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CYTEC CY64/DRV

VXI BUS 64 CHANNEL

RELAY DRIVER

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CYTEC CY64/DRV

VXI BUS 64 CHANNEL

RELAY DRIVER

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DRAWINGS

9-001	CONTROL MODULE
9-028	CY64DRV DRIVER MODULE, 3 SHEETS

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CYTEC CY/64DRV

VXI BUS 64 CHANNEL

RELAY DRIVER

1.0 GENERAL

CYTEC's CY/64DRV **(Drwg. #9-028)** 64 channel relay driver is designed for general purpose relay drive in VXI Bus C sized mainframes. The module is capable of seven different relay operating modes, four modes of multiplexing allowing for single and multiple relay drive and three modes of multiple relay or group drive selections. The mode is set by a DIP switch on the relay module and the use of any mode is determined by switching application.

Relay drive selection is made by byte writes to the Data Low Register. The write follows VXI Bus revision 1.4 Message Based handshake rules and a Begin Normal Operation command must precede data writes.

Relay drives are organized in eight groups of eight. Each group provides eight relay drives. Each group can be set up to operate independently or in accordance with other groups.

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1.1 SPECIFICATIONS

General

VXI Revision:	1.4.
Module Size:	'C' per VXI spec.
Logical Address:	DIP Switch setting.
Module ID (MODID):	Supported.
Communication:	Register or Message Based.
Bus/Address Type:	D16/A16.
Write/Write Cycle:	less than 500 nsec.

Environmental

Operating Temperature:	0 to 55° C.
Cooling:	<10° C rise with 1.5 liter/sec. air low and pressure drop 0.04mm H_2O.
Humidity:	Less than 95% RH no condensation to 30° C.
Radiated Emission:	Per VXI specification.
Conducted Emission:	Per VXI specification.
Mounting Position:	Any position with type S or LT relays. Vertical only with type M relays.
Storage Temperature:	-25 to 80° C.

Power

Power Requirements:	+5 Volts, 2.1 A. Max. +12 Volts, 0.2 A. Max.

Relay Drive

Connections:	Internal 16 pin headers.
Drive IC:	ULN2803
Max Voltage:	50 VDC
Max Current per Drive:	500mA
Max Total Current per Package:	1A

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2.0 SETUP

2.1 LOGICAL ADDRESS

The VXI logical address is set by an eight position DIP switch located near the bottom of the VXI P1 connector on the control module **(Drwg. #9-001)**. The switch allows for selecting one of 256 possible base addresses in A16 address space. Switch position 1 through 8 select the address A06 through A13 respectively. Setting a Switch ON represents a binary 0 and setting a Switch OFF a binary 1.

Address = V * 64 + 49152 where V = DIP switch setting.

Factory Default Dip Switch Setting = 7 Giving an address of 49,600 decimal, C1C0 hexadecimal. Switches 0, 1, 2 OFF, 3, 4, 5, 6, 7 ON.

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2.2 DRIVE MODE DIP SWITCH SETTINGS

The relay driver can be used in a variety of drive configurations, depending on both how the internal mode DIP switch is set, and how the eight relay drive groups are to be used. The unit is normally shipped from the factory configured to select one of 64 drives. The shipped configuration of your unit will be shown on the **Shipped Configuration** sheet included at the end of this manual.

The mode setting DIP switch is located next to the control module at the opposite end of the front panel. These switches determine the mode of operation MULTIPLEX/GROUP and the Multiplex or Group SIZE.

Mode Setting
Setting the MODE switch OFF selects Multiplexer operation, either single (64x1) or multiple (2-32x1, 4-16x1, 8-8x1). Setting Mode to ON forces multiple relay drives to be energized in parallel for multipole switching: 32x1, 4 wire; 16x1, 8 wire or 8x1, 16 wire .

Size Setting
The two SIZE switches determine how many relay drives may be energized at one time. Keep in mind that this setting only determines the allowable programmatic operation of the unit, and must coincide with any relay signal wiring. For example; if you have wired relays for operation as a 64 channel multiplexer, you must have the DIP switch set for that configuration. Setting the DIP switches to any configuration other than that for which you have wired or jumpered the signals for will most likely result in undesirable or harmful results.

Switch 1 Mode	Switch 2 Size 1	Switch 3 Size 2	Operation
OFF	OFF	OFF	64x1 Multiplexer.
OFF	ON	OFF	2 - 32x1 Multiplexers.
OFF	OFF	ON	4 - 16x1 Multiplexers.
OFF	ON	ON	8 - 8x1, Multiplexers.
ON	ON	OFF	32x1 Multiplexer, 2 paralleled drives.
ON	OFF	ON	16x1 Multiplexer, 4 paralleled drives.
ON	ON	ON	8x1 Multiplexer, 8 paralleled drives.

