ELTROL CORPORATION

Rev 11/08

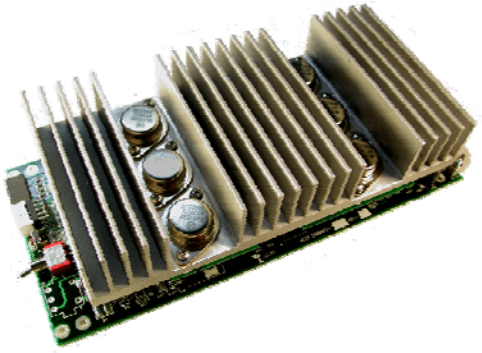
EUROCARD SERIES 57 LINEAR SINE DRIVE SERVO AMPLIFIER

FEATURES

- **High performance DSP based Linear Servo Amplifier controls brushless linear or rotary motor force or torque**
- **Linear operating mode does not emit EMI, has high servo stiffness, and no dead zone**
- **DSP platform provides programmable configuration, fault protection, self-test, calibration, and status reporting via RS232 port**
- **Accepts sinusoidal commutation signals from a digital motion controller**
- **Smooth velocity and precise nanometer position accuracy can be obtained with sinusoidal control of a linear motor's current**
- **Current loop bandwidth and the transconductance, amps/volt scale factor, are adjustable**
- **Fault protection for amplifier SOA, over and under voltage, temperature, current overloads, and motor shorts**
- **Seven-segment LED display shows drive status**
- **Digital inputs for Enable/Reset, and (4) programmable for Brake, DIR, and ± Travel Limits**
- **Operates with low inductance motors**
- **High and low supply voltage versions**
- **High and low power versions**
- **Operates from one low cost unregulated DC power supply with optional internal ± 12V DC-DC converter**

APPLICATIONS

- **Linear stages, air bearings, and gantry systems**
- **Integrated circuit manufacturing and inspection**
- **High accuracy electronic assembly**
- **High accuracy measurement**
- **Laser Machining**



PRODUCT DESCRIPTION

This size 3U EUROCARD provides closed loop four quadrant force or torque control of brushless linear or rotary motors.

It operates with digital motion controllers that use software to derive sinusoidal commutation waveforms from an encoder. Two differential amplifiers accept sinusoidal A and B input commands. The input commands have a 120 degrees phase difference. A high bandwidth current feedback loop is used to transform the input voltage commands to control motor phase A and B current. The amplifier derives phase C current.

Sinusoidal control of brushless DC motors minimizes torque or force ripple. Motor torque or force is approximately constant and independent of position. This is especially important when controlling linear motors in applications requiring smooth constant velocity and micron-positioning accuracy.

The linear operating mode is highly advantageous for noise sensitive applications because it does not generate EMI. PWM switching noise is difficult to eliminate from sensitive sensors and transducers. This degrades velocity and position accuracy.

Excessive power dissipation is the main reliability consideration for linear amplifier operation. This model uses a digital signal processor (DSP) to monitor the safe operating area (SOA) of the output devices to prevent them from overheating and failing

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EUROCARD SERIES 57 LINEAR SINE DRIVE SERVO AMPLIFIER

GENERAL SPECIFICATIONS LOW VOLTAGE MODELS

10/08

ELTROL MODEL	5-900-048-57E	5-360-048-57F
POWER AMPLIFIER	Linear Mode Drive	Linear Mode Drive
PEAK OUTPUT POWER	900 watts [1]	360 watts [1]
PEAK OUTPUT CURRENT	25 amps[1] (1 sec typ.)	10 amps[1] (1 sec typ.)
CONT. OUTPUT CURRENT	Note 1	Note 1
MAX CONTROLLER DISSIPATION	200 watts[1]	150 watts[1]
OUTPUT VOLTAGE @ PEAK OUTPUT CURRENT	40V with 48V Nominal bus	41V with 48V Nominal bus
INPUT POWER BUS [6]	24 to 60 VDC	24 to 60 VDC
INPUT ANALOG P.S.[2]	+12 VDC/0.5AMPS MAX	+12 VDC/0.5AMPS MAX
INPUT ANALOG P.S. [2]	-12 VDC/0.2AMPS MAX	-12 VDC/0.2AMPS MAX
INPUT LOGIC SUPPLY[2]	5 VDC / 0.3 AMPS MAX	5 VDC / 0.3 AMPS MAX
OPERATING TEMPERATURE	0 TO 50 Degrees C [1]	0 TO 50 Degrees C [1]
CURRENT COMMAND S.F.	2.5 or 2 AMP/VOLT	1 or 0.5 AMP/VOLT
CURRENT LOOP BANDWIDTH	Adjustable 0.5 to 4 KHZ	Adjustable 0.5 to 4 KHZ
SIZE	100 W x 220 L x 56 H mm	100 W x 220 L x 45 H mm
WEIGHT	.87 kg (1.92 lb)	.69 kg (1.53 lb)

