TrueTime

Model 560-5145
Quad Fiber Optic Transmitter Manual

SECTION ONE

1 FUNCTIONAL DESCRIPTION

1.1 PURPOSE OF EQUIPMENT

The Model 560-5145 Fiber Optic Transceiver card is a rear chassis mounted plug-in option card for the Model 56000. This Assembly provides four Fiber Optic output channels which are driven by the passively combined result of the three signal buses REF A, B, and C, all of which have the same frequency signal on them.

1.2 PHYSICAL SPECIFICATIONS

Dimensions:	0.8”w X 4.4”h X 5.0”d (2 cm X 11 cm X 13 cm)
Weight:	Approximately ½ pound (¼ kg)

1.3 ENVIRONMENTAL SPECIFICATIONS

Operating Temp:	0° to +50°C
Storage Temp:	-40° to +85°C
Humidity:	Up to 95% relative, non-condensing
Cooling Mode:	Convection
Altitude:	Sea level to 10,000 ft.

1.4 POWER REQUIREMENTS

Voltage:	18 - 72 VDC
Power:	3.5 W

1.5 FUNCTIONAL SPECIFICATIONS

1.5.1 REF A, B AND C INPUTS

Signal Type:	Squarewave or Sinewave
Amplitude:	2-5 Vpp
Frequency:	1, 5 or 10 MHz (switch-selectable)

1.5.2 FIBER OPTIC OUTPUT

Wavelength:	820nM
Level:	-14 to -21 dBm into 50/125 micron fiber
Level:	-10 to -18 dBm into 62.5/125 micron fiber
Connector:	ST

1.5.3 CARD COMPATIBILITY

Location:	Slots 1-17 (rear)
Compatibility:	See Card Compatibility Matrix

SECTION TWO

2 INSTALLATION AND OPERATION

2.1 HOT-SWAPPING

All cards, input cables and output cables are hot swappable. It is not necessary to remove chassis power during insertion or removal. Hot swapping and reference-source changes are abrupt, the effects difficult to characterize; however, the system is designed to protect against permanent effects and minimize temporary effects of these events.

Typically, adjacent-card hot swapping has a negligible effect on the Fiber Optic Transmitter. The hot swapping event typically lasts less than one clock-period and has an average of 0 Volts. The effect of redundant power supply switch-over is also negligible.

Hot swapping of a Fiber Optic Transceiver affects the system in varying ways depending upon whether it is configured to drive REF A, B, or C and depending upon which reference input is the currently-highest priority. These effects are discussed in individual card manuals.

The 560-5145 card can operate without a Fault Monitor CPU card installed in the system. In this mode, the 560-5145 card offers automatic REF A, B, and C passive combiner operation as previously stated. When the 560-5145 card is used in a system that includes the Fault Monitor CPU card, the REF A, B, and C inputs are also controlled by the CPU. When a REF A source's Fault Status is detected (monitored by the CPU), the REF A input on the 560-5155-1 card is disabled. The REF B and REF C inputs are operated similarly -- they are turned off whenever a Fault Status condition for that reference exists. The CPU's REF A, B, and C control feature ensures that only a viable reference oscillator is used on the 560-5145 card.

2.2 REMOVAL AND INSTALLATION

CAUTION: Individual components on this card are sensitive to static discharge. Use proper static discharge procedures during removal and installation.

Refer to CARD COMPATIBILITY section prior to installing new card.

To remove card, loosen the captive retaining hardware at the top and bottom of the assembly, then firmly pull on the handle (or on any connector on rear panel adapter cards) at the bottom of the card. Slide the card free of the frame. Refer to the SETUP section for any required switch settings; or, set them identically to the card being replaced. Reinstall the card in the frame by fitting it into the card guides at the top and bottom of the frame and sliding it in slowly, avoiding contact between bottom side of card and adjacent card front panel, until it mates with the connector. Seat card firmly to avoid contact bounce. Secure the retaining screws at the top and bottom of the card assembly.