Relay Control Switch Setting

DIP switches 4 and 5 control relay addressing properties. For operation as described in this manual these switches **MUST** be set to Switch 4 - ON and Switch 5 - OFF.

Switch 4	Switch 5	Comments
ON	OFF	**MUST** be set in these positions

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3.0 RELAY DRIVE CONNECTIONS

Relay drive connections **(Drwg #. 9-028/2&3)** are provided by eight 16 pin header connectors. These connections provide the 8 relay drives and connections for +12 (opt. +24) and ground.

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4.0 VXI COMMUNICATION

4.1 GENERAL REGISTERS

The Module has the following VXI required registers for Message Based operation and handshaking.

Address(dec)	R/W	Register Function
base + 00	R	**ID Register**, returns the value 48970 (BF4A hex). Message Based, A16 Only, Manufacturers ID 3914 (F4A hex).
base + 02	R	**Device Type**: returns 65290 (FF72 hex).
base + 04	R	**Status**: bit 14 MODID* signal. bit 3 RDY signal. bit 2 PASSED signal.
base + 04	W	**Control Register**: bit 0 RESET signal, opens all channels.
base + 08	R	**Protocol Register**: returns 61439 (EFFF hex). Servant Only. No Signal Register. No Master Capability. No Interrupter Capability. No Fast Handshake.
base + 10	R	**Response Register**: returns ERR*, Read Ready and Write Ready information per VXI 1.3 spec.
base + 14	R/W	**Data Low Register**.

Examples

```
VXIinReg(la, 0, &id);                   /* read/test Manuf. ID */
if (id != 0xBF4A)
        printf("Error Manufacturers ID.\n");
VXIinReg(la, 2, &device);     /* read/test Device Type */
if (device != 0xFF72)
        printf("Error Device Type.\n");
```


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4.2 WORD SERIAL COMMANDS

The module supports the following word serial commands:

Command	Hex Code
ABORT NORMAL OPERATION	C8FF
BEGIN NORMAL OPERATION	FCFF, FDFF
BYTE AVAILABLE	BCdd, BDdd, dd=data
BYTE REQUEST	DEFF
CLEAR	FFFF
END NORMAL OPERATION	C9FF
READ PROTOCOL	DFFF
READ PROTOCOL ERROR	CDFF

These commands are executed by a write to base+14, the DATA LOW register. All commands except BYTE AVAILABLE and CLEAR will cause a response to be put into the modules output register and may be retrieved by a read at base+14, DATA LOW register.

Abort Normal Operation hex C8FF

Turns off RDY flag, prevents control of relays, DATA LOW response 0FFFE hex.

Begin Normal Operation hex FCFF, FDFF

Turns on RDY flag, allows control of relays, DATA LOW response 0FFFE hex.

Byte Available hex BCdd, BDdd, dd = data

Send data byte to relays, if RDY, No DATA LOW response.

Byte Request hex DEFF

Loads data to DATA LOW Register for read operation. Bit 8 END is sent true (1).
DATA LOW response relay status.

Clear hex FFFF

Clears Read Ready and Error flags, does NOT affect relays, no DATA LOW response.

End Normal Operation hex C9FF

Turns off RDY flag, prevents control of relays, DATA LOW response 0FFFE hex.

Read Protocol hex DFFF

Loads relay module protocols into the DATA LOW register, DATA LOW response 0FF7B hex.

Read Protocol Error hex CDFF

Loads the most recent error code into the DATA LOW register.
The following table indicates possible errors:

Responses, hex	Error
FFFF	None.
FFFD	Unsupported command.
FFFA	Read Ready Violation.

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5.0 RELAY DRIVE CONTROL

Data will be received by the module after a BEGIN NORMAL OPERATION command has been received. Data is sent to the DATA LOW Register with the most significant byte indicating BYTE AVAILABLE.

BYTE AVAILABLE Word Format

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	X = don't care
1	0	1	1	1	1	0	X	d	d	d	d	d	d	d	d	d = data

dd = Relay Module Data Byte, preceeding bits indicate a BYTE AVAILABLE command.

```
Example:    VXIoutReg(la, 14, 0xFCFF);          /* Begin Normal Operation */
            s[0] = relay;
            WSwrt(la, s, 1, 0, &cnt);           /* Message Write */
                  or
            VXIoutReg(la, 14,  0xBC00+relay);   /* Register Write */
```

5.1 RELAY DRIVE DATA BYTE

Relays are controlled by writing a BYTE with the BYTE AVAILABLE word serial command to register 14.