GENERAL SPECIFICATIONS HIGH VOLTAGE MODELS

ELTROL MODEL	5-1400-080-57G	5-700-080-57H
POWER AMPLIFIER	Linear Mode Drive	Linear Mode Drive
PEAK OUTPUT POWER	1400 watts [1]	700 watts [1]
PEAK OUTPUT CURRENT	20 amps[1] (1 sec typ.)	10 amps[1] (1 sec typ.)
CONT. OUTPUT CURRENT	Note 1	Note 1
MAX CONTROLLER DISSIPATION	200 watts[1]	150 watts[1]
OUTPUT VOLTAGE @ PEAK OUTPUT CURRENT	73V with 80V Nominal bus	73V with 80V Nominal bus
INPUT POWER BUS [6]	50 to 85 VDC	50 to 85 VDC
INPUT ANALOG P.S.[2]	+12 VDC/0.5AMPS MAX	+12 VDC/0.5AMPS MAX
INPUT ANALOG P.S. [2]	-12 VDC/0.2AMPS MAX	-12 VDC/0.2AMPS MAX
INPUT LOGIC SUPPLY[2]	5 VDC / 0.3 AMPS MAX	5 VDC / 0.3 AMPS MAX
OPERATING TEMPERATURE	0 TO 50 Degrees C [1]	0 TO 50 Degrees C [1]
CURRENT COMMAND S.F.	2.5 or 2 AMP/VOLT	1 or 0.5 AMP/VOLT
CURRENT LOOP BANDWIDTH	Adjustable 0.5 to 4 KHZ	Adjustable 0.5 to 4 KHZ
SIZE	100 W x 220 L x 56 H mm	100 W x 220 L x 45 H mm
WEIGHT	.87 kg (1.92 lb)	.69 kg (1.53 lb)

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GENERAL SPECIFICATIONS

OPERATING CONTROL SIGNALS and INDICATORS

Input analog A & B control signal [3]	± 10 Volts differential
Peak current limit	Adjustable
Drive Enable/Reset	5V logic
Programmable digital inputs (4):	5V logic
Direction Logic	
(+) Travel Limit	
(-) Travel Limit	
Brake [4]	
Amplifier Status indicator	Seven Segment LED

AUXILIARY OUTPUTS

Motor current monitor	Analog Signal
Drive status 4 outputs	Digital

SERIAL I/O

RS232
I2C

FAULT PROTECTION CIRCUITS

Safe Operating Protection
Short circuit
Over temperature [5]
Over current [5]
Over / under voltage

Notes:

1. Depends on ambient operating temperature, motor winding resistance, and heat sink airflow. See note 5. For the rated maximum controller power dissipation, forced convection cooling with a minimum airflow of 200 CFM is required. Derate at 1.7 watts/degree C for ambient greater than 30 degrees C. Maximum controller dissipation occurs when the power out is minimum (motor stalled). It can be calculated as follows:

Pd = Pin - Pmtr
Pin = (Vs)(Io)
Pmtr = 1.5(Io)^2(Rt/2)

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Notes: continued

Where

Pd is controller dissipation in watts
Pin in input power
Pmtr is motor dissipation in watts
Vs is supply voltage
Io is output current in amps
Rt is motor terminal-to-terminal resistance for wye winding in ohms.
Consult factory for assistance.

2. Optional internal DC – DC converter is available for applications requiring only one power supply to the amplifier.

3. Optional A and B ± 1% gain match can be provided for precision applications.

4. Actuating brake at high motor speeds may damage the controller or motor. Consult factory for details.

5. Over temperature or over current protection is determined from the DSP monitoring of amplifier operating heat sink temperature and output device power dissipation magnitude versus time. When power device junction over temperature protection is activated, the amplifier output will be disabled. A fault report is available via the RS232 port.

6. The user should protect the Amplifier and any external circuits from a catastrophic failure by fusing the input power connections to the amplifier. See Application Note Supplementary Fuse Protection.

