

File E344836  
Project 11CA08269

October 21, 2011

REPORT

on

ENERGY MANAGEMENT EQUIPMENT

Crestron Electronics, Inc.  
Rockleigh, NJ

Copyright © 2011 Underwriters Laboratories Inc.

Underwriters Laboratories Inc. authorizes the above-named company to reproduce this Report provided it is reproduced in its entirety.

## DESCRIPTION

## PRODUCT COVERED:

USL, CNL - Open Type, Energy management Equipment, Model DIN-DALI-2

## GENERAL:

The device covered by this Report is an Open Type device provided with housings and DIN rail mounting means for installation into a suitable enclosure.

The device is powered by either 24 Vdc supply Class 2 Supply Source or 48 Vdc POE Power Supply. The 24 Vdc and 48 Vdc POE circuits are isolated from one another on the main PWB.

The unit is intended to be powered from a power supply mfr'd by Crestron(E324810-QQGQ2), Model DIN-PWS50, rated 100-240 Vac, 50-60Hz, 0.6 A input and 2.1 A, 24 LPS output or a POE power supply mfr'd by Crestron(E300305-QQGQ), Model PWE-4803RY(PW180KB4800F03), 100-250 V input, 50-60 Hz, 0.5 A, 48 Vdc, 0.35 A output.

The device is a DALI(Digital Addressable Lighting Interface) for Crestron systems providing control of up to two individual DALI loops. The device is provided with the mating Input supply and output load mating terminal blocks which are suitable for Field Wiring when it ships from the factory.

The device is intended to be mounted as per NEC, NFPA 70 and CEC requirements.

## ELECTRICAL RATINGS -

Models	Input (CTRL)	Input/Output (LOAD)	Load Type And Ratings
DIN-DALI-2	24 Vdc, 9 watts max. 48 Vdc, 13 watts max.	Signal	Control Circuits No output rating provided as the device output is a signal level control.

## ENGINEERING CONSIDERATIONS (NOT FOR UL REPRESENTATIVE USE):

Note: CNL = Canadian National Standards - Listed

USL - United States Standards - Listed

CNL - Indicates investigation to Canadian National Standard C22.2 No. 205-1983(R2009).

USL - Indicates investigation to UL 916, Energy management Equipment, Fourth Edition

## CONSTRUCTION DETAILS:

The details of construction are covered in the following photographs and accompanying descriptive pages and illustrations.

Tolerances - All dimensions are nominal unless otherwise noted.

Corrosion Protection - All ferrous metal parts are protected against corrosion.

Spacings -

These components have been judged on the basis of the required spacings in the Standard for Safety For Insulation Coordination Including Clearances and Creepage Distances for Electrical Equipment, UL 840, Table 8.1 and Table 9.1 as per UL 916, Energy management Equipment Fourth Edition, Par. 27.1.1. Minimum creepage distances of 1.9 mm and a minimum clearance of distance of 0.8 mm.

Specifically construction provided with:

Provided with 6 mm spacing between logic circuit and output circuit as measured at U21, U23, U24, U17-U19, U13-U15.

Provided with 2 mm spacing between POE supply circuit and logic circuit.

Spacings of the 24Vdc supply circuit and logical circuit are not specified.

MARKINGS - The equipment shall be legibly and permanently marked with:

- a) The Listee's name, trademark, or other descriptive marking by which the organization responsible for the product may be identified;
- b) The date or other dating period of manufacture not exceeding any three consecutive months;
- c) A distinctive model number or the equivalent; and
- d) The electrical rating.

Warning Markings - See Section General for details.

Printed Wiring Boards - All printed wiring boards are R/C (ZPMV2) rated V-0, min 130°C.

All wiring - R/C (AVLV2) 12-22 AWG, 300V, 105 deg. C.

Wiring terminals shall be marked to indicate the proper connections for the power supply, load, control circuit, and the like, or a wiring diagram coded to the terminal marking shall be securely attached to the equipment.

Each piece of accessory equipment shall be marked with the manufacturer's name, trademark or other descriptive marking by which the organization responsible for the product may be identified and a distinctive catalog number or equivalent identification.

CAUTIONARY MARKING:

Each unit shall be marked with the following Cautionary Marking: The word "CAUTION" and the following or the equivalent: "Risk of Electric Shock - More than one disconnect switch may be required to de-energize the equipment before servicing."

The word "CAUTION" shall be in letters not less than 1/8 inch (3.2 mm) high. The remaining letters of such marking, unless specified otherwise in individual marking requirements, shall not be less than 1/16 inch (1.6 mm) high.

MARKING SYSTEM:

All required Engineering markings shall be permanent. Adhesive Backed R/C (PGDQ2) labels or die stamping may be employed for the marking system/means.

ILLUSTRATIONS

Schematic User Interface (For Reference Only)	Ill. # 1
Schematic Lower PWB (For Reference Only)	Ill. # 2

MODEL DIN-DALI-2

FIG. 1, 1A

General- Fig. 1 and 1A show an overall view and bottom view of the Model DIN0DALI-2. All components are mounted on printed circuit board assembly, unless otherwise indicated.

1. Housing - Polymeric. Overall dimensions approximately 15.9 cm (6.26 in) long by 9.42 cm (3.71 in) wide by 5.8 cm (2.29 in) high, min thickness 1.5 mm thick. Provided with back plate that snap fits into place with DIN rail mounting means. Provided with various cutouts for Terminal Blocks and Push Buttons and LED display and associated labels.

2. Terminal Block (24Vdc Supply, P2, P3) - 4 position, 2 provided, R/C (XCFR2) mfr'd by Phoenix Contact GmbH, Cat. No. 1.5/4-ST-3.5, rated 300 V, 8 A, 4 lb-in., CU, FW=2, 30-14 AWG. Consists of header and pin combination. Soldered to lower PWB.

Alternate - Same as above except mfr'd by Amphenol Connex, Cat. No. ELXT046GO, rated 300 V, 12 Amps, 2 lb-in, CU, FW=2, 28-16 AWG. Consists of header and pin combination.

3. Terminal Block (Override, P4, P5) - 2 Position, 2 Provided, R/C (XCFR2) mfr'd by Phoenix Contact GmbH, Cat. No. MCVW 1.5/2-ST-3.5, rated 300 V, 8 A, 4 lb-in., CU, FW=2, 30-14 AWG. Consists of header and pin combination. Soldered to lower PWB.

Alternate - Same as above except mfr'd by Amphenol Connex, Cat. No. ELXT026GO, rated 300 V, 12 Amps, 2 lb-in, CU, FW=2, 28-16 AWG. Consists of header and pin combination.

4. LAN Connector - Any R/C (NWQG2 or DUXR2) Ethernet Module, soldered to lower PWB.

Alternate - R/C (DUXR2) mfr'd by Bel Stewart Connector, Cat. No. MagJack, SI-52003-F, Ethernet Connector, rated 48 Vdc, 175 mA max.

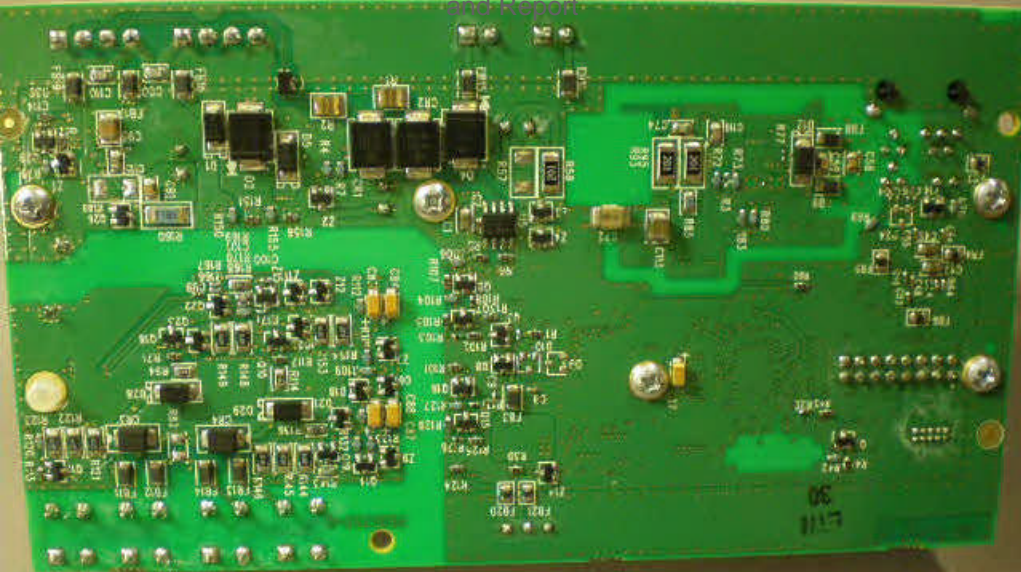
5. Terminal Block (Load Terminals, TB1, TB2, TB3, TB4) - 2 position each, R/C (XCFR2) mfr'd by Phoenix Contact GmbH, Cat. No. MKDS2/5X-5.08, rated 300 V, 20 A, 5-7 lb-in., CU, FW=2, 30-12 AWG. Consists of header and pin combination. Soldered to lower PWB.

6. PWB, (User Interface) - R/C (ZPMV2) rated V-0, min 130°C. Measures overall 152 mm long by 34 mm wide. Secured to lower PWB by stand offs and associated screws. Provided with various control components, push buttons, LED display, etc.

## and Report

7. PWB, (Lower) - R/C (ZPMV2) rated V-0, min 130°C. Measures overall 156 mm long by 87 mm wide. Provided with the below components in Items 8 to soldered to PWB.
8. Diode Bridge - D16 and D17 Located in 48Vdc POE circuit. D20 and D23 located in output circuit. Any R/C (QQQX2) rated min. 600 V
9. Opto Isolators - U13-U15, U17-U19, U23-U25. Provided between supply circuits and load circuits. Any R/C (FPQU2), rated min. 600 V isolation.
10. Transformer - T2 - Mfr'd by Coil Craft, Cat. No. POE13P-24L, rated 24 V, 0.54 A, 13 Watts flyback transformer for POE applications. Isolates POE circuit from logic circuit.
11. Transformer - T3 - Located in circuit that is powered by 24Vdc, 2.1 A R/C LPS power supply which is field installed and isolates 24Vdc circuit to logic circuit. Rated 9-23 V input, 4.0 V output.
12. Surge Capacitor - C98 - Any R/C (FOWX2) rated min. 300 V. Located in circuit that is powered by 24Vdc, 2.1 A R/C LPS power supply which is field installed and isolates 24Vdc circuit to logic circuit.
13. Traics - Q24, Q26 - 2 provided, switches 24 Vdc output signal on TB1, TB2, TB3, TB4, rated min. 60 V, 7.7 A.



