown in Figure 3-2 contains the following test points:

1 PPS Module 1 PPS monitor

5 MPPS Module 5 MPPS monitor

COMPOSITE Module Composite monitor

IRIG-B Module IRIG-B modulated time code monitor

GND Ground

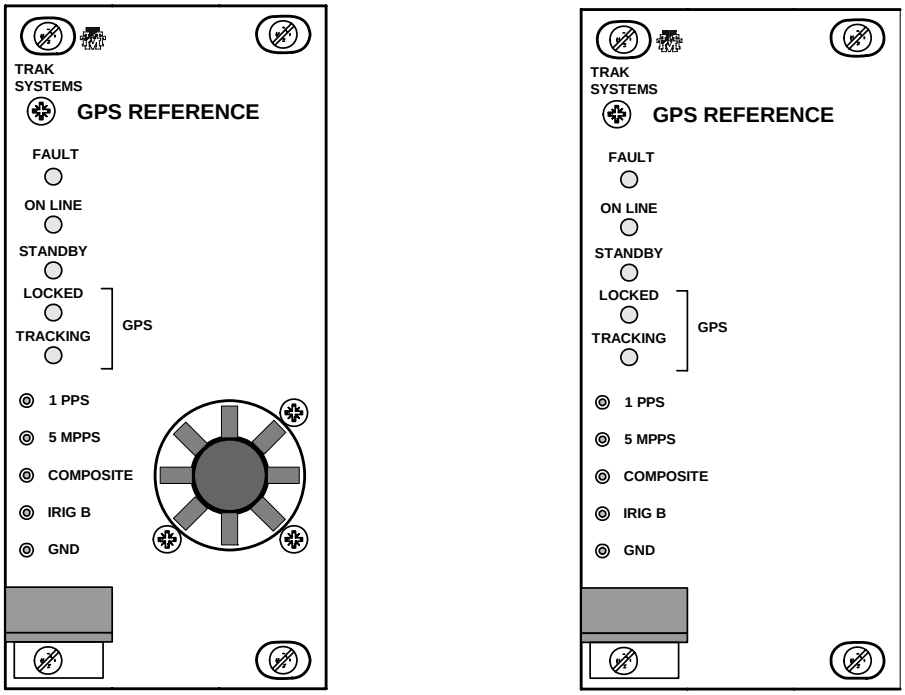


Figure 3-2. Model 9101 GPS Reference Module (GPS)

NOTE: GPS Reference modules that contain a front panel fan have an internal Rubidium oscillator. Modules without the fan contain a crystal oscillator.

3-2.2 Digital Distribution Module

The Model 9106 (DDM) front panel shown in Figure 3-3 contains a FAULT indicator and four output test points. The FAULT illuminates when one or more of the four outputs fail. The FAULT indication is latched until cleared by “FAULT RESET” switch on the front panel of the FSU. The output test points allow monitoring of selected outputs from the front panel.

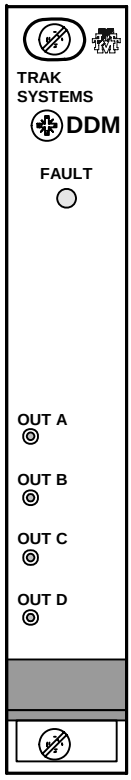


Figure 3-3. Model 9106 Digital Distribution Module (DDM)

3-2.3 Telecommunications Signal Generator Module

The Model 9111 (TEL) front panel shown in Figure 3-4 contains a FAULT indicator and two 15 pin “DD” connectors, one for RS-422 telecom clock and the other for telecom framed outputs The FAULT illuminates when an output fails. The FAULT indication is latched until cleared by “FAULT RESET” switch on the front panel of the FSU.

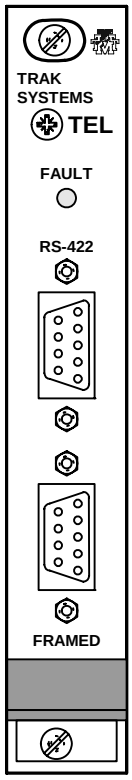


Figure 3-4. Model 9111 Telecom Signal Generator Module (TEL)

3-2.4 Frequency Distribution Module (FDM)

The Model 9107 (FDM) front panel shown in Figure 3-5 contains a FAULT indicator, input test point and four output test points. The FAULT illuminates when one or more of the four outputs fail. The FAULT indication is latched until cleared by “FAULT RESET” switch on the front panel of the FSU. The input and output test points allow monitoring of selected outputs from the front panel.

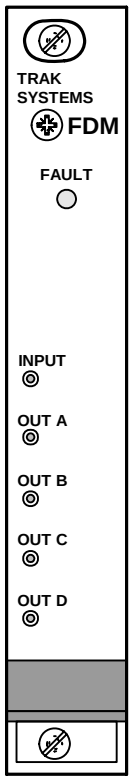


Figure 3-5. Model 9107 Frequency Distribution Module (FDM)

3-2.5 Fault Sense Units (FSU)

The Model 9104 Fault Sense Unit front panel shown in Figure 3-6 contains the following LED indicators:

FAULT red, module fault summation

STANDBY green, indicated module is in standby

ON LINE green, indicates module is on line

SELECT A green, indicates manual mode A is selected

AUTO green, indicates FSU is in the automatic A to B fail over mode

SELECT B green, indicates manual mode B is selected

The Model 9104 Fault Sense Unit front panel shown in Figure 3-6 contains the following switches:

A AUTO B Selects the operational mode. Default mode is AUTO. To change to A or B (usually for testing or module replacement) press FAULT RESET while actuating the momentary switch to the desired mode. This double actuation prevents accidental mode changes.

If the system is not redundant, the switch is not functional. Actuating the switch will cause the selected LED to flash.

FAULT RESET Pressing FAULT RESET clears any latched faults.

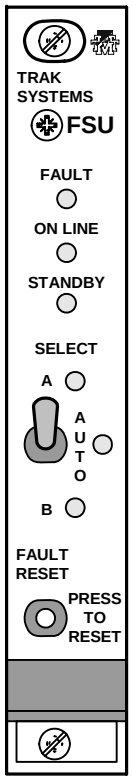


Figure 3-6. Model 9104 Fault Sense Unit (FSU)

3-2.6 Power Supplies, A11 and A12

The Model 9120 Power Supply front panel shown in Figure 3-7 contains a red FAULT indicator and three green power supply output voltage status indicators. The FAULT indicator illuminates if any of the three power supply voltages drop below a set level. The appropriate green power supply indicators are normally illuminated and will extinguish if the voltage is out of range.

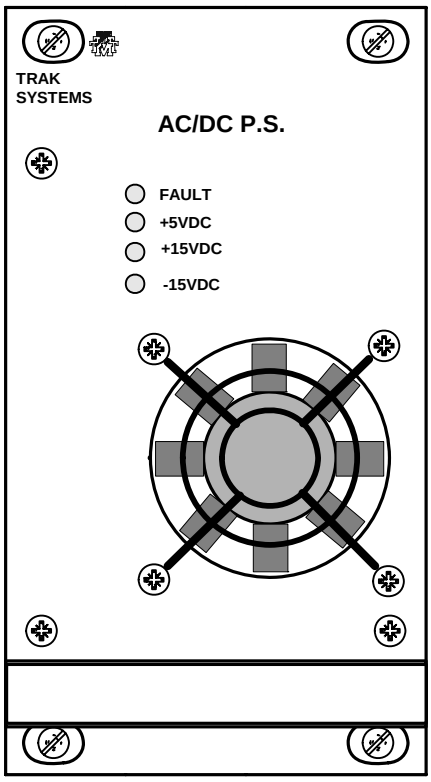


Figure 3-7. Model 9120 Power Supply

3-3 INITIALSYNCHRONIZATION

With all signal connections made, antenna(s) installed, connected and power applied, the Model 9100 automatically performs initial synchronization. No operator intervention is necessary other than setting the antenna cable delay, if different than the factory setting of 65 nanoseconds. Antenna cable delay can be changed through the RS-232 interface using the SDC command. Propagation delay for common cable type is provided in Table 2 of Appendix E.

Warning: Connecting the antenna(s) to the Model 9100 after power is applied may cause the GPS receiver to take longer than normal to acquire satellites. If power is applied without antenna(s) connected for greater than 1-hour, it is recommended that power be cycled to allow the GPS receiver to perform normal satellite search.

At power up and for 20 to 45 minutes, the system front panel LEDs provide indication of the initialization stages. These are the sequence of events and that occur.

a. All Power Supply green LEDS should be illuminated.

b. All FSU LEDs illuminate for 5 seconds, then the AUTO LED remains on and all others off, indicating initialization of the FSU is complete.

c. The GPS REF modules FAULT, ONLINE and STANDBY LED illuminate for 20 seconds, then the FAULT, ON LINE, and STANDBY LEDS of the GPS REF modules go out, indicating CPU initialization of the GPS REF modules is complete.

d. Once the GPS REF module is initialized the LOCKED LED flashes until the GPS receiver acquires satellites, oscillator warm-up is complete, and 1 PPS phase is within $\pm$ 400 nanoseconds of the GPS 1 PPS. The TRACKING LED will normally illuminates within 5 to 10 minutes after power up. The module is operational when the LOCKED LED remains ON. This normally takes 20 to 45 minutes.

NOTE: While the LOCKED LED flashes the 1 PPS, 5 MPPS and Composite outputs of the GPS REF module are muted. If redundant GPS REF modules are installed and the backup GPS REF locks first it will be placed on line until the primary module locks.

3-4 TOD OUTPUT

The Model 9100 provides an ASCII time of day (TOD) output message that is output once per second. Two formats are available and are selected through the RS-232 I/O or 10 BASE T using the SCM command. Refer to section 3-5 for description of this command.

3-4.1 Time Format 1

Time is output once per second from the TOD output port in the following format:

TYYYY,MM,DD,HH:mm:SS,F<CR/LF>

Where:

T = Start of string (RS-232 positive going edge of the start bit that comprises the ASCII "T" is the "on-time mark").
YYYY = Year
MM = Month of year
DD = Day of month
HH = Hours of day
mm = Minutes of hour
SS = seconds of minute
F = Time Figure of Merit (TFOM), "0" when time is unknown or > 1μs and "4" when time is valid and < 1μs.
CR/LF = Carriage return/Line feed

3-4.2 Time Format 2

Time is output once per second from the TOD output port in the following format:

<CR/LF>FspspDDDspHH:MM:SSspDsTZ=xx<CR/LF>

Where:
First CR/LF = Start of string (RS-232 positive going edge of the start bit that comprises the first ASCII "CR" is the "on-time mark").
F = TFOM, "Space" when time is valid and < 1μs, "?" when time is unknown or > 1μs, or "*" when in holdover mode
spsp = space space
DDD = Day of year
sp = space
HH = Hours of day
MM = Minutes of hour
SS = seconds of minute
sp = space
Ds = Daylight savings, "**S**" during periods of standard time for selected DST schedule, "**I**" for 24 hour preceding DST, "**D**" DST, and "**O**" for 24 hour period after DST
TZ = Time zone
xx = time zone number (Example: Eastern time zone is 05. Pacific is 08)

3.5 REMOTE OPERATION

The Model 9100 can be setup and monitored remotely through the RS-232 I/O or 10 BASE T using TELNET. There are two modes that can be set; one is the “Local Echo” mode where each character that is input is echoed back to the host. The second is the “Computer” mode where the input characters are not echoed. The “computer” is the default mode.

3-5.1 Computer Mode

The Computer Mode is the default mode of RS-232 communications port and is used when controlling the Model 9100 from a remote computer. No echoing of input commands is given, and the once-per-second time output, if commanded, is active, when enabled. When writing interface programs, do not issue three or more successive carriage return <CR> commands. This will switch the port communications mode to Local Echo. To reenter the Computer Mode after using the Local Echo mode, issue a control <^E>.

3-5.2 Local Echo Mode

Use this mode when controlling the Model 9100 from a terminal program such as Hyper Terminal. Enter the Local Echo Mode by typing three successive carriage returns <CR>. 9100> prompt is displayed in this mode, and all input key strokes are echoed to the screen. While in the Local Echo mode, once-per-second time outputs from this port are suspended. To exit this mode, type a control E <^E>.

NOTE

Before attempting to use the RS-232 port, assure that the remote computer or terminal is set to 9600 baud, 8 data bits, 1-stop bit and no parity.

3-5.3 Remote Interface Commands

The following section contains a list and description of all remote interface commands. Request commands are prefixed with “RQ” and return status. Setup commands are prefixed with ”S” and allow system parameter changes by writing data in the parameter field. All commands are initiated from the host computer. All entries must be terminated with a carriage return <CR>. The Model 9100 will respond with a <CR> and a <LF>.

The setup commands will reply with the command and “DONE” if the command and the data received is valid. If the command or data is not valid, the command replies with the setup command that was issued and “ERROR”. Setup commands can also be used for status if no data is sent.

Commands can be directed to a specific GPS Reference module. These commands are prefixed with an “X”, where “X” is an “A” for the primary GPS Reference module and “B” for the backup GPS Reference module. Omitting the “X” prefix will cause different results, depending on the command is being used in the setup mode or request mode. If the “X” prefix is omitted, and the command is in the request mode, it will be directed to the on-line module. If the “X” prefix is omitted, and the command is in the set mode, it will be directed to both modules. The response will always contain the “X” parameter, indicating which module responded to the command. If the response is caused by a command that was sent to both modules, the “X” parameter will be ‘D’. Commands that have this capability are prefixed with an “X” in the command description.

Examples of remote interface command.

1. Request time mode from primary GPS Reference module using the STM command.

   Host sends: A.STM <CR>

   9100 replies: A.STM U <CR><LF>

2. Request time mode from backup GPS Reference module using the STM command.

   Host sends: B.STM <CR>

   9100 replies: B.STM U <CR><LF>

3. Set Time mode to UTC on primary and backup GPS Reference modules

   Host sends: STM U <CR>

   9100 replies: D.STM DONE <CR><LF>

A list of available request status commands and setup commands with descriptions and factory default parameters are provided in Table 3-1 and 3-2 respectively.

Table 3-1 Request Commands List

COMMAND	DESCRIPTION	DEFAULT
X.RQDR	Request oscillator DAC value	N/A
X.RQIR	Request difference between internal 1 PPS and selected time reference	N/A
X.RQLK	Request 1 PPS reference locked status	N/A
X.RQLN	Request navigation solution	N/A
X.RQLS	Request Leap Second Status	N/A
X.RQST	Request list of satellites being tracked	N/A
X.RQBT	Request GPS Reference module bit status	N/A
X.RQSD	Request Currently Visible Satellite Position and Tracking Status and Dilution of Precision (DOP)	N/A
RQFS	Request fault status	Off
RQSW	Request software version and compile data	N/A

Table 3-2 Setup Commands List

COMMAND	DESCRIPTION	DEFAULT
SCM 1, 2	Set time mode to Time Format 1 or 2	Time Format 1
X.SDC	Set and request user and antenna delay compensation.	0 ns user delay 65 ns antenna delay
X.SDD	Set and request spring and fall dates for daylight savings and standard times.	Spring Date: 4/1 Fall DATE: 10/28
X.SLP	Set and request user entered position	N/A
X.SPS	Set and request position source	Computed average position
X.SUT	Set UTC time and request current time.	N/A
X.STM	Set and request time mode.	UTC
X.STI	Set and request receiver unlock time-out delay	5 days RUB 2 days DXTL
SOS	Switch on-line source	AUTO
FRST	Remote fault reset	N/A

3-5.4 Request Commands

Request DAC reference value

Indicates the voltage level which when applied to the internal oscillator control input will place the oscillator at its' 10 MHz center frequency. This value is used to indicate when the oscillator needs calibration. If the DAC value is < 6,554 or >58,982 the OSC CAL minor alarm is activated.

Host sends:	X.RQDR<CR>
9100 replies:	X.RQDR ddddd<CR><LF>
Where:	ddddd is DAC setting (range is 0 to 65535) X is described on command summary page

NOTE: The ddddd field is not padded with zeros or spaces and will contain only the digits necessary to represent the value.