EUROCARD SERIES 57 LINEAR SINE DRIVE SERVO AMPLIFIER

EXTERNAL SIGNALS AND INTERCONNECTIONS

EDGE CONNECTOR J1 IS A 48 POLE DIN 41612 SERIES F
(REF EPT P/N 109-40064) or (FCI P/N 5159009486394111)

TERMINAL	SIGNAL NAME	DESCRIPTION
J1-2D, B, Z	MTR PHASE A	OUTPUT TO MOTOR PHASE A WINDING
J1-4D, B, Z	VDC POWER BUS RETURN	POWER SUPPLY RETURN
J1-6D, B, Z	MTR PHASE B	OUTPUT TO MOTOR PHASE B WINDING
J1-8D, B, Z	VDC POWER BUS IN	POWER SUPPLY INPUT, <10>
J1-10D, B, Z	MTR PHASE C	OUTPUT TO MOTOR PHASE C WINDING
J1-12D	DS1	DRIVE STATUS CODE <7>
J1-12B	DS2	DRIVE STATUS CODE <7>
J1-12Z	MTR SHIELD	MOTOR SHIELD GND
J1-14D	(+) LIMIT	LOGIC 1= (+) LIMIT, <1>, <3>
J1-14B	MTR CUR	MOTOR CURRENT MONITOR, SF=SEE FUNC DIAG
J1-14Z	DS4	DRIVE STATUS CODE <7>
J1-16D	BRAKE CMD	LOGIC 1= BRAKE, <1>, <5>
J1-16B	ENABLE/RESET	LOGIC 0=ENABLE, <1>, <2>
J1-16Z	Vcc OUT	5VDC OUT
J1-18D	(-) LIMIT	LOGIC 1= (-) LIMIT, <1>, <4>
J1-18B	B COMMAND (+)	DIFFERENTIAL ANALOG ± 10V B INPUT COMMAND, <6>
J1-18Z	B COMMAND (-)	DIFFERENTIAL ANALOG ± 10V B INPUT COMMAND, <6>
J1-20D	+12VDC IN	12 V POWER SUPPLY INPUT <9>
J1-20B	DS3	DRIVE STATUS CODE <7>
J1-20Z	DRIVE FAULT	LOGIC 1= FAULT <8>
J1-22D	DIR LOGIC	INPUT FROM MOTION CONTRL, LOGIC 1=(+) DIRECTION<1>
J1-22B	(-) 12VDC IN	(-) 12 V POWER SUPPLY INPUT <9>
J1-22Z	NC	RESERVED
J1-24D	NC	NO CONNECTION
J1-24B	NC	NO CONNECTION
J1-24Z	NC	RESERVED
J1-26D	A COMMAND (+)	DIFFERENTIAL ANALOG ± 10V A INPUT COMMAND, <6>
J1-26B	A COMMAND (-)	DIFFERENTIAL ANALOG ± 10V A INPUT COMMAND, <6>
J1-26Z	NC	RESERVED
J1-28D	±12V RTN	±12V POWER SUPPLY RETURN
J1-28B	NC	NO CONNECTION
J1-28Z	NC	NO CONNECTION
J1-30D, B	Vcc RTN	5VDC RTN
J1-30Z	NC	NO CONNECTION
J1-32D	POWER DEVICE TEMP FAULT	JUNCTION TEMPERATURE FAULT, LOGIC 1=CC FAULT <7>
J1-32B	AMP TEMPERATURE FAULT	LOGIC 1=HEAT SINK TEMPERATURE FAULT <7>
J1-32Z	+5VDC IN	5 V POWER SUPPLY INPUT <9>

NOTES:

<1> OPTICALLY ISOLATED INPUT WITH INTERNAL 332 OHM PULL-UP RESISTOR TO 5VDC. SEE FUNCTIONAL DIAGRAM.

<2> SWITCH S1 ON PCB IS IN SERIES WITH THIS LOGIC INPUT CMD. INSTALLATION OF JUMPER JP1 WILL DISABLE THE EXTERNAL CMD.

<3> (+) LIMIT IS THE TRAVEL LIMIT THE MOTOR WILL DRIVE TOWARD WHEN THE DIRECTION SIGNAL IS A LOGIC 1. INSTALLATION OF JUMPER JP3 WILL DISABLE THIS FEATURE.