Each operating mode changes the purpose of certain bits for relay addressing. We are still addressing 1 of 64 relay drives but the mode functionally changes how the drives interact.

	bit							
MODE	7	6	5	4	3	2	1	0
64x1 Mux	0	0	Drv32	Drv16	Drv8	Drv4	Drv2	Drv1
2 - 32x1 Mux's	0	0	Mux1	Drv16	Drv8	Drv4	Drv2	Drv1
4 - 16x1 Mux's	0	0	Mux2	Mux1	Rly8	Drv4	Drv2	Drv1
8 - 8x1 Mux's	0	0	Mux4	Mux2	Mux1	Drv4	Drv2	Drv1
32x1, 4 wires	0	0	0	Drv16	Drv8	Drv4	Drv2	Drv1
16x1, 8 wires	0	0	0	0	Drv8	Drv4	Drv2	Drv1
8x1, 16 wires	0	0	0	0	0	Drv4	Drv2	Drv1

Drv32 - Drv1 = Relay Drive Addresses, weighted binary.
Mux4 - Mux1 = Multiplexer Group Number, weighted binary.

```
example:    VXIoutReg(la, 4, 0xBC00 +7);        /* Relay 7 */
```


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5.2 OPENING ALL RELAYS

Register 4 RESET

Setting then resetting bit 0 in VXI register 4 will force a reset to the module. A Begin Normal command **MUST** be re-issued after a RESET to enable relay selection. This is the preferred reset operation.

```
example:    VXIoutReg(la, 4, 1);            /* Reset On. */
            VXIoutReg(la, 4, 0);            /* Reset Off. */
            VXIoutReg(la, 14, 0xFCFF);      /* Begin Normal */
```

Alternate RESET (64x1 mode only)

NOTE: This reset mode only works for 64x1 mode. Do not use this reset method for any other configuration.

bit	7	6	5	4	3	2	1	0
	0	1	0	0	0	1	0	0

```
example:    VXIoutReg(la, 14, 0xBC44); /* Reset */
```


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5.3 STATUS RETURN

The status, energized or off, for selected relay drives may be read after requesting a status return operation. The status return request is signified by having the most significant bit in the data byte set to one and the desired relay address in the least significant three bits. This byte is then sent by a BYTE AVAILABLE command to the module by a write to base+14. Relay selections are not affected by this write.

After selecting the drive for status return a BYTE REQUEST command must be given to the module to load the output register with the status information. A read at base+14 will now return the status data.

The returned byte will contain a pattern of 1's and 0's indicating energized status for the addressed drive in each group, 1-8. A total of eight writes and reads is required to return the status of all 64 drives. Unused relay drives may appear as latched channels and should be ignored.

Select Relay For Status Return

Message Based Write, 1 Byte. Relay Addressed

7	6	5	4	3	2	1	0
1	0	X	X	X	Drv4	Drv2	Drv1

Message Based Read, Status Byte

A high or 1 bit indicates addressed relay drive in the group is energized.

Relay Drive	Drive Bit Position							
Addressed	7	6	5	4	3	2	1	0
0	56	48	40	32	24	16	8	0
1	57	49	41	33	25	17	9	1
2	58	50	42	34	26	18	10	2
3	59	51	43	35	27	19	11	3
4	60	52	44	36	28	20	12	4
5	61	53	45	37	29	21	13	5
6	62	54	46	38	30	22	14	6
7	63	55	47	39	31	23	15	7

example

```
s[0] = (drive&7) + 0x80;        /* status group address */
WSwrt(la, s, 1, 0, &cnt);
WSrd(la, s, 1, 0, &cnt);        /* read status */
if (s[0] & (1<<(drive/8))       /* test drive bit position */
        printf("Drive On.\n");
else
        printf("Drive Off.\n");
```


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5.4 STATUS DRIVE POSITIONS

Multiplexer Modes: 64x1, 2-32x1, 4-16x1, 8-8x1

	Drive Bit Position							
Address	7	6	5	4	3	2	1	0
0	56	48	40	32	24	16	8	0
1	57	49	41	33	25	17	9	1
2	58	50	42	34	26	18	10	2
3	59	51	43	35	27	19	11	3
4	60	52	44	36	28	20	12	4
5	61	53	45	37	29	21	13	5
6	62	54	46	38	30	22	14	6
7	63	55	47	39	31	23	15	7

Group Switch Modes

32x1, 2 Parallel Drives	Drive Bit Position								
Address	7	6	5	4	3	2	1	0	
0	28	24	20	16	12	8	4	0	
1	29	25	21	17	13	9	5	1	1st Drive
2	30	26	22	18	14	10	6	2	
3	31	27	23	19	15	11	7	3	
4	28	24	20	16	12	8	4	0	
5	29	25	21	17	13	9	5	1	2nd Drive
6	30	26	22	18	14	10	6	2	
7	31	27	23	19	15	11	7	3	