Request difference between the internal 1 PPS reference and the selected time reference

Host sends:	X.RQIR<CR>
9100 replies:	X.RQIR ttt REF – mmm, "string"<CR><LF>
Where:	ttt (time ref) is "INT" if internal reference mmm (measurement ref) is "UTC" or "GPS" "string" is either the difference (in nanoseconds) or a status message X is described on command summary page

Request internal 1 PPS reference locked status

Provides time stamp of when internal oscillator locked or unlocked.

Host sends:	X.RQLK<CR>
9100 replies:	X.RQLK NO LOCK SINCE POWERUP<CR><LF>
or	X.RQLK FREE RUN SINCE ddd:hh:mm:ss<CR><LF>
or	X.RQLK LOCKED SINCE ddd:hh:mm:ss<CR><LF>
Where:	X is described on command summary page

Request navigation solution being received from GPS receiver

NOTE: The position returned from this request is the position the GPS receiver is using to output precise time. If the position source is “NA” or “N”, the position returned from this command will update every second until the new position computed by the receiver. If the position source is “U” or “A”, the receiver will then return either the user input or the average position respectively.

Host sends:	X.RQLN <CR>
9100 replies:	X.RQLN dd:mm.fffN,ddd:mm.fffW,Shhhhh.f<CR><LF>
Where:	dd:mm.fffN is Latitude, where N is North or S is South ddd:mm.fffW is Longitude, where W is West or E is East Shhhhh.f is signed Height in meters X is described on command summary page

Request leap second status

This command provides date of the next pending leap second. If no leap second is scheduled, the data are all zeros. (Data is automatically down loaded from GPS).

Host sends:	X.RQLS<CR>
9100 replies:	X.RQLS yy,mm,dd<CR><LF>
Where:	yy = year; e.g. (two digit year) mm = month dd = day of month X is described on command summary page

Request Currently Visible Satellite Position and Tracking Status and Dilution of Precision (DOP) Values -

Host sends:	X.RQSD <CR>
9100 replies:	X.RQSD PRN sv, AZ=AAA, EL=EE, SN=SS.S,TRK=t<CR><LF> X.Current DOP = DDD.D<CR><LF>
where:	sv is the satellite number AAA is the azimuth in degrees EE is the elevation is degrees SS.S is the signal to noise ratio T is the tracking status (“Y”= tracking, “N”= not tracking) DDD.D is the PDOP in 3D fix HDOP in 2D fix or 00 in position hold mode (DOP = dilution of precision) X is described on command summary page

The “RQSD” line is repeated for each satellite currently visible up to a maximum of 12 satellites. In addition, each comma is followed by a space character.

Request list of satellites being tracked –

This command provides the PRN numbers of the satellites being tracked.

Host sends:	X.RQST<CR>
9100 replies:	X.RQST sv,sv,sv,sv,sv,sv,sv,sv,sv,sv,sv,sv<CR><LF>
or	X.RQST NONE<CR><LF>
Where:	sv is the satellite PRN number X is described on command summary page

NOTE: The “X.RQST sv” line is shown in its longest form. The actual response length will vary depending on the number of satellites being tracked at the time.

Request GPS Reference Module BIT Status

This command provides the BIT status of the GPS Reference module.

Host sends:	X.RQBT<CR>
9100 replies:	X.GPS BIT STATUS ABCDEFGHIJ
Where:	A is GPS status, G or F *B* is GPS Rubidium Lock and 10 MHz Status, G or F *C* is GPS 5 MHz status, G or F *D* is GPS Composite Status, G or F *E* is GPS IRIG-B status, G or F *F* is GPS 1 PPS status, G or F *G* is GPS CPU status, G or F *H* is GPS Antenna status, G or F *I* is GPS oscillator calibration or DAC failure, G or F J is GPS on-line status, Y or N X is described on command summary page

Request Fault Status

This command provides system BIT status information. The status can be quarried or automatically output with a change in status.

Request Mode

Host sends: RQFS<CR>

9100 replies: FSU *AB* GPS *CDEFGHIJKL* PWR *M* DST *NOPQ* <CR/LF>

Where:
A is CPU status of the FSU, G or F (Good or Fail)
B is On-line status of the FSU, A or B

C is GPS status, G or F
D is GPS Rubidium Lock and 10 MHz Status, G or F
E is GPS 5 MHz status, G or F
F is GPS Composite Status, G or F
G is GPS IRIG-B status, G or F
H is GPS 1 PPS status, G or F
I is GPS CPU status, G or F
J is GPS Antenna status, G or F
K is GPS oscillator calibration or DAC failure, G or F
L is GPS on-line status, A, B, or M (both A and B muted)

M is Power Supply status, G or F

N is Distribution Frequency output status, G of F
O is Distribution TEL output status, G or F
P is Distribution TTL output status, G or F
Q is Distribution TFL status, G or F

Set Mode:

Host sends: RQFS string <CR>

Where: string is ON to enable automatic output of the above message when a change in status is detected.
String is OFF to disable automatic output

9100 replies: RQFS DONE <CR><LF>

Request software version and compile date-

Host sends: RQSW<CR>

9100 replies:
FSU: A Date: Ver:
Slot 1: Date: Ver:
Slot 2: Date: Ver:
Slot 3: Date: Ver:
Slot 4 Date: Ver:
Slot 5: Date: Ver:
Slot 6: Date: Ver:
Slot 7: Date: Ver:
Slot 8: Date: Ver:

3-5.4 Request / Setup Commands

Set/Request Time Format 1 or Time Format 2

This command sets or requests the time format of the TOD output port.

Request mode:

Host sends: SCM <CR>

9100 replies: TIME FORMAT X <CR><LF>

Where: X is 1 for Time Format 1
X is 2 for Time Format 2

Set mode:

Host sends: SCM 1 <CR> (For Time Format 1 (see para. 3-4.1)
SCM 2 <CR> (For Time Format 2 (see para. 3-4.2)

9100 replies: SCM Done

Set/Request user offset and antenna delay compensation

This command provided the user to offset the GPS 1 PPS reference for antenna delay compensation and to offset the GPS 1 PPS from UTC.

Request mode:

Host sends: X.SDC<CR>

9100 replies: X.SDC suuuuuuuuu,aaaaaa<CR><LF>

Where: suuuuuuuuu is the signed user offset in nanoseconds up to 500000000ns
aaaaaa is the antenna delay compensation in nanoseconds up to 999999ns
X is described on command summary page

Set mode:

Host sends: X.SDC suuuuuuuuu,aaaaaa<CR>

9100 replies: X.SDC DONE<CR><LF>

Where: Same as for SDC request mode

WARNING: Time accuracy is degraded if incorrect offset or antenna delay compensation is entered.

Set/Request DST dates

This command enters the day light savings time (DST) Spring and Fall change dates. Refer to Table 3-2 for factory default dates. Local standard time may be selected when DST is not used.

Request mode:

Host sends: X.SDD<CR>

9100 replies: X.SDD mm,dd,mm,dd,M<CR><LF>

Where: 1st mm,dd - is Spring's date and
2nd mm,dd - is Fall's date
M is a "D" if daylight or an "S" if standard
X is described on command summary page.

Set mode:

Host sends: X.SDD mm,dd,mm,dd,M<CR>

9100 replies: X.SDD DONE<CR><LF>

Where: Same as for SDD request mode.

Set/Request local position

The position entered with this command may be used in two ways. If the position source is “N” or “NA”, the GPS receiver will accept and use the entered position, but will update it as navigation solutions are computed; if the position source is “U”, the entered position will be used and no position solutions will be performed. If the position source is “A”, the entered position will not be used, but will be stored for later retrieval should the user decide to change the position source. Refer to SPS command for further clarification of when this command is used.

Warning: Entering an incorrect position will degrade the GPS REF module timing accuracy and in some cases, the GPS will cease satellite tracking.

Request mode:

Host sends: X.SLP<CR>

9100 replies: X.SLP dd:mm.fffN,ddd:mm.fffW,Shhhhh.f<CR><LF>

Where: dd:mm.fff is Latitude (N is North or S is South)
ddd:mm.fff is Longitude (W is West or E is East)
Shhhhh.f is signed Height in meters
X is described on command summary page

Set mode:

Host sends: X.SLP dd:mm.fffN,ddd:mm.fffW,Shhhhh.f<CR>

9100 replies: X.SLP DONE<CR><LF>

Where: Same as for SLP request mode.

Set/Request position source

Average position is the default mode and should be used for most applications. This mode performs an average of 10,000 2D or 3D position fixes. If the averaging is interrupted, the averaging resumes where it left off when tracking is resumed. Once the averaging is complete, the GPS receiver automatically enters position hold mode and the average position latitude, longitude and height is stored in NV memory. On subsequent power up a mini-average is computed and if the mini-average passes a GPS receiver is placed in Position Hold mode with the antenna position that was saved in NV memory. If the position source is changed to “N” or “U” during an average, the averaging operation will be halted and reset. All averaging data will be erased and the GPS satellite tracking will cease and reacquire. If the user changes the position source to “U”, the unit will enter this mode on the next power-up and will not perform an average position operation.

User Position mode should only be used if an accurate antenna survey is known. If the GPS receiver is set to User Position with a wrong position will cause degraded time accuracy and in some cases, the GPS will cease satellite tracking. However, if the GPS is powered up in User Position a mini-site survey is performed. If the mini-site survey fails, the GPS receiver is automatically placed in Average Position mode.

The Navigation mode should only be used on moving platforms. In this mode, the time accuracy is degraded.

Warning: Timing accuracy is degraded in Navigation mode or in User Position with the incorrect position entered in the SLP command.

Request mode:

Host sends:	X.SPS<CR>
9100 replies:	X.SPS m<CR><LF>
Where:	m - is an "N" if the receiver navigation solution is selected m - is a "NA" if the computed average position is selected and the average position computation is not complete m - is a "A" if the computed average position is selected and the average position computation has completed m - is an "U" if the user entered position is selected X is described on command summary page

Set mode:

Host sends:	X.SPS m<CR>
Where:	m - is an "N" if use of the receiver navigation solution is desired m - is a "A" if use of the computed average position is desired m - is an "U" if use of the user entered position is desired X is described on command summary page
9100 replies:	X.SPS DONE<CR><LF>

Set/Request time mode

This command selects GPS, UTC or Local for all time outputs in the unit. Hours and minutes offset between time zones can be entered. If GPS is selected, the offset between GPS and UTC is updated automatically when the unit tracks satellites.

Any changes to these parameters should be made after power-up and before antenna position averaging takes place.

Warning: UTC is the default time mode and is normally used in most applications. If the time mode is change to local or GPS, the IRIG B, TOD port and optional NTS will output time in the selected mode.

Request mode:

Host sends:	X.STM<CR>
9100 replies:	X.STM t,ooo,mm<CR><LF>
Where:	t is a "G" if GPS t is a "U" if UTC t is a "L" if LOCAL ooo is the signed offset value in hours (±HH) for Local mm is the offset in minutes (00-59) for Local X is described on command summary page

Set mode:

Host sends:	X.STM t,ooo,mm<CR>
9100 replies:	X.STM DONE<CR><LF>
Where:	Same as for STM Request mode

Note: The minor time mode is set to UTC if UTC or LOCAL are selected and GPS if GPS is selected. It is not necessary to enter the hours and minutes offset when switching to LOCAL time. The unit will use the last entered offset values if none are specified.

Set/Request receiver unlock time-out delay -

This command provides a user settable time out that will mask an unlock (holdover) condition from causing a GPS REF module failure until the time out elapses. The time out is set in hours and days and if the STI is requested while the GPS REF module is locked, the response will contain the user setting. However, if the GPS REF module is in holdover, the STI responds with the user set timeout and the current minutes, hours and days left for the timeout to elapse. If the timeout elapses, the GPS REF module will indicate a failure.

Request mode:	
Host sends:	X.STI<CR>
9100 replies:	X.STI dd:hh<CR><LF> (if in non-holdover mode) X.STI dd:hh DD:HH:MM <CR><LF> (if in holdover mode, elapsed time of holdover)
Where:	dd is the time-out in days, user set time out hh is the time-out in hours, user set time out DD is the number of days left before timeout elapses if in holdover HH is the number of hours left before the timeout elapses if in holdover MM is the time out in minutes left before the timeout elapses if in holdover X is described on command summary page
Set mode:	
Host sends:	X.STI dd:hh <CR>
9100 replies:	X.STI DONE<CR><LF>
Where:	Same as for STI request mode

Set/Request UTC time -

(Optional). This command is never required but is provided to allow the unit to be used as a time code generator, without the need of a satellite. This command can also be used to request the current time.

Warning: Time can not be set if GPS REF module is tracking satellites.

Request mode:

Host sends: X.SUT<CR>

9100 replies: X.SUT ddd:hh:mm:ss.ff0,Q<CR><LF>

Where: ddd is day of year
hh is hours
mm is minutes
ss is seconds
ff0 is milliseconds with 10 ms resolution
Q is Quality byte
0 = Unknown
4 = Phase < 1uS
X is described on command summary page

Set mode:

Host sends: X.SUT yyyy,MM,dd,hh,mm,ss<CR>

9100 replies: X.SUT DONE <CR><LF>

Where: yyyy is year; e.g. 1991
MM is month
dd is day of month
others fields are as previously described

Set/Request On-line source

In request mode, this command provides the status of the FSU front panel SELCT switch. In set mode the command duplicates the front panel selection.

Warning: If changing the setting from "T" to "A" or "B" will override the automatic switchover function.

Request mode:

Host sends: SOS<CR>

9100 replies: SOS S<CR><LF>

Where: S is T for auto
S is A for source A
S is B for source B

Set mode:

Host sends: SOS S<CR>

9100 replies: SOS DONE<CR><LF>

Where: Same as for SOS request mode

Fault Reset command

This command will attempt to clear any Model 9100 latched failures.

Set mode:

Host sends: FRST <CR>

9100 replies: FRST DONE<CR><LF>

CHAPTER 4

Maintenance

4-1 GENERAL

The Model 9100 provides maintenance-free operation for the life of the system. This chapter contains instructions for locating and correcting failures in the Model 9100 MFTS. Troubleshooting instructions are provided for locating and replacing modules. No troubleshooting aids are provided beyond the module level.

4-2 MAINTENANCE PHILOSOPHY

All circuits in the Model 9100 are in front-panel replaceable modules, allowing rapid repair at the system operational level. Additionally, all modules contain fault indicators, allowing rapid recognition and replacement of a failed module. No attempt should be made to repair a module. These assemblies should be returned to the factory for repair.

4-3 PREVENTATIVE MAINTENANCE

Preventive maintenance of the system consists mainly of cleaning and general inspection to maintain the best environment for the equipment operation. Power Supplies and GPS Reference modules contain fans; these modules should be periodically cleaned to remove any dust buildup.

4-4 REPLACEMENT of MODULES

All modules are “hot-swappable”, however, the power supply module swapping should be limited to those times when disruption of power would cause problems in the main system. A procedure for Power Supply replacement is provided in Paragraph 4-5.3.

4-5 TROUBLE SHOOTING GUIDE

The following paragraphs provide corrective actions for system failures. Included are procedures for fault recognition, failed module location, and for module replacement.

4-5.1 GPS Reference Failure

If a primary or backup GPS Reference module fails, the red front-panel FAULT indicator lights. Before replacing a failed GPS module, verify the following:

1. Through the RS-232 I/O or optional 10BaseT port, identify the failure by issuing the RQBT command to collect the BIT status of the failed module. Refer to the RQBT message response below for description of message response.

2. If the failure is due to the GPS Receiver BIT, or the antenna BIT, check the following. For any other failures the module must be replaced and sent back to the factory for repair.

    A. Perform continuity test of antenna cable and verify the cable is not open or shorted.

    B. Antenna is mounted vertically and above obstructions that prevent clear view of the sky.

    C. Antenna cable connectors are secure and if lightning arrestor is used, verify it is installed according to manufacturer's instructions.

    D. Antenna cable is within the minimum and maximum length. Refer to Appendix E, Table 2 for the proper antenna cable lengths.

    E. If the Model 9100 has redundant GPS REF modules, swap antenna inputs A and B, and verify if the failure in the failed GPS REF module clears. If it does the replace the antenna.

