Theater Deployable Communications

Baseline Requirements Document

Crypto Module

CM (v2.1)

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1.0 SCOPE

This requirements document establishes the performance, manufacture and test requirements for the TDC ICAP Crypto Module v2.1.

2.0 APPLICABLE DOCUMENTS

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

Table 1 - Standards and Applicable Documents

Document Number	Title
Group Technologies Corporation Spec. No. 36024531	Performance and Interface Specification for KIV-19A Trunk Encryption Device (TED)
Group Technologies Corporation Spec. No. 36025801	Performance and Interface Specification and Installation Manual for the KIV-19A Rack mount Adapter
MIL-STD-810F	Environmental Test Methods
TIA/EIA–422–B	Electrical Characteristics of Balanced Voltage Digital Interface Circuits (ANSI/TIA/EIA–422–B–94) (May, 1994)
EIA-530	High Speed 25-Position Interface for Data Terminal Equipment and Data Circuit-Terminating Equipment (June 1992)
EIA/TIA-232-E	Interface between Data Terminal Equipment and Data Circuit-Terminating Equipment employing serial binary data interchange (rates to 20 Kbps) (July 1991)
Zyfer GSync Protocol 385-8002 Rev M	Zyfer Serial Communication Protocol Manual
FEI-Zyfer Options Maunal 385-8003 Rev E	CommSync II/GSync Options User's Manual
Zyfer GSync User Manual 391-8000 Rev C	GSync Model 391 Synchronized Time and Frequency System User's Manual
DNE Technologies, Inc 24001109-000	Operation and Installation Guide for the CV-8448 NRZ to CDI Converters
	TDC Standards Document

3.0 REQUIREMENTS

3.1 Module Definition

The Crypto Module v2.1 (Figure 1) provides four KIV-19A Trunk Encryption Devices (TEDs) for long haul bulk encryption of ICAP's off base trunks. The KIV-19A can handle data rates from 9.6 Kbps to 13 Mbps. The Crypto Module v2.1 accepts four red data streams and produces four black encrypted data streams in both NRZ (RS-422) and CDI (Conditioned Diphase, CX-11230) formats. The NRZ interface operates for data rates from 9.6 Kbps to 13 Mbps. The CV-8448-D converter CDI interface operates at the following data rates:

Balanced:	16 Kbps to 2048 Kbps
Unbalanced:	72 Kbps to 4608 Kbps
Optical CDI Standard:	72 Kbps to 8448 Kbps

The Crypto Module v2.1 also contains a Primary Reference Source (PRS) that provides a station clock timing reference for the ICAP network.

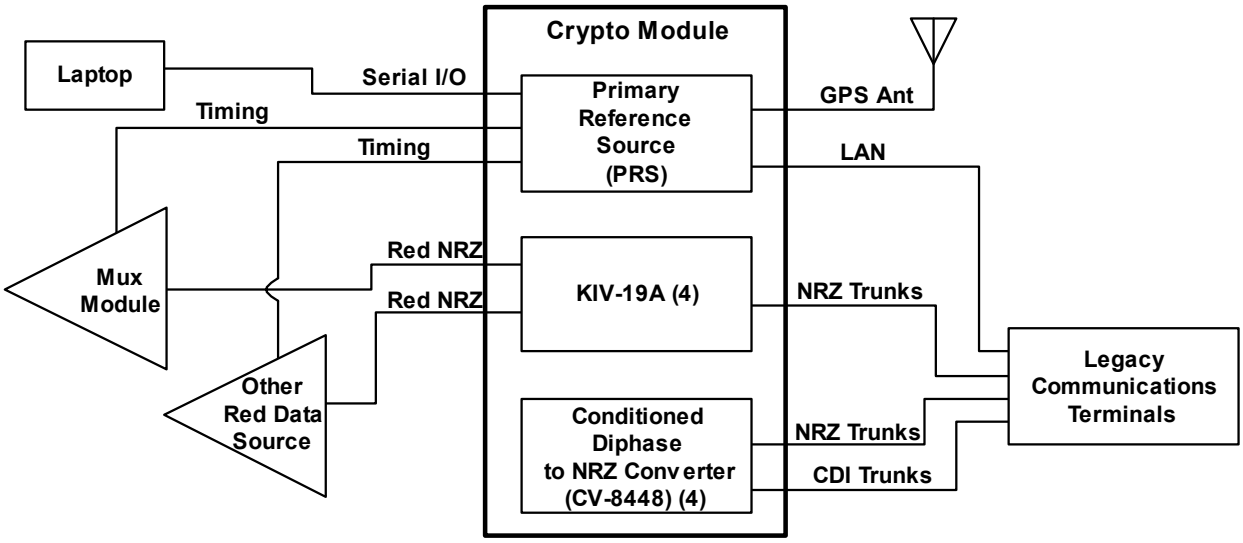


Figure 1 - Application in TDC ICAP

Figure 2 provides a context diagram of the Crypto Module v2.1 showing inputs and outputs. Detailed characteristics of each interface are detailed in Paragraph 3.2.

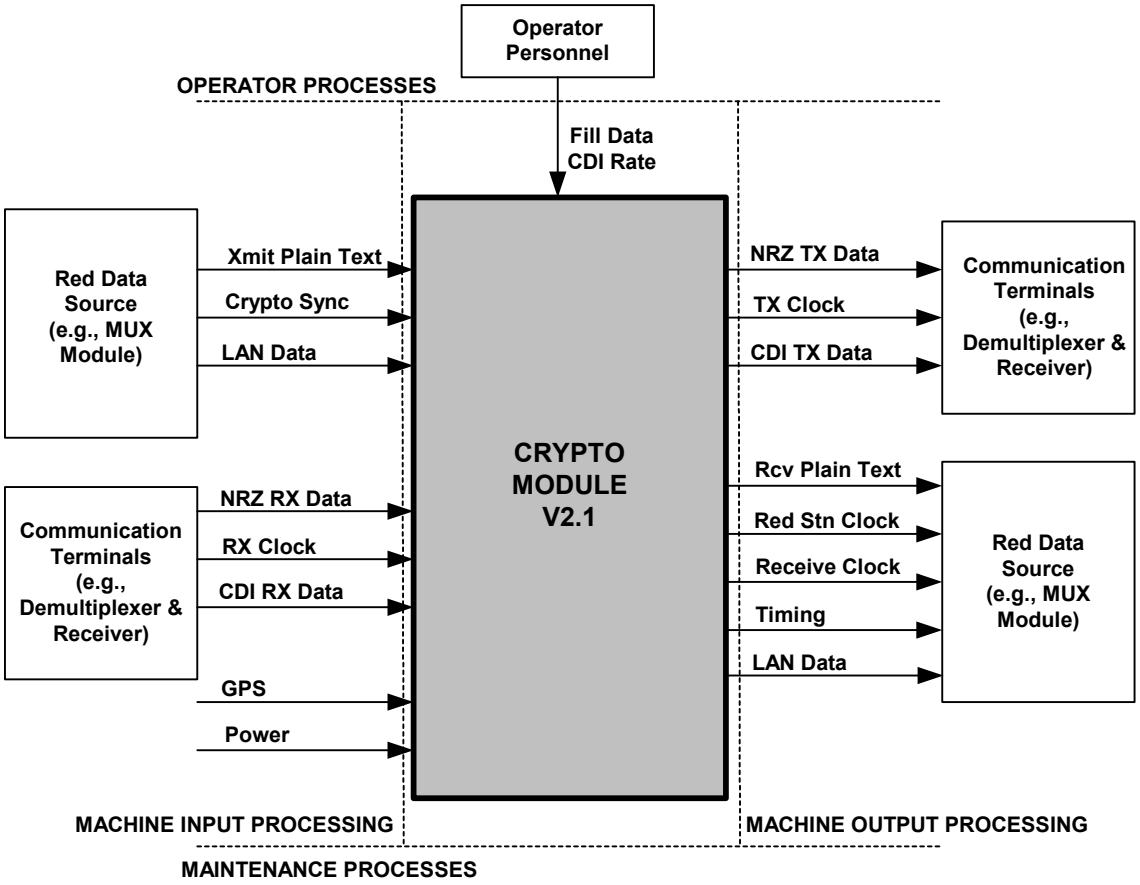


Figure 2 - Block Diagram External Module Interfaces

3.2 Performance Requirements

3.2.1 Electrical Interfaces (External)

The Crypto Module v2.1 available external interfaces, as shown in Figure 6, are described in Table 2.

Table 2 - RDM External Interface Characteristics

Signal Name	Quantity	I/O	Connector	Primary Interface	Electrical Characteristics
Prime Power	1	I	IEC 320 C-20 Receptacle	AC Power	100-240 VAC, 47-63 Hz.

Table 2 - RDM External Interface Characteristics

Signal Name	Quantity	I/O	Connector	Primary Interface	Electrical Characteristics
RED I/O	4	I/O	DB-25(F)	P-MUX Module, SA-TRK	EIA-530
USD TIMING	4	I	DB-25(F)	P-MUX Module, USD	EIA-530
BLK I/O	4	I/O	DB-25(F)	CV-8448, NRZ (530)	EIA-530
NRZ (RS-530)	4	I/O	DB-25(F)	KIV-19A, BLACK I/O	EIA-530
UNBALANCED (CDI)	4	I/O	UG-1837/G	Proprietary Manchester Interface	Conditioned Diphase per TRI-TAC ICD-002
CONVERTER ADMIN (GANGED)	1	I/O	DB-9(F)	Laptop	RS-232
GPS ADMIN	1	I	DB-9 (F)	Laptop	RS-232
BSC	4	I	Triax (F)	KIV-19	EIA-422
USD CLK	4	I	Triax (F)	P-MUX Module, USD	EIA-422
RECOVERED CLK	4	O	Triax (F)	KIV-19A, BLACK I/O	50 Ohm, RS-422
1A-1D, 2A-2D	1ea. 8 total	O	Triax (F)	USD CLK, BSC	50 Ohm, RS-422
RATE OUT	1	O	BNC (F)	User option	50 Ohm
AUX REF	1	I	BNC (F)	User option	50 Ohm
1 PPS	1	O	BNC (F)	User option	50 Ohm
EXT CLOCK	4	I	BNC (F)	PRS	50 Ohm, RS-422
TX (Optical)	4	O	ST	Proprietary Manchester Interface	62.5/125 micrometer MM at 1300 nm
RX (Optical)	4	I	ST	Proprietary Manchester Interface	62.5/125 micrometer MM at 1300 nm
XMT (black) (Balanced CDI)	4	O	Binding Post	Proprietary Manchester Interface	Conditioned Diphase per TRI-TAC ICD-002
REC (black) (Balanced CDI)	4	I	Binding Post	Proprietary Manchester Interface	Conditioned Diphase per TRI-TAC ICD-002
NET	1	I/O	RJ-45 (F)	LAN	Ethernet, IEEE 802.3
GPS ANT	1	I	N-type	GPS Antenna	75 Ohm, RG-59

Table 2 - RDM External Interface Characteristics

Signal Name	Quantity	I/O	Connector	Primary Interface	Electrical Characteristics
Clock Phase Select	4	N/A	Double pole switch	P-MUX Module, SA-TRK	N/A

3.2.1.1 Prime Power

The Crypto Module v2.1 operates from 100-240 VAC, 47-63 Hz., single phase, and three-wire power. The Crypto Module v2.1 includes:

- An IEC–320 C-20 male connector (or equivalent) for prime power.
- An internal line transient suppressor to minimize line variations.

3.2.1.2 RED Data Interfaces – RED I/O & USD TIMING

Four RED I/O and four USD TIMING interfaces are on the RED I/O Panel. These interfaces use DB-25(F) type connectors. Pin assignments are shown in Table 3 and Table 4. These interfaces will be connected "normal-through" to the KIV-19A Red I/O.

