



Certified ISO 9001

SYSTEM INTERFACE SI-2™ AND SI-ARCADE™

Technical Manual

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SI ARCADE

SIARCADE INTRODUCTION

The System Interface Arcade (SI Arcade) is a stationary mounted sports radar system for K-band antenna operation. The basic SI Arcade processor board is included in the K-band antenna housing. It displays the fastest speeds of the event, which are from processed raw Doppler signals that are generated by the microwave transceiver and is specifically designed for tracking the speed of baseballs in an arcade environment. The SI Arcade includes an RS232 communications port for operation with standard numeric display signs. The SI Arcade software detects targets within the speed ranges of 25 – 125 mph (40 – 200 kph).

Standard Package

K-band antenna

Test tuning fork

15.5 ft power/serial communications cable with an attached DB-9 connector with a cigar type plug for externally supplied power

One-year full warranty

Default Settings

Continuous mode on power up

Units of measure set to mph (available in kph)

Speed range set to 25 – 125 mph

Data output format set to standard ASCII characters (hundreds, tens, ones, carriage return)

Options

Units of measure set to kph

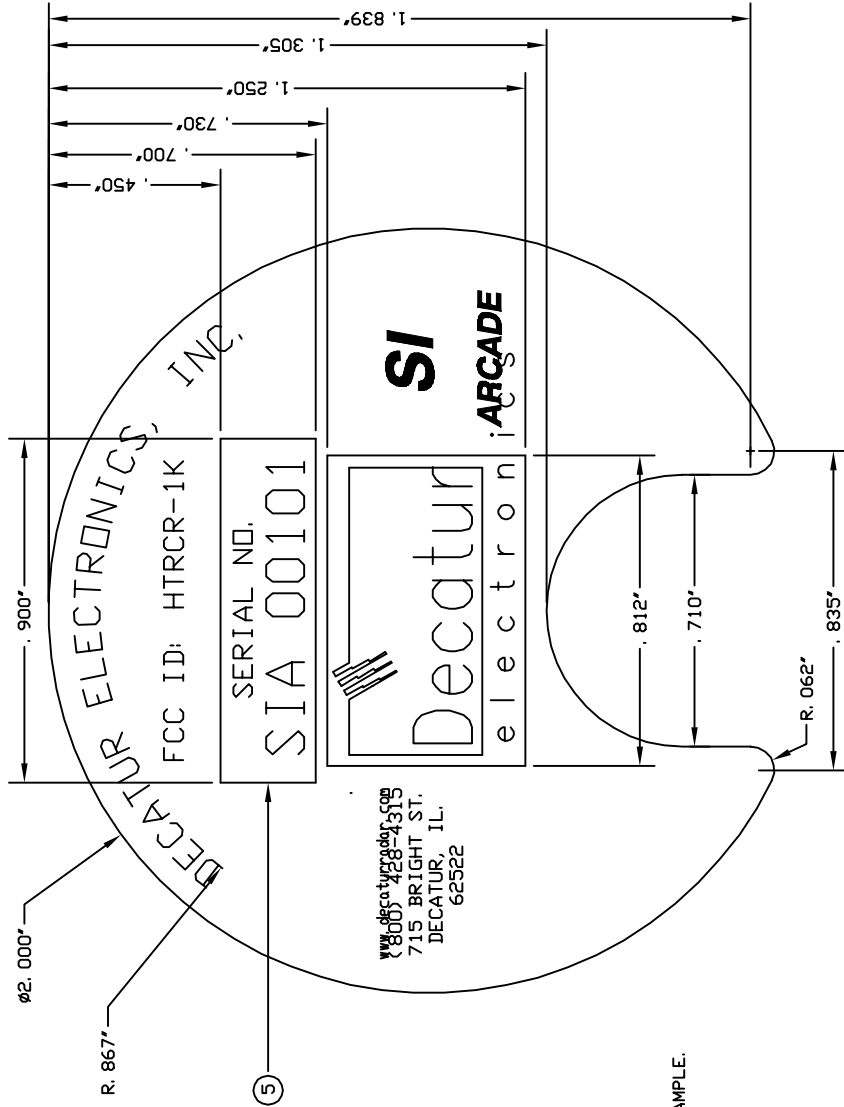
Operation

The SI Arcade's radar beam is always active as long as the unit has power. The unit displays the fastest speed for about 5 seconds, then clears the speed. After the speed clears, the unit is ready for another speed.

SIARCADE ANTENNA OPERATION AND CIRCUITRY

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VIEW BELOW IS 2X FOR DIMENSIONING PURPOSES ONLY



NOTES:

1. COLORS SIMILAR TO ARTWORK SAMPLE.
2. TEXT SIMILAR IN STYLE AND SIZE TO ARTWORK SAMPLE.
3. 'SI ARCADE' TEXT HAS 10° OBLIQUE.
4. WHITE BACKGROUND INSIDE BOX WITH BLACK TEXT.
5. SERIALIZATION SHALL BEGIN WITH 'SIA 00101'.
6. ADHESIVE BACKING. (3M9472)
7. MATERIAL: .010" CLEAR LEXAN WITH UV VELVET FINISH.
8. SECOND SURFACE PRINTED WITH WHITE, RED ON BLACK BACKGROUND.
9. REV 'A' PUTS A TITLE BLOCK AROUND DRAWING.

DECATUR ELECTRONICS, INC. 715 BRIGHT STREET DECATUR, IL. 62522 PHONE (217) 428-4315		DIMENSIONS IN INCHES TOLERANCE: ±.010 DRAWN: JOL REV.: JOL CHK.: B BENZ ENG.: T. J. COTTLE		SCALE: N/A 17MAY00 17MAY00 17MAY00 17MAY00		TITLE: SI ARCADE SERIAL TAG	
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2.750

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and
(2) This device must accept any interference received.

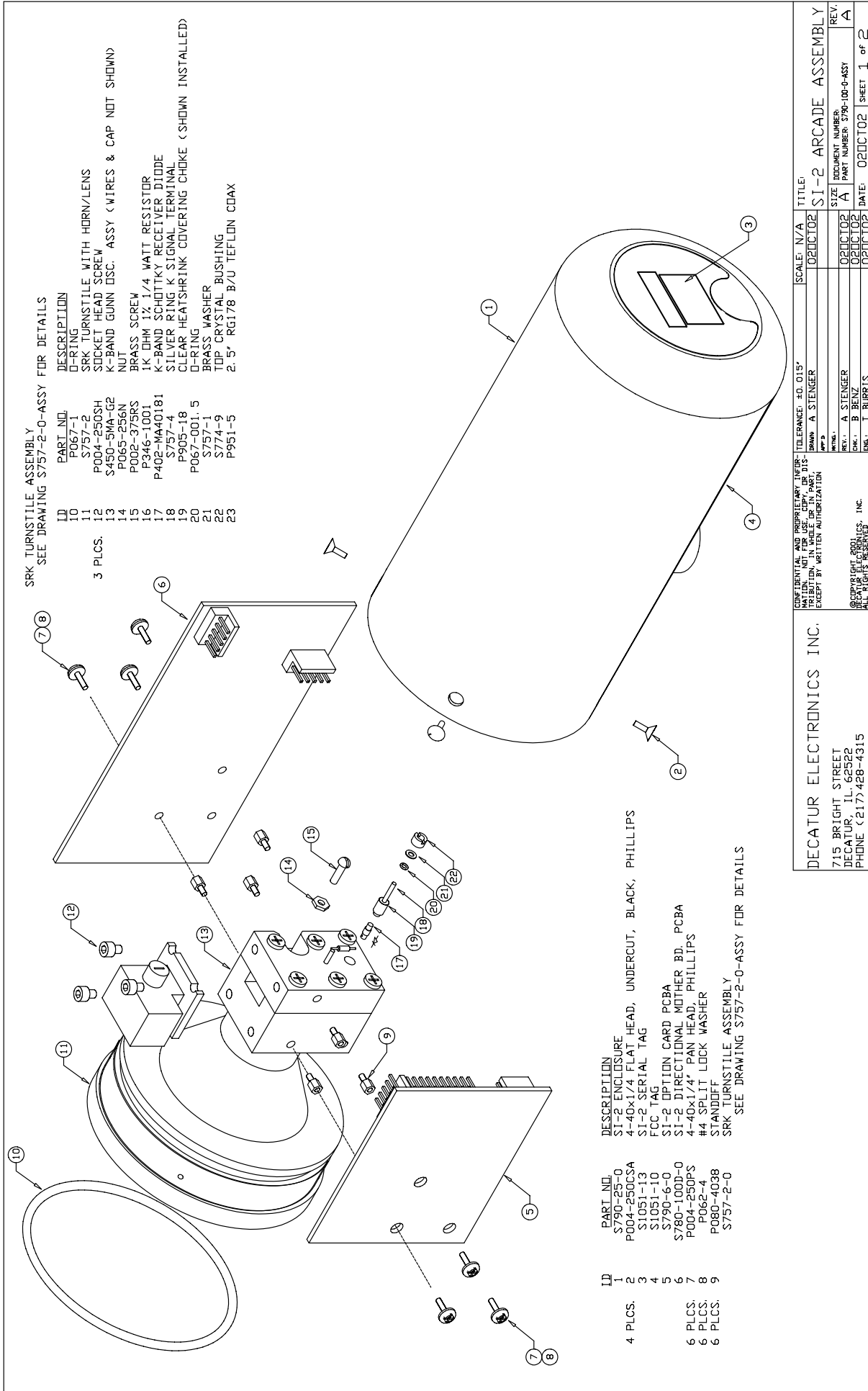
This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and
(2) This device must accept any interference received.

R.125 x4

NOTES:

1. MATERIAL: .002" BRUSHED SILVER POLYESTER.
2. ADHESIVE: .002" V-156.
3. FIRST SURFACE PRINTED WHITE COPY ON A BLACK BACKGROUND. FINISH TO BE INK RECEPTIVE MATTE DT#206 FLODD, WITH A .001" MATTE POLYESTER LAMINATION.
4. FONT: ROMANT. SHX WITH A .8 LINE WIDTH.
5. REV "A" PUTS TITLE BLOCK AROUND DRAWING.

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	©COPYRIGHT 1999 DECATUR ELECTRONICS, INC. ALL RIGHTS RESERVED		DRAWN: JOL	26AUG99	SIZE: A	
			REV: JOL	26AUG99	DOCUMENT NUMBER: S1051-10	REV: A
			CHK: B BENZ	26AUG99	PART NUMBER:	DATE: 26AUG99
		ENG: T J COTTLE	26AUG99	SHEET 1 of 1		



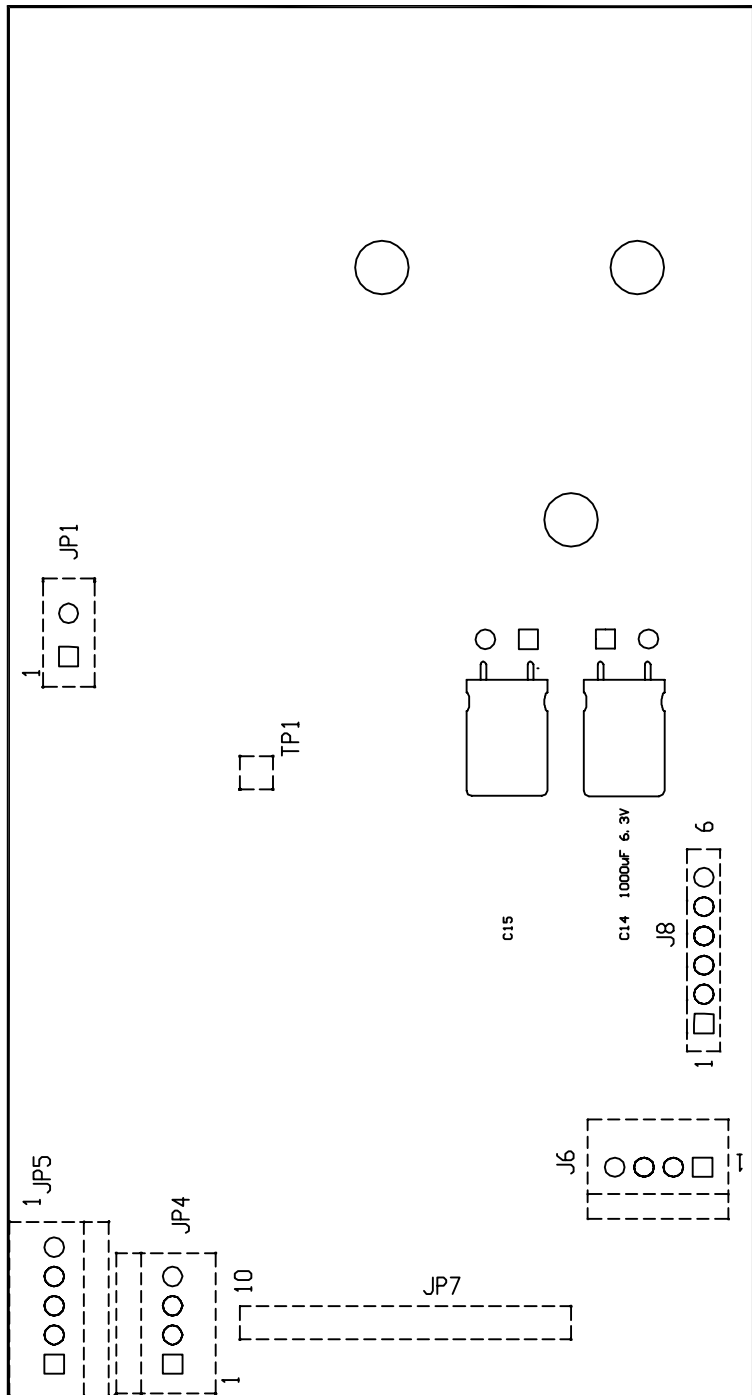
SRK TURNSTILE ASSEMBLY
SEE DRAWING S757-2-0-ASSY FOR DETAILS

ID	PART NO.	DESCRIPTION
10	P067-1	D-RING
11	S757-2	SRK TURNSTILE WITH HORN/LENS
12	P004-250SH	SOCKET HEAD SCREW
13	S450-5MA-G2	K-BAND GUNN OSC. ASSY (WIRES & CAP NOT SHOWN)
14	P065-256N	NUT
15	P002-375RS	BRASS SCREW
16	P346-1001	1K OHM 1/4 WATT RESISTOR
17	P402-MA40181	K-BAND SCHOTTKY RECEIVER DIODE
18	S757-4	SILVER RING K SIGNAL TERMINAL
19	P905-18	CLEAR HEATSHRINK COVERING CHOKE (SHOWN INSTALLED)
20	P067-001.5	D-RING
21	S757-1	BRASS WASHER
22	S774-9	TOP CRYSTAL BUSHING
23	P951-5	2.5" RG178 B/U TEFLON COAX

ID	PART NO.	DESCRIPTION
1	S790-25-0	SI-2 ENCLOSURE
2	P004-250CSA	4-40x1/4" FLAT HEAD, UNDERCUT, BLACK, PHILLIPS
3	S1051-13	SI-2 SERIAL TAG
4	S1051-10	FCC TAG
5	S790-6-0	SI-2 OPTION CARD PCB
6	S780-100D-0	SI-2 DIRECTIONAL MOTHER BD. PCB
7	P004-250PS	4-40x1/4" PAN HEAD, PHILLIPS
8	P062-4	#4 SPLIT LOCK WASHER
9	P080-4038	STANDOFF
	S757-2-0	SRK TURNSTILE ASSEMBLY

SEE DRAWING S757-2-0-ASSY FOR DETAILS

DECATUR ELECTRONICS INC.		SCALE: N/A	TITLE: SI-2 ARCADE ASSEMBLY
715 BRIGHT STREET DECATUR, IL 62522 PHONE (217) 428-4315		TOLERANCE: ±0.015"	REV: A
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COPYRIGHT © 2001 DECATUR ELECTRONICS, INC. ALL RIGHTS RESERVED.		CHK: B. BENZ	REV: A
		ENCL: T. BURRIS	REV: A
			DATE: 02OCT02
			PART NUMBER: S790-100-0-ASSY
			SHEET 1 of 2



715 BRIGHT STREET DECATUR, IL. 62522 PHONE (217) 428-4315		N/A		N/A		JUGS MOTHERBOARD SOLDER SIDE ASSEMBLY	
		DRAMN: KJS	APP'D:	27SEP99	N/A	A	S777-100H-0
CONFIDENTIAL AND PROPRIETARY INFORMATION. NOT FOR USE, COPY OR DISTRIBUTION, IN WHOLE OR IN PART, EXCEPT BY WRITTEN AUTHORIZATION. ©COPYRIGHT 1999, DECATUR ELECTRONICS, INC. ALL RIGHTS RESERVED.		REV. 1: JDL	30SEP99	30SEP99	30SEP99	30SEP99	
		CHECK#1: B BENZ	30SEP99	30SEP99	30SEP99	30SEP99	
		CHECK#2: K J SMITH	30SEP99	30SEP99	30SEP99	30SEP99	

STUFFING INSTRUCTION AND INSPECTION GUIDE

1. Y1 AND Y2 SHALL BE INSULATED FROM PCB BY BEADS OR WASHER
2. JP7 SHALL BE STUFFED ON THE COMPONENT SIDE OF PCB
3. JP5 SHALL HAVE LOCKING TAB FACING TOWARDS BOTTOM SIDE OF PCB
4. J6 SHALL HAVE LOCKING TAB FACING TOWARDS RIGHT SIDE OF PCB
5. C14 TO BE RTVd TO SOLDER SIDE OF PCB.
6. C13, C15, C17, C20, C21
C25, C26, C28, C31, C32
C51, C52, C53, C54, D3, D4
JP4, J8, R24, R27, R28, R30
R32, R34, R37, R38, R40, R42
R44, R47, R48, R50, R53, R59
R60, R62, R63, R64, R65, U5
U10, U11, U13, U15, U17

7. PANELIZED PCB WITH BREAK TABS.

A) TOP/BOTTOM OF PCB, TRIMMED WITH MINIMAL PROTRUSION FROM EDGE.

B) LEFT/RIGHT OF PCB, FLUSH WITH NO EXPOSED TRACES OR DE-LAMINATIONS.

8. DEI 100 PERCENT INSPECTION POINTS

A) PROPER VOLTAGE RATING ON C6, C7

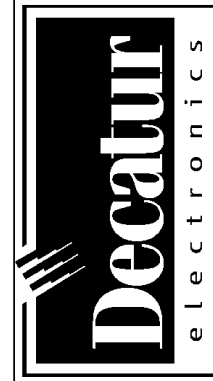
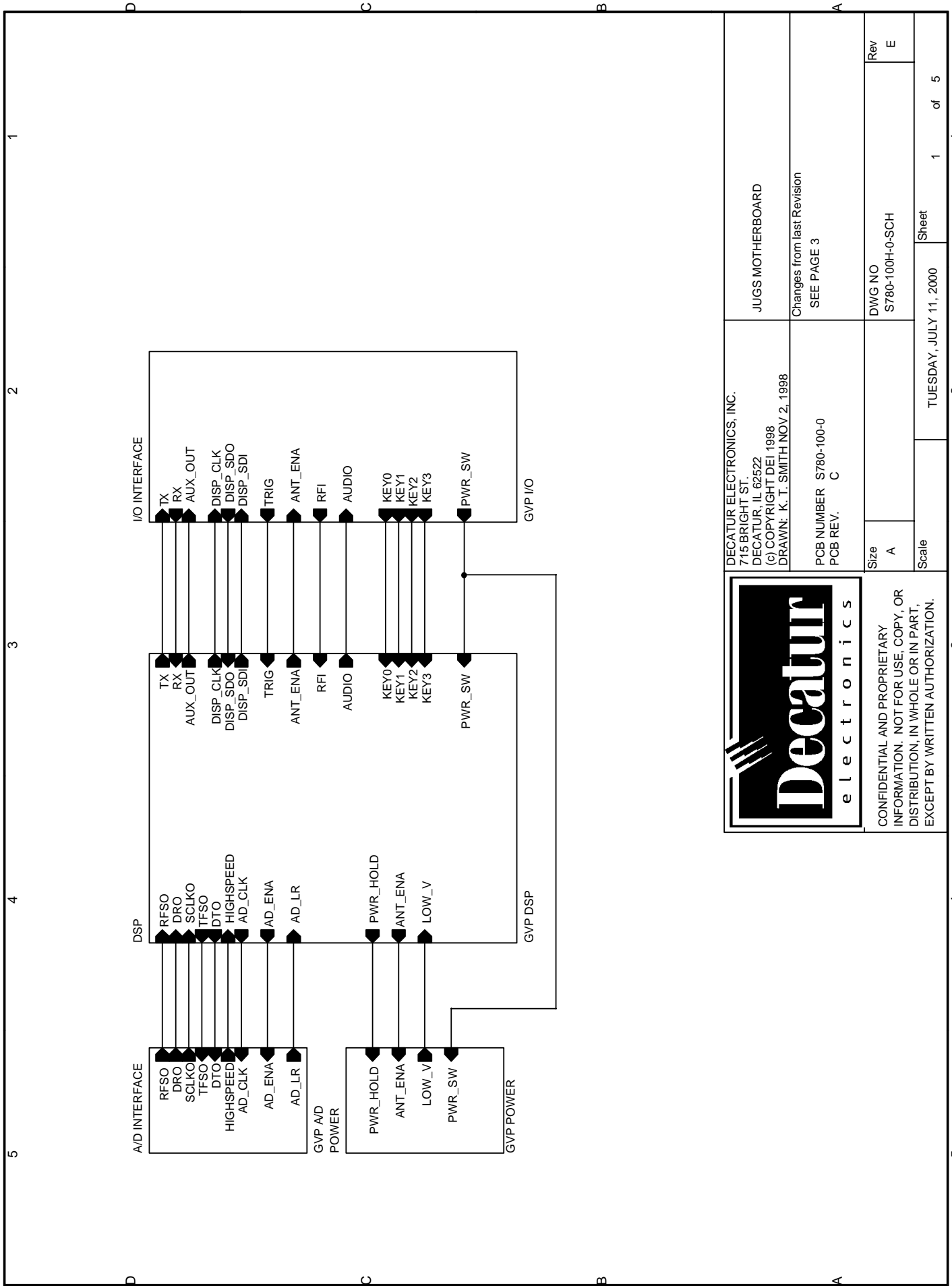
9. WORKMANSHIP AND MATERIALS MUST MEET IPC-A-610 REV B CLASS 2 SPECIFICATIONS UNLESS NOTED.