<4> (-) LIMIT IS THE TRAVEL LIMIT THE MOTOR WILL DRIVE TOWARD WHEN THE DIRECTION SIGNAL IS A LOGIC 0. INSTALLATION OF JUMPER JP2 WILL DISABLE THIS FEATURE.

<5> WHEN ACTIVE, THE MOTOR WINDINGS ARE SHORTED TOGETHER. IF THE BRAKE FEATURE IS NOT REQUIRED, INSTALL JUMPER JP4. CAUTION: BRAKE CMD AT HIGH SPEED MAY DAMAGE MOTOR AND/OR CONTROLLER. CONSULT FACTORY FOR ASSISTANCE.

<6> COMMAND POLARITY DETERMINES DIRECTION OF MOTION, SIGNAL AND SIGNAL RETURN CAN BE EXCHANGED. SEE <3>, <4>.

<7> OUTPUT FROM DIGITAL PROCESSOR. SEE DRIVE STATUS CODE TABLE. 0=TTL LOW, Z=HIGH IMPEDANCE.
LIMIT SINK CURRENT TO ≤ 1ma. JUNCTION TEMP >120C, HEAT SINK >70C

<8> OUTPUT FROM OPTO ISOLATOR. SEE FUNCTIONAL DIAGRAM.

<9> NOT REQUIRED WHEN OPTIONAL DC-DC CONVERTER IS ORDERED.

<10> SEE APPLICATION NOTE SUPPLEMENTARY FUSE PROTECTION.