16x1, 4 Parallel Drives	Drive Bit Position								
Address	7	6	5	4	3	2	1	0	
0	14	12	10	8	6	4	2	0	
1	15	13	11	9	7	5	3	1	1st Drive
2	14	12	10	8	6	4	2	0	
3	15	13	11	9	7	5	3	1	2nd Drive
4	14	12	10	8	6	4	2	0	
5	15	13	11	9	7	5	3	1	3rd Drive
6	14	12	10	8	6	4	2	0	
7	15	13	11	9	7	5	3	1	4th Drive

8x1, 8 Parallel Drives	Drive Bit Position								
Address	7	6	5	4	3	2	1	0	
0	7	6	5	5	3	2	1	0	1st Drive
1	7	6	5	5	3	2	1	0	2nd Drive
2	7	6	5	5	3	2	1	0	3rd Drive
3	7	6	5	5	3	2	1	0	4th Drive
4	7	6	5	5	3	2	1	0	5th Drive
5	7	6	5	5	3	2	1	0	6th Drive
6	7	6	5	5	3	2	1	0	7th Drive
7	7	6	5	5	3	2	1	0	8th Drive

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6.0 EXAMPLE PROGRAM

```
/* File: CY64DRV.C - CY64DRV Example Program  */
/* The program was run on a IBM PC compatible using a National  Inst. NI-MXI Interface */
/* Build in large memory model and Link with National Inst.  Module NIVXIDOS.L  */
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#define VXIDOS
#include <nivxi.h>

#define CY64DRV             7               /* CY64DRV Logical Address */

/* Output Constants */
#define STATUS              0x80
#define BEGIN_NORMAL        0xFCFF
#define BYTE_AVAIL          0xBC00
#define BYTE_REQ            0xDEFF

int main()
{
        int relay, mask, data, cnt, err;
        char s[2];

        if (InitVXIlibrary()) {
                printf("VXI Library error.\n");
                return 1;
        }
        err = VXIoutReg(CY64DRV, 4, 1);  /* Clear via Reset register 4*/
        err = VXIoutReg(CY64DRV, 4, 0);
        err = VXIoutReg(CY64DRV, 14, BEGIN_NORMAL);

        /* Message based control */
        for (relay=0; relay<64; relay++) { /* see notes below */
                mask = 0x01<<(relay/8);       /* relay bit position for status*/
                s[0] = relay;
                err = WSwrt(CY64DRV, s, 1, 0, &cnt);
                err = WSrd(CY64DRV, s, 1, 0, &cnt);
                if ((s[0] & mask) != mask)
                        printf("Message Op Error Relay %d, Status = %02x.\n", relay, s[0]);
                /* Register Control */
                VXIoutReg(CY64DRV, 14, BYTE_AVAIL+relay);
                VXIoutReg(CY64DRV, 14, BYTE_REQ);
                VXIinReg(CY64DRV, 14, &data);
                if ((data & mask) != mask)
                        printf("Register Op Error Relay %d, Status %02x.\n", relay, data);
        }
```


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```
        /* Status check of Specific Relay, address only no relay operation */
        relay = 63;
        mask = 0x01 << (relay/8);
        s[0] = STATUS + (relay&7);
        WSwrt(CY64DRV, s, 1, 0, &cnt);
        WSrd(CY64DRV, s, 1, 0, &cnt);
        if ((s[0]&mask) != mask) /* single bit test */
                printf("Error point %d not closed.\n", relay);

        err = VXIoutReg(CY64DRV, 4, 1);  /* Clear via Reset register 4*/
        err = VXIoutReg(CY64DRV, 4, 0);
        err = VXIoutReg(CY64DRV, 14, BEGIN_NORMAL);

        CloseVXIlibrary();
        return 0;
}

/* NOTES:
   multiple multiplexers
    size      mux's     relays   output data
    ---------------------------------------------
    64X1      0         0 to 63    relay
    2:32X1    0 to 1    0 to 31    mux*32 + relay
    4:16X1    0 to 3    0 to 15    mux*16 + relay
    8:8X1     0 to 7    0 to 7     mux*8 + relay
    status check,  AND data with mask
        mask = 1<<relay;
        if ((data&mask) != mask) error();

   multiple pole status return:
    4 wire       relay = 0 to 31,    mask = 0x11<<(relay/8);
    8 wire       relay = 0 to 15,    mask = 0x55<<(relay/8);
    16 wire      relay = 0 to 7,     mask = 0xff;
*/

