SERVICE MANUAL

for

Systemline Commander

Prepared by: PD Cheney

Authorised by: S Privett

Contents

Appendices

DISCLAIMER

WARNING:
Dangerous voltages, capable of causing death are present in this unit. ONLY qualified personnel should attempt repair of this unit. Use extreme caution when the cover is removed, when testing and adjusting internal components.

1.0 FEATURES

The Commander is not an autonomous unit and is designed to work as part of an integrated system with a Systemline Controller 4.4 from which it derives its power supply. The main function is to learn the remote control codes of the user's source equipment, which it then allocates to specific keys on the Systemline RHS4 handset. The commands are routed to either a dedicated output transducer (window emitter) or wired RC5 bus for each source component.
In this way a multitude of different equipment can be controlled from the one handset via the DMS user interface module, or via automatically mapped keys on a choice of KMS, CMS, NMS or PC Keypad modules. Uniquely, the Commander can allocate up to 6 sequential commands to any of 4 single keys on the handset, these "macro" commands being entirely user programmable.
The Commander can also supply triggering functions for peripheral devices such as power amps and can route the IR signals for equipment such as lights and blinds back to any of the four zones over which it has separate control. The Commander has facility to learn any known code and can adjust its carrier frequency automatically within a certain range and to either of two factory-set frequencies. It also gives the user the ability to select a custom oscillator, which can be used for any unusual carrier frequencies that may be required.
The Commander has the ability to independently select the Bass, Treble and Turn on Volume for each Zone and can also allow the user to select the same source in each Zone with a single command from any one of the Zones. More than one Commander may be used in conjunction with an equal number of Controllers and loop in and loop out facilities are provided for this.

2.0 CIRCUIT DESCRIPTIONS

2.1 Overview:

The Systemline Commander consists of three PCBs mounted in a metal chassis. The unit derives its power from the Systemline Controller through the zone data cable connections. The front pcb accommodates the LCD display, control buttons and Infra Red reception circuitry for learning IR codes. The main PCB contains the micro-processor, electrically erasable memory and associated control logic.

2.2 Front Panel PCB:

The LCD 2x16 character display DS1 is driven directly by the processor U3 on the main PCB via connector J1. The display contains its own ROM character generator and display memory, characters being accessed via a parallel data bus D0-D7. Switches SW1 to SW4 are active low, and tell the processor which functions need to be accessed within the software. The IR capture circuit consists of a dual op-amp U1 and dual comparator U2. IR signals are received by infra-red receiver diode D1, the drive current is set via R5. The signal is high frequency filtered by R6/C14 before being amplified by U1:A. The signal is inverted and amplified further by U1:B. DC Blocking capacitors C5, C13 and C7 ensure that there is very little DC gain within the two stage amplifier.

The output of U1 is split into two signals, one of which is the envelope of the IR signal generated by integrating the output via D2/C9 and R14. This is then squared at the threshold set by R17/R18 at the negative input of comparator U2:A. The second signal is the modulated IR signal, this is buffered and output directly to the microprocessor U3 after noise rejection set by the voltage threshold of the potential divider R19/R20 at the positive input of U2:B.

2.3 Main Circuit PCB:

The core of the circuit is the PIC17C756 processor running at 19.66MHz. This processor contains 16Kx16 of program memory together with three timer/counters, two USART's and hardware I^2C interface in a 68 pin PLCC package. Brown-out reset and power-on reset protection is also provided. The part is pre-programmed with the current version of software before shipment. The

crystal frequency of 19.66Mhz is used to ensure minimum timing error at the baud rate of 38,400 bits/s used for uploading and downloading information via the serial RS232 connection to a PC.

In normal operating mode the Commander monitors the IR data lines coming from the four remote zones. The software within the processor U3 decodes Systemline 5 Bit and 6 Bit PPM codes and decides whether a learnt IR command needs to be generated. The IR signals are buffered via 2x 4503 buffer IC's U13 and U14 before being re-transmitted to the Controller. The IR signals are modulated Pulse Position signals, the modulation is removed before reaching the processor U3 by the circuit formed around the quad comparator U19. Filter components R62/61/59/60 and C19/20/21/22 remove the carrier and the signal is restored at a common threshold set by R5 and R6, signals are then conditioned correctly for decoding.
Infra Red commands are stored in 8 x 256K E^2 memory devices. Data is written to and clocked out via a 400kHz I^2C bus, this is driven directly by processor U3. Memory is addressed within the I^2C data packets to the address set by the levels A0-A2 on each of the memory devices U1/2/5/7/15/27/28/29. All IR code and configuration settings are contained within this memory, should the main processor U3 by changed or upgraded the settings and codes will remain unchanged.

Infra red commands are routed to source components via a series of CMOS logic gates. All learnt commands exit U3 processor via pin 26 (RF2). NOR gates within IC U25 control the flow of this IR signal. The main processor can generate IR signals with carrier frequencies up-to 80kHz, beyond this frequency external oscillators can are used, U20-22. These are low cost programmable oscillators, and two popular IR frequencies of 455kHz and 1.125MHz are provided as standard. Should a higher carrier frequency by needed the signal is modulated at gate U25:A. The processor selects an external oscillator signal if required, via the 4051 multiplexer. Selection is via address lines C4 and C5. IR signals can be passed from the zones and straight through to the window emitter outputs via the OR gate U18:A. The signals from the zones can be blocked with an inhibit signal applied to U25:B pin 6 INH1, this enables the processor to have a clean signal path for leant IR code generation.

The circuit has two IR transmission modes: All IR TX outputs active or a specific TX output dependent on the source being controlled. Switch Multiplexer 4051 U17 is controlled via address lines C1-C3. When a routed signal is not being transmitted U17 is disabled by the processor, INH2 line, and the common TX output driver 4503 U24 is enabled via its OE1/OE2 pins. The six outputs IR1 to IR6 drive open collector darlington driver arrays U8 and U16, these interface to the IR transmitter 3.5mm sockets on the upper connectors pcb. Driver U16 drives the back to zone IR signals and also the Opto-coupler 'trigger' outputs U9/10/11/12, the transistors of these devices are protected by re-settable fuses FU1/2/3/4. Hard wired IR signals are available via phono sockets J2/3. The processor routes signals to the IR5/6 output lines when the set-up configuration calls for IR1/IR2 output. Comparator circuits U26:A and U26:B demodulate the signals with filter components R77/C30 and R78,C26 prior to transmission. Signals are output positive going to +5V.

Serial Communication is via an RS232 transceiver to correctly match the logic levels between the processor and a PC's serial port 9 pin COM1 or COM2 connection. A second USART connection is made to the processor U3's TX2/RX2 pins via the bus link. This is a two-way communications link to enable commands to be passed between Commanders in a multiple controller installation.

Power is provided via the controller connections at J7. Any one of four zones may provide power, so a network of diodes D5/6/3/4 and resistors R18/19/20/21 ensure that the power is managed correctly and that incorrect connection does not cause damage to the product. Diodes D25/26/27/28 ensure that power can only be provided via the Controller's connection to the 'OUT' socket. All supply lines are fused via re-settable fuses FU6/7/8/9. Voltage regulator 7805 U6 drops the input voltage from +11.5VDC to +5VDC for the circuit.

2.4 Connectors Circuit PCB:

This board contains additional socketry for the connection of the IR transmitters J8/9/10/11/12/13. These outputs are current limited with resistors R1 to R6. When the bus link is

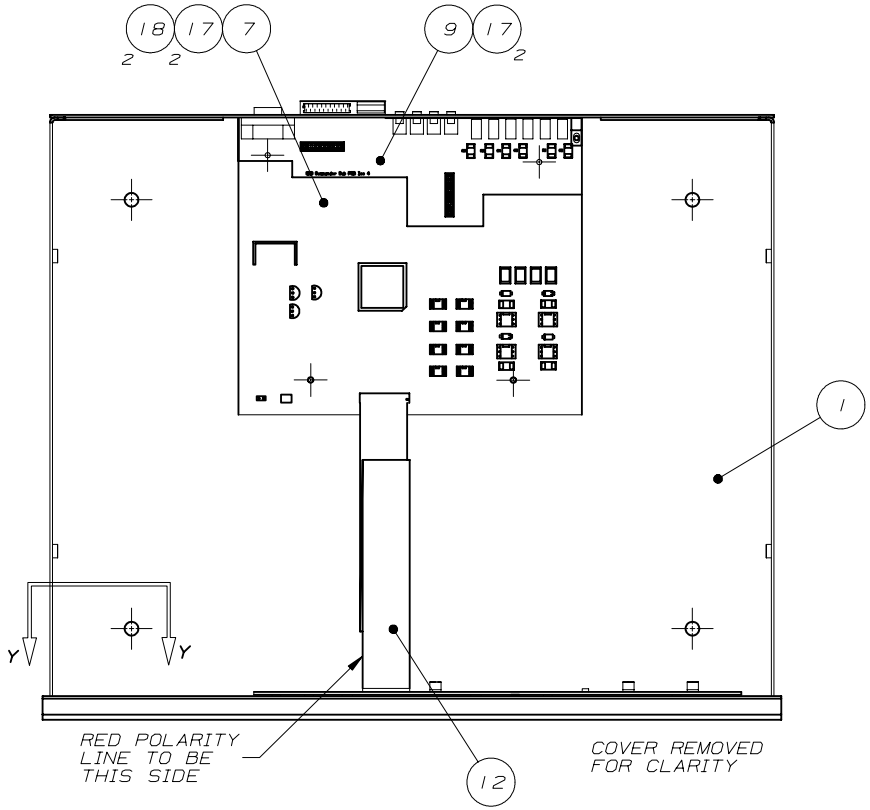
used an 'active' Commander has the ability to inhibit IR output and take over TX outputs on connected units. This is achieved via a 'BUSY' signal (active high) that disables the U24 IR1-IR6 outputs on adjoining units. IC U1 then becomes active, which effectively enables U17 (main circuit) within the controlling commander to take control of IR outputs throughout the system. The IR routing capability is therefore preserved in a multiple commander installation. Clamping transistor Q2 enables the processor U3 (main circuit) to over-ride the 'BUSY' signal by providing an ANDed 'BUSY' and 'INH2' signal. This ensures that the necessary 'BUSY' signal can be nulled when required by the 'driving' Commander.

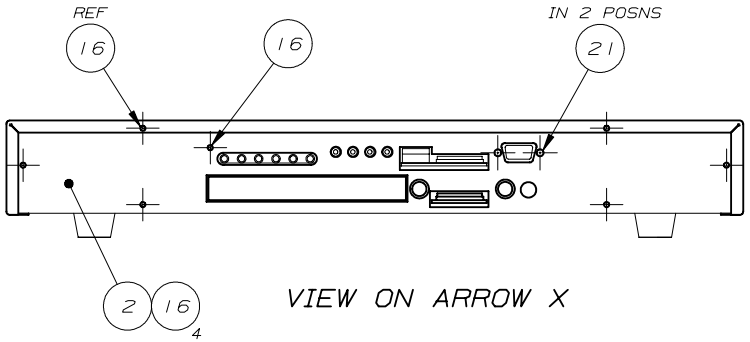
APPENDIX A

Commander Main Assembly

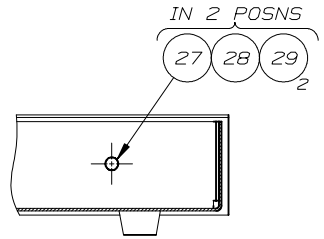
DRAWING NUMBER

DO NOT SCALE

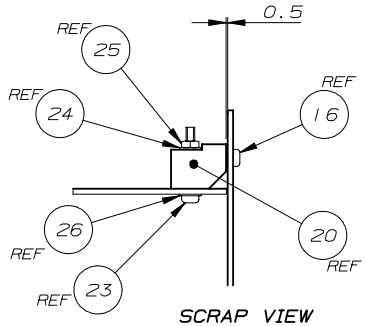




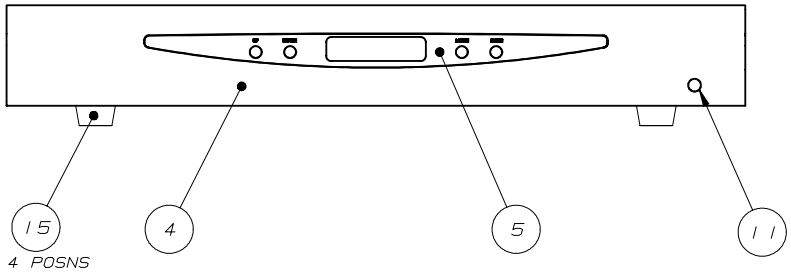
VIEW ON ARROW X

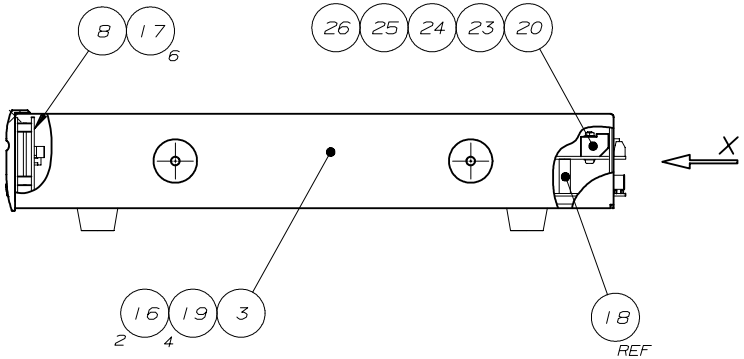


SCRAP SECTION Y-Y



SCRAP VIEW SHOWING FITTING OF BRACKET





NOTES:

1. ENSURE THAT BRACKET (ITEM 20) IS SET BACK 0.5MM TO PULL REAR PANEL IN TIGHT

DRN	ISSUE	A						SCALE	
PDC	DATE	20-03-01						1 : 1	
	Change No.								
CH'KD	MATERIAL		FINISH					TOLERANCES: UNLESS OTHERWISE STATED ARE: 1 DP: ±0.4 2 DP: ±0.15 ANG.: ±1.0° DIMS : mm	
APP									

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TITLE

SYSTEMLINE COMMANDER FINAL ASSEMBLY

DRAWING NUMBER

Drawing Number: Q1XXXX/IL

Items List for: SYSTEMLINE COMMANDER FINAL ASSEMBLY

Approved for Production: _____

Issue: 1 **Date:** 12/03/2001 **Change Number:**

Item No.	Part No.	Description	Units	Manf. Part No.	Qty	Iss	Remarks
A							
1	ZENC300	SYSTEMLINE COMMANDER CHASSIS	EA	Q10149/DE	1	7	
2	ZENC301	SYSTEMLINE COMMANDER REAR PANEL	EA	Q10150/DE	1	6	
3	ZENC302	SYSTEMLINE COMMANDER COVER	EA	Q10148/DE	1	5	
4	ZENC303	SYSTEMLINE COMMANDER FRONT PANEL	EA	Q10151/DE	1	4	
5	ZENC304	SYSTEMLINE COMMANDER WINDOW	EA	Q10153/DE	1	4	
6							
7	ZPCB130	COMMANDER MAIN PCB ASSEMBLY	EA	Q10466/AS	1	D	
8	ZPCB131	COMMANDER FRONT PCB ASSEMBLY	EA	Q10467/AS	1	C	
9	ZPCB132	COMMANDER SUB PCB ASSEMBLY	EA	Q10468/AS	1	C	
10							
11	ZENC000	COMMANDER PURPLE IR WINDOW CLIP	EA		1		
12	ZCAB050	COMMANDER LINK LEAD	EA	Q10413/AS	1		
13							
14							
15	ZMIS000	FEET CONTROLLER/AMPLIFIER	EA	FF-3	4		
16	ZSRW056	4 X 3/8 SELF TAP POZI BRIGHT	EA	AZ127040X0024D	7		REAR PANEL FIXING
17	ZSRW018	M3X6 PANHEAD POZI - BRIGHT	EA		10		PCB FIXING
18	ZMIS035	PILLAR NYLON M3 TYPE B 20.0 HIGH	EA	G&B NP6.5/20.0/B/M3	2		PCB FIXING
19	ZSRW054	M4X8 A2 SOCKET BTN	EA	NSBUTM040008	4		COVER FIXING
20	MIS-M-0008	BRACKET RIGHT ANGLE PCB MOUNT	EA	RS 303-5330	1		BRACKET FIXINGS
21	MIS-M-0009	SCREWS FOR D-TYPE SOCKETS	EA	RS 453-886	2		
22							
23	SCR-M-0046	SCREW SLOTTED PAN HD M2.5 X 20 ZINC	EA	RS 560-748	1		BRACKET FIXINGS
24	SCR-M-0034	WASHER PLAIN M2.5 ZINC FINISH	EA	RS 560-322	1		BRACKET FIXINGS
25	SCR-M-0008	NUT PLAIN M2.5 ZINC FINISH	EA	RS 560-287	1		BRACKET FIXINGS

Production Cross Reference:

Drawing Number: Q1XXXX/IL

Items List for: **Approved for Production:** _____

SYSTEMLINE COMMANDER FINAL ASSEMBLY

Issue: 1 **Date:** 12/03/2001 **Change Number:**

Item No.	Part No.	Description	Units	Manf. Part No.	Qty	Iss	Remarks
26	SCR-M-0026	WASHER CRINKLE M2.5 ZINC FINISH	EA	RS 428-622	1		BRACKET FIXINGS
27	ZSRW064	M4 X 6MM HEX HEAD SCREW	EA		2		FRONT PANEL FIXING
28	SCR-M-0029	WASHER CRINKLE M4 ZINC FINISH	EA	RS 428-650	2		FRONT PANEL FIXING
29	SCR-M-0037	WASHER PLAIN M4 ZINC FINISH	EA	RS 525-925	4		FRONT PANEL FIXING
30							
31							
32							
33	ZCAR100	PACKAGING	EA		1		
34		PRINTED MANUAL	EA		1		
35		CD	EA		1		
36							
37							
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46							
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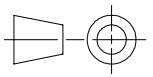
51							

Production Cross Reference:

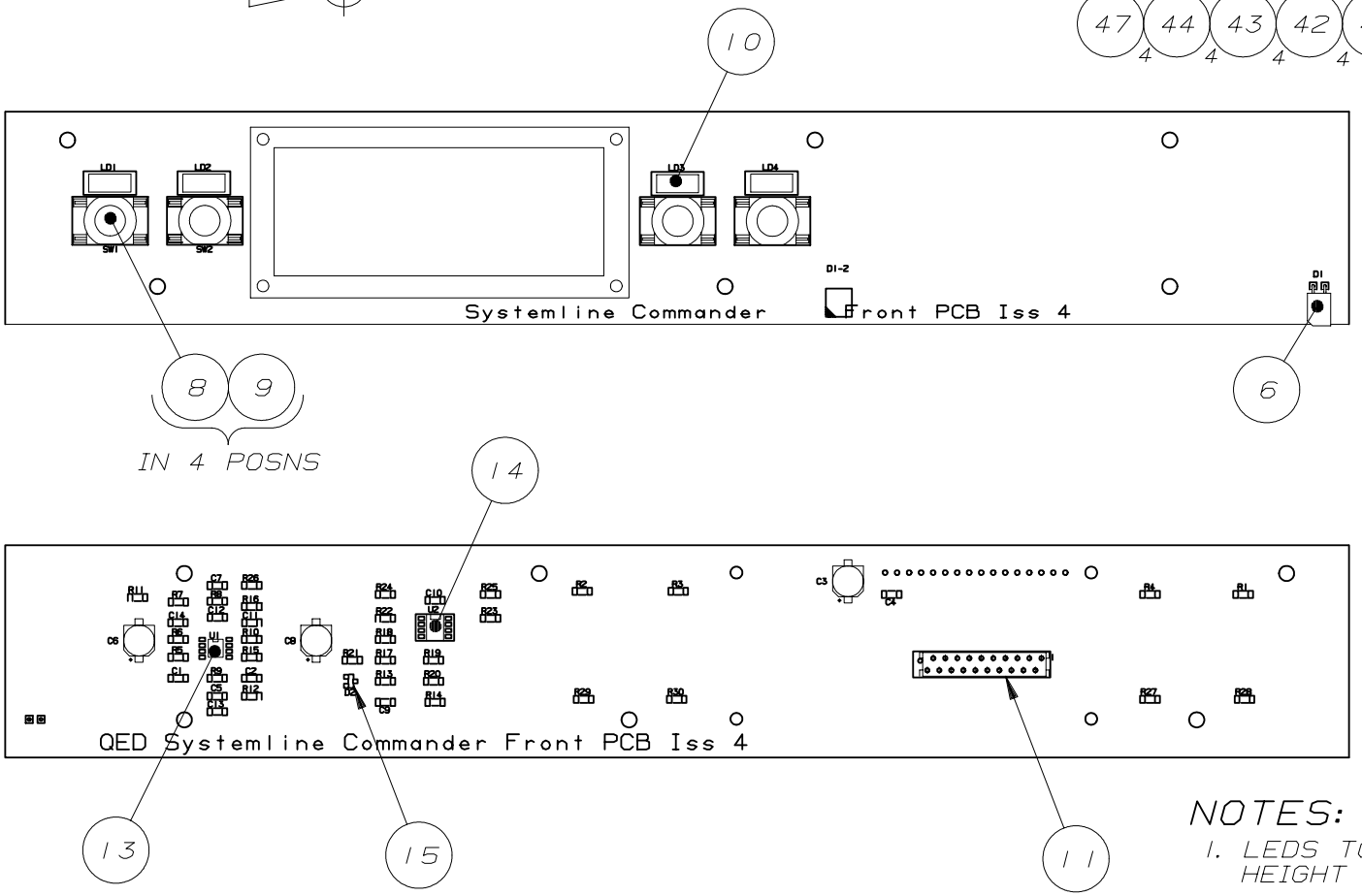
APPENDIX B

Commander Front PCB Assembly

DRAWING NUMBER
Q10467/AS



DO NOT SCALE



NOTES:

1. LEDS TO BE SPACED OFF TO HEIGHT SHOW

DRN	ISSUE	C						SCALE
PDC	DATE	12-03-01						| : |
	Change No.							
CH'KD	MATERIAL		FINISH		TOLERANCES: UNLESS OTHERWISE STATED ARE: 1 DP: ±0.4 2 DP: ±0.15 ANG.: ±1.0° DIMS : mm			
APP								

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TITLE

SYSTEMLINE COMMANDER FRONT PCB ASSEMBLY

DRAWING NUMBER
Q10467/AS

Drawing Number: Q10467/IL

Items List for: Q10467/AS **Approved for Production:** PROTOTYPE

SYSTEMLINE COMMANDER FRONT PCB ASSEMBLY

Issue: C **Date:** 20/02/2001 **Change Number:**

Item No.	Part No.	Description	Units	Manf. Part No.	Qty	Iss	Remarks
A							
1	PCB-M-00005	COMMANDER FRONT PCB	EA		1	4	
2							
3							
4							
5	OPT-T-0004	DISPLAY, VIKAY VK2035	EA	2035STLDYGBN-D	1		DS1
6	OPT-T-0003	DIODE, IR RECEIVER, BPW41N	EA	FAR 327-438	1		D1
7							
8	SWA-S-0005	SWITCH 6MM SURFACE MOUNT	EA	MEC 3FSH9	4		SW1, SW2, SW3, SW4
9	SWA-M-0006	SWITCH CAP - BLACK	EA	MEC 1S09-16.0	4		FIT ON SW1, SW2, SW3, SW4
10	LED-T-0002	LED, LIGHT BAR, GREEN	EA	RS 247-2160	4		LD1, LD2, LD3, LD4
11	CON-T-0004	CONN, 20 WAY TOP, MICRO MATCH	EA	RS 341-7704	1		J1
12							
13	ICS-S-00001	OP AMP, TL072CD, SOIC	EA	RS 857-907	1		U1
14	ICS-S-00002	COMPARATOR, TLC3702CD SOIC8	EA	RS 858-118	1		U2
15	DIO-S-0023	DIODE SMALL SIGNAL BAS21 SM SOT23	EA	RS 287-241	1		D2
16							
17	RES-S-0016	RES 150R 5% 0.25W 1206	EA	RS 136-676	4		R1,R2,R3,R4
18	RES-S-0048	RES 68K 5% 0.25W 1206	EA	RS 169-193	1		R5
19	RES-S-0038	RES 10K 5% 0.25W 1206	EA	RS 169-159	5		R6,R12,R16,R21,R26
20	RES-S-0055	RES 270K 5% 0.25W 1206	EA	RS 136-907	2		R7,R11
21	RES-S-0043	RES 27K 5% 0.25W 1206	EA	RS 136-834	3		R8, R10, R20
22	RES-S-0037	RES 8K2 5% 0.25W 1206	EA	RS 136-799	1		R9
23	RES-S-0050	RES 100K 5% 0.25W 1206	EA	RS 169-200	5		R13,R27 - R30
24	RES-S-0047	RES 56K 5% 0.25W 1206	EA	RS 136-856	3		R14,R24,R25
25	RES-S-0034	RES 4K7 5% 0.25W 1206	EA	RS 169-137	1		R15