Table 3 - Red I/O, Red I/O Panel

Pin	Signal	I/O	Pin	Signal	I/O
1	Shield	–	14	Transmit Plain Text (-)	I
2	Transmit Plain Text (+)	I	15	Red Station Clock (+)	O
3	Receive Plain Text (+)	O	16	Receive Plain Text (-)	O
4	Resync (-)	I	17	Receive Plain Text Clock (+)	O
5	NC	–	18	NC	–
6	NC	–	19	Resync (+)	I
7	Ground	–	20	NC	–
8	NC	–	21	NC	–
9	Receive Plain Text Clock (-)	O	22	NC	–
10	NC	–	23	NC	–
11	NC	–	24	NC	–
12	Red Station Clock (-)	O	25	NC	–
13	NC	–			

Table 4 - USD Timing, Red I/O Panel

Pin	Signal	I/O	Pin	Signal	I/O
1	Shield	–	14	NC	–
2	NC	–	15	NC	–
3	NC	–	16	NC	–

Table 4 - USD Timing, Red I/O Panel

Pin	Signal	I/O	Pin	Signal	I/O
4	NC	–	17	NC	–
5	NC	–	18	NC	–
6	NC	–	19	NC	–
7	NC	–	20	NC	–
8	NC	–	21	NC	–
9	NC	–	22	NC	–
10	NC	–	23	NC	–
11	USD Clock (-)	O	24	USD Clock (+)	O
12	NC	–	25	NC	–
13	NC	–			

3.2.1.3 Black Data DCE Interface – BLK I/O

The four BLK I/O interfaces, located on the Black Interface Panel, use DB-25(F) type connectors. Pin assignments are shown in Table 5. The DCE interfaces are provided to allow NRZ connection to EIA-530 standard communication devices (i.e. CSU's). These signals are "normal-through" connected to Black Data DTE interfaces (Table 5).

Table 5 - Blk I/O Data, Black Interface Panel

Pin	Signal	I/O	Pin	Signal	I/O
1	Shield	–	14	Tx Data Out (-)	O
2	Tx Data In (+)	O	15	Tx Clock Out (+)	I
3	Rx Data Out (+)	I	16	Rx Data Out (-)	I
4	NC	–	17	Rx Clock Out (+)	I
5	NC	–	18	NC	–
6	NC	–	19	NC	–
7	Signal Return	–	20	NC	–
8	NC	–	21	NC	–
9	Rx Clock Out (-)	I	22	NC	–
10	NC	–	23	NC	–
11	Tx Clock In (-)	O	24	Tx Clock In (+)	O
12	Tx Clock Out (-)	I	25	NC	–
13	NC	–			

3.2.1.4 Black Data DTE Interface – NRZ (RS530)

The four NRZ (RS-530) interfaces on the Black Interface Panel use DB-25 (F) type connectors. Pin assignments are shown in Table 6. The DTE interfaces are provided to allow NRZ connection

to the KIV-19A Black I/O outputs. These signals are “normal-through” connected to the KIV-19A.

Table 6 - RS-232 IP Asyncchronous Serial

Pin	Signal	I/O	Pin	Signal	I/O
1	NC	–	14	Tx Data Out (-)	I
2	Tx Data In (+)	I	15	Tx Clock Out (+)	O
3	Rx Data Out (+)	O	16	Rx Data Out (-)	O
4	NC	–	17	Rx Clock Out (+)	O
5	NC	–	18	NC	–
6	NC	–	19	NC	–
7	Signal Return	–	20	NC	–
8	NC	–	21	NC	–
9	Rx Clock Out (-)	O	22	NC	–
10	NC	–	23	NC	–
11	Tx Clock In (-)	I	24	Tx Clock In (+)	I
12	Tx Clock Out (-)	O	25	NC	–
13	NC	–			

3.2.1.5 Unbalanced CDI Data Interface

The four unbalanced CDI I/O on the Black Interface Panel use UG-1837/G connectors that interface to a CX-11230 cable. Adapting the separate XMT and RCV Triax connectors from the CV-8448-D, CDI Converter, provides this interface.

3.2.1.6 Administrative Interfaces – Converter Admin (Ganged) & GPS Admin

The CONVERTER ADMIN (GANGED) on the Black Interface Panel and the GPS ADMIN located on the Timing Panel use DB-9 (F) type connectors with pin assignments as shown in Table 7.

Table 7 - RS-232 IP Asyncchronous Serial

Pin	Signal	I/O	Pin	Signal	I/O
1	NC	–	6	NC	–
2	Transmit Data	I	7	NC	–
3	Receive Data	O	8	NC	–
4	NC	-	9	NC	–
5	Signal Ground	–			

3.2.1.7 Triax Interfaces – BSC, USD CLK, Recovered CLK, & 1A-1D, 1A-2D

PRS clocking interfaces utilize Triax connectors. All Triax connectors will be female at the panels. These include BSC, USD CLK, RECOVERED CLK, and 1A-1D, 2A-2D. The N.8 clock (1A-1D and 2A-2D) are provided by two Dual Output N.8 Clock Rate Modules. The N.8 Clock Rate Module provide 4 Triax ports which are not independently programmable output ports. A 2+2 port configuration is used, this mean that the first two ports (1A and 1B) are programmed for the same output rate when Register 1 is programmed. Outputs 1C and 1D are programmed for the same output rate when Register 2 is programmed. Refer to Clock Rate Control (Input/Output) in the Serial Communication Protocol Manual for instruction on programming Clock Rate registers to the desired Frequency. The formula (F out = 8k times the variable V) where V is the Frequency output multiplier is used to determine the Clock Rate Out.

Note: For example to program register 1 (1A&1B) for a frequency out of 8192k, the variable is (8192k divided by 8k), the formula is (8192k = 8k times 1024) where 1024 is the variable.

3.2.1.8 BNC Interfaces – RATE OUT, AUX REF, 1PPS, EXT CLOCK

The Timing Panel RATE OUT, AUX REF (1PPS In), 1PPS (Output), and the Black Interface Panel EXT CLOCK are female BNC connections at the panels.

3.2.1.9 Optical Interfaces – TX & RX

The four TX, and corresponding RX, interfaces are ST-type connectors operating in multimode at 1300 nm. These signals are pulled directly from the CV-8448-D converters.

3.2.1.10 Balanced CDI Interfaces – XMT (black) & REC (black)

The four pairs of XMT, and their corresponding REC, connectors use binding posts to accommodate WF–16/U or equivalent field wire for connection to TRI-TAC communications equipment.

3.2.1.11 NET Interface

The NET connector uses an RJ-45 Ethernet/802.3 connection to interface to the local 10/100BaseT LAN network.

3.2.1.12 GPS Antenna Interface – GPS ANT

The GPS ANT connector uses an N-type connector on a 75 Ohm, RG-59 cable. The center conductor of this connector can also be used to supply 5 VDC power to the connected antenna.

3.2.1.13 Clock Phase Select

The Crypto Module v2.1 makes available, as shown in Figure 6 on the Red I/O Panel, the Phase Select switch for each TED. This toggle switch will invert the RSC signal at the point where TXPT data is clocked into the KIV-19A. This will allow the proper phase relationship to be

maintained between the internal signal Buffered Transmit Plain Text Clock, that is derived from the Black Station Clock, and Buffered Transmit Plain Text Data.

3.2.2 Electrical Interfaces (Internal)

The Crypto Module v2.1 utilizes several types of internal interfaces. Paragraph 6.3 and Paragraph 6.4 contain detailed information.

3.2.3 Functional Requirements

3.2.3.1 Module Equipment Details

The following subsections provide details of the functionality of the major equipment of the Crypto Module v2.1 as seen in Figure 3.

3.2.3.1.1 KIV-19A

The Crypto Module v2.1 (Figure 3) provides four KIV-19A (KG-94, 194 compatible) crypto devices for encryption/decryption of aggregate data channels that interface to legacy communication terminals and the LMST. In addition, the module contains a GPS based primary reference source (PRS) for network timing that must be connected to the network via the MUX Module when interfacing TDC ICAP digital trunks to external multiplexed networks.

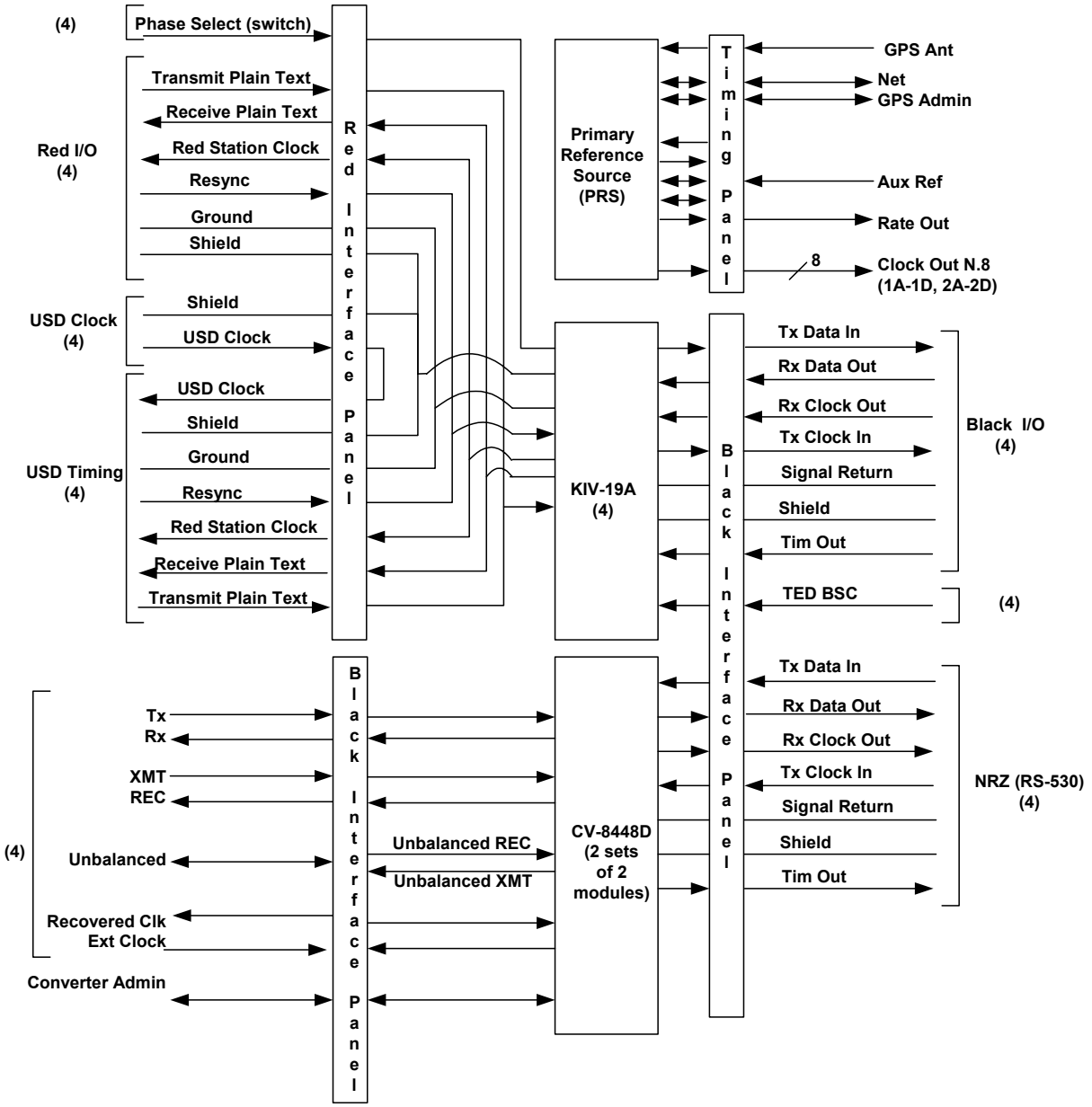


Figure 3 - Block Diagram Showing Internal Module Functions

3.2.3.1.2 Crypto Fill

The KIV-19A traditional keying material is loaded into the KIV-19A. The following loading equipment can be used to load the KIV-19A Key Loader KYK-13, KYX-15, KOI-18 and KOK-12. In combination with the KIV-19A the Data Transfer Device (DTD) interfaces directly to the DS-102 fill port of the KIV-19A.

3.2.3.1.3 NRZ to CDI Converter

The DNE CV-8448-D provides conversion of NRZ data from the KIV–19A to a Conditioned Diphase signal for connection to TRI-TAC communications equipment. The CV-8448-D provides:

- Signal conversion from EIA–530 interfaces to CDI or FO
- Balanced signals over WF–16/U or equivalent field wire using binding post terminations
- Unbalanced signals using UG1837/G connectors
- Fiber optic signals using ST connectors
- Interface to KIV–19A and TRI-TAC equipment
- Modular converter supports two converter modules. The CV-8448-D can be mated to another CV-8448-D via an expansion port to form a four-channel (4-PACK) configuration that may be controlled from a single terminal interface.

Full equipment specifications can be found at http://www.dnetech.com/

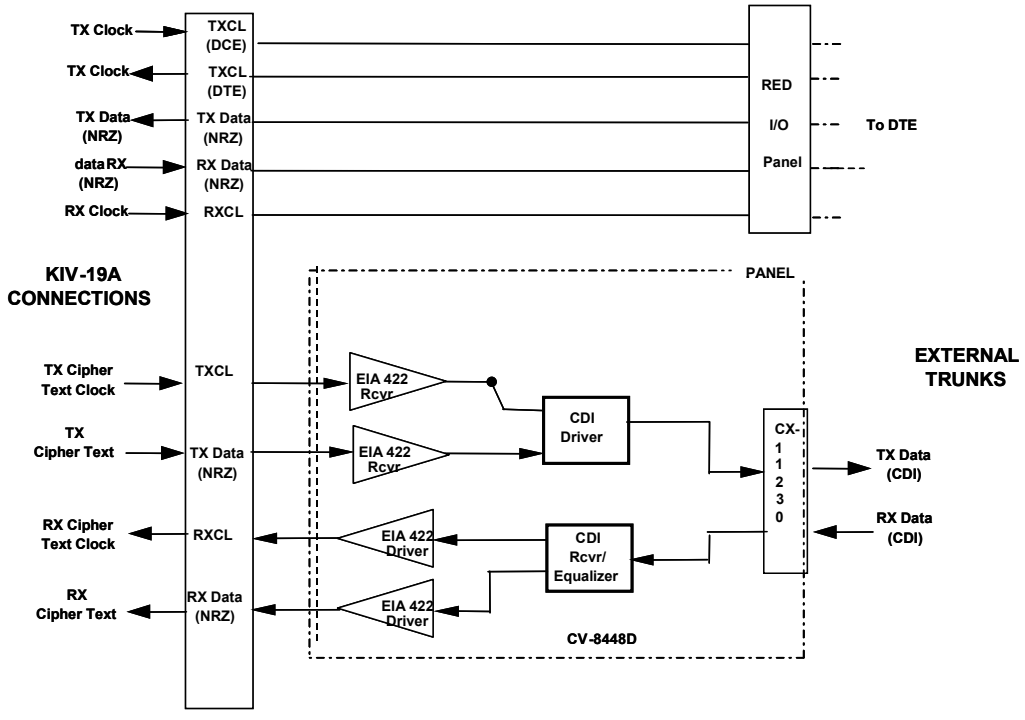


Figure 4 - Block Diagram of a Single Channel

3.2.3.1.4 GSync Time and Frequency System

The Primary Reference Source (PRS) provides a station clock timing reference for the network. The PRS Rubidium oscillator develops a STRATUM 1 timing reference when disciplined by the GPS receiver reference. The PRS contains a self-contained Frequency Discipline Machine (FDM), consisting of an ultra-stable oscillator (Rubidium), single GPS receiver and GPS antenna, and a single power supply. The user serial interface connections are made through a DB-9F connector identified “RS-232”, using a standard RS-232 control interface. A 10 MHz and a 1 PPS TTL level output signal is available through BNC connector “10MHz” and “1PPS” respectively.

If the system is set to the Switch mode, GPS is the default reference source. If GPS becomes unavailable and the external reference input is present, the module will automatically switch to the external 1PPS, 1/5/10 MHz input (depending on the module configuration). If the external input is not present then the system switches to the Coasting or Holdover mode. When GPS becomes available again, the system automatically starts to use the GPS source again.

Two N.8 option cards are required to provide 4 independently programmable ports. The Dual Clock Rate RS-422 Output Module version provides RS-422 output via 2+2 Triax connector configuration. A 2+2 Triax output configuration provides two independently programmable ports per card. They have a frequency range of 8 KHz to 8192 KHz in 8 KHz increments. The clock rate can be selected through the front panel keypad and menu or commands from the I/O port.

An Ethernet I/O External Input Module provides a 10/100 Base-T TCP/IP Ethernet connection for remote control and monitor of the system through either TELNET, or SNMP. Two BNC connectors on the -02 version of this module provide external clock/synchronization for 1PPS, 1 MHz, 5 MHz and 10 MHz inputs.

The Crypto Module v2.1’s PRS generated timing signals are used as a reference by the MUX Module and/or an AN/FCC-100 multiplexer and as the Black Station Clock (BSC) which is input to the black side of KIV-19A. BSC provides the timing reference for the Red Station Clock (RSC), which clocks the TX data (Transmit Plain Text) into the Encryptor from the terminal equipment (MUX). NRZ Cipher Text data from the KIV-19A interfaces is output as NRZ on the Black Interface Panel. This signal may then be input into the CV-8448-D by jumper cable, where it is then output from the CV-8448-D as CDI electrical waveforms to external communication terminals. Output timing maintains the same stability as the PRS.

3.2.3.2 Configuration Options

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

- Fireberd Analyzer Kit
- Cable Maintenance Kit
- LAN Kit
- Laptop Computer Kit

- Router Kit
- Data Extension Kit

3.2.4 Physical Characteristics

3.2.4.1 Transit Case

The module is housed in an 11U man-transportable container (transit case), approximately 22.5”W x 34.5”D x 23.4”H. The transit case is designed to stack on top of and mechanically interlock to like cases. It is designed (with covers in place) to protect the electronic equipment inside from direct exposure to environmental conditions; e.g., rain, snow, ice, dust, etc., likely to be encountered during world wide military transit.

3.2.4.2 Weight

The module, including all internally carried cables, does not exceed 261 lbs.

3.2.4.3 Storage Space

The module transit case includes storage pouches within its covers to contain cables, manuals, etc. that must be transported and used with the module.

3.2.4.4 Marking

Ensure that the Zyfer GPS Antenna is appropriately labeled to indicate the following.

Proper antenna power rating (+5.0 VDC).
“To be used with the Zyfer GPS unit only.”

See the TDC Standards Document for required markings.

3.2.5 Cables and Accessories

The Crypto Module v2.1 includes the following cables and equipment listed in Table 8. Unique cables are marked with the module’s red and purple color code as indicated. Cable integrity is accomplished using strain relief management. Strain relief and cable management hardware are provided with the module.

Table 8 - Cables and Terminators included with CM

Function	Color Code	Quantity	Description
Power	red & purple	1	IEC 320 female (or equivalent) to NEMA-5P.
Crypto Module v2.1 to MUX Modules (Trunks)	red & purple	8	Black I/O Jumper Cable

Table 8 - Cables and Terminators included with CM

Function	Color Code	Quantity	Description
KIV-19A to CV-8448 NRZ Jumper	red & purple	4	Inter-module Cable; DB-25 Male-to-Male (straight-through) 3’
Breakout box	red & purple	1	Breakout/Cable Tester
Admin Cable	red & purple	1	Admin Cable, DB9 plug to DB9 jack, 10 ft. (Stored in Pouch)
CV-8448 NRZ Loopback (Remote)	red & purple	1	RS530 loopback plug
KIV-19A Red Loopback (Remote)	red & purple	1	RS530 loopback plug
KIV-19A Black Loopback (Local)	red & purple	1	RS530 loopback plug
Fireberd Test Cable	red & purple	1	Miniature Twinax to Triax cable, 6’
L1GPS Antenna	red & purple	1	GPS Antenna w/ Antenna Cable 50’
Antenna Adaptor	red & purple	1	Lighting Protection Cable Adapters
PRS Ethernet Cable	red & purple	1	Ethernet Patch Cable 7’ 350MHz
CV8448 Fiber Optic CDI Interface	red & purple	1	8448 MM CDI Fiber w/ST Connectors, Cable 40’
8448 Inter-module	red & purple	4	8448 Inter-Module DB25 Male to Male 10 inch cable 10”
Crypto Timing	red & purple	8	3’ Triax to Triax Timing Jumper Cable

3.2.6 Reliability

The module with its standard complement of LRUs, have a mean time between failure (MTBF) commensurate with similar commercial equipment in its class. The actual MTBF for the major system components are shown in Table 9. Where reliability data is not readily available from the vendor, this is indicated.

Table 9 - MTBF of Major Components

Component	MTBF
CV-8448	Not Available
KIV-19A	5000 hours at -40 to 71 C, 10,000 hours at 25 C
GSync	55079 hours at 30 C

3.2.7 Maintainability

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

3.2.7.1 Mean Time Between Preventive Maintenance

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

3.2.8 Environmental Conditions

During storage, transport and operation the modules can withstand exposure to temperatures as shown in Table 10.

3.2.8.1 Temperature

Temperature characteristics for the major equipment components are shown in Table 10.

Table 10 - Module Temperature Characteristics

	Temperature (degrees C)	
Equipment	**Operating**	**Non-Operating**
CV-8448	0 to 50	-20 to 65
KIV-19A	-40 to 71	-57 to 71
GSync	0 to 50	-40 to 85

3.2.8.2 Relative Humidity

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

Table 11 - Module Humidity Characteristics

	Humidity
Equipment	**Non-condensing**
CV-8448	95%
KIV-19A	95%
GSync	95%

3.2.8.3 Altitude

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

Table 12 - Module Altitude Characteristics

Equipment	Altitude (feet)	
	Operating	**Non-Operating**
CV-8448	15,000	40,000
KIV-19A	15,000	40,000
GSync	-60m to 5000m	-60m to 9000m

3.2.8.4 Sand and Dust

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

3.2.8.5 Shock

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

3.2.8.6 Vibration

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

3.3 Design and Construction

3.3.1 Material Parts and Processes

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

3.3.2 Safety

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

3.3.2.1 Electrical Safety

This module is designed to eliminate the hazard to personnel of inadvertent lethal voltage contact. All electrical conductors carrying voltages in excess of 70 volts shall be insulated to prevent

contact or covered by a protective barrier. All removable protective barriers shall be interlocked to automatically disconnect power behind the barrier upon removal or clearly marked with a warning label that indicates the voltage potential that will be encountered behind the barrier. All warning labels shall remain visible after the cover has been removed.

3.3.2.2 Mechanical Safety

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

3.4 Logistics

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

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

4.0 QUALITY ASSURANCE PROVISIONS

4.1 General

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

4.2 Responsibility for Inspection

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

4.3 Product Qualification Test (PQT)

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

4.4 Production Acceptance Test (PAT)

Each module delivered to the Government undergoes an Acceptance Test Process as identified in Table 13. The acceptance test verifies that the module interfaces are operating properly prior to delivery to the Government.

4.5 Verification Cross Reference Matrix (VCRM)

Table 13 provides a list of each Section 3 requirement and the verification method to be used. The following paragraphs define the codes employed in the VCRM. Unless otherwise noted, where more than more one verification method is shown, one method or a combination of methods may be used to show compliance.

4.5.1 Not Required (N/R)

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

4.5.2 Inspection

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

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

4.5.3 Analysis

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

4.5.4 Demonstration

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

4.5.5 Test

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

Table 13 - Verification Cross Reference Matrix

		Verification Method					
			PQT				
Paragraph	Title	N/R	Inspect	Analysis	Demo	Test	ATP
3.0	Requirements	X					
3.1	Module Definition	X					
3.2	Performance Requirements	X					
3.2.1	Electrical Interface Requirements (External)	X					
3.2.1.1	Prime Power					X	X
3.2.1.2	Red Data Interface - Red I/O and USD Timing		X		X		X
3.2.1.3	Black Data DCE Interface - Blk I/O		X		X		X

Table 13 - Verification Cross Reference Matrix

Paragraph	Title	Verification Method					
			PQT				
		N/R	Inspect	Analysis	Demo	Test	ATP
3.2.1.4	Black Data DTE Interface NRZ (RS530)		X		X		X
3.2.1.5	Unbalanced CDI Interface		X		X		X
3.2.1.6	Administrative Interfaces Converter Admin (Ganged) and GPS Admin		X		X		X
3.2.1.7	Triax Interfaces BSC, USE CLK, Recovered CLK and 1A-1D, 1A-2D		X		X		X
3.2.1.8	BNC Interfaces - Rate Out, Aux Ref, IPPS, Ext Clock		X		X		X
3.2.1.9	Optical Interfaces - Tx and Rx		X		X		X
3.2.1.10	Balanced CDI Interfaces - Xmt (black) and REC (black)		X		X		X
3.2.1.11	NET Interface		X		X		X
3.2.1.12	GPS Antenna Interface - GPS Ant		X		X		X
3.2.1.13	Clock Phase Select		X		X		X
3.2.2	Electrical Interface (Internal)	X					
3.2.3	Functional Requirements	X					
3.2.3.1	Basic Configuration	X					
3.2.3.1.1	KIV-19A				X		X
3.2.3.1.2	Crypto Fill				X		X
3.2.3.1.3	NRZ to CDI Converter				X		X
3.2.3.1.4	GSync Time and Frequency System				X		X
3.2.3.2	Configuration Options	X					
3.2.4	Physical Characteristics	X					
3.2.4.1	Transit Case		X				
3.2.4.2	Weight					X	
3.2.4.3	Storage Space		X				
3.2.4.4	Marking		X				X
3.2.5	Cables And Accessories		X		X		X
3.2.6	Reliability			X			
3.2.7	Maintainability			X			
3.2.7.1	Mean Time Between Preventive Maintenance [MTBPM]			X			
3.2.8	Environmental Conditions	X					
3.2.8.1	Temperature					X	
3.2.8.2	Relative Humidity			X			
3.2.8.3	Altitude			X			
3.2.8.4	Sand and Dust			X			