/* end: CY64DRV.c */
```


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SHIPPED CONFIGURATION

NOTE: Default settings are shown in Bold, values are circled if other than default.

VXI Logical Address

Logical Address (sum of weights): **7** decimal

Switch Number	8	7	6	5	4	3	2	1
Binary 0	**ON**	**ON**	**ON**	**ON**	**ON**	ON	ON	ON
Binary 1	OFF	OFF	OFF	OFF	OFF	**OFF**	**OFF**	**OFF**
Weight	128	64	32	16	8	**4**	**2**	**1**

SWITCH MODULE MODE AND SIZE

SW1 (Mode)	SW2 (Size1)	SW3 (Size2)	OPERATION
OFF	**OFF**	**OFF**	64x1 Multiplexer
OFF	ON	OFF	2 - 32x1 Multiplexers
OFF	OFF	ON	4 - 16x1 Multiplexers
OFF	ON	ON	8 - 8x1 Multiplexers
ON	ON	OFF	32x1, 4 wire Multiplexer
ON	OFF	ON	16x1, 8 wire Multiplexer
ON	ON	ON	8x1, 16 wire Multiplexer

RELAY DRIVE CONTROL

Switches 4 and 5 **MUST** be set in the following positions.

SW4	SW5	CONTROL MODE
ON	**OFF**	Multi-BYTE Multiplex

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REFERENCES

The following publications are available from VITA, VME International Trade Association, 10229 N. Scottsdale Rd., Suite E, Scottsdale, AZ 85253.

VXIbus System Specification, Revision 1.4

VMEbus Specification Manual, IEEE STD 1014-1987

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MAINTENANCE

CY SERIES SWITCHING SYSTEMS

GENERAL

The CY Series of Switching Systems use all solid state devices except for the relays. There are two possible types of Relays used, hermetically sealed reed relays on most models, and heavy duty armature type relays on power switching units.

The units are "burned in" to eliminate marginal solid state devices and the relays are switched for 100,000 operations and individually checked for contact deterioration. No maintenance should be required if the switches operate within their rated voltage and current. The single largest cause of failure in reed relay switching systems is due to exceeding voltage and current specs which will cause the relay contacts to stick or weld closed. This problem can occur even when you seem to be operating the relays within spec if you have large capacitive or inductive loads which cause voltage or current spikes. It is recommended that in these instances you incorporate diode suppression into the circuit, ramp supplies to unload switches during operation, or use programmatic controls such as delays which will allow levels to settle before switch is operated.

TROUBLESHOOTING

The most likely problem encountered is due to excess current through the reed relays which would cause them to burn out or weld closed. To reduce the possibility of this type of fault, the signal wiring to the unit should be thoroughly checked before power is applied. Debugging of the computer programs should always be done without power to the signal wiring.

The Units all have Status feedback and can be checked using a diagnostic program which latches and unlatches each relay and checks the Status after each operation. This checks all the logic up to and including the driver to the relay.

Relay Failure

If, when using the Status diagnostic, the system checks out and a relay fails to open or close, then the fault can only be in the relay. This should be confirmed by a continuity test of the relay switch paths.

Unit Repairs

Units can be sent back to CYTEC for repair, either under warranty or on a time and material charge basis. Repairs can also be made by any competent technician. The boards within the unit can normally be troubleshot in the chassis simply by removing the top cover. Complete schematics are included in this manual. If defective parts are discovered, it will be necessary to remove the boards from the chassis to get at the solder joints.

