X-ray Multi-mirror Mission Optical Monitor

DEM Power Supply Unit Electronic Design

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A. Table of Contents

B. Abstract

This document describes the design of the Digital Electronics Module (DEM) Power Supply Unit (PSU), which supplies low–voltage to the Digital Processing Unit (DPU) and the Instrument Control Unit (ICU).

C. Document Status

This is the first issue of this document, which has been prepared for the Experiment Intermediate Design Review (EIDR).

D. Document Change Record

Date	Version	Comments
30 March 95	1.0	Initial Issue

1. Introduction

1.1 Purpose

This document describes the design of the Digital Electronics Module (DEM) Power Supply Unit (PSU), which supplies low–voltage to the Digital Processing Unit (DPU) and the Instrument Control Unit (ICU). The DEM PSU was designed and constructed at Sandia National Laboratories.

1.2 Scope

This document covers only the DEM Power Supply Unit. The Telescope Power Supply Unit is discussed elsewhere.

2. Requirements

1.0 Inputs

1.1 Vin experiment, 26 to 30 Volts DC @ 11.1 Watts.

1.2 Vin keep alive, 11 to 13 Volts DC @ 0.25 Watts.

1.3 131.072 K Hz, 5 Volt peak to peak, square wave for chopper synchronization.

2.0 Outputs

2.1 Output Voltages

2.1.1 Vdbu, 6.0 +/- 5% Volts DC, Imax 128 mA. Derived from Vin experiment.

2.1.2 Vdpu, 5.3 +/- 5% Volts DC, Imax 792 mA. Derived from Vin experiment. †

2.1.3 Vicu, 5.3 +/- 5% Volts DC, Imax 580 mA. Derived from Vin experiment.†

2.1.4 Vdpukal, 3.3 +/- 5% Volts DC, Imax 5 mA. Derived from Vin keep alive. ‡

2.1.5 Vicukal, 3.3 +/- 5% Volts DC, Imax 25 mA. Derived from Vin keep alive.‡

2.2 Output Self Protection

2.2.1 The sum of the keep alive currents will be hard limited to 45 mA (Iicukal + Idpukal < 45 mA.).

2.2.2 The DEM power supply will contain an electrical mechanism that will turn off power to the DPU (2.1.2 and 2.1.4) in the event that a latch-up (or any other

† Outputs 2.1.2 and 2.1.3 share a common 5.3 Volt DC supply, additional circuitry is used to:

1) To prevent any interaction of the two loads sharing the common supply.
2) Limit current output to the DPU (Idpu).
3) Enable 2.1.2 to be switched off in the event of a latch-up (or any other high current anomaly), without perturbing 2.1.3.

‡ Outputs 2.1.4 and 2.1.5 share a common 3.3 Volt DC supply, additional circuitry is used to:

1) To prevent any interaction of the two loads sharing the common supply.
2) Limit current output to the DPU (Idpukal).
3) Enable 2.1.4 to be switched off in the event of a latch-up (or any other high current anomaly), without perturbing 2.1.5.

high current anomaly) is detected by the internal DPU circuit breaker circuitry.

NOTE: There will be two (2) ways to re-enable 2.1.2 and 2.1.4:

1) Power Cycle DEM Power Supply.

2) The ICU will have access to a digital input line to the DEM power supply (0.0 to 5.0 Volts DC), by pulsing this line low for 1.0 msec., 2.1.2 and 2.1.4 will be re-enabled.

3.0 Monitors

3.1 The DEM power supply will provide analog monitors that operate over a full scale range of 0.0 to 2.5 Volts DC for each of the following Voltages: 2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.1.5. Each monitor output will be filtered with a 0.1 second time constant.

3.2 As board space permits, the DEM power supply will provide analog monitors that operate over a full scale range of 0.0 to 2.5 Volts DC for the Currents associated with the following outputs: 2.1.1, 2.1.2, 2.1.3 and the sum of 2.1.4, 2.1.5. As a minimum, there will be current monitors for: 2.1.2, 2.1.3 and the sum of 2.1.1 through 2.1.5 .

