TRUETIME

Model 560-5148
HEX Fiber Optic Transmitter Manual

SECTION ONE

1. FUNCTIONAL DESCRIPTION

1.1. PURPOSE OF EQUIPMENT

The Model 560-5148 Fiber Optic Transceiver card is a rear chassis mounted plug-in option card for the Model 56000. This Assembly provides six Fiber Optic output channels which are driven directly through the backplane by the six independent DRVOUT A thru F input signals from the associated front card.

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:	95% relative, non-condensing
Cooling Mode:	Convection

1.4. POWER REQUIREMENTS

Voltage:	18 - 72 VDC
Power:	3.5 W

1.5. FUNCTIONAL SPECIFICATIONS

1.5.1. DRVOUT A THRU F INPUTS

Signal Type:	Squarewave
Amplitude:	2-5 Vpp
Frequency:	45 Hz to 45 MHz

1.5.2. FIBER OPTIC OUTPUT

Wavelength:	820 nM
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 effect of redundant power supply switch-over is also negligible.

Hot swapping of this Fiber Optic Transceiver affects the system only as a power supply transient. The effect on other cards are discussed in individual card manuals.

The 560-5148 card can operate without a Fault Monitor CPU card installed in the system. When the 560-5148 card is used in a system that includes the Fault Monitor CPU card, the FLTOUT A thru F source's Fault Status is detected (monitored by the CPU).

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 560-5148 Fiber Optic Transmitter does not require setup.

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 560-5148 card DRVOUT A thru F carrier status.

The Verbose report displays the Fault status. In this context, a reported fault indicates a problem. The Machine report, when used, reports the current status (settings) of the switches and faults in hexadecimal characters. Together, they pinpoint problems and help the technician view the switch settings on the cards without removing them. This status is available via the Fault Monitor CPU serial port. Individual bit definitions are as follows.

2.4.3 VERBOSE REPORTS

The following is an example of a Fault Monitor CPU report in Verbose mode:

TrueTime 56000 Site 01
Automatic Reports **Enabled**
Periodic Reports **Disabled**
Primary Inputs Selected REFA No REFB No REFC Off PRI OK SEC OK TER Off

1. Undefined	OK	Undefined	OK
2. Undefined	OK	Undefined	OK
3. 5148	**LOCAL OSC FAULT 0007**	**Undefined**	**OK**
4. Undefined	OK	Undefined	OK

The above sample tells you that:
Automatic reports are enabled and Periodic reports are disabled.
Primary inputs REF A and REF B are not bussing AUX REF. REF C is off. Primary and Secondary status inputs OK, Tertiary is OFF.

Numbers 1-4 are slots (not all slots are shown in the example). Slots 1,2,and 4 are undefined (empty) and functional (OK).

Slot 3 is read as follows:
5148 is the abbreviation of the 560-5148 card. The fault reading is 0007.

2.4.4 MACHINE REPORTS

The Fault Monitor CPU has another serial output mode called machine report mode. This mode is usually used with a computer program to interrogate the 56000 system status.
The machine report mode displays hexadecimal (HEX) characters like the verbose mode report.

The following is an example of a Fault Monitor CPU report in Machine Mode:

TrueTime 56000 Site 01
AR1
PR10
P A1 B1 Co P1 S1 To
01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
02 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
03 4048 00 07 0000 00 00 00 00 00 00 00 00 00 00 00 00 00 00
04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
(card slots 05 through 14 HEX not shown)

Example from card slot 3 above:

03 | 4048 | 00 07 | 00 00 | 00 00 00 00 00 00 00 00 00 00 00 00 00 00

Fault Byte 1 (F1)
Fault Byte 0 (F0)
SW1 Switch Status (S1)
SW2 Switch Status (S0)

Slot 3 shows that the Fault status is 0007 (F1, F0). The Status report read-out is 0000(S1,S0).

2.4.5 REPORT CONVERSIONS

This section deals with how to read and convert the Fault and Status read-outs using various tables and binary conversions. To decipher a Fault Status report, use Fig. A.