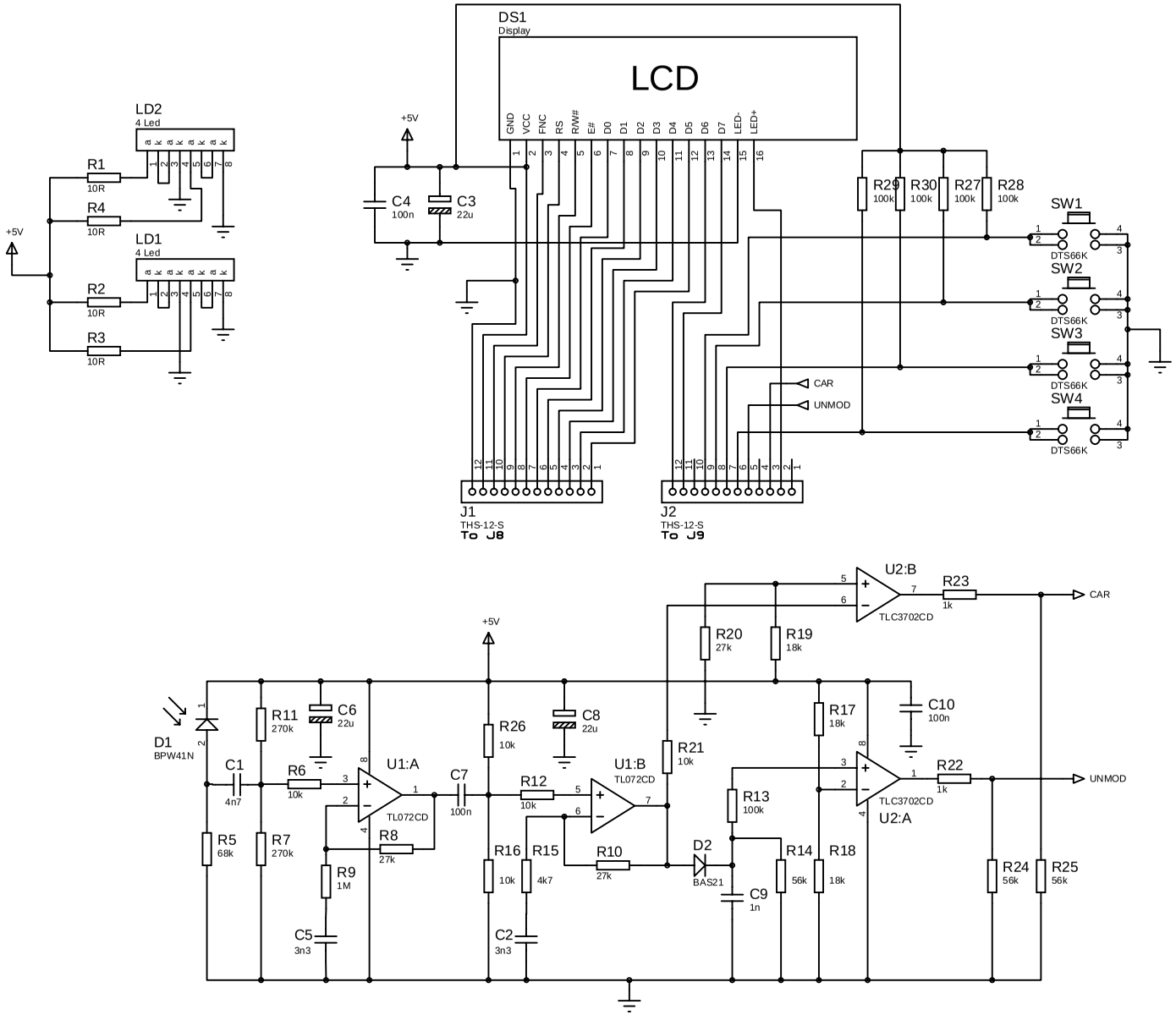
Drawing Number: Q10467/IL

Items List for: Q10467/AS **Approved for Production:** PROTOTYPE

SYSTEMLINE COMMANDER FRONT PCB ASSEMBLY

Issue: C **Date:** 20/02/2001 **Change Number:**

Item No.	Part No.	Description	Units	Manf. Part No.	Qty	Iss	Remarks
26	RES-S-0041	RES 18K 5% 0.25W 1206	EA	RS 136-828	3		R17,R18,R19
27	RES-S-0026	RES 1K0 5% 0.25W 1206	EA	RS 169-109	2		R22,R23
28							
29							
30	CAP-S-00114	CAP 4.7nF 5% 50V 1206	EA	RS 211-3489	1		C1
31	CAP-S-00113	CAP 3.3nF 5% 50V 1206	EA	RS 211-3467	2		C2, C5
32	CAP-S-00029	CAP ELEC SM 22uF 25V 85C CASE D	EA	RS 108-249	3		C3, C6, C8
33	CAP-S-00122	CAP 100nF 5% 50V 1206	EA	RS 211-3401	3		C4, C7, C10
34	CAP-S-00110	CAP 1nF 5% 50V 1206	EA	RS 211-2650	1		C9
35	CAP-S-00092	CAP 33pF 5% 50V 1206	EA	RS 211-2802	2		C11, C12
36	CAP-S-00098	CAP 100pF 5% 50V 1206	EA	RS 211-2644	2		C13, C14
37							
38							
39							
40	MIS-M-0003	SPACER M3 CLEARANCE 3.0 HIGH	EA	G&B NS03-32	4		USE TO SECURE DISPLAY
41	SCR-M-0045	SCREW SLOTTED PAN HD M2.5 X 12 ZINC	EA	RS 560-732	4		USE TO SECURE DISPLAY
42	SCR-M-0034	WASHER PLAIN M2.5 ZINC FINISH	EA	RS 560-322	4		USE TO SECURE DISPLAY
43	SCR-M-0008	NUT PLAIN M2.5 ZINC FINISH	EA	RS 560-287	4		USE TO SECURE DISPLAY
44	SCR-M-0017	WASHER SPRING M2.5 ZINC FINISH	EA	RS 526-798	4		USE TO SECURE DISPLAY
45							
46							
47	MIS-M-0004	HEADER SINGLE STRIP 16 WAY	EA	RS 334-549	1		CUT TO SIZE & USE TO CONNECT DS1 TO PCB
48							
49							
50							
51							



QED Audio Products Ltd
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Front Learning PCB

Drawn by: Steve P

File: CMNDfrontpcb-1r2.DSN
Rev: 1.2
Created: 22/03/2002
Modified: 13/03/2000
Page: 1/1

APPENDIX C

Commander Main PCB Assembly

DRAWING NUMBER
Q10466/AS

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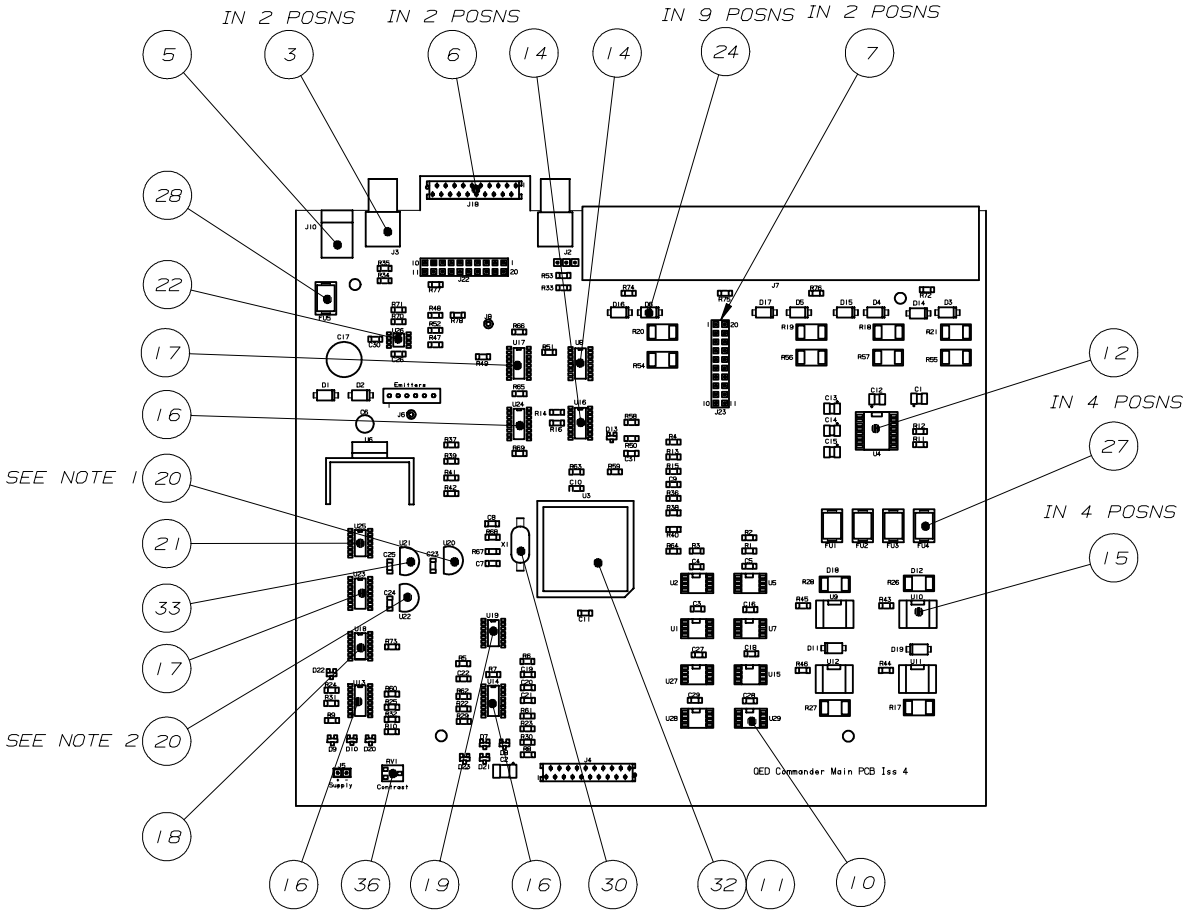
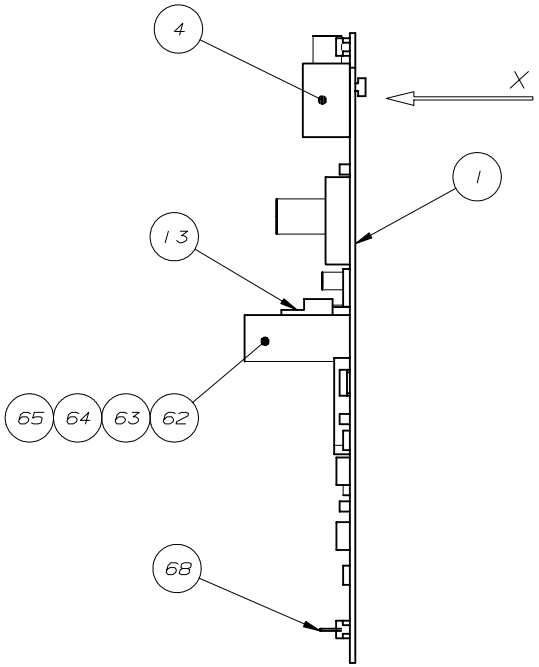
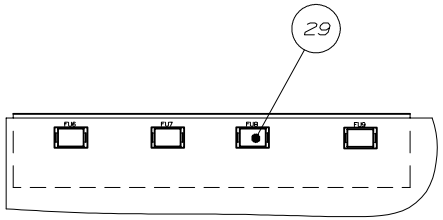




NOTES:

1. PROGRAM DEVICE FOR FREQUENCY 455MHz
2. PROGRAM DEVICE FOR FREQUENCY 1.125MHz



SCRAP VIEW ON ARROW 'X'

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CH'KD	MATERIAL		FINISH					TOLERANCES: UNLESS OTHERWISE STATED ARE: 1 DP: ±0.4 2 DP: ±0.15 ANG.: ±1.0° DIMS : mm	
APP									

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TITLE
SYSTEMLINE COMMANDER
MAIN PCB ASSEMBLY

DRAWING NUMBER
Q10466/AS

Drawing Number: Q10466/IL

Items List for: Q10466/AS **Approved for Production:** PROTOTYPE

SYSTEMLINE COMMANDER MAIN PCB ASSEMBLY

Issue: D **Date:** 29/03/2001 **Change Number:**

Item No.	Part No.	Description	Units	Manf. Part No.	Qty	Iss	Remarks
A							
1	PCB-M-00004	COMMANDER MAIN PCB	EA		1	2	
2							
3	CON-T-0010	SOCKET, PHONO SINGLE GOLD	EA	TW - SCP624UGG1	2		J2, J3
4	CON-T-0011	SOCKET RJ45 8 WAY SHIELDED	EA	TOBY - 3012S-08	1		J7
5	CON-T-0012	SOCKET 2.1MM DC	EA	RS 486-662	1		J10
6	CON-T-0004	CONN, 20 WAY TOP, MICRO MATCH	EA	RS 341-7704	2		J4, J18
7	CON-T-0013	CONN, DIL 20 WAY	EA	Toby PGF2-20-5-020-B	2		J22, J23
8							
9							
10	ICP-S-0002	IC 256K SERIAL EEPROM	EA	Microchip 24LC256-I/SM	8		U1, U2, U5, U7, U15, U27 - U29
11	ICP-S-0003	PIC 17C756A-33/L 32K PLCC68H	EA	Microchip 170756A-33/L	1		U3 - PROGRAM =
12	ICS-S-00006	IC TRANSCEIVER MAX232CWE 16 WIDE SO	EA	FAR 571-593	1		U4
13	ICR-S-0002	REGULATOR LM7805CT	EA	RS 648-422	1		U6
14	ICS-S-00007	IC DARLINGTON DVR ULN2004AD SOIC16	EA	RS 858-203	2		U8, U16
15	ICS-S-00008	OPTOCOUPLER H11G2 6PDIP	EA	RS 111-172	4		U9 - U12
16	ICL-S-0005	LOGIC MC14503BD SOIC16	EA	FAR 639-904	3		U13, U14, U24
17	ICL-S-0011	IC LOGIC CD4051BCM SOIC16	EA	RS 345-5548	2		U17, U23
18	ICL-S-0010	IC LOGIC HEF14072BD SOIC14	EA	RS 355-9016	1		U18
19	ICS-S-00005	IC COMPARATOR LM339D SOIC14	EA	RS 858-411	1		U19
20	ICS-S-00003	IC OSC, PROGAMABLE DS1065T-60	EA	RS 325-4957	2		FIT IN POSITIONS U20 & U22
21	ICL-S-0003	IC LOGIC MC14001BD SOIC14	EA	RS 197-5876	1		U25
22	ICS-S-00002	COMPARATOR, TLC3702CD SOIC8	EA	RS 858-118	1		U26
23							
24	DIO-S-0001	DIODE RECTIFIER GF1A SM DO214	EA	RS 422-242	9		D2, D3, D4, D5, D6, D11, D12, D18, D19
25	DIO-S-0010	DIODE ZENER BZX84C5V1LT1 SM SOT23	EA	RS 348-5971	9		D7 - D10, D13, D20 - D23