4.0 Efficiency / Power Dissipation

4.1 The DEM power supply will operate at a minimum efficiency of 70% in the generation of: 2.1.1, 2.1.2, 2.1.3.

4.2 The DEM power supply will operate at a minimum efficiency of 40% in the generation of: 2.1.4, 2.1.5.

4.3 The DEM power supply will dissipate a maximum of 3.43 Watts $((11.1 \times 0.3) + (0.25 \times 0.4))$.

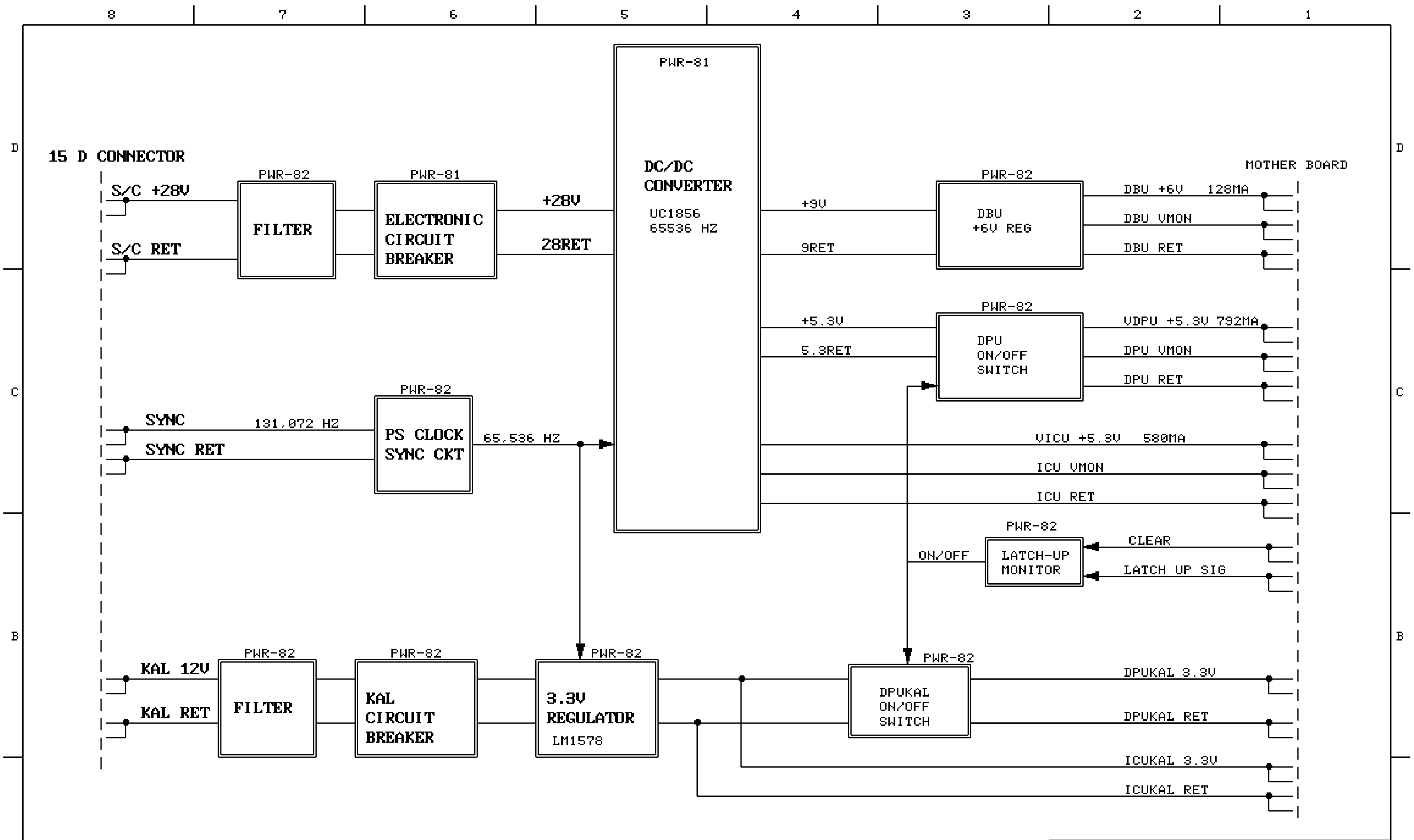
5.0 Other Requirements

5.1 If Primary input Current exceeds 600 mA, (nominal 396 mA @ 28 Volts DC) turn off all outputs (go to High Impedance). The input used to sense the current will be filtered with a one second time constant.

5.2 The DEM power supply chopper frequency will operate at 65536 Hz +/- 0.1% (1/2 of the synchronization frequency of 131.072 K Hz).

5.3 If the chopper synchronization signal should fail, the DEM power supply chopper will free run at a frequency of 65536 Hz +/- 10%.

3. Block Diagrams



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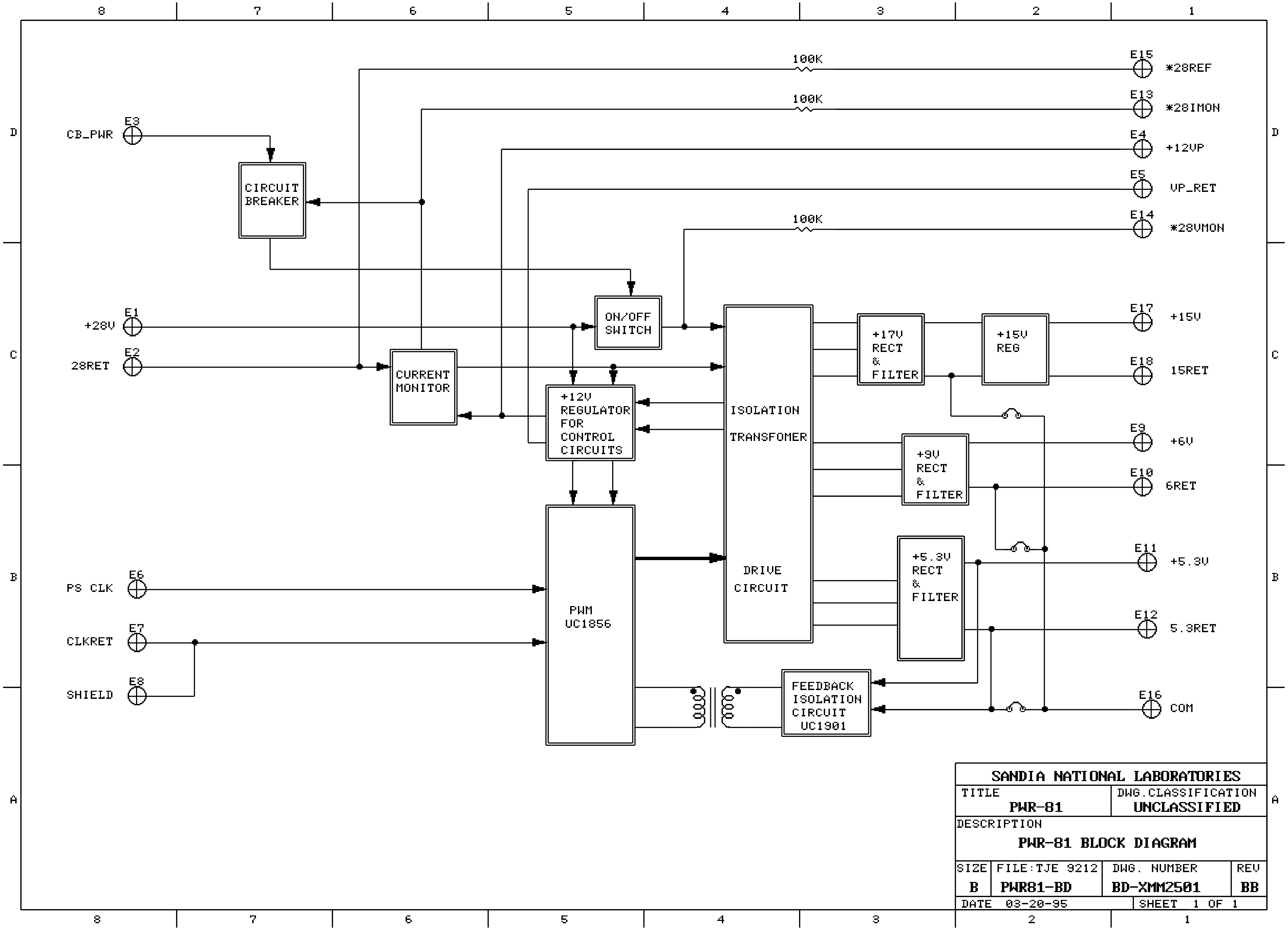
DATE 02-15-95		SHEET 1 OF 1	