Fig. A

Undefined	Undefined	Undefined	Undefined	Undefined	Undefined	Undefined	Power Cycled	Undefined	Undefined	Output Fault F*	Output Fault E*	Output Fault D*	Output Fault C*	Output Fault B*	Output Fault A*
8	**4**	**2**	**1**	**8**	**4**	**2**	**1**	**8**	**4**	**2**	**1**	**8**	**4**	**2**	**1**
2^3	2^2	2^1	2^0	2^3	2^2	2^1	2^0	2^3	2^2	2^1	2^0	2^3	2^2	2^1	2^0
0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*1*	*1*

Upper Byte High Nibble	Upper Byte Low Nibble	Lower Byte High Nibble	Lower Byte Low Nibble
0	**0**	**0**	**7**

Fault Status F1 Report

Fault Status F0 Report

Key:

Above each 8,4,2,1 is the corresponding fault for that bit. For instance, above the 8 bit in the Upper byte/Low nibble reads Primary Source, which is the fault .

Shaded area
Informational only. The upper row: Bit value hex weights (8,4,2,1) The Lower row corresponds to the hex weight above. For instance, a readout of 7 equals 111 in binary and 4+2+1 hex weight. Each section of 8,4,2,1 is a nibble of either an Upper or Lower byte and separated for easy recognition. Each nibble = 4 bits and each byte = 8 bits. "00" is the F1 report, "07" the F0 report.

Non-shaded area
This area is used according with the report read-out after a report is converted to binary. The 0407 is an example from a report.
Always read the report from Upper (High) byte to Lower (Low) Byte.

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

BINARY CONVERSION TABLE

Decimal	Displayed in report as	Binary
0	0	0
1	1	1
2	2	10
3	3	11
4	4	100
5	5	101
6	6	110
7	7	111
8	8	1000
9	9	1001
10	A	1010
11	B	1011
12	C	1100
13	D	1101
14	E	1110
15	F	1111

Binary:
1 = Fault/Switch On
0 = No Fault/Switch Off

Use the Binary Conversion table to convert a read-out from the monitor to binary.
For instance, if the report read-out was 3C15, this would be:

11\1100\1\101 in binary.

USING THE FAULT STATUS REPORT (F0,F1)

The hex weight (fault importance) has been assigned 8, 4, 2, 1. Beneath each number is the corresponding fault. Use Fig. A. The report example read 0007. The 0 is high byte/high nibble, the 0, high byte/low nibble, the 0, low byte/high nibble and 7, low byte/low nibble. Each nibble falls under a section on Fig. A, high to low or left to right.

Look at Fig. A. Below this is a sample read-out. This read-out would appear on the monitor when a Verbose report is requested. In the example, there are no faults in the upper byte/high nibble or in the lower byte/high nibble because both are zero (0). In the upper byte/low nibble, a 0 is reported. Looking directly above this, a 0 bit is easily spotted. The fault is Undefined. However, In the lower byte/low nibble a 7 is reported. There is no 7 listed, only a 1, 2, 4, 8. Use the Binary Conversion table to determine the faults.

Seven (7) is converted to 111 in Binary. In Binary, a 1 = fault and 0 = no fault. Read 111 from right (low bit) to left (high bit) using the lower byte/low nibble group. The first three (from low bit to high bit) are 1's, indicating there is a fault with the Output Faults A,B and C.

Note that the hex weight assigned totals to 7 (4+2+1). If the 7 had been a 6, in binary this is 110. Reading from low bit to high bit, the 1's (i.e., faults) fall under hex weight 4 and 2, which equals a hex weight of 6.

Of course, glancing at the lower byte/low nibble, you can quickly see (without converting to binary) that under 4 and 2 (i.e., 6) are the Output B and Output C that are in fault.

Each of the four nibbles is grouped by category for easy visual identification of an offending fault. Each nibble has 15 possible fault combinations. All faults are asserted as a logic 1.

QUICK REFERENCE SHEET FOR READING FAULT AND STATUS REPORTS

1. Run a report. This is a portion of a sample Machine report.

TrueTime 56000 Site 01
AR1
PR10
P A1 B1 Co P1 S1 To
01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
02 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
03 4048 00 07 0000 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
(card slots 05 through 14 HEX not shown)

0007 is the Fault Status read-out
0000 is the Status read-out report

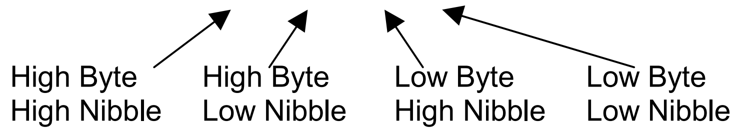
00 = Fault Status 1 (F1) report
07 = Fault Status 0 (F0) report
00 = Status 1 (S1) report
00 = Status 0 (S0) report

03 4048 00 07 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

Fault Byte 1 (F1)
Fault Byte 0 (F0)
SW1 Switch Status (S1)
SW2 Switch Status (S0)

What's in a number?