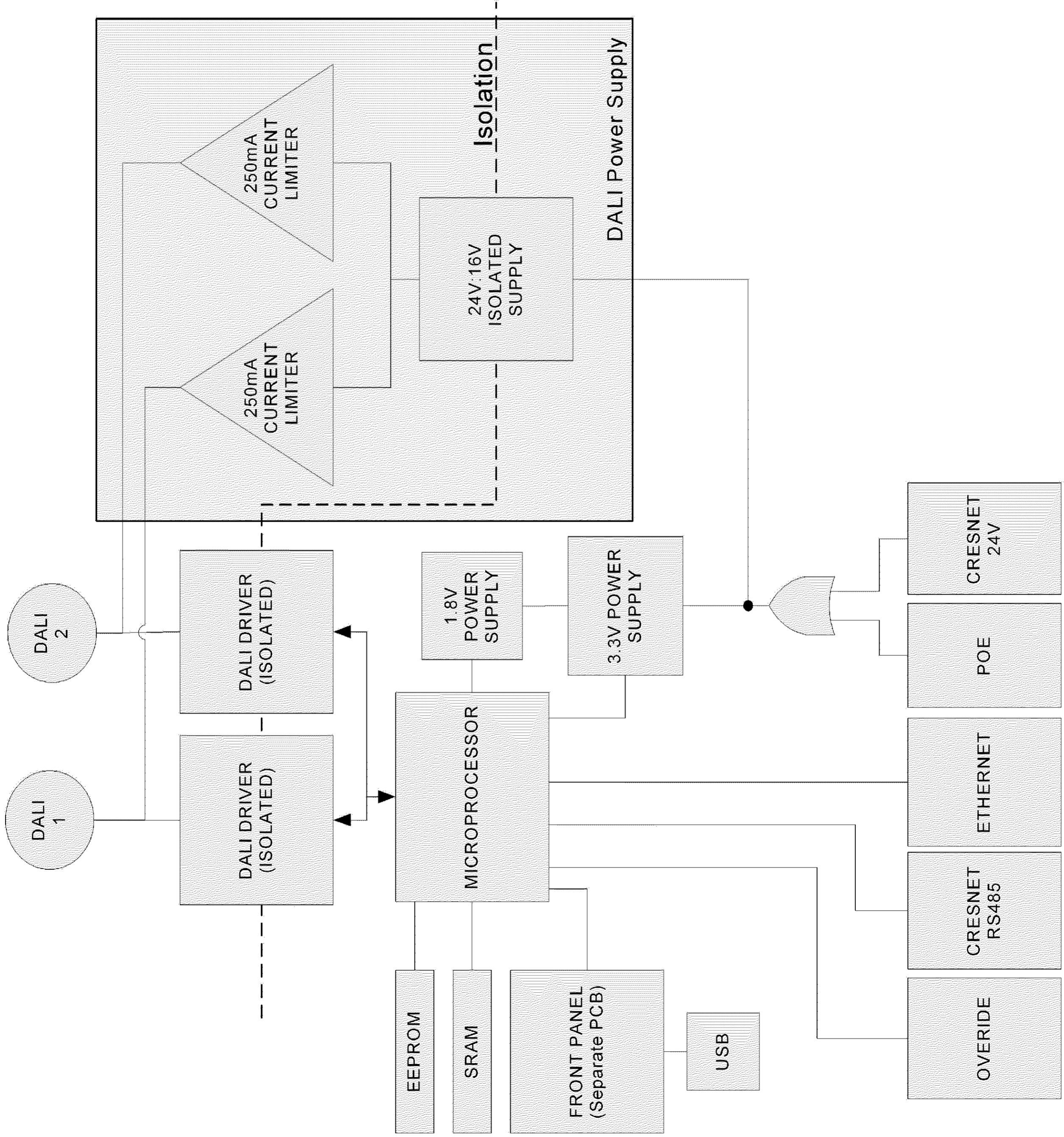




1 2 3 4 5 6

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	INITIAL PROTOTYPE RELEASE PER EW01599	10/07/2009	MJM
B	REVISED PER EW01599	10/15/2009	MJM
C	REVISED PER EW01599	10/21/2009	MJM
D	REVISED PER ECN9543	06/28/2010	MJM

### DALI FRONT PANEL



FINISHED GOODS		SORT NAME		PWB PART NO/VERSION/REVISION	
6??????	C				
6??????	C				
6??????	C				
6??????	C				
6??????	C				
6??????	C				

USED ON	
SHEET NAME:	INDEX
ALL PARTS AND PROCESSES MUST BE ROHS COMPLIANT	
NAME	DATE
DRAWN BY: BS	06/28/10
CHECKED: MJM	06/28/10
ENGR. APPVL:	
MFG. APPVL:	

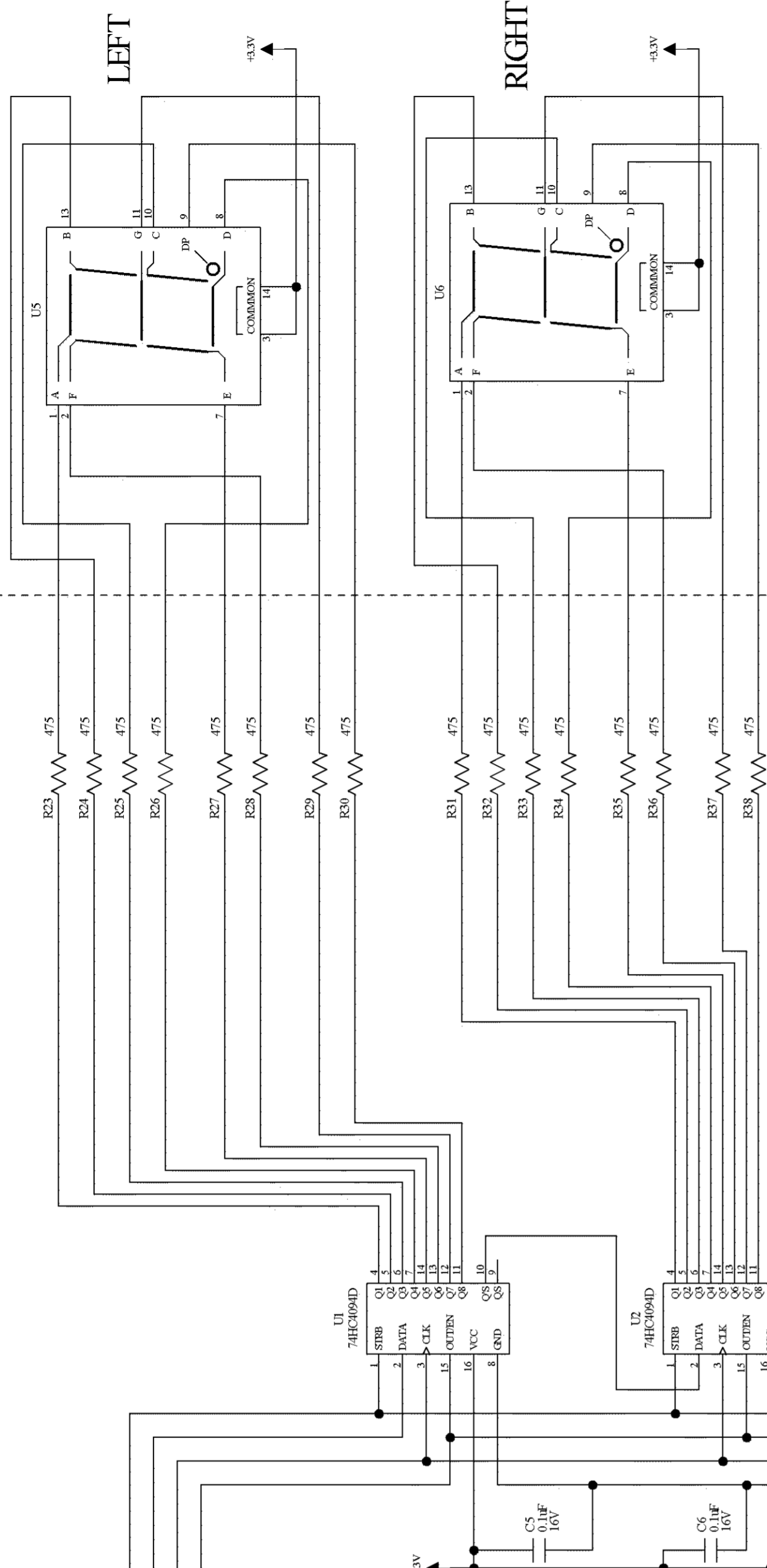
CRESTRON	
22 LINK DRIVE, ROCKLEIGH, N.J. 07647	
(201) 750-7004 FAX (201) 767-5772	
SCHEMATIC	
DALI CONTROLLER FRONT PANEL BOARD	
SIZE: C	DRAWING NO. SE 06754
REV D	

THESE DRAWINGS AND SPECIFICATIONS ARE THE EXCLUSIVE PROPERTY OF CRESTRON ELECTRONICS, INC. AND ARE ISSUED IN STRICT CONFIDENCE. DISCLOSURE OR REPRODUCTION IN WHOLE OR IN PART, WITHOUT PRIOR WRITTEN PERMISSION, IS PROHIBITED EXCEPT FOR THE MANUFACTURE OF ARTICLES FOR CRESTRON ELECTRONICS, INC.

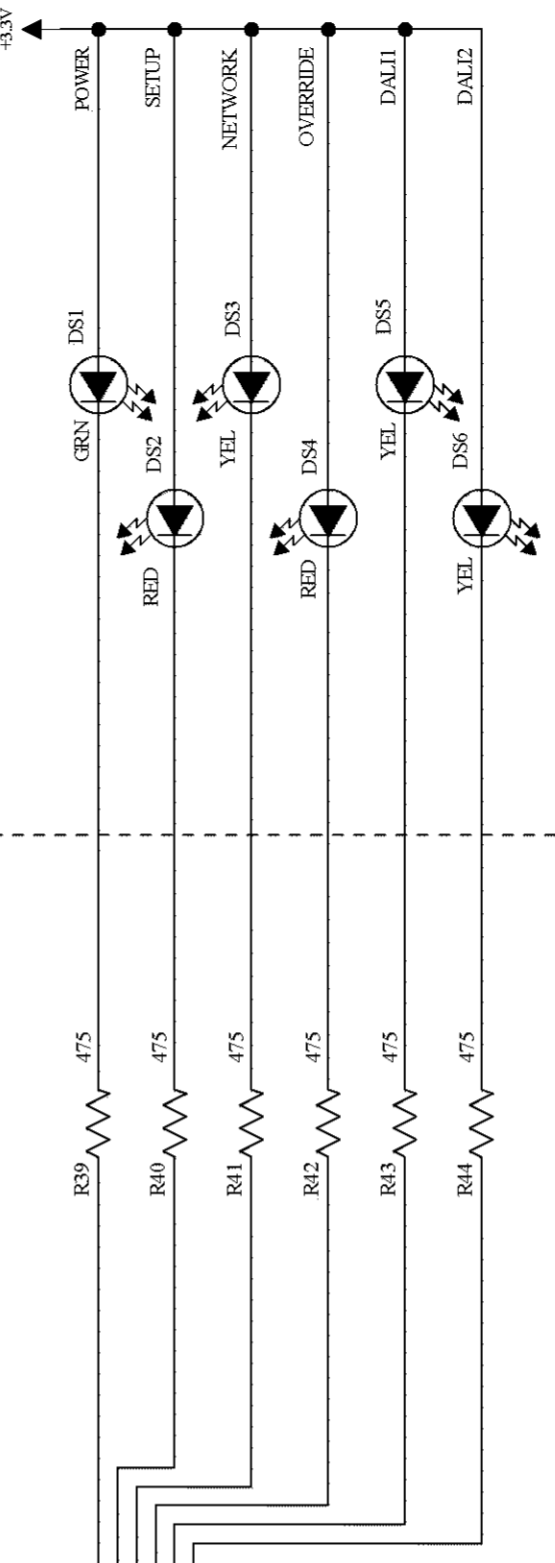
1  
2  
3  
4  
5  
6

THESE DRAWINGS AND SPECIFICATIONS ARE THE EXCLUSIVE PROPERTY OF CRESTRON ELECTRONICS, INC. AND ARE ISSUED IN STRICT CONFIDENCE. DISCLOSURE OR REPRODUCTION IN WHOLE OR PART, WITHOUT PRIOR WRITTEN PERMISSION, IS PROHIBITED EXCEPT FOR THE MANUFACTURE OF ARTICLES FOR CRESTRON ELECTRONICS, INC.

