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REVISIONS

DCN	LTR	DESCRIPTION	DATE	CHANGED	CHECKED	APPROVED
2552	C	RELEASED FOR PRODUCTION	981110	SAR		M.Morales
4039	D	REVISED PER DCN	011002	SA		M.Morales
4308	E	REVISED PER DCN	030331	SA		M.Morales
4397	F	REVISED PER DCN	030910	SA		M.Morales
4617	G	REVISED PER DCN	041025	PAJ		M.Morales
4874	H	REVISED PER DCN	060427	PAJ		M.Morales
5443	J	REVISED PER DCN	091222	PAJ		M.Morales

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TOLERANCES

DECIMAL
.XX = N/A
.XXX = N/A

TITLE

MANUAL, OPERATING
MODEL 8800D

ANGULAR	SCALE	SIZE	FSCM	SHEET	DRAWING NUMBER	REV.
X = N/A	N / A	A	61651	1 OF --	3973	J

DWG#: 3973
REV: J
FILE#: 3973J.doc
DATE: 091222
DCN#: 5443

OPERATING MANUAL
FOR
MODEL 8800D

HIGH POWER PULSED
LASER DIODE CONTROLLER

Analog Modules, Inc.
126 Baywood Avenue
Longwood, FL 32750

Approval: _____
Gary Sweezey, Product Manager

_____
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DWG#: 3973
REV: J
FILE#: 3973J.doc
DATE: 091222
DCN#: 5443

TABLE OF CONTENTS

CAUTION 1

1.0 INTRODUCTION 2

2.0 SET-UP AND INTERFACE 3

2.1 The Microprocessor Menu Structure 3
2.2 The RS232 Serial Interface Specification 9

3.0 OPERATING INSTRUCTIONS 10

3.1 System Interlock Requirements 10
3.2 Start-Up Procedure 10
3.3 Shut-Down Procedure 11

4.0 SYSTEM VERIFICATION 12

4.1 Software Configuration 13
4.2 Electrical Configuration 13
4.3 Chassis Configuration 13

5.0 MAINTENANCE AND RECOMMENDED SPARES 26

5.1 Maintenance 26
5.2 Recommended Spares 26

6.0 DOCUMENTATION 27

DWG#: 3973
REV: J
FILE#: 3973J.doc
DATE: 091222
DCN#: 5443

CAUTION

READ THIS BEFORE PROCEEDING FURTHER

The voltages generated by this equipment are ***LETHAL***. To avoid electrocution, good care and judgment must be used. The safety interlocks are provided for your protection and should never be disabled or defeated. Covers should not be removed without first disconnecting the AC power lines servicing this equipment. All storage capacitors should be discharged before any attempt is made to enter the unit, move connectors, or touch laser diode(s) or output cable. If any doubt exists, check capacitors with a HV probe or voltmeter. Ensure all metal boxes are connected to ground.

When shipping, the rack boxes should be appropriately supported or removed to avoid damage due to mechanical shock. Inspect all cables for looseness at connectors and visual damage. Do not support units by front panel only--use multiple supports. Protect exposed power and lamp connections from human touch.

SECTION 1

INTRODUCTION

1.0 INTRODUCTION

The ***Model 8800D*** laser diode controller provides pulsed (quasi-CW) output currents to drive laser diode(s) for pumping solid-state lasers. The microprocessor provides the flexibility and convenience of software control. The system status is presented on an easy-to-read LCD graphics display. The system can be configured to include custom software, and 1 or 2 internal power modules. The ***Model 8800D*** slowly ramps the output current to the level set by the user and an adjustable precision current limit protects the laser diode from exceeding its maximum rating. The microprocessor can also control two independent outputs for OSC/AMP laser applications. The ***Model 8800D*** package comes in a convenient 19" rack mounted assembly.

SECTION 2

SET-UP AND INTERFACE

2.0 SET-UP AND INTERFACE

Model 8800D is a microprocessor based pulsed laser diode controller with an alpha-numeric control panel and graphics display. The microprocessor can be controlled from the alpha-numeric membrane switch panel or from the RS232 serial interface.

The microprocessor has a predefined menu structure which allows the user to adjust settings such as pulse rate, delays, and laser diode current or energy. The menu also has a continuous runtime/shot counter and non-operational diagnostic tests.

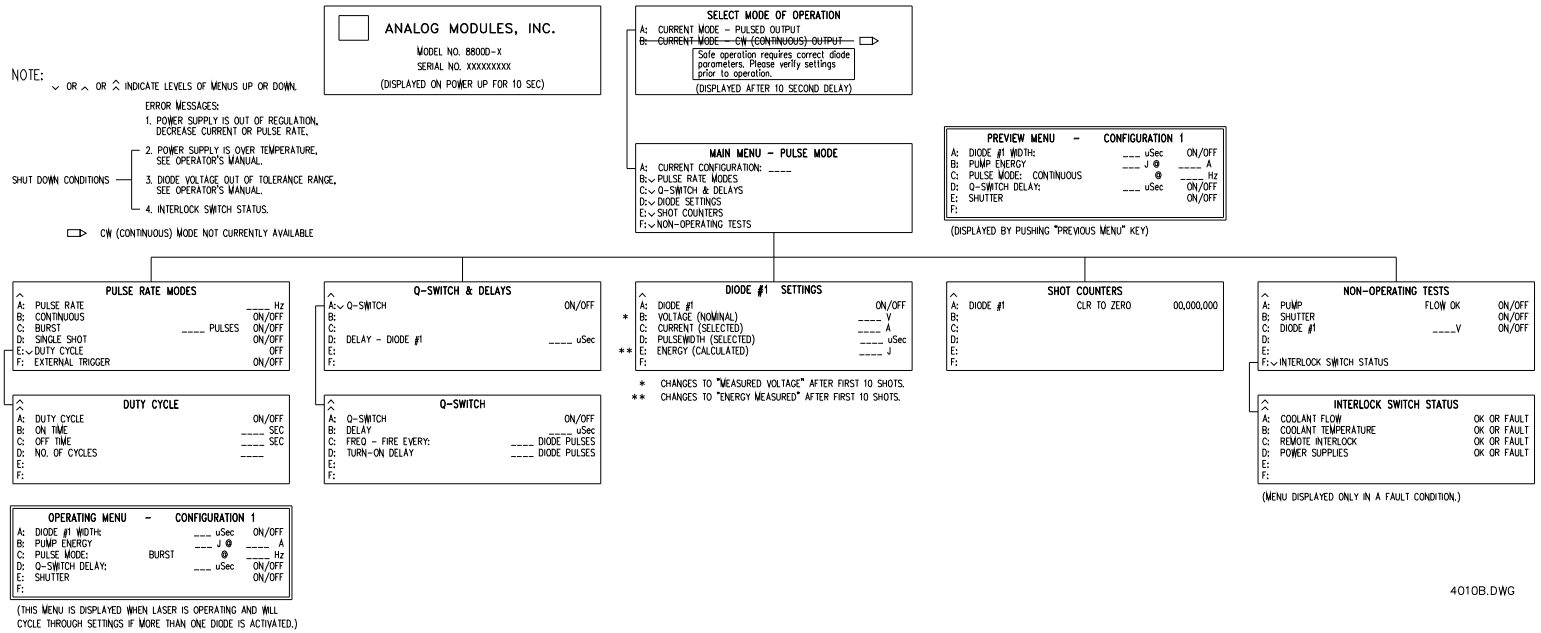
The rear panel of the controller is the central interface panel for any other subcomponents purchased with the 8800D system. The laser diode output and interlock connections are also on the rear panel of controller.

2.1 The Microprocessor Menu Structure

See Figure 2.1 Model 8800D Microprocessor Menu Structure.

When the controller is turned on via the front panel key switch, power is applied to the microprocessor. This initiates a 10 second warning delay indicating that power has been applied to the microprocessor. During this delay period, Analog Modules' logo, system model number and serial number are displayed, but no commands can be sent to the microprocessor either via key pad or the RS232 serial interface.

After this delay period, the Select Mode of Operation Window appears. This window allows the operator to select the current mode operation and warns the operator that "safe operation requires correct diode parameters." This is a warning to the operator to "please verify settings prior to operation." Since the 8800D has a configuration storage feature, it is important to first check that the correct operating parameters are in place prior to laser diode operation.



8800D Microprocessor Menu Structure

Figure 2.1

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REV: J
FILE#: 3973J.doc
DATE: 091222
DCN#: 5443

The operator must select "A" on the key pad for pulsed (quasi-CW) operation. CW (continuous) operation is not available at this time.

2.1.1 The Main Menu Window

After selection of the current operation mode, the Main Menu window for that mode appears. This is the highest level of the menu for a particular operation mode. From this point, the operator can access any other branch of the menu by pressing the corresponding letter on the key pad which appears to the left of the line which describes that branch. The stored configuration number (1-3) is also displayed on the "A" or top line. The operator can store up to three different operating conditions. Configurations can be stored by pressing the "Save Config" key on the key pad. Configurations can be recalled by pressing the "A" key while in the main menu window and entering the configuration (1-3) to be recalled. Once the number has been entered, the system operating parameters will be changed to the last conditions stored in that location. The operator can then proceed with the start up procedures.

While in the main menu window, the operator can also preview the operating parameters by pushing "Previous Menu" key on the keypad. This feature allows the operator to preview all of the primary laser diode operation settings such as energy, current, pulsewidth, operation mode and rep rate prior to laser diode operation. As an additional safety check, it is highly recommended that the operator always preview the system operating parameters prior to beginning laser diode operation.

2.1.2 The Pulse Rate Modes Window

From the main menu the operator can access "Pulse Rate Modes" by pressing "B" on the key pad. The pulse rate mode window will appear on the display. This window allows the operator to adjust the laser diode pulse mode. The operator can enter the rep rate by pressing the "A" key on the key pad and entering a rep rate. Once the rep rate has been selected, the operator can then select between continuous, burst, single shot, duty cycle, or external trigger mode.

Continuous mode is a continuous pulse at the entered rep rate. The laser diode will trigger when "RUN" key is pressed and continue until the "STOP" key is pressed.

Burst mode is a batch command. This instructs the microprocessor to run a burst or to trigger the laser diode for the entered number of pulses at the entered rep rate and stop automatically. The system will not burst again until the "RUN" key is again pressed.

Single shot is a single event command. When single shot is selected, the laser diode will trigger one time when the "RUN" key is pressed and will stop automatically. The laser diode will not trigger again until the "RUN" key is again pressed.

Duty cycle mode is a feature which allows the operator to trigger the laser diode for a specified ON period and stop the laser diode for a specified OFF period and repeat this ON/OFF cycle a specified number of times.

External trigger mode allows the user to provide an external TTL trigger to trigger laser diode. This input is opto-isolated and requires ≥2.2VDC at ≥20μS pulse to trigger laser diode. When using this mode, the 8800D internal clock is ignored and the repetition rate is dependent upon input trigger frequency. This external trigger also becomes the "T_o" or time zero for all other system delays. See paragraph 2.1.3 Delays Window for a discussion of delays.

2.1.3 The Delays Window / Soft Start Ramp

From the main menu, the operator can access "Delays" by pressing the "C" on the key pad. The delays window will appear on the display. This window allows the operator to access the "Q-Switch" delays window, set delays for multiple laser diode output applications.

From the Delays window, the operator can access the "Q-Switch" window by pressing the "A" key on the key pad. This window allows the operator to set a delay from "T_o" of 0 to 10,000μS for a Q-Switch. T_o is the laser diode trigger command and is the time zero reference for the timing of all subsequent delays. The T_o pulse can be generated internally by the 8800D clock or can be provided externally when in the external trigger mode. The 8800D provides a "Q-SW SYNC" output on the rear panel to trigger a Q-Switch driver. This driver is used to drive a Q-Switch for Q-Switching a solid-state laser.

If desired, a specific delay from "T_o" can be set for the laser diode trigger. This delay is set in line "D", "Delay - Diode #1."

In Soft-Start Ramp window, a ramp up time to current setting can be entered in line "A".

2.1.4 The Diode Settings Window

From the main menu the operator can access "Diode Settings" by pressing "D" on the key pad. The lamp settings window will appear on the display. This window allows the operator to set nominal voltage and a specific current and pulsewidth requirement for the laser diode(s).

Line "A" of this window allows the operator to turn laser diode output ON/OFF. This is a redundant safety feature which allows the operator to allow activation of the laser diode output when the "RUN" key is pressed. This will typically remain in the "ON" state.

Line "B" of this window is either a "Nominal" or a "Measured" parameter. During the set up, the operator is required to enter an expected voltage value on this line. This voltage value should be slightly greater than expected and does not need to be exact. It is simply a starting point for the power supply.

After laser diode triggers for 10 pulses or run continuous for 5 seconds, the 8800D will measure the voltage demand and adjust the power supply to required voltage value. This auto-regulation feature minimizes heat dissipation on the current switching device. After auto-regulation, the voltage changes from "Nominal" to "Measured" and is reported in line B.

Line "C" of this window allows the operator to adjust the laser diode operating current. The 8800D is a current controlled device. The value entered into this field will always be a "selected" value.

Line "D" of this widow allows the operator to adjust the output current pulsewidth. This value is a "Selected" value.

Line "E" reports the energy "Calculated" when a "Nominal" voltage is entered on line B, a "Selected" current is entered on line C and a pulsewidth is selected on line D. The microprocessor calculates the energy using the voltage, current and pulsewidth.

After the laser diode triggers for 10 pulses, the microprocessor will update this "Energy (Calculated)" parameter to a "Energy (Measured)" parameter. This is accomplished by sampling the

actual current and voltage waveforms in real time and integrating the product over the actual pulsewidth of each trigger. The microprocessor will update this information every 10 shots as it takes a running average over those 10 shots.

Energy Displayed in the single shot mode, however, will be "Calculated" not "Measured".

2.1.5 The Shot Counter Window

From the main menu, the operator can access "Shot Counters" by pressing the "E" on the key pad. The shot counter window will appear on the display. This window records the total number of elapsed shots on the laser diode up to 99,999,999. This counter is non-volatile, but can be reset by selecting Diode #1 or Diode #2 and pressing the clear, "CLR", key on the key pad. The counter will return to 00,000,000.

2.1.6 The Non-Operational Tests Window

From the main menu, the operator can access "Non-Operational Tests" by pressing "F" on the key pad. The non-operational tests window will appear on the display. This window allows the operator to set the pump/shutter output state, test the internal or external power supply's command program voltage or survey the system interlocks.

The pump/shutter output is a 24VDC output provided on the rear panel of the controller. This 24VDC could drive a relay to actuate a cooling pump or open/close the shutter of a solid state laser. The lamp PSU test feature allows the operator to enter a command program voltage to test the command signals to the internal or external power supplies non operationally without triggering the laser diode(s).

Then a voltage is entered on the PSU test line and the ON/OFF select is "OFF", a command program voltage is sent to the internal or external charger, but the power supplies are inhibited by the "OFF" condition and will not charge the capacitors. To verify that the correct command voltage has been sent to the internal or external power supplies, check the charger I/O pinout to verify the correct analog control voltage. This is considered a non-operational test because a command program voltage can be sent to the internal or external power supplies without actually triggering the laser diode.

When a voltage is entered on the PSU test line and the ON/OFF select is "ON", a command program voltage is sent to the internal or external power supply but the supplies are enabled by the "ON" condition and will charge the capacitors to the set voltage. Note that the same HV precautions must be taken with this non-operational test as with normal laser diode triggering conditions because with the power supplies enabled with the "ON" condition, the capacitors will be charged!

The interlock switch status line provides access to the "Interlock Status" window when the "F" key on the key pad is pressed. The interlock status window will appear on the display. This window provides a quick survey of the system interlock situation.

During system operation an interlock fault causes an immediate shutdown condition which stops the laser diode trigger and prompts a corresponding interlock error message on the display. This also dumps the HV on the capacitors.

2.2 The RS232 Serial Interface Specification

See paragraph 4.0, verification for Model 8800D Serial Interface Specification to operate the 8800D remotely via the RS232 interface.

SECTION 3

OPERATING INSTRUCTIONS

3.0 OPERATING INSTRUCTIONS

3.1 System Interlock Requirements

Prior to system operation, the system interlocks must be closed. All interlocks are located on the 8800D rear panel External I/O connector. The following steps are required to close system interlocks.

1. Covers must be installed.
2. External I/O, DB25S on rear panel of 8800D requires following connections:

   Remote/Door (+), Pin 1 to Remote/Door (-), Pin 14
   Flow (+), Pin 2 to Flow (-), Pin 15
   Coolant Temp (+), Pin 3 to Coolant Temp (-), Pin 16
   Load must be connected to the unit.

3.2 Start-Up Procedure (using the 8800D Fixed Pulsewidth Controller alpha-numeric control panel and graphics display)

1. Turn key switch to "ON" on 8800D controller.

2. Wait for 10 second audible delay period. Note, no commands can be sent to the 8800D microprocessor during this period.

3. Push any key on the 8800D alpha-numeric key pad to access microprocessor "Mode of Operation" window. See paragraph 2.1 for a discussion on interfacing with the 8800D microprocessor menu structure.

4. Select pulsed mode of operation.

5. Press "Previous Menu" key to verify that the stored laser diode operating conditions match the desired laser diode operating parameters prior to laser diode operation. It is recommended that this preview feature always be used prior to laser diode trigger.

6. Adjust system settings until they match desired laser diode operating conditions. See paragraph 2.1 for a discussion on interfacing with the 8800D microprocessor menu structure.

7. Press “RUN” key to enable system HV and begin laser diode operation. Caution: HV will be present on the 8800D capacitor bank.

3.3 Shut-Down Procedure

1. Press "Stop" key, this terminates laser diode operation and dumps HV in 8800D capacitors via internal dump circuits. Caution: Capacitors will discharge to a safe state in approximately ten minutes.

2. Turn key switch to "OFF". Wait at least ten minutes prior to touching any HV contacts.

SECTION 4

SYSTEM VERIFICATION

4.0 SYSTEM VERIFICATION

See attached verification sheet for software, electrical, and chassis configuration.

8800D System Verification Sheet

Model Number:
8800D- _____ S/N: _____
8800D- _____ S/N: _____

4.1 **SOFTWARE CONFIGURATION**:

Version _____ S/N _____

Front Panel Keys Operational _____
Power on LED _____
HV on LED _____
Access Code to Select Hidden Menu(s) _____
Interlock Enable Code _____ (Decimal) _____ (Hexadecimal)

PULSED MODE:	DIODE #1		DIODE #2	
Energy Maximum	_____ J	_____ F/S	_____ J	_____ F/S
Volts Maximum (Load)	_____ V	_____ F/S	_____ V	_____ F/S
Amps Maximum	_____ A	_____ F/S	_____ A	_____ F/S
Pulsewidth Maximum	_____ µS		_____ µS	
Duty Cycle Maximum	_____ %		_____ %	
Charge Delay	_____ mS		_____ mS	
-- V offset .1 --	_____ V		-- V offset .2 --	_____ V

4.2 **ELECTRICAL CONFIGURATION**:

DRIVER:	DIODE #1	DIODE #2
No. of Capacitors	_____ (0-3)	_____ (0-3)
Capacitor Value	_____ µF	_____ µF
Capacitor Voltage	_____ V	_____ V
Capacitor Mfg.	_____	_____
Capacitor Part No.	_____	_____
Total Capacitance	_____ µF @ _____ Vmax	_____ µF @ _____ Vmax
Driver Calculations	_____ (attach copy)	_____ (attach copy)
Max Joules/pulse	_____J/pulse	_____J/pulse
Max Pulse Rate	_____ Hz	_____ Hz

CHARGER:	DIODE #1	DIODE #2
External	_____ , Cables, _____ (1,2,3)	_____ , Cables, _____ (1,2,3)
Input Voltage	_____ VAC, 50/60Hz	_____ VAC, 50/60Hz
Input Phase	_____ (1∅, 3∅)	_____ (1∅, 3∅)
Series	_____	
Max Voltage	_____ V	_____ V
Max Pulse Rate	_____ Hz @ _____V	_____ Hz @ _____V
Power	_____ W @ Low Line	_____ W @ Low Line
Internal	_____ , Cables, _____ (1,2,3)	_____ , Cables, _____ (1,2,3)
Series	_____	
Max Voltage	_____ V	_____ V
Burn In Pulse Rate	_____ Hz @ _____V	_____ Hz @ _____V
Power	_____ W @ Low Line	_____ W @ Low Line