0 4 0 7



2. When required, convert Decimal to Binary using the Binary Conversion Table.

BINARY CONVERSION TABLE

Decimal	Displayed in report as	Binary
0	0	0
1	1	1
2	2	10
3	3	11
4	4	100
5	5	101
6	6	110
7	7	111
8	8	1000
9	9	1001
10	A	1010
11	B	1011
12	C	1100
13	D	1101
14	E	1110
15	F	1111

Binary:
1 = Fault/On/Active
0 = No Fault/Off/Not Active

SECTION THREE

3. THEORY OF OPERATION

3.1. GENERAL INFORMATION

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

3.2. CIRCUIT BOARD DESCRIPTION

The 560-5148 Assembly provides six independent Fiber Optic output channels which are driven by the DRVOUT A thru F input signals from the backplane.

3.3. DETAILED DESCRIPTION (Reference Drawing 560-5148)

3.3.1. INPUTS

The 2 to 5 Volt digital DRVOUT A thru F input signals are applied directly to the six analog buffers without any on-board conditioning other than 10 Ohm isolation resistors.

3.3.2. OUTPUTS

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. FAULT MONITORING CIRCUIT

The output of each analog buffer is capacitively coupled to an R-C integrator which provides a DC level to a comparator when the carrier is present. A fault indication is given when the carrier is absent.

3.3.4. 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 six transmitting sections from themselves and other sections of the card.

SECTION FOUR

4. DETAILED DRAWINGS

4.1. 560-5148 DETAILED DRAWINGS / BILL OF MATERIALS

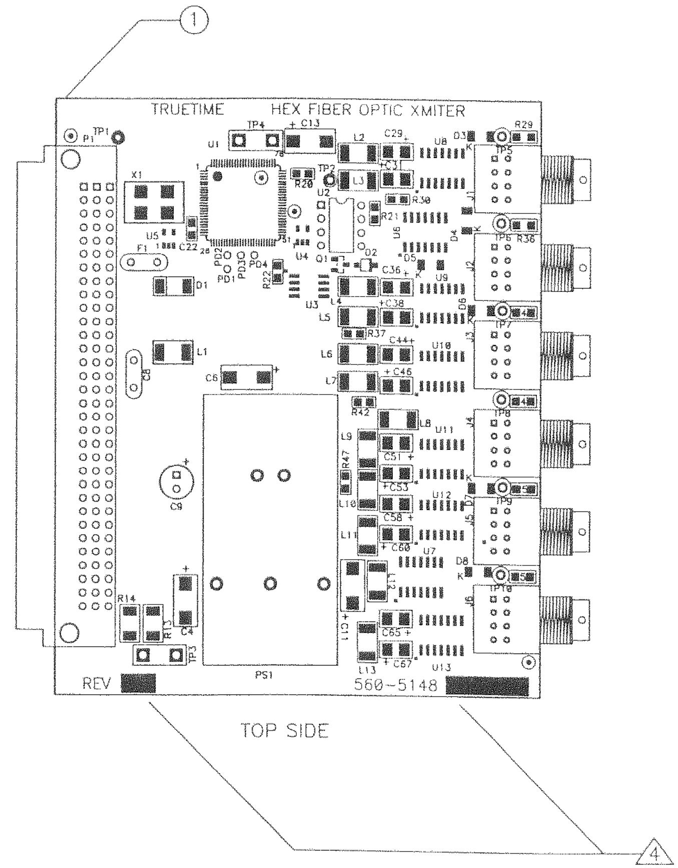
NOTES: UNLESS OTHERWISE SPECIFIED

1. ASSEMBLE PER ASSEMBLY REQUIREMENTS DOCUMENT 421-11.
2. RESISTOR VALUES IN OHMS, CAPACITORS IN MICRO FARADS.
3. POLARIZED CAPACITORS ARE SHOWN WITH A ROUNDED EDGE INDICATING THE POSITIVE SIDE.

△4 STAMP ASSEMBLY AND REVISION LEVEL.

REVISIONS

LTR	DESCRIPTION	DATE	APPROVED
02	DESIGN CHANGE	04-20-98	04-20-98 [signature]



CONTRACT NO.	
APPROVALS	DATE
DRAWN BY r.e.c.	12-5-97
CHECKED	
APPROVED [signature]	4-20-98

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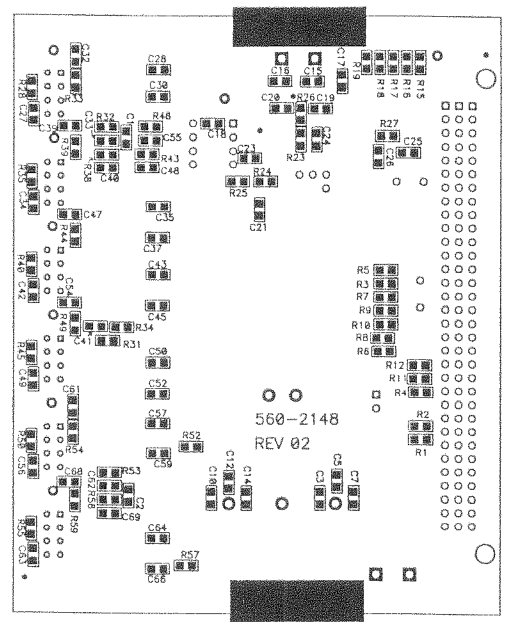
Title	HEX FIBER OPTIC TX ASSEMBLY DRAWING, TOP SIDE	
Size B	Number 560-5148	Rev 02
Date Mon Apr 20 1998 13:31:18		
File name 2148-02 PCB		Sheet 1 of 8



BOTTOM SIDE

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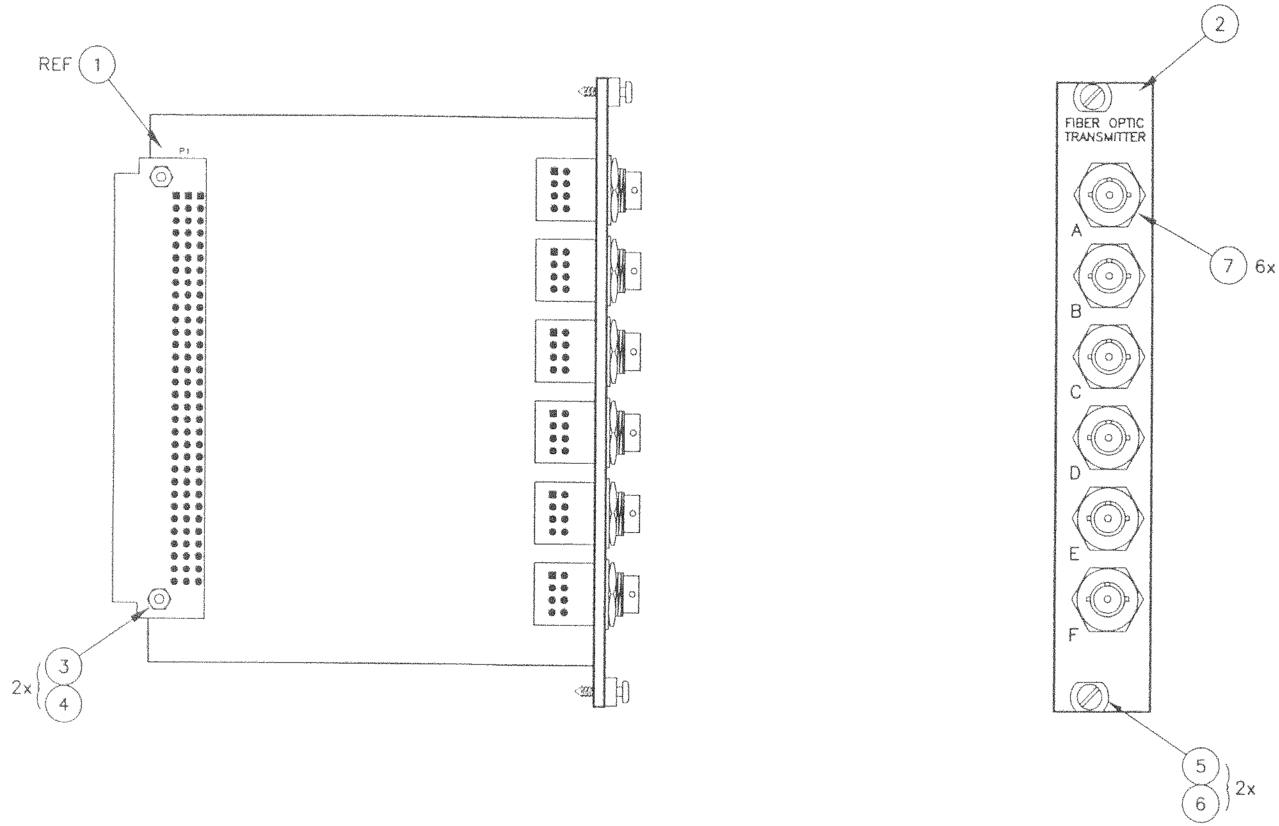
Title	HEX FIBER OPTIC TX ASSEMBLY DRAWING, BOTTOM SIDE	
Size: B	Number: 560-5148	Rev: 02
Date: Mon Apr 20 1998 13:31:17		
Filename: 2148-02.PCB		Sheet 2 of 8



FILENAME: \560\5148
DATE: 04-20-98

NEXT ASSY	SIZE	CODE IDENT NO.	DRAWING NO.	REV
	B		560-5148	02
	SCALE NONE		SHEET 3 OF 8	

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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
560-5148	ASSY HEX FIBER OPTIC TX	MADE FROM 560-2148				EA		
0000-APPROVAL	PARTS LIST APPROVAL		0000		1.0000	EA		GZ/[illegible] 5/98
0000-PL	PARTS LIST REV LEVEL		0000		1.0000	EA		REV 02 (05-26-98)
0000-PRINT	REFERENCE PRINT		0000		1.0000	EA		560-5148 REV 02
0000-REV	PCB REV LEVEL HERE >>>>		0000		1.0000	EA		560-2148 REV 02
002S-40.2R	RES 40.2 OHM 1206	NIC NRC25R40R2TR	0000		6.0000	EA		R29,36,41,46,51,56
003S-1000	RES 100 OHM 1/2W 1% 2010	DALE CRCW20101000FTR	0000		2.0000	EA		R13,14
008S-100	RES 10 OHM 5% 0805	NIC NRC10J100TR	0000		6.0000	EA		R30,37,42,47,52,57
008S-1002	RES 10K OHM 1/8W 1% 0805	NIC NRC12R1002FTR	0000		1.0000	EA		R25
008S-101	RES 100 OHM 1/8W 0805 5%	NIC NRC12R101TR	0000		1.0000	EA		R20
008S-102	RES 1K OHM 1/8W 1% 0805	NIC NRC12R102FTR	0000		1.0000	EA		R26
008S-1022	RES 10.2K OHM 1/8W 1%	NIC NRC12R1022FTR (0805)	0000		1.0000	EA		R31
008S-104	RES 100K OHM 1/8W 1% 0805	NIC NRC12R104FTR	0000		6.0000	EA		R33,39,44,49,54,59
008S-105	RES 1 MEG 1/8W 0805 5%	NIC NRC12R105TR	0000		7.0000	EA		R27,32,38,43,48,53,58
008S-222	RES 2.2K OHM 1/8W 0805 5%	NIC NRC12R222TR	0000		11.0000	EA		R2-12
008S-241	RES 240 OHM 1/8W 0805	NIC NRC12R241TR	0000		6.0000	EA		R28,35,40,45,50,55
008S-472	RES 4.7K OHM 1/8W 0805 5%	NIC NRC12R472TR	0000		8.0000	EA		R15-19,21,22,24
008S-473	RES 47K OHM 1/8W 0805	NIC NRC12R473TR	0000		1.0000	EA		R1
008S-821	RES 820 OHM 1/8W 0805 5%	NIC NRC12R821TR	0000		1.0000	EA		R34
023-010-100	CAP AE 10UF 100V R	PANASONIC ECE-A2AU100	0000		1.0000	EA		C9
036-095	CAP MONO 0.1UF 50V R 20%	MURATA RPE122Z5U104M50V	0000		1.0000	EA		C8
036S-NP0102	CAP .001UF NPO 100V 0805	NIC NMC0805NP0102J100TR	0000		6.0000	EA		C3,5,7,10,12,14
036S-NP0200	CAP 20PF NPO 100V 0805 5%	NIC NMC0805NP0200J100TR	0000		2.0000	EA		C25,26
036S-X7R104-50	CAP .1UF X7R 50V 0805 10%	NIC NMC0805X7R104K50TR	0000		24.0000	EA		
	C1,2,15-24,32,33,39,40,47,48,54,55,61,62,68,69							