10. MOUNTING HOLES TO BE SOLDER FREE.
11. EACH BOARD TO BE LABELLED WITH A DATE CODE. LABELLING SHALL NOT INTERFERE WITH INSTALLATION OR OPERATION OF ASSEMBLY.
12. U3 PROGRAMMED WITH MOST RECENT VERSION OF BOOT LOADER CODE

GENERAL NOTE:

13. REV 'A' PUTS A TITLE BLOCK AROUND DRAWING.

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		DRAM: KJS	27SEP99
REV. 1: JOL		30SEP99	30SEP99
CHECK#1: B BENZ		30SEP99	30SEP99
CHECK#2:		30SEP99	30SEP99
ENG. 1: K J SMITH		30SEP99	30SEP99
715 BRIGHT STREET DECATUR, IL. 62522 PHONE (217) 428-4315		JUGS MOTHERBOARD ASSEMBLY	
		A	B
		30SEP99	3
		30SEP99	3



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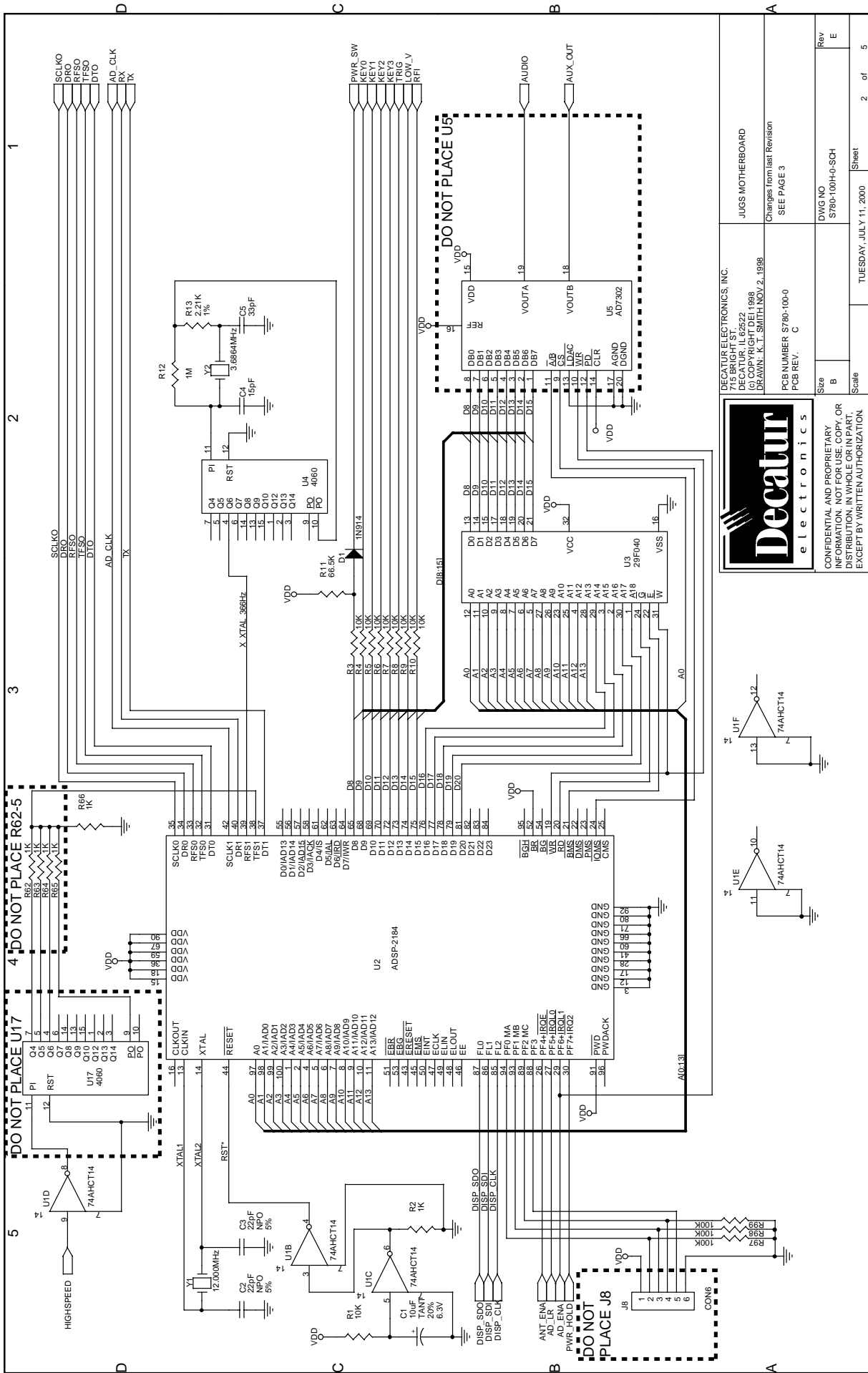
PCB NUMBER S780-100-0
PCB REV. C

JUGS MOTHERBOARD

Changes from last Revision
SEE PAGE 3

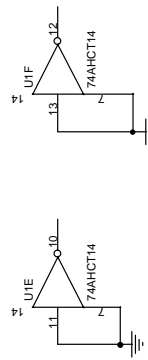
DWG NO S780-100H-0-SCH
Rev E

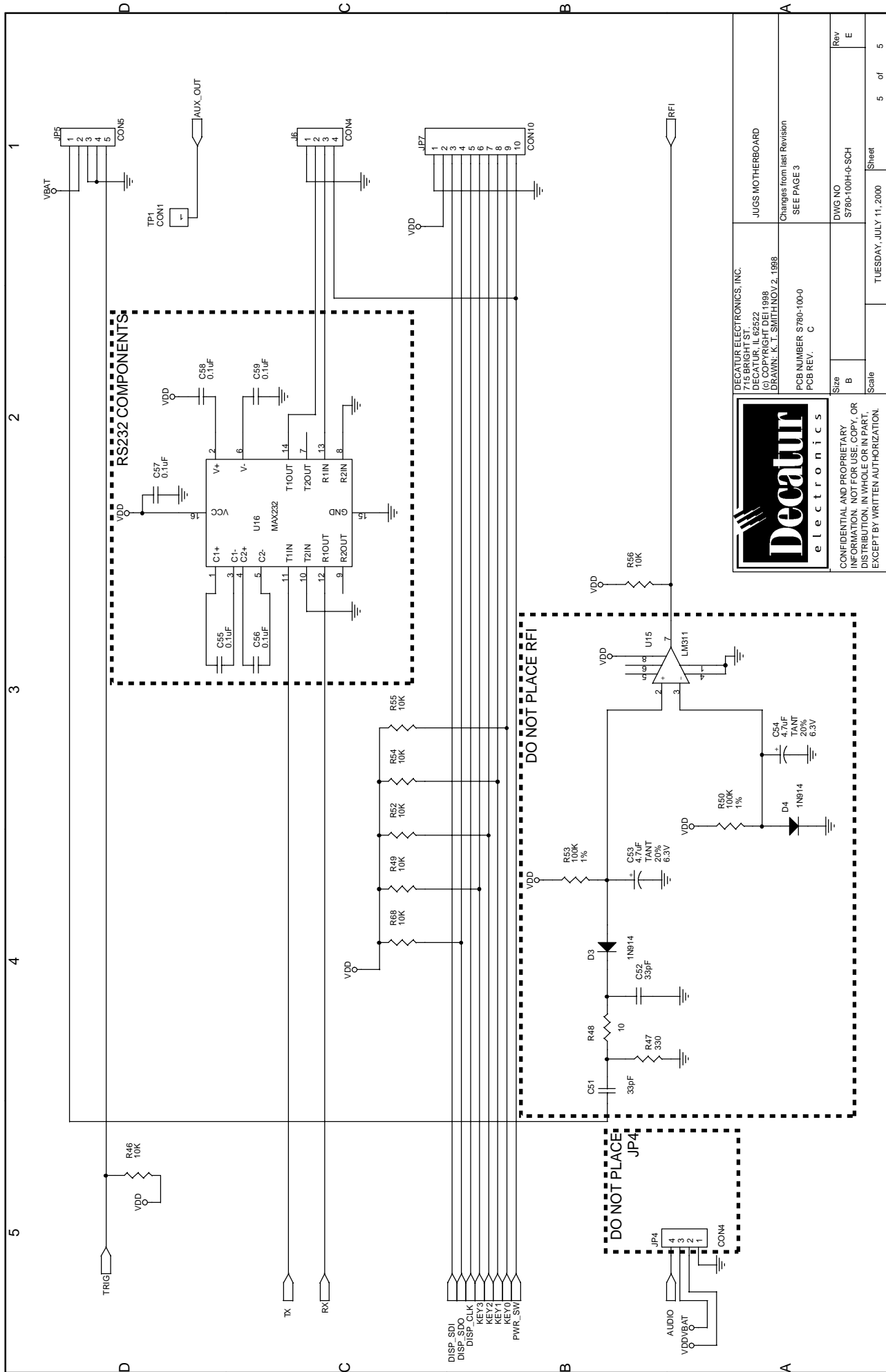
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Sheet 1 of 5



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JUGS MOTHERBOARD	
Changes from last Revision SEE PAGE 3	
Size B	DWG NO S780-100H-0-SCH
Scale	Rev E
TUESDAY, JULY 11, 2000	
Sheet 2 of 5	





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PCB NUMBER: S780-100-0
 PCB REV: C

JUGS MOTHERBOARD
 Charges from last Revision
 SEE PAGE 3

Size: B
 Scale: Sheet 5 of 5
 DWG NO: S780-100H-0-SCH
 Rev: E

MICROWAVE MODULE

The microwave module of the SI Arcade consists of a turnstile junction, which is coupled to a machined horn lens antenna. The antenna radiates microwave energy with right-hand circular polarization and is designed to receive left-hand polarized energy. The antenna returns the Doppler signal, which is coupled to a turnstile. This provides isolation between the microwave oscillator and receiver section. The receiver section is composed of a high-sensitivity mixer diode that is coupled to receive the Doppler shifted transmitted signal and a small amount of the microwave energy from the oscillator. The mixer diode produces a low-level output signal with a frequency shift of approximately 72Hz per mph of the target velocity.

SIARCADE SIGNAL PROCESSING PRINTED CIRCUIT BOARD (PCB) S780-100

Preamplifiers

The heart of the preamplifiers is U9 and U10, MAX410 low-noise low-distortion operational amplifiers. These amplifiers with resistors R29, R31, R33 and capacitor C16 (U9), R30, R32, R34 and C17 (U10) form non-inverting operational amplifier configurations with resistors R31 and R33 (U9) and R32 and R34 (U10), setting the gain at approximately 42dB. Resistors R29 and R30 provide biasing current for the positive input of U9 and U10, respectively, while resistors R25 and R26 and capacitor C14 and R27 and R28 and capacitor C15 provide a 2.5VDC analog ground reference for U9 and U10, respectively. Capacitors C12 and C13 prevent DC current from entering U9 and U10, respectively. Capacitors C16 and C17 provide high-frequency noise filtering.

The second stage in this configuration provides approximately 10dB of gain. This section contains U12B and U13B, OP213 dual low-noise amplifiers. Capacitors C19 and C21 provide DC decoupling. Resistors R35 and R36 with capacitor C18 and resistors R37 and R38 with capacitor C20 form low-noise analog references for U12 and U13 respectively. R57 and C24, which a resistor replaces, set the gain for U12B. RHAND, sits on the pads for U11-pin 11 and U11-pin 13 and C26, which a resistor replaces, and sets the gain for U13B.

C23 and C25 decouple the output signals from the second amplifier stages to unity gain low-pass filters. These filters contain op-amp U12A, resistors R39, R41, and capacitor C27 and op-amp U13A, resistors R40, R42, and capacitor C28. Resistors R39, R40, R41, R42 set a fixed gain at 0dB. The outputs of U12A, pin 1, and U13A, pin 1, are applied to low-pass anti-aliasing filters composed of R43 and capacitor C29 and R44 and capacitor C31, respectively.

Analog to Digital (A/D) Converter

The analog to digital (A/D) converter section digitizes the analog outputs of the two preamplifier sections, transforming the analog information to a digital representation for further processing by the DSP chip. U14, a stereo 16-bit sigma delta A/D converter manufactured by Analog Devices, carries out the A/D conversion. This converter accepts an analog signal and converts it to 16-bit signed digital words. Capacitor pairs C35, C38 and C36, C39 provide power supply filtering for the references. Capacitors C45, C46 provide power supply filtering for the analog supply. Capacitors C47, C48, C49, and C50 provide power supply filtering for the digital supply. Ferrite bead L1 and capacitors C33, C34 filter high-frequency signals from entering the A/D converter's analog section. The DSP chip provides the sampling clock and is applied on pin 28 of U14. The digitized data from the converter is serially output on pins 1, 2, 3, and 26.

Digital Signal Processing

The DSP chip U2, an ADSP-2185 from Analog Devices, performs the following functions:

- (1) receives digitized Doppler signals from the antenna unit
- (2) communicates bi-directionally with a serial port device
- (3) retrieves operational parameters from the flash EPROM
- (4) detects low voltages
- (5) filters Doppler signals
- (6) checks accuracy against an external reference crystal
- (7) determines direction of each target.

U2, Y1, C2, and C3 form a resonant circuit oscillating at 16MHz to supply the clock frequency for the DSP chip. The DSP chip multiplies this frequency by a factor of four, which sets the instruction rate at 32 millions of instructions per second (MIPS).

U3, a 1M-bit flash memory chip, holds the software that the DSP chip executes. At power up, the DSP chip boot loads the software in U3 into internal high-speed program memory where program execution takes place.

The DSP has two serial ports. The first port receives digitized Doppler signals from the A/D converter. The second port provides bi-directional communication to an external serial device. Pins 31-35 are configured as serial port 0 (sport0), with pins 35, 34, and 33 receiving the clock, data, and frame synch respectively. Pins 37 to 42 are configured as serial port 1 (sport1); pins 37 and 40 are set to transmit and receive serial data respectively.

The remaining pins of the DSP chip provide additional I/O control over various parts of the radar unit. DSP Pins 19, 20, 21, and 24 are the control lines for the flash memory. Resistors R97, R98, and R99 control the boot-loading source of the software. On DSP Pin 26 (PF4), a logic high enables the antenna. DSP Pin 30 (PF7) controls power to the radar unit, where a logic high maintains power. DSP Pins 74 accomplishes low voltage detection. (A logic low represents an error condition.) Data lines [D8..D15] receive data from the flash during the boot-loading process at power up. Address lines A[0..13], including D16-D20, provide flash addressing (4-Mbit total address space.)

Second Crystal Check

U4, a 74HC4060 counter, generates the second frequency reference that the second crystal check needs. Y2 with resistors R12, R13 and capacitors C4, C5 set the oscillation frequency to 3.6864MHz. The output frequency of U4 at pin 4 is approximately 57,600Hz. This second crystal also provides the clock reference for the external serial port baud rates.

Reset Circuit

U1B and U1C with resistors R1, R2 and capacitor C1 form a reset circuit for providing the power-on reset for the DSP chip.

Power Supply

Power supplied externally to the SI Arcade enters the DSP board at JP5 and is routed to two regulators, U6 and U7. U6, the main power regulator, is configured to supply +5VDC to all logic and analog circuits. Resistors R17 and R18 program the low-voltage detect circuitry to trip at approximately 5.5VDC. Resistor R20 maintains the low-voltage output at logic high until a low-voltage threshold is met. Resistors R14, R16 and transistor Q1 form the power-on enable for the regulator. When the SI Arcade is powered, current flows through the base of transistor Q1 and resistor R14 and forces the transistor to switch on. Collector current from transistor Q1 flows through resistor R16 increasing the voltage at the regulator enable pin 5. When the voltage at pin 5 exceeds a threshold, the regulator turns on and begins to supply power to the unit. After the unit powers up, the digital signal processor (DSP) maintains power to the unit by pulling pin 5 of U6 high within about 100ms.

Diode D2 protects the DSP chip from reverse currents from the regulator section.

U7 provides power to the Gunn oscillator, which generates the microwave energy. Transistor Q2 and resistors R15 and R19 form the enable circuitry for the Gunn oscillator power supply. The DSP turns on the regulator by bringing ANT_ENA to logic high. As long as power is applied to the SI Arcade, it will transmit. Resistors R21, R22, and R23 set the voltage on the Gunn oscillator. The nominal voltage level from the regulator is +5.51VDC.

Flash Memory

U3, a 1M-bit flash memory chip, holds the software that the DSP chip executes. At power up, the DSP chip boot loads the software in U3 into internal high-speed program memory where program execution takes place. U3 also stores the operational parameters for the radar unit.

Low Voltage and RFI Settings

Low voltage on the SI-Arcade requires no adjustments and is permanently set to trip around 5.5VDC. The RFI trip level is permanently set to trip at normally offending levels and requires no adjustments.

Serial Communication

U16, a MAX232 or equivalent interface chip, with capacitors C55, C56, C58, and C59 generate the proper voltage levels for RS232 transmit and receive signaling. C57 provides by-passing of the digital supply.

SIARCADE ANTENNA SPECIFICATIONS

Antenna Type	Frequency	Nominal Power Out	Output Power Density	Beam Width	Detection Range
K-band	24.150GHz ±50 MHz	10mW nominal	0.5 mW/cm ²	12°	100 ft

Processor

Serial communications	RS232C
Data rate	1200 baud
Data format	8N2 <ASCII Huns> <ASCII Tens> <ASCII Ones> <CR>
Target acquisition time	0.021ms

General

Supply voltage	10.8VDC – 24VDC
Nominal Current Draw	+12V .250mA +24V .120mA
Surge Current Requirements Operating temperature	1 Amp –22°F to +158°F (–30°C to +70°C)
Maximum humidity	100% (Unit is weatherproof, not waterproof)
Polarization	Circular

Mechanical

Weight	1.60 lbs (0.73 kg)
Length	8 in (20.3 cm)
Width	3 in (7.6 cm)

Accuracy

Speed Range	25 – 125 mph
Accuracy	±0.1 mph (±0.1 kph)

DB-9 Connector Pinout

Signal	DB-9 Connector
+12VDC Power	1 (red)*
RS232TX	2 (black)
RS232 RX	3 (green)
Ground (shield)	5 (brown)
Ground	9 (black)*
*Red and black are separate wires.	

SIARACDE PARTS LIST

SYSTEM INTERFACE (SI) ARCADE BILL OF MATERIALS

LEVEL	ITEM#	QTY	DEI PART#	REF#	DESCRIPTION
3	1		S780-100-DR	P.C.B.	DSP PCB
	2	1	P381-150	C4	15pF 5% 50V NPO CER 0805 CAP
	3	2	P381-220	C2,C3	22pF CAP 50V 5% 0805
	4	3	P381-330	C5,C16,C27	33pF 5% 50V NPO 0805 CER CAP
	5	4	P381-471	C41,C42, C43,C44	470pF 50V X7R 10% 0805 CAP
	6	3	P381-103	C29,C47,C48	0.01uF 10% 50V X7R 0805
	7	1	P372-472A	C19	0.0047uF 10% 50V FILM CAP .200"
	8	14	P381-104	C9,C10,C11, C33,C34,C38, C39,C46,C60, C55,C56,C57, C58,C59	0.1uF CAP 50V 10% 0805
	9	2	P372-104E	C12,C23	0.1u FILM CAP 50V 10% .2 SPAC
	10	4	P382-105	C30,C45,C49, C50	1uF 6.3V 20% 3216 TANT CAP
	11	2	P381-475	C35,C36	4.7u 10V 20% 3216 TANT CAP
	12	1	P381-106	C1	10uF TANT 6.3V 20% 3216
	13	2	P381-156	C6,C7	15uF TANT 10V 20% 3528
	14	4	P381-226	C8,C18,C37 C40	22uF TANT 6.3V 20% 3528
	15	1	P371-108	C14	1000uF ELECT CAP 6.3V 20%
	16	2	P411-1N914A	D1,D2	SWITCHING DIODE, SOT-23 SMD
	17	1	P505-167	J6	4-PIN STRAIGHT PCB HEADER
	18	1	P505-168	JP5	5-PIN STRAIGHT PCB HEADER
	19	1	P505-169	JP7	10-PIN RIGHT ANGLE PCB HEADER
	20	1	P615-22	L1	FERRITE BEAD
	21	1	P411-2N3906	Q1	PNP SWITCHING TRANSISTOR
	22	1	P411-2N3904	Q2	NPN SWITCHING TRANSISTOR
	23	1	P342-0000	R58	0 OHM JUMPER 0805
	24	1	P349-10	R23	1 OHM MF 1/4W 5% RESISTOR
	25	1	P342-0100	R45	10 OHM MF 1% 1/10W 0805
	26	1	P342-49R9	R43	49.9 OHM MF 1% 1/10W 0805
	27	1	P342-1000	R31	100 OHM MF 1% 1/10W 0805
	28	2	P342-2210	R25,R26	221 OHM MF 1% 1/10W 0805
	29	2	P342-1001	R2,R66	1K MF 1% 1/10W 0805
	30	1	P342-1541	R22	1.54K MF 1% 1/10W 0805
	31	2	P342-2211	R13,R29	2.21K MF 1% 1/10W 0805
	32	1	P342-4991	R21	4.99K MF 1% 1/10W 0805

LEVEL	ITEM#	QTY	DEI PART#	REF#	DESCRIPTION
	33	24	P342-1002	R1,R3,R4,R5, R6,R7,R8,R9, R10,R15,R16, R20,R35,R36, R39,R41,R46, R49,R52,R54, R55,R56,R57, R68	10K MF 1% 1/10W 0805
	34	1	P342-6652	R11	66.5K MF 1/10W MF1% 0805
	35	1	P342-4993	R61	499K OHM 1/10W MF 1% 0805
	36	7	P342-1003	R14,R18,R19, R33,R97,R98, R99	100K MF 1% 1/10W 0805
	37	1	P342-3573	R17	357K MF 1% 1/10W 0805
	38	2	P342-1004	R12,C24	1M MF 1% 1/10W 0805
	39	1	P410-74HC14	U1	HEX INVERTING SCHMITT TRIG SOIC 14
	40	1	P410-ADSP-2184	U2	ADSP-2184 IC 100-LEAD TQFP
	41	1	P410-AM29F010A	U3	1M FLASH 32-PIN PLCC
	42	1	P410-74HC4060	U4	14 STAGE RIPPLE COUNTER SOIC 16
	43	1	P410-LP2953	U6	ADJ REG 250mA SOIC 16
	44	1	P410-LM2941	U7	IC ADJ REG 1A 5-PIN DPAK
	45	1	P410-MAX410	U9	IC VERY LOW NOISE OP-AMP SOIC 8
	46	1	P410-OP213	U12	DUAL LOW NOISE OP-AMP SOIC 8
	47	1	P410-AD1877	U14	16-BIT SIGMA-DELTA CONVERTER SOIC 28
	48	1	P410-MAX232	U16	RS232 INTERFACE PORT SOIC 16
	49	1	P660-12.000MHZ	Y1	12.000MHz CRYSTAL
	50	1	P367-3.6864	Y2	3.6864MHz CRYSTAL
	51	1		C13,C15,C17, C20,C21,C25, C26,C28,C31, C32,C51,C52, C53,C54,D3, D4,JP4,J8,R24, R27,R28,R30, R32,R34,R37, R38,R40,R42, R44,R47,R48, R50,R53,R59, R60,R62,R63, R64,R65,U5, U10,U11,U13, U15,U17	DO NOT PLACE

SI-2

SI-2 INTRODUCTION

The System Interface (SI-2) is a stationary mounted radar system using a K-band antenna. The SI-2 processor board is included in the K-band antenna housing. It tracks target speeds that are from processed raw Doppler signals, which are generated by the microwave transceiver. The SI-2 antenna is directional, which means it can be set to track targets moving toward or away from it, and the SI-2 includes an RS232 serial port for communication with, for example, standard numeric display signs, changeable radar message trailers, computers, and conveyer belt controls and can be tailored to meet customer needs. The SI software detects targets within the ranges of 25 – 125 mph (40 – 200 kph). You can order an optional program diskette that uses the SI-2 Flash memory design to customize your SI-2 system.