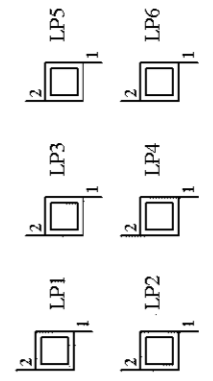
**DUAL 7-SEGMENT DISPLAY**  
INSPECT LED DISPLAYS FOR OBVIOUS DIFFERENCES  
Use only 1 reel for 100% binning



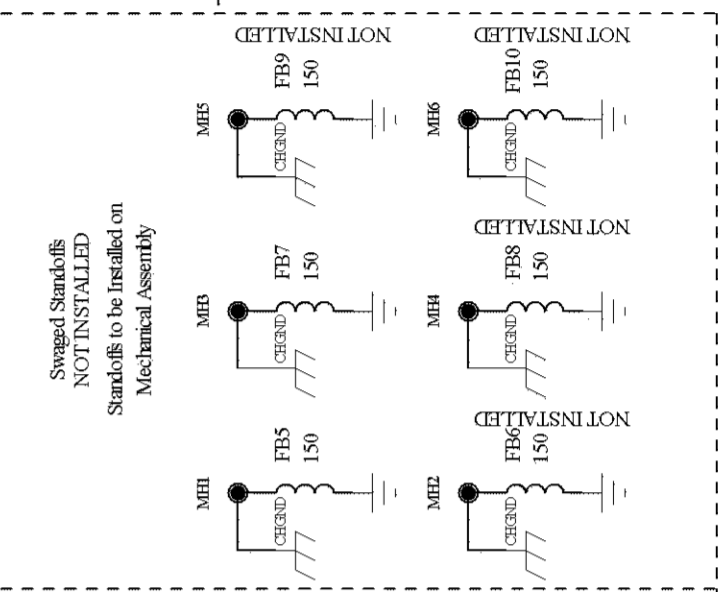
**INDICATOR LEDES**



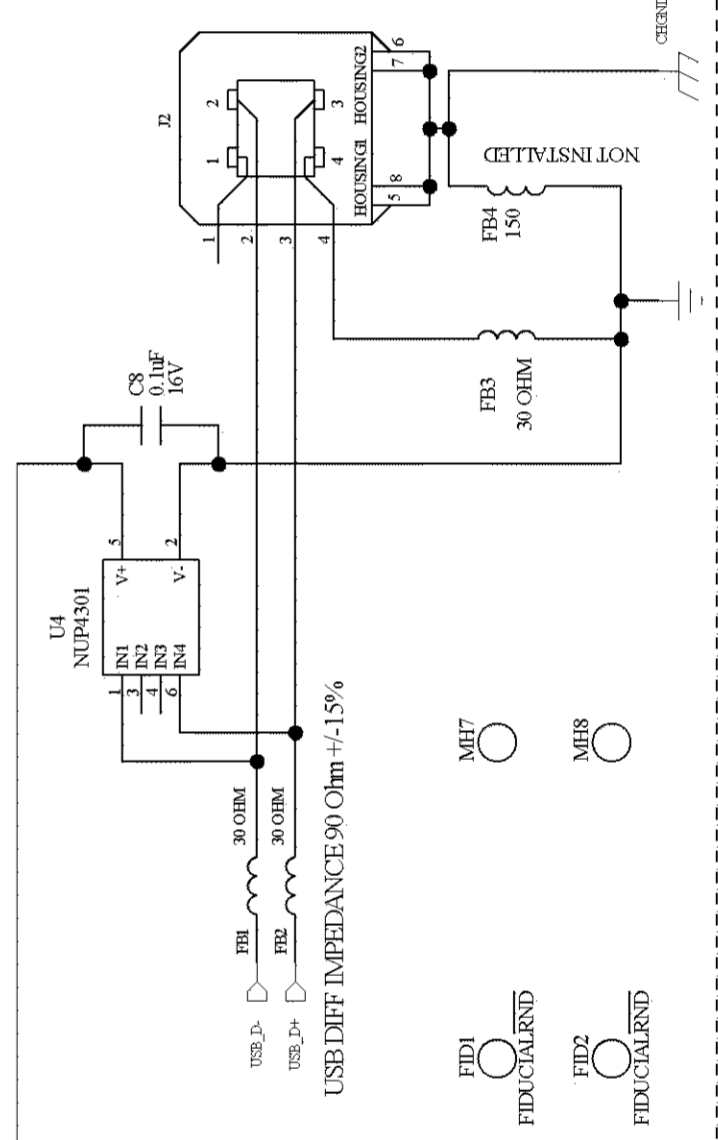
**INDICATOR LED LIGHT PIPES**



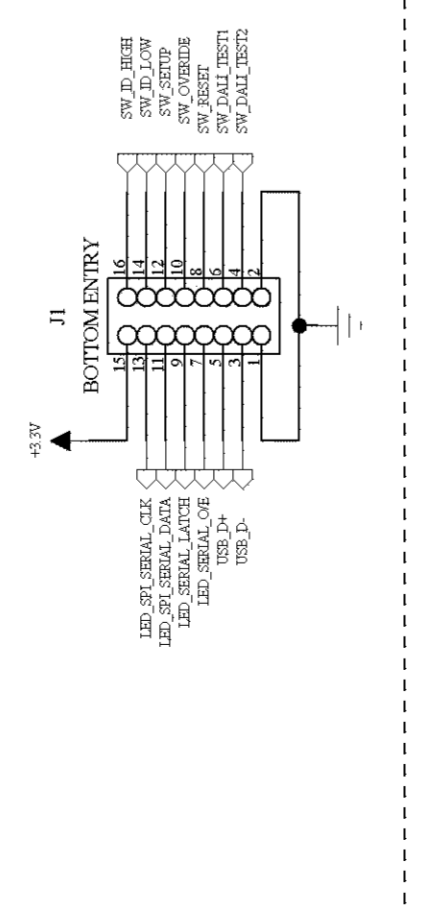
**STANDOFFS**



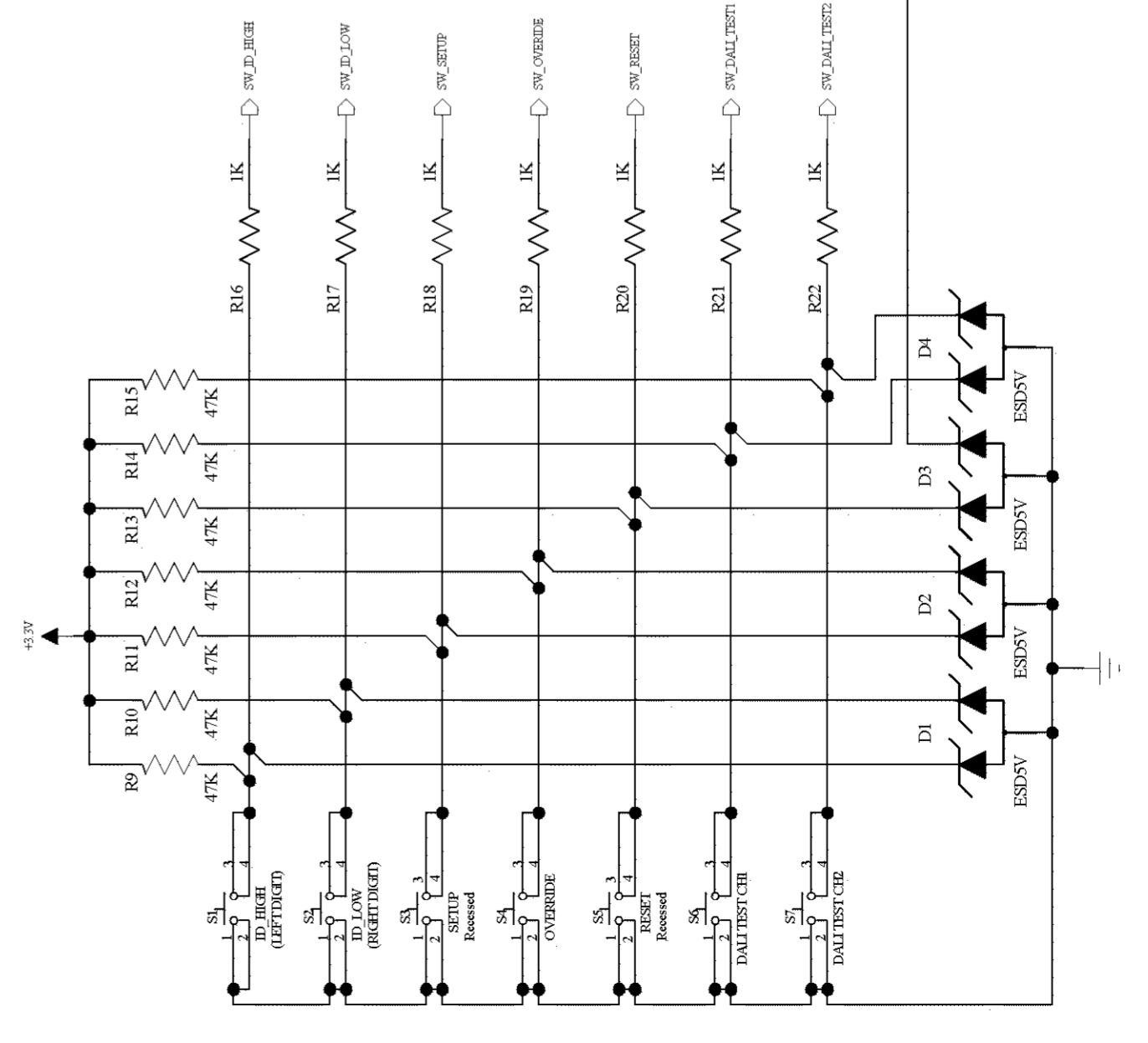
**USB**



**BOARD TO BOARD CONNECTOR TO 06755**



**USER INTERFACE: BUTTONS**



SHEET NAME: FRONT PANEL	
CRESTRON	
22 LINK DRIVE, ROCKLEIGH, N.J. 07647	
(201) 750-7004 FAX (201) 767-5772	
SCHEMATIC	
DALI CONTROLLER	
FRONT PANEL BOARD	
SIZE: C	DRAWING NO. SE 06754
SCALE: NA	FILE NAME: 06754 - D - SCH
REV: D	SHEET: 2 OF 2

1

2

3

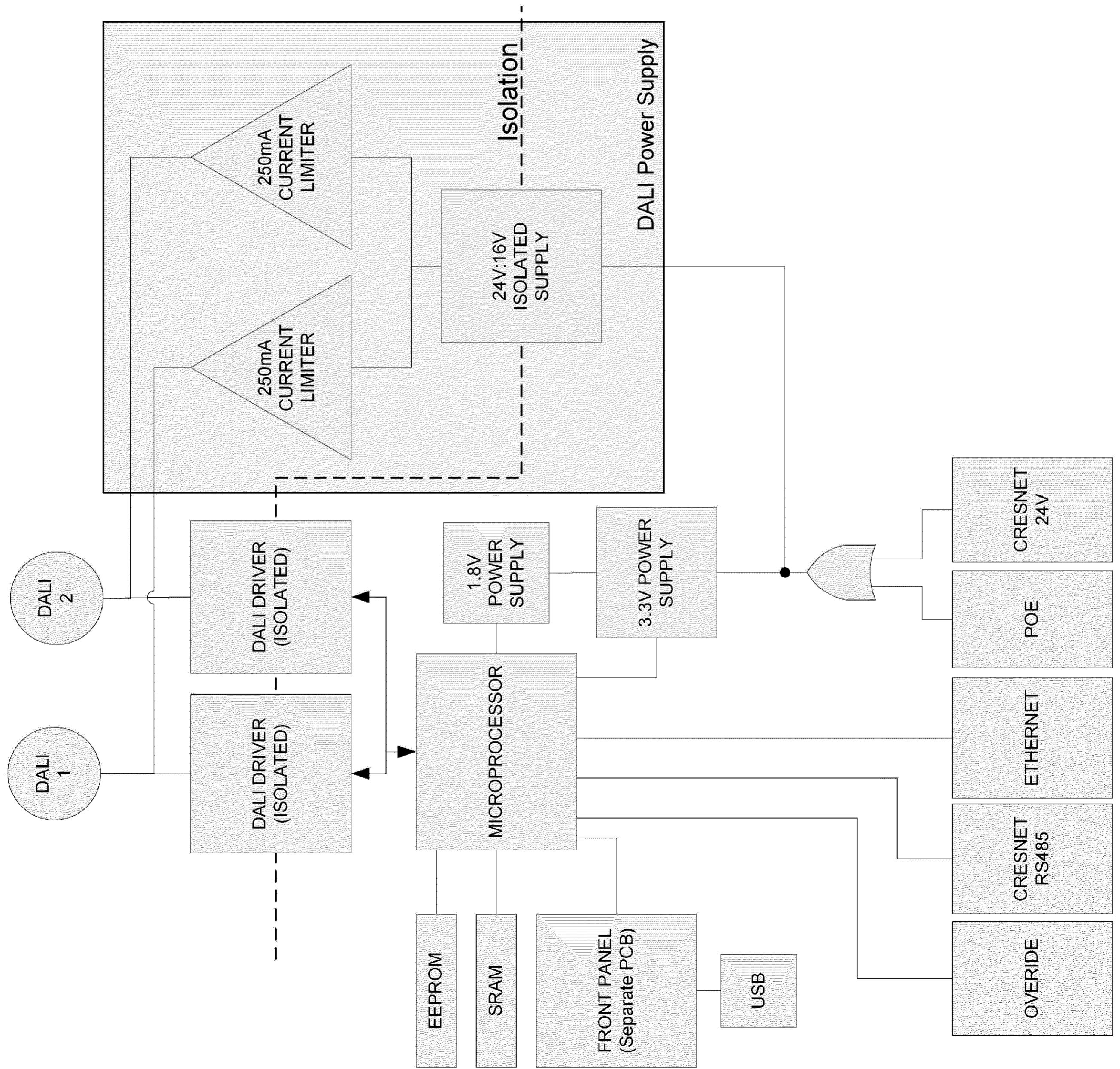
4

5

6

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	INITIAL PROTOTYPE RELEASE PER EW01599		
B	REVISED PER EW01599	01/05/2010	M.J.M.
C	REVISED PER EW01599	05/13/2010	M.J.M.
D	REVISED PER ECN9543	05/13/2010	M.C.
E	REVISED PER ECN9758	08/26/2010	M.J.M.
F	REVISED PER ECN9762	08/30/2010	M.J.M.

# DALI CONTROLLER



FINISHED GOODS		SORT NAME		PWB PART NO / VERSION / REVISION	
6?????	C				
6?????	C				
6?????	C				
6?????	C				
6?????	C				
6?????	C				

USED ON	
ALL PARTS AND PROCESSES MUST BE ROHS COMPLIANT	INDEX
<b>CRESTRON</b> 22 LINK DRIVE, ROCKLEIGH, N.J. 07647 (201) 750-7004 FAX (201) 767-5772	
SCHEMATIC	
DALI CONTROLLER	
DALI INTERFACE BOARD	
SIZE: <b>C</b>	DRAWING NO. <b>SE 06755</b>
REV <b>F</b>	

NAME	DATE
DRAWN BY: BS	08/30/10
CHECKED: M.J.M.	08/30/10
ENGR. APPV.	
MFG. APPV.	

SCALE: NA	FILE NAME: 06755 - F - SCH	SHEET 1 OF 7
-----------	----------------------------	--------------

THESE DRAWINGS AND SPECIFICATIONS ARE THE EXCLUSIVE PROPERTY OF CRESTRON ELECTRONICS, INC. AND ARE ISSUED IN STRICT CONFIDENCE. DISCLOSURE OR REPRODUCTION IN WHOLE OR PART, WITHOUT PRIOR WRITTEN PERMISSION, IS PROHIBITED EXCEPT FOR THE MANUFACTURE OF ARTICLES FOR CRESTRON ELECTRONICS, INC.

1

2

3

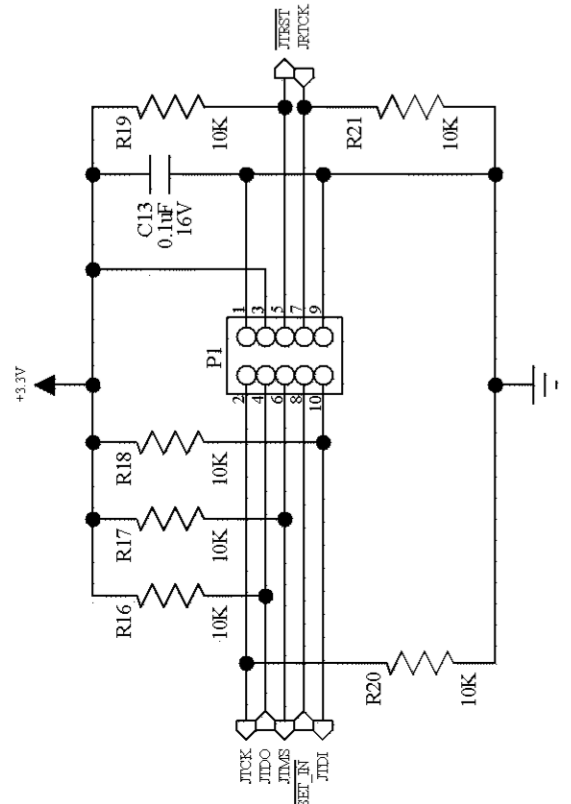
4

5

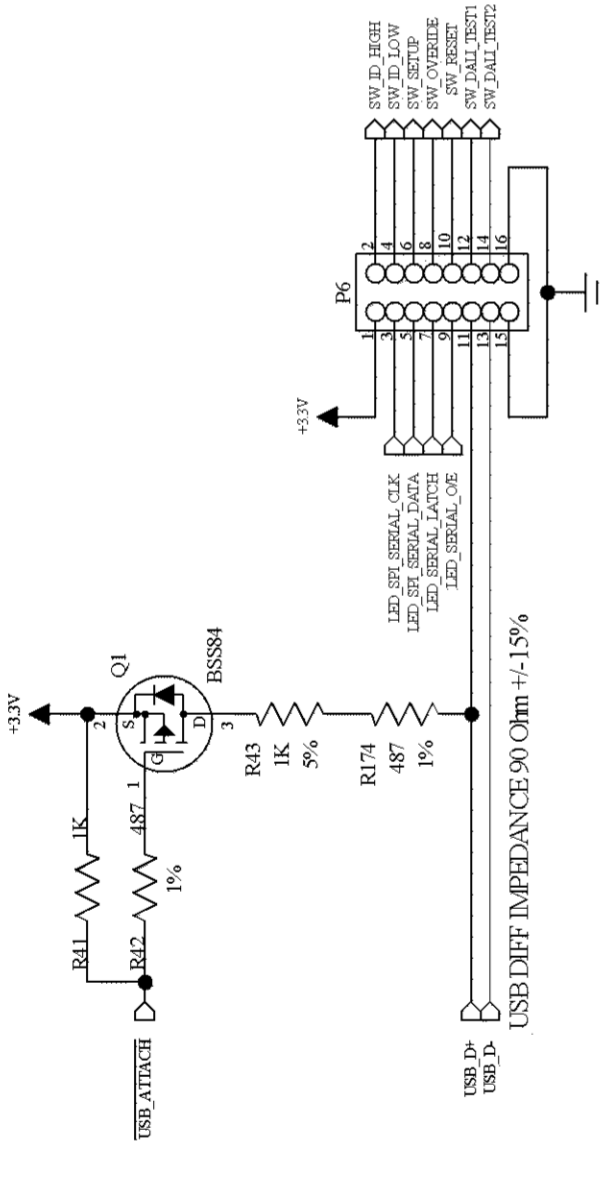
6

THESE DRAWINGS AND SPECIFICATIONS ARE THE EXCLUSIVE PROPERTY OF CRESTRON ELECTRONICS, INC. AND ARE ISSUED IN STRICT CONFIDENCE. DISCLOSURE OR REPRODUCTION IN WHOLE OR PART, WITHOUT PRIOR WRITTEN PERMISSION, IS PROHIBITED EXCEPT FOR THE MANUFACTURE OF ARTICLES FOR CRESTRON ELECTRONICS, INC.

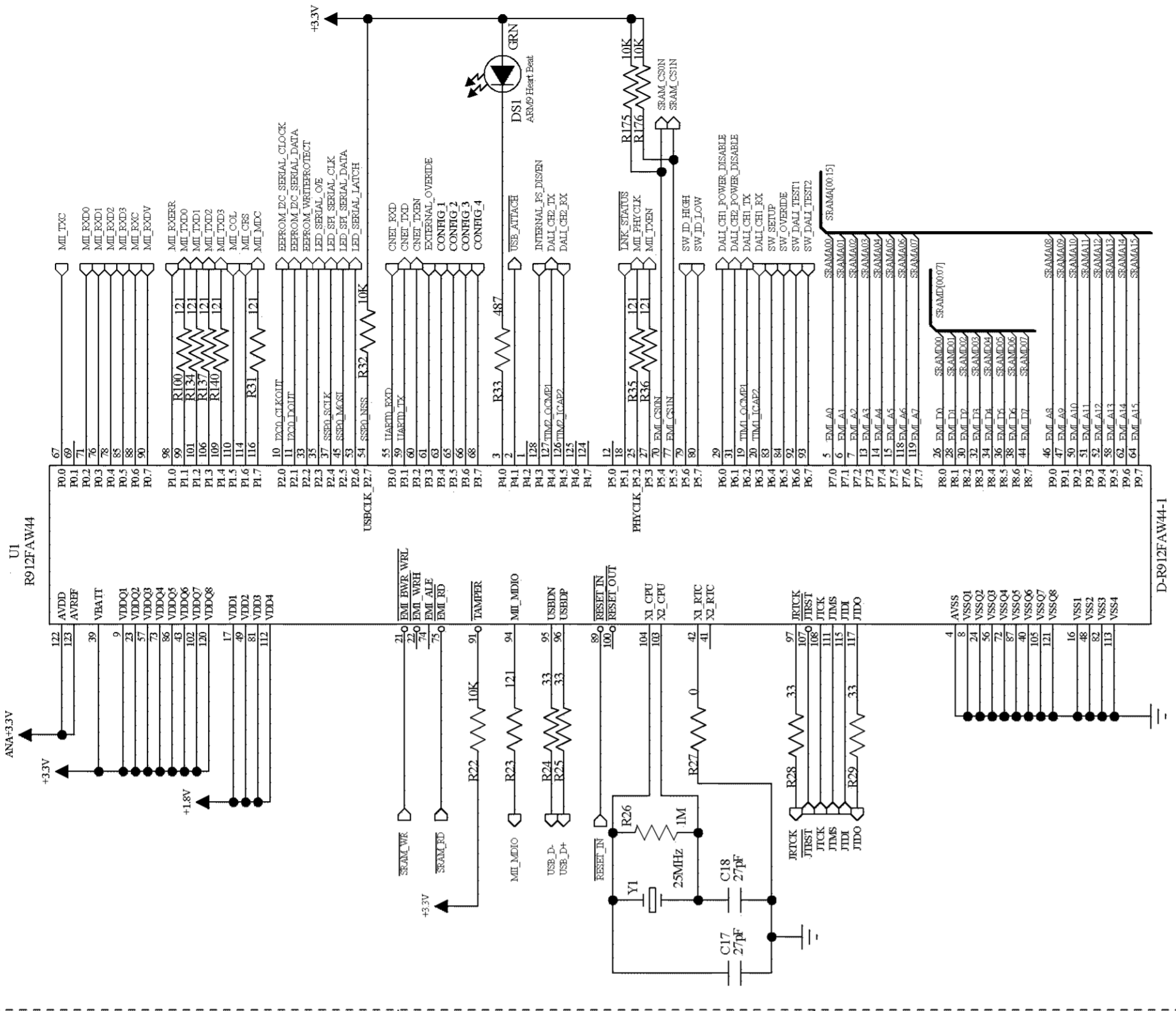
### JTAG PORT



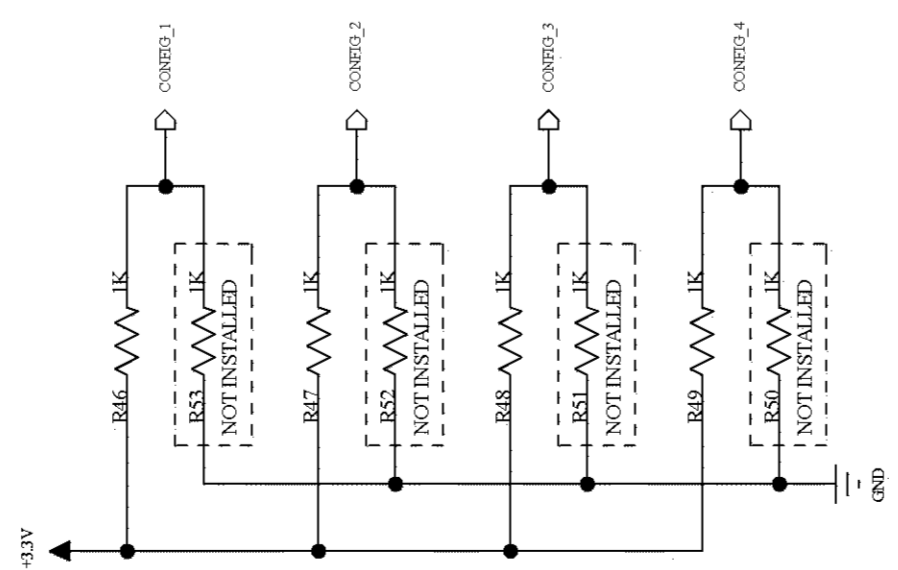
### BOARD TO BOARD CONNECTOR TO 06754



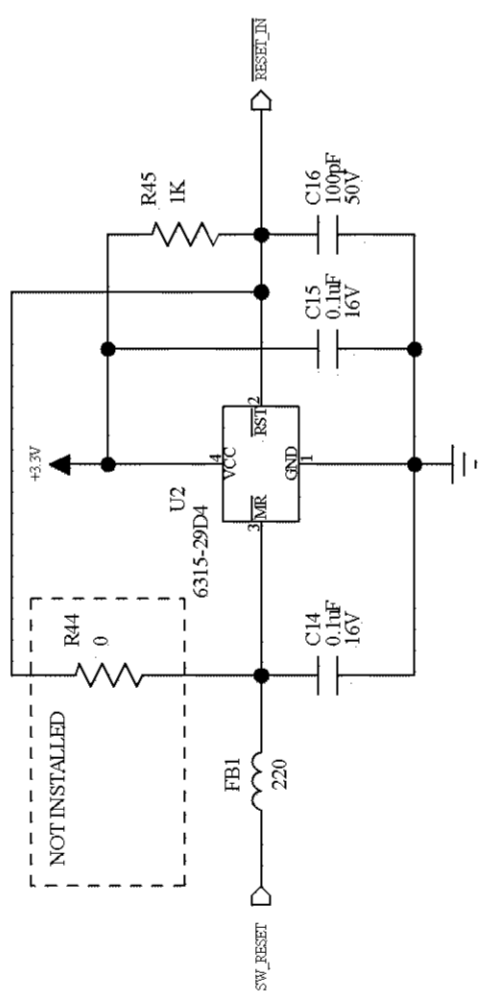
### MICROPROCESSOR



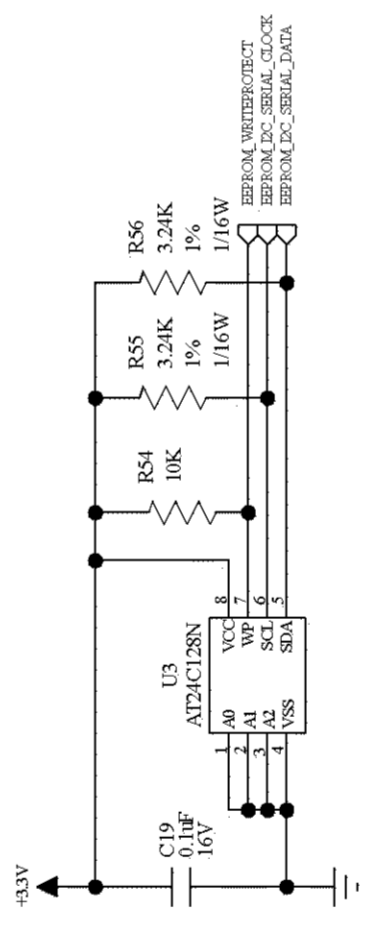
### CONFIG RESISTORS



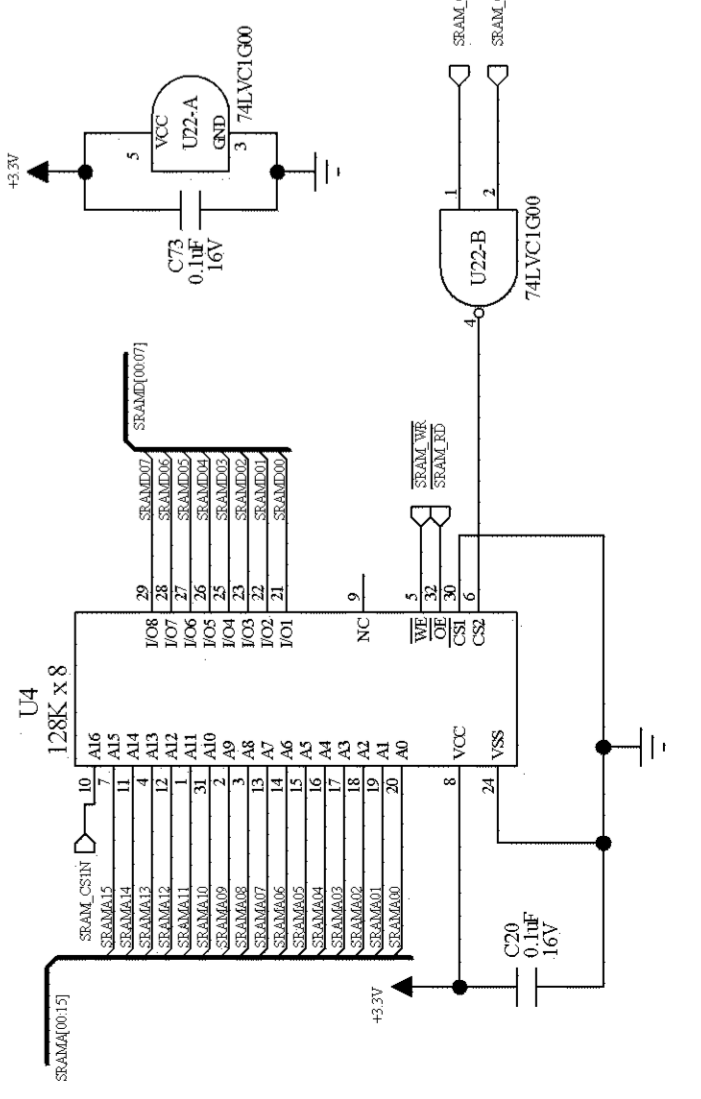
### MICRO RESET



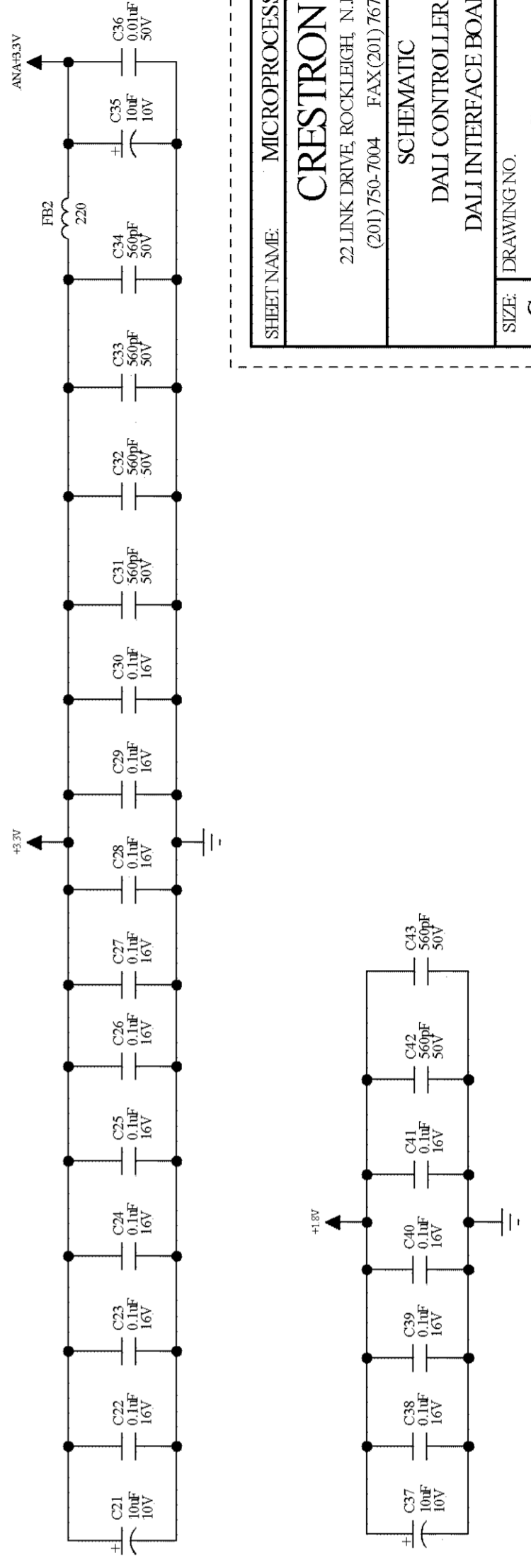
### EEPROM



### SRAM



### MICRO BYPASS CAPACITORS



SHEET NAME: MICROPROCESSOR	
CRESTRON	
22 LINK DRIVE, ROCKLEDGE, N.J. 07647	
(201) 750-7004 FAX (201) 767-5772	
SCHEMATIC	
DALI CONTROLLER	
DALI INTERFACE BOARD	
SIZE: C	DRAWING NO. SE 06755
SCALE: NA	FILE NAME: 06755 - F - SCH
REV: F	SHEET: 2 OF 7

1

2

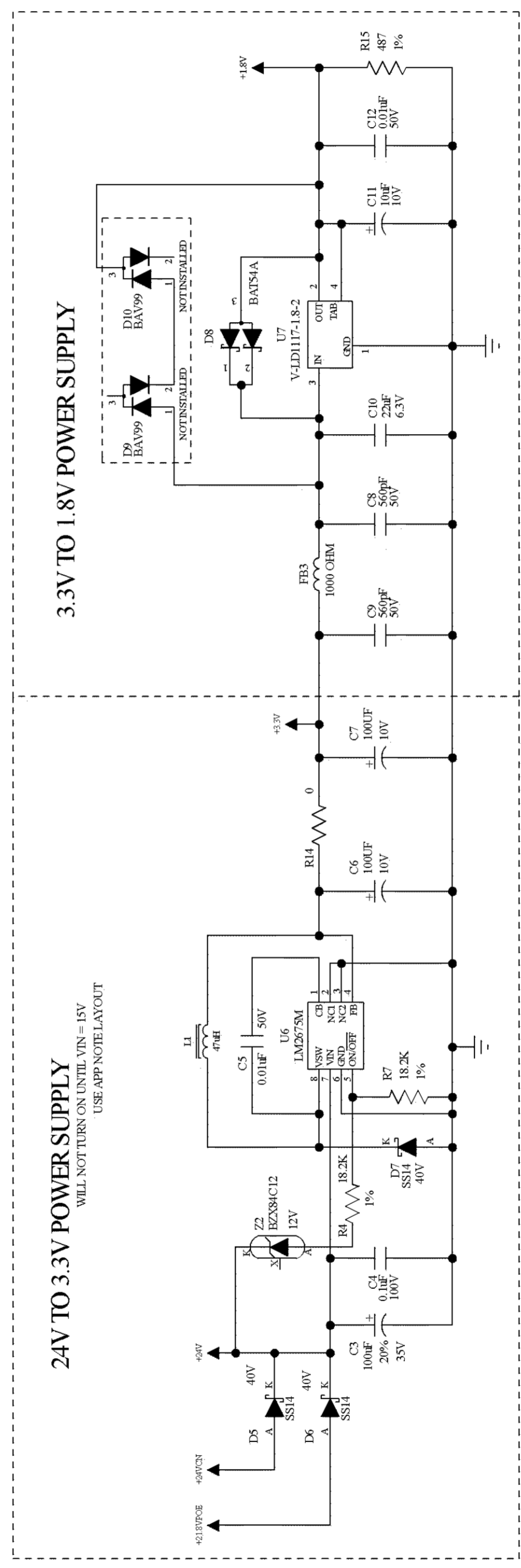
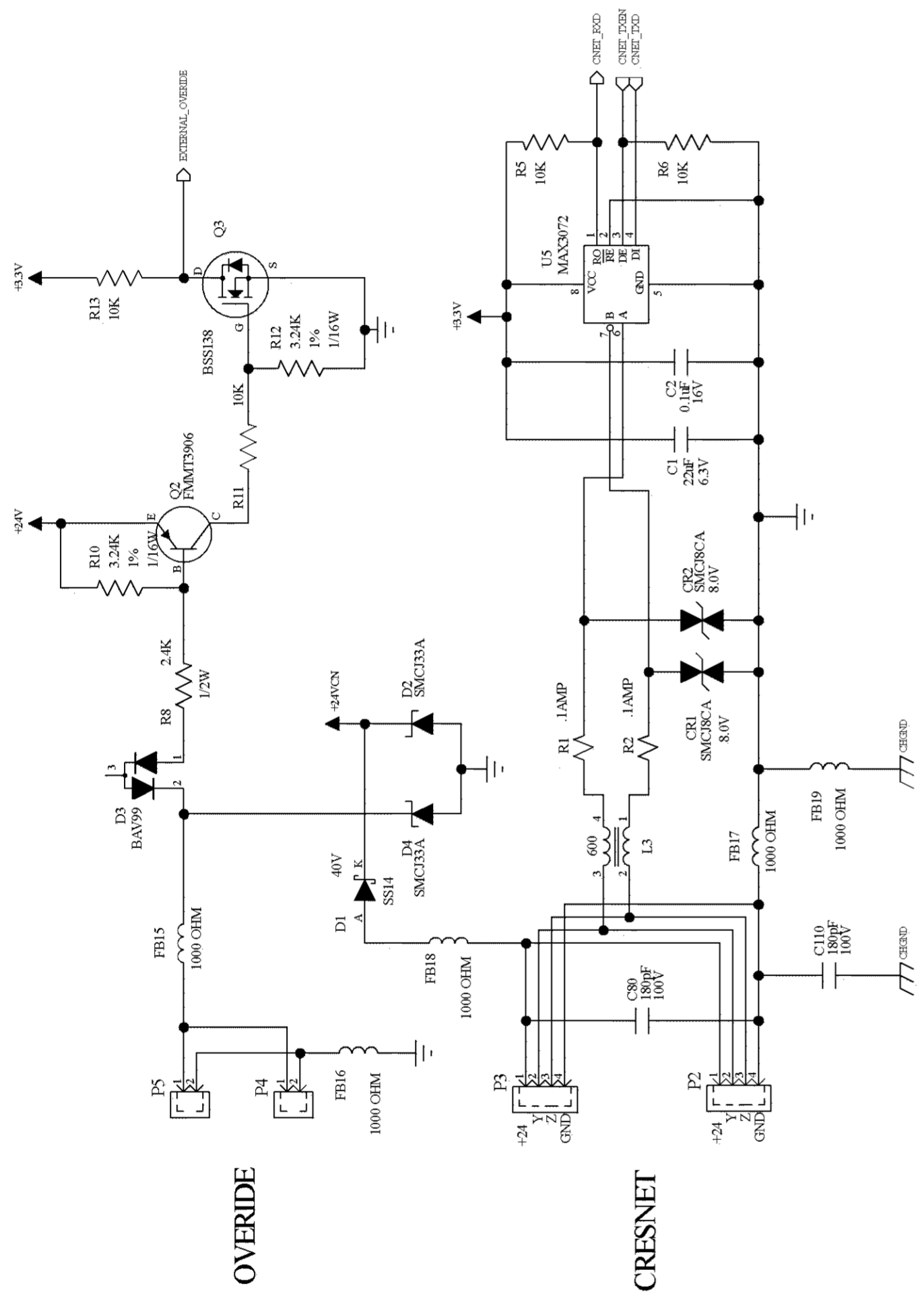
3

4

5

6

THESE DRAWINGS AND SPECIFICATIONS ARE THE EXCLUSIVE PROPERTY OF CRESTRON ELECTRONICS, INC. AND ARE ISSUED IN STRICT CONFIDENCE. DISCLOSURE OR REPRODUCTION IN WHOLE OR PART, WITHOUT PRIOR WRITTEN PERMISSION, IS PROHIBITED EXCEPT FOR THE MANUFACTURE OF ARTICLES FOR CRESTRON ELECTRONICS, INC.



SHEETNAME: CRESNET POWER	
CRESTRON	
22 LINK DRIVE, ROCKLEIGH, N.J. 07647	
(201) 750-7004 FAX(201) 767-5772	
SCHEMATIC	
DALI CONTROLLER	
DALI INTERFACE BOARD	
SIZE: C	DRAWING NO. SE 06755
REV. F	REV. F
SCALE: NA	FILE NAME: 06755 - F - SCH
SHEET 3 OF 7	

1

2

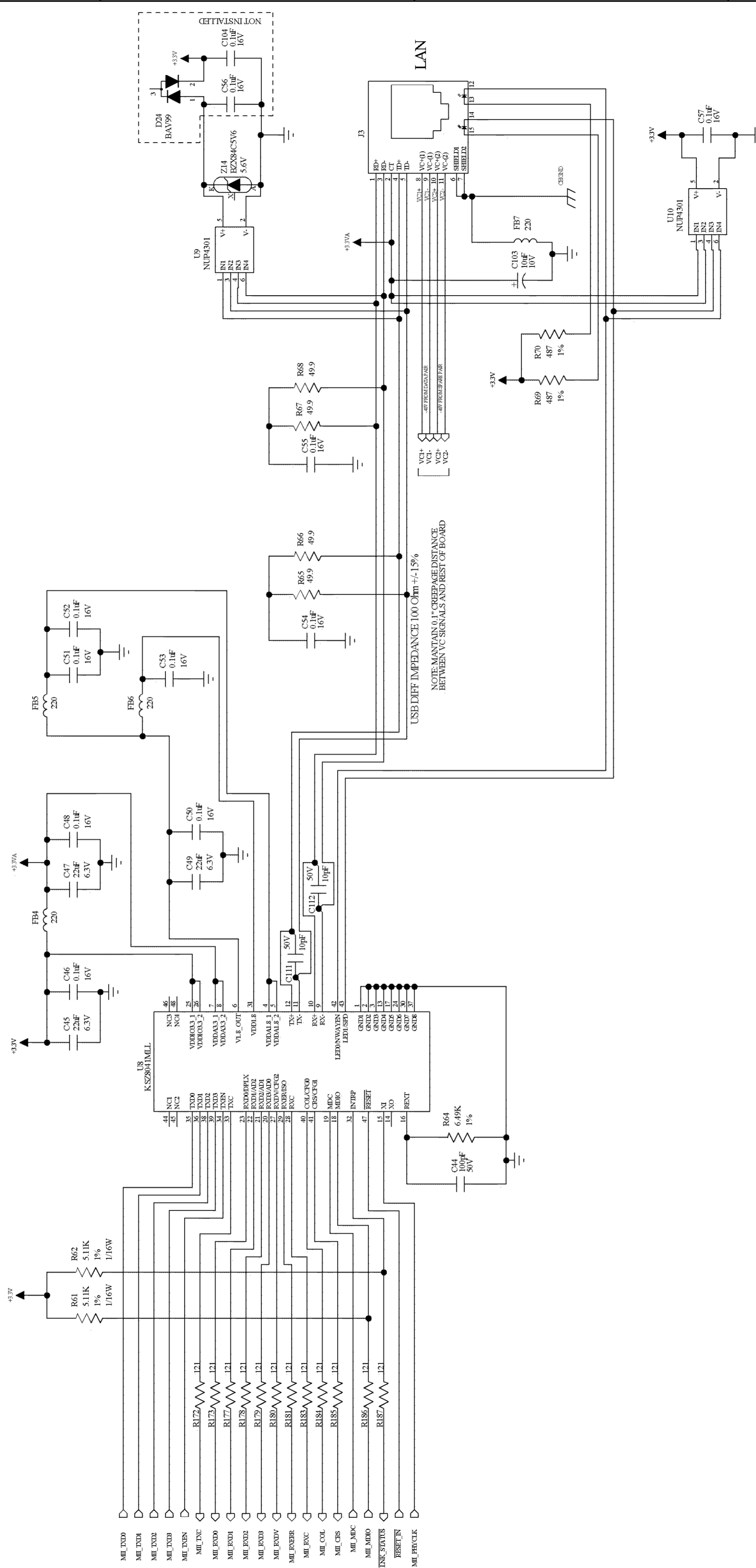
3

4

5

6

# ETHERNET



THESE DRAWINGS AND SPECIFICATIONS ARE THE EXCLUSIVE PROPERTY OF CRESTRON ELECTRONICS, INC. AND ARE ISSUED IN STRICT CONFIDENCE. DISCLOSURE OR REPRODUCTION IN WHOLE OR PART, WITHOUT PRIOR WRITTEN PERMISSION, IS PROHIBITED EXCEPT FOR THE MANUFACTURE OF ARTICLES FOR CRESTRON ELECTRONICS, INC.

SHEET NAME: ETHERNET	
CRESTRON	
22 LINK DRIVE, ROCKLEIGH, N.J. 07647	
(201) 750-7004 FAX (201) 767-5772	
SCHEMATIC	
DALI CONTROLLER	
DALI INTERFACE BOARD	
SIZE: C	DRAWING NO. SE 06755
SCALE: NA	FILE NAME: 06755 - F - SCH
REV: F	SHEET: 4 OF 7

1

2

3

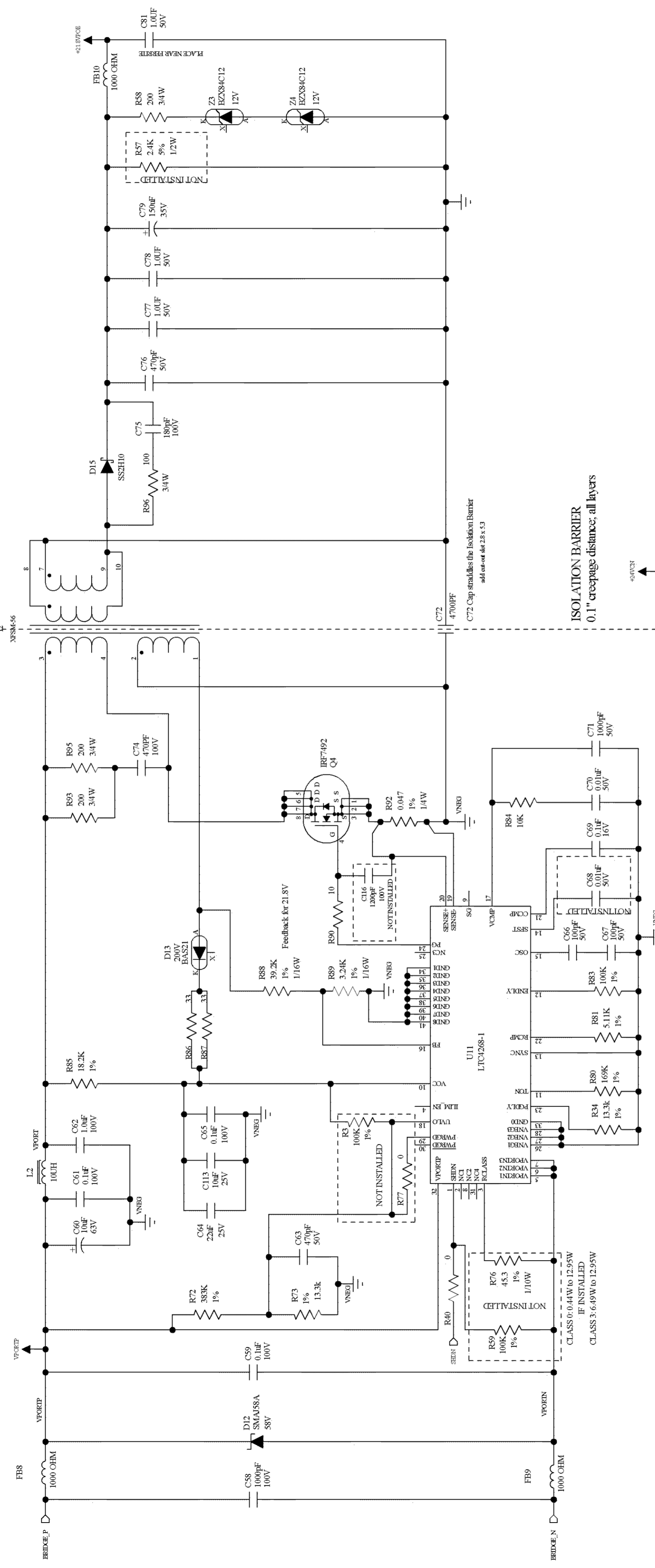
4

5

6

THESE DRAWINGS AND SPECIFICATIONS ARE THE EXCLUSIVE PROPERTY OF CRESTRON ELECTRONICS, INC. AND ARE ISSUED IN STRICT CONFIDENCE. DISCLOSURE OR REPRODUCTION IN WHOLE OR PART, WITHOUT PRIOR WRITTEN PERMISSION, IS PROHIBITED EXCEPT FOR THE MANUFACTURE OF ARTICLES FOR CRESTRON ELECTRONICS, INC.

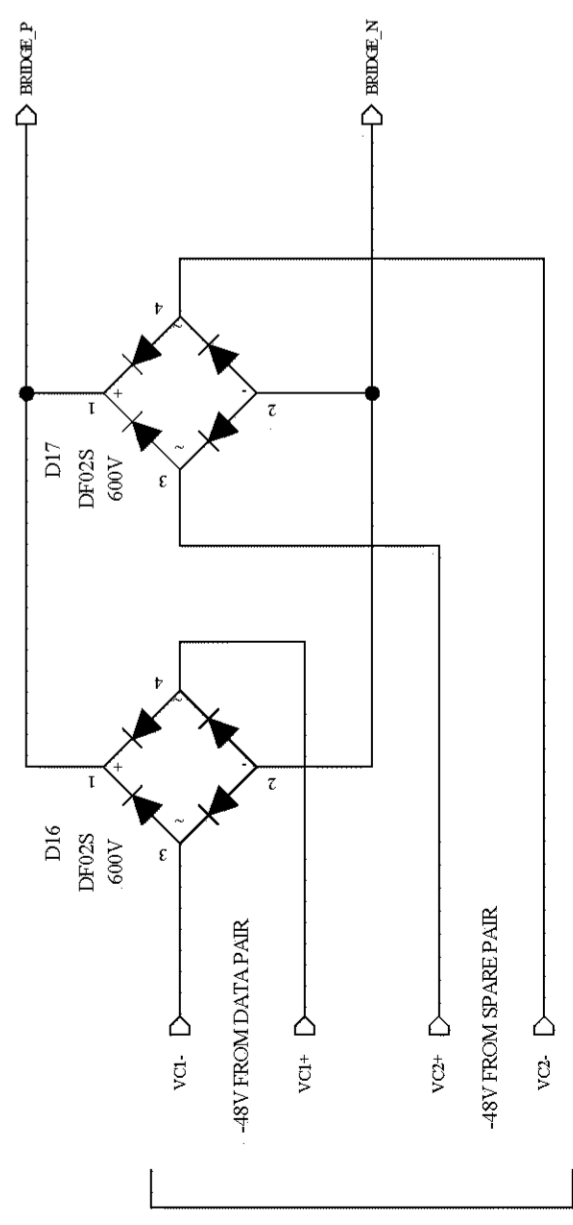
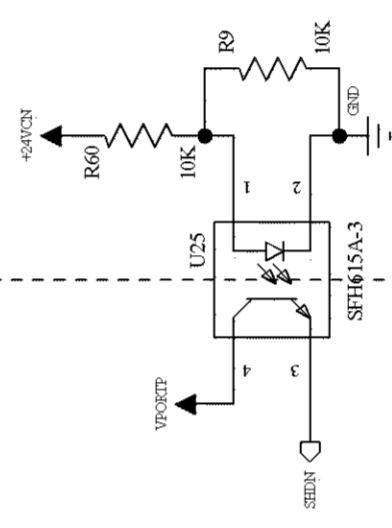
# PoE DC/DC CONVERTER



C72 Cap straddles the Isolation Barrier  
add note on sheet 2.8 & 5.3

ISOLATION BARRIER  
0.1" creepage distance; all layers

NOTE: SENSE+ AND SENSE- TRACES: UNBROKEN GROUND PLANE, WIDE AND SHORT TRACE



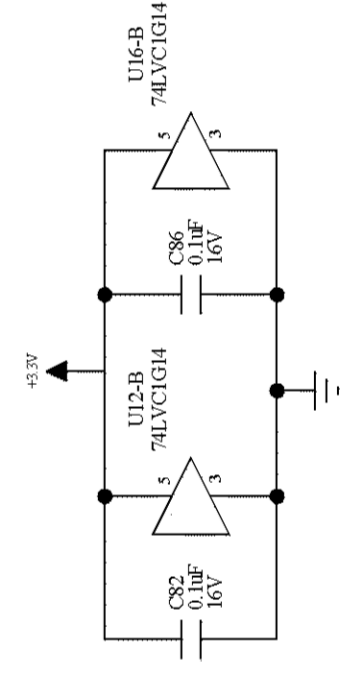
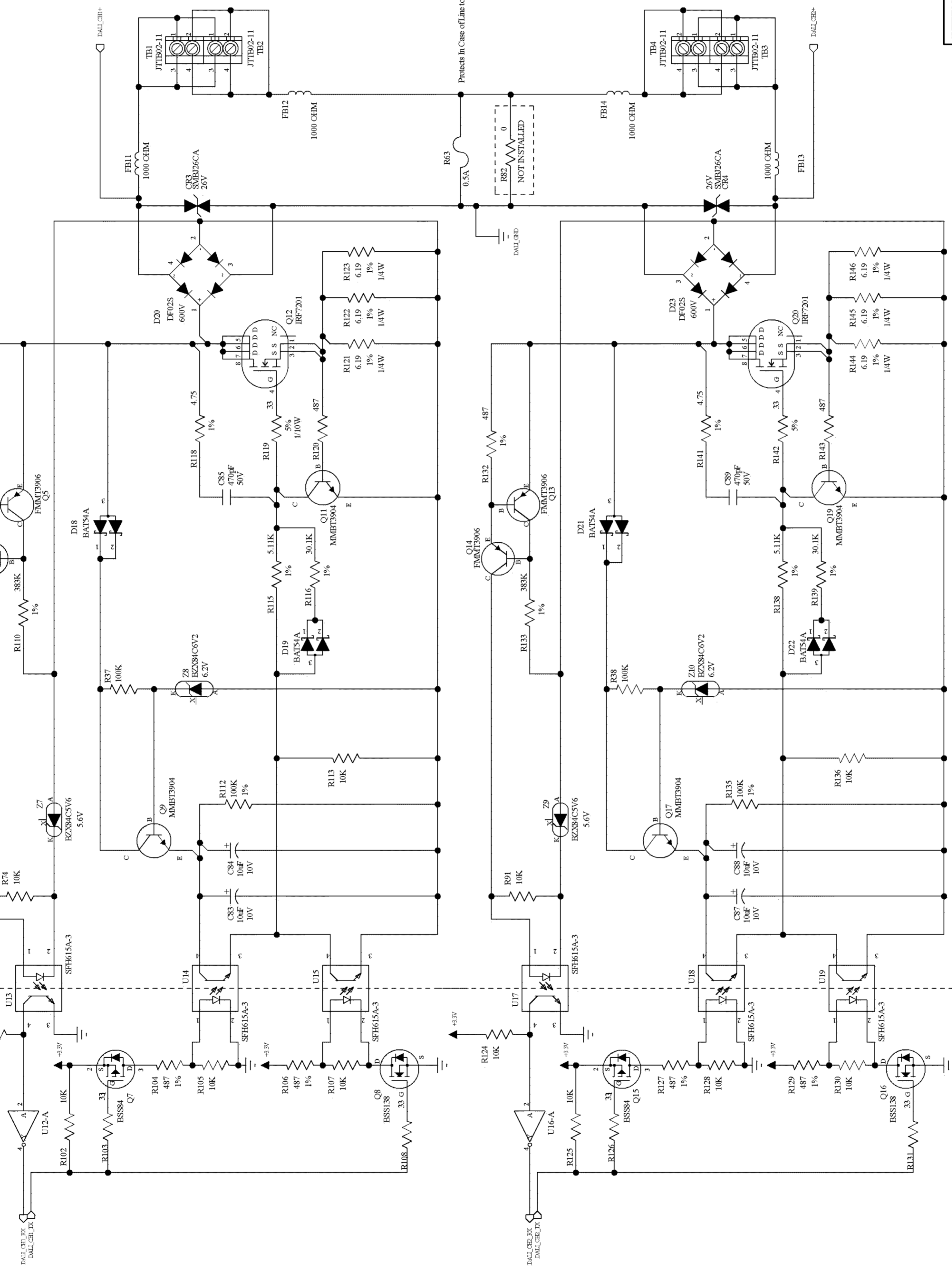
FROM ETHERNET CONNECTOR