X.RQBT<cr><lf>

Module returns: GPS BIT STATUS ABCDEFGHIJ <cr><lf>

Where:
A is GPS Receiver BIT (G = Good, F = Fail)
B is Rub lock or 10 MHz BIT (G = Good, F = Fail)
C is 5 MHz BIT (G = Good, F = Fail)
D is Composite BIT (G = Good, F = Fail)
E is IRIG B BIT (G = Good, F = Fail)
F is 1PPS BIT (G = Good, F = Fail)
G is CPU BIT (G = Good, F = Fail)
H is Antenna BIT (G = Good, F = Fail)
I is Oscillator cal (G = Good, F = Fail) (F will not cause the front panel LED to light, unless DAC failure is detected or DAC reaches its limit of adjustment)
J is Module online Y = Yes, N = No)

If it's determined that a module has failed, follow the instructions below for replacement.

a) Place the FSU Online switch to the non-failed position. For example, if the primary GPS Reference is being replaced set the FSU A/AUTO/B switch to position B.

b) Loosen the four panel screws securing the module to the chassis.

c) Push down on the ejector handle to disengage the module and carefully pull on handle to withdraw module from chassis.

d) Install the new GPS module and secure to chassis by tightening the four front panel screws.

e) At the FSU front panel, depress the FAULT RESET switch and assure that all fault indicators are extinguished.

f) Allow a minimum of 10 minutes for the GPS Reference module(s) to track satellites and an additional 30 minutes to 1 hour for the module to lock. This can be verified by viewing front panel TRACKING and LOCKED indicators.

g) Place the FSU Online switch back to the AUTO position.

4-5.2 Distribution Failures

The Model 9100 may contain DDM, FDM and TEL distribution modules. If any of the modules fail, the front panel indicator of the failed module will illuminate.

Before replacing the failed module, verify the following:

1. Remove all the cables connected to the failed module and depress the FSU "FAULT RESET" switch. If the "FAULT" indicator of the module is cleared, the problem may be a shorted cable, failure at the receiving end of the cable, or the cable is not properly terminated.

2. If the failure persists, replace the failed module as follows:

a) Loosen the two screws securing the failed module to the chassis.

b) Push down on the ejector handle to disengage the module and carefully pull on handle and withdraw module from chassis.

c) Note the configuration of the failed module and configure the replacement module accordingly.

d) Install the new module and secure to chassis by tightening the two front panel screws.

e) Depress the FAULT RESET switch and assure that the FAULT indicator is extinguished.

4-5.3 Power Supply Failure

The Model 9100 contain AC/DC Power Supplies or optional DC/DC Power Supplies. If a Power Supply module fails, the fault indicator of the failed module illuminates. Before replacing the failed module verify the following:

1. Correct input voltage is connected to the rear panel AC or DC input.

2. Rear panel Fuse is not open.

Warning: Power Supplies should not be inserted with power applied

To replace a failed Power Supply Module proceed as follows:

a) Remove AC power to the failed power supply. For example if the Power Supply module closest to the FSU failed, remove power cord on rear panel labeled AC INPUT A. If Power Supply module closest to the edge of the chassis failed, remove power cord on rear panel labeled AC INPUT B.

b) Before removing a failed Power Supply module, check to see if the fuse located on the filter fuse assembly supplying AC power to the Power Supply Module is good. If the fuse is blown, replace fuse with the spare fuse in the fuse compartment of the filter/fuse assembly. Remember to replace spare fuse in filter/fuse assembly.

c) Reconnect AC power cord and verify to see that the power supply is operating properly.

d) If power supply is still inoperative, disconnect AC power cord and loosen the four front panel screws securing the Power Supply to the chassis.

e) Holding the Power Supply module handle, carefully pull on handle and remove module.

f) Install a new power supply and secure to chassis by tightening the four front panel screws. Reconnect AC power cord.

g) Verify that the "FAULT" indicator of the power supply is extinguished and all the green power supply indicators are illuminated.

CHAPTER 5

Replacement Parts List

5-1 GENERAL

The replaceable modules for the Model 9100 are listed in Table 5-1.

Table 5-1 Model 9100 Replaceable Modules

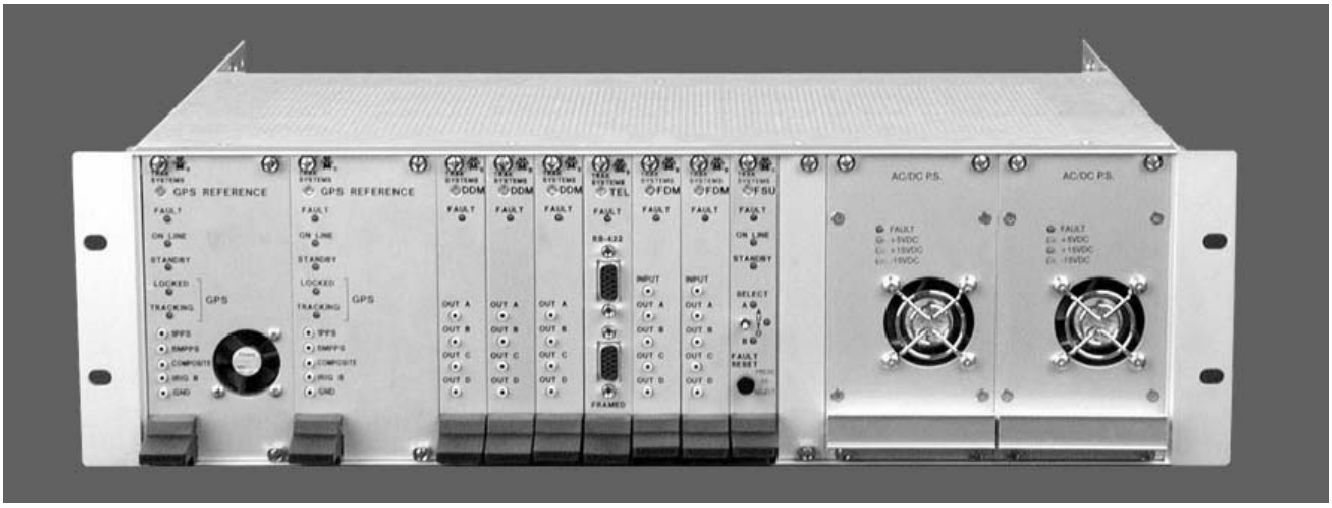
Model Number	Description
9101-3	GPS Reference Module with Rubidium Oscillator
9101-4	GPS Reference Module with Single Oven Oscillator
9101-5	GPS Reference Model with Double Oven Oscillator
9104-1	Fault Sensing Unit
9104-2	Fault Sensing Unit with NTS option
9106-1	Digital Distribution Module
9107-1	Frequency Distribution Module
9111-1	Telecom Signal Generator, T1
9111-2	Telecom Signal Generator, E1
9120-2	AC/DC Power Supply

APPENDIX A

Model 9100 Data Sheet

Time and Frequency Systems

Model 9100 Modular Frequency and Time System



Features

- Single or dual redundant configurations
- GPS discipline of crystal and rubidium oscillators
- Low phase noise and spurious on sine wave outputs
- Modules “Hot Swappable”
- RS-232 and Network interfaces
- Network Time Server

Applications

- Communications networks
- Satellite ground stations
- Mobile radio synchronization
- Station / BITS clock
- Test and measurement systems

The Model 9100 is a robust and versatile modular frequency and time system. Ultra-stable frequencies, rates, and telecom outputs are all referenced to GPS. Disciplined oscillators include single and double oven crystal oscillators as well as rubidium oscillators. Once synchronized to GPS, sophisticated oscillator discipline algorithms maintain a high degree of precision and smoothness on all outputs. With a wide selection of plug-in functional modules, the Model 9100 is highly configurable. Dual redundant configurations include two antennas, GPS receivers, and power supplies. And, for increased versatility, a Digital Distribution Unit, Model 9200, is available and produces as many as 56 additional digital outputs. Model 9200’s may be “daisy – chained” for system users requiring a very large number of digital signals.

Model 9100
Main Frame

Distribution module slots	6
Dimensions	5.22 high (3U), 19 inches wide, and 15 inches deep
Weight	25 pounds with full complement of modules
Finish	Clear anodized aluminum or satin black (optional)
Operating Temperature	-30° C to +60° C, with modules
Humidity	95% relative, non-condensing, with modules

Model 9101
GPS Reference Module with rubidium oscillator

A GPS timing receiver disciplines a rubidium oscillator and provides the following Model 9100 bus outputs:

- 10 MHz
- 5 MHz
- 1 PPS
- IRIG-B
- Others / specials

Rubidium Oscillator Characteristics

Accuracy, with GPS, (*Frequency domain*)	<1 X 10^{-11}, one hour averaging <1 X 10^{-12}, one day averaging
Accuracy, with GPS, (*time domain*)	50 – 100 ns

Model 9101

Aging rate, (no GPS)	<1 X 10^{-11} / day at +25° C, ± 3° <2 X 10^{-11} / month at +25° C, ± 3°
Holdover	≤ 5 – 10 μsec / week after 72 hours of discipline

Model 9101
GPS Reference Module with single oven crystal oscillator

With the exception of specifications, this GPS Reference module is functionally equivalent to the rubidium model.

Crystal Oscillator Characteristics

Accuracy, with GPS, (*Frequency domain*)	<1 X 10^{-11}, one hour averaging <1 X 10^{-12}, one day averaging
Accuracy, with GPS, (*time domain*)	50 – 100 ns
Aging rate, (no GPS)	<5 X 10^{-10} / day at +25° C, ± 3°
Holdover	≤ 5 – 10 μsec / day after 72 hours of discipline

Model 9101
GPS Reference Module with double oven crystal oscillator

With the exception of specifications, this GPS Reference module is functionally equivalent to the rubidium model.

Crystal Oscillator Characteristics

Accuracy, with GPS, (*Frequency domain*)	<1 X 10^{-11}, one hour averaging <1 X 10^{-12}, one day averaging
Accuracy, with GPS, (*time domain*)	50 – 100 ns
Aging rate, C (no GPS)	<5 X 10^{-10} / day –30° C to +60°
Holdover	≤ 5 – 10 μsec / day after 72 hours of discipline

Model 9104
Fault Sense Unit

The FSU detects system failures, provides switching signals to output modules, and contains Alarm, RS-232 I/O, and Network circuitry.

Alarms, Major / minor	Relay, form C contacts

RS-232 I/O

Message Format	Consult factory for details
Baud rate	9600, fixed
Data bits	8
Parity	None
Stop bits	1
Network	10 BaseT
Features	Network Time Server and Telnet

Model 9106
Digital Distribution Module

Four channel digital pulse rate distribution module. Up to six may be installed in main frame.

Output Characteristics

Rise/ all times ≤ 2 ns

Level	TTL
Drive	50Ω
Outputs	4 each
Connectors	BNC female, TNC optional

Model 9107
Frequency Distribution Module

Four channel sine wave and IRIG-B distribution module. Up to six may be installed in main frame.

Output Characteristics

Freq. Response	DC to 50 MHz, ± 2 dB
Level	Fixed, 1 Vrms (+13 dBm), ± 2 dB
Drive	50Ω
Outputs	4 each
Connectors	BNC female, TNC optional

Model 9111
Telecommunications Signal Generator

Telecommunications rates and framed signals, T1 or E1 (configured at factory).

Rates	1.544 MHz or 2.048 MHz
Output Levels	TTL, RS-422 & Framed
Outputs	4 each
Connectors	BNC for single ended for TTL. HDD-15 for RS-422 and Framed Signals
T1 or E1	All “ones” Framing

Model 9114
Digital Rate Generator

Timing and telecommunications rates

Rates	Consult factory for rates
Level	TTL
Drive	50Ω
Outputs	4 each
Connectors	BNC female, TNC optional

Model 9120
AC Input Power Supply

Operational power for all modules.

AC input	Universal, 100-240 Vac, 47 to 63 Hz
Power output	150 watts, maximum

Model 9121
DC Input Power Supply

Operational power for all modules.

DC input	20-60 VDC input floating with respect to ground
Power output	150 watts, maximum

GPS Antenna

Gain	35 dB typical
Signal filter	Triple band-pass
Shape	Conical
Dimensions	Maximum diameter, 3.5 inches Height, 4.0 inches, excluding mast adapter

APPENDIX B

Model 9100 NTS Option

B-1 General

The 9100 contains network interface port that resides on the FSU module. This port is primarily used as a Network Time Server (NTS) but also provides a command line interface through Telnet. There are two fielded configurations of the FSU. The old configuration contains a device server from Lantronix and the new configuration contains a TRAK designed network interface. The part numbers of the old FSU configuration with the Lantronix device server is 9104-1 through 9104-8. The part number of new FSU configuration is 9104-9 and above.

B-2 Network Port Interface Characteristics

The network port characteristics of the two module configurations are tabulated below

Characteristic	9104-1 thru 9104-8	9104-9 and above
10 Base-T	√	
10/100 Base-T		√
NTP v3 (RFC 1305)	√	√
NTP v4 (no RFC)		√
SNTP (RFC 2030)	√	√
IPv4	√	√
IPv6		√
Telnet	√	√
SSH		√
Syslog		√

B-3 9104-1 through 9104-8 Setup

IP Address Setup

Note: While in a Telnet session, time is <u>not</u> available to the network.

The Model 9104 is shipped with a default IP address of 10.1.5.250. To set a different address, the following procedure may be used.

To enter or change the IP address, establish a Telnet session utilizing the default address listed above and entering Port 9999.

Once the Lantronix (NTS engine manufacturer) serial number and software version message is displayed. (MAC Address and serial number will vary from unit to unit)

*** Lantronix NTS ***
Serial Number 5021273 MAC address 00:20:4A:50:53:19
Software version 04.52 (011219)

Press <Enter> quickly to enter the setup mode.

The following messages are displayed:

Change Setup :
0 Basic configuration
1 NTS configuration
7 Factory defaults
8 Exit without save
9 Save and exit

Your choice ?

<0 Enter > (Basic Configuration)

IP address: Enter new IP address

Set Gateway IP Address Default (N) <Enter>

Netmask: Enter Number of bits (enter 24 for A netmask, 16 for B netmask, or 8 for C netmask).

Change Telnet configuration password Default (N) <Enter>

To exit and save above entries, <9 Enter >

This completes the IP address setup, the Model 9100 is now ready for NTP.

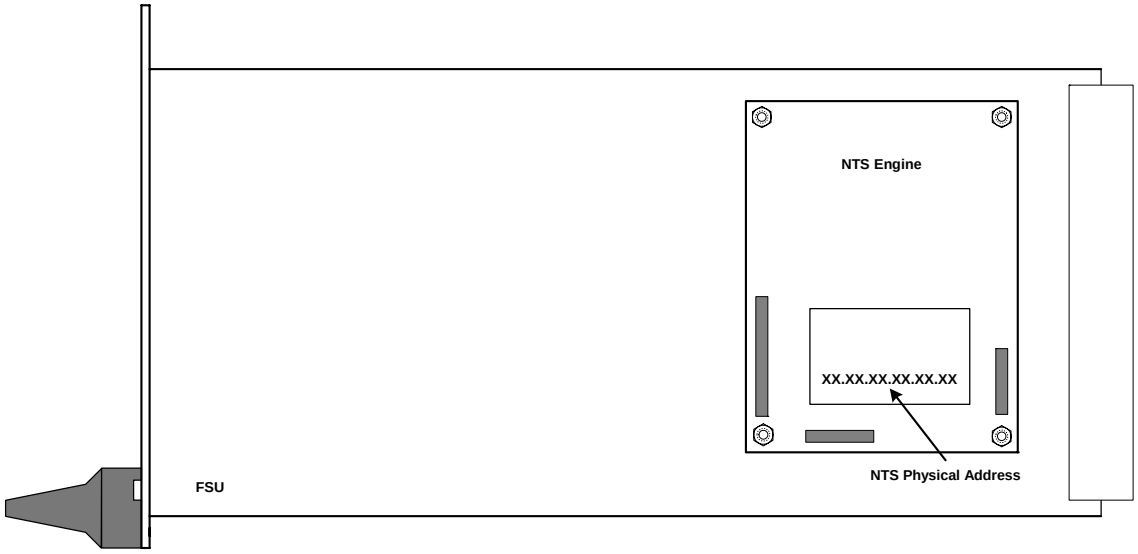


Figure 1, NTS Physical Address Location (FSU)

IP Address Set-up, Second Method

ARP (Address Resolution Protocol) command is required to change address in this mode. This second method of address setting should only be necessary if the factory default IP address is in use on the network, or a non-valid IP address is loaded into the NTS engine by mistake or the address is not known.