Standard Package

Processor board with flash memory and antenna unit in an enclosure (K-band antenna only)

Test tuning fork

RS232 communications format

2 ft power/serial communications cable with a DB9 connector

(The DB9 connector carries both power and data.)

One-year full warranty

Default Settings

Sensitivity set to 17 for maximum distance range

Units of measure set to mph

Speed range set to 2 – 200 mph

Application filter set for road traffic

Data output rate set to continuous mode

Data output format set to standard ASCII characters (hundreds, tens, ones, carriage return)

Directionality set on approaching targets

Cosine (angular) error corrections set on 0° degree error

Single target tracking set to track target's speed continuously

Multiple target tracking set to select target with the strongest return signal

Options

From an program disk and programming cable that you order as an option, you can load settings from a PC, which let adjust the factory default settings:

- Sensitivity (distance range)

- Units of measure (mph and kph)

- Speed range from 2 – 200 mph (3 – 320 kph)

- Application filter

- Data output rate

- Data output format

- Radar directionality

- Cosine (angular) error correction

- Single target tracking

- Multiple target tracking

- Pole mount bracket

- Tripod with mounting adaptor

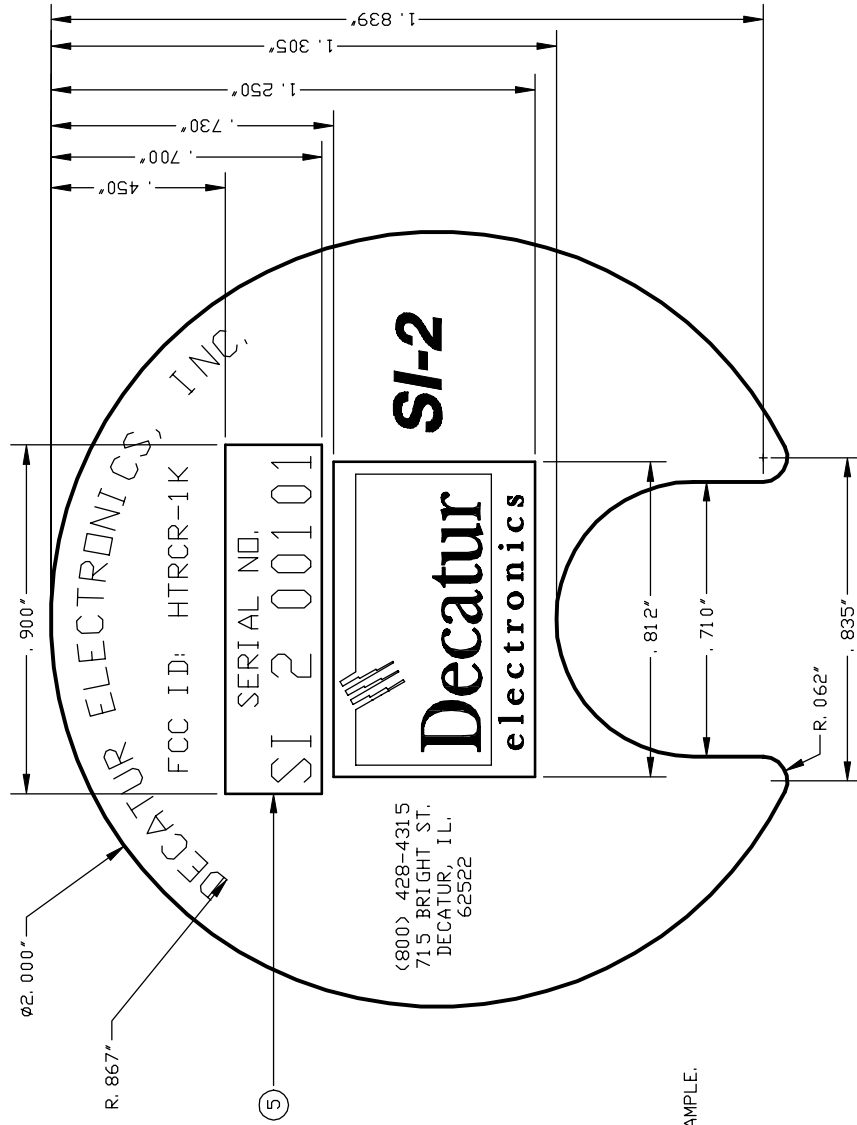
- Deck mount

Programming cable: Y-shaped power/serial communications extension cable with a 10 ft. power cable section terminated with bare wires and a 10-ft. serial communication section terminated with a DB9 connector.

SI-2 ANTENNA OPERATION AND CIRCUITRY

MECHANICAL DRAWINGS	31
EXPLODED VIEW	34
BLOCK DIAGRAM	36
SCHEMATICS	37
COMPONENT PLACEMENT MAPS	41
MICROWAVE MODULE	44
SIGNAL PROCESSING PCB	45
ANTENNA SPECIFICATIONS	49

VIEW BELOW IS 2X FOR DIMENSIONING PURPOSES ONLY

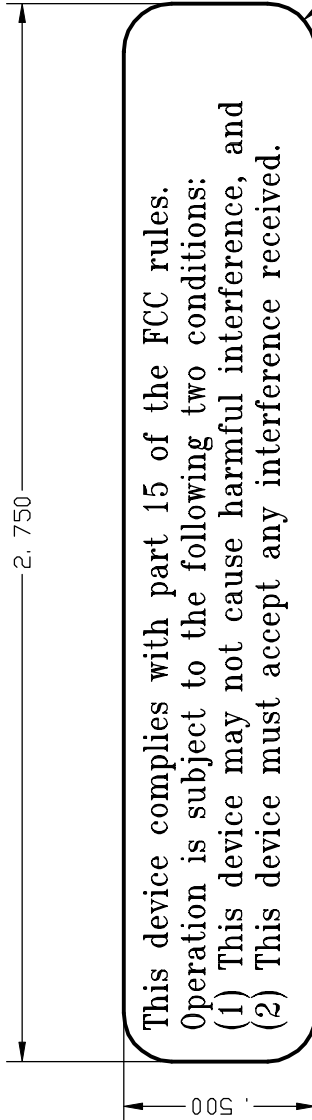


NOTES:

1. COLORS SIMILAR TO ARTWORK SAMPLE.
2. TEXT SIMILAR IN STYLE AND SIZE TO ARTWORK SAMPLE.
3. 'SI-2' TEXT HAS 10° OBLIQUE.
4. WHITE BACKGROUND INSIDE BOX WITH BLACK TEXT.
5. SERIALIZATION SHALL BEGIN WITH 'SI 2 00101'.
6. ADHESIVE BACKING. (3M9472)
7. MATERIAL: .010" CLEAR LEXAN WITH UV VELVET FINISH.
8. SECOND SURFACE PRINTED WITH WHITE, RED ON BLACK BACKGROUND.
9. REV 'A' PUTS A TITLE BLOCK AROUND DRAWING.

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		TOLERANCE: ±.010		SI-2 SERIAL TAG
DRAWN: JDL		26AUG99	SIZE: A	DOCUMENT NUMBER: SI 051-11
REV: JDL		26AUG99	DATE: 26AUG99	REV: A
CHK: B BENZ		26AUG99		
ENG: T. J. COTTLE		26AUG99		SHEET 1 of 1

DECATUR ELECTRONICS INC,
 715 BRIGHT STREET
 DECATUR, IL. 62522
 PHONE (217) 428-4315



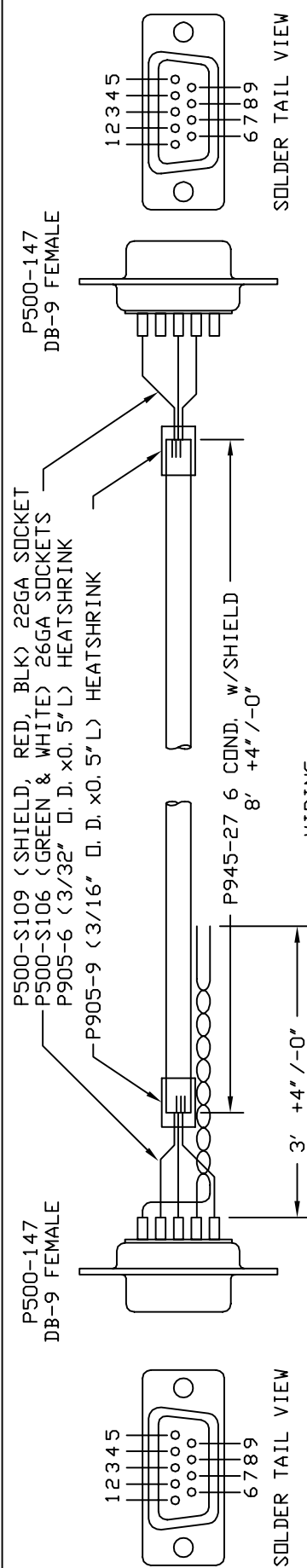
This device complies with part 15 of the FCC rules.
 Operation is subject to the following two conditions:
 (1) This device may not cause harmful interference, and
 (2) This device must accept any interference received.

R. 125 x4

NOTES:

1. MATERIAL: .002" BRUSHED SILVER POLYESTER.
2. ADHESIVE: .002" V-156.
3. FIRST SURFACE PRINTED WHITE COPY ON A BLACK BACKGROUND. FINISH TO BE INK RECEPTIVE MATTE DT#206 FLOOD, WITH A .001" MATTE POLYESTER LAMINATION.
4. FONT: ROMANT. SHX WITH A .8 LINE WIDTH.
5. REV "A" PUTS TITLE BLOCK AROUND DRAWING.

DECATUR ELECTRONICS INC. 715 BRIGHT STREET DECATUR, IL. 62522 PHONE (217)428-4315		CONFIDENTIAL AND PROPRIETARY INFORMATION. NOT FOR USE, COPY, OR DISTRIBUTION, IN WHOLE OR IN PART, EXCEPT BY WRITTEN AUTHORIZATION.		DIMENSIONS IN INCHES TOLERANCE: +/- 0.025"		SCALE: 2X		TITLE:	
		©COPYRIGHT 1999 DECATUR ELECTRONICS, INC. ALL RIGHTS RESERVED		DRAWN: JOL REV.: JOL CHK.: B BENZ ENG.: T J COTTLE		26AUG99 26AUG99 26AUG99 26AUG99		SI -2 FCC TAG SIZE: A DOCUMENT NUMBER: S1051-10 PART NUMBER: A	
						DATE: 26AUG99		SHEET 1 of 1	



PIN	COLOR	FUNCTION
1	RED 24GA	+
2	WHITE	TX
3	GREEN	RX
5	SHIELD	GND
9	BLACK 24GA	GND (-)

PIN	FUNCTION
N. C.	
2	
3	
5	
N. C.	

NOTES:

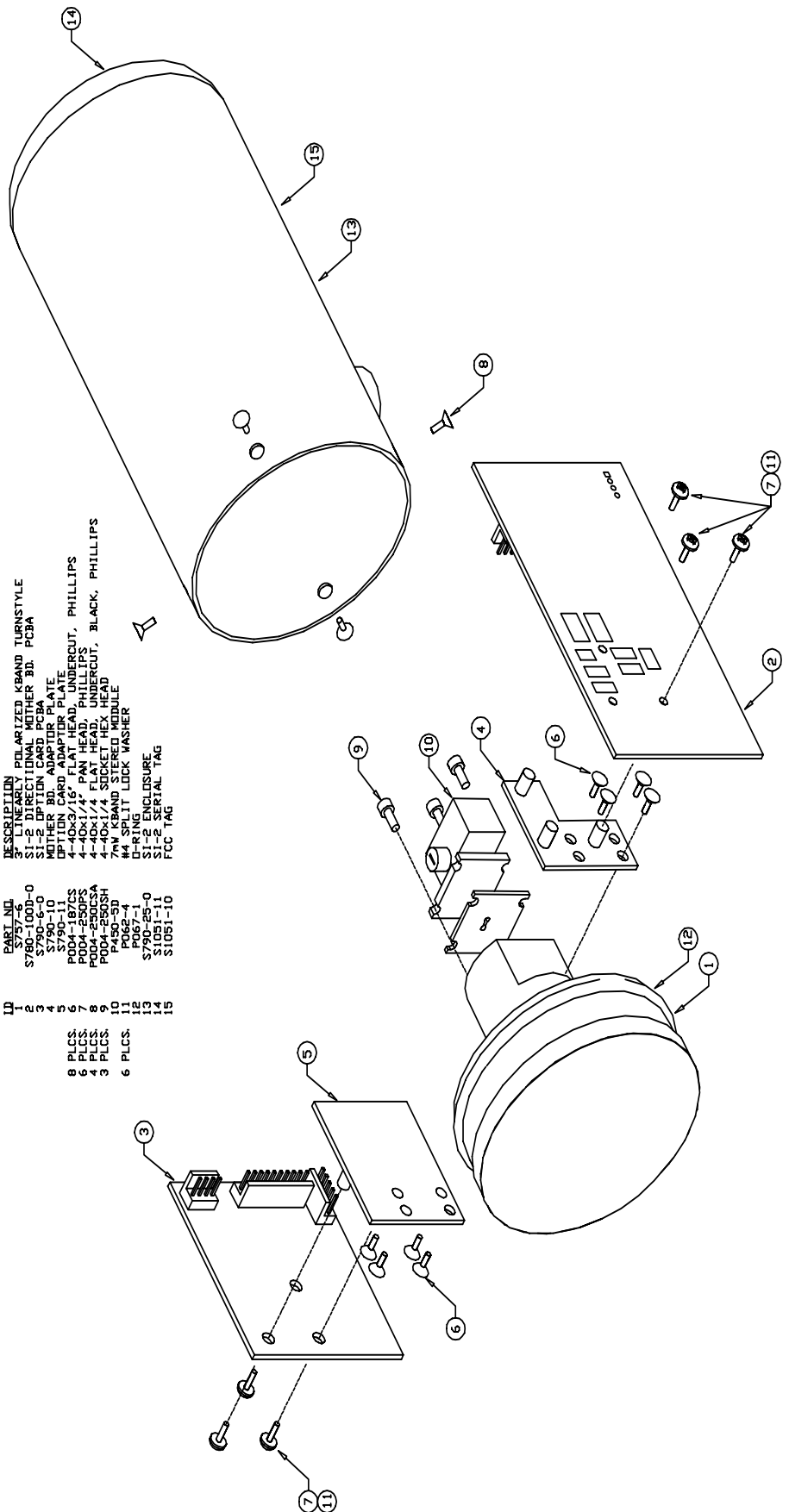
1. TWIST RED/BLACK WIRES TOGETHER TIGHTLY BEFORE INSTALLATION.
2. DB-9: (FOR DETAIL SEE P500-147-ASSY)
 - A) JACKET STRIP = 1.0", COMB OUT BRAID AND CUT BLACK WIRE FLUSH W/JACKET.
 - B) TRIM 'UNUSED' WIRES (SEE CHART) TO APPROXIMATELY .25"
 - C) DRESS BRAID TO ACCEPT 22 GAUGE CRIMP PIN/SOCKET OR CUT BACK BRAID AND SOLDER A 1.0" 22AWG BLACK WIRE TO BRAID.
 - D) STRIP 'USED' WIRES (SEE CHART) .1" +.05"/-.00" FROM END.
 - E) CRIMP 22 GAUGE (RED DOT) PIN/SOCKET TO BRAID/RED/BLACK WIRE AND CRIMP 26 GAUGE (BLUE DOT) PIN/SOCKET TO STRIPPED WIRES.
 - F) COVER BRAID/BLACK WIRE CONNECTION W/CHST (IF USED).
 - G) FOLD WIRES BACK ONTO JACKET AND COVER W/CLEAR HEATSHRINK TUBING (CHST).
 - H) ADJUST CHST FROM JACKET TO COVER FOLDED WIRES AND BRAID TO JACKET JUNCTION.
 - I) SHRINK CHST AND INSERT PINS/SOCKETS INTO CONNECTOR FROM REAR.
3. COVER: P500-148 (NOT SHOWN), INSTALLED AFTER TEST, FOR DETAILS SEE DRAWING #P500-148-ASSY. RUN RED/BLACK WIRES W/CABLE.
4. TEST CABLE: ACQUIRE CORRESPONDING (SAME PART NUMBER) TEST ADAPTER CABLE.
5. REV 'A' PUTS TITLE BLOCK AROUND DRAWING.

DECATUR ELECTRONICS INC. 715 BRIGHT STREET DECATUR, IL. 62522 PHONE (217) 428-4315	CONFIDENTIAL AND PROPRIETARY INFORMATION. NOT FOR USE, COPY, OR DISTRIBUTION, IN WHOLE OR IN PART, EXCEPT BY WRITTEN AUTHORIZATION ©COPYRIGHT 2000 DECATUR ELECTRONICS, INC. ALL RIGHTS RESERVED	DIMENSIONS IN INCHES TOLERANCE: ±.125" UNLESS NOTED DRAWN: <i>F. Burger</i> REV.: JDL CHK.: B BENZ ENG.: T J COTTLE	SCALE: N/A 16MAY94 01MAY00 01MAY00 01MAY00	TITLE: SI-2 PROGRAMMING CABLE
	SIZE: A DOCUMENT NUMBER: S769-127-0 REV.: A	DATE: 01MAY00 SHEET 1 of 1		

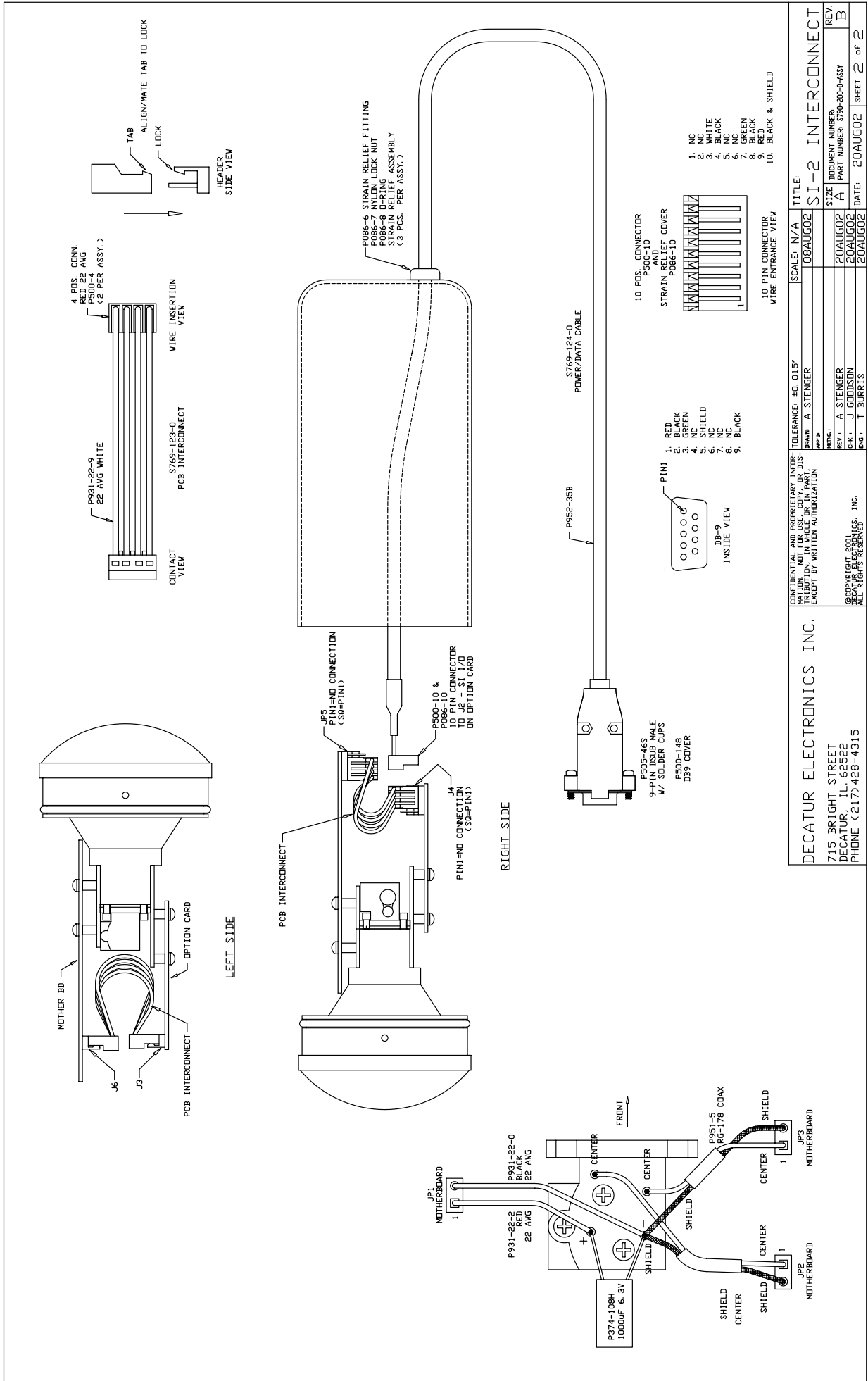
PART NO.	DESCRIPTION
S757-6	LINEARLY POLARIZED KBAND TURNSTYLE
S790-1000-0	SI-2 DIRECTIONAL MOTHER 3D. PCB
S790-670	MOTHER BOARD PCB
S790-11	MOTHER BOARD ADAPTOR PLATE
S790-11	OPTION CARD ADAPTOR PLATE
P004-187CS	4-40x3/16" FLAT HEAD, UNDERCUT, PHILLIPS
P004-250FS	4-40x1/4" PAN HEAD, PHILLIPS
P004-250SH	4-40x1/4" SOCKET HEX HEAD, UNDERCUT, BLACK, PHILLIPS
P430-5D	7MM KBAND STEREO MODULE
P065-4	#4 SPLIT LOCK WASHER
P065-5	1/4" PHENOLIC
S790-PS-0	SI-2 ENCLOSURE
S1051-11	SI-2 SERIAL TAG
S1051-10	FCC TAG

- 1D
 1 8 PLCS.
 2 6 PLCS.
 3 3 PLCS.
 4 6 PLCS.
 5
 6
 7
 8
 9
 10
 11
 12
 13
 14
 15

3 LINEARLY POLARIZED KBAND TURNSTYLE
 SI-2 DIRECTIONAL MOTHER 3D. PCB
 MOTHER BOARD PCB
 MOTHER BOARD ADAPTOR PLATE
 OPTION CARD ADAPTOR PLATE
 4-40x3/16" FLAT HEAD, UNDERCUT, PHILLIPS
 4-40x1/4" PAN HEAD, PHILLIPS
 4-40x1/4" SOCKET HEX HEAD, UNDERCUT, BLACK, PHILLIPS
 7MM KBAND STEREO MODULE
 #4 SPLIT LOCK WASHER
 1/4" PHENOLIC
 SI-2 ENCLOSURE
 SI-2 SERIAL TAG
 FCC TAG

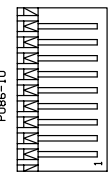


DECATUR ELECTRONICS INC.		SCALE: N/A	TITLE: SI-2 ASSEMBLY
715 BRIGHT STREET		DRWG: DBAUG02	DATE: 20AUG02
DECATUR, IL 62522		DESIGNER: A. STEINGER	REV. B
PHONE (217) 428-4315		CHECKER: A. STEINGER	REV. A
		APPR: T. BURKLE	REV. 1
			REV. 2
			REV. 3
			REV. 4
			REV. 5
			REV. 6
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			REV. 100