CB_PWR
E3
CIRCUIT BREAKER
+28V
E1
28RET
E2
CURRENT MONITOR
ON/OFF SWITCH
+12V REGULATOR FOR CONTROL CIRCUITS
PWM UC1856
PS CLK
E6
CLKRET
E7
SHIELD
E8
ISOLATION TRANSFOMER
DRIVE CIRCUIT
FEEDBACK ISOLATION CIRCUIT UC1901
+17V RECT & FILTER
+15V REG
+9V RECT & FILTER
+5.3V RECT & FILTER
100K
100K
100K
E15 *28REF
E13 *28IMON
E4 +12VP
E5 VP_RET
E14 *28VMON
E17 +15V
E18 15RET
E9 +6V
E10 6RET
E11 +5.3V
E12 5.3RET
E16 COM
SANDIA NATIONAL LABORATORIES
TITLE PWR-81
DWG.CLASSIFICATION UNCLASSIFIED
DESCRIPTION PWR-81 BLOCK DIAGRAM
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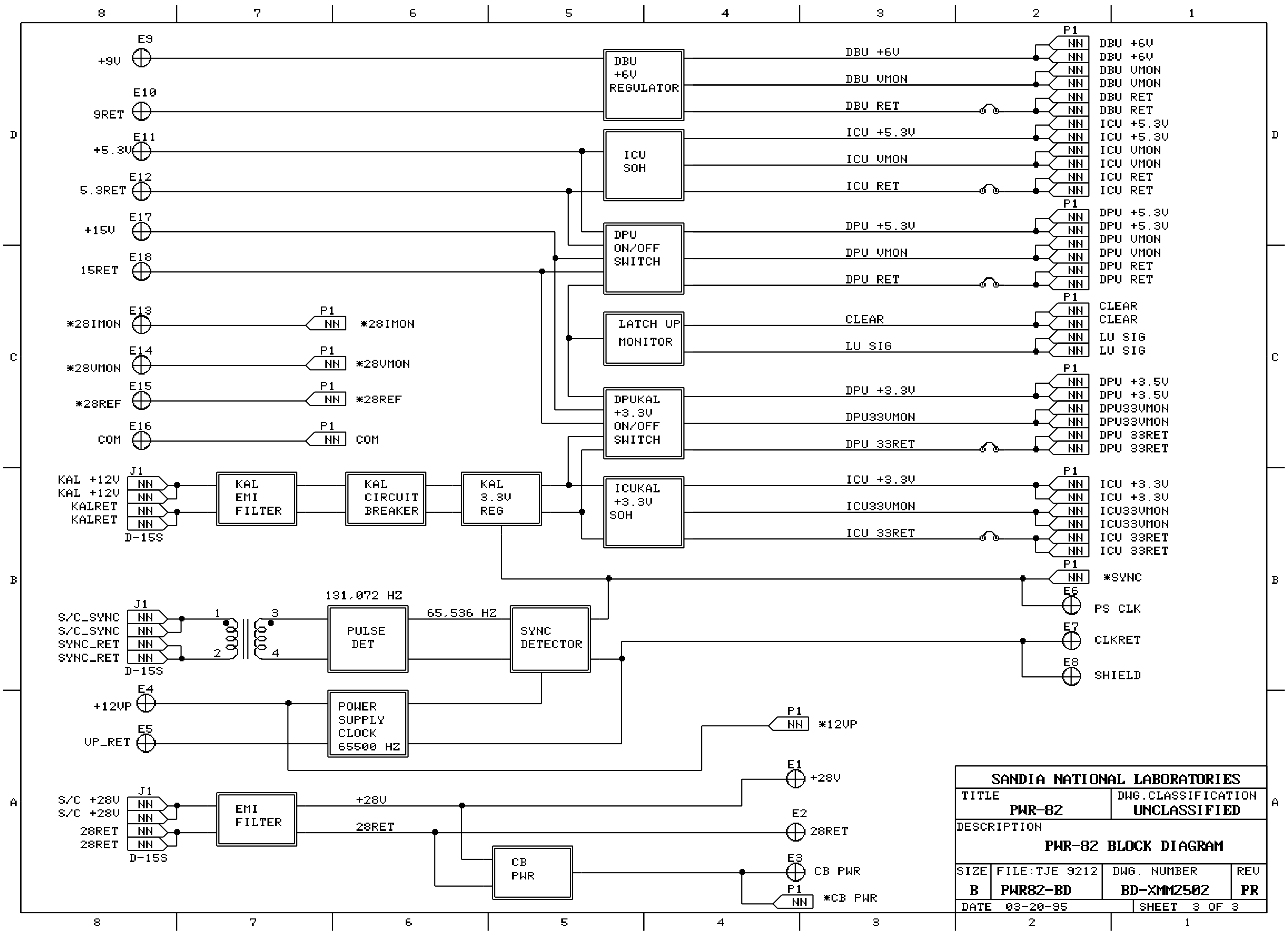
FILE:TJE 9212 PWR81-BD
DWG. NUMBER BD-XMM2501
REV BB
DATE 03-20-95
SHEET 1 OF 1



SANDIA NATIONAL LABORATORIES			
TITLE PWR-82		DWG.CLASSIFICATION UNCLASSIFIED	
DESCRIPTION PWR-82 BLOCK DIAGRAM			
SIZE B	FILE:TJE 9212 PWR82-BD	DWG. NUMBER BD-XMM2502	REV PR
DATE 03-20-95		SHEET 3 OF 3	

4. Schematic Diagrams

Not for Export (will be added after Letter of Agreement is signed).