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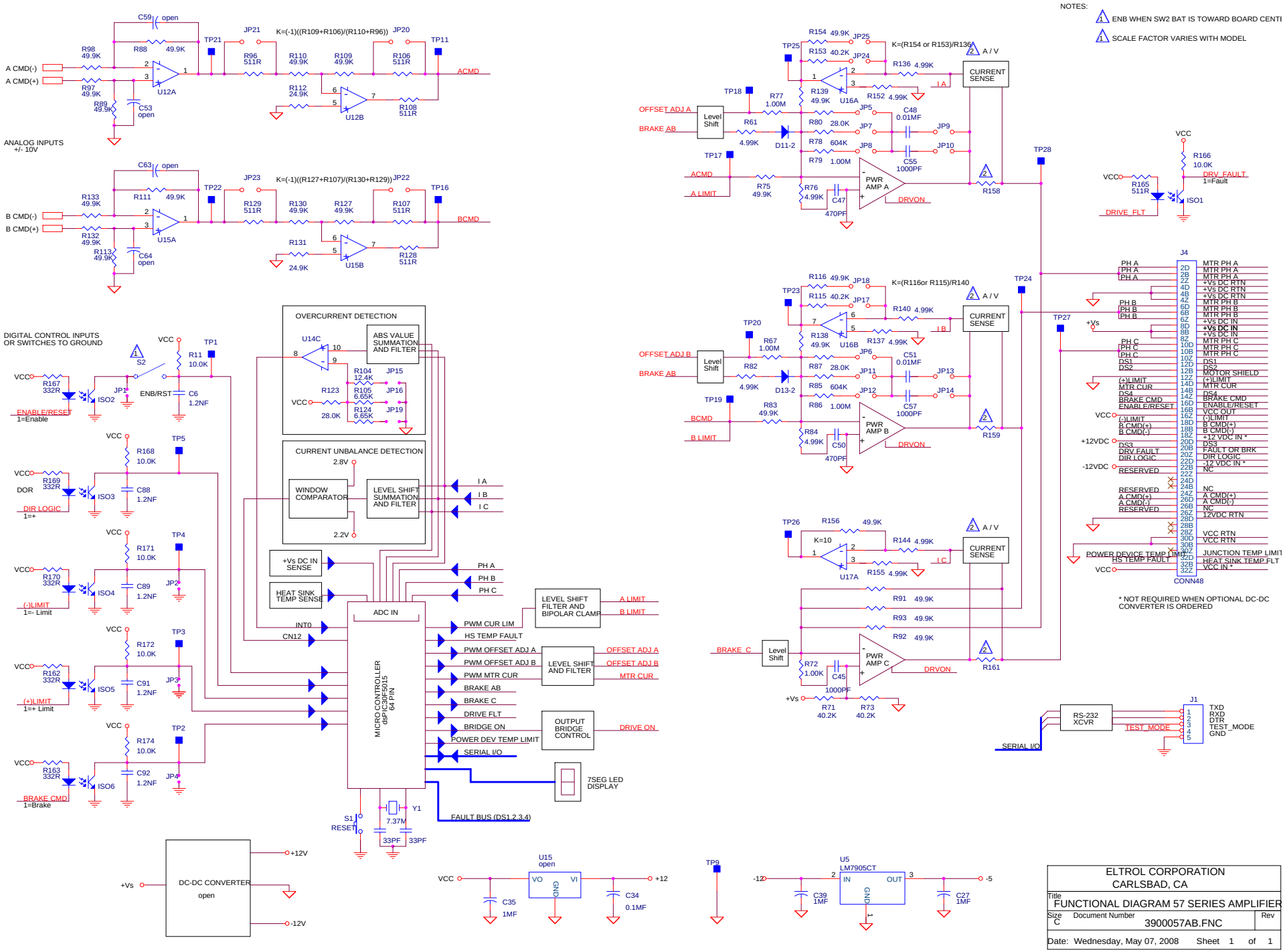
NOTES:
1 ENB WHEN SW2 BAT IS TOWARD BOARD CENTE
1 SCALE FACTOR VARIES WITH MODEL
ANALOG INPUTS
+/- 10V
A CMD(-)
A CMD(+)
B CMD(-)
B CMD(+)
K=(-1)((R109+R106)/(R110+R96))
K=(-1)((R127+R107)/(R130+R129))
ACMD
BCMD
DIGITAL CONTROL INPUTS
OR SWITCHES TO GROUND
ENABLE/RESET
1=Enable
DOR
DIR LOGIC
1=+
(-)LIMIT
1=- Limit
(+)LIMIT
1=+ Limit
BRAKE CMD
1=Brake
ENB/RST
OVERCURRENT DETECTION
ABS VALUE SUMMATION AND FILTER
CURRENT UNBALANCE DETECTION
WINDOW COMPARATOR
LEVEL SHIFT SUMMATION AND FILTER
+Vs DC IN SENSE
HEAT SINK TEMP SENSE
ADC IN
MICRO CONTROLLER
dsPIC30F5015
64 PIN
INT0
CN12
PWM CUR LIM
HS TEMP FAULT
PWM OFFSET ADJ A
PWM OFFSET ADJ B
PWM MTR CUR
BRAKE AB
BRAKE C
DRIVE FLT
BRIDGE ON
POWER DEV TEMP LIMIT
SERIAL I/O
FAULT BUS (DS1,2,3,4)
LEVEL SHIFT FILTER AND BIPOLAR CLAMP
LEVEL SHIFT AND FILTER
OUTPUT BRIDGE CONTROL
7SEG LED DISPLAY
DRIVE ON
OFFSET ADJ A
OFFSET ADJ B
MTR CUR
A LIMIT
B LIMIT
I A
I B
I C
PH A
PH B
PH C
DC-DC CONVERTER
open
+Vs
+12V
-12V
K=(R154 or R153)/R136
K=(R116or R115)/R140