SHEET NAME: POE	
CRESTRON	
22 LINK DRIVE, ROCKLEIGH, N.J. 07647	
(201) 750-7004 FAX (201) 767-5772	
SCHEMATIC	
DALI CONTROLLER	
DALI INTERFACE BOARD	
DRAWING NO. SE 06755	REV F
SCALE: NA	FILE NAME: 06755 - F - SCH
SHEET 5 OF 7	

1 2 3 4 5 6

### DALI COMMUNICATION CHANNEL 1

### DALI COMMUNICATION CHANNEL 2



SHEET NAME: DALI COMM	
CRESTRON	
22 LINK DRIVE, ROCKLEIGH, N.J. 07647	
(201) 750-7004 FAX (201) 767-5772	
SCHEMATIC	
DALI CONTROLLER	
DALI INTERFACE BOARD	
SIZE: C	DRAWING NO. SE 06755
SCALE: NA	FILE NAME: 06755 - F - SCH
SHEET: 6 OF 7	REV: F

THESE DRAWINGS AND SPECIFICATIONS ARE THE EXCLUSIVE PROPERTY OF CRESTRON ELECTRONICS, INC. AND ARE ISSUED IN STRICT CONFIDENCE. DISCLOSURE OR REPRODUCTION IN WHOLE OR PART, WITHOUT PRIOR WRITTEN PERMISSION, IS PROHIBITED EXCEPT FOR THE MANUFACTURE OF ARTICLES FOR CRESTRON ELECTRONICS, INC.

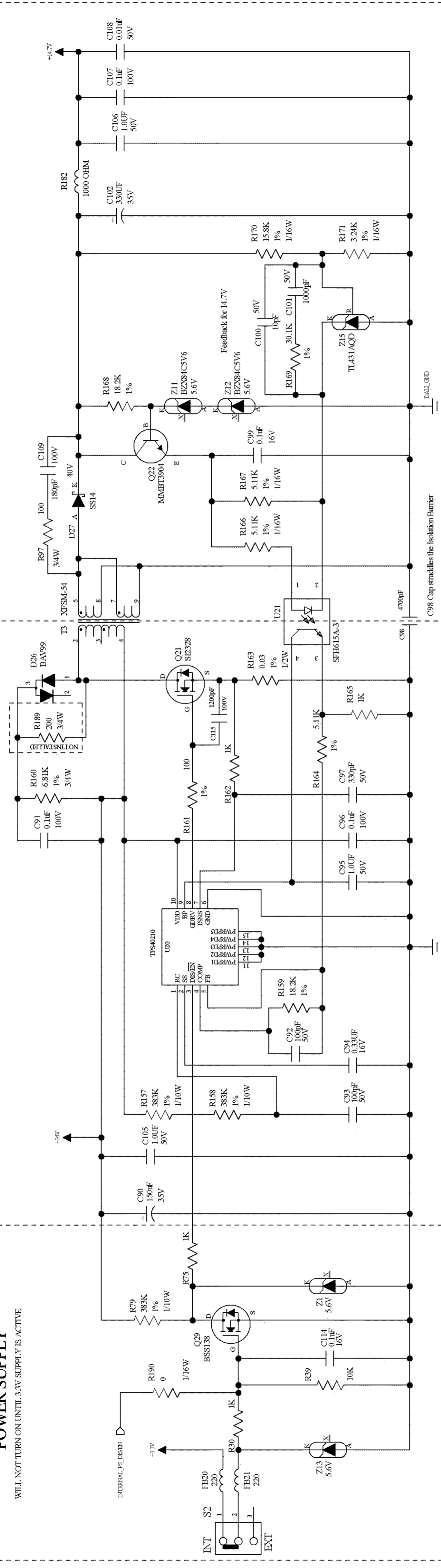


1 2 3 4 5 6

THESE DRAWINGS AND SPECIFICATIONS ARE THE EXCLUSIVE PROPERTY OF CRESTRON ELECTRONICS, INC. AND ARE ISSUED IN STRICT CONFIDENCE. DISCLOSURE OR REPRODUCTION IN WHOLE OR PART, WITHOUT PRIOR WRITTEN PERMISSION, IS PROHIBITED EXCEPT FOR THE MANUFACTURE OF ARTICLES FOR CRESTRON ELECTRONICS, INC.

ISOLATED 16V POWER SUPPLY FOR DALI BUS

EXTERNAL/INTERNAL POWER SUPPLY  
WILL NOT TURN ON UNTIL 3.3V SUPPLY IS ACTIVE



C98 Cap straddles the Isolation Barrier  
ISOLATION BARRIER  
0.25" creepage distance; all layers

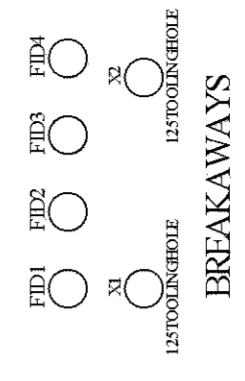
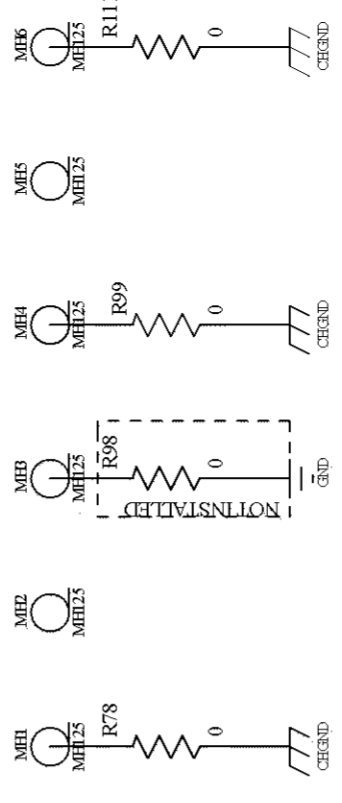
CURRENT LIMIT FOR DALI BUS  
PROTECTION AGAINST CRESNET 24V TO GND MISWIRE  
AND DALI 16V TO GND MISWIRE

CHANNEL 1

CHANNEL 2

ISOLATION BARRIER  
0.25" creepage distance; all layers

ISOLATION BARRIER  
0.25" creepage distance; all layers



SHEET NAME: DALI POWER SUPPLY  
CRESTRON  
22 LINK DRIVE, ROCKLEIGH, N.J. 07647  
(201) 750-7004 FAX (201) 767-5772  
SCHEMATIC  
DALI CONTROLLER  
DALI INTERFACE BOARD

SCALE: NA	FILE NAME: 06755 - F - SCH	SHEET: 7 OF 7
SIZE: C	DRAWING NO.: SE 06755	REV: F

TEST RECORD NO. 1

SAMPLES:

Representative production samples of the DIN-DALI-2 open type energy management equipment as indicated below and constructed as described herein, were submitted by the manufacturer for examination and test.

GENERAL:

Test results relate only to the items tested.

The following tests were conducted.

TEST NAME	Standards
POWER INPUT TEST	UL 916, Par. 39 CSA No. 205, Clause 6.2
TEMPERATURE TEST	UL 916, Par. 40 CSA No. 205, Clause 6.3
DIELECTRIC VOLTAGE-WITHSTAND TEST:	UL 916, Par. 49 CSA No. 205, Clause 6.5
COMPONENT BREAKDOWN TEST:	UL 916, Par. 46 -

The following tests were conducted in accordance with UL916 and are considered representative of the same tests required by Canadian National Standard, CAN/CSA C22.2 No. 205-1983(R2009).

The test methods and results of the above tests have been reviewed and found to comply with the requirements in the Standard for Energy management Equipment, UL 916, 4<sup>th</sup> edition, revised June 4, 2010.

Test Record Summary:

The results of this investigation, including construction review and testing, indicate that the products evaluated comply with the applicable requirements in the Standard for Energy Management Equipment, UL916 4th edition, revised June 4, 2010 and Signal Equipment, CSA C22.2 No. 205-1983, revised 2009 and, therefore, such products are judged eligible to bear UL's Mark as described on the Conclusion Page of this Report.

## CONCLUSION

A sample of the product covered by this Report have been found to comply with the requirements covering the category and the product is found to comply with UL's applicable requirements. The description and test result in this Report are only applicable to the sample investigated by UL and does not signify UL certification or that the product(s) described are covered under UL's Follow-Up Service Program. When covered under UL's Follow-Up Service Program, the manufacturer is authorized to use the UL Listing Mark on such products which comply with UL's Follow-Up Service Procedure and any other application requirements of Underwriters Laboratories Inc. The Listing Mark of Underwriters Laboratories Inc. on the product, or the UL symbol on the product and the Listing Mark on the smallest unit container in which the product is packaged, is the only method to identify products investigated by UL to published requirements and manufactured under UL's Listing and Follow-Up Service.

This Report is intended solely for the use of UL and the Applicant for establishment of UL certification coverage of the product under UL's Follow-Up Service. UL retains all rights, title and interest (including exclusive ownership) in this Report and all copyright therein. Unless expressly authorized in writing by UL, the Applicant shall not disclose or otherwise distribute this Report or its contents to any third party or use this Report for any purpose other than to establish UL certification and become eligible for Follow-Up Service for the product(s) described in this Report. Any other use of this Report including without limitation, evaluation or certification by a party other than UL unless part of a certification scheme, is prohibited and renders the Report null and void. UL shall not incur any obligation or liability for any loss, expense, or punitive damages, arising out of or in connection with the use or reliance upon the contents of this Report to anyone other than the Applicant as provided in the agreement between UL and Applicant. Any use or reference to UL's name or certification mark(s) by anyone other than the Applicant in accordance with the agreement is prohibited without the express written approval of UL or any authorized licensee of UL. Any information and documentation involving UL Mark services are provided on behalf of Underwriters Laboratories Inc. (UL) or any authorized licensee of UL. UL shall not otherwise be responsible to anyone for the use of or reliance upon the contents of this Report.

Report by:



Karl Moeller  
Senior Project Engineer

Reviewed by:



John J. Carrigan  
Staff Engineer