2.3 SETUP

The setup of the 560-5145 Fiber Optic Transmitter involves selection of the Passive Combiner DIP switches SW1 thru SW5. These switches are set to match the system-wide reference frequency on REF A, B, and C: 1, 5, or 10 MHz.

2.3.1 INPUT FREQUENCY SELECT (SW1 thru SW5)

Set SW1 through SW5 to select the appropriate frequency:

REF A, B, C FREQUENCY	10 MHz	5 MHz	1 MHz
SW1-1 thru SW5-1	ON	OFF	OFF
SW1-2 thru SW5-2	OFF	ON	OFF
SW1-3 thru SW5-3	OFF	OFF	ON
SW1-4 thru SW5-4	OFF	OFF	OFF

2.4 FAULT INDICATIONS

The card has no externally visible fault indication LEDs.

2.4.1 INIT. FAULT INDICATOR

This is an on-card fault indicator which is not externally visible; although it can be seen by installing the card next to an empty slot. It indicates a failure of the card to initialize properly during power-up. Occasionally, this fault is caused by a temporary condition related to the cycling of power and can be cleared by a power or hot swap cycle. If this is unsuccessful, the card is defective.

2.4.2 DETAILED FAULT STATUS VIA CPU

The Fault Monitor CPU has access to detailed 1, 5, 10 MHz Frequency Synthesizer card status. This status is available via the Fault Monitor CPU serial port. Individual bit definitions are as follows:

FAULT STATUS 0	BIT	STATUS (1=ACTIVE)
Low	0	Output Fault A*
Nibble	1	Output Fault B*
Low	2	Output Fault C*
Byte	3	Output Fault D*
High	4	Not Defined
Nibble	5	Not Defined
High	6	Not Defined
Byte	7	Not Defined
FAULT STATUS 1	**BIT**	**STATUS (1=ACTIVE)**
Low	0	Power Cycled
Nibble	1	Not Defined
High	2	Not Defined
Byte	3	Not Defined
High	4	Not Defined
Nibble	5	Not Defined
High	6	Not Defined
Byte	7	Not Defined

STATUS REG 0	BIT	STATUS (1=ACTIVE)
Low	0	Not Defined
Nibble	1	Not Defined
Low	2	Not Defined
Byte	3	Not Defined
High	4	Not Defined
Nibble	5	Not Defined
High	6	Not Defined
Byte	7	Not Defined
STATUS REG 1	**BIT**	
Low	0	Not Defined
Nibble	1	Not Defined
High	2	Not Defined
Byte	3	Not Defined
High	4	Not Defined
Nibble	5	Not Defined
High	6	Not Defined
Byte	7	Not Defined

* Latched Fault Bit -- Reset Via Fault Monitor CPU.

CARD ID: 0x3050

SECTION THREE

3 THEORY OF OPERATION

3.1 GENERAL INFORMATION

This section contains a detailed description of the circuits in the Fiber Optic Transmitter card. These descriptions should be used in conjunction with the drawings in SECTION FOUR.

3.2 CIRCUIT BOARD DESCRIPTION

The 560-5145 Assembly provides four Fiber Optic output channels which are driven by the passively combined result of the three signal buses REF A, B, and C, all of which have the same frequency signal on them.

3.3 DETAILED DESCRIPTION (Reference Drawing 560-5145)

3.3.1 PASSIVE COMBINER

The passive combiner is a circuit that strives to always output the desired signal, derived from the three separate inputs REF A, B, and C (named FREQA, B, and C on the schematic), without introducing any switching transient or glitch when one or two of the inputs are lost. It is composed of three input filter sections, three high speed comparators, a weighting network and a passive combining network. The filters and the combining network employ tuned circuits and therefore have to have their values adjusted depending on the required input frequency of either 1, 5, or 10 MHz. This is accomplished by the use of SW1 through SW5, which are 4PST DIP switches.