Drawing Number: Q10466/IL

Items List for: Q10466/AS **Approved for Production:** PROTOTYPE

SYSTEMLINE COMMANDER MAIN PCB ASSEMBLY

Issue: D **Date:** 29/03/2001 **Change Number:**

Item No.	Part No.	Description	Units	Manf. Part No.	Qty	Iss	Remarks
26							
27	FUS-S-0001	POLYSWITCH 0.30A SMD	EA	RS 183-9720	4		FU1 - FU4
28	FUS-S-0003	POLYSWITCH 0.75A SMD	EA	RS 183-9742	1		FU5
29	FUS-S-0002	POLYSWITCH 0.50A SMD	EA	RS 183-9736	4		FU6 - FU9
30	CRY-S-00002	CRYSTAL 19.6608MHZ SXE	EA	Rapid 90-1926	1		X1
31	FUS-S-0003	POLYSWITCH 0.75A SMD	EA	RS 183-9742			
32	ICA-M-0001	SOCKET PLCC 68 PIN SMT	EA	RS 203-9482	1		FIT IN POSITION U3
33	MIS-M-0005	TURNED PIN STRIP, 3 WAY	EA	RS 267-7416	1		CUT TO SIZE & FIT IN POSITIONS U21
34							
35							
36	POT-S-0002	POT 20K SINGLE TURN 4MM SMT	EA	RS 177-368	1		RV1
37							
38	RES-S-0030	RES 2K2 5% 0.25W 1206	EA	RS 169-115	4		R1, R2, R6, R71
39	RES-S-0038	RES 10K 5% 0.25W 1206	EA	RS 169-159	5		R3, R4, R51, R69, R73
40	RES-S-0037	RES 8K2 5% 0.25W 1206	EA	RS 136-799	2		R5, R70
41	RES-S-0050	RES 100K 5% 0.25W 1206	EA	RS 169-200	7		R7 - R10, R35, R53, R63, R64
42	RES-S-0014	RES 100R 5% 0.25W 1206	EA	RS 169-058	27		R11 - R16, R29 - R34, R36 - R42, R47 - R50, R52, R58, R65, R66
43	RES-S-0325	RES 4R7 5% 1W 2512	EA	RS 224-0092	4		R17, R26 - R28
44	RES-S-0322	RES 2R7 5% 1W 2512	EA	RS 224-0064	4		R18 - R21
45	RES-S-0084	RES 330R 1% 0.25W 1206	EA	RS 223-2186	12		R22 - R25, R43 - R46, R72, R74 - R76
46	RES-S-0347	RES 330R 5% 1W 2512	EA	RS 224-0345	4		R54 - R57
47	RES-S-0107	RES 27K 1% 0.25W 1206	EA	RS 223-2445	6		R59 - R62, R77, R78
48	RES-S-0083	RES 270R 1% 0.25W 1206	EA	RS 223-2170	2		R67, R68
49							
50							
51	CAP-S-00106	CAP 470pF 5% 50V 1206	EA	RS 211-2852	1		C31
52	CAP-S-00081	CAP TANT SM T491 1uF 35V CASE B	EA	RS 262-4478	5		C1, C12 - C15

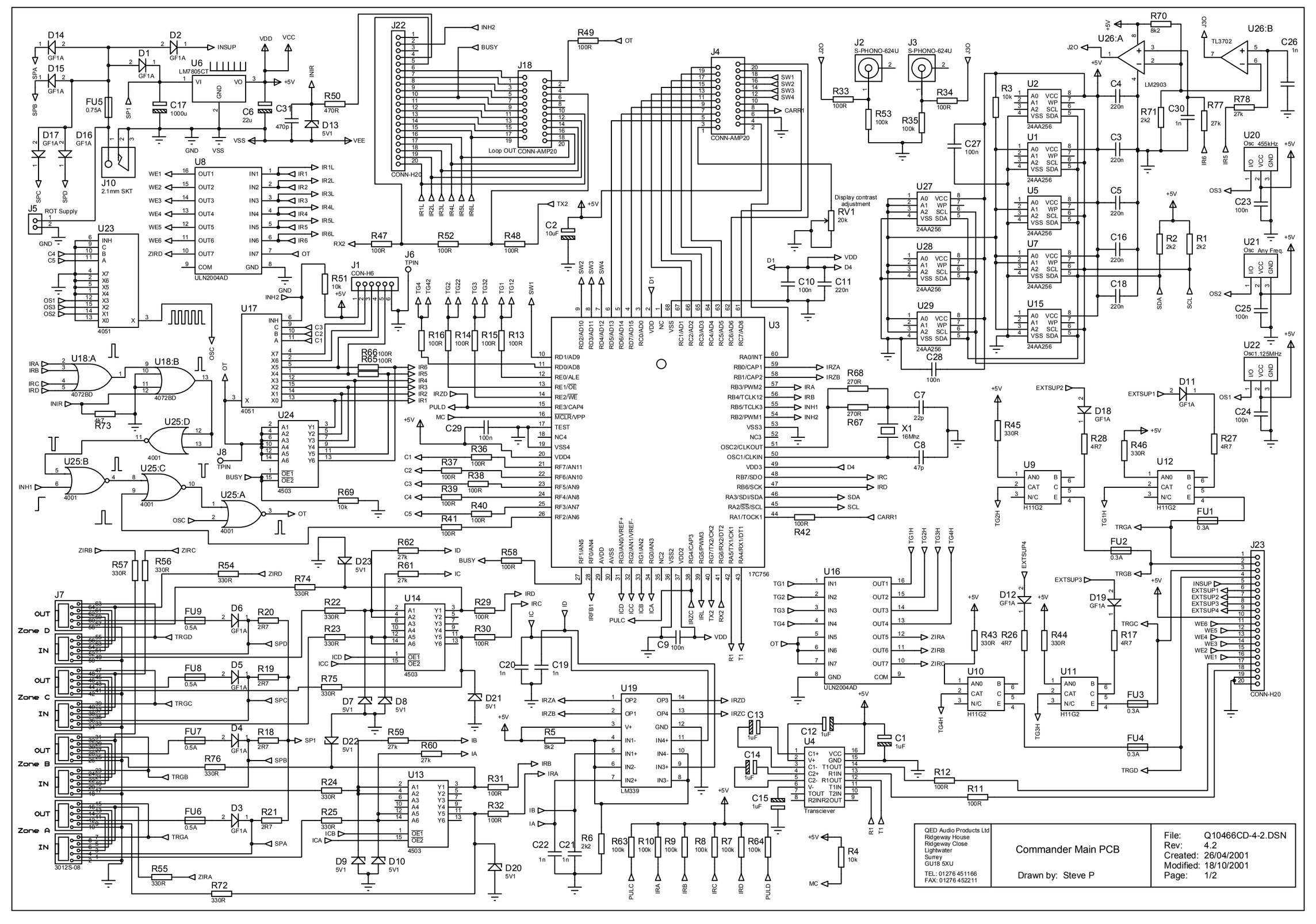
Drawing Number: Q10466/IL

Items List for: Q10466/AS **Approved for Production:** PROTOTYPE

SYSTEMLINE COMMANDER MAIN PCB ASSEMBLY

Issue: D **Date:** 29/03/2001 **Change Number:**

Item No.	Part No.	Description	Units	Manf. Part No.	Qty	Iss	Remarks
53	CAP-S-00083	CAP TANT SM T491 10uF 35V CASE D	EA	RS 262-4709	1		C2
54	CAP-S-00123	CAP 220nF 5% 25V 1206	EA	RS 211-3366	6		C3 - C5, C11, C16, C18
55	CAP-T-00212	CAP 22uF 20% 35V 85C RADIAL	EA	RS 228-6723	1		C6
56	CAP-S-00090	CAP 22pF 5% 50V 1206	EA	RS 211-2751	1		C7
57	CAP-S-00094	CAP 47pF 5% 50V 1206	EA	RS 211-2846	1		C8
58	CAP-S-00122	CAP 100nF 5% 50V 1206	EA	RS 211-3401	8		C9, C10, C23 - C25, C27 - C29
59	CAP-T-00219	CAP 1000uF 20% 35V 85C RADIAL	EA	RS 228-6818	1		C17
60	CAP-S-00110	CAP 1nF 5% 50V 1206	EA	RS 211-2650	6		C19 - C22, C26, C30
61							
62	ICA-M-0002	HEATSINK TO220 TW/VANE 17C/W TAGGS	EA	Anglia - TV1505	1		USE ON U6
63	SCR-M-0084	SCREW POZI PAN HD M3 X 6 ZINC	EA	RS 560-580	1		USE ON U6
64	SCR-M-0009	NUT PLAIN M3 ZINC FINISH	EA	RS 560-293	1		USE ON U6
65	SCR-M-0027	WASHER CRINKLE M3 ZINC FINISH	EA	RS 428-638	1		USE ON U6
66							
67	MIS-M-0007	TEST POINT 1.0MM WHITE	EA	RS 262-2040	2		J6, J8
68	MIS-M-0006	HEADER SINGLE STRIP 2 WAY	EA	RS 334-549	1		J5
69							
70							
71							
72							
73							
74							
75							
76							
77							
78							