To establish a Telnet session to the NTS, an IP address must be associated with the physical hardware.

Setting up a new IP address. (Note: This procedure uses 10.1.5.250 as an example IP address and may differ from that which the user is required to input)

1. Refer to Figure 1 for the location of the NTS physical address. This address appears on a label attached to the NTS engine, located on the Model 9104 FSU (Figure 1).

2. From a DOS prompt in the c:\windows directory type:

arp –s IP address physical address

Example:
arp –s 10.1.5.250 00-20-4a-01-7e-9f

Where: 10.1.5.250 is the IP address to be temporarily assigned, and the
00-20-4a-01-7e-9f is the physical address (See Figure 1 for location) of the NTS module.

3. From a DOS prompt in the c:\windows directory type

   telnet 10.1.5.250 1

   Connection will fail – click OK.

4. Click on Connect, Remote System, then enter the following parameters

   Host: 10.1.5.250
   Port: 9999
   Term Type: vt100

   Then click “Connect”

   The message
   “*** Lantronix NTS ***
   Serial Number 5021273 MAC address 00:20:4A:50:53:19
   Software version 04.52 (011219). . . is displayed

   Press <Enter> quickly (within 3 seconds) to enter the setup mode.

   The following message is displayed:

   Change Setup :
   0 Basic configuration
   1 NTS configuration
   7 Factory defaults
   8 Exit without save
   9 Save and exit
   Your choice ?

5. Basic Configuration –<0 Enter> (Below are the factory settings: user setting may differ)

   IP Address : 10 **.** 1 **.** 5 **.** 250 <enter>
   Set Gateway IP Address (N)
   Netmask: Number of Bits for Host Part (16)
   Change telnet config password (N)

6. To exit and save above entries, <9 Enter>

This completes setting of the new IP address, the NTS is now ready for operation.

7. The module is ready to resume normal operation. Re-connect the 10BaseT connection to the system and resume normal operation. Have a remote operator ping the new address to verify its remote connection.

B-4 9104-9 and Above Setup

The 9104-9 and above is configured through the command line interface using RS-232 I/O port or through the Ethernet port using Telnet or SSH. This module may also be setup by uploading the entire configuration file. To remove a setting, an asterisk * may be entered for an IP address, NETMASK, or GATEWAY. Section B-5 describes the command line interface setup and B-6 describes the configuration file upload.

B-5 Command Line Interface Setup

Command line interface setup can be accomplished through the RS-232 I/O, Telnet (if enabled) or SSH.

Request main configuration setup

Host sends: **cfg**<CR>

9100 replies:

```
*******************************************
*    CONFIGURATION SETTINGS     *
*******************************************

              NETWORK SETTINGS
              ==================
IPADDR        10.1.5.250
NETMASK       255.255.252.0
GATEWAY       *

              INETD PROTOCOLS
              ================
                            IDLE-TIMEOUT          (MINS)
              ON/OFF        DISCONNECT            DISABLE
              -----------   ----------------------  -------------
SSH           ON                    30              --
TELNET        OFF                   10              0
TFTP          OFF                   --              0
HTTP          OFF                   --              0

              SYSTEM SETTINGS
              ----------------------------
RQFS          OFF

              SYSLOG SETTINGS
              --------------------------
 REMOTE       *
LOG_MASK  7F  ->      (7) LOG_DEBUG     OFF
                      (6) LOG_INFO      ON
                      (5) LOG_NOTICE    ON
                      (4) LOG_WARNING   ON
                      (3) LOG_ERR       ON
                      (2) LOG_CRIT      ON
                      (1) LOG_ALERT     ON
                      (0) LOG_EMERG     ON
```

The main configuration menu for the FSU is displayed above. Below are examples for changing the configuration through the command line.

Changing system NETWORK setting

Host sends:	**cfg ipaddr 10.1.233.88**<CR>	(IP Address set or change)
Host sends:	**cfg netmask 10.1.233.88**<CR>	(IP Address set or change)
Host sends:	**cfg gateway 10.1.233.88**<CR>	(IP Address set or change)

Enabling or disabling network interfaces such as TELNET or TFTP,

Format: **cfg <protocol> <on/off>** <CR>

Where the protocol is **SSH**, **Telnet**, **TFTP, or HTTP**

Host sends:	**cfg telnet on** <CR>	(to enable)
Host sends:	**cfg telnet off** <CR>	(to disable)

Host sends:	**cfg tftp on** <CR>	(to enable)
Host sends:	**cfg tftp off** <CR>	(to disable)

The network interfaces have programmable disconnect and disable timers that expire if a connection is made to the interface but no activity has occurred for the specified timeout period. These timers can also be disabled and each interface is described as follows: SSH port does not have a disable timer but does have a disconnect timer which is the **idisconn** command. Telnet has both an auto disconnect and auto disable after the timeout elapses. HTTP and TFTP ports can be setup for auto disable upon the expiration of individual programmable timers if no activity has occurred on that port within the set timeout period. Timers with a setting of zero "0" will never time out (Timer disabled).

Format: **cfg <port> <idisconn/idisable> <timeout setting in minutes>**<CR>

Examples for setting the port-idle disconnect and interface-idle disabling

cfg ssh idisconn 30 <CR>	(SSH is disconnected after 30 minutes inactivity)
cfg telnet idisconn 10<CR>	(Telnet is disconnected after 30 minutes inactivity)
cfg telnet idisable 20<CR>	(Telnet is disabled after 20 minutes of no connection)
cfg tftp idisable 5<CR>	(TFTP is disabled after 5 minutes of no connection)
cfg http idisable 10<CR>	(HTTP is disabled after 10 minutes of no connection)

System Settings
The current status of the RQFS, **R**e**Q**uest **F**ault **S**tatus message is displayed.
(RQFS ON or **RQFS OFF)**

SYSLOG Settings
A remote server on the network may be designated to capture SYSLOG events that occur. A log mask of 2 Hex characters converted to binary will denote which of the log events that will be captured in the SYSLOG file. To set the IP address on the remote server, the following format is used:
Format:
Host sends: **cfg syslog remote <IPaddress><CR>**

The LOG MASK settings are enabled using the following format: **cfg log_mask HH<cr>**
Where: HH is a hex value. The LSB denotes a hex value for a binary representation of the 0 – 3 Log Masks. The MSB denotes the hex value for the binary representation for Log Masks 4 – 7.

Host sends: **cfg log_mask ff<cr>** **(**to enable all logs)

Factory Default Settings

IP address **10.1.5.250**
Netmask **255.255.252.0**
Gateway *****

INETD PROTOCOLS
==========

	ON/OFF	IDLE-TIMEOUT DISCONNECT	(MINS) DISABLE
SSH	ON	30	--
TELNET	OFF	10	0
TFTP	OFF	--	0
HTTP	OFF	--	0

RQFS **OFF**

LOG Masks **00** **(all disabled)**

*** denotes not setup**

Remote login: **rifc**
Password: **trak9100**

B-6 Upload Configuration File

The configuration file can only be uploaded if TFTP is enabled. Below are instructions for loading the configuration file from a Windows platform.

1. Connect to the FSU through the command line using RS-232, Telnet (if enabled), or SSH and type the following from the 9100 prompt **cfgload**<CR>

   The FSU will respond with the following message:

   Platform of remote computer containing configuration file to upload,
   Windows (W), Unix (U), or Linux (L):

2. For a windows environment, type **w**<CR>

   The FSU will respond with the following information

   From a command shell on the remote Windows system, issue
   the following command to upload configuration file:

   tftp <IP> put <filename> /var/tftp/config

   Hit 'Enter' when file upload has completed...

   Where: <IP> is the IP address of the unit to be configured
   <filename> is the path and file to be uploaded

3. Open a command shell on the Windows system and enter the information provided above. When the transfer is complete a message is displayed

Transfer successful: 3054 bytes in 1 second, 3054 bytes/s

Note: the amount of bytes will vary with file size.

4. From the command line hit the “Enter” button. You will see the connection will display each line of the configuration file as it is loaded, as well as any errors in the configuration file.

```
###############################################################################
#
#  EXAMPLE.config
#  An example configuration file for configuring the FSU 9104-9
#
###############################################################################
###############################################################################
#                   Network Settings
#                   ----------------
###############################################################################
CFG IPADDR  10.80.41.228
CFG NETMASK 255.255.252.0
CFG GATEWAY 10.80.40.1
###############################################################################
#                   System Settings
#                   ---------------
###############################################################################
CFG RQFS ON
###############################################################################
#                   SYSLOG Settings
#                   ---------------
###############################################################################
CFG SYSLOG MASK   7F
CFG SYSLOG REMOTE 10.80.41.225
###############################################################################
###############################################################################
#                   INETD Protocols
#                   ---------------
###############################################################################
#
#  Port-idle disconnect / Interface-idle disable timers
#  ----------------------------------------------------
   CFG SSH  IDISCONN 30
   CFG TELNET  IDISCONN 10
   CFG TELNET  IDISABLE 20
   CFG TFTP  IDISABLE  5
   CFG HTTP  IDISABLE 10
#
#  Enable/Disable of INETD Protocols
#  ---------------------------------
   CFG SSH    ON
   CFG TELNET ON
   CFG TFTP   OFF
   CFG HTTP   OFF
-------------------------------------------------------------------------------------------------------------------------
```

B-7 Change or Add User/Password

Login to the remote interface through the Ethernet port (Telnet or SSH) is password protected. The default username/password is:

Username: **rifc**
Password: **trak9100**

Passwords for existing user accounts can be changed and new user accounts may be added using the **PASSWD** command:

Host Sends:	PASSWD<CR>
9100 Replies:	9100 will query for the username, old password (if user already exists), and new password (entered twice).

Examples:

1. Change password for existing user account ‘rifc’

9100>PASSWD

User: rifc
Enter old password: trak9100
Enter new password: newpass
Re-enter new password: newpass

Password for user 'rifc' changed!

9100>

2. Create new user account ‘guest’

9100>PASSWD

User: guest
Enter new password: guestpass
Re-enter new password: guestpass

New user 'guest' added!

9100>

B-8 IP Addresses, Netmask etc

An IP address is a 32-bit value, divided into four octets of eight bits each. The standard representation is four decimal numbers (in the range of 0..255), divided by dots.

Example: 192.2.1.123

This is called decimal-dot notation.

The IP address is divided in two parts: a network and a host part. To support different needs, three “network classes“ have been defined. Depending on the network class, the last one, two or last three bytes define the host, while the remaining part defines the network. In the following text, ‘x’ stands for the host part of the IP address:

IP address 1.x.x.x to 127.x.x.x

Only 127 different networks of this class exist. These have a very large number of potential connected devices (up to 16777216)

Example: 10.0.0.1, (network 10, host 0.0.1)

IP address 128.0.x.x to 191.255.xxx.xxx

These networks are used for large company networks. Every network can consist of up to 65534 devices.

Example: 172.1.3.2 (network 172.1, host 3.2)

IP address 192.0.0.xxx to 223.255.255.xxx

These network addresses are most common. Most small company networks are class C networks. These networks can consist of a maximum number of 254 hosts.

Example: 192.7.1.9 (network 192.7.1, host 9)

The remaining addresses 224.x.x.x - 239.x.x.x are defined as “Class D“ and are used as a multicast address.

Note: No addresses are allowed with the four highest-order bits set to 1-1-1-1. (240.x.x.x. - 254.x.x.x)These addresses, called "class E", are reserved.

The host address with all host bits set to "0" is used to address the network as a whole (for example in routing entries).

The address with the host part bits all set to “1“ is the broadcast address, meaning “for every stations“.

Network and Broadcast addresses must not be used as a host address (e.g. 192.168.0.0 identifies the entire network, 192.168.0.255 identifies the broadcast address).

The netmask is used to divide the IP address differently from the standard defined by the classes A,B,C. By entering a netmask, it is possible to define how many bits from the IP address are to be taken as the network part and how many bits are to be taken as the host part.

Standard IP network netmask

	Network bits	Host bits	Netmask
Class A	8	24	255.0.0.0
Class B	16	16	255.255.0.0
Class C	24	8	255.255.255.0

The number of host bits is entered; the Radio Clock then calculates the netmask. The netmask is displayed in standard decimal-dot notation.

Netmask examples

Netmask	Host
255.255.255.252	2
255.255.255.248	3
255.255.255.240	4
255.255.255.224	5
255.255.255.192	6
255.255.255.128	7
255.255.255.0	8
255.255.254.0	9
255.255.252.0	10
255.255.248.0	11
.	.
.	.
255.128.0.0	23
255.0.0.0	24

If your network is not connected to the Internet and there are no plans to make such a connection, you may use any IP address you wish.

However, if you are not connected to the Internet and have plans to connect to the Internet or you are connected to the Internet and want to operate your Model 9100 on an Intranet you should use one of the sub-networks below for your network. These network numbers have been reserved for such networks. If you have any questions about IP assignment ask your Network Administrator.

Class A 10.x.x.x
Class B 172.16.x.x
Class C 192.168.0.x

For more information regarding IP addressing, see the following documents. These can be located, for example, on the World Wide Web using one of the directories or indices:

RFC 950 Internet Standard Subnetting Procedure

RFC 1700 Assigned Numbers

RFC 1117 Internet Numbers

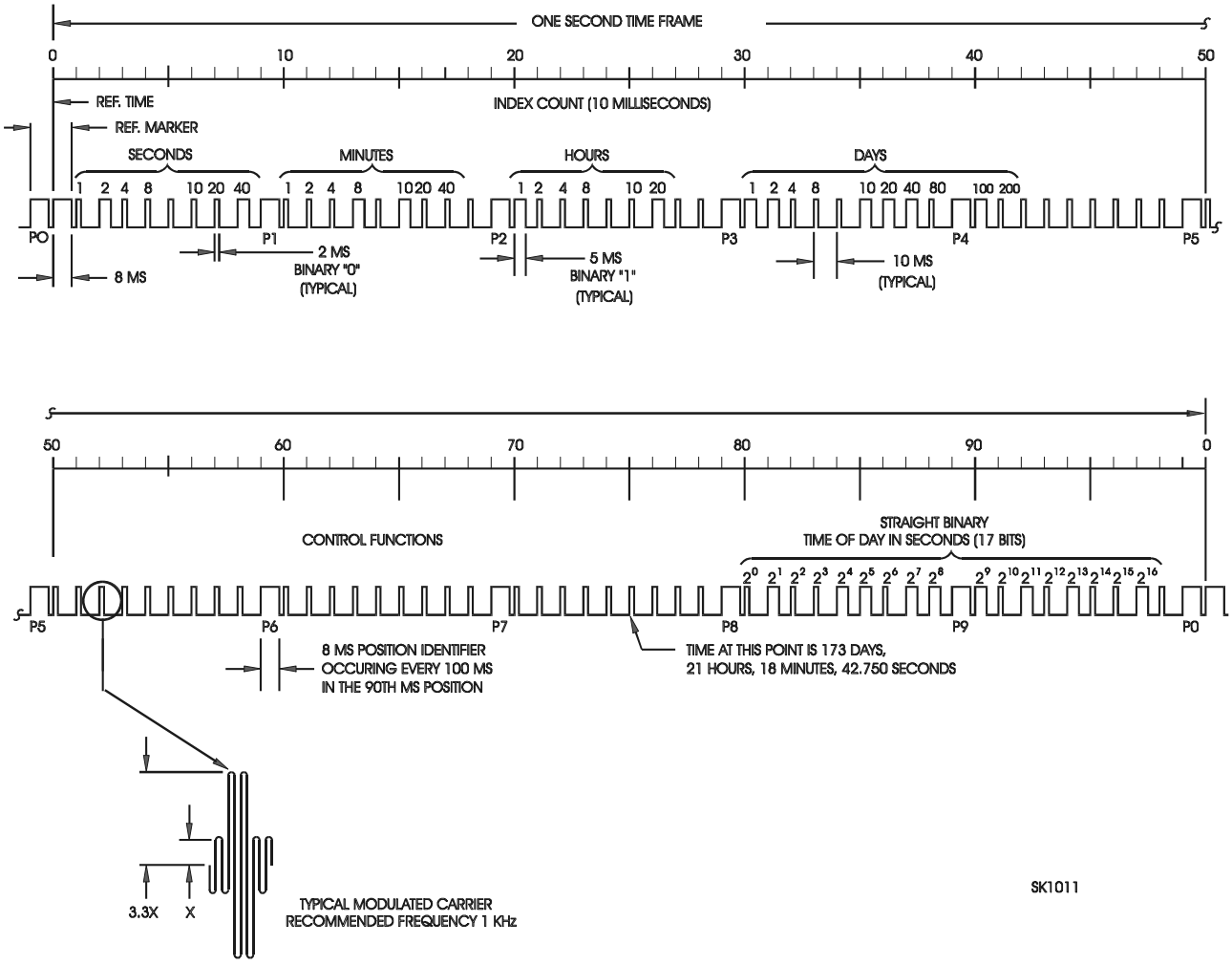
RFC 1597 Address Allocation for Private Internets