036S-Y5V104	CAP CER .1UF Y5V 50V 0805	NIC NMC0805Y5V104Z50TR	0000		19.0000	EA		
	C27,28,30,34,35,37,41,42,43,45,49,50,52,56,57,59,63,64,66							
037S-225	CAP 2.2UF 16V 3528	NIC NTC-T225K16TRB	0000		12.0000	EA		
	C29,31,36,38,44,46,51,53,58,60,65,67							
037S-686	CAP 68UF 6.3V 7343	NIC NTC-T686K63TRD	0000		4.0000	EA		C4,6,11,13
045S-1.8	INDUCTOR 1.8UH 1812	TDK NLC1812-1R8K	0000		1.0000	EA		L1
045S-27UH	INDUCTOR, HICURRENT, 27UH	TDK NLC1812-270K-T	0000		12.0000	EA		L2-13
048-1414T	FIBER OPT XMTR ST STYLE	HP HFBR-1414T	0000		6.0000	EA		J1-6
048-4411	FIBER OPT NUT	HP HFBR-4411	0000		6.0000	EA		07
057S-4002	DIODE 4002	ROHM RLR4002	0000		1.0000	EA		D1
057S-4148	DIODE 1N4148	ROHM RLS4148TR	0000		6.0000	EA		D3-8
058-009	LED RED EXTRA SMALL	HP #HLMP6600	0000		1.0000	EA		D2
059S-20000	XTAL 20.000 MHZ	MPC SM-65N1B2E-20.000MHZ	0000		1.0000	EA		X1
174S-XC5204V	XILINX XC5204V FPGA	XILINX XC5204-6VQ100C	0000		1.0000	EA		U1
175S-2N2907A	TRANSISTOR 2N2907A SOT-23	MOTOROLA MMBT2907AL	0000		1.0000	EA		Q1
176S-LM339	QUAD COMPARATOR LM339	NATL LM339M	0000		2.0000	EA		U6,7
176S-LM6321M	HIGH SPEED BUFFER	NATL LM6321M (SOIC)	0000		6.0000	EA		U8-13
176S-MC34064	UNDER VOLTAGE SENSING CKT	MOTOROLA MC34064D-5	0000		1.0000	EA		U3

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
178-17C128	FPGA CONFIG EEPROM	ATMEL AT17C128-10PC	0000		1.0000	EA		U2
178S-74AHC1G14	SINGLE SCHMITT INVERTER	TI SN74AHC1G14DBVR	0000		1.0000	EA		U4
178S-NC7SU04	SINGLE INVERTER NC7SU04	NATL NC7SU04 (SOT23-5)	0000		1.0000	EA		U5
184-059	XILINX CUFO OUTPUT		0000		1.0000	EA		FOR U2
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		TP3,4
273-015	TERM TEST POINT (WHITE)	COMP. CORP TP-104-01-09	0000		8.0000	EA		TP1,2,5-10
355-BXA10-1	DC-DC 18-75VIN +5/-5 OUT	CPI BXA10-48D05	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 U2
560-1248	PANEL,REAR HEX FOL TX	FAB/SCREEN	0000		1.0000	EA		02
560-2148	PCB HEX FIBER OPTIC TX	FAB	0000		1.0000	EA		01
LA	LABOR ASSEMBLY COST HRS		0000		0	EA		
LT	LABOR TEST COST HOURS		0000		0	EA		
OSV560-5148	OUTSIDE LABOR 560-5148	PCA	0000		1.0000	EA		