The input filters and the comparators serve to produce a very clean squarewave with very good symmetry. These squarewaves are then buffered and applied to a weighting network where they are summed with different weights in order to give the primary source the greatest influence on the final result. This summing results from an interaction between the weighting network and the combining network which is composed of a parallel resonant tank and a series resonant tank. These tanks are tuned slightly off center to lower the Q so that amplitude variations are minimized when input signals are changed. The final output voltage is then buffered and squared to produce the final signal called FREQIN.

3.3.2 OUTPUTS

FREQIN is applied through isolation resistors to the inputs of four analog buffers. The outputs of the analog buffers are applied to the fiber optic transmitters via current limiting networks. These networks limit standby current but allow for a much greater operating current when signals are applied to the transmitters.

3.3.3 POWER SUPPLY

The DC-to-DC Converter converts 48 VDC backplane power to local ±5 VDC power. It is fully-isolated from the backplane power and referenced to signal GND on the Synthesizer card. Backplane power is supplied via a Polyswitch fuse device, diode and Pi-section L-C filter. The poly-fuse protects the backplane power bus from internal DC-to-DC shorts. The diode and L-C filter serve a triple purpose. During live-insertion, the high-current inductor minimizes in-rush current to the DC-to-DC being inserted; and, the diode and capacitor serve to hold up the local voltage at the input to each currently-installed DC-to-DC. During steady-state conditions, the L-C filter minimizes switching noise coupled back into the backplane power bus. During live-extraction, the 0.1 uF capacitor absorbs the inductive-kick of the opened circuit, minimizing contact-arcing.

The -5 VDC side of the supply is artificially loaded, providing a minimum load to improve output voltage regulation. The power-up reset generator, assures that RESET is active while the +5 VDC supply is between 1 and 4.5 VDC. This guarantees proper configuration of the Xilinx FPGA during hot swapping and power-up.

The analog buffer have additional power supply filtering with the use of RF chokes. These chokes isolate the four transmitting sections from themselves and other sections of the card.

SECTION FOUR

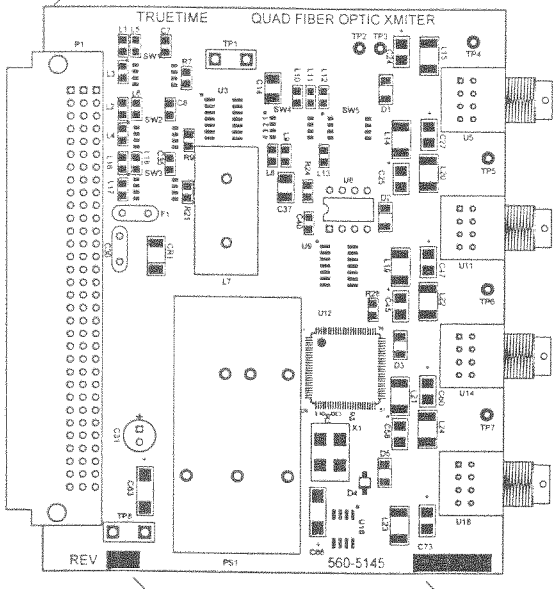
4 DETAILED DRAWINGS

4.1 560-5145 DETAILED DRAWINGS / BILL OF MATERIALS

NOTES: UNLESS OTHERWISE SPECIFIED

1. RESISTORS ARE IN OHMS AND CAPACITORS ARE IN MICRO FARADS.
2. STAMP ASSEMBLY AND REVISION LEVEL.
3. ASSEMBLE PER ASSEMBLY REQUIREMENTS DOCUMENT 421-11.

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
B	REDESIGN	7-31-97	
C	DESIGN UPDATE	9-5-97	
D	DESIGN UPDATE	01-14-98	
E	ECO 1138	02-24-98	
F	ECO1146	05-05-98	



TOP SIDE

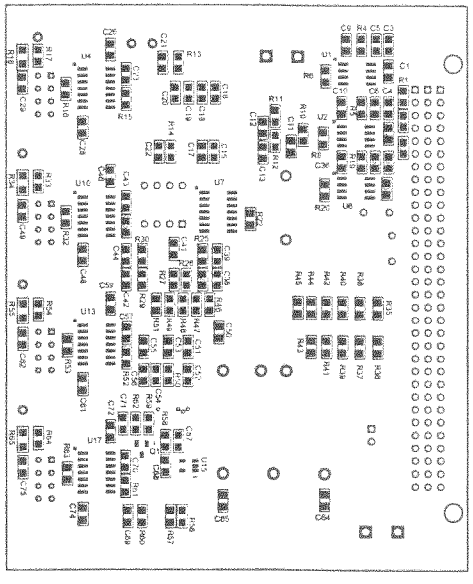
CONTRACT NO		
APPROVALS		DATE
DRAWN BY	S.B.K	9-5-97
CHECKED		
APPROVED		
NEXT ASSY		

TrueTime, Inc.
Santa Rosa, California

Title: ASSY DRAWING QUAD FIBER OPTIC TX

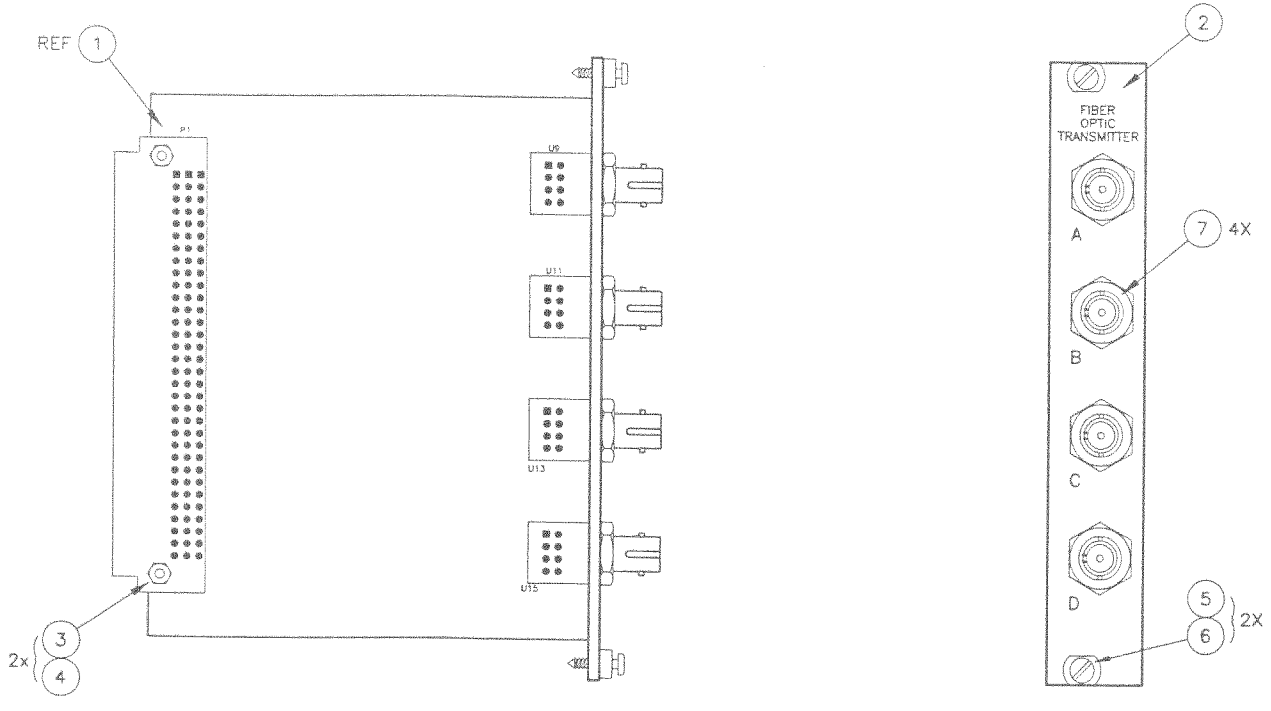
Size	Number	Rev
B	560-5145	F

Date	05-05-98	S.B.K
File Name	2145F.PCB	Sheet 1 of 8



BOTTOM SIDE

TrueTime, Inc.		
Santa Rosa, California		
Title: BOTTOM ASSY DRAWING QUAD FIBER OPTIC TX		
Size: B	Number: 560-5145	Rev: F
Date: 05-05-98		S.B.K.
Filename: 2145F.PCB		Sheet 2 of 8



TrueTime®
"Where Customer Satisfaction is our Highest Priority"
2835 Duke Ct. Santa Rosa, CA 95407

NEXT ASSY	SIZE	CODE IDENT NO.	DRAWING NO.	REV
	B		560-5145	F

FILENAME: \560\5145
DATE: 05-11-98

SCALE NONE

SHEET 3 OF 8

MAX * BILL OF MATERIALS * SINGLE-LEVEL EXPLOSION BY PART IDENTIFIER W/REFERENCE

PART IDENTIFIER	DESCRIPTION 1	DESCRIPTION 2	EFF DATE	ECN #	QTY/ASSY	UOM	REV LVL	REFERENCE DESCRIPTION
560-5145	ASSY QUAD FIBER OPTIC TX	MADE FROM 560-2145				EA		
0000-APPROVAL	PARTS LIST APPROVAL		0000		1.0000	EA		RE/GZ 5/98
0000-PL	PARTS LIST REV LEVEL		0000		1.0000	EA		REV F (05-05-98)
0000-PRINT	REFERENCE PRINT		0000		1.0000	EA		560-5145 REV F
0000-REV	PCB REV LEVEL HERE >>>>		0000		1.0000	EA		560-2145 REV E
002S-40.2R	RES 40.2 OHM 1206	NIC NRC25R40R2TR	0000		4.0000	EA		R18,34,55,65
008S-100	RES 10 OHM 5% 0805	NIC NRC12R100TR	0000		4.0000	EA		R16,32,53,63
008S-1002	RES 10K OHM 1/8W 1% 0805	NIC NRC12R1002FTR	0000		4.0000	EA		R6,8,20,62
008S-101	RES 100 OHM 1/8W 0805 5%	NIC NRC12R101TR	0000		1.0000	EA		R28
008S-102	RES 1K OHM 1/8W 1% 0805	NIC NRC12R102FTR	0000		10.0000	EA		
	R1-3,12,15,27,31,52,57,61							
008S-1022	RES 10.2K OHM 1/8W 1%	NIC NRC12R1022FTR (0805)	0000		3.0000	EA		R7,9,21
008S-104	RES 100K OHM 1/8W 1% 0805	NIC NRC12R104FTR	0000		1.0000	EA		R24
008S-105	RES 1 MEG 1/8W 0805 5%	NIC NRC12R105TR	0000		5.0000	EA		R23,25,29,30,58
008S-1823	RES 182K OHM 1% 0805	NIC NRC12R1823FTR	0000		3.0000	EA		R4,5,19
008S-202	RES 2K OHM 1/8W 0805	NIC NRC12R202TR	0000		2.0000	EA		R11,14
008S-222	RES 2.2K OHM 1/8W 0805 5%	NIC NRC12R222TR	0000		11.0000	EA		R35-45
008S-241	RES 240 OHM 1/8W 0805	NIC NRC12R241TR	0000		4.0000	EA		R17,33,54,64
008S-3741	RES 3.74K 1/8W 1% 0805	NIC NRC12R3741FTR	0000		1.0000	EA		R26
008S-471	RES 470 OHM 1/8W 0805 5%	NIC NRC12R471TR	0000		1.0000	EA		R10
008S-472	RES 4.7K OHM 1/8W 0805 5%	NIC NRC12R472TR	0000		9.0000	EA		R13,22,46-49,51,59,60