In replacing ICs, care should be taken with the CMOS Type to avoid static voltage. The encased relay assemblies are replaced like ICs by removing solder from each pin using a solder sucker. All reed relays and reed switches in the Matrices are built to CYTEC specifications and must be replaced by the identical

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part numbers.

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*** WARRANTY ***

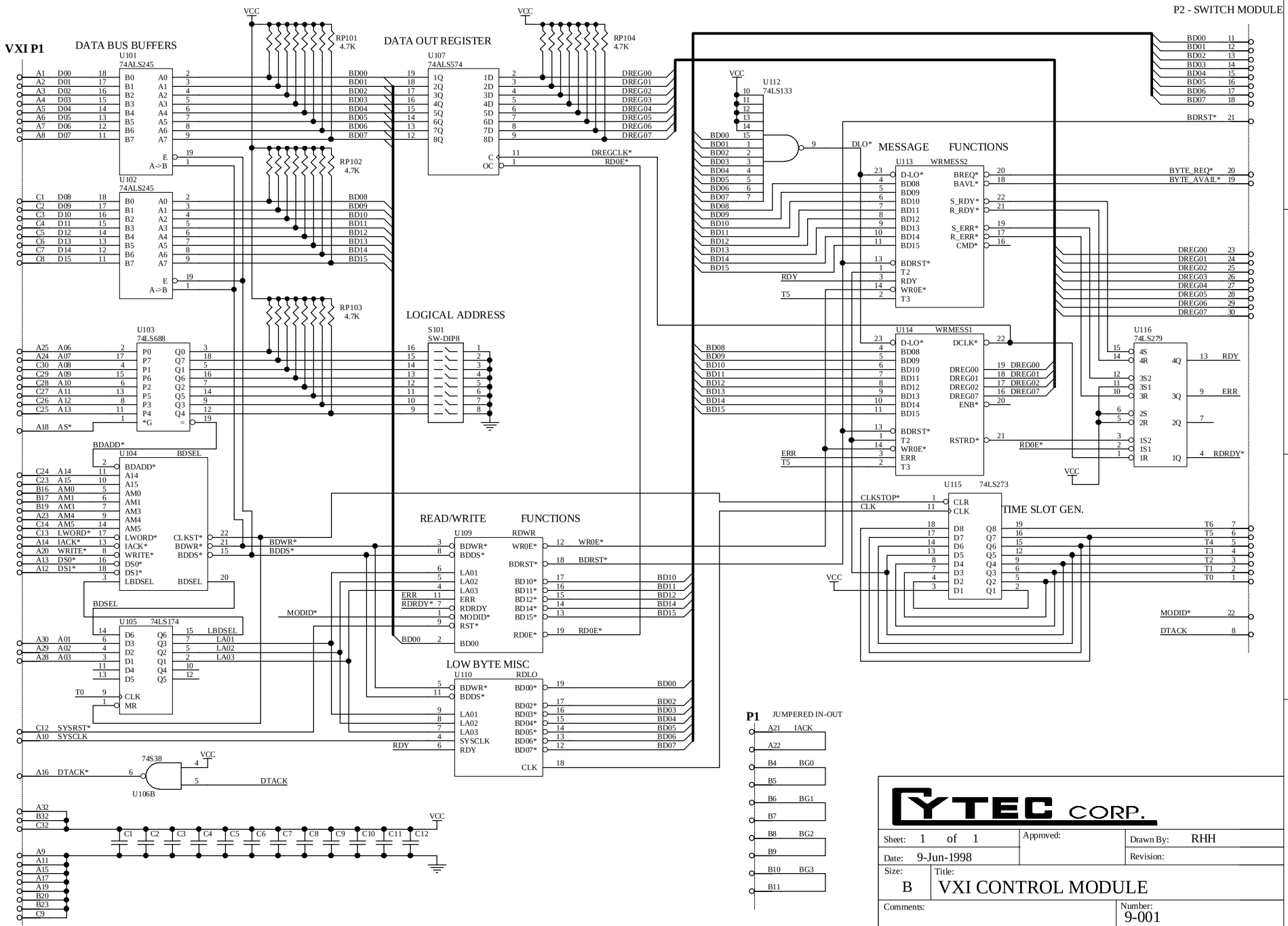
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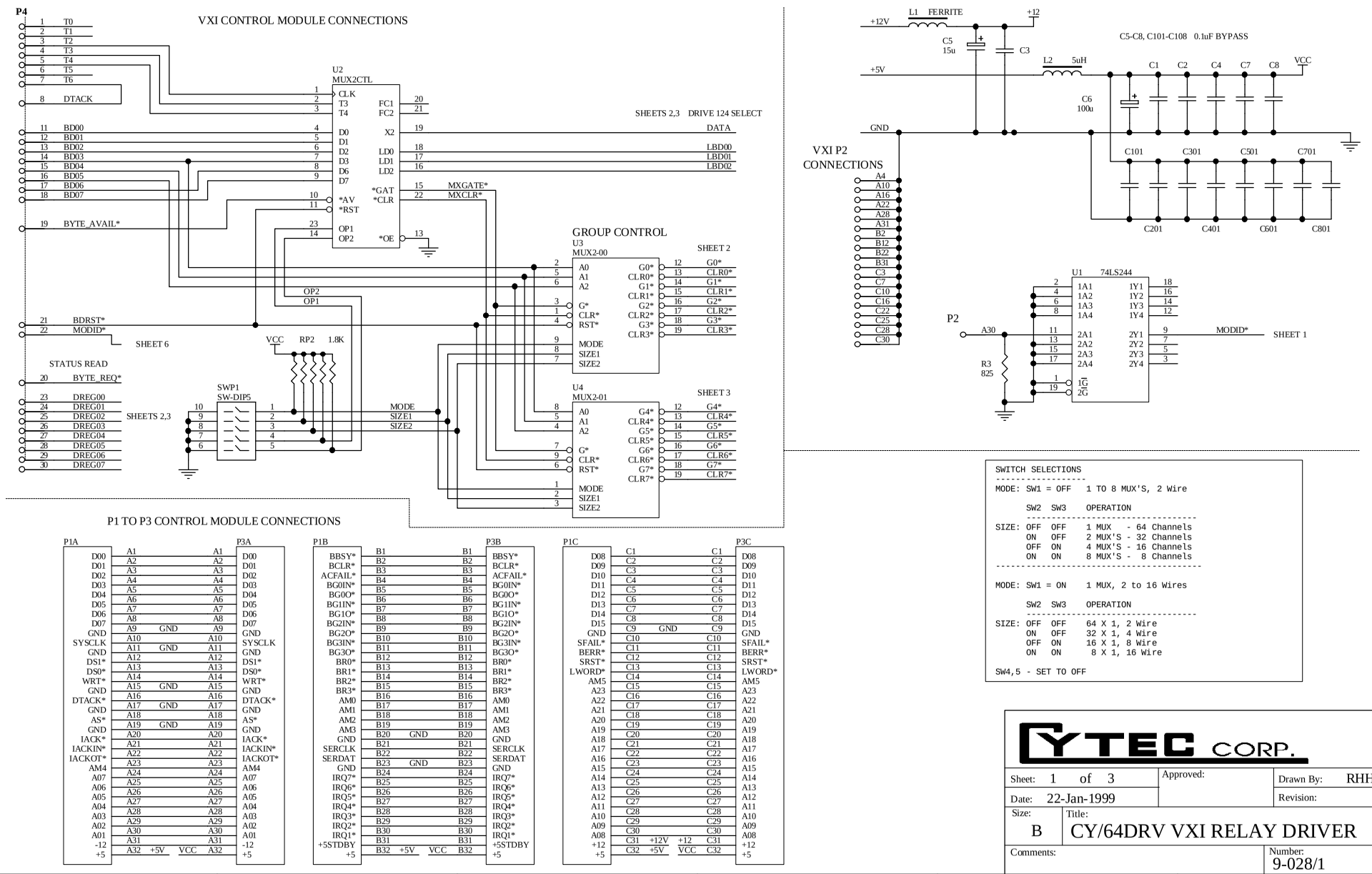
No liability is assumed for expendable items such as lamps or fuses.

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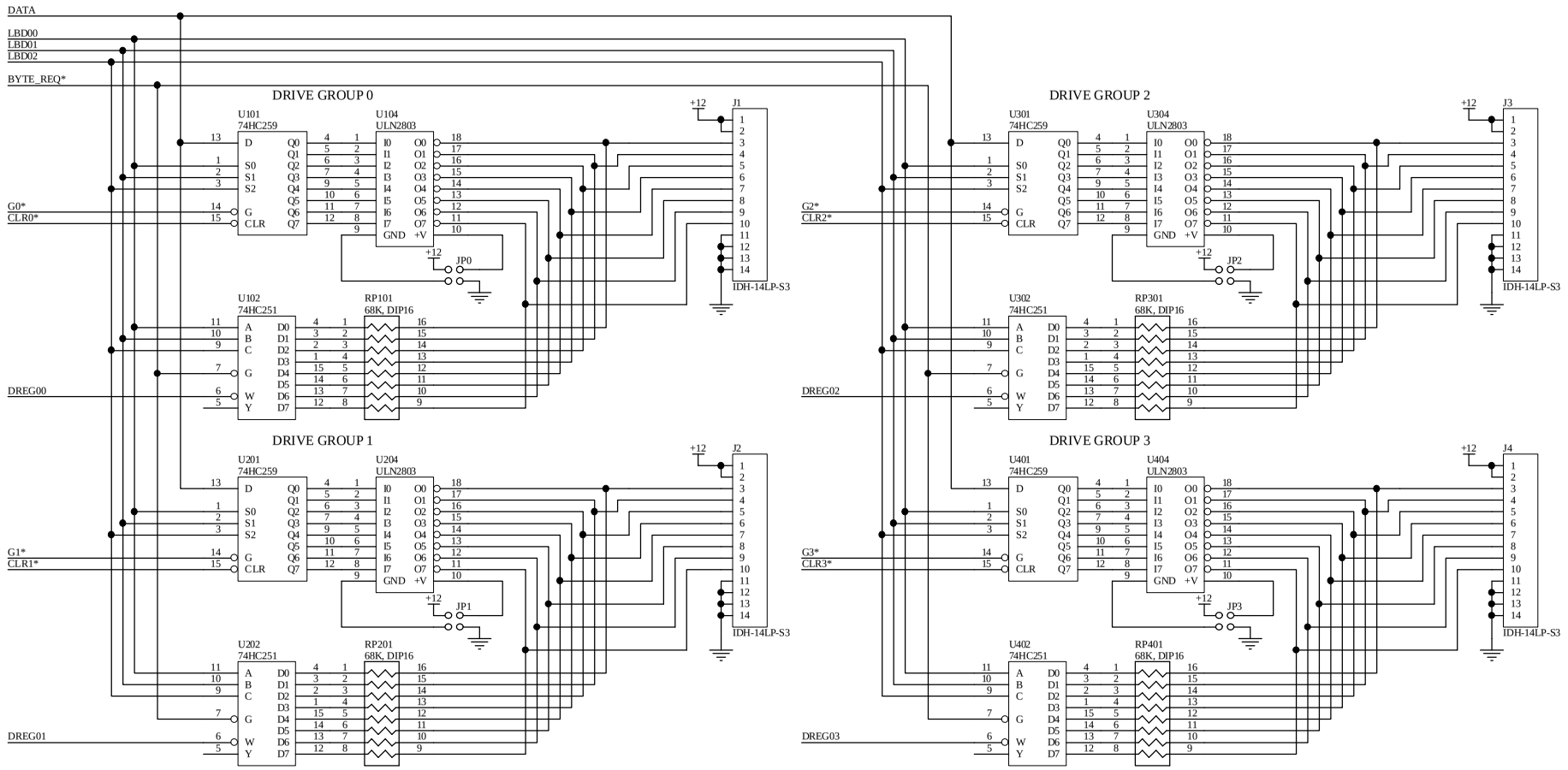
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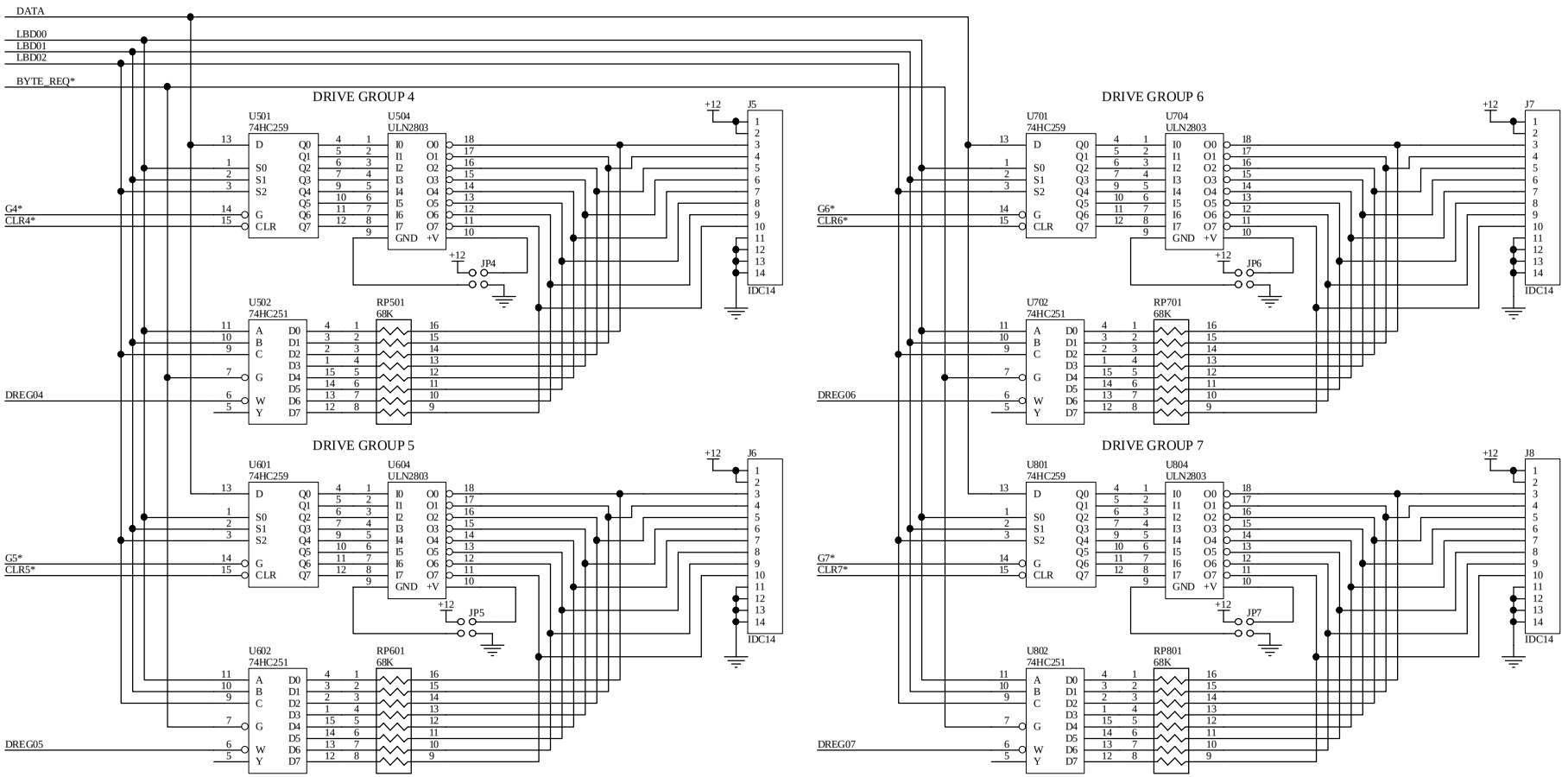
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CYTEC CORP.

Sheet: 2 of 3	Approved:	Drawn By: RHH	
Date: 22-Jan-1999		Revision:	
Size: B	Title: CY/64DRV RELAY DRIVER		
Comments:		Number: 9-028/2	

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