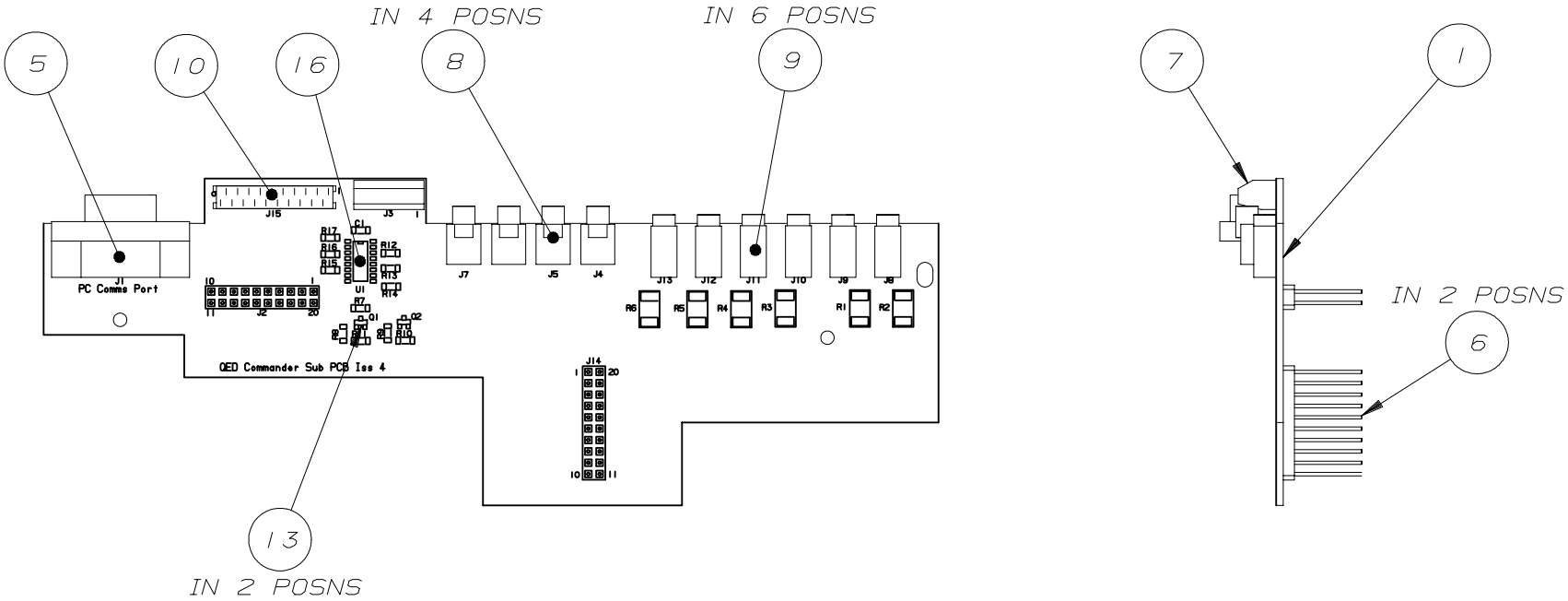

D14 GF1A
D2 GF1A
INSUP
D1 GF1A
D15 GF1A
SPA
SPB
U6 LM7805CT
VDD
VCC
+5V
INIR
R50 470R
FU5 0.75A
C17 1000u
C6 22u
C31 470p
D13 5V1
VSS
VEE
GND
SP1
D17 GF1A
D16 GF1A
J10 2.1mm SKT
SPC
SPD
J5 ROT Supply
U8 ULN2004AD
WE1 WE2 WE3 WE4 WE5 WE6 ZIRD COM
OUT1 OUT2 OUT3 OUT4 OUT5 OUT6 OUT7
IN1 IN2 IN3 IN4 IN5 IN6 IN7
IR1L IR2L IR3L IR4L IR5L IR6L OT
U23 4051
INH C B A X7 X6 X5 X4 X3 X2 X1 X0 X
C4 C5 OS1 OS3 OS2
OSC
U17 4051
C3 C2 C1
U18:A U18:B 4072BD
IRA IRB IRC IRD
R73 4k7
U25:D U25:B U25:C U25:A 4001
INH1
J8 TPIN
BUSY
U24 4503
OE1 OE2
R69 10k
J22 CONN-H20
INH2
BUSY
Loop OUT CONN-AMP20
J18
R49 100R
OT
J4 CONN-AMP20
SW1 SW2 SW3 SW4
CARR1
J2 S-PHONO-624U
J3 S-PHONO-624U
R33 100R
R53 100k
R34 100R
R35 100k
J2O
J3O
R70 8k2
U26:A U26:B TL3702
C26 1n
C4 C3 C5 C16 C18 220n
R3 10k
R71 2k2
C30 1n
R77 27k
R78 27k
LM2903
U2 U1 U5 U7 U15 U27 U28 U29 24AA256
A0 A1 A2 VSS VCC WP SCL SDA
C27 100n
C28 100n
R2 2k2
R1 2k2
SDA SCL
U20 Osc 455kHz
U21 Osc Any Freq.
U22 Osc1.125MHz
I/O VCC GND
C23 100n
C25 100n
C24 100n
OS3 OS2 OS1
IR6 IR5
J6 TPIN
J1 CON-H6
R51 10k
C2 10uF
TX2
RX2
R47 100R
R52 100R
R48 100R
Display contrast adjustment
RV1 20k
C10 100n
C11 220n
U3 17C756
RD1/AD9 RD0/AD8 RE0/ALE RE1/OE RE2/WE RE3/CAP4 MCLR/VPP TEST VSS4 VDD4 RF7/AN11 RF6/AN10 RF5/AN9 RF4/AN8 RF3/AN7 RF2/AN6
RA0/INT RB0/CAP1 RB1/CAP2 RB3/PWM2 RB4/TCLK12 RB5/TCLK3 RB2/PWM1 VSS3 NC3 OSC2/CLKOUT OSC1/CLKIN VDD3 RB7/SDO RB6/SCK RA3/SDI/SDA RA2/SS/SCL RA1/TOCK1
IRZA IRZB IRA IRB IRC IRD SDA SCL CARR1
R16 R14 R15 R13 100R
R66 R65 100R
R68 270R
R67 270R
C7 22p
X1 16Mhz
C8 47p
R42 100R
C29 100n
R36 R37 R38 R39 R40 R41 100R
D11 GF1A
D18 GF1A
R45 330R
R28 4R7
R46 330R
R27 4R7
U9 U12 H11G2
AN0 CAT N/C B C E
TG2H TG1H
FU1 0.3A
FU2 0.3A
FU3 0.3A
FU4 0.3A
TRGA TRGB TRGC TRGD
EXTSUP1 EXTSUP2 EXTSUP3 EXTSUP4
D12 GF1A
D19 GF1A
R43 330R R26 4R7
R44 330R R17 4R7
U10 U11 H11G2
TG4H TG3H
J23 CONN-H20
INSUP EXTSUP1 EXTSUP2 EXTSUP3 EXTSUP4
WE6 WE5 WE4 WE3 WE2 WE1
U16 ULN2004AD
TG1 TG2 TG3 TG4 OT
IN1 IN2 IN3 IN4 IN5 IN6 IN7 GND COM
OUT1 OUT2 OUT3 OUT4 OUT5 OUT6 OUT7
ZIRA ZIRB ZIRC
TG1H TG2H TG3H TG4H
R62 27k
R61 27k
R58 100R
ID
IC
BUSY
R74 330R
R57 330R
R56 330R
R54 330R
ZIRD
ZIRC
ZIRB
J7 3012S-08
Zone D Zone C Zone B Zone A
OUT IN
FU9 FU8 FU7 FU6 0.5A
D6 D5 D4 D3 GF1A
R20 R19 R18 R21 2R7
TRGD TRGC TRGB TRGA
SPD SPC SPB SPA
R22 R23 R24 R25 330R
R29 R30 R31 R32 100R
U14 U13 4503
IRD IRC IRB IRA
ICD ICC ICB ICA
R75 R76 330R
R59 R60 27k
IB IA
D7 D8 D9 D10 D21 D22 D20 5V1
U19 LM339
OP2 OP1 V+ IN1- IN1+ IN2- IN2+ OP3 OP4 GND IN4+ IN4- IN3+ IN3-
IRZA IRZB IRZD IRZC
R5 8k2
C20 C19 1n
C9 100n
PULC
IRZC IRL TX2 RX2 R1 T1
U4 Transceiver
C1+ V+ C1- C2+ C2- V- TOUT R2IN VCC GND T1OUT R1IN R1OUT T1IN T2IN R2OUT
C13 C12 C1 C14 C15 1uF
R12 R11 100R
R4 10k
MC
C22 C21 1n
R6 2k2
R63 R10 R9 R8 R7 R64 100k
PULC IRA IRB IRC IRD PULD
QED Audio Products Ltd
Ridgeway House
Ridgeway Close
Lightwater
Surrey
GU18 5XU
TEL: 01276 451166
FAX: 01276 452211
Commander Main PCB
Drawn by: Steve P
File: Q10466CD-4-2.DSN
Rev: 4.2
Created: 26/04/2001
Modified: 18/10/2001
Page: 1/2

APPENDIX D

Commander Connectors PCB Assembly

DRAWING NUMBER
Q10468/AS

DO NOT SCALE



DRN	ISSUE	C						SCALE
PDC	DATE	12-03-01						| : |
	Change No.							

CH'KD MATERIAL FINISH

APP

TOLERANCES:
UNLESS OTHERWISE STATED ARE:
1 DP: ±0.4
2 DP: ±0.15
ANG.: ±1.0°
DIMS : mm

QED
Ridgeway House,
Ridgeway Close,
Lightwater,
Surrey, GU18 5XU
TEL: 01276 451141
FAX: 01276 452211

TITLE
SYSTEMLINE COMMANDER SUB PCB ASSEMBLY

DRAWING NUMBER
Q10468/AS

Drawing Number: Q10468/IL

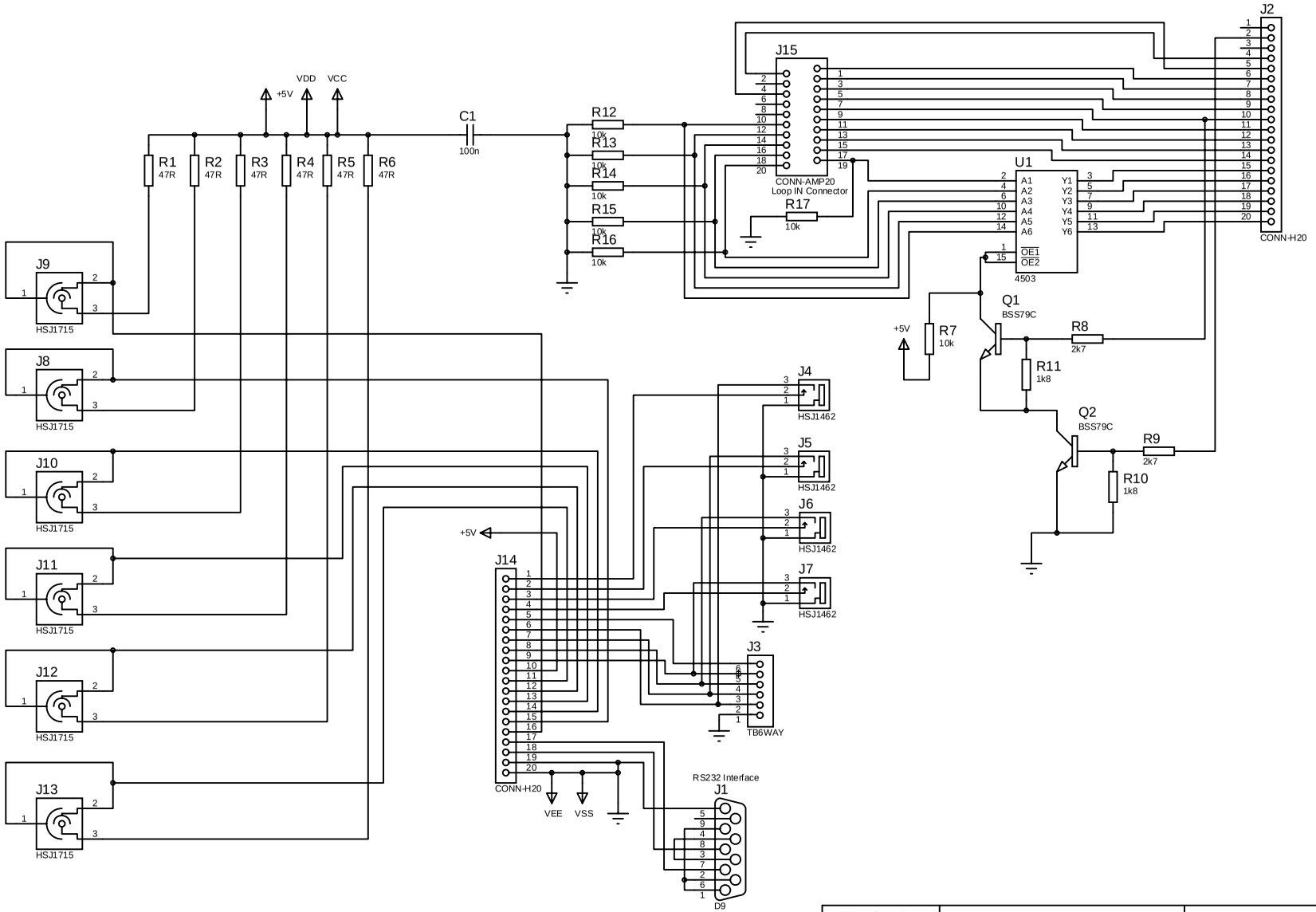
Items List for: Q10468/AS **Approved for Production:** PROTOTYPE

SYSTEMLINE COMMANDER SUB PCB ASSEMBLY

Issue: C **Date:** 20/02/2001 **Change Number:**

Item No.	Part No.	Description	Units	Manf. Part No.	Qty	Iss	Remarks
A							
1	PCB-M-00006	COMMANDER SUB PCB	EA			1	
2							
3							
4							
5	CON-T-0005	CONN, 9 PIN, D TYPE, PCB MOUNT	EA	RS 239-5855	1		J1
6	CON-T-0006	CONN, DIL 20 WAY	EA	Toby FTHD-10-G-23.5/14.	2		J2, J14
7	CON-T-0007	TERM BLOCK, 0.1" PITCH, 6 WAY	EA	RS 220-4305	1		J3
8	CON-T-0008	SOCKET, JACK 2.5MM STEREO	EA	Westside -HSJ1462-01-01	4		J4 - J7
9	CON-T-0009	SOCKET, JACK 3.5MM STEREO	EA	Westside -HSJ1715-01-11	6		J8 - J13
10	CON-T-0004	CONN, 20 WAY TOP, MICRO MATCH	EA	RS 341-7704	1		J15
11							
12							
13	TRA-S-0002	TRANSISTOR BC79C SOT23 SMT	EA	RS 287-415	1		Q1, Q2
14							
15							
16	ICL-S-0005	LOGIC MC14503BD SOIC16	EA	FAR 639-904	1		U1
17							
18	CAP-S-00110	CAP 1nF 5% 50V 1206	EA	RS 211-2650	1		C1
19							
20	RES-S-0337	RES 47R 5% 1W 2512	EA	RS 224-0222	6		R1,R2,R3,R4,R5,R6
21	RES-S-0102	RES 10K 1% 0.25W 1206	EA	RS 223-2394	7		R7, R12 - R17
22	RES-S-0095	RES 2K7 1% 0.25W 1206	EA	RS 223-2322	2		R8, R9
23	RES-S-0093	RES 1K8 1% 0.25W 1206	EA	RS 223-2293	2		R10, R11
24							
25							

Production Cross Reference:



QED Audio Products Ltd Ridgeway House Ridgeway Close Lightwater Surrey GU18 5XU TEL: 01276 451166 FAX: 01276 452211	Commander Connectors PCB Drawn by: Steve P	File: Q10468CD-4-2.DSN Rev: 4.0 Created: 09/02/2001 Modified: 19/10/2001 Page: 1/1

APPENDIX E

Commander Test Specification

Prepared by: J Jeary _____

Checked by: PD Cheney _____

Authorised by: S Privett _____

Introduction

The Commander is not an autonomous unit and is designed to work as part of an integrated system with a Systemline Controller 4.4 from which it derives its power supply. The main function of the Commander is to learn the remote control codes of the user's source equipment, which it then allocates to specific keys on the Systemline RHS4 handset. The commands are routed to either a dedicated output transducer (window emitter) or wired RC5 bus for each source component so that each component need not have different codes. In this way a multitude of different (or similar) equipment can be controlled from the one handset via the DMS user interface module, or via automatically mapped keys on a choice of KMS, CMS, NMS or PC Keypad modules. Uniquely, the Commander can allocate up to 6 sequential commands to any of 4 single keys on the handset, these "macro" commands being entirely user programmable. The Commander can also supply triggering functions for peripheral devices such as power amps and can route the IR signals for equipment such as lights and blinds back to any of the four zones over which it has separate control. The Commander has facility to learn any known code and can adjust its carrier frequency automatically within a certain range and to either of two factory-set frequencies. It also gives the user the ability to select a custom oscillator, which can be used for any unusual carrier frequencies that may be required. The Commander has the ability to independently select the Bass, Treble and Turn on Volume for each Zone and can also allow the user to select the same source in each Zone with a single command from any one of the Zones. More than one Commander may be used in conjunction with an equal number of Controllers and loop in and loop out facilities are provided for this. The following test procedure requires the testing of each of the above listed functions.

