

2411 HIGH DENSITY CONTROL SYSTEM UNIT

This unit is designed to control up to five HD Series routing switchers, interface with multidrop panels, UMD displays and external computer for editing or control purposes.

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Approved [  ]

## 1. General Description

The 2411 is a single board computer with 64K bytes RAM, 64K bytes EEPROM, up to 512K bytes of EPROM, 10 asynchronous serial ports, and video output for Status Page. This unit is designed to control up to five HD series routing switchers, interface with multidrop panels, UMD displays and external computer for editing or control purposes.

## 2. Specification

<b>Processor</b>	68000 running at 16MHz but can be switched to 8MHz for emulation purposes.
<b>RAM</b>	2 x 256K static RAM chips providing 64K bytes.
<b>EEPROM</b>	2 x 256K EEPROM chips providing 64K bytes.
<b>EPROM</b>	4 x 256K EPROM chips allowing use of 256K 512K or 1024K type devices (i.e. 64K to 512K bytes) (IC8 & IC9 can be replaced 256K (1M when available) type RAM or EEPROM chips)
<b>RS485</b>	2 ports for multidrop 6236/7 & 2613 based panels. Up to 16 panels on each port. 5 ports for connection to routing switcher units. 1 port for connection to a string of UMD displays. This provides for up to 15 UMD units.
<b>RS232/485</b>	1 port for connection to external computer for editing or control. 1 port for sundry functions. Both of the above ports are switch selectable for RS232 or RS485.
<b>Status</b>	Provides Mono video out as well as RGB & Sync (TTL level) locked to Ref. input for status display.
<b>Supply Requirements</b>	+5V @ 1.1a +11V to +15V @ 50mA -11V to -15V @ 50mA
<b>Operating Temperature Range</b>	5° Celsius to 50° Celsius ambient.
<b>Mechanical</b>	6U x 280mm HD Series outline

### 3. Circuit Description

IC1 is a Motorola processor type MC68000P16. IC2 to IC9 provide the required memory. The processor executes program stored in EPROM using RAM to store variables, and RAM or EEPROM to store constants. IC10 is a 32MHz oscillator. IC12A divides this frequency by 2. PL4 is used to select between the two frequencies and IC12B divides the selected frequency by 2 again to give a squarewave of 16MHz or 8MHz as the processor clock. IC16 decodes the addresses for the memory devices and generates DTACK signal. Two types of DTACK is generated, for the memory devices it is gated through IC30D, for slower I/O devices and EEPROM write it is delayed by IC28 and gated through IC30C. Chip enables for RAM and EEPROM are gated through IC55 which allows the chip enables to be applied only when power is OK and RESET is released. IC17 decodes the addresses for the peripheral devices.

#### 3.1 Peripheral Devices

IC51 buffers the data between the 68000 and I/O devices. IC45 to IC47 read the switches PL9 to PL32, and IC48 and IC49 drive the on board LEDs. IC50 decodes the addresses for the above ICs.

#### 3.2 Serial I/O

IC21 is an octal universal asynchronous receiver/transmitter (Octal UART). IC24 to IC27 buffer the eight serial outputs of IC21 to RS485 standard. IC22 and IC23 buffer the inputs. Resistor networks RN4 and RN5 bias any unused inputs to high state.

IC32 is a dual universal asynchronous receiver/transmitter (DUART). IC35 buffers the two serial outputs of IC32 to RS485 standard. IC36 buffers the inputs. Resistors R46, R47, R90 and R91 bias any unused inputs to high state. IC33 and IC34 provide the RS232 type input output. PL7 and PL8 select between RS485 and RS232.

#### 3.3 Status Page

IC40 is a single chip semi-graphic display processor. IC41 provides the memory for the display processor. The display processor is locked to the incoming video signal Ref. input. IC40 provides an internal lock to the vertical syncs. Transistor T3 and the circuit around it forms a phase lock oscillator running at 12MHz. Its frequency is controlled by IC39 which compares the phase of the incoming line frequency with the line frequency provided by the display processor. This phase can be preset by RV1. Transistors T1 and T2 buffer the input video reference. IC37 separates the syncs. Transistors T5 and T6 together with R19 and R27 convert the RGB and Sync signals produced by the display processor to 1V MONO video output with 75 Ohm impedance.

### 3.4 Power

The incoming +5 volts is fed through a fuse. D14 together with the fuse provide protection against overvoltage and reverse polarity. Regulators IC52 and IC53 current limit and regulate the higher positive and negative volts required for RS232 I/O and video input buffer circuits.

D7 and T9 form a voltage detector which keeps the processor in a reset state until the input power rises above +4.7V. R60 provides a small amount of positive feedback to form a Schmitt trigger in case of slow rising input voltage.

IC54B forms part of the watchdog circuit. It has to be written to regularly. If the watchdog is not written to it will allow the oscillator formed by IC1C to start up, resetting the processor and then taking the reset high to restart the program from the beginning.

#### 4. Connector Details

##### PL1

Row C	Row A
1 GND	1 GND
2 RS485RX1-	2 RS485RX1+
3 RS485TX1+	3 RS485TX1-
4 GND	4
5	5 GND
6 RS485RX5-	6 RS485RX5+
7 RS485TX5+	7 RS485TX5-
8 GND	8
9	9 GND
10 RS485RX9-	10 RS485RX9+
11 RS485TX9+	11 RS485TX9-
12 GND	12
13	13 GND
14 RS485RX2-	14 RS485RX2+
15 RS485TX2+	15 RS485TX2-
16 GND	16
17	17 GND
18 RS485RX6-	18 RS485RX6+
19 RS485TX6+	19 RS485TX6-
20 GND	20
21	21 GND
22 RS485RX10-	22 RS485RX10+
23 RS485TX10+	23 RS485TX10-
24 GND	24
25	25 GND
26 RS485RX3-	26 RS485RX3+
27 RS485TX3+	27 RS485TX3-
28 GND	28
29	29 GND
30 RS485RX7-	30 RS485RX7+
31 RS485TX7+	31 RS485TX7-
32 GND	32

##### PL3

Row C	Row B	Row A
1	1 +15V	1 DTR11
2 RS232TX11	2 +15V	2 CTS11
3 RS232RX11	3 -15V	3 RTS11
4 DSR11	4 -15V	4
5 GND	5 GND	5
6 GND	6 GND	6 RS485RX4-
7 RS485RX4+	7	7 RS485TX4+
8 RS485TX4-	8	8 GND
9	9	9
10 GND	10	10 RS485RX8-
11 RS485RX8+	11	11 RS485TX8+
12 RS485TX8-	12	12 GND
13	13	13
14 DTR12	14	14 RS232TX12
15 CTS12	15	15 RS232RX12

**PL3 cont'd**

16	RTS12	16	16	DSR12
17		17	17	GND
18	G_OUT	18	18	GND
19	R_OUT	19	19	GND
20	B_OUT	20	20	GND
21	SYNC OUT	21	21	GND
22		22	22	
23	VIDEO_OUT	23	23	GND
24	REF_IP	24	24	GND
25		25	25	
26		26	26	
27		27	27	
28		28	28	
29		29	29	+5VIN
30		30	30	+5VIN
31		31	31	+5VIN
32	GND	32	32	+5VIN

## 5. Parts Lists

### Capacitors

C1, C2, C50	1 $\mu$ F 35V 20% Tantalum Bead
C3 to C5	10 $\mu$ F 25V 20% Tantalum Bead
C6 to C9, C12, C16, C17, C21 to C35, C43	100nF -20 +80% Ceramic
C10	220nF 20% Ceramic 50V
C11	47nF -20 +80% Ceramic
C13, C14, C44 to C49	6.8pF 2% 100V Ceramic Plate
C15	56pF 2% 100V Ceramic Plate
C19, C42	1nF 1% Polystyrene
C20	220pF 2% 100V Ceramic Plate
C36	10nF -20 +80% Ceramic
C37, C39, C40	100pF 2% 100V Ceramic Plate
C38	22pF 2% 100V Ceramic Plate
C41	1nF -20 +80% Ceramic
CV1	0-20pF Trim Side Adj (Orange)

### Diodes

D1 to D4	HLMP 6204 Red Led Array
D5	HLMP 6500 Green Led Min
D6	HLMP 6000 Red Led Small Axial
D7	TL431ACLP Low Tempco Var Zener
D8 to D10	BAT85 Schottky Diode
D11 to D13	1N4148 Silicon Diode
D14	TVS505 Transient Diode
D15	MV104 Dual Varicap

### Integrated Circuits

IC1	68000 16MHz Microprocessor
IC2 to IC5	43256 32KX8 CMOS RAM L/P
IC6 to IC9	27256-20 32K X 8 200NS Eprom
IC11	74HC393 Dual 4 Bit Bin Ctr
IC12	74HC74 Dual D Type Latch
IC13	74HC373 Octal Latch Tristate
IC14 Programmed PA115A	PAL16L8CN Programmable Array
IC15	74HC4078N 8 Input NOR/OR Gate
IC16 Programmed PA116A	PAL22V10 10 Output 12 Input
IC17, IC43, IC50	74HC138 3 to 8 Decoder
IC18, IC20, IC31, IC55	74HC00N HCMOS Quad 2 I/P Nand
IC19, IC29	74HC04N HCMOS Hex Inverter
IC21	SCC2698 Octal-Uart
IC22, IC23, IC36	SN75175 Quad Diff Line Recvr
IC24 to IC27, IC35	SN75174 Quad Diff Line Drive
IC28	74HC164
IC30	74LS05 HEX Inverter (OC)
IC32	SCN 2681 Dual Acia 40 Pin
IC33, IC34	MC145406 RS232 Driver Receiver
IC37	LM1881N Sync Separator
IC38, IC54	74HC4538 HCMOS Dual Mono
IC39	4046 BCP CMOS Phase Lock Loop
IC40	EF9345P Display Processor
IC41	UPD42832 32KX8 Pseudo-Stat Ram
IC42	74HC4049 HCMOS Hex Inverter

IC45 to IC47	74HC244N Octal 3 State Buffer
IC48, IC49	74HC273 Octal D Flip Flop
IC51	74HC245 Octal Bus Transceiver
IC52	78L08 +8 Regulator T092
IC53	79L08 -8V Regulator T092
IC56, IC58	74HC240N CMOS Octal Inverter
IC57	74HC4053 HCMOS 4X2 I/P Mux

**Choke**

L1	22 $\mu$ H 10% 0.25W RF Choke
L2	33 $\mu$ H 10% 0.25W RF Choke
L3	6.8uH 10% 0.25W RF Choke

**Resistors**

R1, R9, R39, R52, R53	100K 1% 0.4W Metal Film
R2, R49	220R 1% 0.4W Metal Film
R3	6K8 1% 0.4W Metal Film
R4	620R 1% 0.4W Metal Film
R5, R38	4K7 1% 0.4W Metal Film
R6, R8	39K 1% 0.4W Metal Film
R7, R13	680K 1% 0.4W Metal Film
R10, R12, R40, R41, R46, R47, R90, R91	47K 1% 0.4W Metal Film
R11, R24, R54 to R59, R62, R80, R81, R92 to R95	2470R 1% 0.4W Metal Film
R14	56K 1% 0.4W Metal Film
R15, R25	560R 1% 0.4W Metal Film
R16	3K3 1% 0.4W Metal Film
R17, R18, R20, R21	22R 1% 0.4W Metal Film
R19	680R 1% 0.4W Metal Film
R22	330R 1% 0.4W Metal Film
R23	1K8 1% 0.4W Metal Film
R26	75R 0.1% 0.2W Metal Film
R27	3K9 1% 0.4W Metal Film
R28 to R31	68R 1% 0.4W Metal Film
R32, R33, R36	1K0 1% 0.4W Metal Film
R34, R35, R43, R44, R61, R96	10K 1% 0.4W Metal Film
R37, R60	220K 1% 0.4W Metal Film
R42, R64 to R79, R82 to R89	10R 1% 0.4W Metal Film
R45	330K 1% 0.4W Metal Film
R48, R50, R51	2K2 1% 0.4W Metal Film
R63	18K 1% 0.4W Metal Film
RN1, RN2	3K3X7 5% 0.19W Sil Network
RN3	6K8X7 5% 0.19W Sil Network
RN4, RN5, RN6	10KX8 5% 0.19W Sil Network
RN7, RN8	680RX8 2% Sil Network
RV1	5K0 Var 10% 0.33W Cermet (10)



**Transistors**

T1 to T4, T7 to T9      2N3904 NPN Transistor  
T5, T6                    2N3906 PNP Transistor

**Fuses**

FS1                        Fuse 3A Quick Blow 20mm

**Crystals**

XL1                        Crystal 12MHz IQD A158A  
XL2                        Crystal 3.686MHz IQD A169A  
IC10                       32MHZ Quartz Oscillator

**Switches**

SW1                        Switch Sub Min Push Button RTL