APPENDIX C

TIME CODE FORMATS

APPENDIX C

IRIG B CODE FORMAT



The IRIG B time code has a one-second time frame and contains BCD time information representing seconds, minutes, hours, days and straight-binary-time-of-day (SBTOD) in seconds. Provisions are made in the format for control functions. An 8-millisecond frame reference marker appears during the first 10 ms of each frame, and 8-millisecond position identifiers appear during the 90th millisecond of each 100 millisecond period. The BCD time data appear in the

First five 100 millisecond time periods of each one-second frame, control functions (when used) appear in the next three 100 millisecond time periods, and the SBTOD data appear in the last two 100 ms time periods. Binary ZEROs and fill bits are 2 ms long, and Binary ONEs are 5 ms long. Modifications to the code include deletion of the days data, deletion of the SBTOD data, and deletion of both of these data groups

APPENDIX D

Model 9100 DC Power Input Option

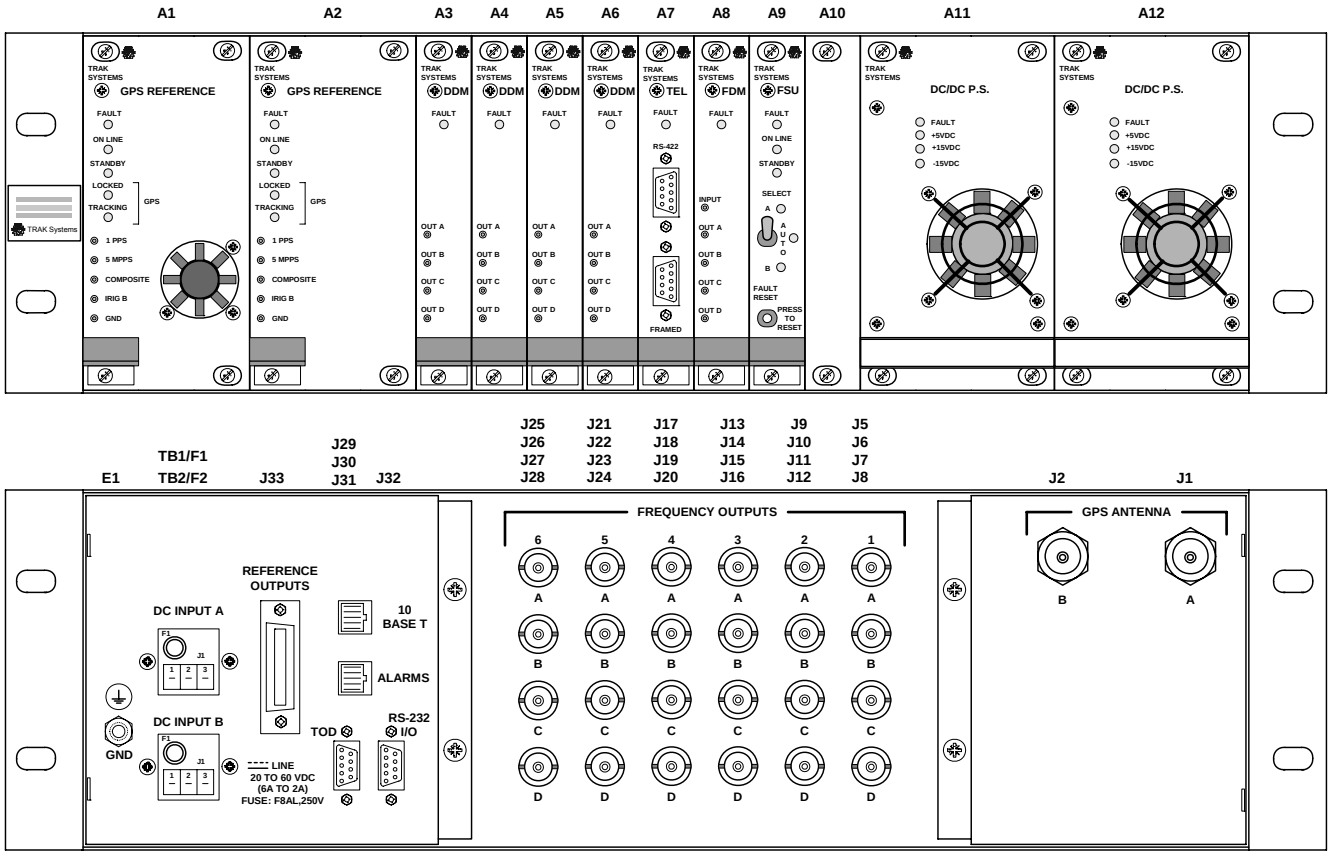


Figure D-1. Model 9100DC Front and Rear Panel Views

D-1. OPTIONAL DC POWER INPUT

Appendix D contains only DC power input information. All other information pertaining to the Model 9100 is covered in the main body of this manual. The DC option is factory installed and is specified at time of order. DC versions of the Model 9100 contain a DC model suffix, (9100-8DC) located on the model and serial label on the front, left side of the main frame.

D-2 DC INPUT CONNECTIONS

DC power input pin connections, for connectors mating with TB1 / TB2, are listed in Table D-1. **It is recommended that DC power be applied only after power connections are applied to unit.** The DC power supplies accept 20 to 60 VDC. For DC power input to Power Supply A (A11), connect power to DC INPUT A (TB1) and for DC power input to Power Supply B (A12), connect power to DC INPUT B (TB2). The DC Power Supplies are designed to operate over the input range of 20 to 60 VDC and input is floating with respect to chassis / system ground. Therefore, the DC power supplies operate in both +24 volt and –48 volt systems, with only attention to power input connections required. Each DC input is separately fused at the DC input connection. 8 amp fast-blow 5mm X 20mm 250 volt fuses are installed. **Replace ONLY with fuse(s) of the same ratings.**

Table D-1. DC Power Input Connections, TB1 & TB2

Pin Number	Connection	For +24 VDC Input	For –48 VDC Input
1	Positive DC voltage	+24 VDC Input	48 VDC Return
2	Chassis Ground	Chassis Ground	Chassis Ground
3	Negative DC voltage	24 VDC Return	-48 VDC Input

Note: DC power input returns and connecting cable shield should be connected to chassis ground, pin 2.

Table D-2. DC Power Input Interface Cables for EMC Compliance

Reference Designator	Mating Connector	Interface Cable Type
TB1 & TB2	7.62 mm	Shielded cable, 14 AWG minimum size

Table D-3. DC Power Input Rear Panel Connectors and Fuses

Reference Designator	Function	Chassis Connector	Mating Connector / Fuse
TB1	20-60 VDC power input to PS A (A11)	Phoenix 1804690	Phoenix 1804917
TB1-F1	8 amp, fast blow fuse for PS A (A11)		Little Fuse 217 008
TB2	20-60 VDC power input to PS B (A12)	Phoenix 1804690	Phoenix 1804917
TB2-F2	8 amp, fast blow fuse for PS B (A12)		Little Fuse 217 008

D-3 DC POWER SUPPLIES, A11 and A12

The Model 9121 DC/DC Power Supply, shown in Figure D-2, contains a red FAULT indicator and three green power supply output voltage status indicators. The FAULT indicator illuminates if any of the three power supplies voltages fall below a reference level. The appropriate green power supply indicators are normally on and extinguish if a voltage drops below a reference level. The Model 9121 Power Supply is supplied with Model 9100 DC input versions. The DC and AC power supplies have different back plane power connections to avoid damage if the wrong power supply is installed.

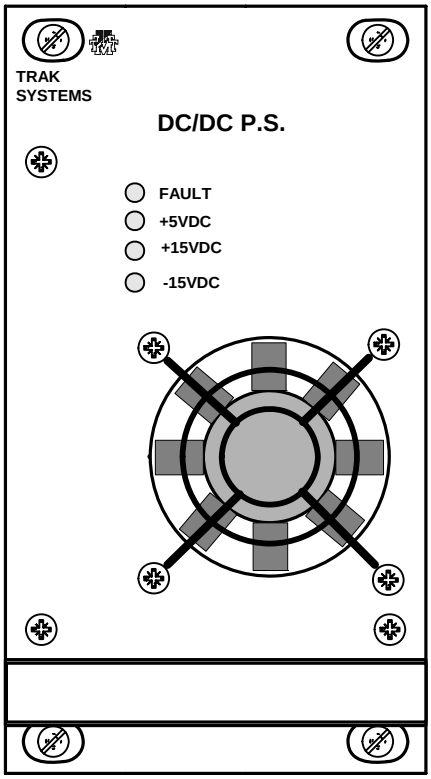


Figure D-3. Model 9121 DC Power Supply

D-4. POWER SUPPLY FAILURE

If a power supply fails, the FAULT indicator illuminates. To replaced a failed power supply module, proceed as follows:

a) Remove DC power from the failed power supply. For example, if the power supply closest to the FSU failed, remove DC power on the rear panel connector labeled DC INPUT A.
b) Before removing a failed DC power supply, check the condition of the fuse located in the fuse holder associated with the DC power input connector. If the fuse if blown, replace with the same rating as specified in Table D-3.
c) Reconnect DC power to determine if the failed power supply is operational.
d) If not, again disconnect DC power and loosen the four front panel screws securing the power supply to the chassis.
e) Holding the power supply module handle, carefully pull on the handle and remove the power supply.
f) Install the power supply in the reverse order and reconnect DC power.

g) Verify the replaced power supply red FAULT indicator is extinguished and the three green status indicators are illuminated.

D-5 REPLACEMENT PARTS LIST

Table D-4. Model 9100DC Power Supply

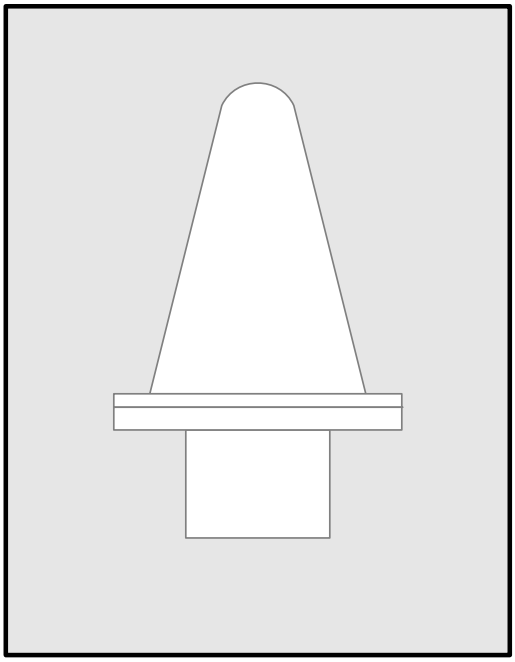
Model Number	Description
9121-1	DC / DC Power Supply

Appendix E

GPS Antenna, Installation, and Cable Options

Application Note 3.1

April 2004



GPS Antenna

(Typical View)

- **Triple Band Pass Filter**
- **LNA, 35 dB Gain**
- **Surge Protect Circuitry**
- **Conical Radome**

Antenna Types

Two antenna types are described, one for 12 volt systems and the other for 5 volt systems. Except for operational voltage, connector types, and mast adapters, both have identical characteristics.

Specifications

Operating Frequency: 1575.42 MHz

Filtering: Triple filter, -60 dB @ 1575.42, ±50 MHz

Gain: >30 dB, (35 dB typical)

*N*oise Figure 2.2 dB maximum

Protection: 80V, IEC1000-4-5

Polarization: Right hand, circular

Power supply voltages:
5 volt antenna, +5Vdc, ± 0.5Vdc
12 volt antenna, +4.5Vdc to +15 Vdc

Power supply current: 20 ma (typical), 27 ma (maximum), both types

Connector types:
5 volt antenna, “N” female
12 volt antenna, “TNC” female

Radome color: White

Radome shape: Conical

Dimensions: Diameter, 3.5 inches and Height, 4.0 inches (excluding mast adapter)

Weight: .7 pounds (excluding mast adapter)

Temperature:
Operational, -40° C to +85° C
Storage, -45° C to +90° C

Antenna Installation

1-0 General

Depending on model, one of two antenna types and a variety of different coaxial cable types and lengths are typically supplied with every TRAK Time and Frequency Systems (TFS) GPS system. Each type antenna requires a different assembly and mounting procedure. The antenna cable type and length depend on the distance between the antenna and the GPS receiver to maintain optimal gain. Before the antenna is assembled and installed, important considerations of personal safety, antenna location, coaxial cable length / type, and lightning protection are required. Suggestions are outlined in the following paragraphs.

1-1 Personal Safety

Personal safety is a common sense consideration. Do not attempt to install antenna during rain, lightning, or high winds. Stay clear of power lines and other dangerous objects.

1-2 Antenna Site Selection

The antenna should be mounted in a location that has an unobstructed view of the sky. A hemispheric view 5-degree above the horizon is ideal. Roof mounting or mounting on the cable bridge between antenna tower and equipment shelter is usually acceptable. Height is not important, a clear view of the sky is. In northern areas subject to high degrees of snow and ice, do not mount near high structures where falling ice can damage the antenna.

Another consideration is to stay as far as possible from other microwave antennas or other sources of RF radiation that could affect reception of the GPS signal and away from lightning rods.

1-3 Coaxial Cable Selection

Coaxial cable type and length is very important to maintain the antenna system gain within the limits of the GPS receiver. Therefore, the gain of the antenna, cables, in-line amplifiers, and splitters must be accurately calculated for the system to operate within these limits. Section 2 provides attenuation of different coaxial cables that TRAK provides so end-users can calculate the external gain if cables are altered or not purchased from TRAK.

1-4 Lightning Protection

Surge suppressors are not supplied as standard with antennas and coaxial cables. These must be ordered as options. Option L60 is used with the 12 volt antenna (TNC connectors) and Option L60N is used with the 5 volt antenna (N connectors).

The surge suppressor should be installed at the point where the coaxial cable enters the building or equipment shelter. It is imperative that the surge suppressor ground lug be connected to a good low impedance earth ground. Some installations require the outer conductor of the coaxial cable also be connected to a low impedance earth ground. Andrew ¼ inch Superflex coaxial cable with an Andrew ground strap (Option L61) is ideal for this requirement.

1-5 Antenna used in 12 Vdc systems (TFS part number 1001661-131)

This antenna is identified by the TNC female connector on the antenna base and a threaded mast adapter, see Figure 1. This antenna is used with the following TFS models: 8812, 8820, 8821, 8900, and 9000.

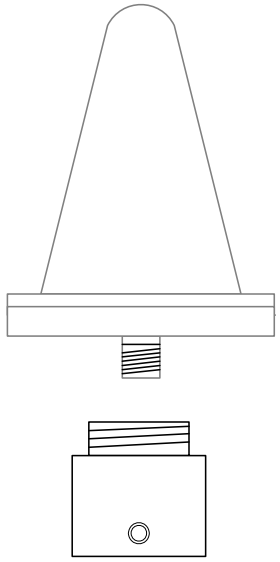


Figure 1, 12 volt antenna

1-5-1 Antenna and Mast Adapter Assembly

Pass the coaxial cable with male TNC connector through the threaded mast adapter and connect the cable to the antenna connector. Screw the mast adapter into the base of the antenna. Refer to Figure 1.

1-5-2 Antenna Mounting

The mast adapter accepts a mast in the ¾ to 1 inch diameter range. The mast is not supplied due to the wide variety of mounting requirements in field installations.

1-6 Antenna used in 5 Vdc systems (TFS part number 4702337)

This antenna is identified by the N female connector on the antenna base and a mast adapter attached to the antenna base with four screws, see Figure 2. This antenna is used with TFS model 9100.

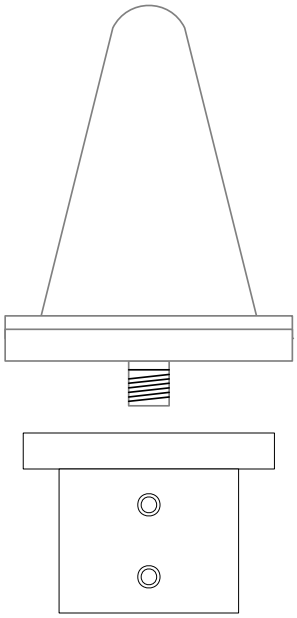


Figure 2, 5 volt antenna

1-6-1 Antenna and Mast Adapter Assembly

Pass the coaxial cable with male N connector through the mast adapter and connect the cable to the antenna connector. Attach the mast adapter to the base of the antenna with the four captive screws provided. Refer to Figure 2.

1-6-2 Antenna Mounting

The mast adapter accepts a mast in the 1.5 to 1.7 inches diameter range. The mast is not supplied due to the wide variety of mounting requirements in field installations.

Coaxial Cable and Accessories Selection

2-0 General

50 feet of RG-58 type coaxial cable is supplied as standard with every GPS model. If a length greater than 50 feet or non-RG-58 cable is required, options are available. A 20 dB line amplifier is available when using long cable runs, consult factory for special applications and considerations.

2-1 Available Antenna Cable Options

The common available antenna cable options and accessories are shown in Table 1. If a longer cable is required, consult factory for cable type and GPS line amplifier (if required).

Table 1, Standard Coaxial Cable Options

Antenna Option	Option No.	Description	Used On
1001661-131	L9A	Antenna & mast adapter, TNC connector, 12VDC	Note 1
1001661-209	**L10A**	**L9A & 50' RG-58**	Note 1
1001661-210	**L11A**	**L9A & 100' RG-213**	Note 1
1001661-221	**L22A**	**L9A & 250' Belden 9913**	Note 1
1001661-222	**L23A**	**L9A & 2 x 250' Belden & 20 dB amp**	Note 1
1001661-227	**L28A**	**L9A & 2 x 200' Belden 9913 & 20 dB amp**	Note 1
1001661-150	L50	¼" Andrews TNC- 50' w/ spare TNC connector	Note 1
1001661-151	L51	¼" Andrews TNC- 100' w/ spare TNC connector	Note 1
1001661-152	L52	¼" Andrews TNC- 200' w/ spare TNC connector	Note 1
1001661-157	L9N	Antenna & mast adapter, "N" connector, 5 VDC	Note 2
1001661-158	**L70**	**L9A & L60 & L51 & L61 (100' cable)**	Note 1
1001661-159	**L71**	**L9A & L60 & L50 & L61 (50' Cable)**	Note 1
1001661-156	**L72**	**L9A & L60 & L52 & L61 (200' Cable)**	Note 1
1001661-160	L60	Lightning /surge suppressor (TNC-TNC)	Note 1
1001661-161	L61	¼" Andrews grounding kit	Note 1, Note 2
1001661-162	L62	¼" Andrews cutting tool	Note 1, Note 2
1001661-163	L50N	¼" Andrews N- 50' w/ spare N connector	Note 2
1001661-164	L51N	¼" Andrews N- 100' w/ spare N connector	Note 2
1001661-165	L52N	¼" Andrews N- 200' w/ spare N connector	Note 2
1001661-166	L60N	Lightning /surge suppressor (N-N)	Note 2
1001661-167	**L70N**	**L9N & L60N & L51N & L61 (100' cable)**	Note 2
1001661-168	**L71N**	**L9N & L60N & L50N & L61 (50' Cable)**	Note 2
1001661-169	**L72N**	**L9N & L60N & L52N & L61 (200' Cable)**	Note 2
4700012	------	20 dB GPS Line Amplifier, TNC connectors	Note 1

Note 1: These assemblies are designed for the 12 volt, TNC connector series which include; 8812, 8820A, 8821, 8900, and 9000.These units Use the L9A antenna, 4.5 to 15 VDC. Standard Antenna Option for these Models unless otherwise specified 1001661-209

Note 2: These assemblies are designed for 5 Volt, "N" connector series, which include the 9100. These units use the L9N antenna option. Standard antenna option for these models unless otherwise specified is 1001661-157 (L9N) & 1001661-163 (L50N)

Note 3: Bold options are complete antenna & cable options.

2-1.1 Calculating Antenna System Gain

As stated in paragraph 1-3, when selecting the coaxial cable type and length it is very important to maintain the external gain within the limits of the GPS receiver. For the TFS models: 8821, 8900, and 9000 the gain must be greater than 13 dB and less than 23 dB with an optimum gain of approximately 18 in front of the GPS receiver. The TFS Model 9100 gain must be greater than 18 dB but less than 36 dB with an optimum goal of approximately 25 dB in front of the GPS receiver. These values include 3 dB of margin for the minimum and maximum values. Below is an example of how to calculate antenna system gain. Table 2 provides coaxial cable attenuation and delay with the minimum and maximum cables lengths for commonly used cables.

Note: TFS 9100 systems sold prior to April 2004 contain a different GPS receiver. The antenna gain for these systems must gain must be greater than 13 dB but less than 30 dB with an optimum goal of approximately 22 dB in front of the GPS receiver.

Antenna System Component	Gain (dB)
Antenna	~35
Cable (50' RG58)	-12.45
System connectors and internal cables (typ)	- 2
Gain at front end of GPS receiver	20.55

Table 2 Coaxial Cable Delay and Attenuation

Coaxial Cable Type	Delay ns/ft (m)	Atten dB/ft (m)	Cable Length for 9100 ft (m) Bold values in MAX & OPTM Column for units sold after April 2004					Cable for Length for 8821, 8900 & 9000 ft (m)		
			Min	Max		Optm		Min	Max	Optm
RG-58	1.54 (5.06)	0.249 (0.817)	12 (4)	80 (24)	**68 (20)**	52 (16)	**40 (12)**	28 (9)	80 (24)	68 (21)
RG-213	1.54 (5.06)	0.129 (0.423)	23 (7)	155 (47)	**150 (39)**	100 (31)	**77 (23)**	54 (17)	155 (47)	132 (40)
9913 Belden	1.21 (3.97)	0.071 (0.233)	42 (13)	281 (85)	**239 (72)**	183 (56)	**140 (42)**	99 (30)	281 (85)	239 (73)
FSJ1-50A Andrew	1.21 (3.97)	0.078 (0.256)	38 (12)	256 (78)	**217 (66)**	166 (51)	**128 (39)**	90 (27)	256 (78)	218 (66)
FSJ2-50A Andrew	1.23 (3.98)	0.054 (0.177)	55 (17)	370 (112)	**314 (95)**	241 (73)	**185 (56)**	130 (113)	370 (112)	315 (96)
LDF4-50A Andrew	1.15 (3.76)	0.031 (0.101)	97 (30)	645 (196)	**548 (167)**	419 (128)	**322 (98)**	226 (69)	645 (196)	548 (167)

Note 1: Delay per cable type is specified in nanoseconds (ns) per unit of length at 1575.42 MHz. Factory default setting for the antenna cable delay compensation is 65 ns. This value can be changed through the remote interface or front panel user interface of available.

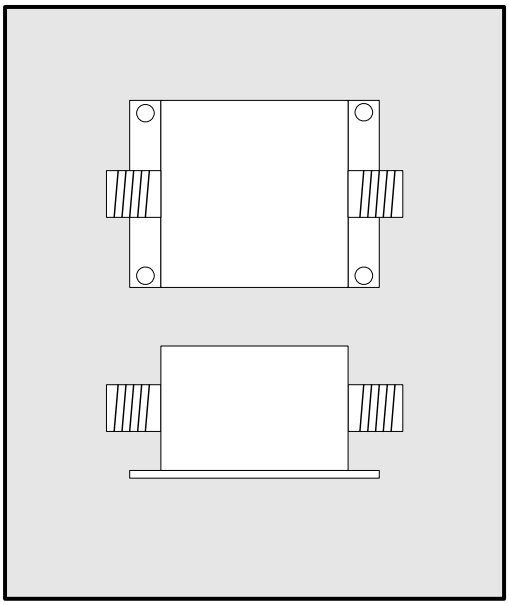
Note 2: The delay should be calculated for each installation and entered into the GPS receiver.

Note 3: Attenuation is specified in decibels (dB) per unit length at 1575.42 MHz.

NOTE 4: TRAK will not guarantee the performance of the GPS receiver if minimum or maximum cable attenuation is exceeded.

2.2 Attenuator

For installations with cable lengths shorter than the minimum cable length in Table 2, an inline attenuator should be used to maintain the external gain within the limits of the GPS receiver. The attenuator must be designed to pass the DC voltage from the receiver to the antenna. This type attenuator is available from GPS Networking Inc. with a specified range of 1 dB to 30 dB attenuation. The attenuation value should be selected to maintain the antenna system near the optimum gain in front of the GPS receiver. The attenuator is not contained in a weather proof housing and therefore must be installed in a protected area.



GPS Line Amplifier
(Typical Views)

Operating Frequency: 1.1 – 1.7 GHz

Gain: 20 dB, minimum

Noise Figure: < 3.5 dB

Input / Output Impedance: 50Ω

Reverse Isolation: 35 dB minimum

Operating Voltage: 3.6 – 15 Vdc (min-max)

Operating Current: < 10 ma (amplifier only)

Operating Temperature: -40^0 C to $+75^0$ C

Dimensions:
Height: 1.3"
Body length (ex. connectors): 2.5"

Base plate length: ***3.25"***
Width: 2.5"

Weight: 10 oz.

Specifications

- **DC pass through for active antenna**
- **20 dB Gain**

GPS Line Amplifier Installation

3-0 General

The GPS Line Amplifier provides necessary gain lost in installations requiring long coaxial cable runs. It's operational voltage, along with the antenna, is supplied by the GPS receiver.

3-1 Installation

The GPS Line Amplifier is not contained in a weather proof housing and therefore must be installed in a protected area. Also, the amplifier must be installed as close to the antenna as permitted by the weather protected area. Consult factory for additional installation information.

APPENDIX F

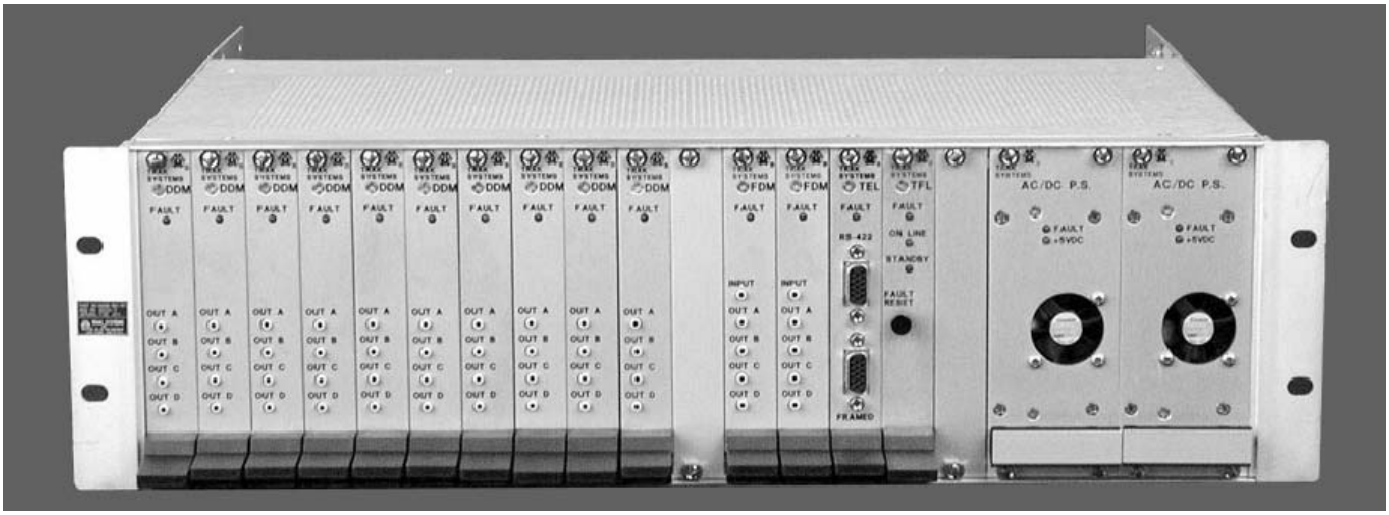
Model 9200 Manual

TECHNICAL MANUAL

MODEL 9200

Modular Frequency/Time System, Digital Distribution Unit

March 2002



TRAK Systems Model 9200 – Digital Distribution Unit

TABLE OF CONTENTS

CHAPTER 1
INTRODUCTION

Paragraph		Page
1-1	General	1-1
1-2	Level of Coverage	1-1
1-3	Organization of Manual	1-1
1-4	Functional Description	1-6
1-5	Physical Description	1-6
1-6	Environmental Characteristics	1-6
1-7	Power Requirement	1-6
1-8	EMC/EMI	1-6
1-9	Output Characteristics	1-7

CHAPTER 2
INSTALLATION

2-1	Unpacking Procedure	2-1
2-2	Normal Mounting Procedure	2-1
2-3	Model 9100,9200 Interconnection	2-1
2-4	Rear Panel Connectors	2-2
2-5	Reference Signal Input Connections	2-4
2-6	Distribution Module Switch and Configuration Jumper Settings	2-4

CHAPTER 3
OPERATION

3-1	General	3-1
3-2	Front-Panel Controls and Indicators	3-1
3-3	Model 9106 Digital Distribution Module (DDM) Front Panel	3-2
3-4	Model 9111 Telecommunications Module	3-3
3-5	Model 9250 Terminal & Fault Logic Module (TFL) Front Panel	3-4
3-6	Model 9220 Power Supply Front Panel	3-5
3-7	Operation	3-6

CHAPTER 4
MAINTENANCE

4-1	General	4-1
4-2	Maintenance Philosophy	4-1
4-3	Preventive Maintenance	4-1
4-4	Replacement of Modules	4-1
4-5	Troubleshooting Guide	4-1

LIST OF ILLUSTRATIONS

Figure		Page
	Model 9200 Digital Distribution Unit	
1-1	Model 9200 Module Locations	1-4
1-2	Model 9200 Modular Frequency/Time System Block Diagram	1-5
2-1	Model 9200 Rear Panel	2-2
2-2	Model 9106 Digital Distribution Module (DDM) Switch Locations	2-4
2-3	Model 9111 Telecommunications Module Switch and Jumper Locations	2-5
2-4	Model 9250 Terminal & Fault Logic Module (TFL) Switch Locations	2-6
3-1	Model 9200 Front Panel	3-1
3-2	Model 9250 Terminal & Fault Logic Module (TFL) Front Panel	3-2
3-3	Model 9220-1 Power Supply A5 A6 Front Panel	3-3

LIST OF TABLES

Table		Page
1-1	Interface Cables for EMC Compliance	1-5
2-1	Rear Panel Connectors, Fuse, and Switch	2-2
2-3	Reference Inputs	2-3
2-4	DDM Output Signal Switch Positions	2-4
2-5	TEL Framing Format Switch Positions, T1	2-6
3-1	Model 9100 Front Panel Locations	3-1

CHAPTER 1

INTRODUCTION

1-1 GENERAL

This manual contains the description, installation, operation, and maintenance instructions for the Model 9200 Digital Distribution Unit (DDU). It is intended to provide electronics personnel with the information necessary to operate and to maintain it to the lowest replaceable unit, LRU, or assembly level.