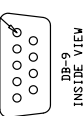


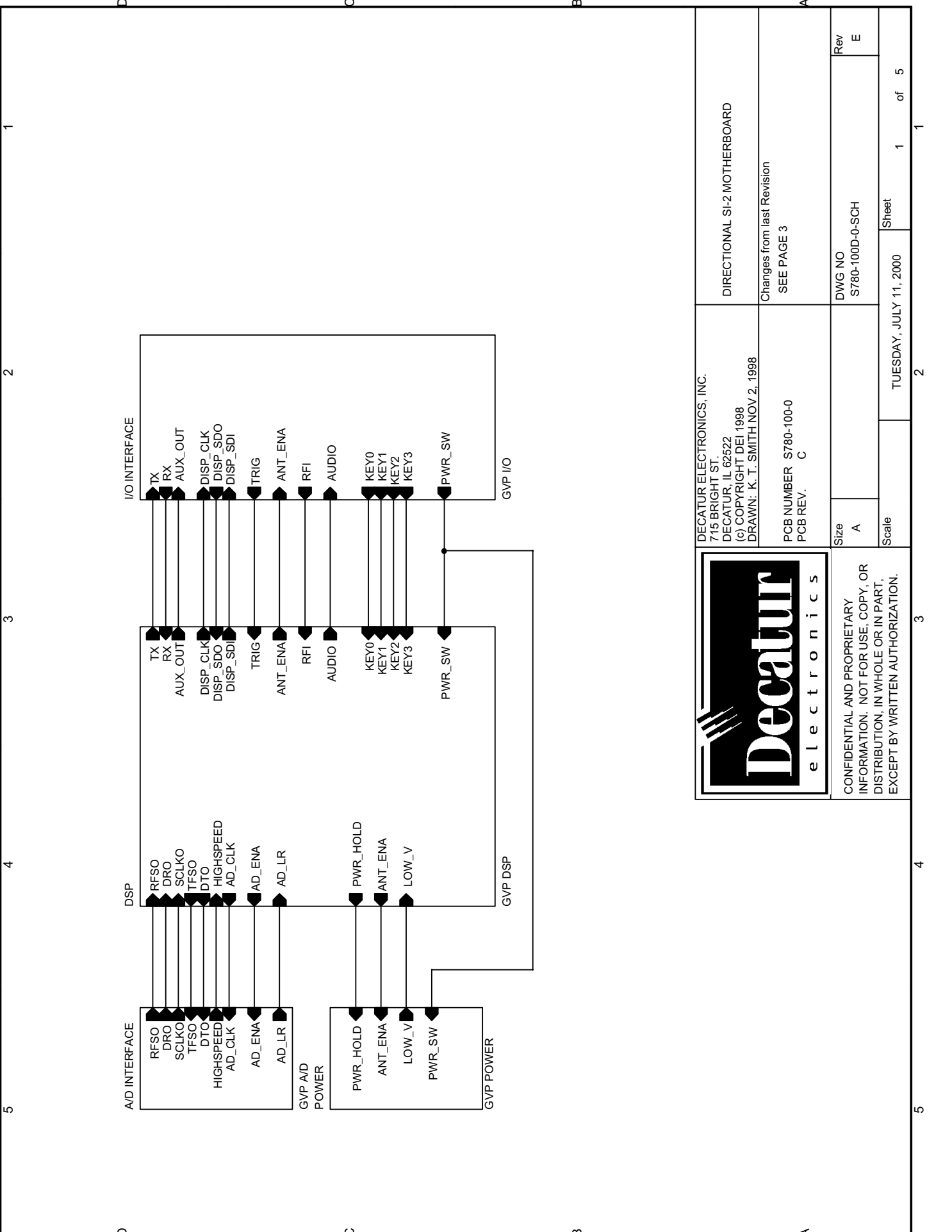
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715 BRIGHT STREET DECATUR, IL. 62522 PHONE (217) 428-4315		SCALE: N/A	
TOLERANCE: ±0.015"		DRAWN: A. STENGER	
CHECKED: J. GODDARD		DATE: 20AUG02	
ENGINEER: T. BURRIS		REV. B	
PART NUMBER: S790-00-ASSY		DOCUMENT NUMBER: A	
DATE: 20AUG02		SIZE: A	
SHEET 2 of 2		REV. B	

1. NC
2. WHITE
3. BLACK
4. NC
5. GREEN
6. BLACK
7. RED
8. BLACK & SHIELD



1. RED
2. BLACK
3. GREEN
4. NC
5. SHIELD
6. NC
7. NC
8. NC
9. BLACK





1

2

3

4

5

D

C

B

A

I/O INTERFACE


DSP

A/D INTERFACE

GVP I/O

GVP DSP

GVP POWER

		DECATUR ELECTRONICS, INC. 715 BRIGHT ST. DECATUR, IL 62522 (C) COPYRIGHT DEI 1998 DRAWN: K. T. SMITH NOV 2, 1998		DIRECTIONAL SI-2 MOTHERBOARD	
		Changes from last Revision SEE PAGE 3			
		PCB NUMBER S780-100-0 PCB REV. C		DWG NO S780-100D-0-SCH	
		Size A		Rev E	
		Scale TUESDAY, JULY 11, 2000		Sheet 1 of 5	

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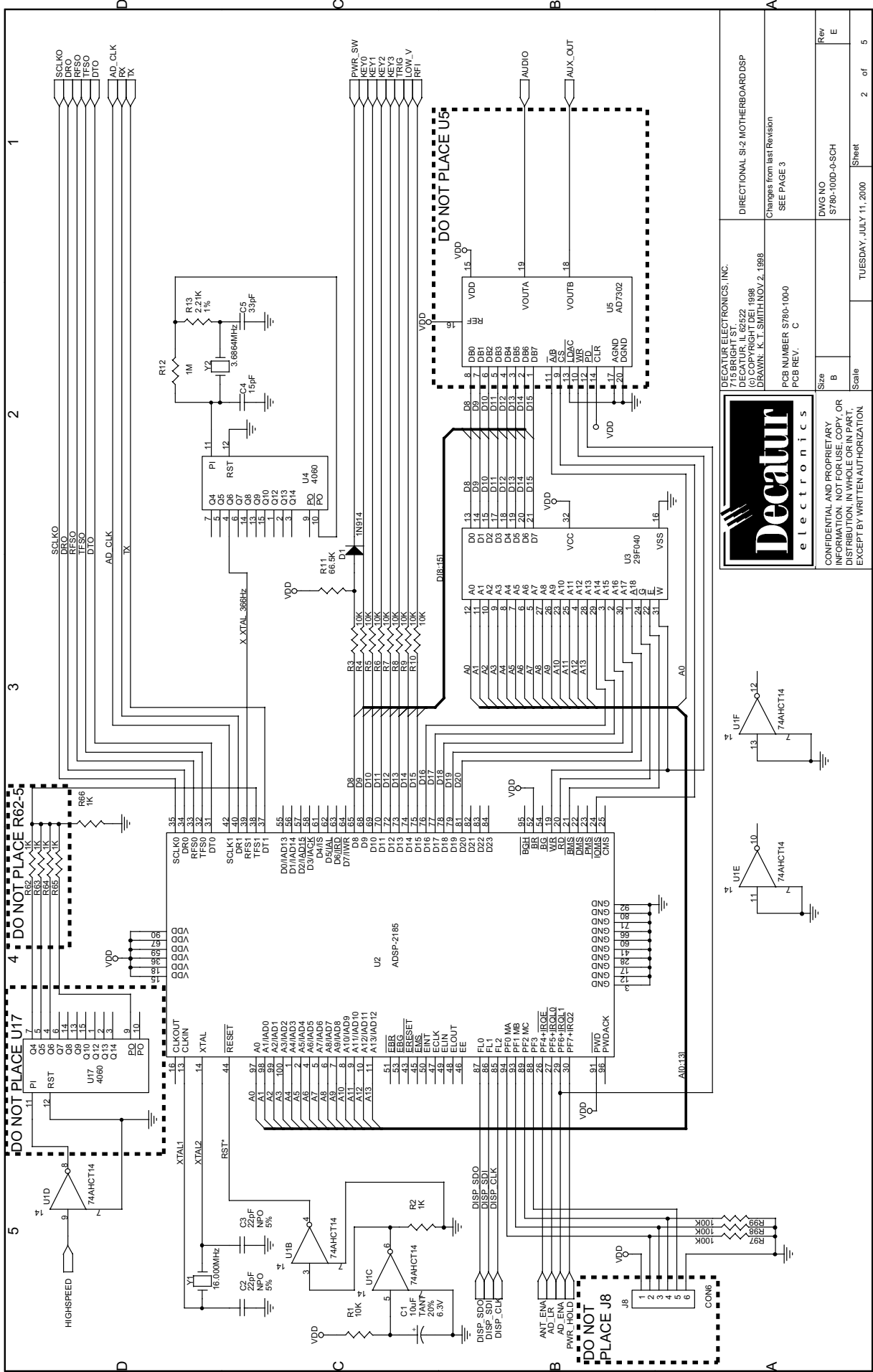
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D

C

B

A

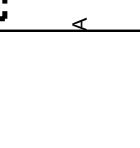
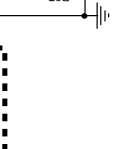
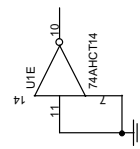


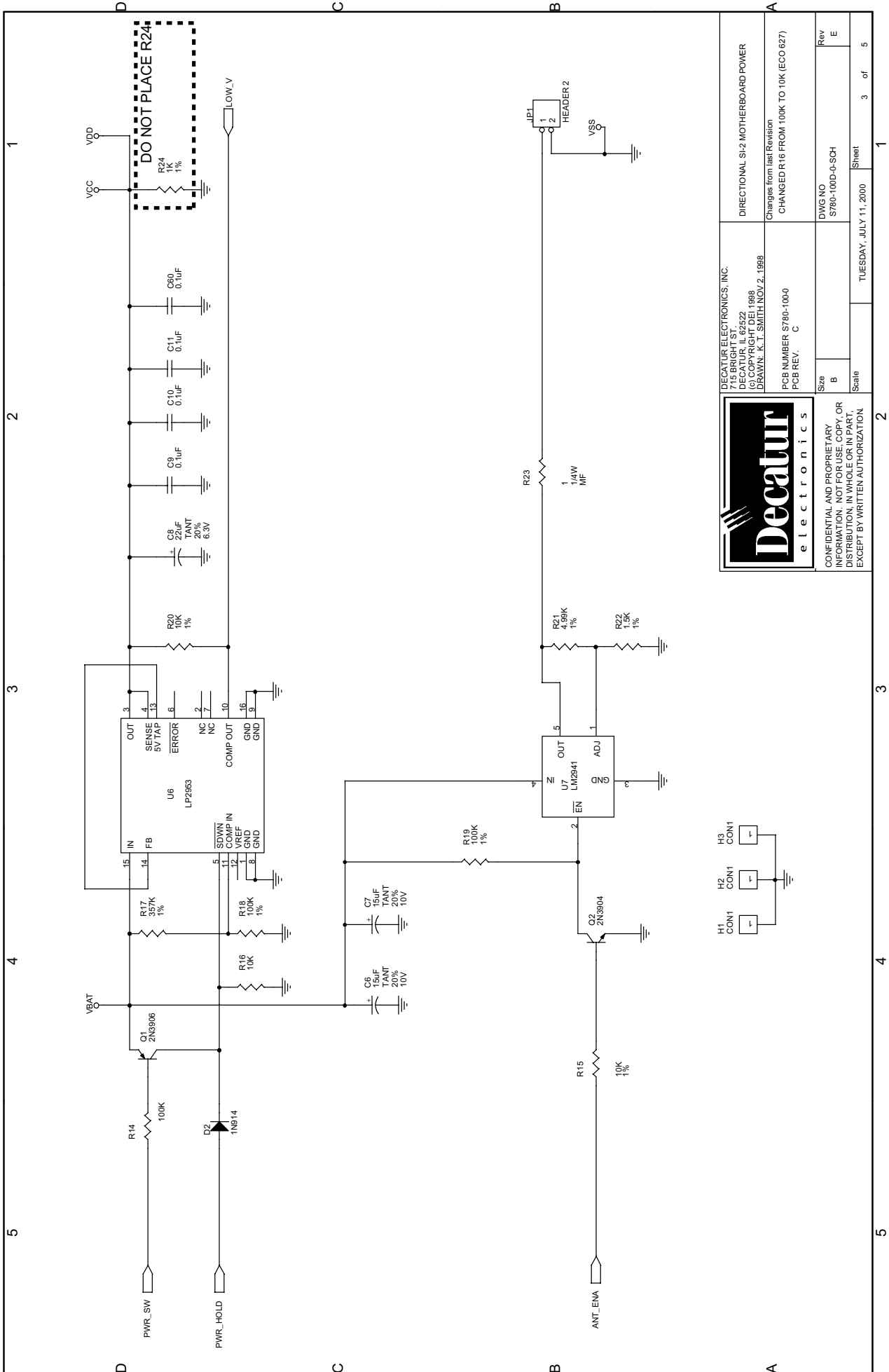
DECATUR ELECTRONICS, INC.
 DECATUR, IL 62522
 (C) COPYRIGHT DEI 1998
 DRAWING: K. T. SMITH NOV. 2, 1998
 PCB NUMBER: S780-1000
 PCB REV.: C

Size	B	DWG NO	S780-1000-0-SCH
Scale		Rev	E

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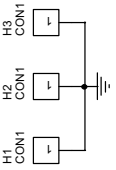
TUESDAY, JULY 11, 2000	Sheet	2	of	5
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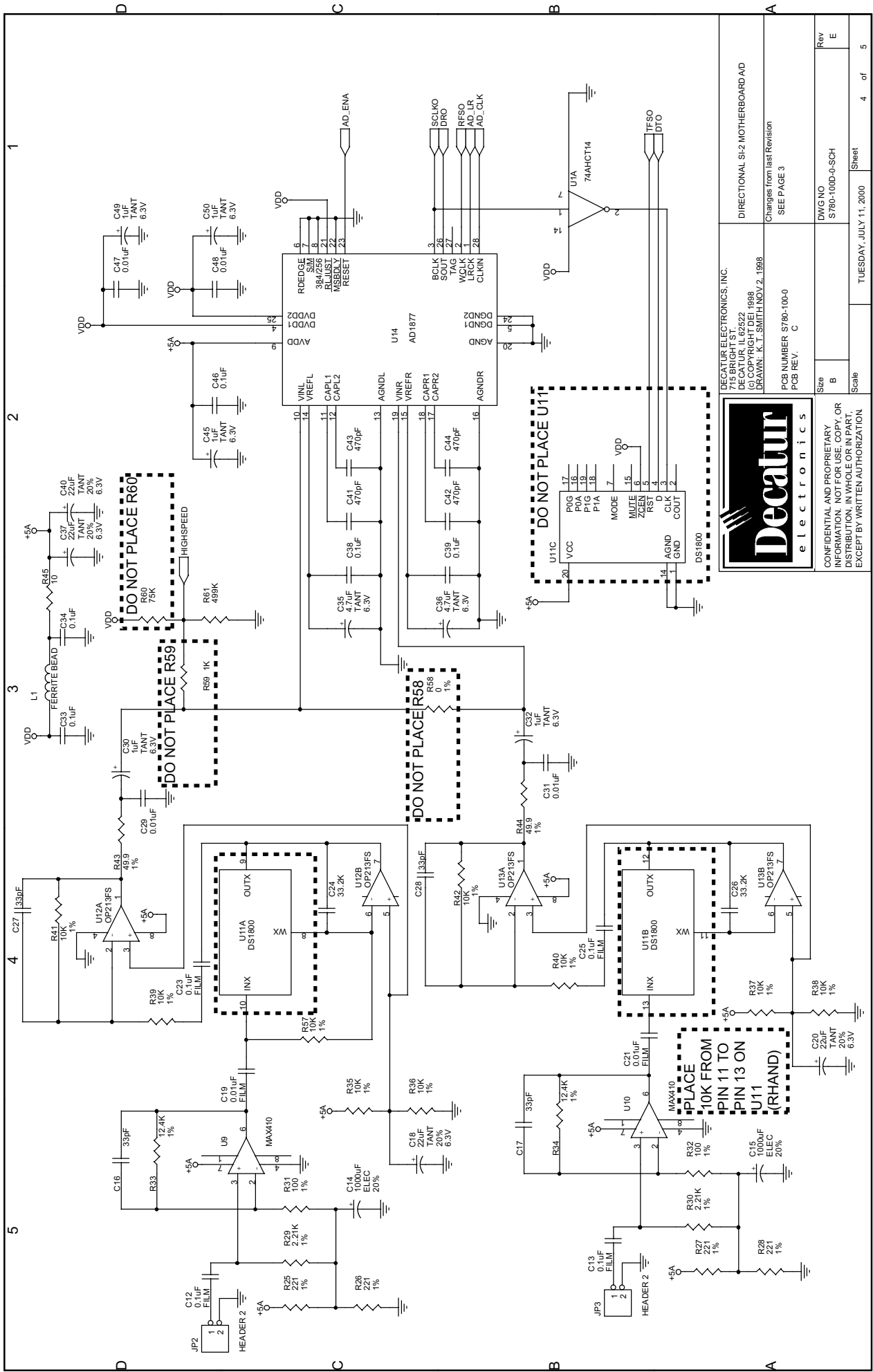




DECATUR ELECTRONICS, INC. 715 BRIGHT ST. DECATUR, IL 62522 (312) 426-1688 DRAWN: K.T. SMITH, NOV. 2, 1988		DIRECTIONAL SI-2 MOTHERBOARD POWER Changes from Last Revision CHANGED R16 FROM 100K TO 10K (ECO 627)	
PCS NUMBER S780-1000 PCB REV. C		DWG NO S780-1000-0-SCH	
Size B		Rev E	
Scale TUESDAY, JULY 11, 2000		Sheet 3 of 5	

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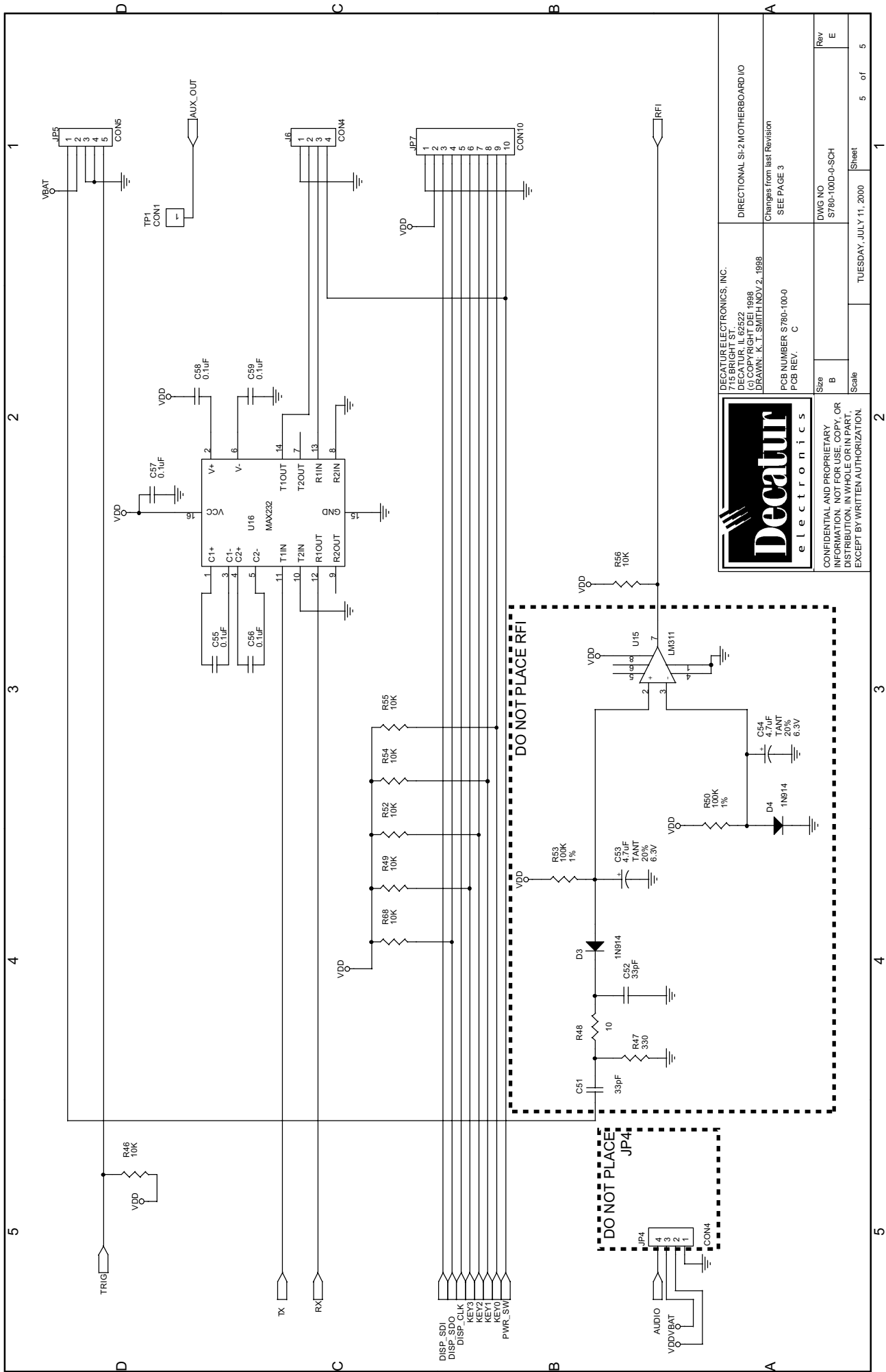
DECATUR ELECTRONICS, INC.
 7558 BRIGHT ST
 DECATUR, GA 30022
 (G) COPYRIGHT DEI 1988
 DRAWN: K.T. SMITH NOV. 2, 1988