INPUT:		
Voltage	_____ VAC, 50/60Hz	_____ VAC, 50/60Hz
	_____ (1∅, 3∅)	_____ (1∅, 3∅)
OTHER:		
Input Power Module	_____	_____
Input Power Cord/Plug	_____ (U.S., other)	_____ (U.S., other)

4.3 **CHASSIS CONFIGURATION**:

Front Panel	_____ (3.5", 7.0")	_____ (3.5", 7.0")
Chassis Depth	_____ (17", other)	_____ (17", other)

Rear Panel Connector Pinout:

Connector/Signal	Description	Location	CKT	Verification
RS232 I/O	Serial COM port, See page 19	DB9S, rear panel		_____
EXTERNAL I/O	See Sheet 15	DB25S, rear panel		_____
SUPPLY 1 I/O	See Sheet 16	DB15S, rear panel		_____
SUPPLY 2 I/O	See Sheet 17	DB15S, rear panel		_____
DIODE 2 I/O	See Sheet 18	DB15S, rear panel		_____
HV IN	Input from external charger	MHV, rear panel		_____
CURRENT MON	Current Monitor ÷ 100	BNC, rear panel		_____
EXT TRIGGER IN	TTL, Opto-isolated external trigger input ≥ 2.2VDC, 20nS	BNC, rear panel	E	_____
LASER SYNC	Provides "T_o", clock time zero reference output, 5V, 100µS typ.	BNC, rear panel	K	_____
DELAY 1	Provides "T_1", Delay #1 output, 10V, 0-10,000µS adjustment range	Reserved	C	_____
DELAY 2	Provides "T_2", Delay #2 output, 12V, 0-10,000µS adjustment range	Reserved	C	_____
DELAY 3	Provides "T_3", Delay #3 output, 5V, 0-10,000µS adjustment range	Reserved	C	_____
Q-SW SYNC	Provides Q-Switch sync output, 5V, 0-10,000µS adjustment range	BNC, rear panel	K	_____
DIODE OUTPUT	HV output to diode with ground stud	AMP flat conductor connector, rear panel		_____
AC INPUT	115/220VAC, 1Ø, 50/60HZ, Fused	Power cord with plug termination		_____Fuse _____ A

External I/O Connector Pin-Out:

Signal	Description	Location	CKT	Verification
Remote/Door (+)	Remote/Door interlock, must be tied to door (-) to close interlock	Pin 1	D	_____
Remote/Door (-)	Return for Remote/Door (+)	Pin 14		_____
Flow (+)	Flow interlock, must be tied to Flow (-) to close interlock	Pin 2	D	_____
Flow (-)	Return for Flow (+)	Pin 15		_____
Coolant Temp (+)	Coolant Temp interlock, must be tied Coolant Temp (-) to close interlock	Pin 3	D	_____
Coolant Temp (-)	Return for Coolant Temp (+)	Pin 16		_____
Pump (+)	+24VDC to drive pump relay transistor switch to ground, 300mA max.	Pin 4	I	_____
Pump (-)	Return for Pump (+)	Pin 17		_____
Shutter (+)	+24VDC to drive shutter solenoid transistor switch to ground, 300mA max.	Pin 5	I	_____
Shutter (-)	Return for Shutter (+)	Pin 18		_____
+24VDC	+24VDC Output, 10mA maximum	Pin 6		_____
+24VDC RTN	Return for +24VDC	Pin 19		_____
+15VDC	+15VDC, 10mA maximum	Pin 7		_____
+15VDC RTN	Return for +15VDC	Pin 20		_____
+24VDC(Switched)	Switched +24VDC, Output occurs when HV enabled, 10mA maximum	Pin 8		_____
+24VDC(Switched) RTN	Return for +24VDC(Switched)	Pin 21		_____
Spare Output 1	Digital output, 5V	Pin 9	K	_____
Spare Output 1 RTN	Return for Digital output	Pin 22		_____
Oven Poweer (Optional)	No connection, optional	Pin 10		_____
Oven Poweer RTN	No connection, optional	Pin 23		_____
Reserved	No connection	Pin 11		_____
Reserved	No connection	Pin 24		_____
Reserved	No connection	Pin 12		_____

Reserved	No connection	Pin 25		_____
Reserved	No connection	Pin 13		_____

Supply 1 I/O Connector Pin-Out:

Signal	Description	Location	CKT	Verification
+24VDC (Switched)	Switched +24VDC, Output occurs when HV enabled	Pin 1		_____
+24VDC (Switched) RTN	Return for +24VDC (Switched)	Pin 9		_____
+24VDC	+24VDC Output	Pin 2		_____
+24VDC RTN	Return for +24VDC	Pin 14		_____
Interlock	Input, pull low to close interlock	Pin 10	D	_____
V_{mon} (+)	Input, monitors high voltage from supply	Pin 3	G	_____
V_{mon} (-)	Return for V_{mon} (+)	Pin 11		_____
Program (+)	Output, provides programming voltage to set the HV Output voltage	Pin 4	H	_____
Program (-)	Return for Program (+)	Pin 12		_____
Reserved	No connection	Pin 5		_____
Temp Interlock	Input, pull low to close interlock	Pin 13	D	_____
Temp Interlock RTN	Return for Temp Interlock	Pin 14		_____
INT/EXT	Input, when pulled low, this line selects the supply's external program input	Pin 6	GND	_____
Inhibit	Output, supply will be inhibited when line rises above 3V. Used to temporarily disable supply during laser diode trigger	Pin 7	B	_____
Reserved	No connection	Pin 15		_____
Reserved	No connection	Pin 8		_____

Supply 2 I/O Connector Pin-Out:

Signal	Description	Location	CKT	Verification
+24VDC (Switched)	Switched +24VDC, Output occurs when HV enabled	Pin 1		_____
+24VDC (Switched) RTN	Return for +24VDC (Switched)	Pin 9		_____
+24VDC	+24VDC Output	Pin 2		_____
+24VDC RTN	Return for +24VDC	Pin 14		_____
Interlock	Input, pull low to close interlock	Pin 10	D	_____
V_{mon} (+)	Input, monitors high voltage from supply	Pin 3	G	_____
V_{mon} (-)	Return for V_{mon} (+)	Pin 11		_____
Program (+)	Output, provides programming voltage to set the HV Output voltage	Pin 4	H	_____
Program (-)	Return for Program (+)	Pin 12		_____
Reserved	No connection	Pin 5		_____
Temp Interlock	Input, pull low to close interlock	Pin 13	D	_____
Temp Interlock RTN	Return for Temp Interlock	Pin 14		_____
INT/EXT	Input, when pulled low, this line selects the supply's external program input	Pin 6	GND	_____
Inhibit	Output, supply will be inhibited when line rises above 3V. Used to temporarily disable supply during laser diode trigger.	Pin 7	B	_____
Reserved	No connection	Pin 15		_____
Reserved	No connection	Pin 8		_____

DIODE 2 I/O Connector Pin-Out:

Signal	Description	Location	CKT	Verification
Enable In High	Input, +24VDC @ 5mA	Pin 1		_____
Crowbar Enable	Input, +5 to +15VDC FET input	Pin 14		_____
Current Monitor Out	Output, 0 to 10VDC Yield 0 to Imax 10mA typical	Pin 3		_____
Crowbar Out	Output, Latched signed Indicates crowbar tripped active high +15V appr. over 1kohm	Pin 16		_____
Pulse In High	Input, Optically isolated signal requires 10mA (internal 300 ohms resistor)	Pin 5		_____
Mode In Low	Input, select pulsed Internally powered @ 24V over 3.32 kohms.	Pin 19		_____
Current Control In	Input, 0 to 10VDC yields 0 to max output current (50 kohms impedance)	Pin 7		_____
Diff. Voltage Out	Output, Impedance isolated signal 0 to 10V across the driver.	Pin 20		_____
Pulse In Low	Input, Optically isolated signal, pulled low to activate the output pulse, operates @ 10mA, PW determines output pulsewidth.	Pin 9		_____
Voltage Monitor Out	Output, Impedance isolated signal 10VDC yields 0 to 300V across the load.	Pin 12		_____
Ground	Ground	Pin 2, 4, 6, 8, 10, 24		_____
NC	Not Used	Pin 15, 17, 18, 21, 22, 23, 11, 25, 13		_____

RS232 Serial Interface

Using the RS232 Serial Interface Specification, the system integrator can select maximum operating points for the system.

The maximum operating points include:

Maximum Rep Rate
Maximum Energy
Maximum Voltage
Maximum Pulsewidth
Interlock Code

When any of these maximum parameters are exceeded by the operator, an error message is prompted explaining that the selected value is "Out of Range", and an acceptable range is provided for reference. When the "CLR" key is pressed, the prompt is cleared and the system will wait for an entry that is in the acceptable range.

This interface also allows the system integrator to configure system software interlocks. Configuration is typically done at installation and is usually a one time requirement provided the system sub-component (hardware) configuration does not change.

This is an added feature of flexibility which allows a solid state laser manufacture to purchase a general AMI controller and configure it with other AMI components as well as other typical laser components such as a chiller. A brief discussion will be included here for the operators reference.

The microprocessor has both hardware and software interlocks. The hardware is configured to match the system sub-component configuration and the software is enabled or matched to the hardware interlock configuration.

The hardware interlocks are configured on the microprocessor PCB by installing specific jumpers. The door/remote, flow and temperature interlocks, however, are not usually jumper selectable and must be completed at the controller rear panel. See the list below for the complete list of system hardware/software interlocks.

HARDWARE / SOFTWARE INTERLOCKS

Interlock Displayed	Actual Function	Microprocessor Numerical Designation
PS3 Overtemp	No Load Driver 2	1
PS3 Interlock	No Load Driver 1	2
PS2 Overtemp	PS2 Overtemp	4
PS2 Interlock	Crowbar 2 Activated	8
PS1 Overtemp	PS1 Overtemp	16
PS1 Interlock	Crowbar 1 Activated	32
Internal Interlock Overtemp	Dump Circuit Overtemp	64
Internal Interlock	Internal Interlock	128
Remote Interlock	Remote Interlock	256
Flow Interlock	Flow Interlock	512
Temp Interlock	Temp Interlock	1024

All selected hardware interlocks must be completed/defeated to enable system HV. The 8800D system software interlocks are only a redundant safety feature, but must be matched to the hardware interlocks, so the microprocessor can diagnose and report an interlock fault to the system operator.

The software interlocks are preset at the factory. In future software releases, these software interlocks and other features will be available to the system integrator.

If a hardware interlock is faulty and the software has been enabled for that interlock(s), an error message will be displayed on the graphic display.

Serial Interface Specification:

The model 8800D digitally controlled power supplies provide a RS-232 interface for remote control of the operating parameters of the power supplies. All commands have the following syntax:

$name ##cr

where **$** Indicates a command follows.

name Is the command name. Note that for clarity commands are not abbreviated, only the first four characters must be sent. No spaces are allowed between the **$** and the **name**.

Is an unsigned, integer associated with name. A space must be inserted between **name** and **##**.

cr Carriage return (0Dh).

Unidentified commands and most out of range conditions results in the power supply ignoring the command. Only one command will be processed per message. Commands are not processed until the carriage return is sent. If an error is made and identified prior to sending the carriage return sending a new $ will reset the input buffer and allow a corrected command to be sent.

To determine the current value of a parameter the syntax is:

$name ?cr

where **?** Replaces **##**

This will return an integer followed by a space, carriage return, and line feed (20h 0Dh 0Ah).

Communications is set at 9600 baud, 8 bits, parity = none, and 1 stop bit. To help establish communications, after power up systems running version 2.0 and later software emit **AMI** approximately every 500 ms until the power supply receives a **$** .

Commands will not be received until after a current mode is selected from the front panel of the power supply.

MODE ## Sets the pulse generator mode. Valid range 1-5

1 = continuous
2 = burst mode (valid only in pulse mode)
3 = duty cycle mode
4 = single shot (valid only in pulse mode)
5 = external trigger/gate

FREQ ## Sets the repetition frequency mantissa.

Valid range: 1 - 10000

SCALE ## Sets the repetition frequency range.

Valid range: 0 - 2

Note: FREQ and SCALE must be used together to set the repetition frequency. FREQ must be sent first. SCALE set the number of decimal places in FREQ. For example to set the repetition frequency at 15 Hz:

$FREQ 1500cr

$SCALE 2cr

Which interprets FREQ with two decimal places. i.e. 15.00. The frequency must be within the allowed minimum and maximum.

DCON ## Sets the on time, in seconds, for the duty cycle mode.

Valid range: 1 - 10000 Sec

DCOFF ## Sets the off time, in seconds, for the duty cycle mode.

Valid range: 1 - 10000 Sec

CYCLES ## Sets the number of cycles for the duty cycle mode.

Valid range: 0 - 10000

Where zero indicates continuous duty cycle operation.

BURST ## Sets the number pulses in the burst mode.

Valid range: 1 - 10000

1DIODE ## Turns diode #1 high voltage on or off.

Valid range: 0 - 1 (0=off, 1=on)

2DIODE ## Turns diode #2 high voltage on or off.
Valid range: 0 - 1 (0=off, 1=on)

1DELAY ## Sets the delay, in microseconds, for diode pulse #1.
Valid range: 0 - 10000 μS

2DELAY ## Sets the delay, in microseconds, for diode pulse #2.
Valid range: 0 - 10000 μS

1SOFT ## Sets the soft start ramp period, in mS, for diode pulse #1.
Valid range: 0 - 10000 mS

2SOFT ## Sets the soft start ramp period, in mS, for diode pulse #2.
Valid range: 0 - 10000 mS

QSWITCH ## Set Q-switch on or off.
Valid range: 0 - 1 (0=off, 1=on)

QDELAY ## Sets the Q-switch delay, in microseconds, from diode pulse #1.
Valid range: 1 - 1000

QFREQ ## Sets the rate the Q-switch will be fired relative to the diode pulse rate. The rate is given by (diode frequency)/(Q-switch frequency)
Valid range: 1 - 1000

QWAIT ## Set the number of pulses to wait after starting the laser before enabling the Q-switch. Note: this is used to allow time for the laser to stabilize.
Valid range: 0 - 10000

1AMP ## Sets the current for diode #1.
Valid range: 0 - Imax (256)

2AMP ## Sets the current for diode #2.

Valid range: 0 - Imax (256)

Note: Imax is set for each system to be within the safe limits of the power supply and the laser system.

1VOLT ## Sets the nominal voltage for diode #1.

Valid range: 0 - Vmax v

2VOLT ## Sets the nominal voltage for diode #2.

Valid range: 0 - Vmax v

Note: Vmax is set for each system to be within the safe limits of the power supply and the laser system.

1WIDTH ## Sets the Pulsewidth, in microseconds, for diode #1.

Valid range: 50 - 10000 uS

2WIDTH ## Sets the Pulsewidth, in microseconds, for diode #2.

Valid range: 50 - 10000 uS

Note: The Pulsewidth is set for each system to be within the safe limits of the system duty factor and/or maximum energy.

BEEP ## Beeps the buzzer, ## times.

Valid range: 1 - 1000

PUMP ## Turns the pump on or off

Valid range: 0 - 1 (0=off, 1=on)

SHUTTER ## Opens or closes the shutter.

Valid range: 0 - 1 (0=close, 1=open)

FIRE ## Starts the run mode.
Valid range: 1

STOP ## Stops the run mode.
Valid range: 0

STATUS ## No action if a number is specified, but will return the interlock status if followed by the **?** query. The result may vary in some systems but the standard configuration is as follows:

HEX:	**DEC:**	
0001h	1	No Load Driver 2
0002h	2	No Load Driver 1
0004h	4	Power Supply #2 Overtemp
0008h	8	Crowbar 2 Activated
0010h	16	Power Supply #1 Overtemp
0020h	32	Crowbar 1 Activated
0040h	64	Dump Circuit Overtemp
0080h	128	Internal Power Supply Interlock
0100h	256	Remote Interlock
0200h	512	Coolant Low Flow
0400h	1024	Coolant Overtemp

A 1 in any position indicates an interlock failure. Only interlocks which have been enabled in the system configuration are reported.

Tested By: _____ **Date:** _____

Quality Acceptance By: _____ **Date:** _____

SECTION 5

MAINTENANCE AND RECOMMENDED SPARES

5.0 MAINTENANCE AND RECOMMENDED SPARES

5.1 Maintenance

No scheduled maintenance is required.

Keep the HV connections free from dust. Examine the laser diode output circuit connections occasionally to ensure no burning.

Failure symptoms should be identified to the area or circuit. Always check for power from the open frame power supplies, then consult the circuit description to identify the faulty circuit.

5.2 Recommended Spares

No spares are recommended.

SECTION 6

DOCUMENTATION

6.0 DOCUMENTATION

See attached prints for layout and connector pinout descriptions.

Title	Drawing Number
8800D Data Sheet	8800D.DS
Final Unit Assy	6572
Front Panel Assy	3677
Left Side Panel Assy	4980
Rear Panel Assy	5378
Rear Panel Assy w/Terminal Block	5528
System Wiring Diagram	6522 (sheets 1 & 2)

ANALOG MODULES, INC.

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MODEL 8800D
HIGH POWER
LASER DIODE CONTROLLER

HIGH POWER PULSED LASER DIODE CONTROLLER

- **MICROPROCESSOR CONTROL**
- **OUTPUT CURRENT UP TO 300 AMPS PULSED**
- **DIODE VOLTAGE – UP TO 280 VDC**
- **VARIABLE PULSEWIDTH 50μs TO 5ms**
- **MULTIPLE CONFIGURATION STORAGE**
- **RS232 PORT FOR REMOTE CONTROL**



DESCRIPTION:

The ***Model 8800D*** laser diode controller provides pulsed output current to drive laser diodes for pumping solid-state lasers. An internal microprocessor provides the flexibility and convenience of software control and the system status is presented on an easy-to-read LCD graphics display. The Model 8800D can be configured with one or two power modules for up to 2.8kW of output power Protection features of the 8800D include an adjustable precision current limit which protects the laser diode from exceeding its maximum rating.

SPECIFICATIONS:

Input	198-253VAC 1∅, 50/60Hz
Output	
Current	Up to 300A pk
Risetime	≤10μs
Diode Voltage	Up to 280V
Pulsewidth	<100μs to >5ms (load dependent)
Pulsed Repetition Frequency	<1Hz to 1kHz
Protection	Transient suppression, fast reverse polarity diodes and hardware and software limits for peak current, PRF and pulsewidth.
Status Indicators	System status displayed on LCD Power On LED High Voltage LED

Size	
Front Panel	7.0” x 19.0”
Chassis	6.5” x 17.0” x 17.0”
Weight	35 lbs.
Standard Features	Microprocessor Control RS232 port Menu driven interface Adjustable delays, Q-Switch trigger Low inductance output cable Fast reverse polarity output diodes Floating output Operating Manual
Optional Accessories	Custom Software 1.4kW or 2.8kW

ISO Certified 9001:2000

Specifications subject to change without notice.

Contact our applications staff for detailed information.

APPLICATIONS:

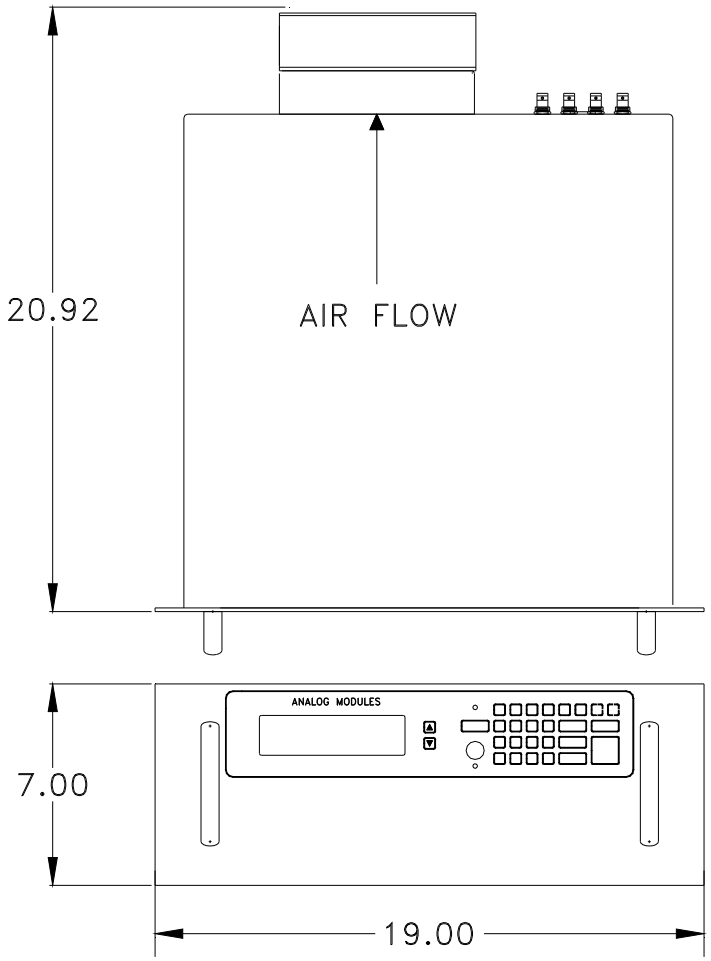
Solid-State Laser Control where Pulsed Laser Diode Pumping is Required

126 BAYWOOD AVENUE ♦ LONGWOOD, FLORIDA 32750-3426 ♦ USA
(407) 339-4355 ♦ FAX (407) 834-3806 ♦ E-mail: ami@analogmodules.com
www.analogmodules.com

OPERATING MAXIMUMS	MODEL 8800D					
	8800D-5				8800D-10	
	-40	-100	-200	-300	-200	-300
Max. Diode Load	30V	80V	180V	280V	180V	280V
Max. Power Pulsed at 100A (Add -100 to part number)	1.0kW	1.4kW	1.4kW	1.4kW	2.8kW	2.8kW
Max. Power Pulsed at 200A (Add -200 to part number)	700W	1.2kW	1.2kW	1.2kW	2.4kW	2.4kW
Max. Power Pulsed at 300A (Add -300 to part number)	500W	1.2kW	1.2kW	1.2kW	2.4kW	2.4kW

Typical Part Number: ***8800D-10-200-300-D =***

Power Supply:	2.4kW
Compliance Voltage:	180V
Maximum Pulsed Current:	300A
Input Voltage:	198-253VAC,1∅



NOTES:

1. INSTALL PS2 ONLY FOR 8800D-2-10.
2. INCLUDE OUTPUT FLAT CABLE (ITEM 28).
3. INCLUDE INPUT POWER (CABLE DETAIL "B") FOR -09 ONLY.
4. INSTALL JUMPERS JP1 AND JP3 (ON PCBOARD 6544-XX) IF USING CHARGERS IN A MASTER/SLAVE CONFIGURATION.
5. CHECK IF JUMPER IS INSTALLED FOR 8800D VERSION OF DWG 6525.

REVISIONS

ZONE	DCN	LTR		DATE	CHANGED	APPROVED
	4969	E	REVISED PER DCN (P/L CHANGE)	061012	SA	GSweezey
	5026	F	REVISED PER DCN (P/L CHANGE)	061220	SA	MMorales
	5212	G	RELEASED P/L 6572/2-C-3-D	080716	SA	MMorales
	5589	H	REVISED P/L 6572/2-C-3-D	100708	SA	MMorales
	5730	J	ADD P/L 6572/2-C-1-D	110126	SA	RThompson

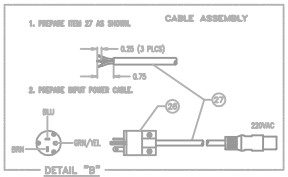


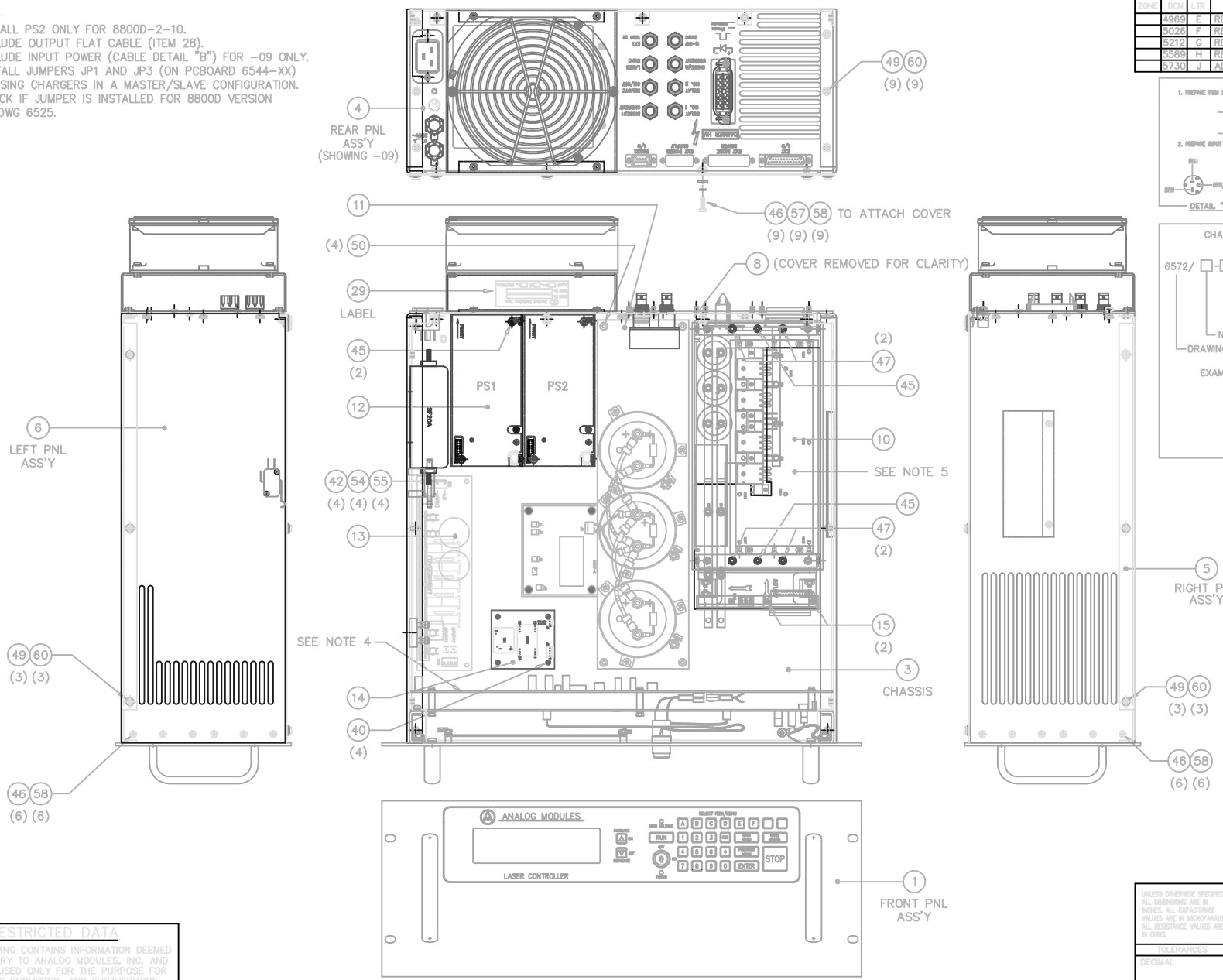
CHART FOR CREATING PART NUMBERS

6572/ □-□-□-□

- □ INPUT (C=115VAC) (D=230VAC) (D3=208 3 PHASE)
- □ CURRENT (1=100A) (2=200A) (3=300A)
- □ OUTPUT VOLTAGE (A=40V) (B=100V) (C=200V) (D=300V)
- □ NUMBER OF CHARGERS (1 OR 2)
- DRAWING NUMBER

EXAMPLE: 6572/1-A-2-D

- 1 CHARGER
- 40V OUTPUT
- 200A OUTPUT
- INPUT 230VAC



2 CHGR,200V,200A,230V	6572/2C20/-365	E
2 CHGR,300V,300A,230V	6572/2-D-3-D	F
2 CHGR,300V,200A,230V	6572/2-D-2-D	E
2 CHGR,200V,300A,230V	6572/2-C-3-D	H
2 CHGR,200V,200A,230V	6572/2-C-2-D	E
2 CHGR,200V,100A,230V	**6572/2-C-1-D**	**J**
1 CHGR,300V,200A,230V	6572/1-D-2-D	E
1 CHGR,300V,100A,230V	6572/1-D-1-D	E
1 CHGR,200V,300A,230V	6572/1-C-3-D	E
1 CHGR,200V,200A,230V	6572/1-C-2-D	E
1 CHGR,100V,300A,230V	6572/1-B-3-D	E
1 CHGR,100V,200A,230V	6572/1-B-2-D	E
1 CHGR,100V,100A,230V	6572/1-B-1-D	E
1 CHGR,40V,300A,230V	6572/1-A-3-D	E
1 CHGR,40V,200A,230V	6572/1-A-2-D	F
TYPE	BOM NO.	REV

ACAD FILENAME: 6572J.DWG | SHT 1 | REV J

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES. ALL CAPACITANCE VALUES ARE IN MICROFARADS. ALL RESISTANCE VALUES ARE IN OHMS.

TOLERANCES
DECIMAL
ANGULAR

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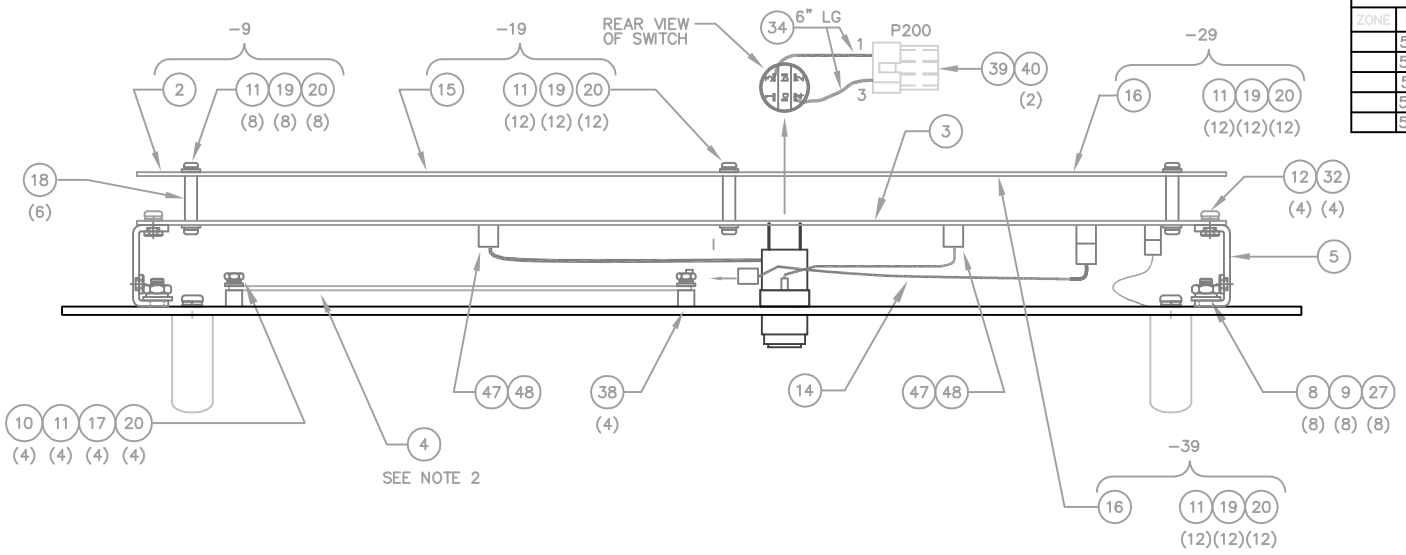
DRAWN BY	DATE	CHECKED BY	DATE
LOPES	021008	GSweezey	030415
LEAD APPROVAL	DATE	FINAL APPROVAL	DATE
MMorales	030409	CGSmith	4/15/03

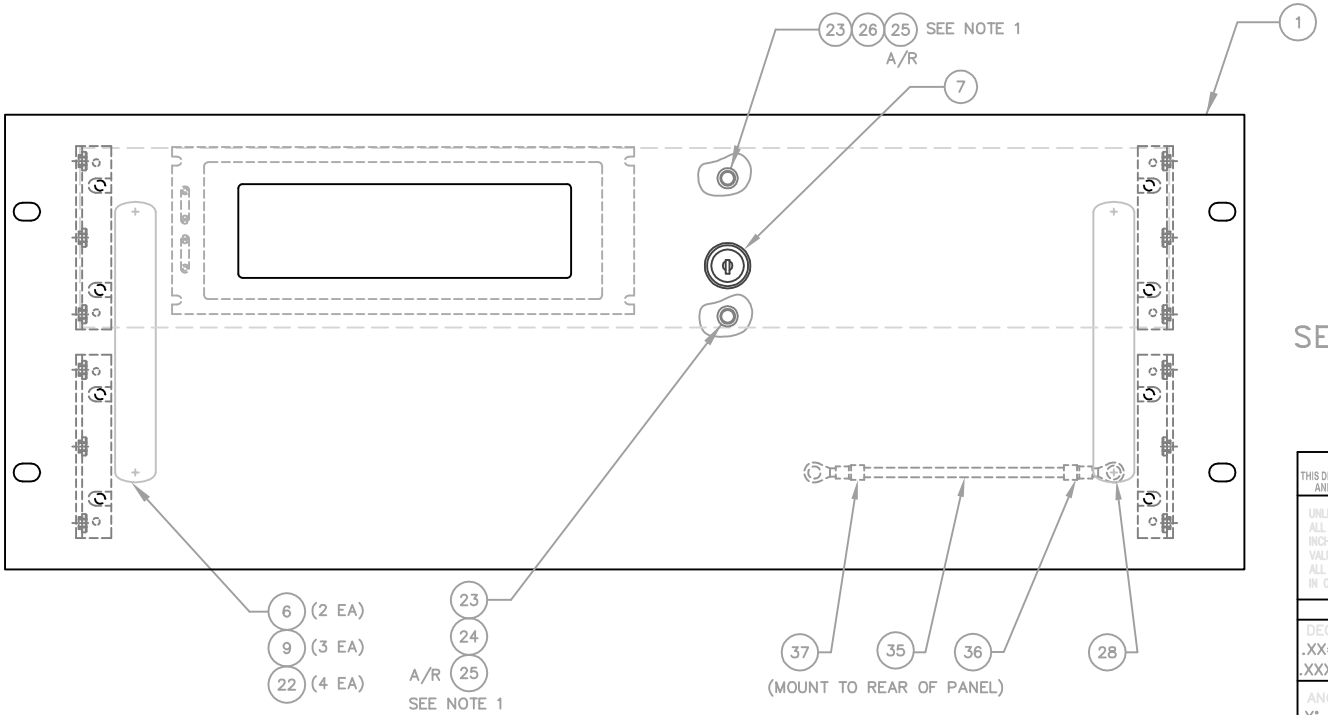
TITLE: UNIT ASSEMBLY

SCALE	SIZE	FSCM	SHEET	DRAWING NUMBER	REV.
1:2	D	61651	1 OF 1	6572	J

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REVISIONS						
ZONE	DCN	LTR		DATE	CHANGED	APPROVED
	5012	AD	ADDED PART NUMBER CHART	061107	SA	TimAyres
	5026	AE	REVISED PER DCN	061220	SA	M. Morales
	5231	AF	REVISED PER DCN (P/L CHANGE)	080916	SA	R.Thompson
	5302	AG	REVISED PER DCN (P/L CHANGE)	090413	SA	TimAyres
	5643	AH	ADDED TP-6728 TO PL	101014	SA	R.Thompson

NOTES:

1. EPOXY TO:
   (A) MOUNT LED IN HOLDER.
   (B) MOUNT HOLDER TO PANEL.
2. REMOVE PROTECTIVE COVER MATERIAL FROM LCD BEFORE INSTALLING ONTO FRONT PANEL.

PART NUMBER CHART

3677-XX / □

- B = W/O ADAPTER PCB
- C = WITH ADAPTER PCB
- -09 = 8800S-7" SYSTEMS SINGLE CHANNEL
- -19 = 8800V-7" SYSTEMS SINGLE CHANNEL
- -39 = 8800D " SYSTEMS SINGLE CHANNEL 8800D SYSTEMS DON'T USE ADAPTER PCB

CAUTION
SENSITIVE ELECTRONIC DEVICE

BOM NO.	REV
3677-39	AH
3677-19/C	AH
3677-19/B	AH
3677-19	AH
3677-09/C	AH
3677-09/B	AH
3677-00	AF

ACAD FILENAME: 3677AH.DWG | 1 SHT | AH REV

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TOLERANCES
DECIMAL
.XX=±.02
.XXX=±.005
ANGULAR
X°=±1°

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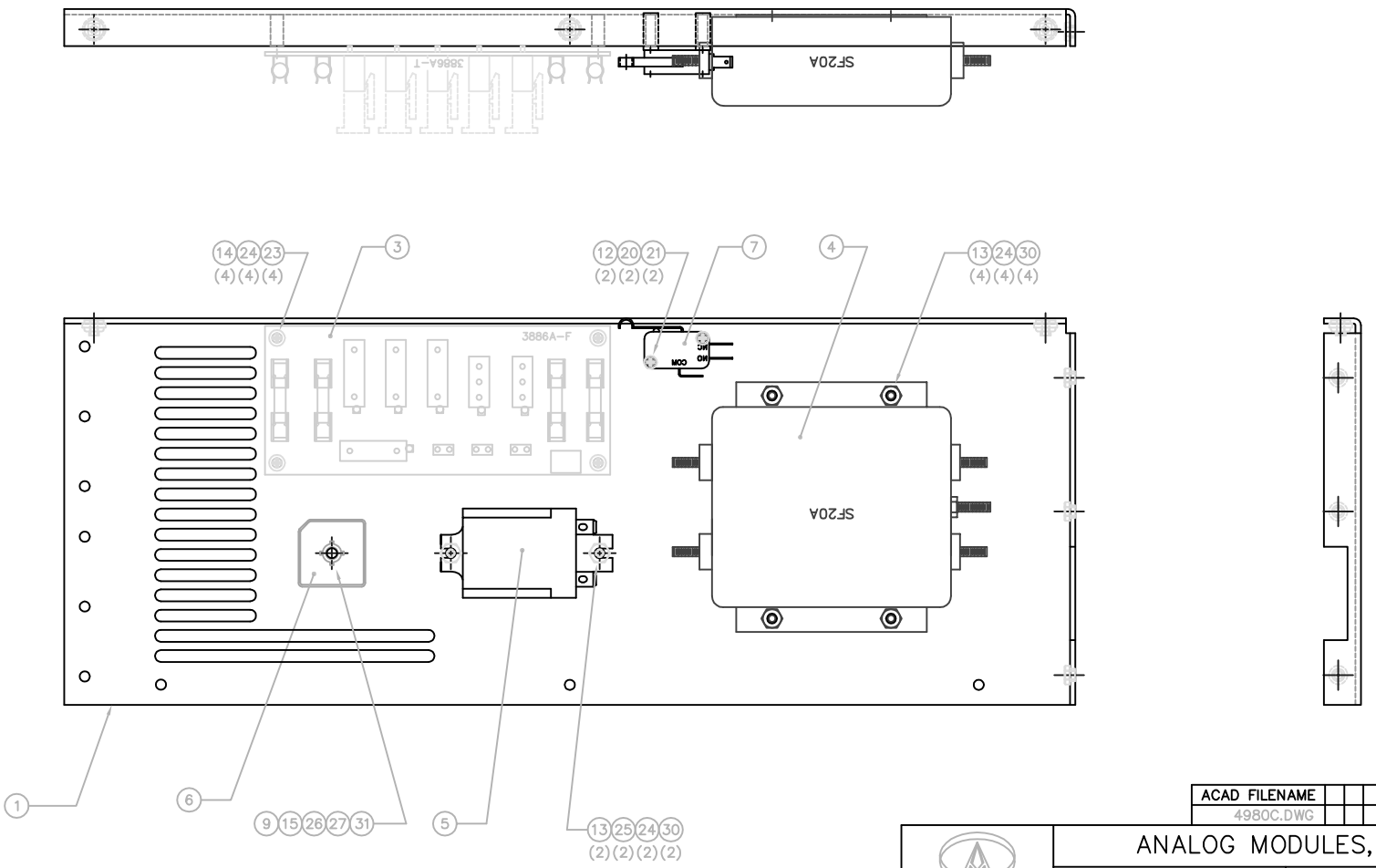
DRAWN BY	DATE	CHECKED BY	DATE
J. LEITER	940120	J. LEITER	940204
LEAD APPROVAL	DATE	FINAL APPROVAL	DATE
S. REDMAN	940204	C. SMITH	940208

TITLE: FRONT PANEL ASS'Y

SCALE	SIZE	FSCM	SHEET	DRAWING NUMBER	REV.
1:1	D	61651	1 OF 1	3677	AH

REVISIONS

ZONE	DCN	LTR		DATE	CHANGED	APPROVED
		A	RELEASED FOR PRODUCTION	970902	SA	SWR
	2499	B	REVISED PER DCN	980914	SA	SWR
	6455	C	REVISED -09 BOM (45003891.657 WAS 45000016.0)	140407	SA	J.Harwick



4980-09	C
BOM NO.	REV

ACAD FILENAME	1	SHT
4980C.DWG	C	REV

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DRAWN BY	DATE	CHECKED BY	DATE
S. AVALO	970902	S. REDMAN	970911
	DATE		DATE
LEAD APPROVAL	DATE	FINAL APPROVAL	DATE
JIM KEATLEY	970911	CG SMITH	970911

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES.

TOLERANCES

DECIMAL
.XX=±.02
.XXX=±.005

ANGULAR
X°=±1°

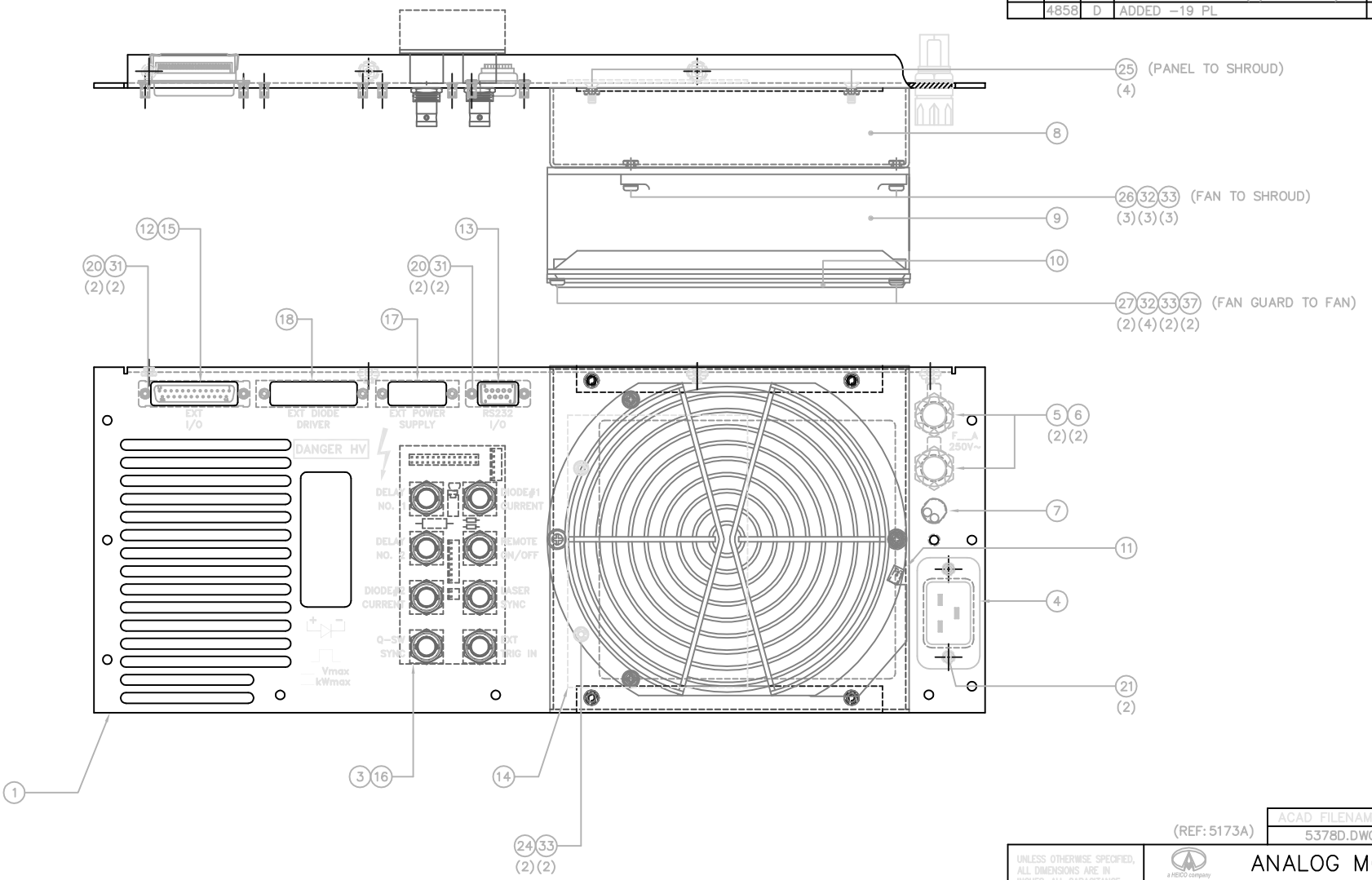
TITLE: LEFT PANEL ASSEMBLY
MODEL 8800D-2

SCALE	SIZE	FSCM	SHEET	DRAWING NUMBER	REV.
1:1	D	61651	1 OF 1	4980	C

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REVISIONS						
ZONE	DCN	LTR		DATE	CHANGED	APPROVED
	4408	C	REVISED PER DCN (P/L CHANGE)	030926	SA	MMorales
	4858	D	ADDED –19 PL	051205	SA	MMorales



5378-19	D
5378-09	C
BOM NO.	REV

(REF: 5173A)

ACAD FILENAME		
5378D.DWG	1	SHT
	D	REV

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TOLERANCES

DECIMAL
.XX=±.02
.XXX=±.005

ANGULAR
X°=±1°

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DRAWN BY	DATE	CHECKED BY	DATE
S. AVALO	981002	S. REDMAN	990324
LEAD APPROVAL	DATE	FINAL APPROVAL	DATE
M. MORALES	990324	C. SMITH	990324

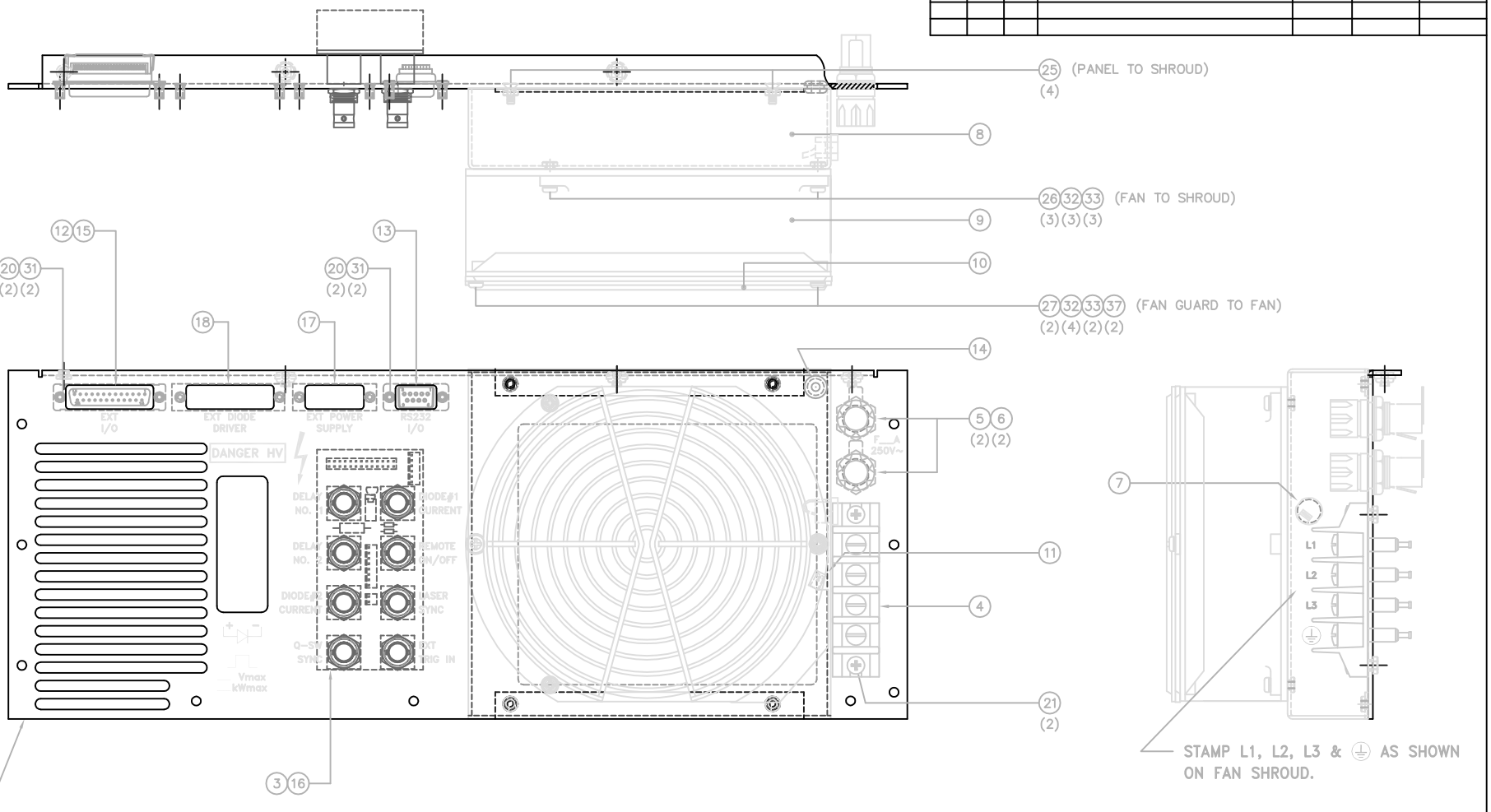
TITLE: REAR PANEL ASSEMBLY

SCALE	SIZE	FSCM	SHEET	DRAWING NUMBER	REV.
1:1	D	61651	1 OF 1	5378	D

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REVISIONS						
ZONE	ECN	LTR		DATE	CHANGED	APPROVED
	2551	A	RELEASED FOR PRODUCTION	990308	SA	



(REF: 5378A)

ACAD FILENAME											1	SHT
5528A.DWG											A	REV

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES. ALL CAPACITANCE VALUES ARE IN MICROFARADS. ALL RESISTANCE VALUES ARE IN OHMS.

TOLERANCES

DECIMAL
.XX=±.02
.XXX=±.005

ANGULAR
X°=±1°

ANALOG MODULES, INC.

DRAWN BY	DATE	CHECKED BY	DATE
S AVALO	990216		
LEAD APPROVAL	DATE	FINAL APPROVAL	DATE

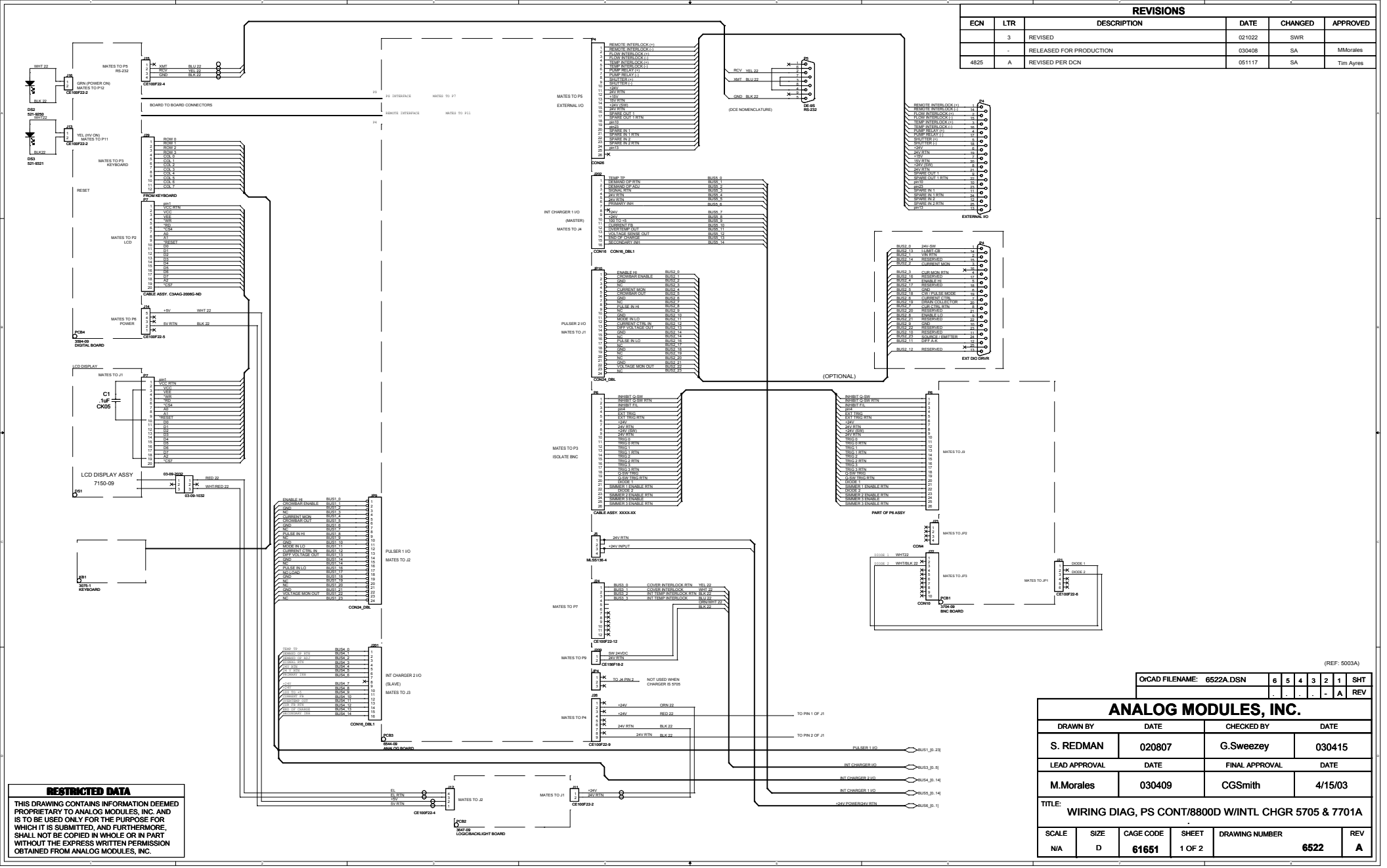
TITLE: REAR PANEL ASSEMBLY
MODEL 8800D-2-10

SCALE	SIZE	FSCM	SHEET	DRAWING NUMBER	REV.
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REVISIONS					
ECN	LTR	DESCRIPTION	DATE	CHANGED	APPROVED
	3	REVISED	021022	SWR	
	-	RELEASED FOR PRODUCTION	030408	SA	MMorales
4825	A	REVISED PER DCN	051117	SA	Tim Ayres



(REF: 5003A)

OrCAD FILENAME: 6522A.DSN	6	5	4	3	2	1	SHT
	.	.	.	.	-	A	REV

ANALOG MODULES, INC.

DRAWN BY	DATE	CHECKED BY	DATE
S. REDMAN	020807	G.Sweezey	030415
LEAD APPROVAL	**DATE**	**FINAL APPROVAL**	**DATE**
M.Morales	030409	CGSmith	4/15/03

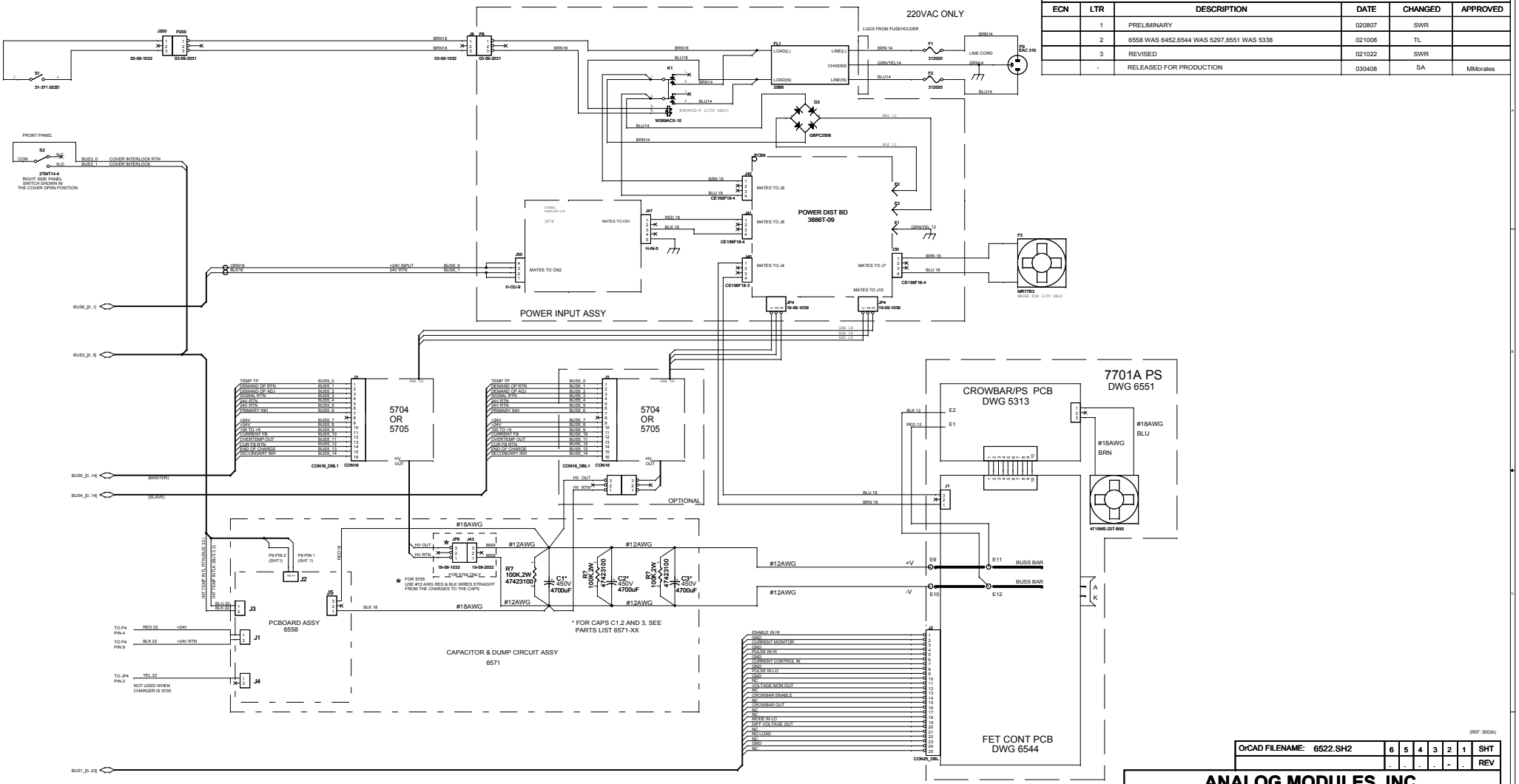
TITLE: WIRING DIAG, PS CONT/8800D W/INTL CHGR 5705 & 7701A

SCALE	SIZE	CAGE CODE	SHEET	DRAWING NUMBER	REV
N/A	D	61651	1 OF 2	6522	A

RESTRICTED DATA

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REVISIONS					
ECN	LTR	DESCRIPTION	DATE	CHANGED	APPROVED
	1	PRELIMINARY	020807	SWR	
	2	6558 WAS 6452,6544 WAS 5297,6551 WAS 5338	021008	TL	
	3	REVISED	021022	SWR	
	-	RELEASED FOR PRODUCTION	030408	SA	MMorales



(REF: 5003A)

OrCAD FILENAME: 6522.SH2	6	5	4	3	2	1	SHT
	.	.	.	.	-	.	REV

ANALOG MODULES, INC.

DRAWN BY	DATE	CHECKED BY	DATE
S. REDMAN	020807	G.Sweezey	030415
LEAD APPROVAL	**DATE**	**FINAL APPROVAL**	**DATE**
M.Morales	030409	CGSmith	4/15/03

TITLE: WIRING DIAG, PS CONT/8800D W/INTL CHGR 5705 & 7701A

SCALE	SIZE	CAGE CODE	SHEET	DRAWING NUMBER	REV
N/A	D	61651	2 OF 2	6522	-

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