Contents

1.0 TEST EQUIPMENT LIST

Digital Volt Meter
Digital Oscilloscope (100MHz)
Systemline 4.4 Test Bed House with 4×DMS and Connection Leads
Systemline Controller S4.4
PC Keypad Software
Suitable Windows PC
RS 232 lead
RC5 Source Equipment (Marantz CD player)
RC5 Handset
Systemline RHS4 Handset (with masked off
B&O Handset (or other suitable high frequency carrier)
12V Plug Top Power Supply
Emitter/Trigger Test Jig
IR Relay and Trigger Indicators

2.0 INSPECTION & INITIAL SET-UP

2.1 Initial Inspection

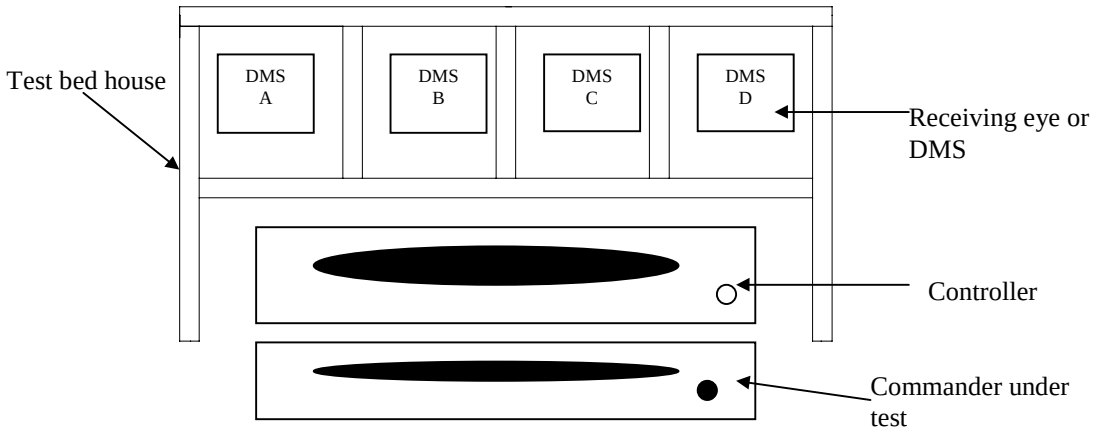
Fully inspect the Main Board, Rear Board and Front Board for correct component placing and orientation and ensure that all solder joints are good, especially around the various sockets and connectors that are not surface mounted.

The Main Board should be mounted in a chassis to which a Front Panel with Receiver Window attached is already affixed. The Main Board is fixed in place with two M3×6 screws to the front and two nylon pillars to the rear. The Rear Board is attached to the Main Board via its two 20 way sockets and then secured through two more M3×6 screws into the top of the nylon pillars. The Rear Panel is attached with self-tapping screws and two small RS232 bolts. A nylon bracket to the Rear Panel further secures the Rear Board. The bracket is secured to the Rear Board by a M2.5x20 nut and bolt and to the Rear Panel by a self-tapping screw. Ensure that all these fixings are tight and that no movement is possible. It is important that the Rear Board Bracket holds the PCB in such a way that the sockets TX1 – 6 protrude proud of the Rear Panel. Ensure that the ribbon cable is correctly attached from J4 on the Main Board to J1 on the Front Board.

Insert a pre- programmed PIC17C756 Microcontroller IC containing the latest software set into the socket of U3 noting the chamfered corner and pin 1 marker on both the chip and the PCB.

2.2 Set-up

The Systemline Commander must be tested in a “real world” situation which means it must be tested in conjunction with a Systemline Controller 4.4 fully set up in the test bed provided.



Systemline Test Bed Mk. II

The main board is tested in conjunction with the rear board and both should be installed in a fully assembled chassis along with a tested and inspected front board with the lid left off to facilitate various measurements. The Commander under test is then connected into the test bed as shown in the diagram above and the various connections required should be made in accordance with the diagram shown in the Appendix.

3.0 INITIAL TEST

3.1 General Measurements

Switch on the S4.4 Controller and perform the following checks on the Commander under test.

Using a Digital Voltmeter make the following measurements with reference to GND (Test point J6):

Test 1 Output of U6 (can be measured at Emitters pin 1) +5V±0.25V

Using a Digital Oscilloscope set to 2V/div and 0.5µs/div D.C. coupled referenced to ground:

Test 2 Left Hand leg of U20 455kHz±10Hz @5V±0.25Vpk-pk

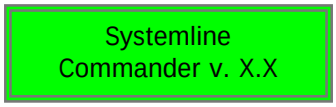
Test 3 Left Hand leg of U22 1.125MHz±100Hz @5V±0.25Vpk-pk

A certain amount of ringing is allowable at these frequencies but should not exceed the ±20% margin.

3.2 Front Board Measurements

Test 4 Check that the LCD is fully and evenly illuminated and that all four of the text illumination LEDs, LD1-4, operate with a similar brightness and fully illuminate each word on the front lens.

Test 5 With a suitably sized flat blade screwdriver carefully adjust the contrast pot. RV1 in the lower left hand corner of the motherboard, until the display clearly reads:



This is the Commander Home Screen. The text should have maximum contrast with the back light and only the letters should be visible in each 5×8 dot matrix block when viewed perpendicularly from the front - rather than at an angle. The unit may need to be angled toward the face to facilitate correct adjustment.

Test 6 Check that the four front panel keys operate by performing the following procedure. The keys are named from left to right; Up (1), Down (2), Mode (3), Enter (4):

Key #	Key	Number of presses	Display Text
3	Mode	1	Program New IR Codes?
4	Enter	1	Select Code Type Use Up/Down Keys
2	Down	1	Select Code Type Normal (Default)
1	Up	1	Select Code Type 455kHz (B&O)
3	Mode	9	Enter=Exit Mode=Continue
4	Enter	1	Systemline Commander vX.X

The keys should all operate with an audible click and positive feel *without sticking*. If they stick it may be necessary to adjust the position of the LED holders by re-soldering. If multiple presses are required or the display is of random letters then a fault condition is indicated. Note also that when

pressing the Mode key nine times the display changes after each press until finally arriving at the text shown.

If at any time during testing it is required to start again, the Commander can be returned to its home screen by pressing Mode (3) until the Exit option is displayed via this screen and pressing Enter (4) to exit. **The Commander will not perform any of its special functions until it is returned to the Home Screen**.

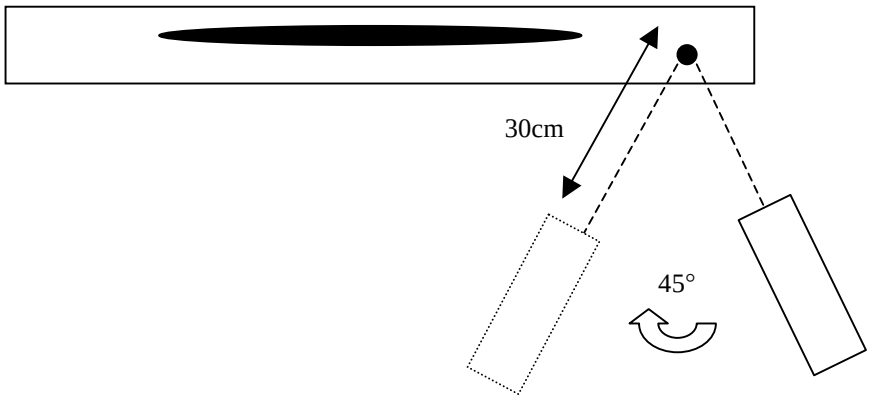
The following measurements all refer to components or places on the Front Board under test.

Test 7 With a Cathode Ray Oscilloscope (CRO) set to 2V/div and 2 ms/div DC coupled, monitor the signal at test point J3 whilst simultaneously firing a code from a suitable RC-5 hand-set *at the receiver window on the front panel of the Commander*. A GND test pin is included on the PCB as a reference for the oscilloscope.

There should be a good clean square wave displayed on the 'scope with sharp corners and a peak to peak voltage of 5V. Depending on the code fired, 8 or so cycles of a varying mark:space ratio should be visible. When no code is fired the 'scope should show a 0V DC level.

The 'scope trace should remain strong through an angle of 45° and up to approximately 30 cm away when the handset output is placed in a direct line of sight to the receiver window (see diagram below). Outside these parameters there should be no trace – *this is an important characteristic of the Commander.*

Please also note that the receiver characteristics will ***not*** conform to these parameters if the front board is not secured to the front panel so that the receiver diode is correctly positioned behind its little window.



Test 8 With a CRO set to 2V/div and 2ms/div DC coupled, monitor the signal at test point J2 whilst simultaneously firing a code from a suitable RC-5 hand-set.

There should be a good clean square wave displayed on the 'scope with sharp corners and a peak to peak voltage of 5V. Depending on the code fired, 8 or so cycles of a varying mark:space ratio should be visible. When no code is fired the scope should show a 5V DC level.

The trace should remain when the handset is placed within the parameters outlined above and disappear when outside them as before.

Test 9 With a CRO set to 2V/div and 0.2ms/div DC coupled, monitor the signal at test point J2 whilst simultaneously firing a code from a suitable RC-5 hand-set ***at a distance of about 15cm***.

There should be a good clean square wave displayed that has a higher frequency carrier super-imposed on it. This will appear as a series of many small dots representing numerous cycles of the carrier, followed by a gap and then more dots on the screen if the scope is set up correctly. The carrier frequency is 38kHz but it is sufficient merely to check that it is present.

Test 10 With a CRO set to 2V/div and 0.2ms/div DC coupled, monitor the signal at test point J3 whilst simultaneously firing a code from a suitable RC-5 hand-set at a distance of about 15cm.

There should be a good clean square wave displayed that ***does not have*** the higher frequency carrier super-imposed on it. This will appear as a single cycle on the screen if the scope is set up correctly.

Whilst monitoring the test point and still firing the code, check that the carrier frequency (the small dots) do reappear when the handset is moved back to its range limit of approximately 30cm. Again check that the carrier frequency is not present from at least 15cm range right up to the window at 0cm range.

3.3 Mother Board Measurements

3.3.1 PPM Demodulation

With an oscilloscope set to 2V/div and 0.2ms/div measure the following signals:

Test 11 Aim the RHS4 handset at the Zone A DMS in the test bed house. Fire any code (except a source code) and monitor the signal at pin 1 of U19. There should be a good clean square wave displayed of 5Vpk-pk and no carrier frequency should be visible as in Test 10 above.

Test 12 Aim the RHS4 handset at the Zone B DMS in the test bed house. Fire any code (except a source code) and monitor the signal at pin 2 of U19. There should be a good clean square wave displayed of 5Vpk-pk and no carrier frequency should be visible as in Test 10 above

Test 13 Aim the RHS4 handset at the Zone C DMS in the test bed house. Fire any code (except a source code) and monitor the signal at pin 13 of U19. There should be a good clean square wave displayed of 5Vpk-pk and no carrier frequency should be visible as in Test 10 above

Test 14 Aim the RHS4 handset at the Zone D DMS in the test bed house. Fire any code (except a source code) and monitor the signal at pin 14 of U19. There should be a good clean square wave displayed of 5Vpk-pk and no carrier frequency should be visible as in Test 10 above

3.3.2 IR Pass Through

Test 15 Connect the test jig to the TX1-TX6 sockets, the TG1-TG4 and the TG Format connector sockets the red wire to pin 6 and fire an RC5 code at each of the Zones in turn. All the green LEDs on the test jig should flash when a code is fired at each of the zones and all of the IR Relay LEDs in the "house" should flash too.

Test 16 Ground out the Commander chassis using the Digital Voltmeter ground lead. None of the green LEDs on the test jig should light. If they do check the correct alignment of the Rear Board bracket.

3.4 Functionality Tests

3.4.1 Testing DMS Function via RJ45 Sockets

Test 17 Using the RHS4 handset aimed at the Zone A DMS in the "house" press, *source one/Tuner*. The zone relays should click, the *zone active* LED should light on the Controller, and the DMS should scroll "Good morning…" and display "**Tunr."** Repeat this procedure for Zone B but instead press *source two/Disc* noting the same effects, with the DMS reading **"Cd."** In Zone C press the *source three/ Satellite* key and in Zone D the *source four/ Video* key so that the DMS reads **"Sat"** and **"Vcr"** respectively.

Test 18 Now back in Zone A press *source two/Disc* and note that both Zone A and Zone B DMS read **"cd" -** the first letter being in lower case.

Test 19 Press all the source keys in turn noting that when any two zones display the same source they are always in lower case characters. Return the Zone to its original source.

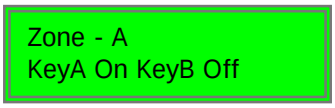
Test 20 Repeat Test 19 for Zone B, C and D

Test 21 Perform a "master power down". Pointing at any zone press and hold the standby button on the RHS4 handset for more than 5 seconds. See that the DMS in question displays **"standby"** and then **"off"** at which time all the zones will switch off and return to standby simultaneously.

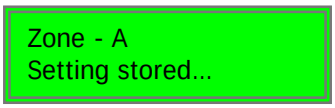
3.4.2 Trigger Function

Set the Commander up as follows. Using the Mode button, select the following menu and press Enter:

Using the Up/Down keys select Zone A and press Enter. Using the Up/Down keys select the following menu and press Enter



Ensure that the following confirmation screen is shown after pressing Enter:



Using the Up/Down keys select Zone B and proceed as before. After setting stored use the Up/Down keys to select the next zone. Continue by performing the same procedure for all the other Zones so that the Triggers are programmed to operate in each zone by using both *A* and *B* keys on the RHS4 handset. **After programming is finished return to the home screen, as explained in Test 6.**

Connect a suitable 12V-plug top power supply lead into the outlet at the rear of the Commander.