PCB NUMBER: S780-100-0
 PCB REV: C

DIRECTIONAL SIZ: MOTHERBOARD
 Changes from last Revision
 SEE PAGE 3

Size	B	DWG NO	S780-100-0-SCH
Scale		Rev	E

TUESDAY, JULY 11, 2000
 Sheet 4 of 5



DECATUR ELECTRONICS, INC.
 715 BRIGHT ST.
 DECATUR, IL 62522
 (9) COPYRIGHT DEI 1998
 DRAWN: K. T. SMITH, NOV. 2, 1998

PCB NUMBER S780-100-0
 PCB REV. C

Changes from last Revision
 SEE PAGE 3

DIRECTIONAL SI-2 MOTHERBOARD I/O

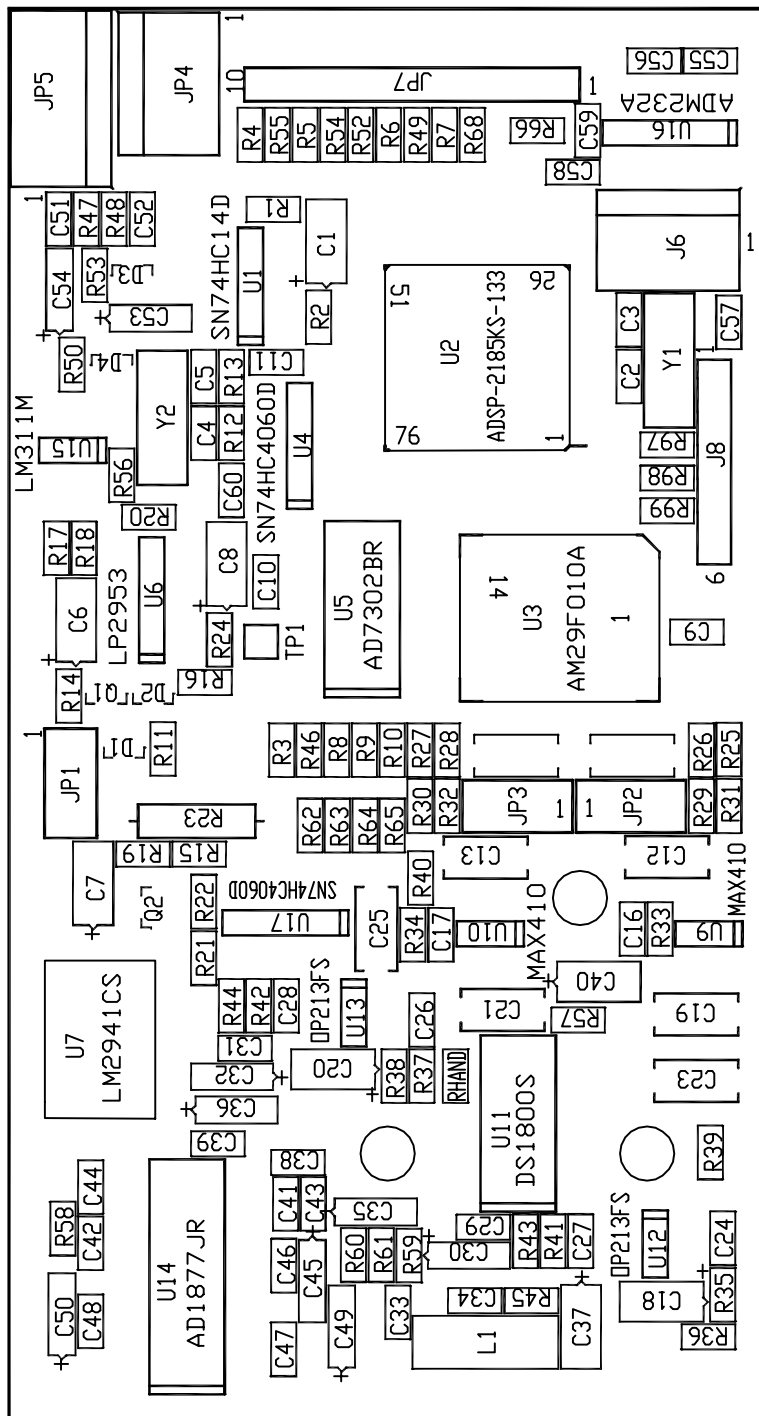
Size B
 Scale

DWG NO S780-100D-0-SCH
 Rev E

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TUESDAY, JULY 11, 2000
 Sheet 5 of 5

- C39 0.1uF
- C38 0.1uF
- C36 4.7uF
- C32 1uF
- C20 22uF
- C33 .1uF
- R58 470pF
- C42 470pF
- C46 0.1uF
- C50 1uF
- C45 1uF
- R60 499K
- R61 499K
- R59 499K
- C44 470pF
- C41 470pF
- C43 470pF
- C35 4.7uF
- C28 33pF
- R21 4.99K
- C25 0.1uF
- C7 15uF
- Q2 2N3904
- D1 1N914
- R11 66.5K
- R3 10K
- C28 33pF
- R21 4.99K
- C25 0.1uF
- C7 15uF
- Q2 2N3904
- D1 1N914
- R11 66.5K
- R3 10K
- R23 10HM
- R62 10K
- R63 10K
- R64 10K
- R65 10K
- R15 10K
- R19 100K
- R22 1.54K
- R15 10K
- R23 10HM
- R62 10K
- R63 10K
- R64 10K
- R65 10K
- R15 10K
- R19 100K
- R22 1.54K
- R15 10K
- R46 10K
- R8 10K
- R9 10K
- R10 10K
- R14 100K
- Q1 2N3906
- D2 1N914
- R16 10K
- R46 10K
- R8 10K
- R9 10K
- R10 10K
- R14 100K
- Q1 2N3906
- D2 1N914
- R16 10K
- C6 15uF
- R24 3.6864MHZ
- R17 357K
- R18 100K
- C8 22uF
- C10 0.1uF
- R20 10K
- C60 0.1uF
- R56 10K
- Y2 3.6864MHZ
- C4 15pF
- R12 1MEG
- R50 10K
- D4 33pF
- C5 33pF
- R13 2.21K
- C54 10K
- R53 10K
- R48 10K
- C52 10K
- C51 10uF
- R4 10K
- R55 10K
- R5 10K
- R54 10K
- R6 10K
- R49 10K
- R7 10K
- R68 10K
- C59 10K
- U16 ADM232A
- C55 0.1uF
- C56 0.1uF



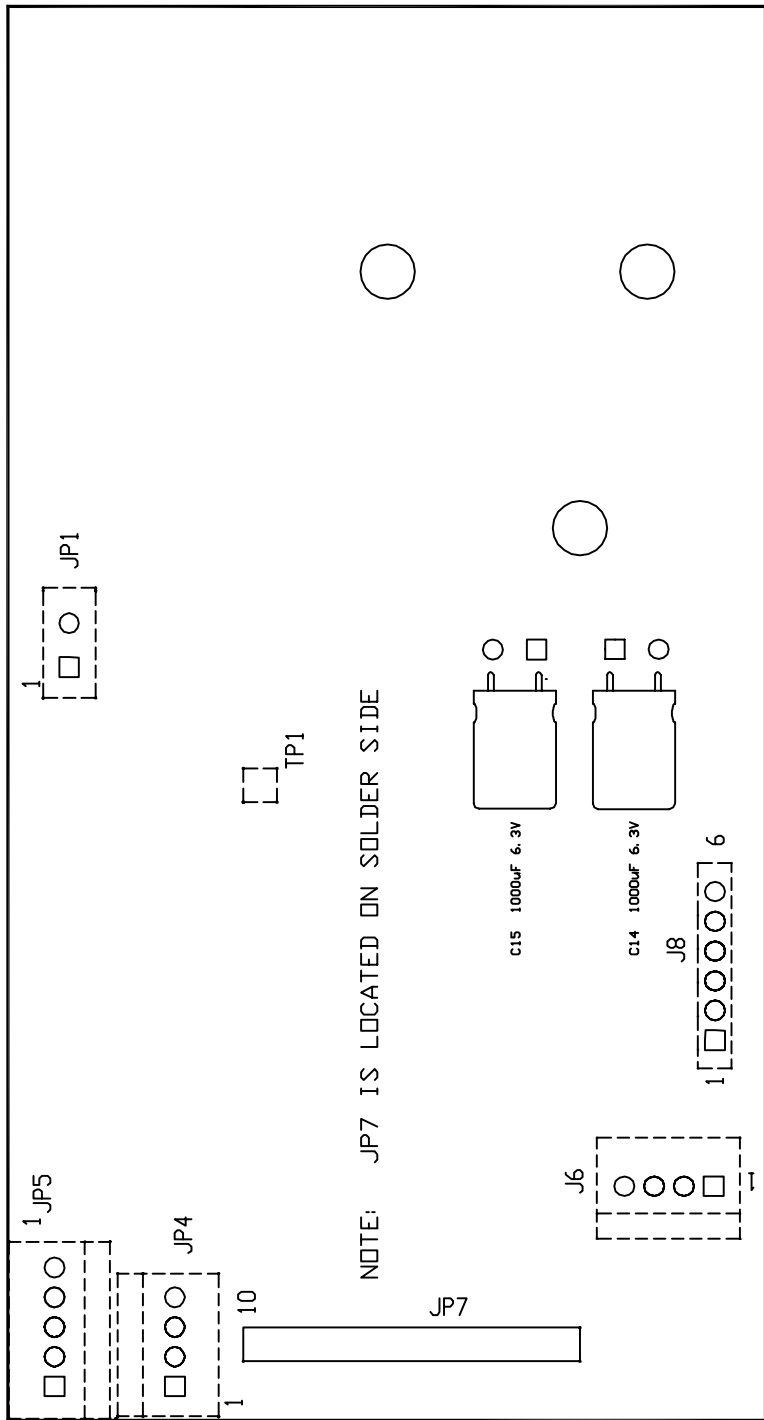
LEFT

RIGHT

- RHAND 10K
- L1 FERRITE
- C37 22uF
- C18 22uF
- R36 10K
- R35 10K
- C34 0.1uF
- R45 10
- C30 1uF
- R43 49.9
- R41 10K
- C27 33pF
- C24 33.2K
- C29 0.01uF
- R39 10K
- R37 10K
- C23 0.1uF
- C26 33.2K
- C21 0.01uF
- R57 10K
- C19 0.01uF
- R39 10K
- R34 12.4K
- C17 33pF
- C16 33pF
- R33 12.4K
- R40 10K
- C13 0.1uF
- C12 22uF
- R30 2.21K
- R32 100
- R29 2.21K
- R31 100
- R27 221
- R28 221
- R25 221
- C9 0.1uF
- R99 100K
- R98 100K
- R97 100K
- C2 22pF
- C3 22pF
- Y1 16.000MHZ
- C57 0.1uF
- C58 0.1uF
- R7 10K
- R68 10K
- R66 1K
- C59 0.1uF

CONFIDENTIAL AND PROPRIETARY INFORMATION. NOT FOR USE, COPY, OR DISTRIBUTION, IN WHOLE OR IN PART, EXCEPT BY WRITTEN AUTHORIZATION		N/A		DIRECTIONAL S1-2 MOTHERBOARD COMPONENT SIDE ASSEMBLY	
DRAWN:	KJS	APP'D:	27SEP99		
REV. 1:	JOL	CHECK#1:	B BENZ	A	S780-100D-0
CHECK#2:		CHECK#3:			
ENG. 1:	K J SMITH			30SEP99	1
					3

715 BRIGHT STREET
 DECATUR, IL, 62522
 PHONE (217) 428-4315



715 BRIGHT STREET DECATUR, IL. 62522 PHONE (217) 428-4315		CONFIDENTIAL AND PROPRIETARY INFORMATION NOT FOR USE, COPY, OR DISTRIBUTION, IN WHOLE OR IN PART, EXCEPT BY WRITTEN AUTHORIZATION		N/A		N/A	
		DRAWN: KJS	APP'D:	27SEP99	DIRECTIONAL SI-2 MOTHERBOARD SOLDER SIDE ASSEMBLY		
		REV. 1: JOL	CHECK#1: B BENZ	30SEP99	A	S777-100D-0	B
		CHECK#2:	ENG. 1: K J SMITH	30SEP99	30SEP99	2	3

STUFFING INSTRUCTION AND INSPECTION GUIDE

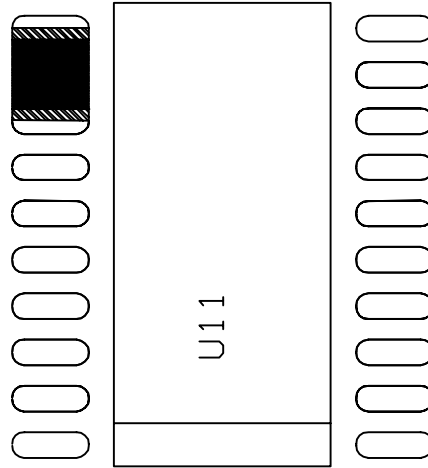
1. Y1 AND Y2 SHALL BE INSULATED FROM PCB BY BEADS OR WASHER
2. JP7 SHALL BE STUFFED ON THE SOLDER SIDE OF PCB
3. JP5 SHALL HAVE LOCKING TAB FACING TOWARDS BOTTOM SIDE OF PCB
4. J6 SHALL HAVE LOCKING TAB FACING TOWARDS RIGHT SIDE OF PCB
5. C14 and C15 TO BE RTVD TO SOLDER SIDE OF PCB.
6. C51, C52, C53, C54, D3, D4, JP4, J8, R24, R47, R48, R50, R53, R58, R59, R60, R62, R63, R64, R65, U5, U11, U15, U17 DO NOT STUFF
7. PANELIZED PCB WITH BREAK TABS.
 - A) TOP/BOTTOM OF PCB, TRIMMED WITH MINIMAL PROTRUSION FROM EDGE.
 - B) LEFT/RIGHT OF PCB, FLUSH WITH NO EXPOSED TRACES OR DE-LAMINATIONS.
8. DEI 100 PERCENT INSPECTION POINTS
 - A) PROPER VOLTAGE RATING ON C6, C7
9. WORKMANSHIP AND MATERIALS MUST MEET IPC-A-610 REV B CLASS 2 SPECIFICATIONS UNLESS NOTED.
10. RESISTOR RHAND TO BE PLACED BETWEEN PINS 11 AND 13 OF U11
SEE DETAIL BELOW FOR MORE INFORMATION

11. MOUNTING HOLES TO BE SOLDER FREE.
12. EACH BOARD TO BE LABELLED WITH A DATE CODE. LABELLING SHALL NOT INTERFERE WITH INSTALLATION OR OPERATION OF ASSEMBLY.
13. U3 PROGRAMMED WITH MOST RECENT VERSION OF BOOT LOADER CODE

GENERAL NOTE:

14. REV 'A' PUTS A TITLE BLOCK AROUND DRAWING.

10K RESISTOR PLACED
ACROSS PINS 11 AND 13
OF U11



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		DRAWN: KJS	APP'D:	27SEP99	DIRECTIONAL SI-2 MOTHERBOARD ASSEMBLY		
		REV. 1: JOL	30SEP99	A	S777-100D-0	B	
		CHECK#1: B BENZ	30SEP99				
		CHECK#2:	30SEP99				
		ENG. 1: K J SMITH	30SEP99				

MICROWAVE MODULE

The microwave module of the SI-2 consists of a directional Gunn oscillator assembly, which is connected to a machined horn lens antenna. The antenna radiates and receives the microwave energy and returns the Doppler signal to the receiver section. The receiver section contains two coupled high-sensitivity mixer diodes that receive the Doppler-shifted transmitted signal and a small amount of the microwave energy from the oscillator. The mixer diodes mix these two signals to produce two low-level output signals with a Doppler frequency shift of approximately 72Hz per mph of the target velocity and a phase shift between them to determine the target direction. Two coax cables connect the Doppler signal to the DSP board, and two wires connect the Gunn Oscillator to it.

SI-2 SIGNAL PROCESSING PRINTED CIRCUIT BOARD (PCB) S780-100

Preamplifiers

The heart of the preamplifiers is U9 and U10, MAX410 low-noise low-distortion operational amplifiers. These amplifiers with resistors R29, R31, R33 and capacitor C16 (U9), R30, R32, R34 and C17 (U10) form non-inverting operational amplifier configurations with resistors R31 and R33 (U9) and R32 and R34 (U10), setting the gain at approximately 42dB. Resistors R29 and R30 provide biasing current for the positive input of U9 and U10, respectively, while resistors R25 and R26 and capacitor C14 and R27 and R28 and capacitor C15 provide a 2.5VDC analog ground reference for U9 and U10, respectively. Capacitors C12 and C13 prevent DC current from entering U9 and U10, respectively. Capacitors C16 and C17 provide high-frequency noise filtering.

The second stage in this configuration provides approximately 10dB of gain. This section contains U12B and U13B, OP213 dual low-noise amplifiers. Capacitors C19 and C21 provide DC decoupling. Resistors R35 and R36 with capacitor C18 and resistors R37 and R38 with capacitor C20 form low-noise analog references for U12 and U13 respectively. R57 and C24, which a resistor replaces, set the gain for U12B. RHAND, sits on the pads for U11-pin 11 and U11-pin 13 and C26, which a resistor replaces, and sets the gain for U13B.

C23 and C25 decouple the output signals from the second amplifier stages to unity gain low-pass filters. These filters contain op-amp U12A, resistors R39, R41, and capacitor C27 and op-amp U13A, resistors R40, R42, and capacitor C28. Resistors R39, R40, R41, R42 set a fixed gain at 0dB. The outputs of U12A, pin 1, and U13A, pin 1, are applied to low-pass anti-aliasing filters composed of R43 and capacitor C29 and R44 and capacitor C31, respectively.

Analog to Digital (A/D) Converter

The analog to digital (A/D) converter section digitizes the analog outputs of the two preamplifier sections, transforming the analog information to a digital representation for further processing by the DSP chip. U14, a stereo 16-bit sigma delta A/D converter manufactured by Analog Devices, carries out the A/D conversion. This converter accepts an analog signal and converts it to 16-bit signed digital words. Capacitor pairs C35, C38 and C36, C39 provide power supply filtering for the references. Capacitors C45, C46 provide power supply filtering for the analog supply. Capacitors C47, C48, C49, and C50 provide power supply filtering for the digital supply. Ferrite bead L1 and capacitors C33, C34 filter high-frequency signals from entering the A/D converter's analog section. The DSP chip provides the sampling clock and is applied on pin 28 of U14. The digitized data from the converter is serially output on pins 1, 2, 3, and 26.

Digital Signal Processing

The DSP chip U2, an ADSP-2185 from Analog Devices, performs the following functions:

- (1) receives digitized Doppler signals from the antenna unit
- (2) communicates bi-directionally with a serial port device
- (3) retrieves operational parameters from the flash EPROM
- (4) detects low voltages
- (5) filters Doppler signals
- (6) checks accuracy against an external reference crystal
- (7) determines direction of each target.

U2, Y1, C2, and C3 form a resonant circuit oscillating at 16MHz to supply the clock frequency for the DSP chip. The DSP chip multiplies this frequency by a factor of four, which sets the instruction rate at 32 millions of instructions per second (MIPS).

U3, a 1M-bit flash memory chip, holds the software that the DSP chip executes. At power up, the DSP chip boot loads the software in U3 into internal high-speed program memory where program execution takes place.

The DSP has two serial ports. The first port receives digitized Doppler signals from the A/D converter. The second port provides bidirectional communication to an external serial device. Pins 31-35 are configured as serial port 0 (sport0), with pins 35, 34, and 33 receiving the clock, data, and frame synch respectively. Pins 37 to 42 are configured as serial port 1 (sport1); pins 37 and 40 are set to transmit and receive serial data respectively.

The remaining pins of the DSP chip provide additional I/O control over various parts of the radar unit. DSP Pins 19, 20, 21, and 24 are the control lines for the flash memory. Resistors R97, R98, and R99 control the boot-loading source of the software. On DSP Pin 26 (PF4), a logic high enables the antenna. DSP Pin 30 (PF7) controls power to the radar unit, where a logic high maintains power. DSP Pins 74 accomplishes low voltage detection. (A logic low represents an error condition.) Data lines [D8..D15] receive data from the flash during the boot-loading process at power up. Address lines A[0..13], including D16-D20, provide flash addressing (4-Mbit total address space.)

Second Crystal Check

U4, a 74HC4060 counter, generates the second frequency reference that the second crystal check needs. Y2 with resistors R12, R13 and capacitors C4, C5 set the oscillation frequency to 3.6864MHz. The output frequency of U4 at pin 4 is approximately 57,600Hz. This second crystal also provides the clock reference for the external serial port baud rates.

Reset Circuit

U1B and U1C with resistors R1, R2 and capacitor C1 form a reset circuit for providing the power-on reset for the DSP chip.

Power Supply

Power supplied externally to the SI-2 enters the DSP board at JP5 and is routed to two regulators, U6 and U7. U6, the main power regulator, is configured to supply +5VDC to all logic and analog circuits.

Resistors R17 and R18 program the low-voltage detect circuitry to trip at approximately 5.5VDC. Resistor R20 maintains the low-voltage output at logic high until a low-voltage threshold is met. Resistors R14, R16 and transistor Q1 form the power-on enable for the regulator. When the SI-2 is powered, current flows through the base of transistor Q1 and resistor R14 and forces the transistor to switch on. Collector current from transistor Q1 flows through resistor R16 increasing the voltage at the regulator enable pin 5. When the voltage at pin 5 exceeds a threshold, the regulator turns on and begins to supply power to the unit. After the unit powers up, the digital signal processor (DSP) maintains power to the unit by pulling pin 5 of U6 high within about 100ms.

Diode D2 protects the DSP chip from reverse currents from the regulator section.

U7 provides power to the Gunn oscillator, which generates the microwave energy. Transistor Q2 and resistors R15 and R19 form the enable circuitry for the Gunn oscillator power supply. The DSP turns on the regulator by bringing ANT_ENA to logic high, as long as power is applied to the SI-2 it will transmit. Resistors R21, R22, and R23 set the voltage on the Gunn oscillator. The nominal voltage level from the regulator is +5.51VDC.

Flash Memory

U3, a 1M-bit flash memory chip, holds the software that the DSP chip executes. At power up, the DSP chip boot loads the software in U3 into internal high-speed program memory where program execution takes place. U3 also stores the operational parameters for the radar unit.

Low Voltage and RFI Settings

Low voltage on the SI-2 requires no adjustments and is permanently set to trip around 5.5VDC. The RFI trip level is permanently set to trip at normally offending levels and requires no adjustments.

Serial Communication

U16, a MAX232 or equivalent interface chip, with capacitors C55, C56, C58, and C59 generate the proper voltage levels for RS232 transmit and receive signaling. C57 provides bypassing of the digital supply.

SI-2 ANTENNA SPECIFICATIONS

Antenna Type	Frequency	Nominal Power Out	Output Power Density	Beam Width	Detection Range
K-band	24.150GHz ±50 MHz	10mW nominal	0.5 mW/cm ²	12°	100 ft

Processor

Serial communications	RS232C
Data rate	Baud rates 1200, 2400, 9600, 19200
Data format	(Various, see selectable RS232 output protocols below.)
Target acquisition time	0.021ms

General

Supply voltage	10.8VDC – 24VDC
Nominal current draw	+12V (.250mA) +24V (.120mA)
Surge current requirements	1 Amp
Operating temperature	-22°F to +158°F (-30°C to +70°C)
Maximum Humidity	100% (Unit is weatherproof, not waterproof)
Polarization	Linear

Mechanical

Weight	1.60 lbs. (0.73 kg)
Length	8 in (20.3 cm)
Width	3 in (7.6 am)

Accuracy

Speed range	2 – 200 mph
Accuracy	±0.1 mph (±0.1 kph)

DB-9 Connector Pinout

Signal	DB-9 Connector
+12VDC power	1 (red)
RS232 TX	2 (black)
RS232 RX	3 (green)
Ground (shield)	5 (brown)
Ground	9 (black)

Output Rate

Selectable output rate	1-10 times per second
When target speed changes	
When polled	Data hold time: 1-10 seconds
Low/high speed cutoff	

Power

Input voltage 10.8 – 24VDC

Angle and Direction

Two angle corrections from 0° – 45°
Direction (D) report switch ON/OFF
D = + (approaching target)
D = - (receding target)
D = ? (target from unknown direction)

Selectable RS232 Output Protocols

You can set the RS232 output to one of the following, where D is the optional direction indicator + (toward), - (away), or ?, and A is the target amplitude in dB. Formats in which you want the reported speed to display are as follows:

8N1 <D> <ASCII hundreds> <ASCII tens> <ASCII ones> <CR>
8N1 <D> <ASCII S> <ASCII tens> <ASCII ones> <CR> <7-bit checksum>
8N1 <D> <ASCII hundreds> <ASCII tens> <ASCII ones> <.> <ASCII tenths> <CR>
8N1 <D> <ASCII *> <D><ASCII hundreds> <ASCII tens> <ASCII ones> <.> <ASCII tenths> <.> <3 ASCII characters representing received signal strength in dB 000 through 225> <CR> <LF>
8N2 <D> <ASCII hundreds> <ASCII tens> <ASCII ones> <.> <ASCII 0000.0> <CR>
8N1 <D> HEX [2][84][1][SPEED][1][AA][3]

SI-2 CONTROL FUNCTIONS

Software Installation Instructions

1. Insert the SI-2 disk in the floppy disk drive and/or downloaded SI2Config.exe file. Place it in the folder in which you want it to reside.