Table 13 - Verification Cross Reference Matrix

Paragraph	Title	Verification Method					
			PQT				
		N/R	Inspect	Analysis	Demo	Test	ATP
3.2.8.5	Shock					X	
3.2.8.6	Vibration					X	
3.3	Design and Construction	X					
3.3.1	Materials Parts and Processes			X			
3.3.2	Safety	X					
3.3.2.1	Electrical Safety			X		X	
3.3.2.2	Mechanical Safety		X	X			
3.4	Logistics			X			

5.0 PREPARATION FOR DELIVERY

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

6.0 BASELINE CONFIGURATION

6.1 Equipment

Table 14 - Equipment Listing

Device	Manufacturer	Part Number	Descritpion	Quantity
Lighting Protection	PolyPhaser	DGXZ+06NFNF-A	GPS Lighting Protection	1
Adapter	Connector Tech. Inc.	M55339/20-00201	Lighting Protection Cable Adapters	2
Case	ECS Composites	11721	Transit Case	1
CV-8448-D	DNE	97370010	CV-8448-D Converter Pair (Software Version 2.0)	2
KIV Frame	Sypris Electronics	36025800	House 2 KIV-19A per frame	2
Trunk Encryptor – High Speed	Sypris Electronics	KIV-19A	KIV-19A Encryptor	4
ROM Controller	Sypris Electronics	KIV-19A Firmware	Rev 3	-
GPS	FEI-Zyfer	391-MC-BKD	Chassis w/Backplane, Keypad/ Display	1
GPS	FEI-Zyfer	391-C3-RBX	Standard C/A Receiver w/ Rubidium External Clock Input	1
GPS	FEI-Zyfer	391-PS-115A	115-220VAC Power Input Module (100 Watts)	1
GPS SOFTWARE	FEI-Zyfer	385-3022	GPS Firmware Ver: V1.21.00	1
GPS SOFTWARE	FEI-Zyfer	385-3011	KDC Firmware Ver: V1.18.00	1
GPS	FEI-Zyfer	385-4038-02	Ethernet I/O External Input Module	1
GPS	FEI-Zyfer	385-4007-01	5MHz Output Module	1
GPS	FEI-Zyfer	385-4069-02	N.8 Frequency Synthesizer	2
Conditioner	Marway	MPD411130	Power Conditioner	1
Breakout Box (Stored In Pouch)	International Data Sciences	BB530	EIA-530 Breakout Box	1
Cable Mgmt (Stored In Pouch)	Leviton Telcon	41150-019	Cable Mgmt Bar	2
Cable Loop (Stored In Pouch)	Leviton Telcon	41020-SPR	Cable Mgmt Loop	2
Connector	Fiber Systems Int'l	BSTA2000	Bulkhead Coupler	8
Adapter	Connector Tech. Inc	M553339/13-00492	BNC Bulkhead Adapter	7

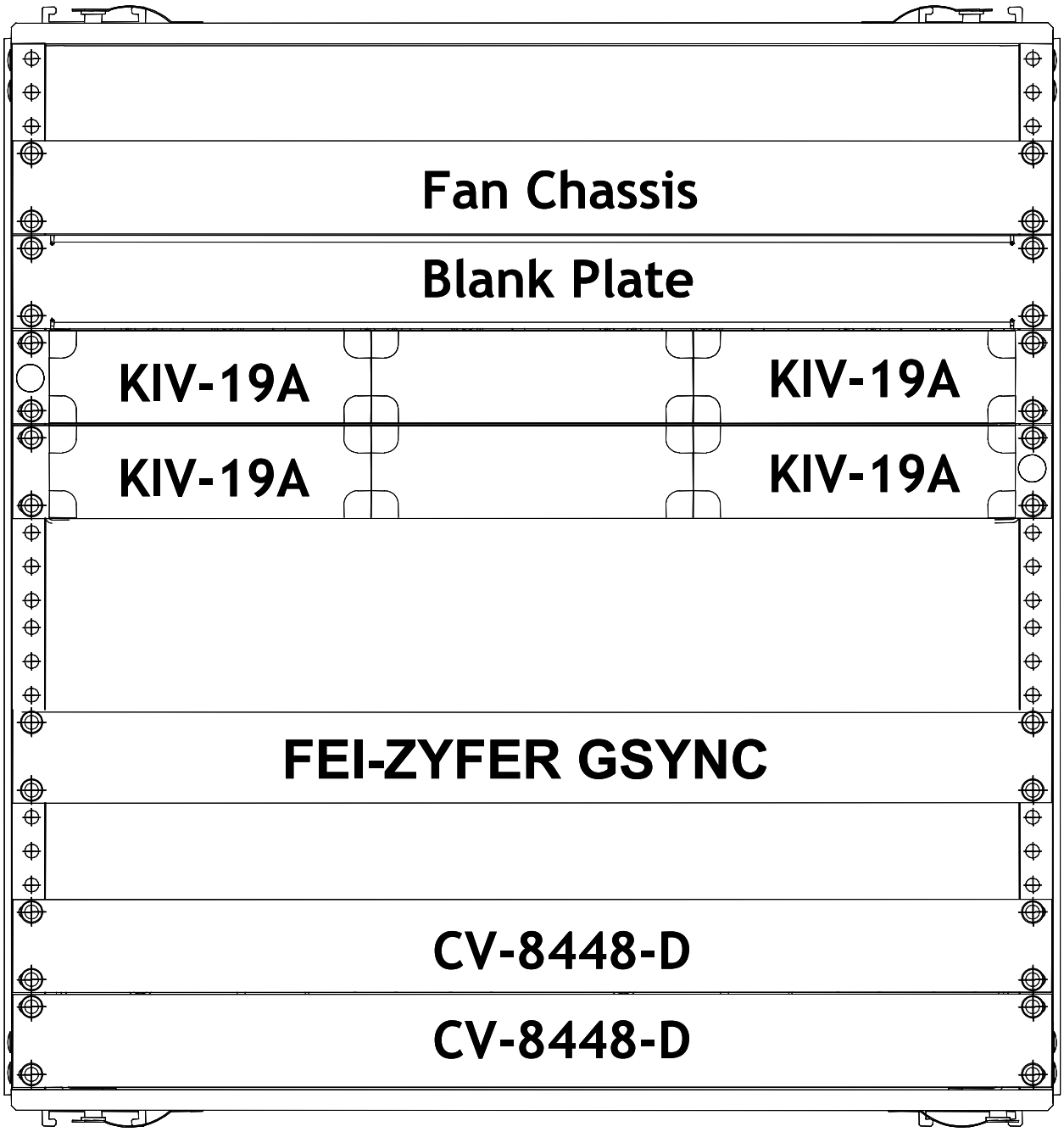
Table 14 - Equipment Listing

Device	Manufacturer	Part Number	Descritpion	Quantity
Connector	Trompeter	BJ78	Triax Pass-through Connectors	20
CV8448 Fiber Optic CDI Interface (Stored In Pouch) P1	TBD	TBD	8448 MM CDI Fiber w/ST Connectors, Cable 40’	1
Fireberd Test Cable (Stored In Pouch) P9	TBD	TBD	Mniature Twinax to Triax 6’	1
Admin Cable (Stored In Pouch) P3	TBD	TBD	Admin Cable	1
Inter-module Cable (Stored In Pouch) P4	TBD	TBD	Inter-module Cable; DB-25 Male-to-Male (straight-through) 3’	4
Black I/O Jumper Cable (Stored In Pouch) P5	TBD	TBD	Black I/O Jumper Cable DB-25 Male to Male (straight-through) 10’	8
8448 Inter-module Cable (Stored In Pouch) P6	TBD	TBD	8448 Inter-Module DB-25 Male-to-Male 10 inch cable	4
PRS Ethernet Cable (Stored in Pouch) P8	TBD	TBD	Ethernet Patch Cable 7’	1
L1GPS Antenna Cable (Stored In Pouch) P2	Gsync	0810384	GPS Antenna and Antenna Cable 50’	1
W001, W023- W024, W029- W030	TBD	TBD	IEC Type Power Cord Components to Power Conditioner	5
W002	TBD	TBD	Time and Freq Gen Admin to Timing Panel	1
W041	TBD	TBD	CV-8448 Admin to Black I/O Panel	1
W003	TBD	TBD	PRS Network to Timing Panel	1
W004, W008 – W010, W031, W040, W043, W052	TBD	TBD	PRS GPS Antenna to Lightning Protection, BNC Clocking	8
W011 – W018	TBD	TBD	N.8 Ports to Timing Panel	8
W019 – W022	TBD	TBD	KIV19A to Red I/O/Phase Select	4
W053 – W056	TBD	TBD	USD Timing to USD CLK	4
W042	TBD	TBD	CV-8448 to J34 and J34	1
W025 – W028	TBD	TBD	KIV19A to Black I/O and BSC	4

Table 14 - Equipment Listing

Device	Manufacturer	Part Number	Descritpion	Quantity
W033, W037, W045, W049	TBD	TBD	CV-8448 J15/J25 Recovered CLK and NRZ (530)	4
W034, W038, W046, W050	TBD	TBD	CV-8448 J11/21 to XMT and REC B/R	4
W032, W036, W044, W048	TBD	TBD	CV-8448 J12/J22 and J13/J23 to Unbal	4
W035, W039, W047, W051	TBD	TBD	CV-8448 FTX 1/2 and FRX 1/2 to Tx and Tx	4
Stored In Pouch P7	TBD	TBD	RS530 Loopback Plug	3
Stored In Pouch P10	TBD	TBD	3” Triax to Triax Timing Jumper Cable	8

6.2 Elevation Drawings



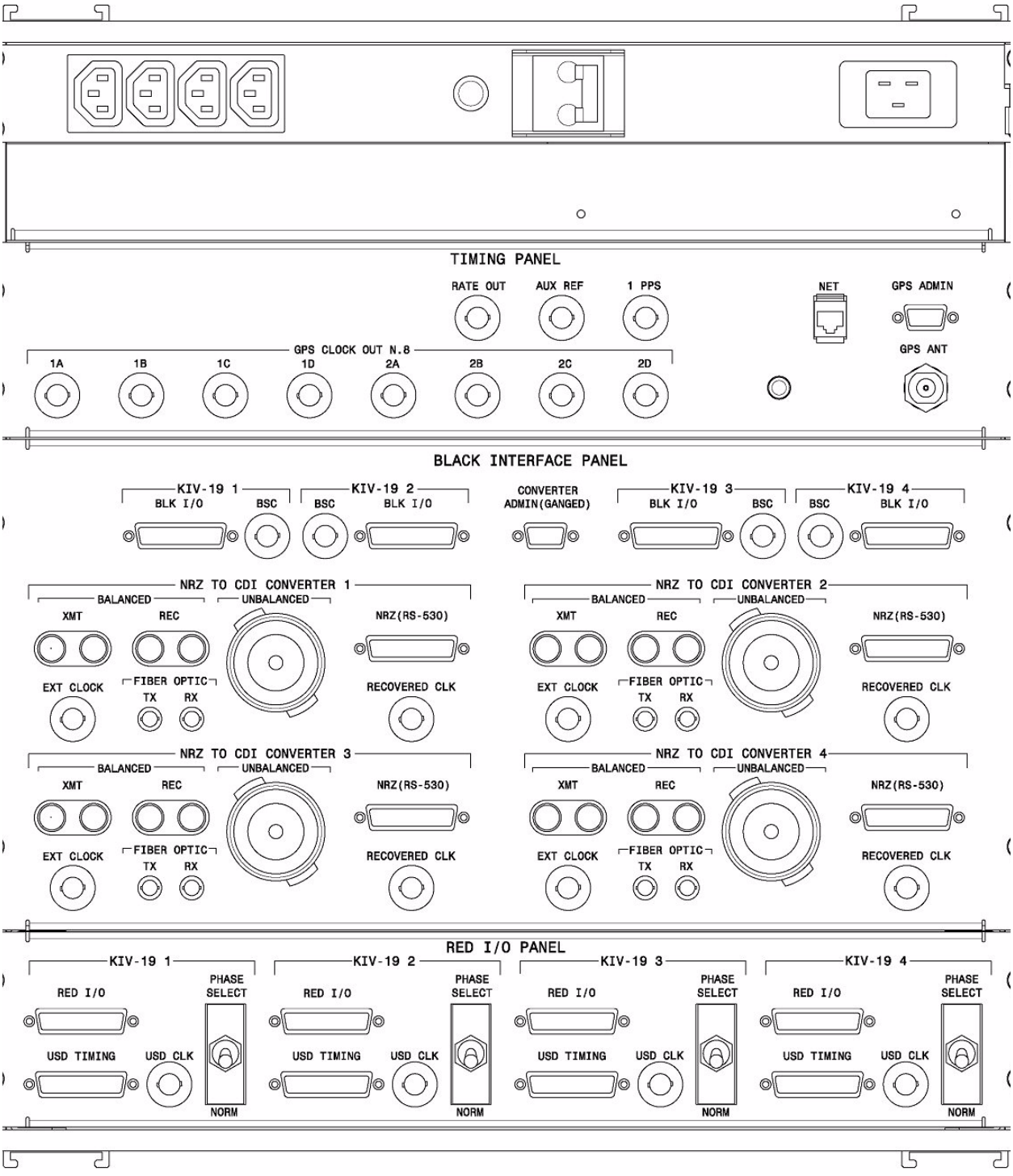


Figure 6 - Rear Elevation

6.3 Cable Diagrams

Table 15 - Cable Diagrams

Wire Number	Manufacturer	Part Number	Description
W001, W023- W024, W029- W030	TBD	TBD	IEC Type Power Cord Components to Power Conditioner
W041	TBD	TBD	CV-8448 Admin to Black I/O Panel
W003	TBD	TBD	PRS Network to Timing Panel
W004,W008 – W010, W031, W040, W043, W052	TBD	TBD	PRS GPS Antenna to Lightning Protection, BNC Clocking
W011 – W18	TBD	TBD	N.8 Ports to Timing Panel
W019 – W022	TBD	TBD	KIV19A to Red I/O/Phase Select
W053 – W056	TBD	TBD	USD Timing to USD CLK
W042	TBD	TBD	CV-8448 J34 to J34
W025 – W028	TBD	TBD	KIV19A to Black I/O and BSC
W033, W037, W045, W049	TBD	TBD	CV-8448 J15/J25 to Recovered Clk and NRZ (530)
W034, W038, W046, W050	TBD	TBD	CV-8448 J11/21 to XMT and REC B/.R
W032, W036, W044, W048	TBD	TBD	CV-8448 J12/J22 and J13/J23 to Unbal
W035, W039, W047, W051	TBD	TBD	CV-8448 FTX1/2 and FRX1/2 to Tx and Rx
W002	TBD	TBD	Time and Freq Gen Admin to Timing Panel
P1	TBD	TBD	8448 MM CDI Fiber w/ST Connectors, Cable 40’
P2	TBD	TBD	GPS Antenna Cable 50’
P3	TBD	TBD	Admin Cable, DB9 plug to DB9 jack, 10 ft.
P4	TBD	TBD	Inter-module Cable; DB-25 Male-to-Male (straight-through) 10’
P5	TBD	TBD	Black I/O Jumper Cable DB-25 Male to Male (straight-through) 3’
P6	TBD	TBD	8448 Inter-Module, DB25 Male to Male 10 inch cable
P7	TBD	TBD	RS530 Loopback Plug
P8	TBD	TBD	Ethernet Patch Cable 7’
P9	TBD	TBD	Miniature Twinax to Triax Cable, 6’
P10	TBD	TBD	Triax to Triax 3’ Timing Jumper Cable

Cable W001, W023 – W024, W029 – W030 Pin Assignments

IEC Type Power Cord Components to Power Conditioner

IEC-320 Receptacle		IEC-320 Plug
Time & Freq. Generator GSync		Power Conditioner
CV-8448 (Top)		**Power Conditioner**
CV-8448 (Bottom)		Power Conditioner
KIV19A (Top)		Power Conditioner
KIV19A (Bottom)		Power Conditioner

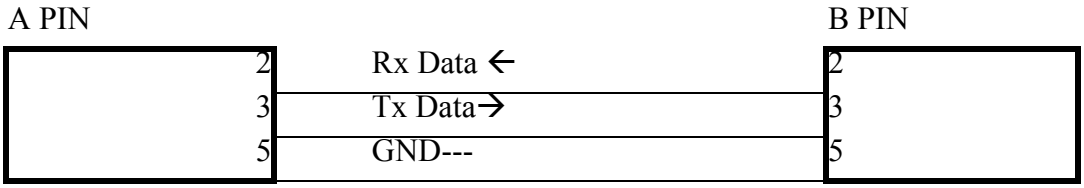
A PIN	Signal	B PIN
1	Line	1
2	Neutral	2
3	GND	3

Cable W041 Pin Assignments

CV-8448 Admin to Black I/O Panel

DB9F Receptacle		DB9F Receptacle
CV-8448 Admin (Ganged)		Converter Admin (Ganged) Black I/ O Panel

SignalDirection

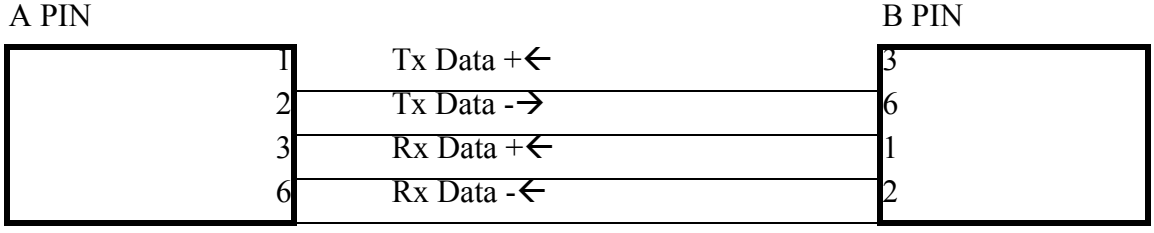


Cable W003 Pin Assignments

PRS Network to Timing Panel

RJ-45 Plug GSync Ethernet		RJ-45 Plug NET

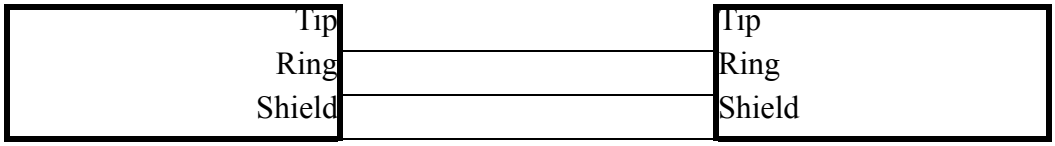
SignalDirection



Cable W004,W008 – W010, W031, W040, W043, W052 Pin Assignments

PRS GPS Antenna to Lightning Protection, BNC Clocking

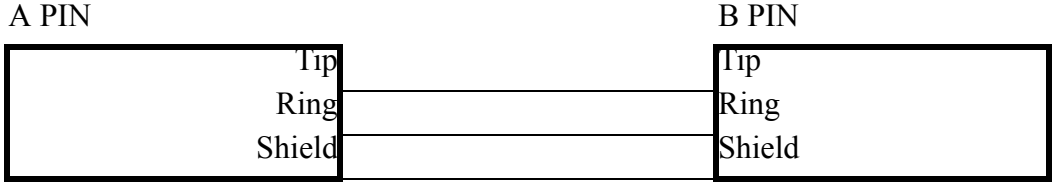
BNC Male	BNC Male
GSync Antenna	Lightning Arrestor
GSync 1 PPS	1 PPS
GSync (slot 2) 5MHz	Rate Out
GSync 1 PPS IN	Aux Ref
CV-8448 (Top) J14	External CLK –1
CV-8448 (Top) J24	External CLK – 2
CV-8448 (Bottom) J14	External CLK – 3
CV-8448 (Bottom) J24	External CLK – 4



Cable W011 – W018 Pin Assignments

N.8 Ports to Timing Panel

Triax Male	Triax Male
N.8 Port 1A	1A
N.8 Port 1B	1B
N.8 Port 1C	1C
N.8 Port 1D	1D
N.8 Port 2A	2A
N.8 Port 2B	2B
N.8 Port 2C	2C
N.8 Port 2D	2D



Cable W019 –W022 Pin Assignments

KIV19A to Red I/O/Phase Select

DB37M Plug KIV19A Red (1-4)		DB25F Receptacle Red I/O (1-4)
A PIN	**SignalDirection**	B PIN
3	RSC +→	**15**
4	RSC -→	12
5	Shield→	1
6	RxPT +→	3
7	RxPT -→	16
9	RxPTCL -→	9
10	RxPTCL +→	17
11	TxPT +←	2
12	TxPT -←	14
-13	GND---	7
17	Resync -←	4
18	Resync +←	19
		Phase Select (1-4) Switch
21	Phase Select→	Open
-13	GND---	Closed

Cable W053 –W056 Pin Assignments
USD Timing to USD CLK

DB25F Receptacle USD Timing (1-4)		Triax Receptacle USD CLK (1-4)
SignalDirection		
A PIN		B PIN
1	Shield→	Shield
11	USD Clock -→	Ring
24	USD Clock +→	Tip

Cable W042 Pin Assignments
CV-8448 J34 to J34

DB9M Plug Master		DB9M Plug Slave
SignalDirection		
A PIN		B PIN
1	Ground---	1
2	Tx Data→	2
3	Rx Data←	3
4	Exp Enable→	9
5	Ground---	5

Cable W025 – W028 Pin Assignments

KIV19A to Black I/O and BSC

DB37F Plug KIV19A Black (1-4)			DB25F Receptacle Black I/O (1-4)
		SignalDirection	
A PIN			B PIN
	12	TxCT -→	14
	11	TxCT +→	2
	7	TxCTCL -→	11
	15	TxCTCL +→	24
	10	RxCT -←	16
	9	RxCT -←	3
	18	RxCTCT -←	9
	17	RxCTCT +←	17
	8	Signal Ground---	7
			Triax
			TED BSC (1-4)
			C PIN
	13	BSCL +←	Tip
	14	BSCL -←	Ring
	16	GND---	Ground

Cable W033, W037, W045, W049 (AM6402) Pin Assignments

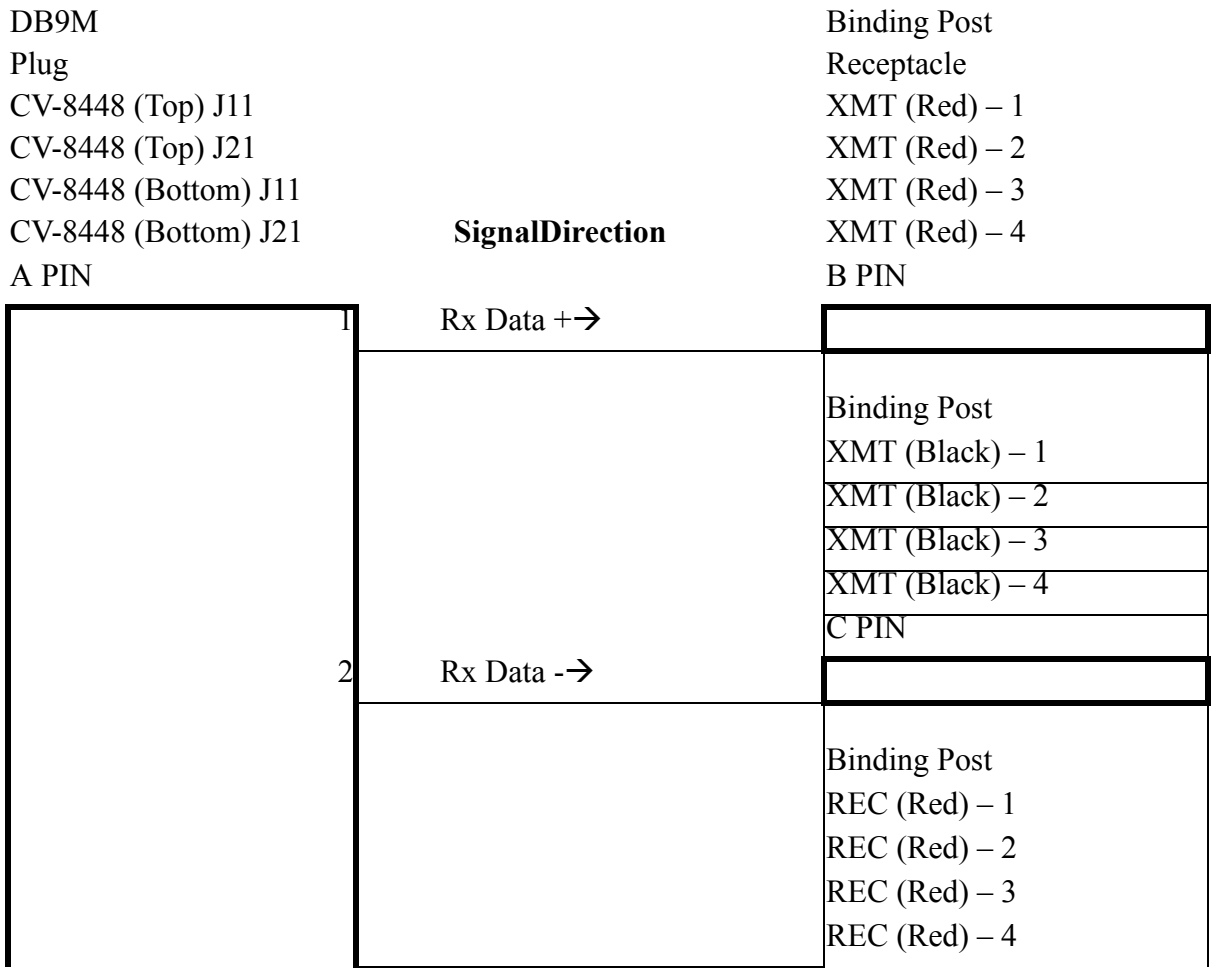
CV-8448 J15/J25 to Recovered Clk and NRZ (530) and Triax

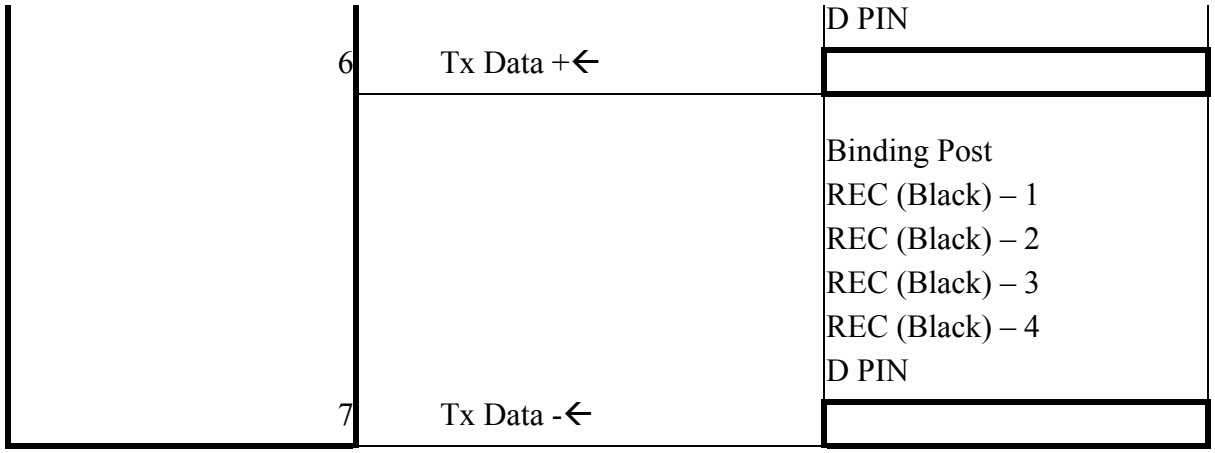
DB25M Plug CV-8448 (Top) J15, J25 CV-8448 (Bottom) J15 J25			DB25F Recpt NRZ (RS-530) 1 and 2 NRZ (RS-530) 3 and 4
A PIN			B PIN
<----	14	Transmit Data In -	14
<----	2	Transmit Data In +	2
<----	11	Transmit Clock In -	11
<----	24	Transmit Clock In +	24
---->	16	Receive Data Out -	16
---->	3	Receive Data Out +	3
---->	9	Receive Clock Out -	9
---->	15	Receive Clock Out +	17
	- 7	Signal Return	7
---->	15	Transmit Clock Out +	15
---->	12	Transmit Clock In	12
----	1	Ground	1

	Triax Recovered Clock C PIN
Transmit Clock Out +	<-- TIP
Transmit Clock In -	<-- Ring
Ground	<-- GND

Cable W034, W038, W046, W050 Pin Assignments

CV-8448 J11/J21 to XMT and REC B/R





Cable W032, W036, W044, W048 Pin Assignments

CV-8448 J12/J22 and J13/J23 to Unbal

UG-1837/G Receptacle		Triax Male
Unbalanced – 1		CV-8448 (Top) J12
Unbalanced – 2		CV-8448 (Top) J22
Unbalanced – 3		CV-8448 (Bottom) J12
Unbalanced – 4		CV-8448 (Bottom) J22

SignalDirection

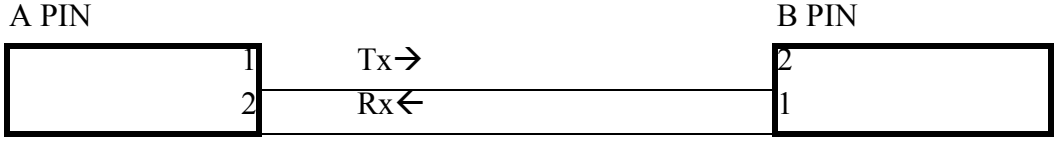
A PIN		B PIN
Top Tip	Tx Data Out +→	Tip
Top Ring	Tx Data Out -→	Ring
Top Shield	Ground---	Shield
		Triax CV-8448 (Top) J13 CV-8448 (Top) J23 CV-8448 (Bottom) J13 CV-8448 (Bottom) J23 C PIN
-Bottom Tip	Rx Data In +→	Tip
Bottom Ring	Rx Data In -→	Ring
Bottom Shield	Ground---	Shield

Cable W035, W039, W047, W051 Pin Assignments

CV-8448 FTX1/2 and FRX1/2 to Tx and Rx

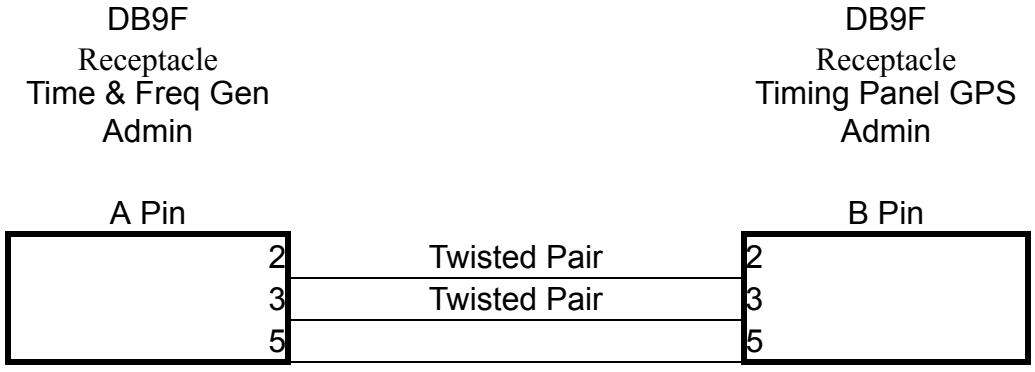
ST Plug		ST Plug
CV-8448 (Top) FTX1/FRX1		Tx/Rx – 1
CV-8448 (Top) FTX2/FRX2		Tx/Rx – 2
CV-8448 (Bottom) FTX1/FRX1		Tx/Rx – 3
CV-8448 (Bottom) FTX1/FRX1		Tx/Rx – 4

SignalDirection



Cable W002 Pin Assignments

Time and Freq Gen Admin to Timing Panel



Cable P8 Pin Assignments

Ethernet Patch Cable 7’

RJ-45 Plug PC		RJ-45 Plug NET
SignalDirection		
A PIN		B PIN
1	Tx Data + ←	1
2	Tx Data - →	2
3	Rx Data + ←	3
6	Rx Data - ←	6

Cable P1 Pin Assignments

8448 MM CDI Fiber w/ST connectors, Cable 40’ (In Pouch)

ST Plug		ST Plug
SignalDirection		
A PIN		B PIN
1	Tx →	1
2	Rx ←	2

Cable P10 Pin Assignments

Triax to Triax 3’ Timing Jumper Cable

Triax Male		Triax Male
A PIN		B PIN
Tip		Tip
Ring		Ring
Shield		Shield

Cable P9 Pin Assignments

Miniature Twinax to Triax cable, 6’

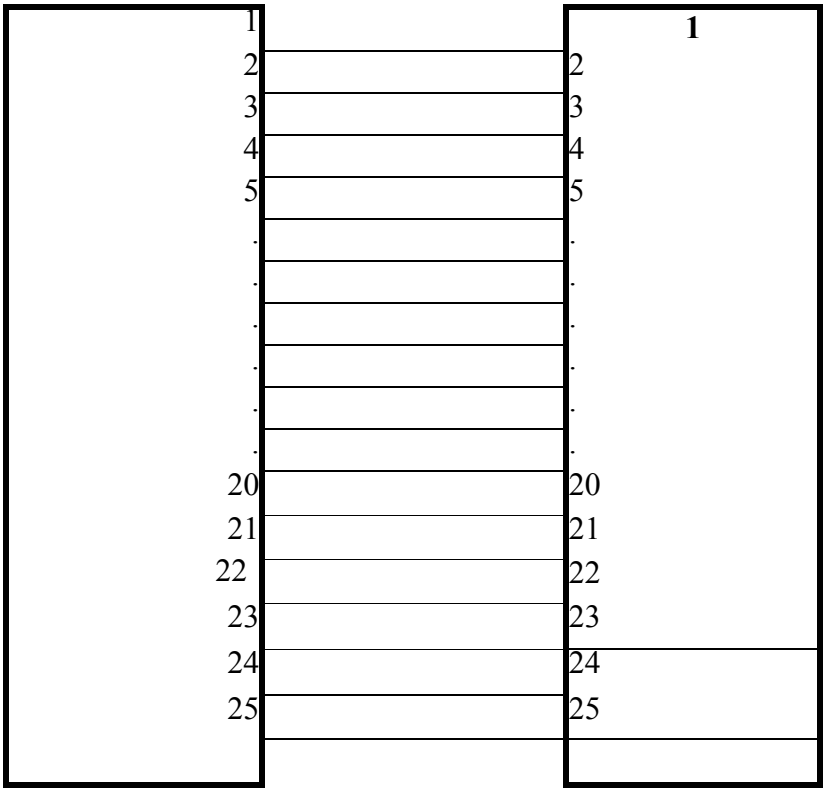
Miniature Twinax Male		Triax Male
A PIN		B PIN
Tip		Tip
Ring		Ring
Shield		Shield

Cable P3 Pin Assignments				
Admin cable, DB9 plug to DB9 jack, 10 ft. (stored in pouch)				
DB9F			DB9M	
Receptacle			Plug	
Laptop COM port			I/O DF	
Terminal, DTE			Various Admin	
	Signal	**Direction**		
2	RD	←	2	
3	TD	→	3	
4	DTR	→	4	
5	GND	---	5	
6	DSR	←	6	
7	RTS	→	7	
8	CTS	←	8	

Cable P4 Pin Assignments

Inter-module Cable; DB-25 Male-to-Male (straight-through) 3’

DB25M Plug	DB25M Plug
Distribution Panel	Distribution Panel
A PIN	B PIN



Note: Pin out is 1:1 straight –thru cable 25 pins

Cable P5 Pin Assignments

Black I/O Jumper Cable DB-25 Male to Male (Straight-through) 10’

DB25M
Plug

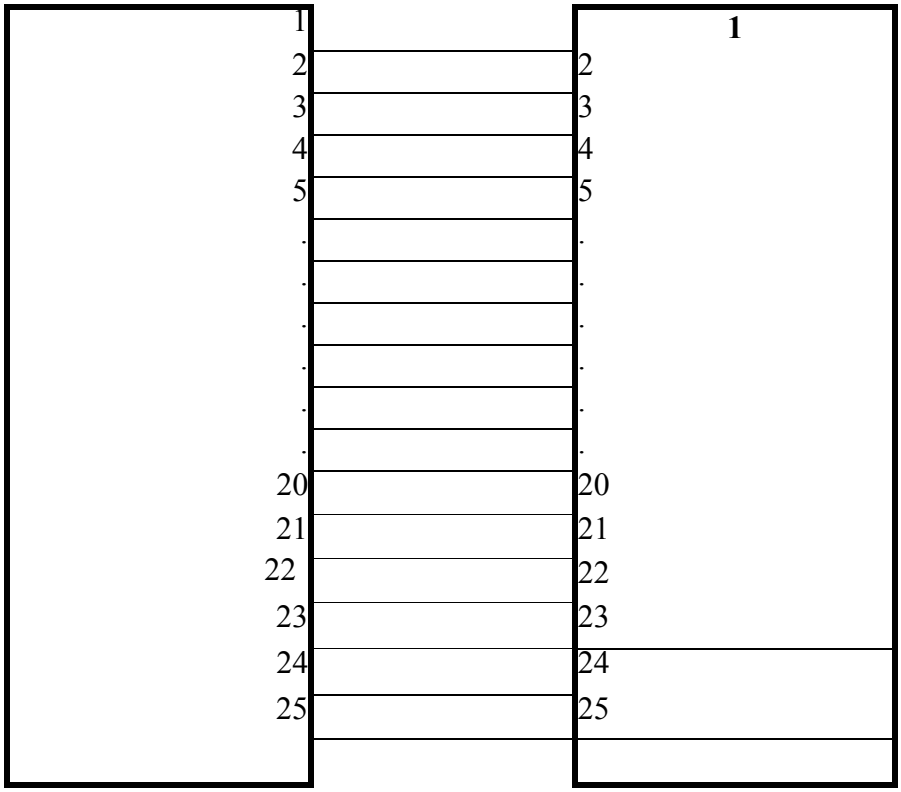
Distribution Panel

A PIN

DB25M
Plug

Distribution Panel

B PIN

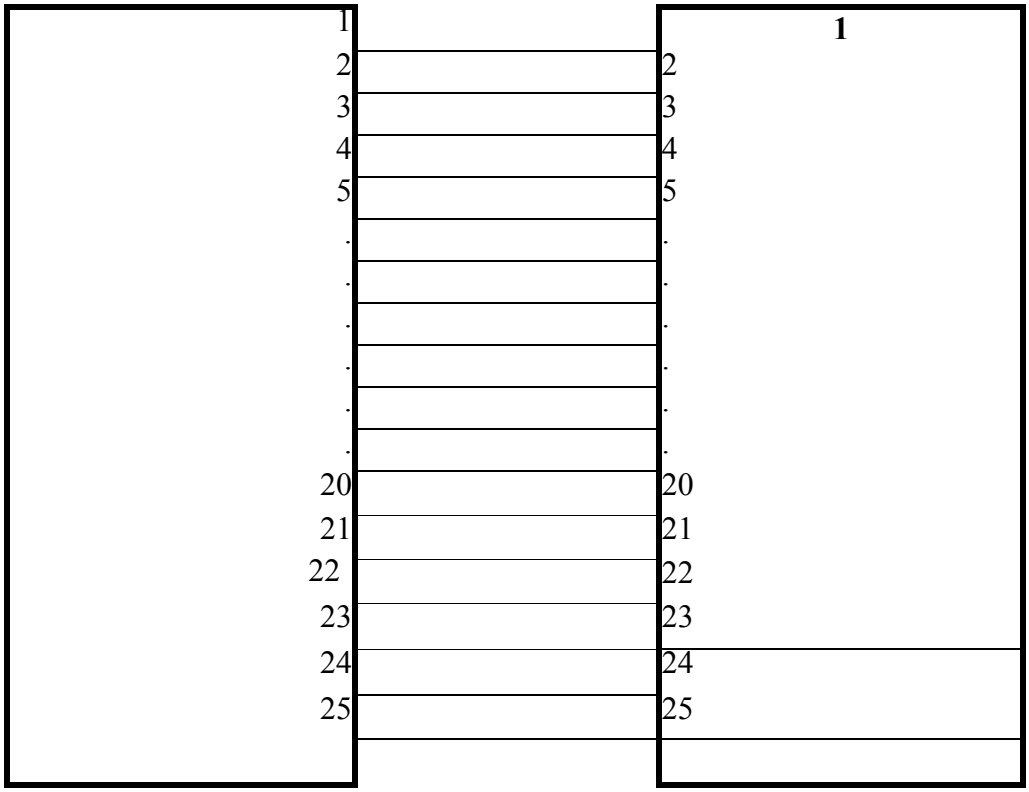


Note: Pin out is 1:1 Straight–thru cable 25 pins

Cable P6 Pin Assignments

8448 Inter-Module Cable; DB-25 Male to Male (straight-through) 10”

DB25M Plug	DB25M Plug
Distribution Panel	Distribution Panel
A PIN	B PIN

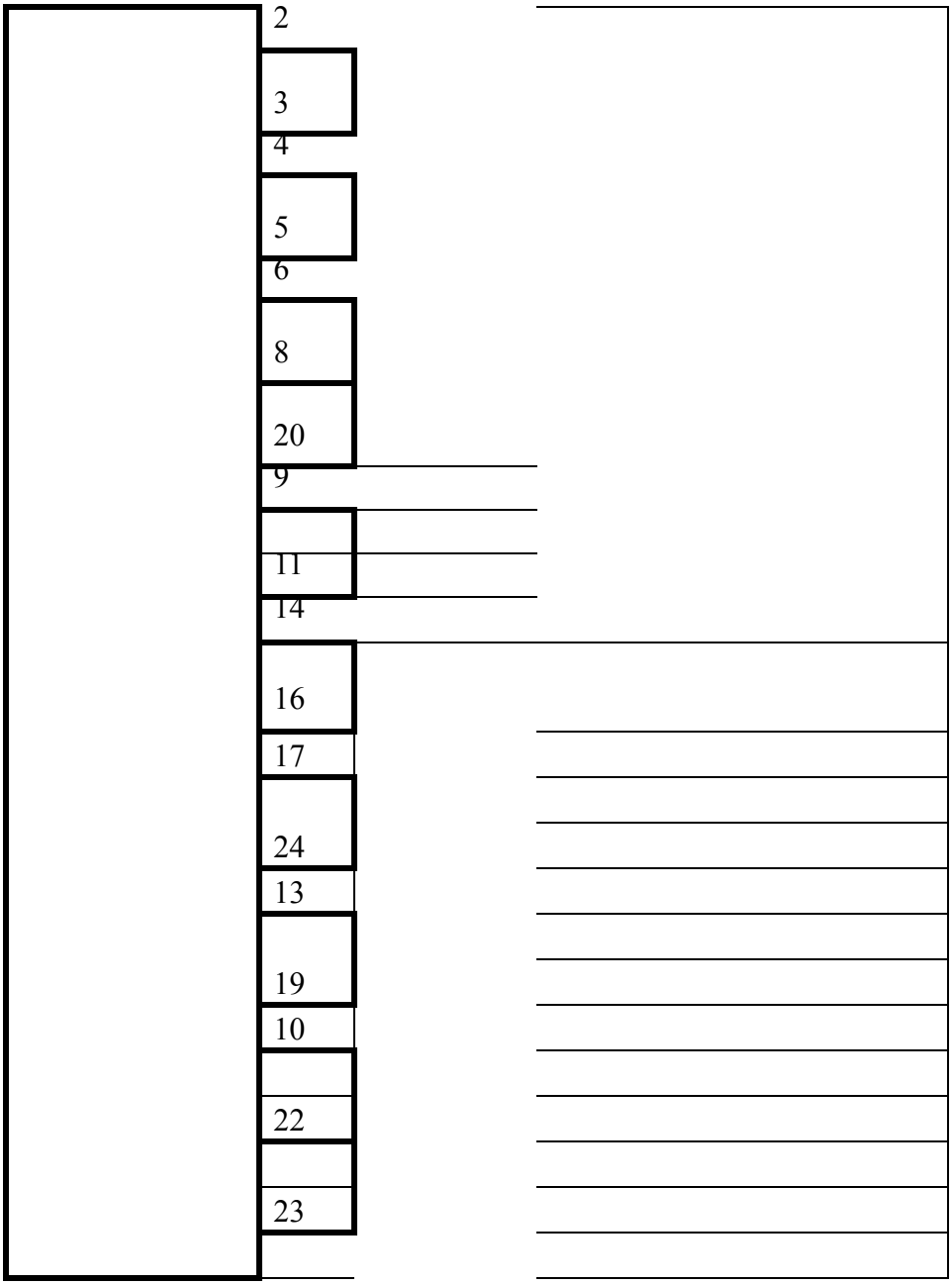


Note: Pinout is 1:1 Straight –thru cable 25 pins

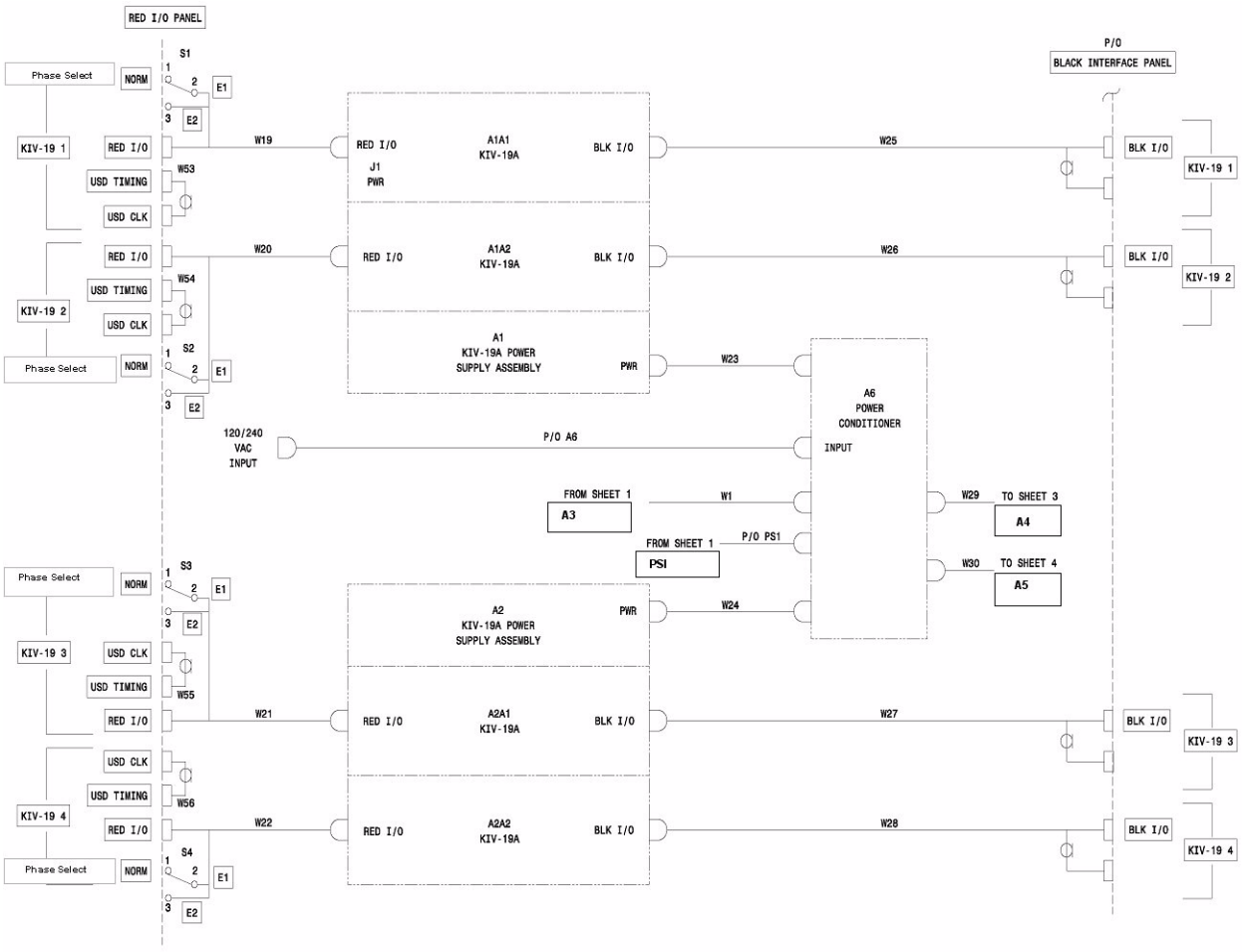
Cable P7 Pin Assignments

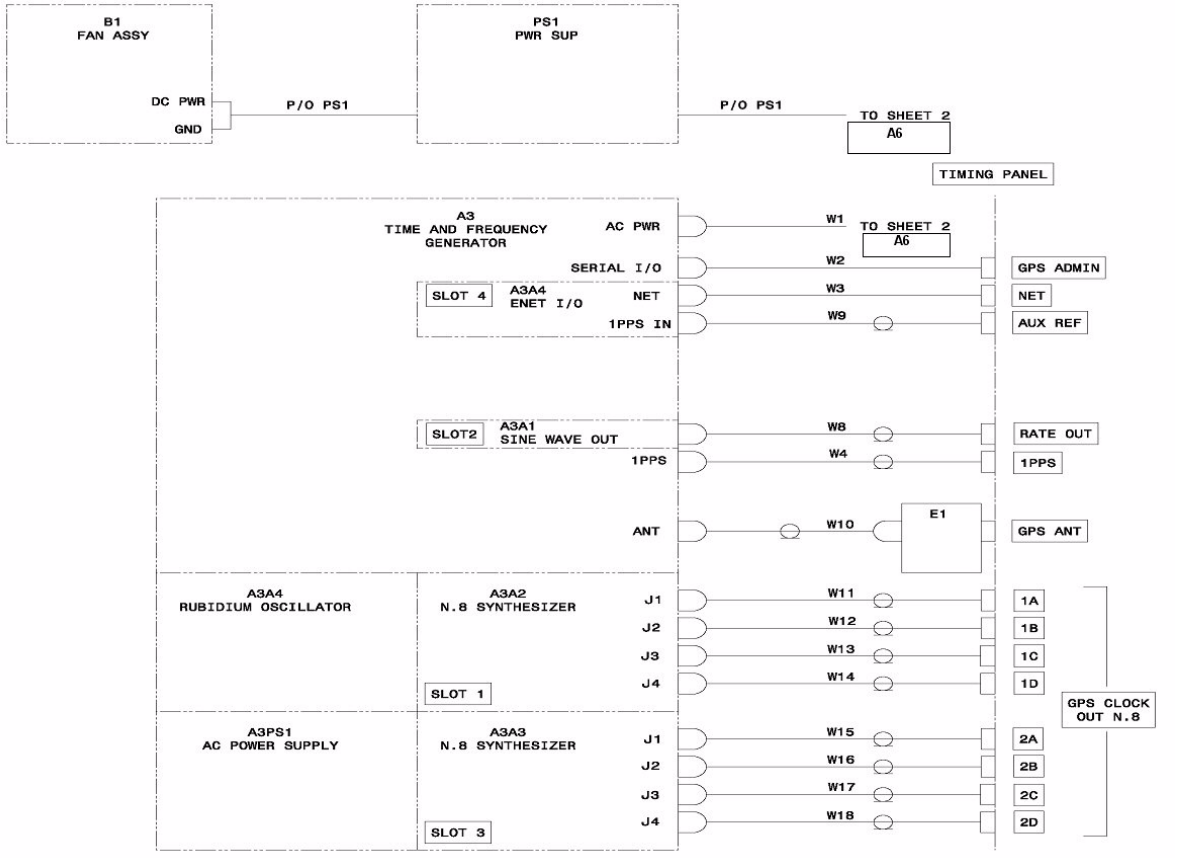
RS530 Loopback Plug

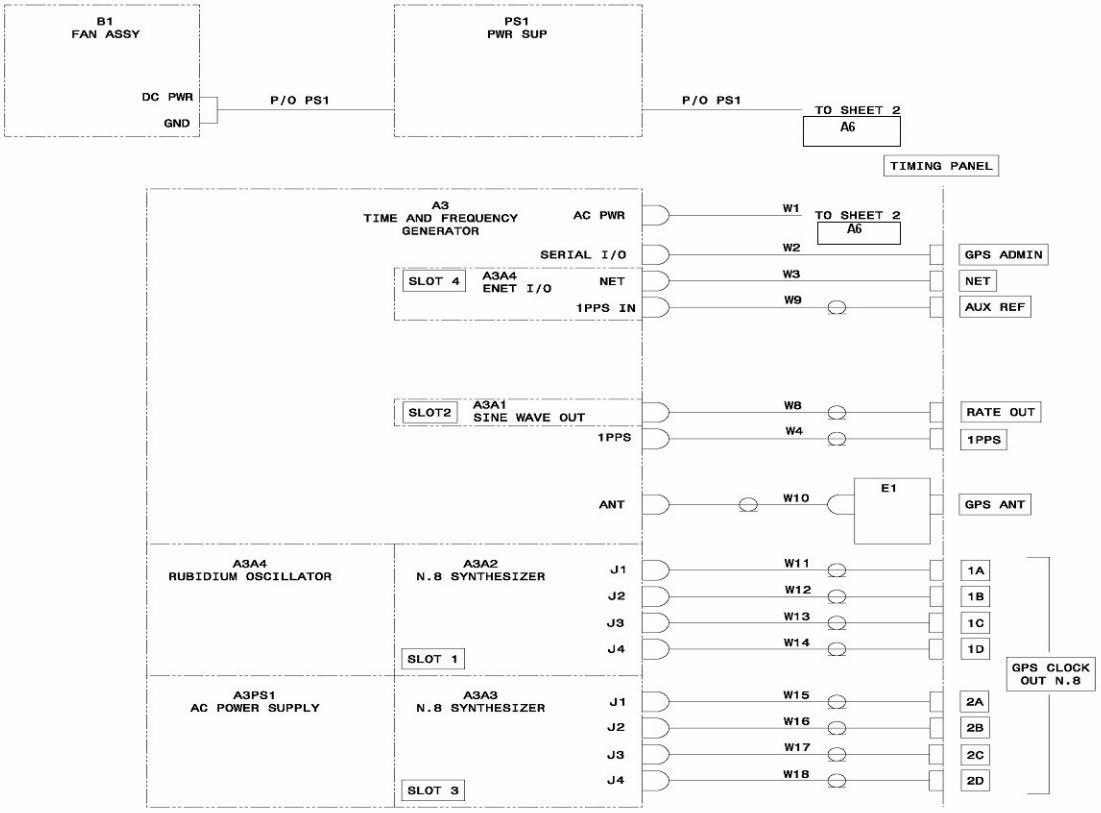
DB25M
Plug

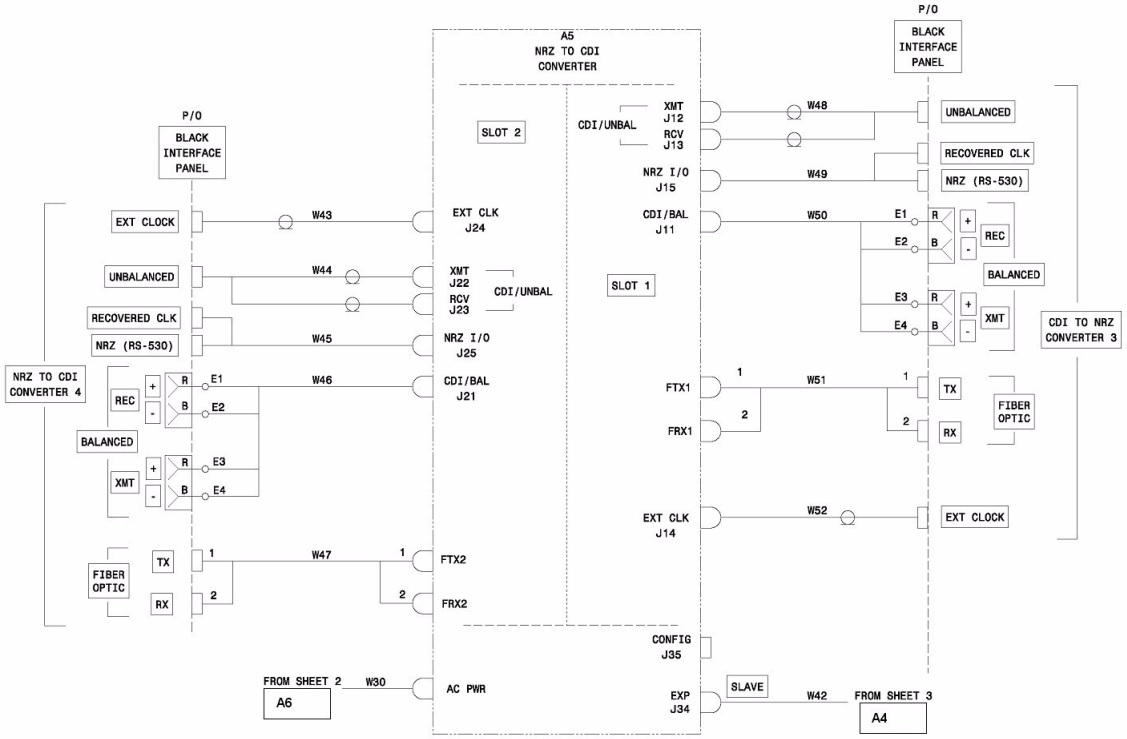


6.4 Interconnect Diagrams




B1
FAN ASSY
DC PWR
GND
P/O PS1
PS1
PWR SUP
P/O PS1
TO SHEET 2
A6
TIMING PANEL
A3
TIME AND FREQUENCY
GENERATOR
AC PWR
W1
TO SHEET 2
A6
SERIAL I/O
W2
GPS ADMIN
SLOT 4
A3A4
ENET I/O
NET
W3
NET
1PPS IN
W9
AUX REF
SLOT2
A3A1
SINE WAVE OUT
W8
RATE OUT
1PPS
W4
1PPS
ANT
W10
E1
GPS ANT
A3A4
RUBIDIUM OSCILLATOR
A3A2
N.8 SYNTHESIZER
J1
W11
1A
J2
W12
1B
J3
W13
1C
J4
W14
1D
SLOT 1
GPS CLOCK
OUT N.8
A3PS1
AC POWER SUPPLY
A3A3
N.8 SYNTHESIZER
J1
W15
2A
J2
W16
2B
J3
W17
2C
J4
W18
2D
SLOT 3


B1
FAN ASSY
DC PWR
GND
P/O PS1
PS1
PWR SUP
P/O PS1
TO SHEET 2
A6
TIMING PANEL
A3
TIME AND FREQUENCY
GENERATOR
AC PWR
SERIAL I/O
SLOT 4
A3A4
ENET I/O
NET
1PPS IN
SLOT2
A3A1
SINE WAVE OUT
1PPS
ANT
W1
TO SHEET 2
A6
W2
W3
W9
W8
W4
W10
E1
GPS ADMIN
NET
AUX REF
RATE OUT
1PPS
GPS ANT
A3A4
RUBIDIUM OSCILLATOR
A3A2
N.8 SYNTHESIZER
J1
J2
J3
J4
SLOT 1
W11
W12
W13
W14
1A
1B
1C
1D
A3PS1
AC POWER SUPPLY
A3A3
N.8 SYNTHESIZER
J1
J2
J3
J4
SLOT 3
W15
W16
W17
W18
2A
2B
2C
2D
GPS CLOCK
OUT N.8


A5
NRZ TO CDI
CONVERTER
P/O
BLACK
INTERFACE
PANEL
SLOT 2
SLOT 1
CDI/UNBAL
XMT
J12
RCV
J13
NRZ I/O
J15
CDI/BAL
J11
EXT CLK
J24
XMT
J22
RCV
J23
NRZ I/O
J25
CDI/BAL
J21
FTX1
FRX1
EXT CLK
J14
FTX2
FRX2
CONFIG
J35
EXP
J34
AC PWR
W48
W49
W50
W51
W52
W43
W44
W45
W46
W47
W30
W42
UNBALANCED
RECOVERED CLK
NRZ (RS-530)
EXT CLOCK
TX
RX
REC
XMT
BALANCED
FIBER
OPTIC
E1
E2
E3
E4
R
B
+
-
SLAVE
FROM SHEET 2
A6
FROM SHEET 3
A4
NRZ TO CDI
CONVERTER 4
CDI TO NRZ
CONVERTER 3