Test 22 Set the dial on the test jig from Test 15 to Zone **A** and press key *A* on the RHS4 handset aimed at Zone **A** DMS. The yellow LED should light on the test jig and the green LED in the Zone **A** compartment of the house should also light. Press button *B* on the handset and ensure that both LEDs are extinguished.

Test 23 Set the dial on the test jig from Test 15 to Zone **B** and press key *A* on the RHS4 handset aimed at Zone **B** DMS. The yellow LED should light on the test jig and the green LED in the Zone **B** compartment of the house should also light. Press button *B* on the handset and ensure that both LEDs are extinguished.

Test 24 Set the dial on the test jig from Test 15 to Zone **C** and press key *A* on the RHS4 handset aimed at Zone **C** DMS. The yellow LED should light on the test jig and the green LED in the Zone **C** compartment of the house should also light. Press button *B* on the handset and ensure that both LEDs are extinguished.

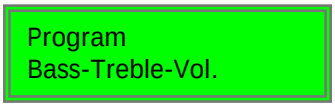
Test 25 Set the dial on the test jig from Test 15 to Zone **D** and press key *A* on the RHS4 handset aimed at Zone **D** DMS. The yellow LED should light on the test jig and the green LED in the Zone **D** compartment of the house should also light. Press button *B* on the handset and ensure that both LEDs are extinguished.

Remove the test jig and plug top power supply connections to the Commander.

3.4.3 Tone Control and Volume Settings

Test 26 Set all the Tone and Volume settings to their default factory settings in the following way:

Using the Mode key, select the following menu and press Enter:



Using the Up/Down keys, select Zone A and press Enter. Again using the Up/Down keys select Bass Level press Enter and ensure that the setting is at +0dB:

Press Enter and ensure that the “setting stored” screen is shown as below:

Using the Up/Down keys to select them repeat this procedure for Treble Level and Turn On Volume options, which should be set to +0dB and 0dB/31 respectively. Using the Up/Down keys select the following screen:

Press Enter and watch whilst the Controller Zone A turns on and off once for each of Bass, Treble and volume, the Code LED lights, the Commander shows "transferring now…" and finally the zone turns off again. This shows that data has been sent to the PICF84.

Test 27 Using the Up/Down keys select Zone B and repeat Test 26 for that zone.

Test 28 Using the Up/Down keys select Zone C and repeat Test 26 for that zone.

Test 29 Using the Up/Down keys select Zone D and repeat Test 26 for that zone.

Return the Commander to the home screen as outlined in Test 6.

Perform a master power down as outlined in Test 21.

3.4.4 Programming the Commander

Capture Procedure (Learning IR Commands)

In order to test its function the Commander need only be programmed with five codes on each "page" of its memory. When the source key of the handset is pressed each key on the handset will perform only the function that has been pre-programmed for that source. For speed and convenience in testing, each source "page" should have the following codes programmed for its corresponding handset keys.

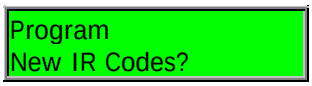
RHS4 Handset Button	RC5 Code
1	Track skip down
2	Track skip up
0*	Play*
Standby*	Stop*
Key Source Input*	Play*

***The "0" ,"standby", and Source Key buttons must be programmed with a code for correct operation of the Commander. This is the factory default setting.**

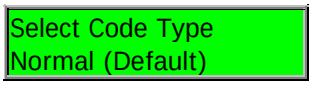
The following procedure is adapted from the Systemline Commander Help File. It explains exactly how to program the "1" key on the RHS4 handset with the "track skip down" RC5 code for source one. Read the Help File in order to understand the Commander functions fully.

NB. As the Commander is to be programmed with the top cover off it is important to ensure that no stray light sources can interfere with the IR sensor. To avoid this it is recommended to cover the top of the Commander with a temporary lid of a suitable opaque material.

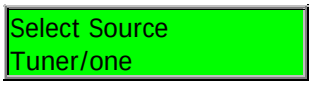
1) Select the following Menu using the Mode Key on the front of the Commander, and then press Enter.



2) Select the Code Type you are learning using the Up/Down keys. Use Normal (Default). Press the Enter key once selected.



3) Select the Source “page” using the Up/Down keys until you locate the Input Source page you want to program the command into. In our example we are programming a Tuner command for Source one. Press 'Enter' once the correct page is selected.



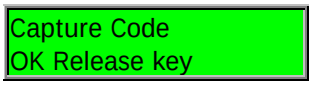
4) Select the command key that you want to program, using the Up/Down keys. Press Enter. For our example we will program the numerical key '1'. Press Enter once the 'Key-1' key is selected.

Note: The top line of the display shows the Source Page you are programming and the bottom line the actual key on the page.

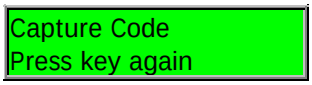
5) The Commander will now ask you to fire the source handset at the IR receiver on the front panel. **Hold the handset approximately 15cm (6 inches) from the receiver window**.

Note: If you want to go back without learning a code press the Mode key.

6) Using the RC 5 handset supplied with the equipment press the track skip down.

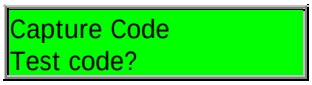


The display will quickly show 'OK Release key', ensure that you **immediately** release the key on the handset when you see this message.
The Commander will ask you to press the **SAME** key again.



Hold the key down until you see 'OK Release key' again.

7) You now have the option of testing the code. Press the Mode key to continue without testing.



Upon releasing the Mode key the display will show the Source Page and Button that has been programmed:

8) Using the Up/Down keys you can now select the next command key on Source page one. Continue by selecting Key 2 and programming track skip up. Then complete the keys/codes for this page from the table above by programming the 0, Source and Standby keys*.

Note: You don't have to program a command key unless you want to. You can step forward and backward through the keys until you find the button you want.

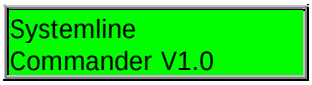
Go on to program the other keys in the table above for this and the other sources CD/two, Satellite/three and Video/four in the following way:

9) Once you have finished learning codes for a particular source you can change to the next Source page using the Mode key. Press the Mode key until you see the following menu.

Use the Up/Down keys to select the new Source Page for the next component and follow the same programming procedure from step 4.

10) You can leave the programming sequence simply by pressing the Mode key to take you back through the menus until you reach the exit page shown below. Press Enter to take the Commander back to normal operation.

Do not forget always to return the Commander to its 'normal' operation mode home screen before checking the system's operation. If you are within any of the set-up pages the Commander will **NOT** respond to Systemline Handsets or Keypads.



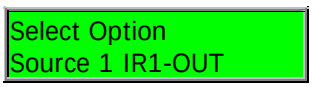
3.4.5 Testing RC5 Bus

IR1/IR2 Set-up procedure

In order to test the function which allows an installation where two Bus controlled RC5 components need to be installed, for example two tuners (without conventional IR receivers) the following set-up is required.

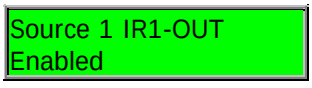
1) Press the Mode key until you reach the 'Program RC5 BUS Routing' menu. Press the Enter key to select.

2) Select the 'Source Page' you want to configure using the Up/Down keys. In order to perform this test we will have to select both Source 1 and Source 2 in turn. Select Source 1 as shown below first:

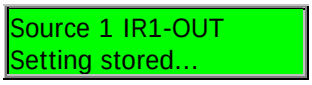


Press the Enter button to select.

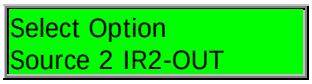
3) The Commander will now show if the IR1 RC5 output is 'Enabled' or 'Disabled'. Using the Up/Down keys select 'Enabled' and then press the Enter key.



4) Once the Enter key has been selected the Commander will store the new setting and momentarily display:

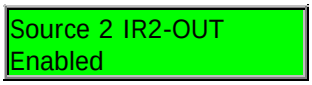


5) Now select the Source 2 configuration for the IR2 output. Using the Up/Down keys select the Source 2 input.



Press the Enter key to select.

6) Using the Up/Down buttons select Enabled for the Source 2 IR2 output. Press Enter to store the setting.



Note: If you want to go back without storing the setting press the Mode key.

7) You can leave the set-up sequence simply by pressing the mode key to take you back through the menus until you reach the exit page shown below. Press the Enter key to take the Commander back to normal operation.

Note: When testing IR commands for Source 1 and Source 2 components you will need to ensure that the RC5 BUS lead is in place together with a suitable ground connection. The ground is normally provided through the audio leads.

Test 30 Plug an RCA lead into “the remote in” input on the back of the test bed RC5 CD player and also into IR1 input on the back of the Commander under test. Aiming at zone A, press *source one/Tuner* on the RHS4 handset ensuring that the play command is sent and then the “1” and “2” keys ensuring that the track skip command is sent to the CD player. Select source two and ensure that the codes are **not** sent to the CD player.

Test 31 Aiming at zone B, press *source/one Tuner* on the RHS4 handset and then the “1” and “2” keys ensuring that the track skip command is sent to the CD player. Select source two and ensure that the codes are **not** sent to the CD player.

Test 32 Aiming at zone C, press *source one/Tuner* on the RHS4 handset ensuring that the play command is sent and then the “1” and “2” keys ensuring that the track skip command is sent to the CD player. Select source two and ensure that the codes are **not** sent to the CD player.

Test 33 Aiming at zone D, press *source one/Tuner* on the RHS4 handset ensuring that the play command is sent and then the “1” and “2” keys ensuring that the track skip command is sent to the CD player. Select source two and ensure that the codes are **not** sent to the CD player.

Test 34 Transfer the RCA lead from Test 30 to the IR2 input on the back of the Commander under test. Aiming at zone A, press *source two/CD* on the RHS4 handset ensuring that the play command is sent and then the “1” and “2” keys ensuring that the track skip command is sent to the CD player. Select source one and ensure that the codes are **not** sent to the CD player.

Test 35 Aiming at zone B, press *source two/CD* on the RHS4 handset ensuring that the play command is sent and then the “1” and “2” keys ensuring that the track skip command is sent to the CD player. Select source one and ensure that the codes are **not** sent to the CD player.

Test 36 Aiming at zone C, press *source two/CD* on the RHS4 handset ensuring that the play command is sent and then the “1” and “2” keys ensuring that the track skip command is sent to the CD player. Select source one and ensure that the codes are **not** sent to the CD player.

Test 37 Aiming at zone D, press *source two/CD* on the RHS4 handset ensuring that the play command is sent and then the "1" and "2" keys ensuring that the track skip command is sent to the CD player. Select source one and ensure that the codes are **not** sent to the CD player.

Unplug the RCA lead from the IR2 socket on the back of the Commander

3.4.6 Testing IR Routing

The following test is designed to make sure that the CD player can only be controlled when the window emitter is plugged into the output corresponding to the source selected and shown on the DMS. It is also equally important to make sure that when these conditions are not satisfied that the CD player cannot be controlled via the window emitter.

Test 38 Connect a window emitter to the TX1 output on the rear of the Commander and ensure that it is affixed to the correct place on the CD player. Starting in zone A press source one and then the "1" and "2" keys and make sure that the CD player ***does not*** respond to the play and track skip commands you have programmed. Check this is the case for the other zones.

Test 39 Move the window emitter to TX2 output on the rear of the Commander. Starting in zone A press source two on the handset and the "1" and "2" keys and again ensure that no commands are sent to the CD player. Check this is the case for the other zones.

Repeat IR1/IR2 set up procedure but instead of enabling the RC5 Bus Routing select "Disable" from the menu and ensure that the setting is stored for sources one and two. Perform a master power down as explained in Test 21 above.

Test 40 Connect a window emitter to the TX1 output on the rear of the Commander and ensure that it is affixed to the correct place on the CD player. Starting in zone A press source one and then the "1" and "2" keys and make sure that the CD player ***responds correctly*** to the play and track skip commands you have programmed.

Test 41 Move the handset to zone B and repeat Test 40

Test 42 Move the handset to zone C and repeat Test 40

Test 43 Move the handset to zone D and repeat Test 40

Test 44 Still in zone D press *source two* and ensure that the CD player does **not** respond to keys "1" and "2" or any other keys that have been programmed.

Test 45 Move the window emitter lead to TX2. Still in zone D press keys "1" and "2" again and make sure that this time the CD player does respond as normal to the commands that have been programmed.

Test 46 Move the handset to zone C and press the "1" and "2" keys and ensure that the CD player does **not** respond to the commands.

Test 47 Still in zone C press *source two* and ensure that the CD player **does** respond to keys "1" and "2".

Test 48 Move the handset to zone B and press the "1" and "2" keys and ensure that the CD player does **not** respond to the commands.

Test 49 Still in zone B press *source two* and ensure that the CD player **does** respond to keys "1" and "2".

Test 50 Move the handset to zone A and press the "1" and "2" keys and ensure that the CD player does **not** respond to the commands.

Test 51 Still in zone A press *source two* and ensure that the CD player **does** respond to keys "1" and "2".

Get the idea yet?

Test 52 Still in zone A move the window emitter lead to TX3. Press keys "1" and "2" and ensure that the CD player does **not** respond

Test 53 Still in zone A press *source three* and ensure that the CD player **does** respond to keys "1" and "2".

Test 54 Move the handset to zone B and press the "1" and "2" keys and ensure that the CD player does **not** respond to the commands.

Test 55 Still in zone B press *source three* and ensure that the CD player **does** respond to keys "1" and "2".

Test 56 Move the handset to zone C and press the "1" and "2" keys and ensure that the CD player does **not** respond to the commands.