SI2Config.exe icon

2. Click the Windows® Start button and choose Run from the Startup menu.
3. Type the name of the file location. For example, if you are using the SI2Config.exe file from your floppy drive called A:, you type A:\SI2Config.exe. You can also use the Browse button to navigate to your floppy drive, then double click the file SI2Config.exe.
4. The Configuration Install dialog box appears. Click the Setup button to start the setup program.



Configuration Install dialog box

5. Follow the instructions on your screen. Most users simply repeatedly click the Next button.



SI-2 Config Setup Program

6. Click the Finish button to exit the Setup program.
7. You will now want to configure your SI-2. Continue to the next page, Configuration Instructions.

Software Configuration Instructions

You configure the SI-2 radar device using the SI-2's attached RS232 cable and an IBM-compatible PC with SI-2 configuration software.

To begin the configuration, you need the following:

- SI-2 radar device
- SI-2 RS232 programming cable
- IBM-compatible PC with Windows® OS (95/98, 2000, WinMe and XP) and an open serial port (COM1)
- SI-2 Configuration software
- 12V power supply with a power switch

1. Shut down your computer.
2. Attach the programming cable to the PC's open serial port, using the end of the cable that is *without* the red and black twisted-pair cable.
3. Power up the PC.
4. Attach the radar device's 9-pin connector to the other end of the programming cable (the end with the red and black twisted-pair cable).
5. If the power supply is on, turn it off.
6. Connect the red and black twisted-pair cable to the power supply with the red wire connecting to positive (+) and the black wire connecting to negative (-).
7. Start the configuration software by double-clicking the Config icon. The Configure Program dialog box will emerge, as Figure 1 shows.



Figure 1 Click Update in the Configure Program dialog box.

8. Click Update. The Update and Configure Unit dialog box will come into view, as Figure 2 shows. Note the instructions in the dialog box.



Figure 2 Click Configure in the Update and Configure Unit dialog box.

9. Click Configure.
10. Within 5 seconds of clicking configure, turn on the power supply.
11. When the program establishes the connection with the SI-2, the Establishing Connection message will appear in the dialog box, as Figure 3 shows.



Figure 3 Establishing connection with the SI-2

If the program times out before you turn on the power supply, the No Unit Detected dialog box (Figure 4) appears.

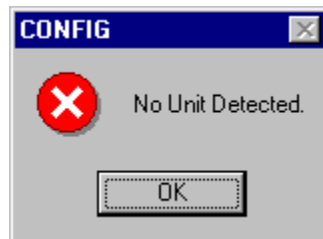


Figure 4 No Unit Detected appears when the program times out before you turn on the power supply.

If “No Unit Detected” occurs, you need to turn off the power supply and click OK. Then repeat the start-up process, by clicking Configure in the Update and Configure Unit dialog box.

After you establish a successful connection with the SI-2 device, the main dialog box appears, as Figure 5 shows. This dialog box is where you choose configuration options and modify existing settings.

IMPORTANT: See Appendix A Table of OEM Supported Settings in the back of this manual for the specific settings to use in this dialog box. Our customers have chosen their own specific settings. (THEY DO NOT ALL HAVE THE SAME SETTINGS.)

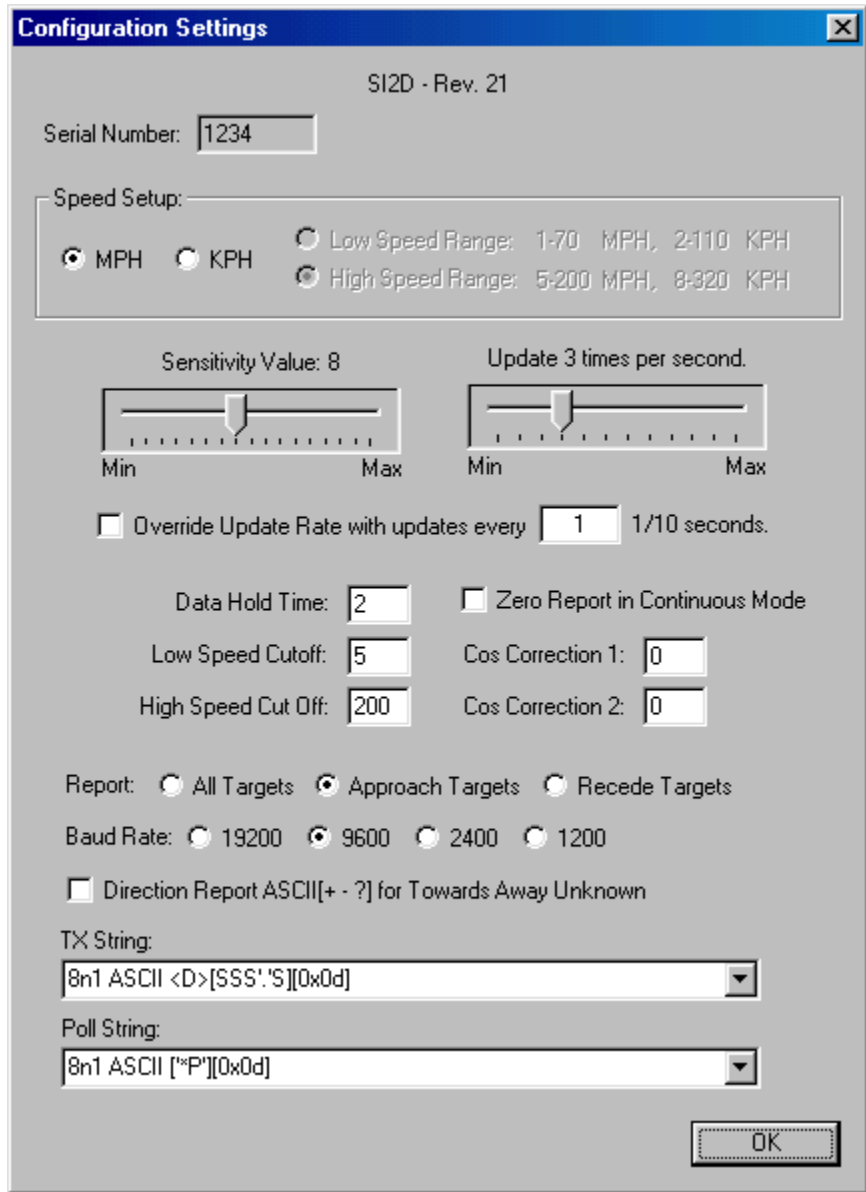


Figure 5 Adjust the configuration settings in this dialog box to the specific settings listed in Appendix A.

The configuration software saves your settings and opens with the settings that were last made to the SI-2.

Serial Number

The Serial Number box shows a digitally encoded serial number of the SI-2 you are connected to.

Speed Setup

You can select the Speed Setup to mph or kph for the following speed ranges. The ranges are determined by the hardware and can not be altered by the configuration program.

Valid Speed Ranges		
Low	1-70 mph	2-110 kph
High	5-200 mph	8-320 kph

Sensitivity Value

The Sensitivity Value slider bar ranges from a minimum of 1 (least sensitive) to a maximum of 17 (most sensitive).

Rate of Update

This slider bar sets the rate that you want the speed to report (polled, at a fixed interval, or when the speed changes). If you set the slider to Min, the speed rate will update when polled, or you can move the slider to the right to set how many times (between 1 and 10 times per second) you want the radar device to report. You can also set the device to update only when the speed changes by moving the slider to the far right position.

Override Update Rate

Checking the Override Update Rate check box lets you override the update rate with a value ranging from 1 to 100 in 1/10 second intervals between updates.

Data Hold Time

The Data Hold Time lets you set the time (from 0 to 10 seconds) to continue reporting the last valid target after it is lost and no new target is replacing it. In other words, the speed will display for the set time until a new target speed replaces it or until the device reaches the set time. If there is no new target speed after the data hold time elapses, the software will report a 0.

Zero Report in Continuous Mode

If the Zero Report in Continuous Mode check box is checked, the system will send zero speed packets every two seconds when a valid speed target is not present. This mode only applies if the unit is set to update only when the speed changes. (Note: This is the speed before the cosine error corrections are applied.)

Low Speed Cutoff

The Low Speed Cutoff option is the lowest speed within the valid speed range that you want the SI-2 to report (see the Valid Speed Ranges above.) Be sure to enter a speed that is less than the highest speed. (Note: This is the speed before the cosine error corrections are applied.)

High Speed Cutoff

The High Speed Cutoff is the highest speed within the valid speed range that you want to report (see the Valid Speed Ranges above.) Be sure you enter a speed that is greater than the lowest speed.

Cosine Correction Angles

To correct cosine angle errors to adjust for the correct speed, set the Cosine Correction Angle boxes to an angle, between 0° and 45°. You can correct for one or two angles.

Report

The Report option lets you choose to report the activity of all targets, approaching targets, or receding targets. During the first minute after power up, the SI-2 will report all targets regardless of the selection above. This allows you to test the unit with a tuning fork.

Baud Rate

You can set the Baud Rate option to 19200, 9600, 2400, or 1200 to match the speed of the device the unit is connected to.

Direction Report

If you want to report the target's direction, click the Direction Report check box. + (toward), - (away) or ? (unknown) will appear in the <D> field in the Tx String. If you don't check the box, nothing will show up in the <D> field .

Tx String

The Tx String pull-down menu lets you pick the format in which you want the reported speed to show. The following are represented in the Tx String:

8N1 <D> <ASCII hundreds> <ASCII tens> <ASCII ones> <CR>
8N1 <D> <ASCII S> <ASCII tens> <ASCII ones> <CR> <7-bit checksum>
8N1 <D> <ASCII hundreds> <ASCII tens> <ASCII ones> <.> <ASCII tenths> <CR>
8N1 <D> <ASCII *> <D><ASCII hundreds> <ASCII tens> <ASCII ones> <.> <ASCII tenths> <,> <3 ASCII characters representing received signal strength in dB 000 through 225> <CR> <LF>
8N2 <D> <ASCII hundreds> <ASCII tens> <ASCII ones> <,> <ASCII 0000.0> <CR>
8N1 <D> HEX [2][84][1][SPEED][1][AA][3]
D = optional direction indicator (+, -, or ?) A = target amplitude in dB

Poll String

The Poll String pull-down menu lists the available formats that you can use to request a speed update from the SI-2. It is only enabled when you select Update When Polled as the Rate of Update.

After making your selections, click OK. A dialog box will come into view that says Configuration Completed, as Figure 6 shows. Then click OK and remove power from the SI-2 device.

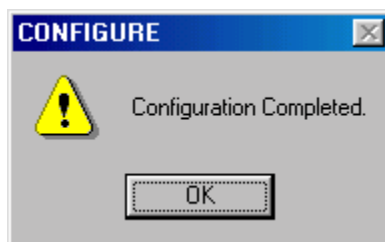


Figure 6 This dialog box indicates the SI-2 has finished configuring.

SI-2 PARTS LIST

SYSTEM INTERFACE (SI-2) BILL OF MATERIALS

LEVEL	ITEM#	QTY	DEI PART#	REF#	DESCRIPTION
3	1	1	S780-100-DR	PCB	DSP PCB
	2	1	P381-0150	C4	15pF CAP 50V 5% 0805 NPO CER
	3	2	P381-0200	C2,C3	22pF CAP 50V 5% 0805 NPO CER
	4	5	P381-0300	C5,C16,C17, C27,C28	33pF CAP 50V 5% 0805 NPO CER
	5	4	P381-0471	C41,C42,C43, C44	470pF CAP 50V 10% 0805 X7R
	6	4	P381-103	C29,C31,C47, C48	0.01uF CAP 50v 10% 0805 X7R
	7	2	P372-103C	C19,C21	0.01uF CAP 50V 5% POLYESTER FILMCAP
	8	14	P381-104	C9,C10,C11, C33,C34,C38, C39,C46,C55, C56,C57,C58, C59,C60	0.1uF CAP 50V 10% 0805 X74 CER
	9	4	P372-104E	C12,C13,C23, C25	0.1uF FILM CAP 50V 10% .2" SPACING
	10	5	P382-105	C30,C32,C45 C49,C50	1uF TANT CAP 6.3V 20% 3216
	11	2	P382-475	C35,C36	4.7uF TANT CAP 6.3V 20% 3216
	12	1	P382-106	C1	10uF TANT CAP 6.3V 20% 3216
	13	2	P382-156	C6,C7	15uF TANT CAP 10V 20% 3528
	14	5	P382-226	C8,C18,C20, C37,C40	22uF TANT CAP 6.3V 20% 3528
	15	2	P371-108	C14,C15	1000uF ELEC CAP 6.3V 20% ELECT CAP
	16	2	P411-1N914A	D1,D2	SWITCHING DIODE, SOT-23 SMD
	17	1	P505-167	J6	HEADER STRAIGHT 4-PIN PCB
	18	1	P505-168	JP5	HEADER STRAIGHT 5-PIN PCB
	19	1	P505-169	JP7	HEADER RIGHT ANGLE 10 PIN
	20	1	P615-22	L1	FERRITE BEAD
	21	1	P411-2N3906	Q1	PNP SWITCHING TRANS SOT-23 SMD
	22	1	P411-2N3904	Q2	NPN SWITCHING TRANS SOT-23 SMD
	23	1	P349-10	R23	1 OHM MF 1/4W 5% RESISTOR
	24	1	P342-0100	R45	10 OHM MF 1% 0805
	25	2	P342-49R9	R43,R44	49.9 OHM MF 1% 0805
	26	2	P342-1000	R31,R32	100 OHM MF 1% 1/10W 0805

LEVEL	ITEM#	QTY	DEIPART#	REF#	DESCRIPTION
	27	4	P342-2210	R25,R26,R27,R28	221 OHM MF 1% 1/10W 0805
	28	2	P342-1001	R2,R66	1K MF 1% 1/10W 0805
	29	1	P342-1541	R22	1.54K MF 1% 1/10W 0805
	30	3	P342-2211	R13,R29,R30	2.21K MF 1% 1/10W 0805
	31	1	P342-4991	R21	4.99K MF 1% 1/10W 0805
	32	29	P342-1002	R1,R3,R4,R5, R6,R7,R8,R9, R10,R15,R16, R20,R35,R36, R37,R38,R39, R40,R41,R42, R46,R49,R52, R54,R55,R56, R57,R68, AT U11 PINS 11 AND 13	10K MF 1% 1/10W 0805
	33	2	P342-1242	R33,R34	12.4K OHM MF 1% 1/10W 0805
	34	2	P342-3322	C24,C26	33.2K MF 1% 1/10W 0805
	35	1	P342-6652	R11	66.5K MF 1% 1/10W 0805
	36	1	P342-4993	R61	499K OHM MF 1% 1/10W 0805
	37	6	P342-1003	R14,R18,R19, R97,R98,R99	100K MF 1% 1/10W 0805
	38	1	P342-3573	R17	357K MF 1% 1/10W 0805
	39	1	P342-1004	R12	1M MF 1% 1/10W 0805
	40	1	P410-74HC14	U1	HEX INVERTING SCHMITT TRIG SOIC 14
	41	1	P410-ADSP-2185	U2	ADSP-2185 IC 100-LEAD TQFP
	42	1	P410-AM29F010A	U3	29F010A 1M FLASH 32-PIN PLCC
	43	1	P410-74HC4060	U4	14 STAGE RIPPLE COUNTER SOIC 16
	44	1	P410-LP2953	U6	ADJ REG 250mA SOIC 16
	45	1	P410-LM2941	U7	IC ADJ REG 1A 5-PIN DPAK TO-263
	46	2	P410-MAX410	U9,U10	IC VERY LOW NOISE OP-AMP SOIC 8
	47	2	P410-OP213	U12,U13	DUAL LOW NOISE OP-AMP SOIC 8
	48	1	P410-AD1877JR	U14	16-BIT SIGMA-DELTA CONVERTER SOIC 28
	49	1	P410-MAX232	U16	RS232 INTERFACE PORT SOIC 16
	50	1	P660-16.000MHZ	Y1	16.000MHz CRYSTAL
	51	1	P367-3.6864	Y2	3.6864MHz CRYSTAL
	52			C51,C52,C53, C54,D3,D4, JP4,J8,R24, R47,R48,R50, R53,R58,R59, R60,R62,R63, R64,R65,U5, U11,U15,U17	DO NOT PLACE

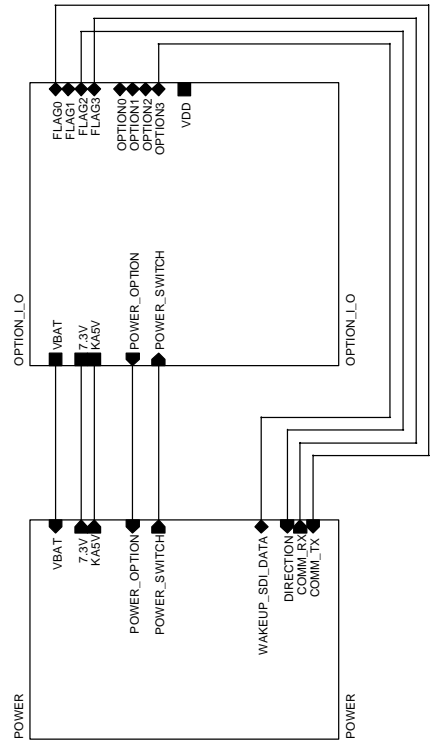
*RHAND IS A 10K RESISTOR PLACED BETWEEN PINS 11 AND 13 OF U11. SEE INSPECTION DRAWING FOR MORE DETAIL.

SI-2 OPTION CARD OPERATION AND CIRCUITRY

BLOCK DIAGRAM	60
SCHEMATICS	61
COMPONENT PLACEMENT MAPS	64
CIRCUITRY DESCRIPTION	68

1 2 3 4 5

D C B A



DECATUR ELECTRONICS, INC.
 ADDRESS: 1152522
 DECATUR, IL 62522
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 DRAWN: K. T. SMITH MAY 27, 1999