K=10
CURRENT SENSE
A / V
PWR AMP A
PWR AMP B
PWR AMP C
Level Shift
OFFSET ADJ A
OFFSET ADJ B
BRAKE AB
BRAKE_C
ACMD
BCMD
A LIMIT
B LIMIT
DRVON
DRIVE_FLT
DRV_FAULT
1=Fault
ISO1
RS-232 XCVR
TEST_MODE
SERIAL I/O
TXD
RXD
DTR
TEST_MODE
GND
CONN48
* NOT REQUIRED WHEN OPTIONAL DC-DC CONVERTER IS ORDERED
POWER DEVICE TEMP LIMIT
HS TEMP FAULT
JUNCTION TEMP LIMIT
HEAT SINK TEMP FLT
VCC IN *
-12 VDC IN *
+12 VDC IN *
MOTOR SHIELD
BRAKE CMD
ENABLE/RESET
VCC OUT
DRV FAULT
DIR LOGIC
RESERVED
12VDC RTN
VCC RTN
U15
LM7905CT
IN
OUT
GND
ELTROL CORPORATION
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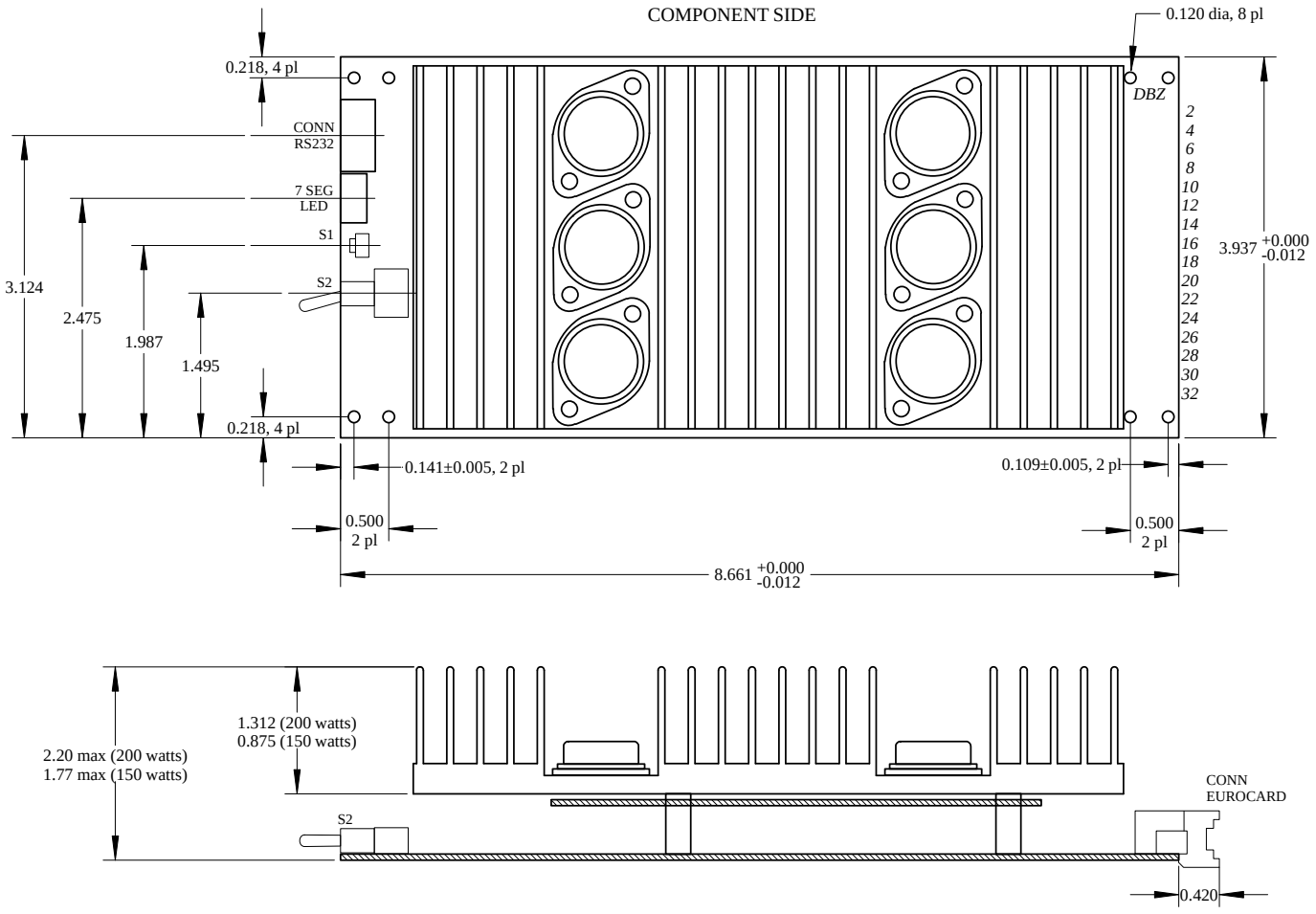
Title
FUNCTIONAL DIAGRAM 57 SERIES AMPLIFIER
Size C
Document Number
3900057AB.FNC
Rev
Date: Wednesday, May 07, 2008
Sheet 1 of 1

EUROCARD SERIES 57 LINEAR SINE DRIVE SERVO AMPLIFIER

MOUNTING DIMENSIONS



NOTES:
1. ALL DIMENSIONS SPECIFIED IN INCHES
2. ALL DIMENSIONS ARE +/- .002 UNLESS OTHERWISE SPECIFIED
3. DO NOT SCALE

ELTROL CORPORATION CARLSBAD, CA	
Title: SERIES 57 DATA SHEET OUTLINE	
Document Number: 3900057 OUTLINE.TCW	Rev:
Date: April 23, 2008	Sheet 1 of 1