1-2 LEVEL of COVERAGE

This manual provides coverage to the LRU only. No schematic or logic diagrams of replaceable assemblies are provided. Unlike instruments in use a few decades ago, where it was possible to troubleshoot to the logic gate level, the Model 9200 uses modern technology consisting of CPU's, gate arrays, and imbedded software. Packaging is largely surface-mount technology. Only factory-trained technicians with a high level of training can perform maintenance below the LRU level. Most LRU's have an MTBF in excess of ten years, so frequent replacements are usually not required.

1-3 ORGANIZATION of MANUAL

The body of this manual describes operation of the basic Model 9200 and its most common plug-in modules.

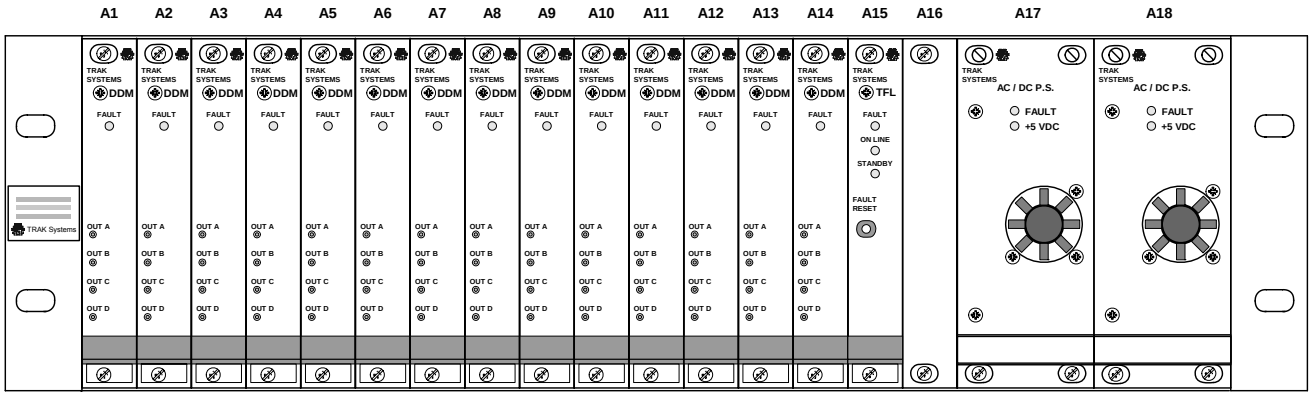


Figure 1-1. Typical Model 9200 Digital Distribution Unit Front Panel

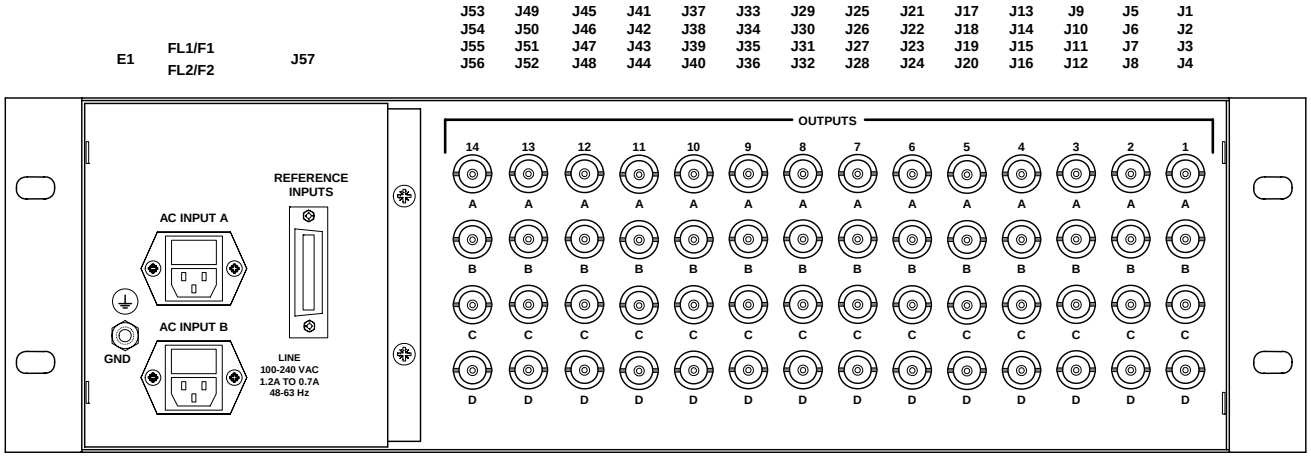


Figure 1-1. Typical Model 9200 Digital Distribution Unit Rear Panel

1-4 FUNCTIONAL DESCRIPTION, DIGITAL DISTRIBUTION UNOT (DDU)

The Model 9200 DDU is an expansion unit and provides additional digital distribution capability for the Model 9100 MFTS. ***Sine wave reference frequencies and IRIG-B cannot be distributed by this unit.*** Features include the following:

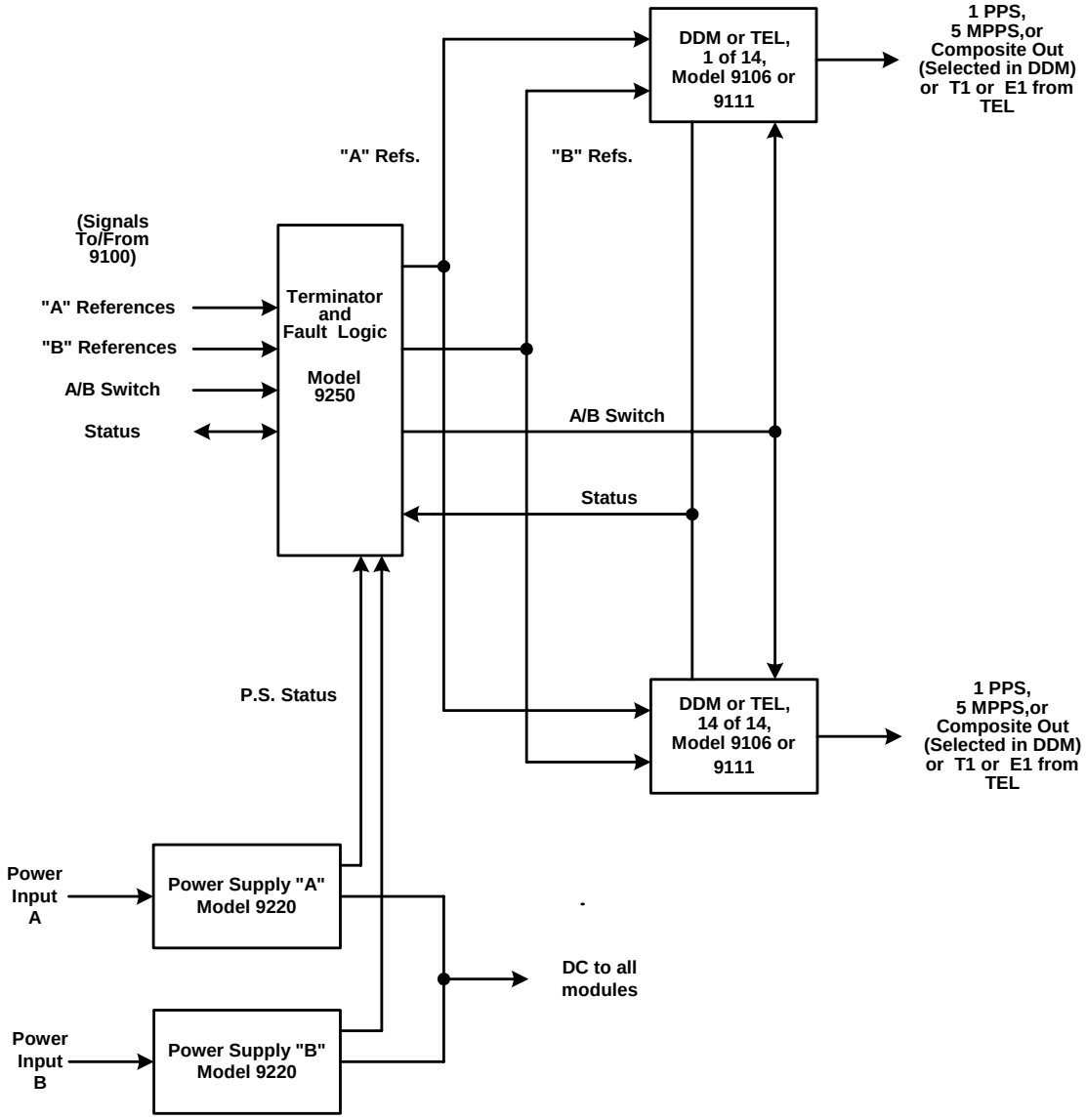
- Up to 14 Digital Distribution and or Telecom modules may be installed
- Fault/Status reporting through Model 9100 interfaces
- Single or redundant power supplies

The Terminator and Fault Logic Module (TFL) provides proper termination for the redundant reference signals produced in the Model 9100. It also functions as the internal fault collection point for all faults developed within the Model 9200 and the communications link between the Model 9200 and 9100.

Redundant power supplies provide all operational DC power for all modules. Power supplies can either universal AC input optional 20-60 Vdc input.

A one-meter signal interconnect cable and line terminator plug are supplied with each Model 9200.

The functional block diagram for the Model 9200 DDU is shown in Figure 1-2.



Model 9200 Block Diagram

Figure 1-2.

1-5 PHYSICAL DESCRIPTION

The Model 9200 DDU is a single chassis designed for mounting in a standard EIA, 19 inch wide equipment rack. Front panel height is 5.22 inches (3U) and overall depth is 15.0 inches exclusive of front panel handles and rear panel connectors. Weight is approximately 25 pounds with all modules installed. All functional modules plug-in through the front of the unit. System controls, status indicators, and test points are located on module front panels.

There are 18 front panel plug-in module locations, A1- A14 are available for Digital Distribution modules (DDM) and / or Telecommunications modules (TEL). A15 and A16 are reserved for Terminator and Fault Logic modules (TFL). Typically only one TFL module is installed in location A15. A17 and A18 are reserved for Power Supply modules. Weight is approximately 25 pounds with all modules installed. System status indicators and test points are located on module front panels. All connections to the unit are via rear panel connectors with exception of the Telecom module, which contains two front panel high-density 15-pin DD-sub connectors for Framed and EIA-RS-422 output signals.

1-6 ENVIRONMENTAL CHARACTERISTICS

Unless otherwise specified, Model 9200 meets all published specifications when operated over the temperature range of –30°C to +60°C with a rate of change <2°C/minute. Maximum operating humidity is 95%, non-condensing. The unit withstands normal shock and vibration found in all forms of common-carrier shipment.

1-7 POWER REQUIREMENTS

The Model 9200 operates from 100 to 240 VAC ± 10%, 48-63 Hz single-phase power. Power consumption with all modules installed is approximately 80 watts.

As an option, the system can be ordered with DC power supply in place of the AC power supply. Input voltage is 20-60 VDC. Refer to Appendix D for further details.

1-8 EMC/EMI

The Model 9200, when used with the Model 9100, meets the requirements of FCC Part 15 Class B for North America and Product Family harmonized standards EN55022 and EN55024 for emissions and immunity compliance of the EMC Directive 89/335/EEC and its amendments.

Note: In order to comply with the standards above, the following interface cables or equivalent listed in Table 1-1 must be used.

Table 1-1 Interface Cables for EMC Compliance

Reference Designator	Connector	Interface cable type
J1 through J56	BNC	RG-400
Telecom Module J1 & J2	HD 15-pin D-SUB	Shielded twisted pair
J57	24 pin	TRAK supplied cable
FL1 & FL2	IEC-320	TRAK supplied power cords

1-9 OUTPUT CHARACTERISTICS

The Model 9200 output signal characteristics are identical to the digital output characteristics of the Model 9100 modules. Refer to the Model 9100 technical manual section 1-9 for output characteristics of the DDM and TEL modules.

1-10 ALARMS

Refer to Model 9100 manual section paragraph 1-11 for complete descriptions.

CHAPTER 2

INSTALLATION

2-1 UNPACKING PROCEDURE

The Model 9200 is packed for shipment in molded foam end-caps. Accessories, such as manual, cables, power cords, and mating connectors are contained in the same box as the Model 9200. Unpack the system as follows:

a. Examine shipping container for any signs of damage and rough handling. Record any damage observed and report to carrier.

b. Remove and retain shipping list from outside of carton.

c. Open shipping carton top and lift out the Model 9200 system.

d. Examine contents for any sign of damage and record any damage noted.

e. Remove accessories from the carton.

f. Check to ensure that all items listed on the packing list have been removed from the shipping carton.

g. Retain shipping carton and packing material for future use.

2-2 SYSTEM MOUNTING PROCEDURE

The Model 9200 is designed for mounting in an EIA standard 19-inch rack. Unit height is 5.22 inches and the depth is 15.00 inches. Allow at least four inches behind the unit for cable clearance. Free flow of circulating air should be available to assure an ambient temperature does not exceed +60^{o}C.

Typically the Model 9200 is located above or below the Model 9100.

2-3 MODEL 9100/9200 INTERCONNECTION

An interconnect cable and terminator plug are supplied with every Model 9200. Connect the Models 9100 and 9200 together. After connecting, place the terminator plug at the Model 9200 end. If more than one Model 9200 is used, terminate the last Model 9200 input.

2-4 REAR PANEL CONNECTORS AND FUSES

The Model 9200 rear panel is shown in Figure 2-1. All connectors, fuses, and indicators are described in Table 2-1.

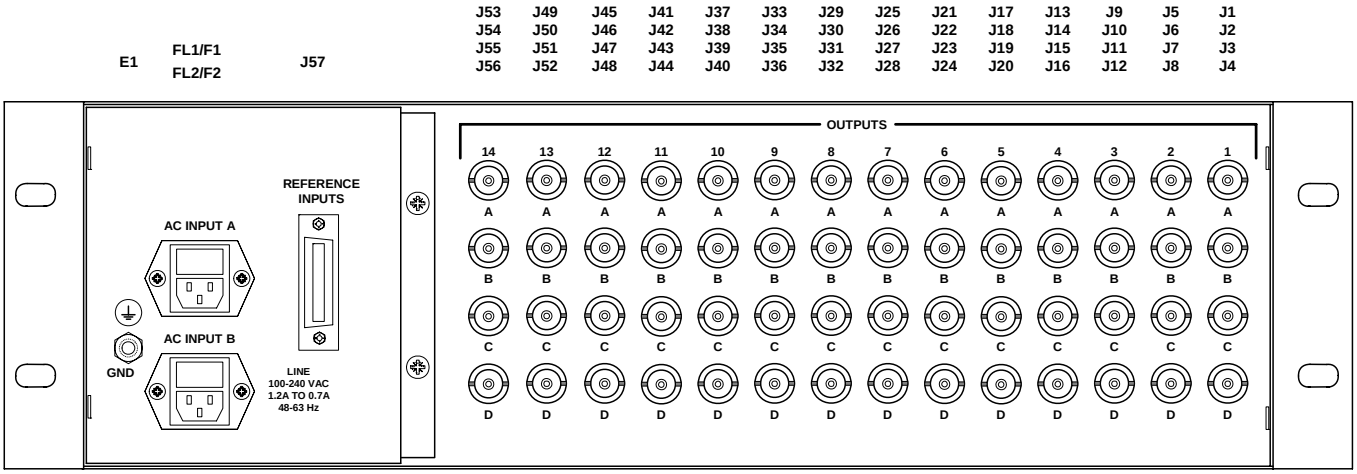


Figure 2-1. Model 9200 Rear Panel

Table 2-1. Rear Panel Connectors and Fuses

REF DES	FUNCTION	CHASSIS CONNECTOR	MATING CONNECTOR
J57	Reference Inputs from Model 9100 (See Table 2-3 for connections)	AMP 554088-1 female	Interface cable, 1meter, supplied by TRAK
J1 – J56	DDM Installed, 1PPS, 5 MPPS, or Comp.	BNC Female	BNC Male
J1 – J56	TEL Installed, TTL level clock, T1 or E1	BNC Female	BNC Male
FL1	100 to 240 Vac, power to PS A (A17)	IEC-320 type	Power Cord
F1	3 amp slo-blo fuse for PS A (A17)	Installed in FL1	
FL2	100 to 240 Vac power to PSB (A18)	IEC-320 type	Power Cord
F2	3 amp slo-blo fuse for PSB (A18)	Installed in FL2	

2-5 REFERENCE SIGNAL INPUT CONNECTIONS

The pin connections for the Frame Reference Inputs, J57, are listed in Table 2-3.

Table 2-3, Reference Inputs, J57

Pin No	FUNCTION	Pin No	FUNCTION
1	RS-232 B	13	Ground
2	RS-232 A	14	Ground
3	1 PPS B	15	Ground
4	1 PPS A	16	Ground
5	5 MPPS B	17	Ground
6	5 MPPS A	18	Ground
7	Composite B	19	Ground
8	Composite A	20	Ground
9	GPS Status A	21	GPS Status B
10	I^2C Interface Data	22	Ground
11	I^2C Interface Clock	23	Ground
12	Not Used	24	Ground

2-6 DISTRIBUTION MODULE SWITCH and CONFIGURATION JUMPER SETTINGS

The Model 9200 accepts both the Model 9106 DDM and the 9111 TEL modules. Either module types may be installed in any position, A1 – A14. Refer to the Model 9100 technical manual section 2-8 for DDM and TEL module configurations.

2-6-1 TERMINATOR and FAULT LOGIC (TFL), (A15, A16)

The Model 9250 TFL is installed in position A15.

The TFL/DDU address switch, S2, must be set so that the Model 9100, FSU "knows" the address of the DDU. Set S2 for 0 for a single DDU, 1 for two DDU's, etc.

Note: Actual TFL address is not important as insuring that no two Model 9200, that are connected to the same Model 9100, have the same address.

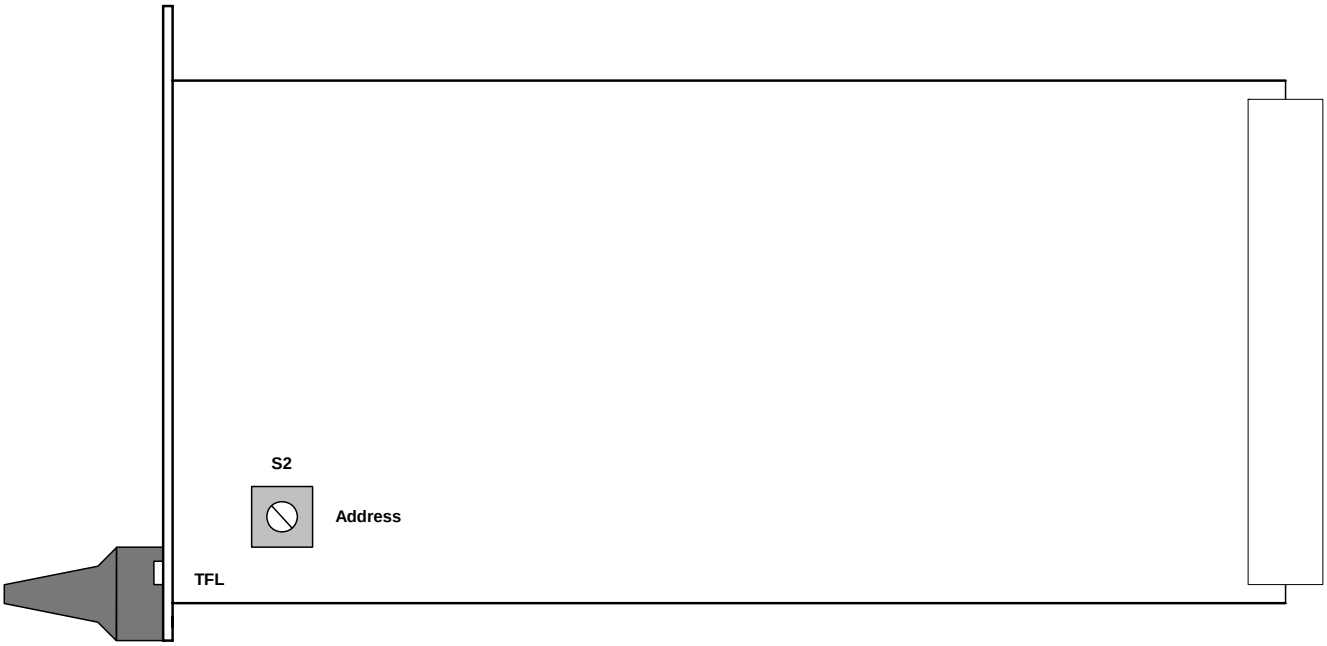


Figure 2-2. TFL Switch Location

CHAPTER 3

OPERATION

3-1 GENERAL

This chapter covers the operation of the Model 9200 including a description of front and rear panel controls and indicators, initial synchronization and fault detection.

3-2 FRONT PANEL CONTROLS AND INDICATORS

The Model 9200 front panel is shown in Figure 3-1. Table 3-1 lists each module with its system reference designator and gives a description of the Module. A view of each module front panel along with a description of controls and indicators is also provided. Further details for each module are given in Appendix G.

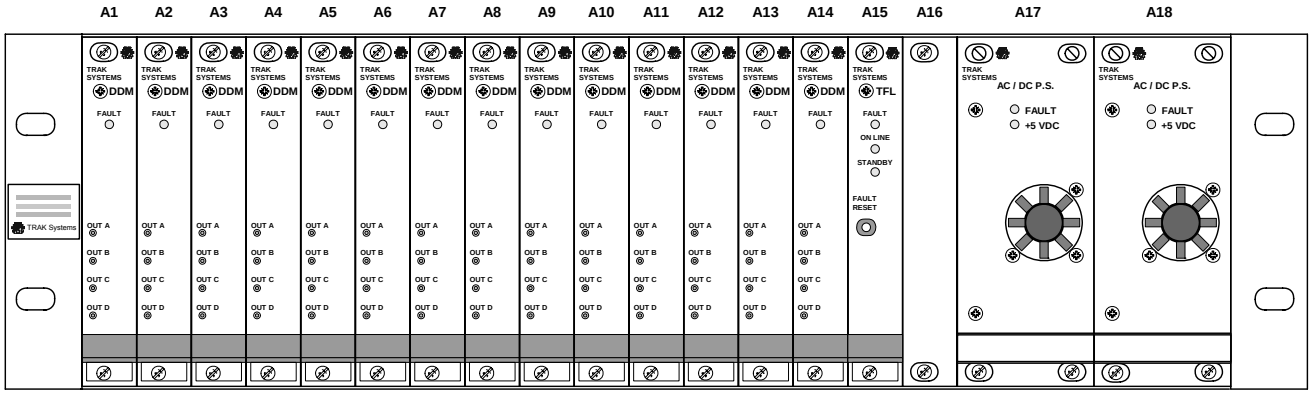


Figure 3-1. Model 9200 Front Panel

Table 3-1. Model 9200 Front-Panel Module Locations and Functions

REF DES	DESCRIPTION
A1-A14	DDM and/or TEL modules may be installed in these locations.
A15,	TFL module position.
A17, A18	Power Supply module. Provides Diode “OR’ed” +5, +15, and -15 Vdc to all modules. Two modules are used for dual redundancy. May be AC or optional 20-60 Vdc input power supplies.

3-3 DIGITAL DISTRIBUTION MODULES

Refer to the Model 9100 technical manual section 3-2 for DDM and TEL module configurations. The TEL is described in the following paragraph.

3-3-1 TERMINATOR and FAULT LOGIC, A15

The Model 9250 Terminator and Fault Logic front panel shown in Figure 3-4 contains the following LED indicators:

FAULT red, module fault summation

ON LINE green, indicates module is on line

STANDBY green, indicated module is in standby (not used)

The Model 9250-1 Terminator and Fault Logic front panel shown in Figure 3-4 contains the following switches:

FAULT RESET Pressing FAULT RESET clears any latched faults in the DDU(s).

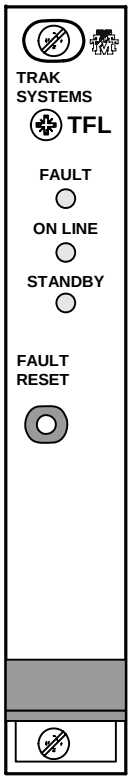


Figure 3-2. Model 9250 Terminator and Fault Logic (TFL) A15

3-6 POWER SUPPLIES, A17 and A18

The Model 9220 Power Supply front panel shown in Figure 3-5 contains the following LED indicators:

FAULT red, power supply fault summation

+ 5 Vdc green, indicates + 5 Vdc power supply good

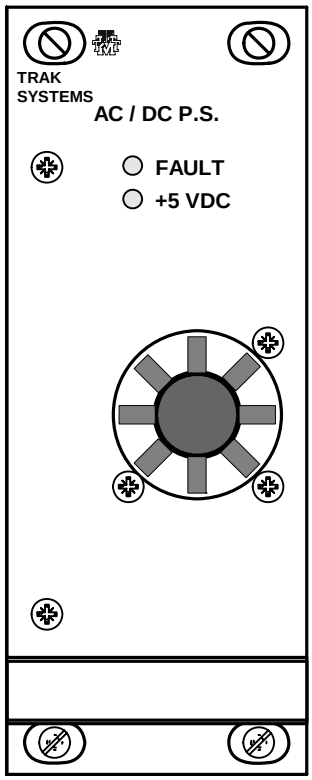


Figure 3-3. Model 9220 Power Supply (A17 and A18)

3-7 OPERATION

With the Model 9200 connected to the Model 9100 and DDM and/or TEL modules are installed, the DDU is operational.

Apply power to the system and observe that all the green power supply indicators are illuminated.

NOTE:

TFL modules take approximately 5 seconds to initialize and all TFL indicators are on at this time.

Pressing FAULT RESET on TFL module should clear all FAULT indicators. The DDU is now operational.

CHAPTER 4

MAINTENANCE

4-1 GENERAL

The Model 9200 provides maintenance-free operation for the life of the system. This chapter contains instructions for locating and correcting failures in the Model 9200. Troubleshooting instructions are provided for locating and replacing modules. No troubleshooting aids are provided beyond the module level.

4-2 MAINTENANCE PHILOSOPHY

All the circuits in the MFTS are in front panel replaceable modules, allowing rapid repair at the system operational level. Additionally, all modules contain fault indicators, allowing rapid recognition and replacement of a failed module. No attempt should be made to repair a module. These assemblies should be returned to the factory for repair.

4-3 PREVENTIVE MAINTENANCE

Preventive maintenance of the system consists mainly of cleaning and general inspection to maintain the best environment for the equipment operation.

4-4 REPLACEMENT OF MODULES

As noted above, hot replacement of power supply modules should be limited to those times when continued system operation is required during normal deployment. A procedure for Power Supply replacement is provided in Paragraph 4-5.3.

4-5 TROUBLESHOOTING GUIDE

The following paragraphs provide corrective actions for system failures. Included are procedures for fault recognition, failed module location, and for module replacement.

4-5.1 Distribution Failures

The Model 9200 contains up to 14 Distribution Modules. If any of the modules fail, the appropriate FAULT indicator on the failed Distribution Module illuminates. Test points are provided to verify reference signals are present.

Before replacing a failed module, remove all coaxial signal output cables, on the rear panel, associated with the failed module and depress the TFL "FAULT RESET" switch (on the 9200). If the "FAULT" indicator of the module is cleared, the problem may be a shorted cable or a failure at the receiving end of the cable. For proper operation of the distribution fault sense circuits, cable ends must be terminated into 50Ω. If the failure persists replace the failed module as follows:

a. Loosen the two screws securing the failed module to the chassis.

b. Holding the handle of the module, carefully pull on the handle and withdraw module.

c. Install the new Distribution module and secure to chassis by tightening the two front panel screws.

d. At the TFL front panel, depress the FAULT RESET switch and assure that the FAULT indicator is extinguished.

4-5.2 Terminator and Fault Logic (TFL) Module Failures

If the FAULT indicator on the TFL module illuminates and/or there is a loss of external communications, replace the TFL module.

a. Loosen the two screws securing the failed module to the chassis.

b. Holding the handle of the module, carefully pull on the handle and withdraw module.

c. Install the new module and secure to chassis by tightening the two front panel screws.

d. Depress the TFL FAULT RESET switch and assure that the FAULT indicator is extinguished.

4-5.3 Power Supply Failure

If a Power Supply Module fails, the fault indicator of the failed module illuminates and one or more of the power present indicators will be out. To replace a failed Power Supply Module proceed as follows:

a. Remove AC power to the failed power supply. For example if the Power Supply module closest to the FSU failed, remove power cord on rear panel labeled AC or DC INPUT A. If Power Supply module closest to the edge of the chassis failed, remove power cord on rear panel labeled AC or DC INPUT B.

b. Before removing a failed Power Supply module, check to see if the fuse located on the filter fuse assembly supplying AC power to the Power Supply Module is good. If the fuse is blown, replace fuse with the spare fuse in the fuse compartment of the filter/fuse assembly. Remember to replace spare fuse in filter/fuse assembly.

c. Reconnect AC power cord or DC and verify that the power supply is operating.

d. If power supply is still not working, disconnect AC power cord or DC and loosen the four front panel screws securing the Power Supply to the chassis.

e. Holding the Power Supply handle towards the left of the module, carefully pull on handle and remove module.

f. Install a new power supply and secure to chassis by tightening the four front panel screws. Reconnect AC power cord or DC.

g. Verify that the “FAULT” indicator of the power supply is extinguished and all the green power supply indicators are illuminated.

CHAPTER 5

REPLACEABLE PARTS LIST

5-1 GENERAL

Table 5-1 lists replaceable modules in the Model 9200. If ordering a module from the factory, either the module part number or model number may be used.

TABLE 5-1 REPLACEMENT PARTS LIST

Ref. Des.	Description	Model number	Qty.
A1-14	Digital Distribution Module (DDM)	9106-1	1-14*
A1-14	Telecom Signal Generator Module, T1	9111-1	1-14*
A1-14	Telecom Signal Generator Module, E1	9111-2	1-14*
A15	Terminator and Fault Logic Module	9250-1	1
A16	Blank Panel		
A11 and A12	AC/DC Power Supply (for AC input)	9220-1	2
A11 and A12	DC/DC Power Supply (for 20-60 Vdc input)	9221-1	2

NOTE: * Number and location of modules varies from site to site.

APPENDIX G

Model 9100 Module Data Sheets

To Be Supplied

APPENDIX H

CE Compliance Certificate

DECLARATION OF CONFORMITY

(In accordance with EN: 45014)

We,

TRAK Microwave Corporation
4726 Eisenhower Blvd.
Tampa, FL 33634

Declare under our sole responsibility that the product,

Modular Frequency/Time System
Model Number 9100

To which this declaration relates is in conformity with the following standards or other normative documents:

89/336/EEC ***The Electromagnetic Compatibility Directive***

EMC:
EN 55022 (1998) Class B
EN 55024 (1998)
IEC 1000-4-2 (1995)
IEC 1000-4-3 (1995)
IEC1000-4-4 (1994) / EN 61000-4-4 (1995)
IEC1000-4-5 (1995) / EN 61000-4-5 (1995)
IEC1000-4-6 (1996) / EN 61000-4-6 (1996)
IEC1000-4-8 (1994) / EN 61000-4-8 (1994)
IEC1000-4-11 (1994) / EN 61000-4-11 (1994)

73/23/EEC ***The Low Voltage Directive***

IEC 60950: 1991 + A1: 1992: + A2: 1993 + A3: 1995 A4:1996

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