DIRECTIONAL SI-2 OPTION CARD
 Changes from last Revision
 SEE PAGE 3

PCB NUMBER S790-5-0
 PCB REV. A

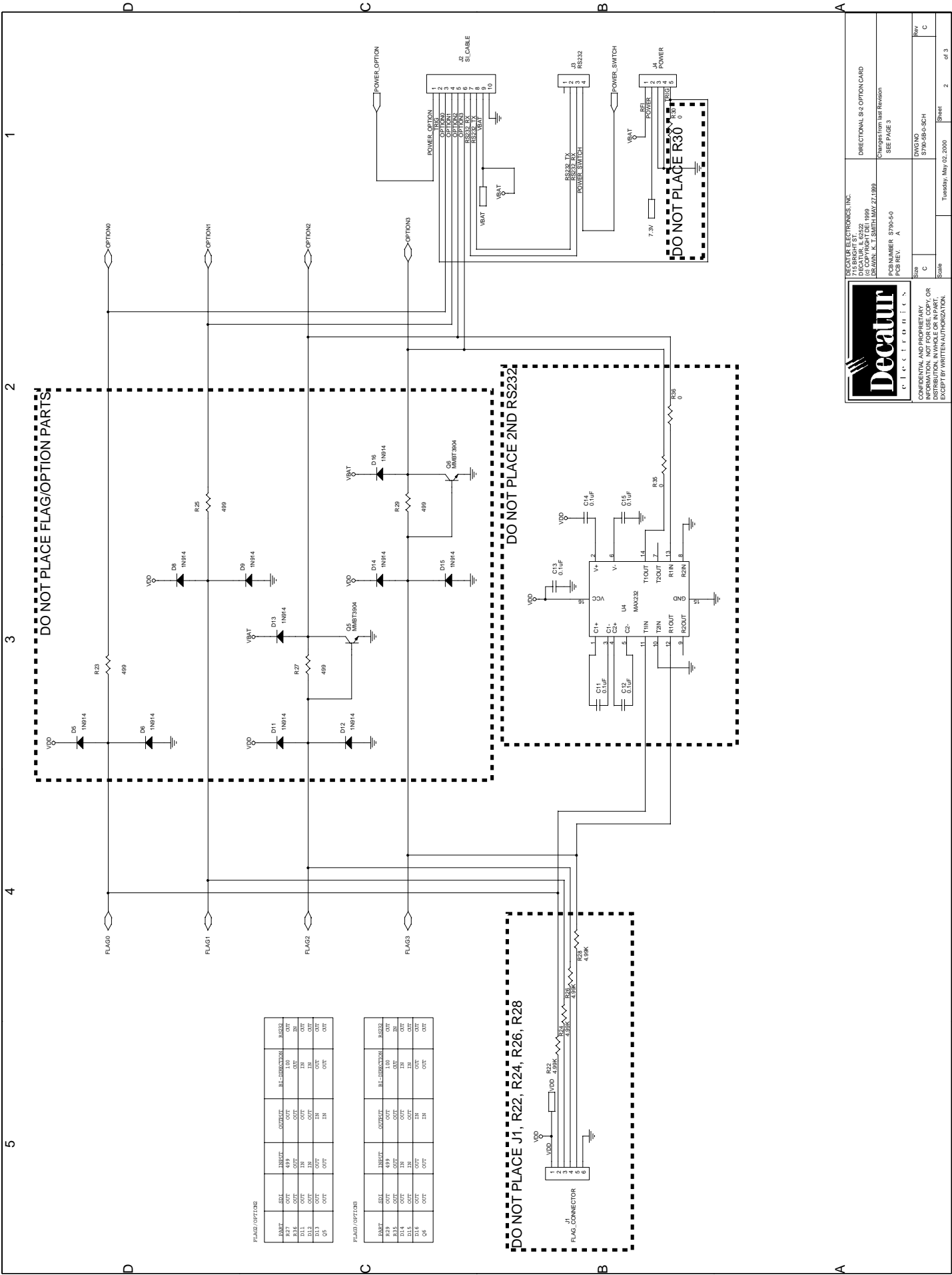
Size B
 Scale

DWG NO. S790-5B-0-SCH
 Rev C

Tuesday, May 02, 2000
 Sheet 1 of 3

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2 3 4 5



FLAG/OPTIONS

PART	QTY	REF	DESCRIPTION	FLAG/OPTIONS
R23	499	499	RES 1/2W 100K	OPTION0
R24	499	499	RES 1/2W 100K	OPTION1
R25	499	499	RES 1/2W 100K	OPTION2
R26	499	499	RES 1/2W 100K	OPTION3
R27	499	499	RES 1/2W 100K	OPTION4
R28	499	499	RES 1/2W 100K	OPTION5
R29	499	499	RES 1/2W 100K	OPTION6
R30	499	499	RES 1/2W 100K	OPTION7
R31	499	499	RES 1/2W 100K	OPTION8
R32	499	499	RES 1/2W 100K	OPTION9
R33	499	499	RES 1/2W 100K	OPTION10
R34	499	499	RES 1/2W 100K	OPTION11
R35	499	499	RES 1/2W 100K	OPTION12
R36	499	499	RES 1/2W 100K	OPTION13
R37	499	499	RES 1/2W 100K	OPTION14
R38	499	499	RES 1/2W 100K	OPTION15
R39	499	499	RES 1/2W 100K	OPTION16
R40	499	499	RES 1/2W 100K	OPTION17
R41	499	499	RES 1/2W 100K	OPTION18
R42	499	499	RES 1/2W 100K	OPTION19
R43	499	499	RES 1/2W 100K	OPTION20
R44	499	499	RES 1/2W 100K	OPTION21
R45	499	499	RES 1/2W 100K	OPTION22
R46	499	499	RES 1/2W 100K	OPTION23
R47	499	499	RES 1/2W 100K	OPTION24
R48	499	499	RES 1/2W 100K	OPTION25
R49	499	499	RES 1/2W 100K	OPTION26
R50	499	499	RES 1/2W 100K	OPTION27
R51	499	499	RES 1/2W 100K	OPTION28
R52	499	499	RES 1/2W 100K	OPTION29
R53	499	499	RES 1/2W 100K	OPTION30
R54	499	499	RES 1/2W 100K	OPTION31
R55	499	499	RES 1/2W 100K	OPTION32
R56	499	499	RES 1/2W 100K	OPTION33
R57	499	499	RES 1/2W 100K	OPTION34
R58	499	499	RES 1/2W 100K	OPTION35
R59	499	499	RES 1/2W 100K	OPTION36
R60	499	499	RES 1/2W 100K	OPTION37
R61	499	499	RES 1/2W 100K	OPTION38
R62	499	499	RES 1/2W 100K	OPTION39
R63	499	499	RES 1/2W 100K	OPTION40
R64	499	499	RES 1/2W 100K	OPTION41
R65	499	499	RES 1/2W 100K	OPTION42
R66	499	499	RES 1/2W 100K	OPTION43
R67	499	499	RES 1/2W 100K	OPTION44
R68	499	499	RES 1/2W 100K	OPTION45
R69	499	499	RES 1/2W 100K	OPTION46
R70	499	499	RES 1/2W 100K	OPTION47
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R78	499	499	RES 1/2W 100K	OPTION55
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R84	499	499	RES 1/2W 100K	OPTION61
R85	499	499	RES 1/2W 100K	OPTION62
R86	499	499	RES 1/2W 100K	OPTION63
R87	499	499	RES 1/2W 100K	OPTION64
R88	499	499	RES 1/2W 100K	OPTION65
R89	499	499	RES 1/2W 100K	OPTION66
R90	499	499	RES 1/2W 100K	OPTION67
R91	499	499	RES 1/2W 100K	OPTION68
R92	499	499	RES 1/2W 100K	OPTION69
R93	499	499	RES 1/2W 100K	OPTION70
R94	499	499	RES 1/2W 100K	OPTION71
R95	499	499	RES 1/2W 100K	OPTION72
R96	499	499	RES 1/2W 100K	OPTION73
R97	499	499	RES 1/2W 100K	OPTION74
R98	499	499	RES 1/2W 100K	OPTION75
R99	499	499	RES 1/2W 100K	OPTION76
R100	499	499	RES 1/2W 100K	OPTION77

FLAG/OPTIONS

PART	QTY	REF	DESCRIPTION	FLAG/OPTIONS
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R23	499	499	RES 1/2W 100K	OPTION1
R24	499	499	RES 1/2W 100K	OPTION2
R25	499	499	RES 1/2W 100K	OPTION3
R26	499	499	RES 1/2W 100K	OPTION4
R27	499	499	RES 1/2W 100K	OPTION5
R28	499	499	RES 1/2W 100K	OPTION6
R29	499	499	RES 1/2W 100K	OPTION7
R30	499	499	RES 1/2W 100K	OPTION8
R31	499	499	RES 1/2W 100K	OPTION9
R32	499	499	RES 1/2W 100K	OPTION10
R33	499	499	RES 1/2W 100K	OPTION11
R34	499	499	RES 1/2W 100K	OPTION12
R35	499	499	RES 1/2W 100K	OPTION13
R36	499	499	RES 1/2W 100K	OPTION14
R37	499	499	RES 1/2W 100K	OPTION15
R38	499	499	RES 1/2W 100K	OPTION16
R39	499	499	RES 1/2W 100K	OPTION17
R40	499	499	RES 1/2W 100K	OPTION18
R41	499	499	RES 1/2W 100K	OPTION19
R42	499	499	RES 1/2W 100K	OPTION20
R43	499	499	RES 1/2W 100K	OPTION21
R44	499	499	RES 1/2W 100K	OPTION22
R45	499	499	RES 1/2W 100K	OPTION23
R46	499	499	RES 1/2W 100K	OPTION24
R47	499	499	RES 1/2W 100K	OPTION25
R48	499	499	RES 1/2W 100K	OPTION26
R49	499	499	RES 1/2W 100K	OPTION27
R50	499	499	RES 1/2W 100K	OPTION28
R51	499	499	RES 1/2W 100K	OPTION29
R52	499	499	RES 1/2W 100K	OPTION30
R53	499	499	RES 1/2W 100K	OPTION31
R54	499	499	RES 1/2W 100K	OPTION32
R55	499	499	RES 1/2W 100K	OPTION33
R56	499	499	RES 1/2W 100K	OPTION34
R57	499	499	RES 1/2W 100K	OPTION35
R58	499	499	RES 1/2W 100K	OPTION36
R59	499	499	RES 1/2W 100K	OPTION37
R60	499	499	RES 1/2W 100K	OPTION38
R61	499	499	RES 1/2W 100K	OPTION39
R62	499	499	RES 1/2W 100K	OPTION40
R63	499	499	RES 1/2W 100K	OPTION41
R64	499	499	RES 1/2W 100K	OPTION42
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R70	499	499	RES 1/2W 100K	OPTION48
R71	499	499	RES 1/2W 100K	OPTION49
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R80	499	499	RES 1/2W 100K	OPTION58
R81	499	499	RES 1/2W 100K	OPTION59
R82	499	499	RES 1/2W 100K	OPTION60
R83	499	499	RES 1/2W 100K	OPTION61
R84	499	499	RES 1/2W 100K	OPTION62
R85	499	499	RES 1/2W 100K	OPTION63
R86	499	499	RES 1/2W 100K	OPTION64
R87	499	499	RES 1/2W 100K	OPTION65
R88	499	499	RES 1/2W 100K	OPTION66
R89	499	499	RES 1/2W 100K	OPTION67
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R95	499	499	RES 1/2W 100K	OPTION73
R96	499	499	RES 1/2W 100K	OPTION74
R97	499	499	RES 1/2W 100K	OPTION75
R98	499	499	RES 1/2W 100K	OPTION76
R99	499	499	RES 1/2W 100K	OPTION77
R100	499	499	RES 1/2W 100K	OPTION78

Decatur
C I C T O N I C S

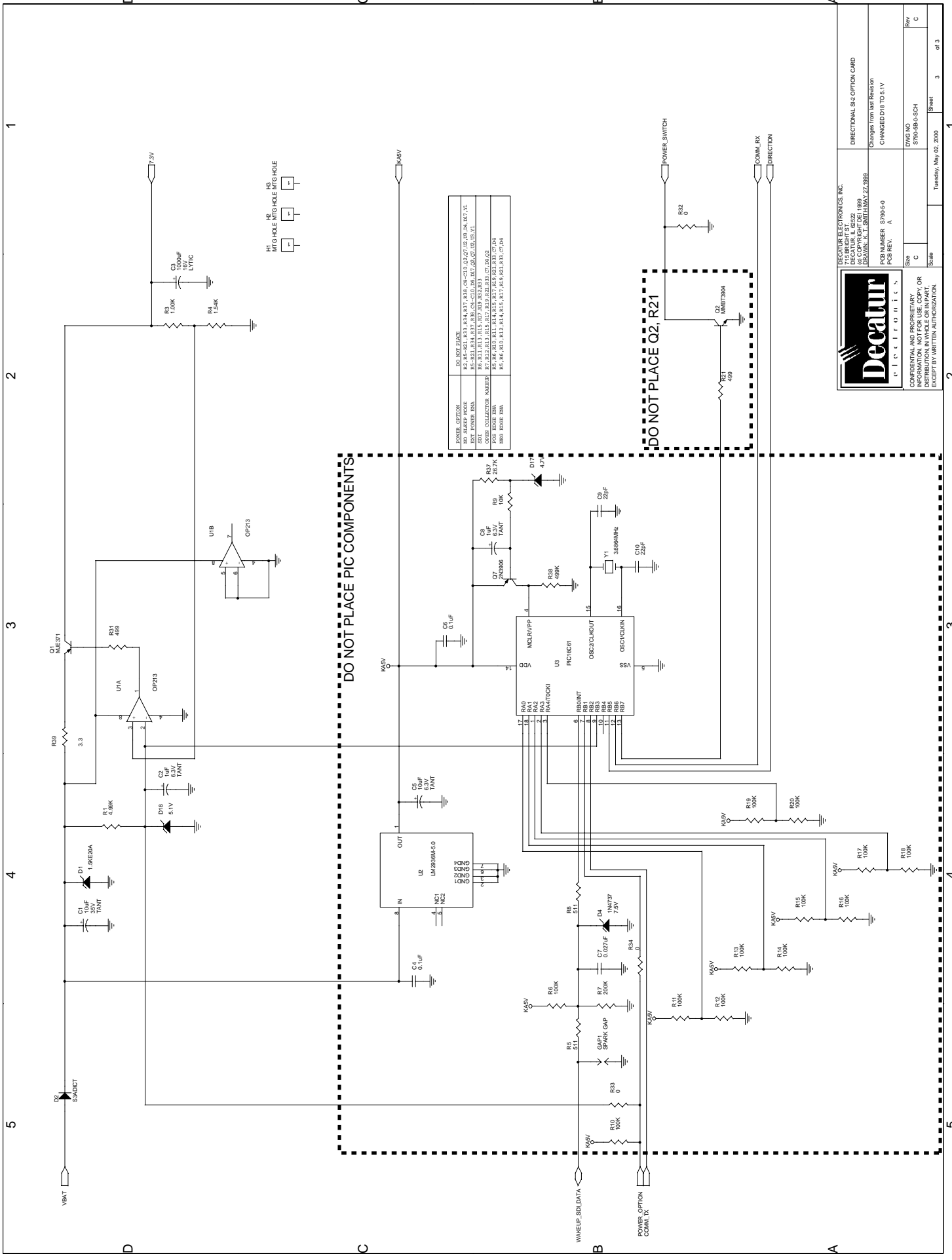
SECRET ELECTRONICS, INC.
775 BRIGHT ST.
DECATUR, GA 30033
DECATUR, GA, T. SMITH, MAY 27, 1989

DIRECTIONAL SWITCH OPTION CARD
CLASSIFICATION: UNCLASSIFIED
PCB NUMBER: S790-5-0
PCB REV: A
SEE PAGE 5

Scale: 1:1
Sheet: 2 of 3

Rev: C
DWG NO: S790-5-0-SCH

DATE: Thursday, May 02, 2008



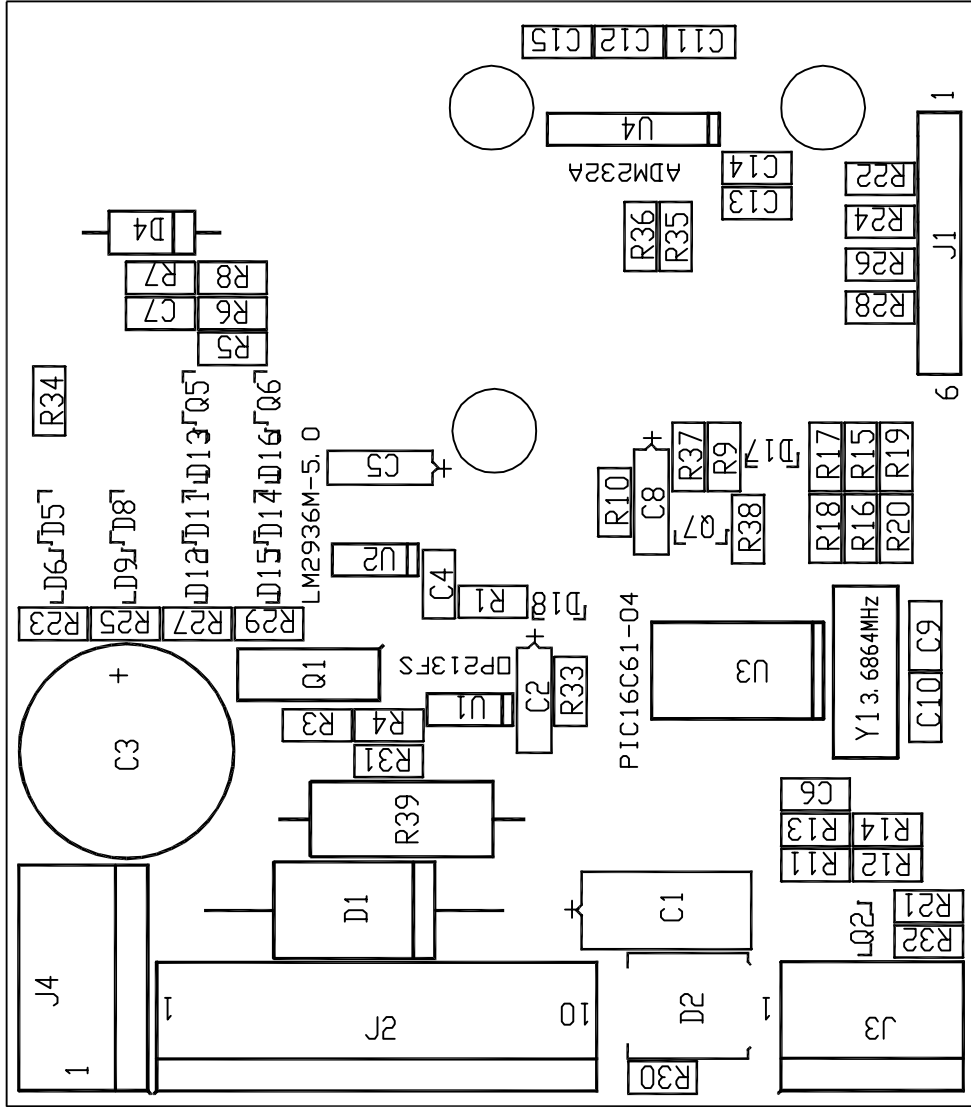
DO NOT PLACE PIC COMPONENTS

DO NOT PLACE Q2, R21



DECALCOR ELECTRONICS, INC.
 1755 BRIDGE ST.
 GILBERT, AZ 85232
 (602) 835-1234
 FAX: (602) 835-1235
 WWW.DECALCOR.COM
 DIRECTIONAL S/S OPTION CARD
 Changes from last Revision
 CHANGED D18 TO 5.1V
 PCB NUMBER: S7905-0
 PCB REV: A
 Scale: 1:1
 Date: Tuesday, May 02, 2000
 Sheet: 3 of 3

- D6
- D9
- D12
- D15
- D5
- D8
- D11
- D14
- R10
- C8
- Q7
- R38
- R18
- R16
- R20
- D13
- D16
- C5
- R37
- R9
- D17
- R17
- R15
- R19
- R34
- Q5
- Q6
- R5
- C7
- R6
- R28
- R7
- R8
- R36
- R35
- R26
- D4
- C13
- R24
- C14
- R22
- C15
- C12
- C11



- R30
- D2 DIODE 2.5A
- D1
- C1 10uF
- Q2
- R32 0 OHM
- R21
- R39 3.3 OHM 1 WATT
- R11
- R12
- R13
- R14
- C6
- C3 1000uF 16V
- R31 499
- R3 1.00K
- R4 1.54K
- C2 1uF TANT
- R33
- Y1
- C10
- C9
- Q1 MJE371 TO225
- R23
- R25
- R27
- R29
- C4
- R1 4.99K
- D18 5.1V ZENER

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715 BRIGHT STREET
 DECATUR, IL, 62522
 PHONE (217) 428-4315

DRAWN	KJS	N/A	N/A
APP'D			27SEP99
REV.1	JDL		30SEP99
CHECK#1	B BENZ		30SEP99
CHECK#2			30SEP99
ENG.1	K J SMITH		30SEP99

DIRECTIONAL SJ-2 OPTION CARD COMPONENT SIDE ASSEMBLY

A			
		\$790-5B-0	C
30SEP99	1	2	

STUFFING INSTRUCTION AND INSPECTION GUIDE

1. J2, J3 AND J4 SHALL BE STUFFED ON COMPONENT SIDE
2. C4, C5, C6, C7, C8, C9
C10, C11, C12, C13
C14, C15, D1, D4, D5
D6, D8, D9, D11, D12
D13, D14, D15, D16,
D17, J1, Q2, Q5, Q6, Q7
R5, R6, R7, R8, R9, R10
R11, R12, R13, R14
R15, R16, R17, R18
R19, R20, R21, R22
R23, R24, R25, R26
R27, R28, R29, R30
R33, R34, R35, R36
R37, R38, U2, U3, U4 AND Y1 NOT STUFFED
3. PANELIZED PCB WITH BREAK TABS.
 - A) TOP/BOTTOM OF PCB, TRIMMED WITH MINIMAL PROTRUSION FROM EDGE.
 - B) LEFT/RIGHT OF PCB, FLUSH WITH NO EXPOSED TRACES OR DE-LAMINATIONS.
4. DEI 100 PERCENT INSPECTION POINTS
 - A) DIODE D2 POLARITY
5. WORKMANSHIP AND MATERIALS MUST MEET IPC-A-610 REV B CLASS 2 SPECIFICATIONS UNLESS NOTED.

6. MOUNTING HOLES TO BE SOLDER FREE.

7. EACH BOARD TO BE LABELLED WITH A DATE CODE. LABELLING SHALL NOT INTERFERE WITH INSTALLATION OR OPERATION OF ASSEMBLY.

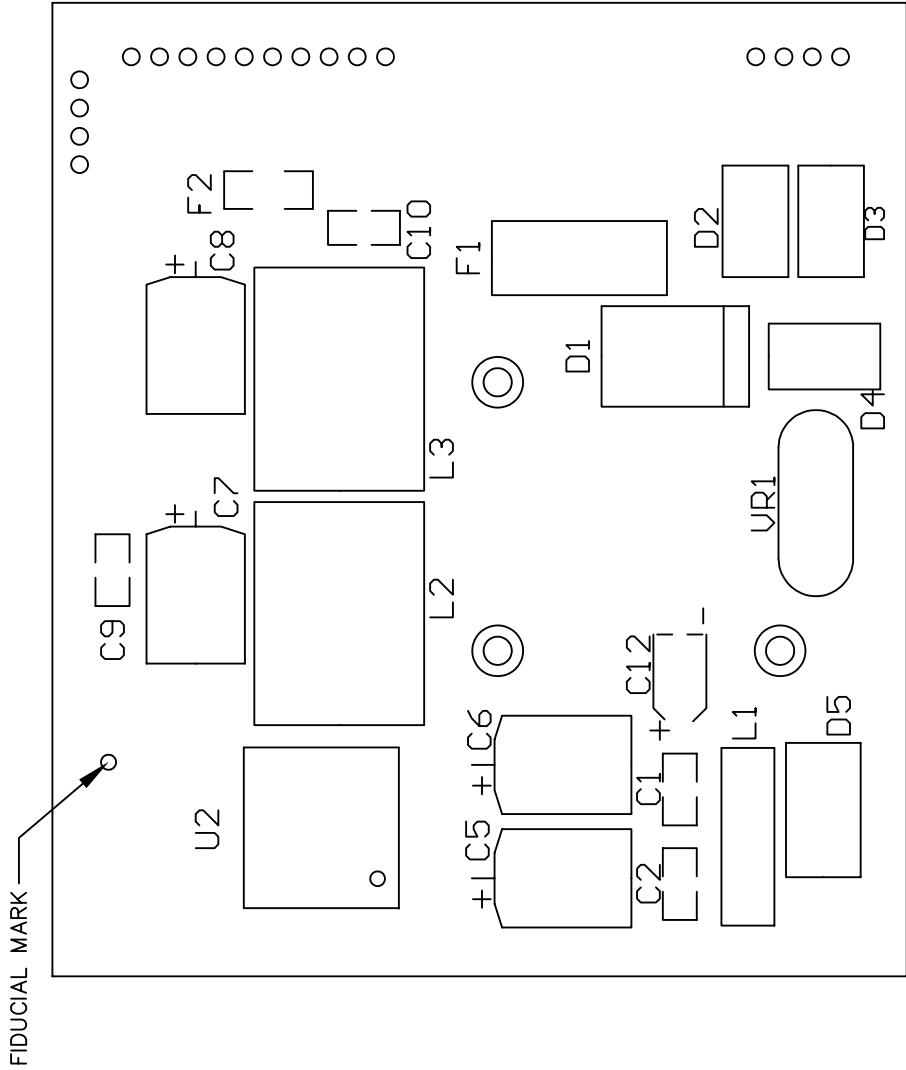
GENERAL NOTE:

8. REV 'B' ADDS STUFFING INSTRUCTIONS TO PAGE 2
9. REV 'C' CHANGES D18 FROM 4.7V ZENER TO 5.1V ZENER

715 BRIGHT STREET DECATUR, IL, 62522 PHONE (217) 428-4315		CONFIDENTIAL AND PROPRIETARY INFORMATION, NOT FOR USE, COPY, OR DISTRIBUTION, IN WHOLE OR IN PART EXCEPT BY WRITTEN AUTHORIZATION		N/A		DIRECTIONAL SI-2 OPTION CARD ASSEMBLY	
DRAWN:	KJS	APP'D:		27SEP99	N/A	A	C
REV. 1:	KJS	CHECK#1:	B BENZ	28MAR00			
CHECK#2:		ENG. 1:	K J SMITH	30SEP99			
				30SEP99		30SEP99	2 2

REVISIONS

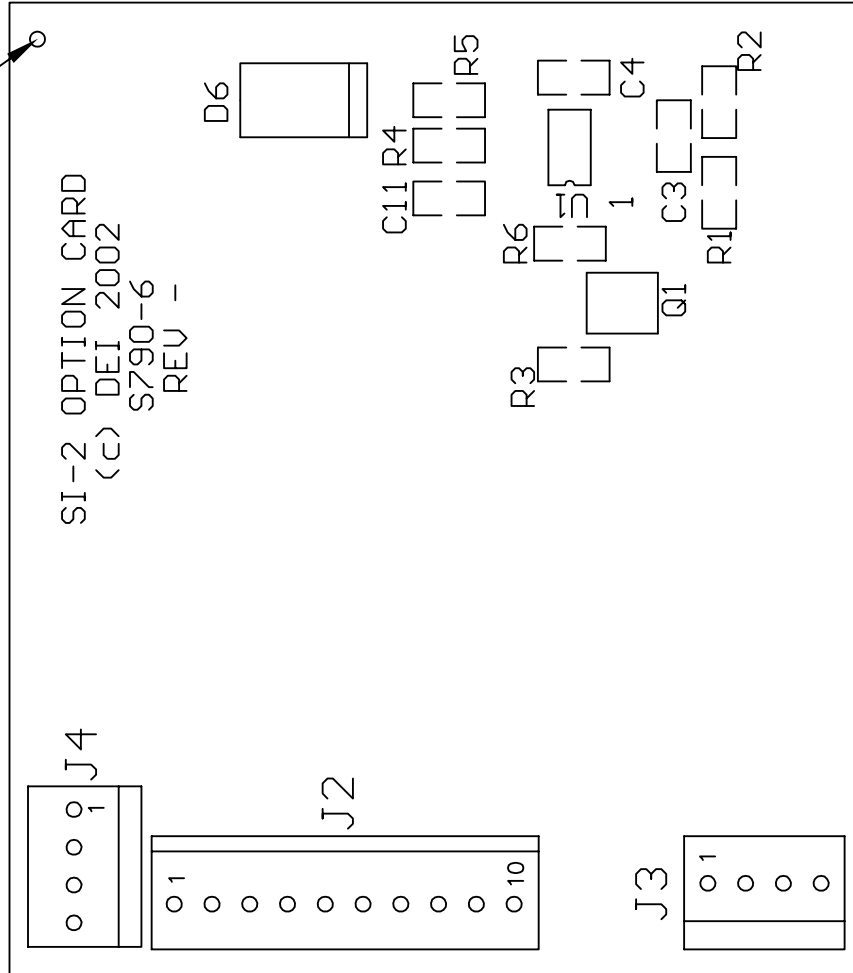
ZONE	REV	DESCRIPTION	DATE	APP'D
	-	SEE ECD #662.	07MAR02	G TEMMER
	A	ADDED NOTES	11APR02	A STENGER
	B	SEE ECD #671.	06AUG02	G TEMMER



- | | | | |
|-----|---------|-------|---------------|
| C1 | 0.1UF | U1 | TL7700 |
| C2 | 0.1UF | U2 | LM2595S |
| C3 | 0.1UF | VR1 | 39Z20 |
| C4 | 0.1UF | F1 | 100 |
| C5 | 33UF | F2 | FG |
| C6 | 33UF | D1 | B340 |
| C7 | 68UF | D2 | P03A |
| C8 | 330UF | D3 | P03A |
| C9 | 0.01UF | D4 | P05A |
| C10 | 0.01UF | D5 | 116 |
| C11 | 5PF | D6 | B260A |
| R1 | 26.7K | Q1 | 2N3904 |
| R2 | 1.54K | J2 | 10 PIN HEADER |
| R3 | 10K | J3,J4 | 4 PIN HEADER |
| R4 | 4.99K | | |
| R5 | 1K | | |
| R6 | 10K | | |
| L1 | FERRITE | | |
| L2 | 100UH | | |
| L3 | 100UH | | |

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		DRAWN: G TEMMER APP'D:	07MAR02	S12 OPTION CARD- TOP COMPONENT
©COPYRIGHT 2002 DECATUR ELECTRONICS, INC. ALL RIGHTS RESERVED.		MFG. I: REV. I: G TEMMER CHK. I: B BENZ ENG. I: T BURRIS	SIZE: A DATE: 13AUG02	DOCUMENT NUMBER: PART NUMBER: S790-6-0-ASSY REV. B
			06AUG02	
			13AUG02	
DECATUR ELECTRONICS INC. 715 BRIGHT STREET DECATUR, IL. 62522 PHONE (217) 428-4315				SHEET 1 of 2

FIDUCIAL MARK



NOTES:

1. WORKMANSHIP TO MEET IPC-A-610 CLASS 2 CURRENT REVISION.
2. MOUNTING HOLES (3) AND SPG1 TO BE SOLDER-FREE.
3. C5, C6, C7, AND C8: WIRE ELECTRODE IS +
4. D2, D3, AND D4 ARE BIDIRECTIONAL.
5. EACH BOARD TO BE LABELED WITH A DATE CODE. LABELLING SHALL NOT INTERFERE WITH INSTALLATION OR OPERATION OF ASSEMBLY.
6. REV "A" ADDED NOTES.
7. REV "B" SEE ECD #671.

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	<p>REV. 1: G. TEMMER</p> <p>CHK. 1: B. BENZ</p> <p>ENG. 1: T. BURRIS</p>	<p>REV. 1: G. TEMMER</p> <p>CHK. 1: B. BENZ</p> <p>ENG. 1: T. BURRIS</p>	<p>06AUG02</p> <p>13AUG02</p> <p>13AUG02</p>	<p>06AUG02</p> <p>13AUG02</p> <p>13AUG02</p>	<p>SIZE: A</p> <p>DOCUMENT NUMBER: S790-6-0-ASSY</p> <p>REV. B</p>

SI-2 OPTION CARD CIRCUITRY DESCRIPTION (S790-6)

The SI-2 option card filters and regulates external power for the SI-2 main board. Unregulated power enters the option card at header J2. Various protection elements are built into the option card that improve reliability and functionality of the SI-2 main board. The circuit is broken into blocks as follows.

Input Protection

Automatic Resettable fuse F1 provides over-current protection. Diode D1 provides reverse voltage protection while D4 (sidactor), VR1 (metal oxid varistor or MOV), and D5 (transient voltage suppressor) protect against over-voltage surges and momentary transients. C1, C2, and L1 are configured as low-pass filters designed to remove high frequency components from the power line.

Voltage Monitoring

U1 is configured as a low voltage detector, where R1 and R2 provide the trip point for enabling the main supply regulator. Capacitor C12 allows a time delay between when power is applied and when power is available to the SI-2 main board. Capacitor C3 provides filtering for the voltage trip point. Transistor Q1 and resistors R3 and R6 provide a logic inverting output for the main switching regulator. Capacitors C5 and C6 provide additional redundant power supply filtering.

Main Power

U2, a LM2595 switching adjustable voltage regulator from National Semiconductor, provides main power for the SI-2 main board. Pin 2 of U2 is the main power input, while pin 5 controls the output state of the regulator. Schottky diode D6 with L2 provide the main circuit components for the switching power supply. Resistor R4, R5 set the output voltage at around 7.2 volts DC.

Post Filtering and Fusing

Capacitors C7, C8, and inductor L3 filter the regulated output voltage. Capacitors C9 and C10 provide additional high frequency filtering. Fuse F2 is a 0.75 amp fast blow (non-resettable) fuse for additional output current safety. Additionally, D2 and D3 offer over-voltage protection for the RS232 input and output lines.

Theory

U1 senses the input unregulated voltage V_{in} and performs the following action:

- (1) If V_{in} is below approximately 11 volts DC, the output to the switching regulator will be at logic high (switching regulator off).
- (2) If V_{in} is above approximately 11 volts DC the output to the switching regulator will be at logic low (switching regulator on).

The delay start-up capacitor C12 provides insures that the power reaching the SI-2 option card is stabilized before power switches on to the SI-2 main board.

SI-2 PARTS LIST

SYSTEM INTERFACE (SI-2) OPTION CARD BILL OF MATERIALS DESCRIPTION

LEVEL	ITEM#	QTY	DEI PART#	REF#	DESCRIPTION
1	1	1	S790-6	PCB	OPTION CARD PCB
	1	2	P381-103	C9,C10	.01uF 10% 50V X7R 0805
	2	4	P381-104	C1,C2,C3,C4	.1uF 10% 50V X7R CER 0805 CAP
	3	1	P342-1001	R5	1K 1% 1/10W 0805 MF
	4	1	P342-1541	R2	1.54K 1% 1/10W 0805 MF
	5	1	P342-4991	R4	4.99K 1% 1/10W 0805 MF
	6	2	P342-1002	R3,R6	10K 1% 1/10W 8050 MF
	7	1	P342-2672	R1	26.7K MF 1% 1/10W 0805
	8	1	P615-22	L1	FERRITE BEAD
	9	1	P411-B340	D1	SCHOTTKY DIODE 3A 40V SMC
	10	1	P411-2N3904	Q1	NPN SWITCHING TRANSISTOR
	11	2	P505-167	J3,J4	4-PIN STRAIGHT PCB HEADER
	12	1	P505-10	J2	10-PIN STRAIGHT PCB HEADER
	13	2	P382-33	C5,C6	33uF 35V 20% TANTALUM CAP
	14	1	P382-68	C7	68uF 25V 20% TANTALUM CAP SMD
	15	1	P382-337	C8	330uF 10V 10% TANTALUM CAP SMD
	16	2	P615-12	L2,L3	100uH FIXED INDUCTOR D10F SMD
	17	1	P401-B260A	D6	SCHOTTKY RECTIFIER DIODE 60V 2A
	18	1	P410-LM2595S	U2	SWITCHER VOLT REG 1A TO-263-5
	19	2	P365-20	D2,D3	SIDACTOR 20V SURG SUP SMD
	20	1	P365-50	D4	SIDACOTR 50V SURGE SUP SMD
	21	1	P401-SMBJ28CA	D5	TRANS VOLT SUP 28V BI-DIR SMB
	22	1	P415-30	F1	POLYSWITCH SMD 1.10A 30V FUSE
	22	1	P410-TL7700	U1	IC SUPPLY VOLT SUPERVISOR 8-SOP
	22	1	P365-31	VR1	MOV, VARISTOR 31V
	23	1	P415-63	F2	FUSE 63V .750A SMD
	24	1	P381-5	C11	5pF 50V CREAMIC CAP SMD 0805
	25	1	P383-10	C12	10uF 16V 20% ELECTROLYTIC CAP SMD

TROUBLESHOOTING

Symptom	Probable Cause	Remedy
Spurious Speeds	Misaligned antenna	<ol style="list-style-type: none"> 1. Align antenna to the target's travel direction. 2. Direct antenna away from moving objects that are not intended to be targets (including cooling fans and other rotating objects). 3. Direct the antenna away from electrically noisy circuitry (such as strong lighting, neon lights, and exposed clock oscillators) and multiplexed displays. 4. Mount the antenna on a stable surface. If the mounting moves, the motion is added into the displayed speed.
No speed reading when a strong target is present	Misaligned power or antenna connector	<p>See above remedy if you believe the problem is with the antenna. If you believe there is something wrong with the power connection, go to the section on power/communications to see if the board and connectors are placed correctly. Also, make sure the processor board is:</p> <ol style="list-style-type: none"> 1. Mounted in an area that is free from exposure to liquids. 2. Mounted where interference from other circuits is minimized. 3. Mounted where the board is not in the beam of the antenna.
No RS-232C communications available	Misaligned communications connector or communications setting in remote device is incorrect	See sections Processor, Power/Communications, and RS-232C commands to make sure RS-232C communications are set up correctly.
Current draw is much greater than normal	Short circuit with board or antenna	Disconnect the board and antenna from the power. Send in the system for repair.

TESTING

SAFETY

Carry out all radar unit service at an approved factory service site and implement all electrostatic discharge (ESD) safeguards. The repair work area needs to include grounded work mats and wrist straps. Microwave Gunn and mixer diodes are sensitive to ESD and require extra precautions. Please contact the factory for additional information about equipping your service site.

MICROWAVE MODULE TESTS

Antenna Tuning Procedure

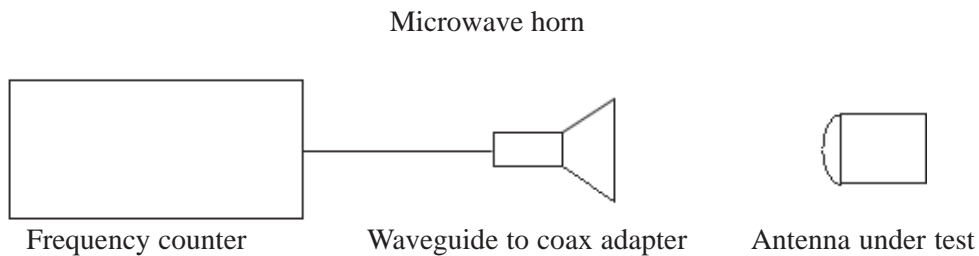
Gunn Oscillator Transmit Frequency

You need to check the antenna transmit frequency before making any adjustments to the antenna.

Required equipment:

- (1) Microwave frequency converter capable of reading up to 25GHz
- (2) K-band horn with at least a 10dB gain
- (3) Waveguide to coax transition
- (4) Low-loss coax cable

Set up the equipment as follows:



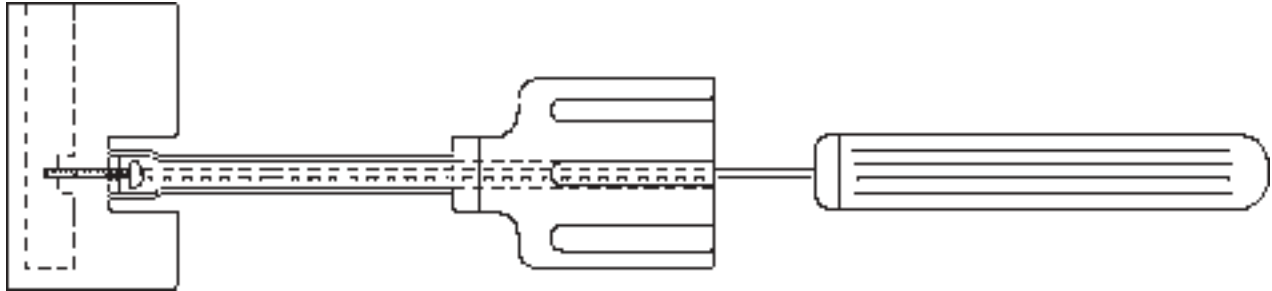
- (1) Turn on the radar.
- (2) Activate the antenna.
- (3) Point the radar at the horn antenna.
- (4) Because the horn antenna is in the near field region of the transmitting antenna, its presence will cause a slight change in the transmit frequency. Adjust the distance between the two antennas, so the measured frequency is at a minimum.
- (5) Record the K-band antenna frequency. 24.1GHz to 24.2GHz are the correct ranges for the frequency bands.
- (6) Adjust the tuning screw on the Gunn diode for a reading of $24.150\text{GHz} \pm 10\text{MHz}$ for K-band antennas. Do not tune the frequency unless frequency is out of band

For information regarding service or replacement, contact the factory at 800.428.4315 (217.428.4315 if you are calling from outside the US.)

K-Band Mixer Diode Voltage Adjustment

Required equipment:

- (1) Digital volt meter (DVM)
- (2) 12VDC power supply
- (3) Modified 1/4" nut driver for the SI-2 and 3/16" nut driver for the SI Arcade (See below.)



Diode Voltage Adjustment

Cut off the handle of the nut driver to expose the hollow shaft. Grind the tip of the nut driver to reduce its diameter to 0.275".

- (1) Remove the turnstile horn lens assembly from the can, leaving the cable harness and ground wire connected.
- (2) Turn the radar on and activate the antenna.
- (3) Place the leads of the DVM across the mixer diode.
- (4) Loosen the locking nut.
- (5) If you are adjusting the SI-2, adjust turnstile-tuning screw, so the voltage is minimized. If you are adjusting the SI-Arcade, adjust the voltage to .150VDC (150mVDC).
- (6) Simultaneously tighten the locking nut and adjust the tuning screw to maintain the screw at the required low voltage point.

SIGNAL PROCESSING PCB TESTS

See the Signal Processing PCB schematics and have an understanding of the theory of operation.

DISPLAY PCB TESTS

See the Display PCB schematics and have an understanding of the theory of operation.

AUDIO PCB TESTS

See the Audio PCB schematics and have an understanding of the theory of operation.

RECOMMENDED TEST EQUIPMENT

The list is not an endorsement to purchase from the listed companies. Keep in mind that equipment models change periodically, therefore the model numbers for the listed equipment may no longer be available (contact the manufacturer.)

STANDARD SERVICING EQUIPMENT

Instrument	Specifications	Recommended Model
1. Digital Multimeter (DMM)	0 – 20V	Beckman Model Tech 310 or 320 Fluke 79 series Fluke 45 series

Any good DMM is acceptable. A diode test and ohm capability test are also necessary.

2. Oscilloscope		at least 60MHz Philips Model PM3350A (60MHz with storage capacity) Hitachi Model V-650F (60MHz no storage) Tektronics Model 2213 (60MHz no storage)
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In some cases, you need to monitor the “reset” and “strobe” pulses of various lines inside the older model radar units. For newer models, it is sometimes necessary to monitor the signals coming from the microprocessor. Some of these areas require at least a 60MHz resolution to properly monitor. Also, when working with the Genesis model radar units, Decatur Electronics highly recommends using oscilloscopes with dual trace capability and a storage feature.

3. Audio Signal Generators	20Hz – 20,000Hz	Heathkit Model IG-5218 (metered) Philips Model PM5190 (unmetered)
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You need to use an audio signal generators to simulate the target speeds for bench servicing. Because many of the alignment procedures involve setting the generator at a specified number of decibels from each other, metered generators or generators that have a displayed dB setting are preferred. Also, you can use generators that read out in either peak to peak or RMS, but you need to calculate the voltage to dB conversion.

4. Soldering and De-soldering Stations

De-soldering stations

Pace Model MVT-101
Automated Production Equipment Corp.
Model EX525

Temperature Controlled Soldering Iron
Surface Mount De-soldering Station

Weller Model TCPS
Pace Model MBT-201A

You must have the correct soldering and de-soldering stations, which are temperature controlled and groundable. Do not use de-soldering tools such as a Soldapullt or similar devices, unless they are electro-static discharge (ESD) safe.

5. Anti-electro-static Discharge Equipment

Ionizer
Simco Model Aerostat XC

Static control table mat and hardware

3-M Model 8212

Components today are much more susceptible to electro-static discharge (ESD); therefore ESD control is extremely important. Use a mat with proper grounding, an ionizer, and wrist straps to insure static control for a reliable repair.

CONSTRUCTED TEST EQUIPMENT

Anechoic Chamber

To test antenna sensitivity while it is on the bench, you need to use an antenna test (anechoic) chamber. Several versions of the chamber are available, ranging from very costly to less expensive. For service work, the chamber does not need to be expensive. The anechoic chamber is basically a wooden box lined with microwave absorbent material, such as Advanced Electromagnetics' AEL -.375. Include in the box, either a feed horn, attenuator, and crystal detector or a K-band horn, lens, and turnstile assembly. The turnstile assembly lets you test the Decatur Electronics line of products. If you need to test other product lines, you might find it necessary to use a feed horn, attenuator, and crystal detector.

EQUIPMENT MANUFACTURERS

EIP Microwave, Inc.
1589 Centre Pointe Drive
Milpitas, CA 95035
(800) 232-3471

General Microwave Corp.
5500 New Horizon Boulevard
Amityville, NY 11701
(516) 226-8900
fax: (516) 226-8966

Hewlett-Packard Corp.
P.O. Box 4026
Englewood, CO 80155-4026
(800) 452-4844

For microwave absorbing material:

Advanced Electromagnetics, Inc.
P.O. Box 711719
Santee, CA 92072-1719
(619) 449-9492
product name: AEL-.375

Used equipment:
Tucker Electronics
P.O. Box 461060
Garland, TX 75046
(800) 527-4642

APPENDIX A: TABLE OF OEM SUPPORTED SETTINGS

You will want to verify that these settings are current before working with them. Settings could have changed since the printing of this manual.

American Signal Co.	
MPH	
Serial communication protocol set for 8N1 <ASCII hundreds> <ASCII tens> <ASCII ones> <CR>	
High-speed	5-200 mph
Sensitivity setting	9
Update Rate	On speed change only
Data hold setting	2 sec
Zero speed report	On no target, set once every 2 seconds
Low Speed cutoff	5 mph
High Speed cutoff	200 mph
Cosine correction angle 1	Set to 0
Cosine correction angle 2	Set to 0
Report targets set for	Approach only
Baud rate	9600 baud
Direction report	OFF

George Ingram Technologies	
MPH	
Serial communication protocol set for 8N1 <D> <ASCII hundreds> <ASCII tens> <ASCII ones> <CR>	
High-speed	5-200 mph
Sensitivity setting	9
Update Rate	On speed change only
Data hold setting	2 sec
Zero speed report	On no target, set once every 2 seconds
Low Speed cutoff	5 mph
High Speed cutoff	200 mph
Cosine correction angle 1	Set to 0
Cosine correction angle 2	Set to 0
Report targets set for	All
Baud rate	9600 baud
Direction report	ON (D = '+' for approach, D = '-' for recede, D = '?' for direction unknown)

Mighty Mover Trailers	
MPH	
Serial communication protocol set for 8N2 <ASCII tens> <ASCII ones> <ASCII tenths> <,> <ASCII 000.0> <CR>	
High-speed	5-200 mph
Sensitivity setting	9
Update Rate	On speed change only
Data hold setting	2 sec
Zero speed report	On no target, set once every 2 seconds
Low Speed cutoff	5 mph
High Speed cutoff	200 mph
Cosine correction angle 1	Set to 0
Cosine correction angle 2	Set to 0
Report targets	Set for approach only
Baud rate	9600 baud
Direction report	OFF

Precision Solar	
MPH	
Serial communication protocol set for 8N1 <ASCII hundreds> <ASCII tens> <ASCII ones> <CR>	
High-speed	5-200 mph
Sensitivity setting	9
Update Rate	On speed change only
Data hold setting	2 sec
Zero speed report	On no target, set once every 2 seconds
Low Speed cutoff	5 mph
High Speed cutoff	200 mph
Cosine correction angle 1	Set to 0
Cosine correction angle 2	Set to 0
Report targets	Set for approach only
Baud rate	9600 baud
Direction report	OFF

Texas Transportation Institute	
MPH	
Serial communication protocol set for 8N1 <ASCII*> <D> <ASCII hundreds> <ASCII tens> <ASCII ones> <. > <ASCII tenths> <,> <3 ASCII characters represent signal strength in dB 000 through 255> <CR> <LF>	
Polling string	8N1 <ASCII * > <ASCII P > <CR >
Low-speed	1-70 mph
Sensitivity setting	9
Update Rate	Polled
Data hold setting	2 sec
No zero speed report	On no targets
Low Speed cutoff	1 mph
High Speed cutoff	70 mph
Cosine correction angle 1	Set to 0
Cosine correction angle 2	Set to 0
Report targets set	For all directions
Baud rate	9600 baud
Direction report	ON (D = '+' for approach, D = '-' for recede, D = '?' for direction unknown)

Washington State DOT	
MPH	
Serial communication protocol set for 8N1 <ASCII S> <ASCII tens> <ASCII ones> <CR> <7-bit checksum>	
High-speed	5-200 mph
Sensitivity setting	9
Update Rate	On speed change only
Data hold setting	2 sec
Zero speed report	On no targets, set once every 2 seconds
Low Speed cutoff	5 mph
High Speed cutoff	99 mph
Cosine correction angle 1	Set to 0
Cosine correction angle 2	Set to 0
Report targets set for	Approach only
Baud rate	1200 baud
Direction report	OFF