008S-473	RES 47K OHM 1/8W 0805	NIC NRC12R473TR	0000		1.0000	EA		R50
023-010-100	CAP AE 10UF 100V R	PANASONIC ECE-A2AU100	0000		1.0000	EA		C31
036-095	CAP MONO 0.1UF 100V R 20%	MURATA RPE122Z5U104M50V	0000		1.0000	EA		C30
036S-NP0101	CAP 100PF NPO 100V 0805	NIC NMC0805NP0101J100TR	0000		4.0000	EA		C38,39,42,44
036S-NP0102	CAP .001UF NPO 100V 0805	NIC NMC0805NP0102J100TR	0000		2.0000	EA		C17,19
036S-NP0151	CAP 150PF NPO 100V 0805	NIC NMC0805NP0151J100TR	0000		3.0000	EA		C3,4,33
036S-NP0200	CAP 20PF NPO 100V 0805 5%	NIC NMC0805NP0200J100TR	0000		2.0000	EA		C67,68
036S-NP0222	CAP 2200PF NPO 0805 100V	NIC NMC0805NP0222J100TR	0000		2.0000	EA		C64,65
036S-NP0331	CAP 330PF NPO 100V 0805	NIC NMC0805NP0331J100TR	0000		2.0000	EA		C15,20
036S-NP0680	CAP 68PF NPO 100V 0805	NIC NMC0805NP0680J100TR	0000		3.0000	EA		C5,6,34
036S-NP0681	CAP 680PF NPO 100V 0805	NIC NMC0805NP0681J100TR	0000		2.0000	EA		C16,18
036S-NP0682	CAP, CHIP, 6800PF 1210	NIC NMC1210NP0682J100TR	0000		2.0000	EA		C14,37
036S-NP0751	CAP 750PF NPO 100V 0805	NIC NMC0805NP0751J100TR	0000		3.0000	EA		C1,2,32
036S-X7R103	CAP .01UF X7R 50V 0805	NIC NMC0805X7R103K50TR	0000		7.0000	EA		C11-13,23,43,57,70
036S-Y5V104	CAP CER .1UF Y5V 50V 0805	NIC NMC0805Y5V104Z50TR	0000		31.0000	EA		
	C7-10,21,22,26,28,29,35,36,40,41,46,48-56,59,61,62,69,71,72,74,75							
037S-225	CAP 2.2UF 16V 3528	NIC NTC-T225K16TRB	0000		8.0000	EA		C24,25,27,45,47,58,60,73
037S-686	CAP 68UF 6.3V 7343	NIC NTC-T686K63TRD	0000		2.0000	EA		C63,66
045-33	INDUCTOR 33UH 5.5A	DALE IHM-2 33UH +/-10%	0000		1.0000	EA		L7
045S-.33UH	INDUCTOR, .33UH 0805	TDK MLF0805-R33KT	0000		2.0000	EA		L10,11
045S-.68UH	INDUCTOR, .68UH, 0805	TDK MLF0805-R68KT	0000		2.0000	EA		L12,13
045S-27UH	INDUCTOR, HICURRENT, 27UH	TDK NLC1812-270K-T	0000		8.0000	EA		L14,15,19-24
045S-3.3	INDUCTOR 3.3UH 0805	TDK MLF0805-3R3KT	0000		5.0000	EA		L5,6,8,9,18

MAX * BILL OF MATERIALS * SINGLE-LEVEL EXPLOSION BY PART IDENTIFIER W/REFERENCE

PART IDENTIFIER	DESCRIPTION 1	DESCRIPTION 2	EFF DATE	ECN #	QTY/ASSY	UOM	REV LVL	REFERENCE DESCRIPTION
045S-33	INDUCTOR 33UH 0805	TDK MLF0805-330KT	0000		3.0000	EA		L3,4,17
045S-6.8UH	INDUCTOR 6.8UH 0805	TDK MLF0805-6R8KT	0000		3.0000	EA		L1,2,16
048-1414T	FIBER OPT XMTR ST STYLE	HP HFBR-1414T	0000		4.0000	EA		U5,11,14,18
048-4411	FIBER OPT NUT	HP HFBR-4411	0000		4.0000	EA		Q7
057S-4002	DIODE 4002	ROHM RLR4002	0000		1.0000	EA		CR1
057S-4148	DIODE 1N4148	ROHM RLS4148TR	0000		4.0000	EA		D1-3,5
058S-001	LED RED X SML W RES SFMT	HP HLMP6600-012	0000		1.0000	EA		D4
059S-20000	XTAL 20.000 MHZ	MPC SM-65N1B2E-20.000MHZ	0000		1.0000	EA		X1
065S-004	SWITCH DIP HALF PITCH	AUGAT GDH04S (GULLWING)	0000		5.0000	EA		SW1-5
174S-XC5204V	XILINX XC5204V FPGA	XILINX XC5204-6VQ100C	0000		1.0000	EA		U12
175S-2N2907A	TRANSISTOR 2N2907A SOT-23	MOTOROLA MMBT2907AL	0000		1.0000	EA		Q1
176S-LM339	QUAD COMPARATOR LM339	NATL LM339M	0000		1.0000	EA		U9
176S-LM6321M	HIGH SPEED BUFFER	NATL LM6321M (SOIC)	0000		4.0000	EA		U4,10,13,17
176S-LT1016	LT1016 (8SO)	LINEAR TECH LT1016CS8	0000		3.0000	EA		U1,2,6
176S-MC34064	UNDER VOLTAGE SENSING CKT	MOTOROLA MC34064D-5	0000		1.0000	EA		U16
178-17C128	FPGA CONFIG EEPROM	ATMEL AT17C128-10PC	0000		1.0000	EA		U8
178S-74HC04	74HC04 (14SO)	RCA CD74HC04M	0000		1.0000	EA		U3
178S-74HCU04	74HCU04 (14SO)	RCA CD74HCU04M	0000		1.0000	EA		U7
178S-NC7SU04	SINGLE INVERTER NC7SU04	NATL NC7SU04 (SOT23-5)	0000		1.0000	EA		U15
184-053	XILINX	FOR 560-5145 QUAD FIBER	0000		1.0000	EA		FOR U8
223-138	SCREW SH CH ZN M2.5X10	SCHROFF #21100-138	0000		2.0000	EA		03
223-144	NUT M2.5	SCHROFF #21100-144	0000		2.0000	EA		04
223-379	SCREW CAP NP M2.5 X 11	SCHROFF #21100-379	0000		2.0000	EA		05
223-464	SLEEVE, STAINLESS	SCHROFF 21100-660	0000		2.0000	EA		06
273-009	TERMINAL TEST POINT	COMP CORP PJ-201-25	0000		2.0000	EA		TP1,8
273-015	TERM TEST POINT (WHITE)	COMP. CORP TP-104-01-09	0000		6.0000	EA		TP2-7
355-8WR-5	DC-DC 18-72VIN +5/-5 OUT	DATEL 8WR-5/700-D48	0000		1.0000	EA		PS1
363-0.9LV	POLYSWITCH 0.9A (60 VOLT)	RAYCHEM RXE090	0000		1.0000	EA		F1
372-96RA	CONN,96-P FM DIN RT ANGLE	BERG 68353-296	0000		1.0000	EA		P1
379-008	SOCKET IC 8 PIN MACHINE	NUGENT ICA-083-STG	0000		1.0000	EA		FOR U8
560-1212-1	PNL,REAR FIBR OPT TXMITTR	FAB/SCREEN	0000		1.0000	EA		02
560-2145	PCB QUAD FIBER TX	FAB	0000		1.0000	EA		01
LA	LABOR ASSEMBLY COST HRS		0000		0	EA		
LT	LABOR TEST COST HOURS		0000		0	EA		
NOTE 1			0000		1.0000	EA		R56 NOT INSTALLED
OSV560-5145	OUTSIDE LABOR 560-5145	PCA	0000		1.0000	EA		