Test 57 Still in zone C press *source three* and ensure that the CD player **does** respond to keys "1" and "2".

Test 58 Move the handset to zone D and press the "1" and "2" keys and ensure that the CD player does **not** respond to the commands.

Test 59 Still in zone D press *source three* and ensure that the CD player **does** respond to keys "1" and "2".

Test 60 Still in zone D move the window emitter lead to TX4. Press keys “1” and “2” and ensure that the CD player does **not** respond.

Test 61 Still in zone D press *source four* and ensure that the CD player **does** respond to keys “1” and “2”.

Test 62 Move the handset to zone C and press the “1” and “2” keys and ensure that the CD player does **not** respond to the commands.

Test 63 Still in zone C press *source four* and ensure that the CD player **does** respond to keys “1” and “2”.

Test 64 Move the handset to zone B and press the “1” and “2” keys and ensure that the CD player does **not** respond to the commands.

Test 65 Still in zone B press *source four* and ensure that the CD player **does** respond to keys “1” and “2”.

Test 66 Move the handset to zone A and press the “1” and “2” keys and ensure that the CD player does **not** respond to the commands.

Test 67 Still in zone A press *source four* and ensure that the CD player **does** respond to keys “1” and “2”. ***Perform a master power down as explained in Test 21 above.***

3.4.7 The Four Zeros

Test 68 Turn on zone A with the source one command. Still aiming the handset at zone A, press the zero or numerical “0” key four times. All the zones should turn on with **“tunr”** displayed on the DMS.

Test 69 Press source two in Zone B and then four zeros again. All the zones should display **“cd”**.

Test 70 Press source three in Zone C and then four zeros again. All the zones should display **“sat”**.

Test 71 Press source four in Zone D and then four zeros again. All the zones should display **“vcr”**.

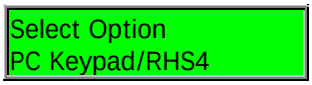
3.4.8 PC Keypad and RS232 Interface

Test 72 Commander PC Keypad set-up procedure

It is important for the RS232 comms. port on the Commander to be configured for use with the PC keypad. The Commander will not respond to the PC unless it is correctly configured. To do this carry out the following steps:

1) Select the following Menu using the Mode Key, and then press Enter.

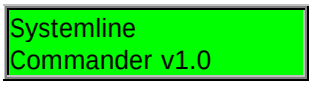
2) Using the Up/Down keys select the 'PC Keypad' option. Press the Enter key to select.



3) Using the Up/Down keys select Enabled and then press the Enter key.

4) Once the Enter key is pressed the Commander will open the comms port with the following message momentarily:

Note: The Commander will revert to normal operation once this message has been displayed.



Test 73 Connect an RS232 lead between the PC and the Commander Comms Port and open the PC Keypad program on the PC. To test the operation of the comms port, perform Test 68 to Test 71

3.4.9 Carrier Frequency Switching Tests

Teach the Commander a code from an equipment handset that uses codes with a carrier frequency of more than 80kHz. Such a handset is one for Bang and Olufsen equipment. Follow the procedure outlined in the Capture Procedure of 3.4.4 but instead of selecting Normal (default) in the Select Code Type menu, select 455kHz(B&O). It may be necessary to experiment with the exact positioning of the teaching handset before codes are successfully captured.

Test 74 Set the scope to 2V/div and 0.5µs/div and have it in storage mode. Using the RHS4 handset send the code which was learned in 3.4.9 to any DMS and monitor pin 3 of U17 with the scope probe. The carrier frequency should be 455kHz±10Hz @5V±0.25Vpk-pk.

Test 75 Repeat but instead of selecting 455kHz (B&O) select 1.125MHz.

Test 76 Set the scope to 2V/div and 0.5µs/div and have it in storage mode. Using the RHS4 handset send the code which was learned in 3.4.9 to any DMS and monitor pin 3 of U17 with the scope probe. The carrier frequency should be 1.125MHz±100Hz @5V±0.25Vpk-pk.

4.0 SOAK TESTS

Not used in this document.

5.0 FINAL TESTS

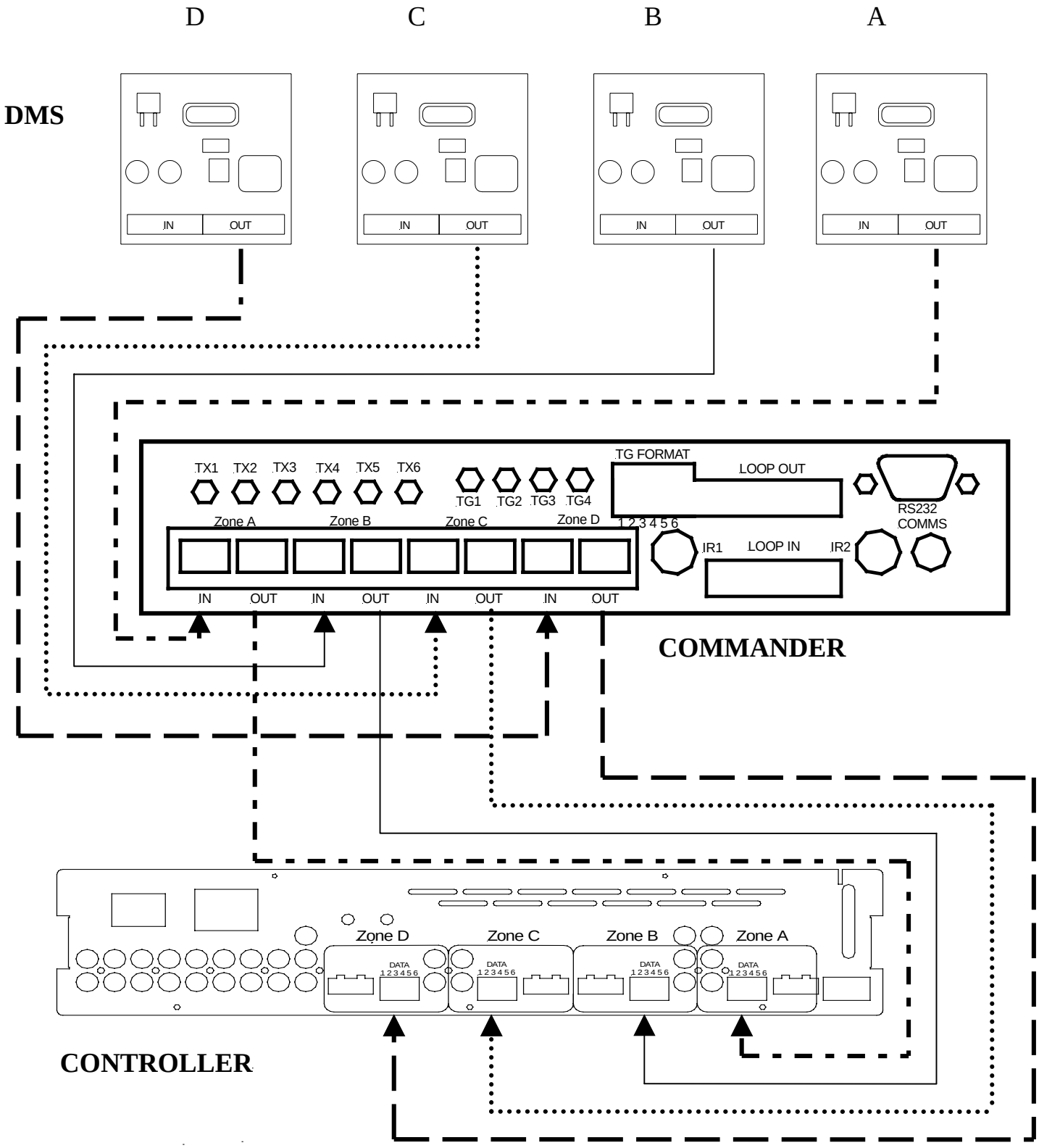
Not used in this document

6.0 SHUTDOWN PROCEDURES

Stick on a pass label with initials month and year
Fit the lid to the Commander

7.0 APPENDIX

7.1 Test Bed connections



8.0 TEST REPORT

Test Report

Product Name: Systemline Commander **Serial Number:……**

Test No.	Description	Expected result	Actual Result
1	Output U6	+5V±0.25V	V
2	Left Hand leg of U20	455kHz±10Hz	kHz
3	Left Hand leg of U22	1.125MHz±100Hz	kHz
4	LCD is fully and evenly illuminated	Cool Green	Yes / No
5	RV1	maximum contrast	Yes / No
6	front panel keys operate	Audible click/screen change	Yes / No
7	test point J3	5Vp-p 0V DC Offset	V
8	test point J2	5Vp-p 5V DC Offset	V
9	test point J2 0.2ms/div	Carrier visible	Yes / No
10	point J3 0.2ms/div	No Carrier visible	Yes / No
11	pin 1 of U19	No Carrier visible	Yes / No
12	pin 2 of U19	No Carrier visible	Yes / No
13	pin 13 of U19	No Carrier visible	Yes / No
14	pin 14 of U19	Relays Do not Buzz	Yes / No
15	TX1-TX6 sockets	green LEDs flash	Yes / No
16	Ground out the Commander chassis	No LED's flash	Yes / No
17	Zone A DMS	Engaged	Yes / No
18	Zone B DMS	Engaged	Yes / No
19	Zone C DMS	Engaged	Yes / No
20	Zone D DMS	Engaged	Yes / No
21	"Master power down".	"standby"	Yes / No
22	Zone A trigger	Green led yellow led	Yes / No
23	Zone B trigger	Green led yellow led	Yes / No
24	Zone C trigger	Green led yellow led	Yes / No
25	Zone D trigger	Green led yellow led	Yes / No
26	Zone A Tone Volume	Data Transfer	Yes / No
27	Zone B Tone Volume	Data Transfer	Yes / No
28	Zone C Tone Volume	Data Transfer	Yes / No
29	Zone D Tone Volume	Data Transfer	Yes / No
30	Zone A RC-5 Bus test Source 1	CD Player skips tracks	Yes / No
31	Zone B RC-5 Bus test Source 1	CD Player skips tracks	Yes / No
32	Zone C RC-5 Bus test Source 1	CD Player skips tracks	Yes / No
33	Zone D RC-5 Bus test Source 1	CD Player skips tracks	Yes / No
34	Zone A RC-5 Bus test Source 2	CD Player skips tracks	Yes / No
35	Zone B RC-5 Bus test Source 2	CD Player skips tracks	Yes / No
36	Zone C RC-5 Bus test Source 2	CD Player skips tracks	Yes / No

Tested By: Date:

Product Name: Systemline Commander **Serial Number:……**

Test No.	Description	Expected result	Actual Result
37	Zone D RC-5 Bus test Source 2	CD Player skips tracks	Yes / No
38	Source 1≠TX1 output	No Response	Yes / No
39	Source 2≠TX2 output	No Response	Yes / No
40	Zone A Source 1=TX1 output	CD Player skips tracks	Yes / No
41	Zone B Source 1=TX1 output	CD Player skips tracks	Yes / No
42	Zone C Source 1=TX1 output	CD Player skips tracks	Yes / No
43	Zone D Source 1=TX1 output	CD Player skips tracks	Yes / No
44	Zone D Source 2≠TX1 output	No Response	Yes / No
45	Zone D Source 2=TX2 output	CD Player skips tracks	Yes / No
46	Zone C Source 1≠TX2 output	No Response	Yes / No
47	Zone C Source 2=TX2 output	CD Player skips tracks	Yes / No
48	Zone B Source 2≠TX1 output	No Response	Yes / No
49	Zone B Source 2=TX2 output	CD Player skips tracks	Yes / No
50	Zone A Source 2≠TX1 output	No Response	Yes / No
51	Zone A Source 2=TX2 output	CD Player skips tracks	Yes / No
52	Zone A Source 2≠TX3 output	No Response	Yes / No
53	Zone A Source 3=TX3 output	CD Player skips tracks	Yes / No
54	Zone B Source 2≠TX3 output	No Response	Yes / No
55	Zone B Source 3=TX3 output	CD Player skips tracks	Yes / No
56	Zone C Source 2≠TX3 output	No Response	Yes / No
57	Zone C Source 3=TX3 output	CD Player skips tracks	Yes / No
58	Zone D Source 2≠TX3 output	No Response	Yes / No
59	Zone D Source 3=TX3 output	CD Player skips tracks	Yes / No
60	Zone D Source 4≠TX3 output	No Response	Yes / No
61	Zone D Source 4=TX4 output	CD Player skips tracks	Yes / No
62	Zone C Source 3≠TX3 output	No Response	Yes / No
63	Zone C Source 4=TX4 output	CD Player skips tracks	Yes / No
64	Zone B Source 3≠TX3 output	No Response	Yes / No
65	Zone B Source 4=TX4 output	CD Player skips tracks	Yes / No
66	Zone A Source 3≠TX3 output	No Response	Yes / No
67	Zone A Source 4=TX4 output	CD Player skips tracks	Yes / No
68	Zone A Four zeroes	**"tunr"**	Yes / No
69	Zone B Four zeroes	**"cd"**.	Yes / No
70	Zone C Four zeroes	**"sat"**.	Yes / No
71	Zone D Four zeroes	**"vcr"**.	Yes / No
72	Comms Port	Port is now open	Yes / No
73	PC Keypad Test	Four Zeros Responses	Yes / No
74	Frequency Switching 1	455kHz±10Hz	kHz
75	Frequency Switching 2	1.125MHz±100Hz	MHz

Tested By: Date: