PLEASE NOTE

This manual has been carefully checked for accuracy, but no warranty is made as to the correctness of this document or the suitability of this product for any particular purpose. No liability is assumed for any damages, consequential or otherwise, that result from the use or misuse of this product.

WARRANTY

KIT: Defective parts will be replaced free of charge if returned to the factory within ten days of receipt of delivery or upon written statement by purchaser that the unit was unassembled or untested for some longer period due to circumstances beyond his control. Completed units returned under similar circumstances will be repaired at a labor cost of $20.00/hour, with defective parts replaced free.

THIS WARRANTY IS VOID IF THE KIT IS SOLDERED WITH CORROSIVE FLUX OR IF INTEGRATED CIRCUIT SOCKETS NOT SUPPLIED BY PERCOM ARE USED IN THE ASSEMBLY OF THIS KIT.

ASSEMBLED: Assembled units are warranted to be free from defects for ninety days from the time of shipment. If they are found to be defective in this period they may be returned to the factory for repair or replacement free of charge including return shipping.

PerCom Data Co.
4021 Windsor
Garland, Texas 75042

NOTICE:

PLEASE READ THE OPERATING INSTRUCTIONS CAREFULLY. IT WILL SAVE US BOTH A LOT OF TIME.

ERRATA FOR THE CIS-3Ø+ CASSETTE/TERMINAL I/O

THE ORIENTATION FOR TRANSISTORS Q2, Q3, Q4, AND Q5 SHOWN ON THE CIS-3Ø+ CIRCUIT CARD SILK SCREEN IS NOT CORRECT FOR THE TRANSISTORS SUPPLIED WITH THIS KIT. THE 'FLAT SIDE' OF THESE TRANSISTORS MUST BE OPPOSITE TO THE ORIENTATION INDICATED ON THE CIRCUIT CARD SILK SCREEN. THE ASSEMBLY DRAWING SHOWS CORRECT ORIENTATION. THE ORIENTATION FOR Q1 IS CORRECT ON BOTH THE ASSEMBLY DRAWING AND THE CIRCUIT CARD SILK SCREEN.

THE PERCOM CIS-3Ø+ IS ESSENTIALLY TWO I/O INTERFACES IN ONE PACKAGE; A DATA TERMINAL I/O AND A CASSETTE I/O. WHEN THE DATA TERMINAL INPUT IS ENABLED, ANY DATA FROM THE CASSETTE IS IGNORED AND VICE VERSA. SWITCHING BETWEEN DATA TERMINAL INPUT AND CASSETTE INPUT IS NORMALLY CONTROLLED AUTOMATICALLY BY THE COMPUTER. WHEN YOU COMMAND THE COMPUTER TO LOAD A PROGRAM (TYPE L), THE CASSETTE INPUT WILL BE ENABLED AND ANY INPUT FROM THE DATA TERMINAL KEYBOARD WILL BE IGNORED. CONTROL WILL BE RETURNED TO THE DATA TERMINAL KEYBOARD WHEN THE PROGRAM LOAD IS COMPLETED OR WHEN YOU PUSH THE COMPUTER RESET BUTTON.
IF YOU MUST LOAD A PROGRAM FROM THE DATA TERMINAL RATHER THAN FROM THE CASSETTE, START THE MIKBUG® LOAD ROUTINE AT ADDRESS EØ13 (PUT EØ13 IN MEMORY LOCATIONS AØ48-AØ49 AND TYPE G). THIS BYPASSES THE INSTRUCTIONS WHICH SELECT THE CASSETTE.

INSTRUCTION MANUAL FOR

THE PERCOM CIS-3Ø+

CASSETTE/TERMINAL INTERFACE

TABLE OF CONTENTS:

INTRODUCTION

THE PERCOM CIS-3Ø PERMITS YOU TO RECORD AND PLAYBACK DATA USING ORDINARY READILY AVAILABLE PORTABLE CASSETTE RECORDERS AT 3Ø, 6Ø, OR 12Ø BYTES/SEC. YOUR RS-232 DATA TERMINAL (3ØØ-12ØØ BAUD) CONNECTS TO THE CIS-3Ø WHICH IN TURN PLUGS INTO EITHER THE CONTROL (MP-C) OR SERIAL (MP-S) INTERFACES CARDS OF THE SWTP 68ØØ COMPUTER. THE CIS-3Ø CAN RECORD ON ONE CASSETTE WHILE SIMULTANEOUSLY READING FROM A SECOND CASSETTE. IT HAS PROVISION FOR REMOTELY CONTROLLING TWO CASSETTE DRIVES (REMOTE CONTROL IS A EXTRA COST OPTION).

THE CIS-3Ø IS COMPATIBLE WITH THE 'KANSAS CITY' OR BYTE STANDARD AND WILL PLAY THE CASSETTE TAPED PROGRAMS SOLD BY SWTP AND OTHER. THIS PARTICULAR TECHNIQUE FOR RECORDING DATA ON AUDIO CASSETTE RECORDERS WAS SELECTED BY A SYMPOSIUM HELD IN KANSAS CITY, MO. IN THE FALL OF 1975. THE STANDARD IS BASED ON THE EXPERIMENTAL WORK OF DON LANCASTER OF SYNERGETICS AND HAROLD MAUCH OF PERCOM DATA CO.

DATA IS RECORDED ON TAPE, BIT SERIAL WITH A START BIT PRECEDING 8 DATA BITS AND TWO OR MORE STOP BITS. THE LOGIC ONE (MARKING STATE) IS IDENTIFIED AS 8 CYCLES OF A 24ØØ HERTZ SIGNAL. THE LOGIC ZERO (SPACING STATE) IS 4 CYCLES OF A 12ØØ HERTZ SIGNAL. THE RECOVERED DATA IS SELF CLOCKING, VIRTUALLY ELIMINATING ERRORS CAUSED BY TAPE SPEED VARIATIONS WHICH PLAGUE FSK AND SIMILIAR MODEM TYPE INTERFACES.

ALTHOUGH THE 3ØØ BIT/SECOND (BAUD) RATE WAS CHOSEN TO PROVIDE MAXIMUM RELIABILITY FOR INTERCHANGE OF DATA, THE 'KANSAS CITY' STANDARD IS A HIGHLY (8X) REDUNDANT FORM OF THE BIPHASE-M OR MANCHESTER CODE. A UNIQUE FEATURE OF THE PERCOM CIS-3Ø IS THE CAPABILITY TO OPERATE AT RATES UP TO 12ØØ BAUD BY CONTROLLING THIS REDUNDANCY. 12ØØ BAUD PERMITS A 4K PROGRAM TO BE LOADED IN LESS THAN 4Ø SECONDS (BINARY FORMAT).

THIS INSTRUCTION NOTE CONTAINS INFORMATION FOR ASSEMBLY, FOR CONNECTION AND USE OF THE CIS-3Ø CASSETTE/TERMINAL INTERFACE.

ASSEMBLY INSTRUCTIONS FOR THE PERCOM CIS-30

READ ALL OF THE FOLLOWING INSTRUCTIONS CAREFULLY

BE SURE TO READ THE WARRANTY PARTICULARLY NOTING THE STATEMENTS REGARDING CORROSIVE SOLDER FLUX AND INTEGRATED CIRCUIT SOCKETS.

CHECK THE KIT PARTS AGAINST THE PARTS LIST.

BRUSH BOTH SIDES OF THE PC CARD VIGOROUSLY WITH A DISCARDED TOOTHBRUSH TO REMOVE ANY ETCH SLIVERS WHICH MAY CAUSE INVISIBLE SHORTS.

INSTALL THE COMPONENTS IN THE FOLLOWING ORDER. REFER TO FIGURE 1 FOR COMPONENT LOCATION AND ORIENTATION.

CHECK THE ERRATA SHEETS FOR CHANGES TO THE FOLLOWING PROCEDURE.

RESISTORS:

CHECK	RESISTOR	VALUE	COLOR CODE
( )	R1	4.7K	YL VI RD
( )	R2	1K	BR BK RD
( )	R3	27K	RD VI OR
( )	R4	1ØK	BR BK OR
( )	R5	1ØK	BR BK OR
( )	R6	1ØK	BR BK OR
( )	R7	1ØØK	BR BK YL
( )	R8	1ØK	BR BK OR
( )	R9	1ØK	BR BK OR
( )	R1Ø	1ØØK	BR BK YL
( )	R11	1K	BR BK RD
( )	R12	82Ø	GY RD BR
( )	R13	18Ø	BR GY BR
( )	R14	1K	BR BK RD
( )	R15	4.7K	YL VI RD
( )	R16	62K	BU RD OR
( )	R17	1ØK	BR BK OR
( )	R18	1ØØK	BR BK YL
( )	R19	1ØK	BR BK OR
( )	R2Ø	47K	YL VI OR
( )	R21	1K	BR BK RD
( )	R22	1ØK	BR BK OR
( )	R23	1ØØ	BR BK BR
( )	R24	2.7K	RD VI RD
( )	R25	-	REMOTE CONTROL OPTION
( )	R26	-	" " "
( )	R27	4.7K	YL VI RD
( )	R28	4.7K	YL VI RD
( )	R29	1ØK	BR BK OR
( )	R3Ø	1ØK	BR BK OR
( )	R31	1ØK	BR BK OR
( )	R32	4.7K	YL VI RD
( )	R33	4.7K	YL VI RD
( )	R34	47K	YL VI OR

BK-BLACK	Ø		
BR-BROWN	1		
RD-RED	2		
OR-ORANGE	3		
YL-YELLOW	4		
GR-GREEN	5		
BU-BLUE	6		
VI-VIOLET	7		
GY-GRAY	8		
WH-WHITE	9		

CHECK	RESISTOR	VALUE	COLOR CODE
( )	R35	4.7K	YL VI RD
( )	R36	47Ø	YL VI BR
( )	R37	4.7K	YL VI RD
( )	R38	18Ø	BR GY BR

DIODES:

CHECK	DIODE	
( )	CR1	IN914
( )	CR2	IN914
( )	CR3	IN914
( )	CR4	IN914
( )	CR5	IN914
( )	CR6	REMOTE CONTROL OPTION
( )	CR7	" " "

SOLDER AND CLIP ALL RESISTOR AND DIODE LEADS

CAPACITORS:

CHECK	CAPACITOR	VALUE	TYPE
( )	C1	Ø.Ø47UF	MYLAR
( )	C2	Ø.Ø1UF	DISC
( )	C3	Ø.Ø1UF	DISC
( )	C4	Ø.ØØ1UF OR 75ØPF	DISC
( )	C5	Ø.Ø1UF	DISC
( )	C6	Ø.Ø47UF	MYLAR
( )	C7	36ØPF	DIPPED MICA
( )	C8	Ø.ØØ1UF OR 75ØPF	DISC
( )	C9	Ø.Ø1UF	DISC
( )	C1Ø	Ø.Ø1UF	DISC
( )	C11	Ø.Ø47UF	MYLAR
( )	C12	25UF(WATCH POLARTY)	ELECTROLYTIC
( )	C13	Ø.Ø1UF	DISC
( )	C14	Ø.Ø1UF	DISC

CHECK THE ERRATA SHEET FOR TRANSISTOR ORIENTATION INSTRUCTIONS. THE ORIENTATION SHOWN ON THE PC CARD SILK SCREEN AND THE ASSEMBLY DRAWING MAY NOT BE CORRECT FOR THE TRANSISTORS INCLUDED IN THIS KIT.

TRANSISTORS:

CHECK		
( )	Q1	PN3565
( )	Q2	PN5138
( )	Q3	PN5135
( )	Q4	PN5135
( )	Q5	PN5135

SOLDER AND CLIP THE CAPACITOR AND TRANSISTOR LEADS

INTEGRATED CIRCUITS:

WARNING: WHILE THE USE OF IC SOCKETS SIMPLIFIES TROUBLESHOOTING, THE USE OF CHEAP IC SOCKETS WILL ONLY COMPOUND TROUBLESHOOTING PROBLEMS. CONSEQUENTLY, THE USE OF ANY IC SOCKET NOT SUPPLIED OR APPROVED BY PERCOM DATA CO. WILL VOID ANY AND ALL WARRANTIES. IF YOU WISH TO USE SOCKETS, A KIT IS AVAILABLE FROM PERCOM. THESE IC SOCKETS ARE OF SUBSTANTIALLY HIGHER QUALITY THAN SOCKETS USUALLY AVAILABLE THROUGH SURPLUS OUTLETS.

IF YOU ARE NOT FAMILIAR WITH INTEGRATED CIRCUIT INSERTION AND SOLDERING TECHNIQUES, REFER TO APPENDIX A FOR HANDLING INSTRUCTIONS.

CHECK	IC	TYPE
( )	Z1	74LS122 (74122)
( )	Z2	74LS74
( )	Z3	74LS74
( )	Z4	74LS197
( )	Z5	74LS153 (74153)
( )	Z6	74LS74
( )	Z7	LM339
( )	Z8	74LS86
( )	Z9	74LS157 (74157)
( )	Z1Ø	74LS113
( )	Z11	REMOTE CONTROL OPTION

RECHECK THE POSITION AND ORIENTATION THEN SOLDER EACH IC.

MISC:

( ) CONNECTOR STRIPS
INSTALL THE TWO 1Ø CONTACT CONNECTOR STRIPS ON THE "TOP" (COMPONENT SIDE) OF THE CIRCUIT CARD. MAKE SURE THE BODY OF EACH CONNECTOR SEATS FIRMLY AGAINST THE CIRCUIT CARD AND THAT EACH PIN EXTENDS COMPLETELY INTO THE HOLES ON THE CIRCUIT CARD. SOLDER ONLY THE END PIN ON EACH CONNECTOR UNTIL YOU ARE SURE THE CONNECTOR STRIPS ARE PROPERLY ALIGNED. WHEN EVERYTHING LOOKS STRAIGHT, SOLDER THE REMAINING PINS.

( ) RT1 22K RESISTOR TRIMMER
( ) RT2 47K " "

SOLDER THE RESISTOR TRIMMER LEADS

( ) TOGGLE SWITCHES

( ) SOLDER 1" LENGTH OF BARE BUS WIRE (RESISTOR LEAD CLIPPINGS ARE IDEAL) TO EACH TERMINAL ON EACH OF THE THREE TOGGLE SWITCHES.

( ) INSTALL THE TWO-POSITION SWITCHES IN S1 AND S2. INSTALL THE THREE-POSITION SWITCH IN S3. *DO NOT SOLDER*. POSITION THE SWITCHES SO THAT THE ANTIROTATION SLOT IS DOWN.

BEND THE BUS WIRES AND POSITION THE SWITCHES SO THAT THE WIRE FROM THE BOTTOM SWITCH TERMINAL PASSES INTO THE CIRCUIT CARD PAD CLOSEST TO THE FRONT PANEL.

PASS THE WIRE FROM THE MIDDLE SWITCH TERMINAL TO THE MIDDLE CIRCUIT CARD PAD.

PASS THE WIRE FROM THE TOP SWITCH TERMINAL TO THE REMAINING PAD.

TEMPORARILY INSTALL THE CIRCUIT CARD IN THE CHASSIS WITH THE SWITCHES PROTRUDING THROUGH THE FRONT PANEL.

( ) WHEN ALL SWITCHES ARE PROPERLY ALIGNED WITH THE CIRCUIT CARD AND THE FRONT PANEL, SOLDER THE LEADS TO THE CIRCUIT CARD.

( ) LIGHT EMITTING DIODE (L1)

WITH THE CIRCUIT CARD TEMPORARILY INSTALLED IN THE CHASSIS AND WITH THE SWITCHES PROTRUDING THROUGH THE FRONT PANEL, ORIENT THE LED SO THAT THE FLAT SIDE OF THE LENS IS FACING SWITCH S2. BEND THE LEADS SO THE LED LENS PROTRUDES THROUGH THE HOLE IN THE FRONT PANEL BETWEEN S1 AND S2. SOLDER THE LED IN PLACE.

( ) EARPLUG CABLE

STRIP 1¼" OF THE PLASTIC SHEATH FROM ONE END OF THE SHIELDED AUDIO CABLE. BE VERY CAREFUL NOT TO NICK THE SHIELD WIRES. STRIP ¼" OF INSULATION FROM THE END OF THE CENTER CONDUCTOR. CONNECT THE CENTER CONDUCTOR TO THE "EARPLUG" PAD. CONNECT THE SHIELD TO THE "GND" PAD. SECURE THE CABLE TO THE CIRCUIT CARD WITH A CABLE TIE AND SOLDER BOTH LEADS.

( ) AUX-MIC CABLE

STRIP 3/4" OF THE PLASTIC SHEATH FROM ONE END OF THE SHIELDED AUDIO CABLE. BE VERY CAREFUL NOT TO NICK THE SHIELD WIRES. STRIP 1/4" OF THE INSULATION FROM THE END OF THE CENTER CONDUCTOR. CONNECT THE CENTER CONDUCTOR TO EITHER THE "MIC" OR THE "AUX" PAD DEPENDING ON WHICH INPUT YOU INTEND TO USE ON YOUR CASSETTE RECORDER (AUX IS PREFERRED IF YOUR RECORDER HAS AN AUX INPUT). CONNECT THE SHIELD TO THE "GND" PAD. SECURE THE CABLE TO THE CIRCUIT CARD WITH A CABLE TIE AND SOLDER BOTH LEADS.

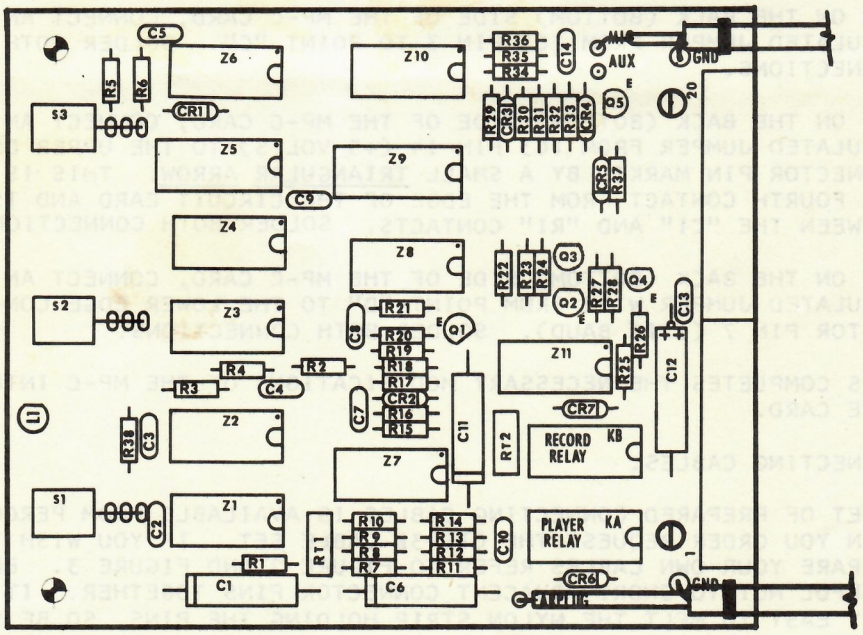
WARNING: SOME RECORDERS HAVE COMMON RETURN CIRCUITS ON THE EARPLUG AND INPUT JACKS WHICH MAY CAUSE GROUND LOOP HUM AND NOISE IF BOTH EARPLUG AND AUX (OR MIC) RETURNS ARE EXTERNALLY GROUNDED. IF THIS IS A PROBLEM, DISCONNECT THE AUX (OR MIC) SHIELD AND LEAVE IT DISCONNECTED. THE EARPLUG RETURN WILL PROVIDE THE RETURN CIRCUIT.

WARNING: SOME RECORDERS LEAVE THE BUILT-IN MICROPHONE ACTIVE EVEN IF A PLUG IS INSERTED INTO THE AUX JACK. THIS WILL ALLOW ROOM NOISE TO 'CLOBBER' YOUR RECORDING. USE THE MICROPHONE JACK OR STICK A 'DUMMY' PLUG INTO THE MICROPHONE HACK TO DISABLE THE BUILT-IN MICROPHONE.

( ) CHASSIS ASSEMBLY

INSTALL THE ASSEMBLED CIRCUIT CARD IN THE CHASSIS USING THE FOUR THREADED SPACERS AND THE 4-40X1/4" MACHINE SCREWS.

TIGHTEN THE NUTS SECURING THE SWITCHES TO THE FRONT PANEL. A NUT AND LOCK WASHER MUST BE BEHIND THE PANEL AND A NUT IN FRONT OF THE PANEL. TO AVOID MARRING THE PANEL, SECURE EACH SWITCH BY TIGHTENING THE NUT *BEHIND THE PANEL*.



CIRCUIT CARD ASSEMBLY
CIS-3Ø
FIGURE 1

CONNECTING TO THE SWTP 6800 COMPUTER:

THE CIS-3Ø+ IS CONNECTED TO EITHER THE CONTROL (MP-C) OR SERIAL (MP-S) INTERFACES OF THE SWTP 68ØØ COMPUTER. INSTRUCTIONS FOR CONNECTING TO THE MP-S INTERFACE ARE CONTAINED IN APPENDIX D.

ADAPTING THE MP-C CONTROL INTERFACE:

IT IS NECESSARY TO ADD THREE JUMPERS TO THE BACK (BOTTOM) OF THE MP-C INTERFACE CARD TO SUPPLY THE CIS-3Ø+ CASSETTE INTERFACE WITH +5 VOLTS AND A 19.2KHZ CLOCK SOURCE. THESE JUMPERS DO NOT DAMAGE THE MP-C IN ANY WAY. THE FIRST JUMPER SHOULD BE INSTALLED ON ALL MP-C INTERFACE CARDS TO CORRECT FOR A FLAW IN THE MIKBUG^{R} MONITOR PROGRAM. YOU WILL WANT TO INSTALL THIS JUMPER EVEN IF YOU DO NOT USE THE PERCOM CIS-3Ø+.

( ) REMOVE ANY JUMPERS CONNECTED TO PADS "C" AND "D" ON THE MP-C INTERFACE CARD.

( ) REMOVE THE INDEXING PLUG FROM THE UPPER CONNECTOR ON THE MP-C INTERFACE CARD. THIS CONTACT WILL BE USED TO PASS +5 VOLTS TO THE CIS-3Ø+

( ) ON THE BACK (BOTTOM) SIDE OF THE MP-C CARD, CONNECT AN INSULATED JUMPER FROM IC5 PIN 3 TO POINT "C". SOLDER BOTH CONNECTIONS.

( ) ON THE BACK (BOTTOM) SIDE OF THE MP-C CARD, CONNECT AN INSULATED JUMPER FROM IC3 PIN 14 (+5 VOLTS) TO THE UPPER EDGE CONNECTOR PIN MARKED BY A SMALL TRIANGULAR ARROW. THIS IS THE FOURTH CONTACT FROM THE EDGE OF THE CIRCUIT CARD AND IS BETWEEN THE "CI" AND "RI" CONTACTS. SOLDER BOTH CONNECTIONS.

( ) ON THE BACK (BOTTOM) SIDE OF THE MP-C CARD, CONNECT AN INSULATED JUMPER WIRE FROM POINT "D" TO THE LOWER EDGE CONNECTOR PIN 7 (12ØØ BAUD). SOLDER BOTH CONNECTIONS.

THIS COMPLETES THE NECESSARY MODIFICATIONS OF THE MP-C INTERFACE CARD.

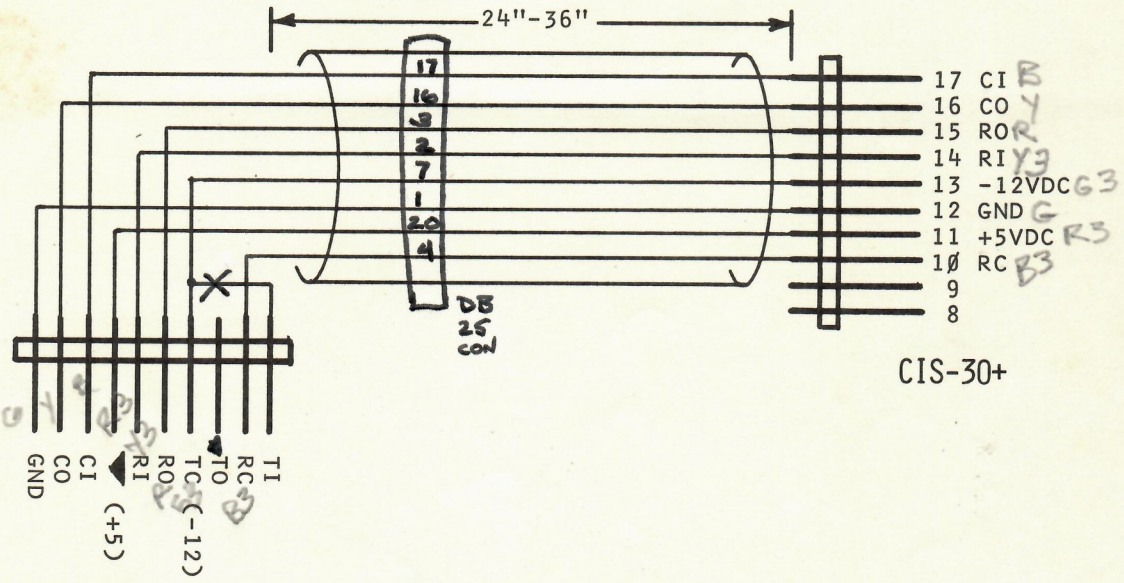
CONNECTING CABLES:

A SET OF PREPARED CONNECTING CABLES IS AVAILABLE FROM PERCOM. WHEN YOU ORDER REQUEST THE CIS-3Ø CABLE SET. IF YOU WISH TO PREPARE YOUR OWN CABLES REFER TO FIGURE 2 AND FIGURE 3. BE CAREFUL NOT TO SHORT ADJACENT CONNECTOR PINS TOGETHER. IT IS VERY EASY TO MELT THE NYLON STRIP HOLDING THE PINS, SO BE SURE TO HEATSINK EACH PIN BETWEEN THE SOLDER POINT AND THE NYLON STRIP.

THE CIS-3Ø+ IS DESIGNED TO BE CONNECTED TO DATA TERMINALS WHICH FEATURE AN RS-232 INTERFACE. IT CANNOT BE CONNECTED TO CURRENT LOOP DEVICES.

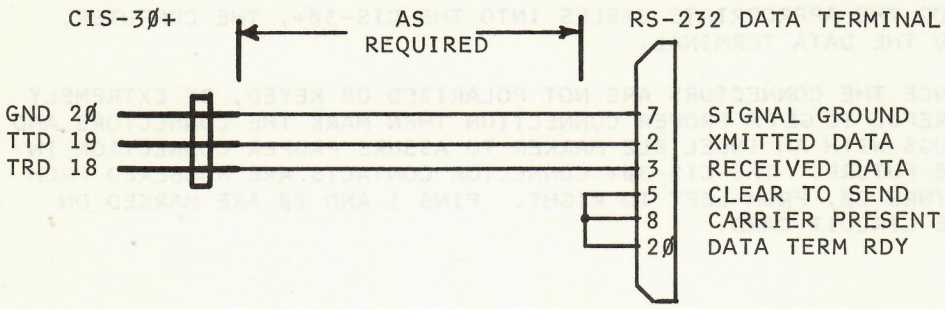
PLUG THE APPROPRIATE CABLES INTO THE CIS-3Ø+, THE COMPUTER, AND THE DATA TERMINAL.

SINCE THE CONNECTORS ARE NOT POLARIZED OR KEYED, BE EXTREMELY CAREFUL TO GET A PROPER CONNECTION THEN MARK THE CONNECTORS AND PLUGS WITH AN INDELIBLE MARKER TO ASSURE PROPER CONNECTION IN THE FUTURE. THE CIS-3Ø+ CONNECTOR CONTACTS ARE NUMBERED FROM 1 THRU 2Ø, FROM LEFT TO RIGHT. PINS 1 AND 2Ø ARE MARKED ON THE CIRCUIT CARD.



INTERCONNECTING CABLE 3ØA

FIGURE 2



RS-232 CABLE 3ØB

FIGURE 3

CIRCUIT ADJUSTMENTS:

( ) AFTER TRIPLE CHECKING AND MARKING ALL CONNECTIONS, TURN ON THE POWER.

( ) MEASURE THE VOLTAGE ACROSS THE 25 UFD ELECTROLYTIC CAPACITOR (C12). IT MUST BE 5±Ø.2 VOLTS.

VCO ADJUSTMENT:

( ) MEASURE THE VOLTAGE AT THE END OF R19 NEAREST Q1. USE A HIGH IMPEDANCE (2ØK OHMS/VOLT) VOLTMETER. CONNECT THE VOLTMETER RETURN TO GROUND. IT SHOULD READ APPROXIMATELY 2 VOLTS. NOTE THE EXACT READING.

( ) WITH A CLIP LEAD OR PIECE OF WIRE, JUMPER FROM THE END OF R34 NEAREST Z1Ø TO THE EARPLUG CENTER CONDUCTOR.

( ) WHILE NOTING THE VOLTMETER READING AT R19 ADJUST TRIMMER RT2. AT SOME POINT IN THE ADJUSTMENT THE VCO WILL 'JUMP INTO LOCK' AND THE VOLTAGE AT R19 WILL FOLLOW THE TRIMMER ADJUSTMENT. ADJUST THE TRIMMER WHEN 'IN LOCK' FOR EXACTLY THE SAME VOLTAGE READING NOTED EARLIER.

DATA RECOVERY ADJUSTMENT:

( ) SET S1 TO THE "ON" POSITION

( ) CONNECT AN AUDIO OSCILLATOR TO THE EARPLUG INPUT. SET THE OSCILLATOR FOR 18ØØ HZ AND ADJUST THE LEVEL UNTIL THE LED ON THE FRONT PANEL TURNS ON.

IF AN AUDIO OSCILLATOR IS NOT AVAILABLE YOU MAY USE THE TEST CASSETTE AVAILABLE FROM PERCOM. THE CASSETTE CONTAINS A PRERECORDED 18ØØ HZ TONE.

( ) CONNECT A VOLTMETER TO EDGE CONNECTOR PIN 14 (RI). ADJUST TRIMMER RT1 UNTIL THE LEVEL AT THE VOLTMETER JUST CHANGES OR FLUTTERS. GET THE ADJUSTMENT AS CLOSE TO THE POINT OF CHANGE OR FLUTTER AS POSSIBLE. IF THE OSCILLATOR IS DECREASED BELOW 18ØØ HZ THE VOLTMETER SHOULD READ POSITIVE. IF THE OSCILLATOR FREQUENCY IS RAISED ABOVE 18ØØ HZ THE VOLTMETER SHOULD READ NEGATIVE.

OPERATING PROCEDURE:

CASSETTE SELECTION AND CARE:

THE CHOICE OF CASSETTETAPE HAS MORE EFFECT ON PERFORMANCE THAN ALL OTHER FACTORS COMBINED. GET THE VERY BEST TAPE YOU CAN BUY. ANYTHING LESS THAN THE BEST WILL RESULT IN MUCH FRUSTRATION. AVOID USING THE C9Ø AND C12Ø CASSETTES. THE TAPE IS TOO THIN AND FRAGILE. C6Ø AND SHORTER LENGTHS ARE MUCH MORE RUGGED AND RELIABLE.

WE HAVE HAD EXCELLENT RESULTS WITH THE MEMOREX MRX2 AND SCOTCH HE CASSETTE TAPE. C3Ø AND C45 ARE PREFERRED LENGTHS. THERE MAY BE OTHER EQUALLY SUITABLE BRANDS. CRITICALLY EXAMINE THE PRESSURE PAD OF A PROSPECTIVE CASSETTE. AN OVERSIZED PAD SUCH AS IS USED ON THE MEMOREX MRX2 IS PREFERRED FOR UNIFORM TAPE-TO-HEAD CONTACT. THE PAD SHOULD BE FREE OF LUMPS AND LOOSE LINT PARTICLES.

IF THE CASSETTE IS NOT IN USE IT SHOULD BE STORED IN ITS CONTAINER IN A DUST FREE LOCATION. KEEP THE CASSETTE RECORDER SPOTLESSLY CLEAN. CLEAN THE HEAD, CAPSTAN, AND PINCH ROLLER WITH A CLEANING SOLUTION SUGGESTED BY THE EQUIPMENT MANUFACTURER. DO NOT SMOKE IN THE ROOM IN WHICH THE CASSETTE EQUIPMENT IS USED OR STORED.

MANY TIMES ERRORS ARE CAUSED BY LINT FIBERS AND DUST WHICH CAN BE REMOVED WITH TWEEZERS OR AN AIR BLAST. IF THE ERROR IS CAUSED BY A PERMANENT FLAW IN THE TAPE THE LOCATION CAN BE NOTED AND AVOIDED. THE GOOD PORTIONS OF A TAPE WITH FLAWS CAN ALSO BE RESPOOLED INTO ANOTHER CASSETTE CASE.

IT IS IMPOSSIBLE TO ADEQUATELY STRESS THE IMPORTANCE OF BUYING THE VERY BEST QUALITY TAPE AND THEN KEEPING IT AND THE TAPE UNIT CLEAN.

IT IS RECOMMENDED THAT EACH CASSETTE BE THOROUGHLY TESTED BEFORE USE. REFER TO APPENDIX C FOR INSTRUCTIONS.

FRONT PANEL SWITCHES:

RATE SWITCH: CONTROLS THE RATE AT WHICH THE COMPUTER WILL SEND AND RECEIVE DATA TO/FROM THE DATA TERMINAL AND CASSETTE. IF YOU WISH TO RECORD OR PLAY 'KANSAS CITY' STANDARD CASSETTES, THE RATE SWITCH MUST BE IN THE "3ØØ" POSITION.

TERMINAL SWITCH: THIS SWITCH SHOULD NORMALLY BE IN THE "LINE" POSITION TO PERMIT PROPER DATA TRANSFER BETWEEN THE DATA TERMINAL AND THE COMPUTER. IF YOU WISH TO USE THE DATA TERMINAL WITHOUT GOING THROUGH THE COMPUTER, SWITCH TO THE "LOCAL" POSITION. THIS WILL ALSO PERMIT YOU TO READ A PRERECORDED CASSETTE.

NOTICE: IF YOU ARE READING A CASSETTE IN THE "LOCAL" MODE, THE TAPE SPEED VARIATIONS CHARACTERISTIC OF PORTABLE AUDIO CASSETTE PLAYERS MAY CAUSE THE PLAYBACK DATA TO BE PASSED AT A BIT RATE SLOWER OR FASTER THAN THE DATA TERMINAL IS CAPABLE OF ACCEPTING. THIS SHOULD NOT BE CAUSE FOR ALARM NOR SHOULD IT BE INTERPRETED AS A CASSETTE ERROR. WHEN THE DATA FROM CASSETTE IS TRANSMITTED TO THE COMPUTER IT IS ACCOMPANIED BY A TIMING PULSE (CLOCK) WHICH IS DERIVED FROM THE RECORDED DATA AND IS IN STEP WITH THE DATA DESPITE TAPE SPEED VARIATION. MOST DATA TERMINALS ARE TIMED FROM THEIR OWN INTERNAL REFERENCE AND ARE SENSITIVE TO RELATIVELY MINOR (±6%) VARIATIONS IN TAPE SPEED.

TAPE SWITCH: CONTROLS SELECTION OF THE DATA TERMINAL OR CASSETTE AS DATA SOURCE FOR THE COMPUTER. IN THE "AUTO" POSITION THE SELECTION IS CONTROLLED BY THE COMPUTER (VIA THE RC OUTPUT FROM THE MP-C OR MP-S INTERFACE CARDS). THE MIKBUG^{R} MONITOR SELECTS THE CASSETTE WHENEVER YOU COMMAND A PROGRAM LOAD (L). SEE INSTRUCTIONS EØØA THRU EØØE OF THE MIKBUG^{R} PROGRAM LISTING. CONTROL IS RETURNED TO THE DATA TERMINAL KEYBOARD WHEN THE LOAD TERMINATES OR WHEN YOU PUSH THE COMPUTER PANEL RESET BUTTON. IF YOU WISH TO SELECT THE CASSETTE AS A DATA SOURCE IN A MODE WHEN THE COMPUTER HAS NOT TURNED ON THE RC OUTPUT, FLIP THE SWITCH TO THE "ON" POSITION. WHEN YOU ARE FINISHED BE SURE TO FLIP THE SWITCH BACK TO "AUTO" TO RETURN CONTROL TO THE DATA TERMINAL KEYBOARD.

RECORDING DATA ON TAPE:

1. SET THE PANEL SWITCH TO THE DESIRED DATA RATE (THE TERMINAL MUST BE AT THE SAME RATE AS THE CASSETTE), LINE MODE, AND AUTO.

2. DO NOT RECORD ON THE FIRST TWO FEET OF TAPE (15 SECONDS). THE LEADER-TAPE SPLICE CAUSES A 'RIPPLE' ON ADJACENT LAYERS WHICH MAY CAUSE ERRORS.

3. PREPARE THE COMPUTER TO OUTPUT THE REQUIRED DATA TO CASSETTE (SET THE START AND FINISH ADDRESS IN AØØ2 THRU AØØ5 IF YOU ARE USING MIKBUG^{R}). DO NOT BEGIN OUTPUTTING THE DATA JUST YET.

4. PLACE THE CASSETTE RECORDER IN RECORD MODE AND START THE TAPE. TURN ON THE AUTOMATIC LEVEL CONTROL OR ADJUST THE RECORDER FOR PROPER SIGNAL LEVEL. HIGHEST QUALITY RECORDINGS WILL BE MADE WITH THE AUTOMATIC LEVEL CONTROL OFF OR DISABLED.

5. ALLOW THE TAPE TO RUN FOR 3 TO 5 SECONDS. THE RECORDER WILL BE RECORDING A 24ØØ HZ 'LEADIN' TONE ON THE TAPE DURING THIS INTERVAL.

6. WHILE ALLOWING THE TAPE TO RUN, CAUSE THE COMPUTER TO BEGIN TRANSFERRING DATA TO THE CASSETTE INTERFACE (BY TYPING P IF YOU ARE USING MIKBUG^{R}).

7. WHEN THE RECORDING IS COMPLETE, LET THE TAPE RUN FOR A FEW SECONDS TO RECORD A 'LEADOUT' TONE.

A CASSETTE RECORDER WITH A DIGITAL COUNTER GREATLY SIMPLIFIES THE PROBLEM OF LOCATING A PREVIOUSLY RECORDED PROGRAM OR FILE. SIMPLY NOTE THE COUNTER READING WHEN YOU BEGIN AND END A RECORDING.

PLAYBACK:

1. THE LED BETWEEN THE TERMINAL AND TAPE SWITCHES INDICATES PROPER INPUT SIGNAL LEVEL FROM THE CASSETTE PLAYER. THE VOLUME CONTROL OF THE CASSETTE PLAYER SHOULD BE SET SO THAT THE LAMP FLICKERS WHEN PLAYING A PRERECORDED CASSETTE. IF THE LAMP IS ON CONTINUOUSLY, THE VOLUME IS TOO HIGH. ADJUST THE TONE CONTROL (IF ONE EXISTS) FOR MAXIUM RESPONSE.

2. LOCATE THE 'LEADIN' 2400 HZ TONE PRECEDING THE DESIRED BLOCK OF DATA. IF A SMALL SPEAKER OR EARPLUG IS CONNECTED TO THE EARPLUG LINE INSIDE THE CIS-30+, THE TONE CAN BE HEARD WITHOUT PULLING OUT THE EARPLUG LEAD FROM THE CASSETTE PLAYER.

3. WITH THE TAPE RUNNING ON THE 'LEADIN' TONE BUT BEFORE THE CASSETTE BEGINS OUTPUTTING DATA, PREPARE THE COMPUTER TO ACCEPT THE DATA WHEN IT ARRIVES. (TYPE "L" IF YOU ARE USING MIKBUG^{R}).

BE CERTAIN THE PLAYBACK IS ONE OR TWO SECONDS INTO THE 'LEADIN' TONE BEFORE ALLOWING THE COMPUTER TO ACCEPT THE PLAYBACK DATA. THIS IS TO AVOID READING THE 'RESIDUALS' FROM PREVIOUS RECORDINGS AND THE 'TRASH' CAUSED BY TURNING THE CASSETTE RECORDER ON AND OFF. SUFFICIENT TIME IS AVAILABLE TO PERFORM THE NECESSARY STEPS IF THE TAPE WAS RECORDED WITH A 3 TO 5 SECOND 'LEADIN' TONE. IF YOU ARE USING MIKBUG^{R}, THE CASSETTE MUST BE PLAYING OUT THE 'LEADIN' TONE WHEN YOU TYPE 'L'.

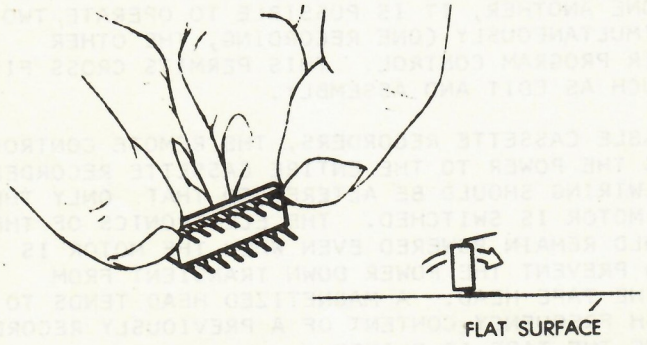
4. IF THE RECORDED DATA HAS AN 'END-OF-FILE' CODE AT THE END OF THE RECORDED BLOCK OF DATA, THE COMPUTER CAN BE MADE TO AUTOMATICALLY IGNORE THE CASSETTE OUTPUT AFTER THE 'EOF' CODE. IF NO SUCH INDICATION EXIST, THE USER WILL HAVE TO DISABLE THE COMPUTER BEFORE TURNING OFF THE TAPE TO PREVENT THE TURNOFF TRANSIENT FROM SENDING CONFUSING 'TRASH' TO THE COMPUTER. OBVIOUSLY A DATA BLOCK TERMINATED WITH SOME FORM OF 'END-OF-FILE' INDICATION IS PREFERRED. FORTUNATELY THE MIKBUG^{R} FORMAT CONTAINS PROPER BEGINNING-OF-FILE (S1) AND END-OF-FILE (S9) INDICATION.

REFER TO APPENDIX B FOR INFORMATION ON SEMIAUTOMATIC OPERATION USING THE CASSETTE RECORDER REMOTE CONTROL JACK.

APPENDIX A

LOADING DIP (DUAL IN-LINE PACKAGE) DEVICES

MOST DIP DEVICES HAVE THEIR LEADS SPREAD SO THAT THEY CAN NOT BE DROPPED STRAIGHT INTO THE BOARD. HOLD THE SIDE OF THE CHIP FIRMLY AGAINST THE FLAT SURFACE WITH BOTH HANDS, ROTATE IT A SHORT DISTANCE TOWARD ITS PINS UNTIL IT IS IN A FULL VERTICAL POSITION. THIS WILL PUT ITS BODY AT A RIGHT ANGLE TO THE ROW OF PINS. PLACE THE OTHER ROW OF PINS ON THE FLAT SURFACE AND REPEAT THE PROCESS AS ABOVE.



(1) ORIENT THE DEVICE PROPERLY. PIN 1 IS INDICATED BY A SMALL EMBOSSED DOT ON THE TOP SURFACE OF THE DEVICE AT ONE CORNER. PINS ARE NUMBERED COUNTERCLOCKWISE FROM PIN 1.

(2) INSERT THE PINS ON ONE SIDE OF THE DEVICE INTO THEIR HOLES ON THE PRINTED CIRCUIT CARD. DO NOT PRESS THE PINS ALL THE WAY IN, BUT STOP WHEN THEY ARE JUST STARTING TO EMERGE FROM THE OPPOSITE SIDE OF THE CARD.

(3) EXERT A SIDEWAYS PRESSURE ON THE PINS AT THE OTHER SIDE OF THE DEVICE BY PRESSING AGAINST THEM WHERE THEY ARE STILL WIDE BELOW THE BEND. BRING THIS ROW OF PINS INTO ALIGNMENT WITH ITS HOLES IN THE PRINTED CIRCUIT CARD AND INSERT THEM AN EQUAL DISTANCE, UNTIL THEY BEGIN TO EMERGE.

(4) PRESS THE DEVICE STRAIGHT DOWN UNTIL IT SEATS ON THE POINTS WHERE THE PINS WIDEN.

(5) TURN THE CARD OVER AND SELECT TWO PINS AT OPPOSITE CORNERS OF THE DEVICE. USING A FINGERNAIL OR A PAIR OF LONG-NOSE PLIERS, PUSH THESE PINS OUTWARDS UNTIL THEY ARE BENT AT A 45 DEGREE ANGLE TO THE SURFACE OF THE CARD. THIS WILL SECURE THE DEVICE UNTIL IT IS SOLDERED.

APPENDIX B:

REMOTE CONTROL:

MOST CASSETTE RECORDERS HAVE REMOTE CONTROL INPUT WHICH SIMPLY TURNS THE POWER TO THE CASSETTE UNIT ON OR OFF. THIS INPUT CAN BE EASILY SWITCHED WITH A RELAY DRIVEN BY THE COMPUTER PROGRAM. THE CIS-3Ø INCLUDES PROVISION FOR TWO DIP REED RELAYS (EXTRA COST OPTION) WHICH MAY BE CONTROLLED BY COMMANDS FROM THE PROCESSOR. SINCE THE CIS-3Ø RECORD AND PLAYBACK CIRCUITS ARE COMPLETELY INDEPENDENT OF ONE ANOTHER, IT IS POSSIBLE TO OPERATE TWO TAPE UNITS SIMULTANEOUSLY (ONE RECORDING, THE OTHER READING) UNDER PROGRAM CONTROL. THIS PERMITS CROSS FILE OPERATIONS SUCH AS EDIT AND ASSEMBLY.

IN MOST PORTABLE CASSETTE RECORDERS, THE REMOTE CONTROL JACK SWITCHES THE POWER TO THE ENTIRE CASSETTE RECORDER. THE RECORDER WIRING SHOULD BE ALTERED SO THAT ONLY THE POWER TO THE MOTOR IS SWITCHED. THE ELECTRONICS OF THE RECORDER SHOULD REMAIN POWERED EVEN WHEN THE MOTOR IS TURNED OFF TO PREVENT THE POWER DOWN TRANSIENT FROM MAGNETIZING THE TAPE HEAD. A MAGNETIZED HEAD TENDS TO ERASE THE HIGH FREQUENCY CONTENT OF A PREVIOUSLY RECORDED TAPE EACH TIME THE TAPE IS PLAYED.

MOST CASSETTE TAPE RECORDERS REQUIRE FROM ONE TO THREE SECONDS TO STABLIZE AFTER THE REMOTE CONTROL IS TURNED ON. CARE SHOULD BE TAKEN TO PREVENT THE 'TRASH' GENERATED DURING THIS STABILIZING PERIOD FROM CONFUSING THE COMPUTER OR ITS PROGRAM. THE FOLLOWING PROGRAMS SUGGEST HOW TO HANDLE THESE 'TRASH' INTERVALS.

TO BE QUITE FRANK, REMOTE CONTROL IS OF VERY LIMITED VALUE WHEN USED WITH ORDINARY CASSETTE RECORDERS. YOU HAVE TO PUSH ONE OR MORE BUTTONS MANUALLY BEFORE YOU CAN BEGIN TO USE THE REMOTE INPUT. FURTHERMORE THE START UP TIME OF MOST CASSETTE RECORDERS IS SO LONG YOU WILL PROBABLY SPEND MORE TIME GENERATING AND BYPASSING INTERRECORD GAPS THAN WRITING AND READING DATA.

IF THE CASSETTE RECORDER IS STOPPED BY THE REMOTE CONTROL INPUT, THE PINCH ROLLER PRESSES THE TAPE AGAINST THE CAPSTAN. IF LEFT IN THIS CONDITON THE TAPE WILL BECOME PERMANENTLY CREASED AND USELESS.

THE CASSETTE IS USED MOST EFFICIENTLY IN SAVING AND LOADING PROGRAMS AND THESE FUNCTIONS ARE BEST PERFORMED MANUALLY.

CAREFULLY CONSIDER YOUR INTENDED USE OF THE REMOTE CONTROL FUNCTION. IT MAY NOT BE AS WORTHWILE AS IT FIRST APPEARS.

WHEN CONTROLLING THE CASSETTE RECORDER REMOTELY, IT IS NECESSARY TO ALLOW SUFFICIENT TIME FOR THE CASSETTE RECORDER TO STABILIZE BEFORE RECORDING OR READING DATA. SINCE THE RESIDENT OPERATING SYSTEM IN THE SWTP 68ØØ COMPUTER WAS DESIGNED TO DUMP AND LOAD PROGRAMS FROM PAPER TAPE (ASR-33), IT DOES NOT PROVIDE THE NECESSARY START UP TIME DELAYS REQUIRED BY THE CASSETTE RECORDER. THE FOLLOWING ROUTINES ILLUSTRATE SUGGESTED PROCEDURE.

IN THESE ROUTINES, REMOTE CONTROL RELAY KA IS CONTROLLED BY THE RC OUTPUT FROM THE MP-C AND MP-S INTERFACE CARDS. IT IS ASSUMED RELAY KB IS CONTROLLED BY AN AUXILIARY DEVICE SUCH AS THE CURSOR CONTROL CARD MANUFACTURED BY SWTP AND IS RESPONSIVE TO "PUNCH-ON" AND "PUNCH-OFF" COMMANDS. RELAY KB MAY ALSO BE CONTROLLED BY ONE OF THE OUTPUTS FROM AN MP-L (PARALLEL INTERFACE CARD). RELAY KA CONTROLS THE CASSETTE PLAYER; RELAY KB CONTROLS THE RECORDER. IF ONLY ONE CASSETTE UNIT IS USED FOR BOTH RECORD AND PLAYBACK, THE INSTRUCTIONS CONTROLLING RELAY KB MUST BE CHANGED.

RECORD:

THIS PROGRAM STARTS THE RECORDER, WAITS 5 SECONDS TO PERMIT THE RECORDER TO STABILIZE THEN JUMPS INTO THE MIKBUG^{r} PUNCH ROUTINE. SETUP THE START AND FINISH ADDRESSES IN AØØ2 THRU AØØ5 BUT DO NOT TYPE P. INSTEAD GO TO THIS ROUTINE (IF YOU ARE INITIATING THE RECORDING MANUALLY, SETUP THE ROUTINE ADDRESS IN AØ48 AND AØ49 THEN TYPE "G").

```
CODE      LABEL   INSTRUCTION     COMMENTS
86 12             LDAA #$12       TURN ON THE RECORDER
BD EØ 75          JSR  OUTCH
CE ØC ØØ          LDX  #$ØCØØ     SETUP 5 SEC TIME DELAY
4F                CLRA
4C          TD1   INCA            TIME DELAY
26 FD             BNE  TD1
Ø9                DEX
26 FA             BNE  TD1
7E E1 42          JMP  $E142      JUMP TO MIKBUGr PUNCH
```

UNFORTUNATELY THE MIKBUG^{r} FIRMWARE DOES NOT TURN OFF THE CASSETTE RECORDER.

THE FOLLOWING SEQUENCE WILL TURN OFF THE CASSETTE RECORDER AND MAY BE INSERTED IN PROGRAMS REQUIRING THIS FUNCTION.

```
CODE            INSTRUCTION
86  14          LDAA  #$14
BD  EØ 75       JSR   OUTCH
```

PLAYBACK:

THE FOLLOWING PROGRAM STARTS THE CASSETTE PLAYER THEN REQUIRES THAT THE FILE BE PRECEDED BY ONE SECOND OF "TRASH FREE" LEADER TONE. IT THEN JUMPS INTO THE MIKBUG^{r} LOAD ROUTINE.

INSTEAD OF TYPING "L" TO INTIATE A PROGRAM LOAD, GO TO THIS PROGRAM (IF YOU ARE INITIATING THE LOAD MANUALLY, SET UP THE ROUTINE ADDRESS IN AØ48 AND AØ49 THEN TYPE "G").

```
CODE      LABEL   INSTRUCTION     COMMENTS
86 3C             LDAA #$3C       TURN ON CASSETTE PLAYER
B7 8Ø Ø7          STAA $8ØØ7
CE FF FF  RST     LDX  #$FFFF     SET UP 1 SEC LOOP
B6 8Ø Ø4  DLY     LDAA $8ØØ4      INPUT CASSETTE
2A F8             BPL  RST        RESTART IF TRASH OR NO SIGNAL
Ø9                DEX             TIME DELAY LOOP
26 F8             BNE  DLY
73 EØ 13          JMP  $EØ13      JUMP TO MIKBUG$^{r}$ LOAD
```

WHEN THE LOAD IS COMPLETED (THE LOADER ROUTINE DETECTS AN "S9") MIKBUG^{r} WILL TURN OFF THE CASSETTE PLAYER AUTOMATICALLY.

THE FOLLOWING SEQUENCE WILL TURN OFF THE CASSETTE PLAYER AND MAY BE INCLUDED IN PROGRAMS REQUIRING THIS FUNCTION.

```
CODE            INSTRUCTION
86 34           LDAA #$34
B7 8Ø Ø7        STAA $8ØØ7
```

APPENDIX C:

'CERTIFYING' THE TAPE:

FOR BEST RESULTS A TAPE CASSETTE SHOULD BE TESTED BEFORE USE TO DETERMINE IF IT CONTAINS FLAWS WHICH WILL CREATE ERRORS. COMPUTER GRADE TAPE IS SUBJECTED TO A SERIES OF TESTS WHICH 'CERTIFY' ITS FREEDOM FROM SUCH ERROR PRODUCING FLAWS. SINCE 'CERTIFIED' CASSETTES SELL FOR TWO TO FOUR TIMES THE PRICE OF HIGH QUALITY AUDIO CASSETTES, YOU WILL PROBABLY PREFER TO TEST THE AUDIO QUALITY CASSETTES YOURSELF. THE TEST TO BE DESCRIBED IS NOT AS THOROUGH AS THE COMPUTER GRADE CERTIFICATION PROCEDURE BUT IT IS MORE THAN ADEQUATE FOR THE HOBBYIST.

THE PROCEDURE IS SIMPLY TO RECORD A CONTINUOUS SIGNAL ON TAPE THEN PLAY BACK AT REDUCED LEVEL AND LET THE CASSETTE INTERFACE WATCH FOR LOSS OF SIGNAL. IF THE TAPE PASSES THE TEST AT REDUCED PLAYBACK LEVEL IT IS ALMOST CERTAIN TO BE ADEQUATE UNDER NORMAL LEVEL CONDITIONS.

PROCEDURE:

1. RECORD A CONTINUOUS 24ØØ HZ TONE AT NORMAL OPERATING LEVEL ON THE CASSETTE. THIS CAN BE DONE BY CONNECTING THE TAPE RECORDER TO THE CIS-3Ø CASSETTE INTERFACE SINCE THE INTERFACE GENERATES A 24ØØ HZ SIGNAL WHEN IDLE.

2. LOAD THE FOLLOWING PROGRAM INTO YOUR COMPUTER.

DATA	LABEL	INSTRUCTION		REMARKS
86 3C		LDAA	#$3C	SELECT CASSETTE INPUT
B7 8Ø Ø7		STAA	$8ØØ7	AND START THE PLAYER
B6 8Ø Ø4	LP	LDAA	$8ØØ4	INPUT CASSETTE
2B FB		BMI	LP	LOOP IF NO FAULT
86 34		LDAA	#$34	STOP THE TAPE
B7 8Ø Ø7		STAA	$8ØØ7	
3F		SWI		RETURN TO MIKBUG[r]

3. CONNECT THE CASSETTE PLAYER TO THE EARPLUG INPUT OF THE CIS-3Ø.

4. REDUCE THE PLAYBACK SIGNAL LEVEL TO HALF OF THE NORMAL LEVEL.

5. START THE TAPE AND LET IT RUN FOR TWO TO THREE SECONDS.

6. NOW START THE COMPUTER EXECUTING THE ABOVE PROGRAM. (ENTER THE STARTING ADDRESS IN AØ48 AND AØ49 THEN TYPE G) AS LONG AS THERE ARE NO FLAWS IN THE TAPE THE PROGRAM WILL CONTINUE TO EXECUTE.

CERTIFICATION PROCEDURE CONT'D.

7. WHEN A FLAW IS ENCOUNTERED THE CASSETTE PLAYER WILL TURN OFF (ASSUMING THE REMOTE CONTROL OPTION IS INSTALLED) AND THE PROGRAM WILL RETURN TO THE MIKBUG^{r}.

EXPECT THE PROGRAM TO RETURN TO MIKBUG^{r} AT THE END OF TAPE.

MANY TIMES ERRORS ARE CAUSED BY LINT FIBERS AND DUST WHICH CAN BE REMOVED WITH TWEEZERS OR AN AIR BLAST. IF THE ERROR IS CAUSED BY A PERMANENT FLAW IN THE TAPE THE LOCATION CAN BE NOTED AND AVOIDED. THE GOOD PORTIONS OF A TAPE WITH FLAWS CAN ALSO BE RESPOOLED INTO ANOTHER CASSETTE CASE. EMPTY CASSETTE CASES ARE AVAILABLE FROM RADIO SHACK AND OTHER SOURCES.

WE HAVE HAD EXCELLENT RESULTS WITH MEMOREX MRX2 AND SCOTCH HE CASSETTE TAPE. C3Ø AND C45 ARE PREFERRED LENGTHS. THERE MAY BE OTHER EQUALLY SUITABLE BRANDS. CRITICALLY EXAMINE THE PRESSURE PAD OF A PROSPECTIVE CASSETTE. AN OVERSIZED PAD SUCH AS IS USED ON THE MEMOREX MRX2 IS PREFERRED FOR UNIFORM TAPE-TO-HEAD CONTACT. THE PAD SHOULD ALSO BE FREE OF LUMPS AND LOOSE LINT PARTICLES.

APPENDIX D

CONNECTING TO THE MP-S INTERFACE:

THE CIS-3Ø+ MAY BE CONNECTED TO THE SWTP MP-S INTERFACE IN MUCH THE SAME WAY AS IT IS CONNECTED TO THE MP-C INTERFACE. OBVIOUSLY YOU MUST PROVIDE YOUR OWN SOFTWARE WHEN USING THE MP-S INTERFACE SINCE THE MIKBUG® MONITOR IS THE SWTP COMPUTER COMMUNICATES THROUGH THE MP-C INTERFACE ONLY.

ADAPTING THE MP-S SERIAL INTERFACE:

THERE ARE TWO WAYS TO ADAPT THE MP-S INTERFACE TO THE PERCOM CIS-3Ø+. EACH HAS ADVANTAGES AND DISADVANTAGES. WHICH WAY YOU CHOOSE DEPENDS ON HOW YOU INTEND TO USE THE CASSETTE. WE SUGGEST YOU TRY THE FIRST METHOD TO BE DESCRIBED SINCE IT IS THE EASIEST TO IMPLEMENT. YOU MAY LATER IMPLEMENT THE SECOND METHOD IF YOU FIND IT NECESSARY.

MP-S ADAPTATION PROCEDURE #1:

( ) PROGRAM THE MP-S INTERFACE FOR 12ØØ BAUD. THE PADS ARE MARKED ON THE TOP SIDE OF THE CIRCUIT CARD. USING A 1" PIECE OF #26 INSULATED BUS WIRE, ATTACH AND SOLDER ONE END OF THE WIRE TO THE 12ØØ BAUD RATE SELECTION PAD. ATTACH THE OTHER END OF THE WIRE TO THE PAD ADJACENT TO THIS CONNECTION. REMOVE ANY JUMPER INSTALLED FOR OTHER BAUD RATES.

( ) REMOVE THE INDEXING PLUG FROM THE UPPER CONNECTOR ON THE MP-S INTERFACE CARD. THIS CONTACT WILL BE USED TO PASS +5 VOLTS TO THE CIS-3Ø+.

( ) ON THE BACK (BOTTOM) SIDE OF THE MP-S CARD, CONNECT AN INSULATED JUMPER WIRE FROM IC1 PIN 12 (+5 VOLTS) TO THE UPPER EDGE CONNECTOR PIN MARKED BY A SMALL TRIANGULAR ARROW. THIS IS THE FOURTH CONTACT FROM THE EDGE OF THE CIRCUIT CARD AND IS BETWEEN THE "CI" AN "RI" CONTACTS. SOLDER BOTH CONNECTIONS.

THIS COMPLETES THE ESSENTIAL MODIFICATION TO THE MP-S INTERFACE.

MP-S ADAPTATION PROCEDURE #2:

THE CLOCK WHICH DRIVES THE ACIA (IC-1 ON THE MP-S CARD) IS OBTAINED FROM THE PERCOM CIS-3Ø+. IN ALL MODES EXCEPT CASSETTE PLAYBACK, THIS CLOCK IS DERIVED FROM THE CRYSTAL CONTROLLED CLOCK SOURCE IN THE SWTP 68ØØ COMPUTER (VIA THE BAUD RATE GENERATOR AND THE "CO" OUTPUT FROM THE MP-S CARD). DURING CASSETTE PLAYBACK THE CLOCK WHICH DRIVES THE ACIA RECEIVER IS DERIVED FROM THE DATA RECORDED ON TAPE. THIS IS TO ASSURE THE RELIABILITY OF DATA RECOVERY DESPITE TAPE SPEED VARIATION. BECAUSE OF INEVITABLE TAPE SPEED VARIATIONS DURING PLAYBACK, THE CLOCK DRIVING THE ACIA ON THE MP-S CARD WILL VARY IN STEP WITH THE PLAYBACK TAPE SPEED. THIS IS FINE AND

DESIRABLE FOR THE ACIA RECEIVER CLOCK. HOWEVER, ON THE MP-S INTERFACE THE CLOCK INPUTS TO BOTH THE TRANSMITTER AND RECEIVER SECTIONS OF THE ACIA ARE TIED TOGETHER. THIS MEANS THAT ANY DATA BEING TRANSMITTED BY THE ACIA TRANSMITTER IS BEING CLOCKED BY A SIGNAL WHICH IS VARYING IN STEP WITH THE TAPE SPEED OF THE PLAYBACK DATA GOING TO THE ACIA RECEIVER.

THIS IS NOT A PROBLEM UNLESS DATA IS BEING TRANSMITTED BY THE ACIA TRANSMITTER WHILE THE ACIA RECEIVER IS RECEIVING DATA FROM THE TAPE.

IF YOU PLAN TO RECORD (OR OUTPUT) DATA FROM THE MP-S INTERFACE WHILE SIMULTANEOUSLY READING DATA FROM CASSETTE, IT IS NECESSARY TO MODIFY THE MP-S INTERFACE CARD TO SEPARATE THE TRANSMITTER AND RECEIVER CLOCKS.

( ) PERFORM THE MODIFICATIONS DESCRIBED IN PROCEDURE #1.

( ) ON THE BACK (BOTTOM) SIDE OF THE MP-S CIRCUIT CARD, CUT THE CIRCUIT TRACE GOING TO IC1 PINS 3 AND 4. USE AN XACTO KNIFE AND MAKE THE CUT CAREFULLY SO THAT IT MAY BE REPAIRED LATER IF YOU WISH.

( ) ON THE BACK (BOTTOM) SIDE OF THE MP-S CIRCUIT CARD, CUT THE CIRCUIT TRACE BETWEEN IC1 PINS 3 AND 4 THEREBY SEPARATING PINS 3 AND 4.

( ) STRIP 1/4" FROM EACH END OF A SHORT LENGTH OF #26 INSULATED BUS WIRE. ON THE BACK (BOTTOM) SIDE OF THE MP-S CARD CONNECT ONE END OF THE WIRE TO IC1 PIN 3. CONNECT THE OTHER END OF THE WIRE TO THE CIRCUIT TRACE WHICH WAS CUT EARLIER. THERE IS A FEED THRU HOLE AT THE END OF THE TRACE NEAR IC1 PIN 12 WHICH MAY BE USED TO CONNECT THE WIRE.

( ) STRIP 1/4" FROM EACH END OF ANOTHER SHORT LENGTH OF #26 INSULATED BUS WIRE. ON THE BACK (BOTTOM) SIDE OF THE MP-S CARD, CONNECT ONE END OF THE WIRE TO IC1 PIN 4. CONNECT THE OTHER END OF THE WIRE TO THE BAUD RATE SELECTION PAD FOR THE RATE AT WHICH YOU WISH THE MP-S TRANSMITTER TO OPERATE.

WITH THIS MODIFICATION, THE MP-S TRANSMITTED OUTPUT DATA RATE IS CONTROLLED BY THE WIRE JUMPER CONNECTED TO IC1 PIN 4. IT IS NOT CONTROLLED BY THE RATE SWITCH ON THE PANEL OF THE CIS-3Ø+.

IF YOU WISH, PERCOM WILL PERFORM THE ABOVE DESCRIBED MODIFICATIONS FOR YOU FOR A $5.ØØ CHARGE PLUS SHIPPING. THE MODIFICATION WILL BE MADE ONLY ON MP-S INTERFACE CARDS WHICH ARE ASSEMBLED AND WHICH FUNCTION PROPERLY IN OUR TEST FIXTURE. YOUR LOCAL DEALER MAY ALSO ASSIST YOU IN THE MODIFICATION.

USING THE MP-S INTERFACE:

SINCE THE ACIA ON THE MP-S INTERFACE CARD IS A PROGRAMMABLE DEVICE, THE MANNER IN WHICH IT MAY BE USED IS HIGHLY VARIABLE. WE SUGGEST YOU THOROUGHLY STUDY THE INFORMATION REGARDING THE ACIA (MC685Ø) IN THE SWTP 68ØØ SYSTEM DOCUMENTATION NOTEBOOK.

THE PERCOM CIS-3Ø+ IS ESSENTIALLY TWO I/O INTERFACES IN ONE PACKAGE; A CASSETTE I/O AND A DATA TERMINAL I/O. THE READER CONTROL (RC) OUTPUT FROM THE MP-S INTERFACE CARD DETERMINES WHETHER THE DATA TERMINAL KEYBOARD OR THE CASSETTE PLAYER WILL SUPPLY DATA TO THE MP-S INTERFACE VIA THE RI (RS-232) INPUT. IF THE $\overline{\text{RTS}}$ OUTPUT FROM THE ACIA ON THE MP-S CARD IS LOW, THE RC (READER CONTROL) OUTPUT FROM THE MP-S CARD WILL BE OFF AND THE DATA TERMINAL KEYBOARD WILL BE CONNECTED TO THE MP-S RI INPUT VIA THE CIS-3Ø+. IF THE $\overline{\text{RTS}}$ OUTPUT FROM THE ACIA IS HIGH, THE READER CONTROL (RC) OUTPUT FROM THE MP-S WILL BE ON AND THE CASSETTE PLAYER WILL SUPPLY DATA TO THE MP-S VIA THE CIS-3Ø.

THE $\overline{\text{RTS}}$ OUTPUT FROM THE ACIA IS CONTROLLED BY BITS 5 AND 6 IN THE CONTROL REGISTER INTERNAL TO THE ACIA. THE $\overline{\text{RTS}}$ SIGNAL WILL BE LOW (RC OUTPUT OFF) IF BIT 6 IS A Ø OR IF BOTH BITS 5 AND 6 =1.

THE CIS-3Ø+ ASSUMES THE ACIA IS PROGRAMMED FOR A DIVIDE RATIO OF 16. THE DIVIDE RATIO IS DETERMINED BY BITS Ø AND 1 IN THE CONTROL REGISTER.

IT IS RECOMMEMDED THAT TAPES BE RECORDED WITH TWO STOP BITS FOR MAXIMUM RELIABILITY AND INTERCHANGEABILITY. THIS (AND OTHER PARAMETERS OF THE ACIA) ARE CONTROLLED BY BITS 2, 3, AND 4 IN THE CONTROL REGISTER.

A THOROUGH STUDY AND UNDERSTANDING OF THE MC685Ø DATA SHEET IS CRITICAL FOR PROPER UTILIZATION OF THE MP-S INTERFACE. YOU MAY FIND IT NECESSARY TO READ IT SEVERAL TIMES BEFORE IT BEGINS TO MAKE SENSE. ALSO STUDY THOROUGHLY THE NOTES REGARDING THE ACIA CONTAINED IN THE HARDWARE SECTION OF THE SWTP DOCUMENTATION NOTEBOOK.

APPENDIX E:

OPERATING AT 12ØØ BAUD - A BINARY LOADER

THE MIKBUG^{R} MONITOR IN THE SWTP 68ØØ COMPUTER IS NOT CAPABLE OF LOADING A PROGRAM AT 12Ø BYTES/SEC. THE TIME REQUIRED BY THE MIKBUG^{R} HEX LOADER TO CONVERT THE INCOMING ASCII-HEX CHARACTERS TO BINARY DATA EXCEEDS THE TIME AVAILABLE AT DATA RATES IN EXCESS OF APPROXIMATELY 1ØØ BYTES/SEC. OBVIOUSLY THIS DOES NOT PREVENT YOU FROM USING YOUR TERMINAL AT 12ØØ BAUD. TO LOAD PROGRAMS OR DATA AT 12Ø BYTES/SEC REQUIRES A LOADER PROGRAM WHICH EXECUTES MORE RAPIDLY THAN THE LOADER IN MIKBUG^{R}.

THE FOLLOWING SOFTWARE PERMITS YOU TO DUMP AND LOAD A RANGE OF MEMORY IN A CHECKSUM BINARY FORMAT. A BINARY LOADER EXECUTES MORE RAPIDLY BECAUSE THE INCOMING DATA DOES NOT HAVE TO BE CONVERTED FROM ASCII-HEX TO BINARY. FURTHERMORE THE PROGRAM WILL LOAD IN HALF THE TIME REQUIRED BY THE ASCII-HEX LOADER AT THE SAME BAUD RATE. THE DISADVANTAGE IS THAT IT DOES NOT PRODUCE A READABLE DISPLAY ON THE DATA TERMINAL.

AT 12ØØ BAUD A 4K PROGRAM RECORDED ON TAPE IN THE BINARY FORMAT WILL LOAD IN LESS THAN 4Ø SECONDS. THIS IS LESS THAN ONE EIGHTH THE TIME REQUIRED TO LOAD THE SAME PROGRAM IN THE ASCII-HEX FORMAT AT 3ØØ BAUD (KANSAS CITY STANDARD).

THE FOLLOWING SOFTWARE IS RELOCATABLE AND IS AVAILABLE ON THE PERCOM TEST CASSETTE (TC-1Ø5) IN THE MIKBUG^{R} LOADER FORMAT AT 3ØØ BAUD.

THE BINARY DUMP ROUTINE:

THIS ROUTINE DUMPS A RANGE OF MEMORY ONTO TAPE IN A RE-LOADABLE CHECKSUM BINARY FORMAT.

PROCEDURE:

1. LOAD OR ENTER THE BINARY DUMP PROGRAM. IF IT IS NOT AT A DESIRABLE LOCATION MOVE IT USING THE COPY PROGRAM AT $ØFEØ.
2. ENTER THE BEGINNING ADDRESS OF THE PROGRAM YOU WISH TO DUMP ONTO CASSETTE IN $AØØ2-AØØ3 USING MIKBUG^{R}.
3. ENTER THE ENDING ADDRESS OF THE PROGRAM YOU WISH TO DUMP ONTO CASSETTE IN $AØØ4-AØØ5.
4. ENTER THE EXECUTION ADDRESS OF THE BINARY DUMP PROGRAM ($ØFØØ) IN LOCATION $AØ48-AØ49.
5. TYPE "G" AND START THE CASSETTE RECORDER.
6. IMMEDIATELY FLIP THE RATE SWITCH TO THE RATE AT WHICH YOU WANT THE DATA TO BE RECORDED (12ØØ). THE DUMP PROGRAM INCLUDES A 5 SECOND DELAY TO GIVE YOU SUFFICIENT TIME TO START THE RECORDER AND CHANGE THE RATE.

7. AFTER THE 5 SECOND DELAY, THE COMPUTER WILL BEGIN OUTPUTTING THE DATA. THIS PRODUCES A TOTALLY MEANINGLESS DISPLAY ON THE DATA TERMINAL.
8. WHEN THE DUMP IS COMPLETED, STOP THE TAPE, FLIP THE RATE SWITCH BACK TO THE DATA TERMINAL RATE, AND RESET THE COMPUTER.

```
                    *BINARY FORMAT DUMP ROUTINE*
ØFØØ  86 12         LDAA   #$12       TURN ON RECORDER (PUNCH)
ØFØ2  BD EØ 75      JSR    OUTCH
ØFØ5  8D 5D         BSR    DLY        5 SEC TIME DELAY
ØFØ7  FE AØ Ø4      LDX    ENDA       INCREMENT END ADDRESS
ØFØA  Ø8            INX
ØFØB  FF AØ Ø4      STX    ENDA
ØFØE  CE AØ ØØ LOOP LDX    #ZONE
ØF11  A6 Ø5         LDAA   5,X        LSB END ADDRESS
ØF13  AØ Ø3         SUBA   3,X         "  START  "
ØF15  E6 Ø4         LDAB   4,X        MSB END ADDRESS
ØF17  E2 Ø2         SBCB   2,X         "  START  "
ØF19  27 Ø2         BEQ    P1         LEAVE A ALONE
ØF1B  86 FF         LDAA   #FF        FORCE A
ØF1D  A7 ØE      P1 STAA   E,X        BYTE COUNT (AØØE)
ØF1F  86 96         LDAA   #$96       OUTPUT SYNC CHARACTER
ØF21  8D 2C         BSR    OUT
ØF23  5F            CLRB              CLEAR CHECKSUM
ØF24  A6 ØE         LDAA   E,X        OUTPUT BLOCK LENGTH
ØF26  8D 27         BSR    OUT
ØF28  27 21         BEQ    QUIT       QUIT IF LENGTH IS ZERO
ØF2A  A6 Ø2         LDAA   2,X        OUTPUT MSB ADDRESS
ØF2C  8D 21         BSR    OUT
ØF2E  A6 Ø3         LDAA   3,X        OUTPUT LSB ADDRESS
ØF3Ø  8D 1D         BSR    OUT
ØF32  EE Ø2         LDX    2,X        SET INDEX TO DATA
ØF34  A6 ØØ      P2 LDAA   X          OUTPUT DATA BYTE
ØF36  8D 17         BSR    OUT
ØF38  Ø8            INX
ØF39  7A AØ ØE      DEC    BCNT
ØF3C  26 F6         BNE    P2
ØF3E  53            COMB              OUTPUT CHECKSUM
ØF3F  17            TBA
ØF4Ø  8D ØD         BSR    OUT
ØF42  FF AØ Ø2      STX    BEGA       STORE BEGINNING ADDRESS
ØF45  2Ø C7         BRA    LOOP       DO NEXT BLOCK
ØF47  Ø1 Ø1 Ø1      NOP    3          RESERVED FOR PROGRAM LINKAGE
ØF4A  Ø1 Ø1         NOP    2
ØF4C  7E EØ E3 QUIT JMP    CONTRL     RETURN TO CONTROL
```

```
ØF4F  36          OUT     PSHA
ØF5Ø  8D Ø4               BSR     OT1
ØF52  32                  PULA                UPDATE CHECKSUM
ØF53  1B                  ABA
ØF54  16                  TAB
ØF55  39                  RTS
ØF56  37          OT1     PSHB
ØF57  BD E1 A5            JSR     SAV
ØF5A  C6 Ø9               LDAB    #$9
ØF5C  BD E1 EF            JSR     DEL
ØF5F  6A ØØ               DEC     O,X
ØF61  7E E1 DA            JMP     OUT1
ØF64  CE ØC ØØ    DLY    LDX     #$ØCØØ      SETUP 5 SEC DELAY
ØF67  4F                  CLRA
ØF68  4C          TD1     INCA                TIME DELAY LOOP
ØF69  26 FD               BNE     TD1
ØF6B  Ø9                  DEX
ØF6C  26 FA               BNE     TD1
ØF6E  39                  RTS
```

THE ABOVE PROGRAM RECORDS THE DATA IN THE FOLLOWING MANNER:

1. THE RANGE OF MEMORY TO BE RECORDED IS BROKEN INTO BLOCKS OF 255 BYTES. THE LAST BLOCK MAY HAVE LESS THAN 255 BYTES.
2. EACH BLOCK BEGINS WITH A SYNC CHARACTER (1ØØ1Ø11Ø) FOLLOWED BY A BLOCK LENGTH CODE (11111111 IF THE BLOCK IS 255 BYTES LONG), THE MEMORY ADDRESS OF THE FIRST DATA BYTE, THEN THE DATA.
3. FOLLOWING THE LAST DATA BYTE IS A CHECKSUM CODE WHICH IS THE ONE'S COMPLEMENT OF THE SUM OF THE BLOCK LENGTH CODE, THE MEMORY ADDRESS AND ALL OF THE DATA BYTES.
4. THE END OF THE FILE IS IDENTIFIED BY A SYNC CHARACTER FOLLOWED BY A ZERO LENGTH BLOCK CODE (ØØØØØØØØ).

THE DURATION OF THE START TIME DELAY IS CONTROLLED BY THE CONTENTS OF MEMORY LOCATION $ØF65-ØF66. IF YOU NEED MORE TIME SIMPLY INCREASE THE NUMBER STORED IN THIS LOCATION.

THE BINARY LOADER ROUTINE:

THIS PROGRAM WILL LOAD A CASSETTE RECORDED USING THE BINARY DUMP PROGRAM DESCRIBED EARLIER.

PROCEDURE:

1. LOAD OR ENTER THE BINARY LOADER PROGRAM. IF IT IS NOT AT A DESIRABLE LOCATION, MOVE IT USING THE MOVE PROGRAM AT $ØFEØ.
2. ENTER THE EXECUTION ADDRESS OF THE BINARY LOADER ($ØF7Ø) IN $AØ48-AØ49.
3. START THE TAPE PLAYING.
4. WHEN YOU ARE ON THE 'LEADIN' TONE PRECEDING THE DATA, TYPE "G" AND IMMEDIATELY FLIP THE RATE SWITCH TO THE RATE AT WHICH THE DATA WAS RECORDED (12ØØ) IF DIFFERENT THAN THE TERMINAL RATE.
5. THE LOADER PROGRAM MONITORS THE CHECKSUM. IF A CHECKSUM ERROR IS DISCOVERED, THE PROGRAM WILL OUTPUT A QUESTION MARK TO THE DATA TERMINAL AND WILL RETURN TO MIKBUG^{R} CONTROL. OBVIOUSLY THE TERMINAL WILL PRINT THE QUESTION MARK ONLY IF IT IS AT THE SAME RATE AS THE RATE SELECTION SWITCH.

   IF NO ERROR IS ENCOUNTERED, THE PROGRAM WILL RETURN DIRECTLY TO MIKBUG^{R} CONTROL WHEN THE LOAD IS COMPLETED.
6. WHEN THE LOAD IS COMPLETED; RETURN THE RATE SWITCH TO THE TERMINAL RATE IF NECESSARY AND RESET THE COMPUTER.

THE BLOCK MOVE ROUTINE:

ALTHOUGH THIS ROUTINE WAS INCLUDED TO PERMIT YOU TO MOVE THE BINARY DUMP/LOAD ROUTINES TO A MORE DESIRABLE LOCATION, IT MAY BE USED TO MOVE ANY DATA FROM ONE PLACE IN MEMORY TO ANOTHER.

PROCEDURE:

1. ENTER THE BEGINNING ADDRESS OF THE BLOCK OF MEMORY TO BE COPIED IN $AØØ2-AØØ3
2. ENTER ONE MORE THAN THE ENDING ADDRESS OF THE BLOCK OF MEMORY TO BE COPIED IN $AØØ4-AØØ5.
3. ENTER THE DESTINATION ADDRESS OF THE FIRST BYTE OF THE BLOCK OF DATA IN $AØØ6-AØØ7.
4. ENTER THE EXECUTION ADDRESS OF THE COPY ROUTINE ($ØFEØ) IN $AØ48-AØ49
5. TYPE "G".

NOTE: THE DESTINATION ADDRESS CANNOT LIE BETWEEN THE BEGINNING AND ENDING ADDRESS SINCE IT WOULD DESTROY PART OF THE DATA TO BE COPIED.

```
                        *BINARY FORMAT LOADER ROUTINE*
ØF7Ø  86 3C             LDAA   #$3C        TURN ON READER
ØF72  B7 8Ø Ø7          STAA   PIASB
ØF75  8D 32      L1     BSR    IN          WAIT FOR SYNC CHAR
ØF77  C1 96             CMPB   $96
ØF79  26 FA             BNE    L1
ØF7B  CE AØ ØØ          LDX    #AØØØ
ØF7E  4F         L2     CLRA               CLEAR CHECKSUM
ØF7F  8D 2B             BSR    IN          GET BYTE COUNT
ØF81  27 24             BEQ    QUIT        QUIT IF ZERO
ØF83  E7 ØB             STAB   B,X         STORE BYTE COUNT
ØF85  8D 25             BSR    IN          GET MSB ADDRESS
ØF87  E7 ØC             STAB   C,X
ØF89  8D 21             BSR    IN          GET LSB ADDRESS
ØF8B  E7 ØD             STAB   D,X
ØF8D  EE ØC             LDX    C,X         GET ADDRESS INTO INDEX
ØF8F  8D 1B      L2     BSR    IN          GET DATA
ØF91  E7 ØØ             STAB   Ø,X
ØF93  Ø8                INX
ØF94  7A AØ ØB          DEC    $AØØB       DECREMENT BYTE COUNT
ØF97  26 F6             BNE    L2
ØF99  8D 11             BSR    IN          GET CHECKSUM
ØF9B  4C                INCA
ØF9C  26 Ø6             BNE    ERROR
ØF9E  8D ØD             BSR    IN
ØFAØ  C1 96             CMPB   $96
ØFA2  27 D7             BEQ    L1
ØFA4  7E EØ 4Ø  ERROR   JMP    LOAD19
ØFA7  7E EØ E3  QUIT    JMP    CONTRL
ØFAA  Ø1 Ø1 Ø1          NOP    3
                        *SERIAL INPUT ROUTINE*
ØFAD  36        IN      PSHA               SAVE CHECKSUM
ØFAE  BD E1 A5          JSR    SAV
ØFB1  A6 ØØ      IN1    LDAA   Ø,X         LOOK FOR START BIT
ØFB3  2B FC             BMI    IN1
ØFB5  6F Ø2             CLR    2,X         SET TIMER FOR ½ BIT TIME
ØFB7  BD E1 F3          JSR    DE          START TIMER
ØFBA  BD E1 EF          JSR    DEL         DELAY
ØFBD  A6 ØØ             LDAA   Ø,X
ØFBF  2B FØ             BMI    IN1         START BIT WAS A FLUKE
ØFC1  86 Ø4             LDAA   #4          SET DELAY FOR FULL BIT TIME
ØFC3  A7 Ø2             STAA   2,X
ØFC5  48                ASLA               SETUP COUNTER FOR 8 COUNTS
                        *
ØFC6  BD E1 EF  IN2     JSR    DEL         DELAY
ØFC9  ØD                SEC
ØFCA  69 ØØ             ROL    Ø,X
ØFCC  56                RORB
ØFCD  4A                DECA
ØFCE  26 F6             BNE    IN2
ØFDØ  BD E1 EF          JSR    DEL         WAIT OUT STOP BIT
ØFD3  FE AØ 12          LDX    $AØ12       RESTORE XR
ØFD6  32                PULA
ØFD7  1B                ABA                UPDATE CHCKSUM
ØFD8  39                RTS
```

```
                        *BLOCK MOVE ROUTINE*
ØFEØ   FE AØ Ø2  MOVE    LDX     BEGA
ØFE3   BC AØ Ø4          CPX     ENDA
ØFE6   27 11             BEQ     FINISH
ØFE8   A6 ØØ             LDAA    Ø,X
ØFEA   Ø8                INX
ØFEB   FF AØ Ø2          STX     BEGA
ØFEE   FE AØ Ø6          LDX     NEW
ØFF1   A7 ØØ             STAA    Ø,X
ØFF3   Ø8                INX
ØFF4   FF AØ Ø6          STX     NEW
ØFF7   2Ø E7             BRA     MOVE
ØFF9   7E EØ E3  FINISH  JMP     CONTRL
```

THE BINARY LOADER PROGRAM MAY ALSO BE RECORDED ON TAPE AHEAD OF THE ACTUAL BINARY FORMAT DATA. THIS WILL SIMPLIFY THE PROCESS OF LOADING THE BINARY PROGRAM. RECORDING SUCH A TAPE IS A LITTLE COMPLICATED, BUT IT IS WORTH THE EFFORT IF THE PROGRAM IS LOADED FREQUENTLY.

PROCEDURE:

1. LOAD OR ENTER THE BINARY LOAD/DUMP SOFTWARE USING MIKBUG^{R} (3ØØ BAUD). MOVE IT TO A MORE DESIRABLE LOCATION IF NECESSARY.
2. RECORD THE LOADER ONTO TAPE (3ØØ BAUD) USING MIKBUG^{R}.
3. STOP THE TAPE.
4. ENTER THE BINARY LOADER EXECUTION ADDRESS ($ØF7Ø) IN MEMORY LOCATIONS $AØ48 AND $AØ49.
5. ENTER AØ,48 AØ,49 IN MEMORY LOCATIONS AØØ2 THRU AØØ5.
6. START THE TAPE (RECORD).
7. TYPE P AND RECORD THE BINARY LOADER EXECUTION ADDRESS (3ØØ BAUD).
8. FLIP THE CIS-3Ø TERMINAL SWITCH TO 'LOCAL' MODE.
9. TYPE S9G (3ØØ BAUD).
1Ø. STOP THE TAPE, FLIP THE CIS-3Ø BACK TO "LINE" MODE, AND RESET THE COMPUTER.
11. ENTER THE START AND FINISH ADDRESS OF THE DATA TO BE DUMPED IN AØØ2 THRU AØØ5.
12. ENTER THE BINARY DUMP PROGRAM EXECUTION ADDRESS IN AØ48 AND AØ49.
13. TYPE G AND START THE TAPE (RECORD). IMMEDIATELY FLIP THE RATE SWITCH TO THE DESIRED RATE.
14. AFTER A 5 SECOND DELAY THE COMPUTER WILL BEGIN OUTPUTING THE DATA IN BINARY FORMAT. THIS WILL PRODUCE A TOTALLY MEANINGLESS DISPLAY.
15. WHEN THE DUMP IS COMPLETED, STOP THE TAPE, FLIP THE RATE SWITCH BACK TO THE DESIRED RATE, AND RESET THE COMPUTER.

TO LOAD THE PROGRAM:

1. START THE TAPE PLAYING, TYPE "L", FLIP THE RATE SWITCH TO 3ØØ, (IF NECESSARY) AND FLIP THE TAPE SWITCH TO ON.
2. AFTER THE BINARY LOADER IS LOADED A "G" WILL APPEAR ON THE TERMINAL (3ØØ BAUD); FLIP THE RATE SWITCH TO 12ØØ IMMEDIATELY.
3. WHEN THE LOAD IS COMPLETED FLIP THE TAPE SWITCH BACK TO AUTO, FLIP THE RATE SWITCH TO THE TERMINAL RATE, AND RESET THE COMPUTER.

APPENDIX F

HOW IT WORKS:

REFER TO THE SCHEMATIC DIAGRAM THROUGHOUT THE FOLLOWING DESCRIPTION.

THE CIS-3Ø+ IS AN RS-232 DATA TERMINAL INTERFACE AND AN AUDIO CASSETTE INTERFACE FOR THE SWTP 68ØØ COMPUTER.

DATA TERMINAL INTERFACE:

THE DATA TERMINAL TRANSMITTED DATA IS CONNECTED TO REAR EDGE CONNECTOR PIN 19. R33, CR4, Q5, AND R3Ø FORM AN RS-232 TO TTL LEVEL SHIFTER. Z9-A IS ONE SECTION OF A 2 INPUT MULTIPLEXER WHICH SELECTS EITHER THE DATA TERMINAL OR THE CASSETTE AS A DATA SOURCE FOR THE COMPUTER. SWITCHING OF Z9 IS CONTROLLED BY THE RC (READER CONTROL) OUTPUT FROM THE COMPUTER VIA Q4 AND RELATED COMPONENTS. THE SELECTED OUTPUT FROM Z9-A IS CONVERTED BACK TO RS-232 LEVELS BY Q2 AND IS FED TO THE COMPUTER THROUGH EDGE CONNECTOR PIN 14.

IF THE CIS-3Ø+ TERMINAL SWITCH IS IN THE "LINE" POSITION, DATA FROM THE COMPUTER PASSES STRAIGHT THROUGH THE CIS-3Ø+ TO THE DATA TERMINAL RECEIVED DATA OUTPUT AT EDGE CONNECTOR PIN 18. IF THE TERMINAL SWITCH IS IN THE "LOCAL" POSITION, A LOCAL LOOP IS FORMED CAUSING DATA TERMINAL TRANSMITTED DATA OR CASSETTE PLAYBACK DATA TO BE SENT BACK TO THE DATA TERMINAL WITHOUT GOING THROUGH THE COMPUTER.

CASSETTE PLAYBACK CIRCUIT:

THE SIGNAL FROM THE CASSETTE PLAYER EARPHONE OUTPUT IS SHAPED INTO A SQUARE WAVE BY Z7-D, R9, R1Ø, AND RELATED COMPONENTS. EXCLUSIVE-OR GATE Z8-C, R21, AND C8 CONVERT THE SQUARE WAVE INTO A STRING OF NARROW PULSES. ONE SHOT Z1 AND SHIFT REGISTER Z2 RECOVER THE DATA, Z3 RECOVERS THE TIMING INFORMATION (CLOCK).

WHEN A 24ØØ HZ SIGNAL IS RECEIVED, Z1 IS CONSTANTLY RETRIGGERED BEFORE IT IS ALLOWED TO TIME OUT. THIS CAUSES OUTPUT Z1-8 TO REMAIN HIGH. WHEN THE 12ØØ HZ SIGNAL IS RECEIVED, THE ONE SHOT(Z1) IS ALLOWED TO TIME OUT. SINCE Z2-A IS CLOCKED BY THE SAME PULSE WHICH TRIGGERS Z1, AND SINCE THE OUTPUT OF Z1 IS LOW WHEN THE TRIGGER PULSE OCCURS, Z2-A WILL BE CLOCKED LOW AND WILL STAY LOW FOR THE DURATION OF THE 12ØØ HZ SIGNAL. Z2-B REMOVES THE DISSYMMETRY FROM THE RECOVERED DATA WAVEFORM. THE NRZ DATA OUTPUT FROM Z2-B IS SENT TO THE COMPUTER VIA SELECTOR GATE Z9-A AND Q2.

Z3-B BEHAVES AS A SIMPLE DIVIDE-BY-TWO CIRCUIT WHEN THE 24ØØ HZ SIGNAL IS RECEIVED BECAUSE THE OUTPUT FROM Z1-8 IS HIGH. WHEN 12ØØ HZ IS RECEIVED, THE FALLING EDGE OF Z1-8 CREATES A PULSE VIA C4 AND R4 WHICH RESETS Z3-B. THIS CAUSES Z3-B TO BEHAVE AS A DIVIDE-BY-ONE (NO DIVISION) SO THE OUTPUT OF Z3-B IS THE SAME FREQUENCY (24ØØ HZ) WHEN EITHER THE 12ØØ HZ OR 24ØØ HZ SIGNAL IS RECEIVED. Z3-A ASSURES THE SIGNAL FED TO THE PAHSE DETECTOR (Z8-4) IS A SYMMETRICAL SQUARE WAVE.

EXCLUSIVE-OR GATE Z8-B ACTS AS A PHASE DETECTOR FOR THE PHASE LOCKED LOOP (PLL) MADE UP OF VOLTAGE CONTROLLED OSCILLATOR (VCO) Z7-B, DIVIDER Z4 AND RELATED COMPONENTS. THE PLL FOLLOWS THE RECOVERED CLOCK (Z3-5) AND ACTS AS A FREQUENCY MULTIPLIER TO PROVIDE THE 16X CLOCK REQUIRED BY THE MP-C AND MP-S INTERFACES. THE VCO NOMINAL FREQUENCY IS 19.2 KHZ. Z4 DIVIDES THE VCO OUTPUT BY SIXTEEN AND CLOSES THE LOOP BACK TO THE PHASE DETECTOR (Z8-5). Z5-B IS A MULTIPLEXER WHICH SELECTS THE APPROPRIATE FREQUENCY OUTPUT FROM Z4 TO FEED TO THE COMPUTER. THE FREQUENCY DEPENDS ON THE SELECTED DATA RATE:

3ØØ	BAUD	SELECTS	THE	48ØØ	HZ	POINT	ON	THE	DIVIDER	Z4	
6ØØ	"	"	"	96ØØ	HZ	"	"	"	"	"	
12ØØ	"	"	"	19.2	KHZ	OUTPUT	FROM	THE	VCO		

THE MP-C OR MP-S INTERFACES MAY BE CLOCKED BY A SIGNAL DERIVED FROM THE VCO OR FROM A SIGNAL DERIVED FROM THE HOST COMPUTER'S CRYSTAL OSCILLATOR. THE SELECTION IS VIA Z9-B WHICH IS CONTROLLED BY THE READER CONTROL (RC) OUTPUT FROM THE THE COMPUTER VIA Q4 OR SWITCH S1.

CASSETTE RECORD CIRCUIT:

CASSETTE MODULATOR Z1Ø, Z8-A, AND Q3 SAMPLES THE DATA GOING TO THE DATA TERMINAL RECEIVED DATA OUTPUT. TYPICALLY THIS IS DATA FROM THE COMPUTER. R37, CR5, AND Q5 CONVERT THE RS-232 LEVEL TO TTL LEVEL. Z8-A IS SIMPLY AN INVERTER. WHEN Z8-3 IS LOW, JK FLIP-FLOP Z1Ø-A IS PREVENTED FROM TOGGLING AND THE Q OUTPUT IS FORCED TO THE HIGH STATE. Z1Ø-B DIVIDES THE 48ØØ HZ CLOCK FROM Z6-6 BY TWO PRODUCING A 24ØØ HZ SQUARE WAVE AT Z1Ø-9. WHEN Z8-3 IS HIGH, FLIP-FLOP Z1Ø-A IS PERMITTED TO TOGGLE WHICH INHIBITS THE TOGGLING OF Z1Ø-B ON EVERY OTHER CLOCK PULSE. THE NET RESULT IS THAT THE OUTPUT OF Z1Ø-9 IS NOW A 12ØØ HZ SQUARE WAVE. WHEN THE DATA FROM THE MP-C OR MP-S "RO" OUTPUT IS A LOGIC ONE, A 24ØØ HZ SIGNAL IS GENERATED AND WHEN THE DATA IS A LOGIC ZERO, A 12ØØ HZ SIGNAL IS GENERATED. THE SQUARE WAVE IS ATTENUATED AND FILTERED BY R34, R35, R36, C14 AND IS FED TO THE AUXILIARY OR MICROPHONE INPUTS OF THE CASSETTE RECORDER.

THE MODULATOR 48ØØ HZ CLOCK IS DERIVED FROM THE 19.2 KHZ FROM THE HOST COMPUTER (CO OUTPUT). Z6 DIVIDED THE 19.2 KHZ TO 48ØØ HZ. Z5-A IS A MULTIPLEXER WHICH SELECTS THE APPROPRIATE FREQUENCY OUTPUT FROM Z6 TO FEEDBACK TO THE COMPUTER. THE FREQUENCY DEPENDS ON THE SELECTED DATA RATE.

THE TIMING BETWEEN DATA AND CLOCK IS SUCH THAT AT 3ØØ BAUD, A LOGIC ONE DATA BIT IS 8 CYCLES OF 24ØØ HZ AND A LOGIC ZERO BIT IS 4 CYCLES OF 12ØØ HZ. AT THE HIGHER DATA RATES, THE 24ØØ AND 12ØØ HZ TONES REMAIN BUT THE NUMBER OF CYCLES PER DATA BIT IS PROGRESSIVELY REDUCED UNTIL AT 12ØØ BAUD A LOGIC ONE IS TWO CYCLES OF 24ØØ HZ AND A LOGIC ZERO IS ONE CYCLE OF 12ØØ HZ.

REMOTE CONTROL CIRCUIT:

AS DESCRIBED EARLIER, THE READER CONTROL (RC) OUTPUT FROM THE MP-S AND MP-C CARDS CONTROLS SELECTION OF THE CASSETTE OR DATA TERMINAL AS DATA SOURCE FOR THE COMPUTER. IF A RELAY IS INSTALLED IN KA, THE RC LINE WILL TURN ON THE RELAY WHENEVER THE CASSETTE PLAYER IS SELECTED. CR6 SUPPRESSES THE BACK-EMF TRANSIENT FROM THE RELAY COIL WHEN Q4 IS TURNED OFF.

TO OPERATE RELAY KB REQUIRES A SEPARATE CONTROL CIRCUIT. THE RY AND RX INPUTS MAY BE CONNECTED TO A FUNCTION DECODER SUCH AS THE CURSOR CONTROL CARD IN THE SWTP VIDEO TERMINAL OR TO AN OUTPUT FROM THE PARALLEL INTERFACE (MP-L) CARD. A LOW PULSE ON THE RY INPUT TURNS ON RELAY KB, A LOW PULSE ON THE RX INPUT TURNS OFF THE RELAY. IF RX IS CONNECTED PERMANENTLY TO GROUND, THE RELAY WILL BE CONTROLLED BY THE LEVEL OF RY; LOW TURNS ON THE RELAY, HIGH TURNS IT OFF. CR7 SUPPRESSES THE BACK-EMF OF THE RELAY COIL.

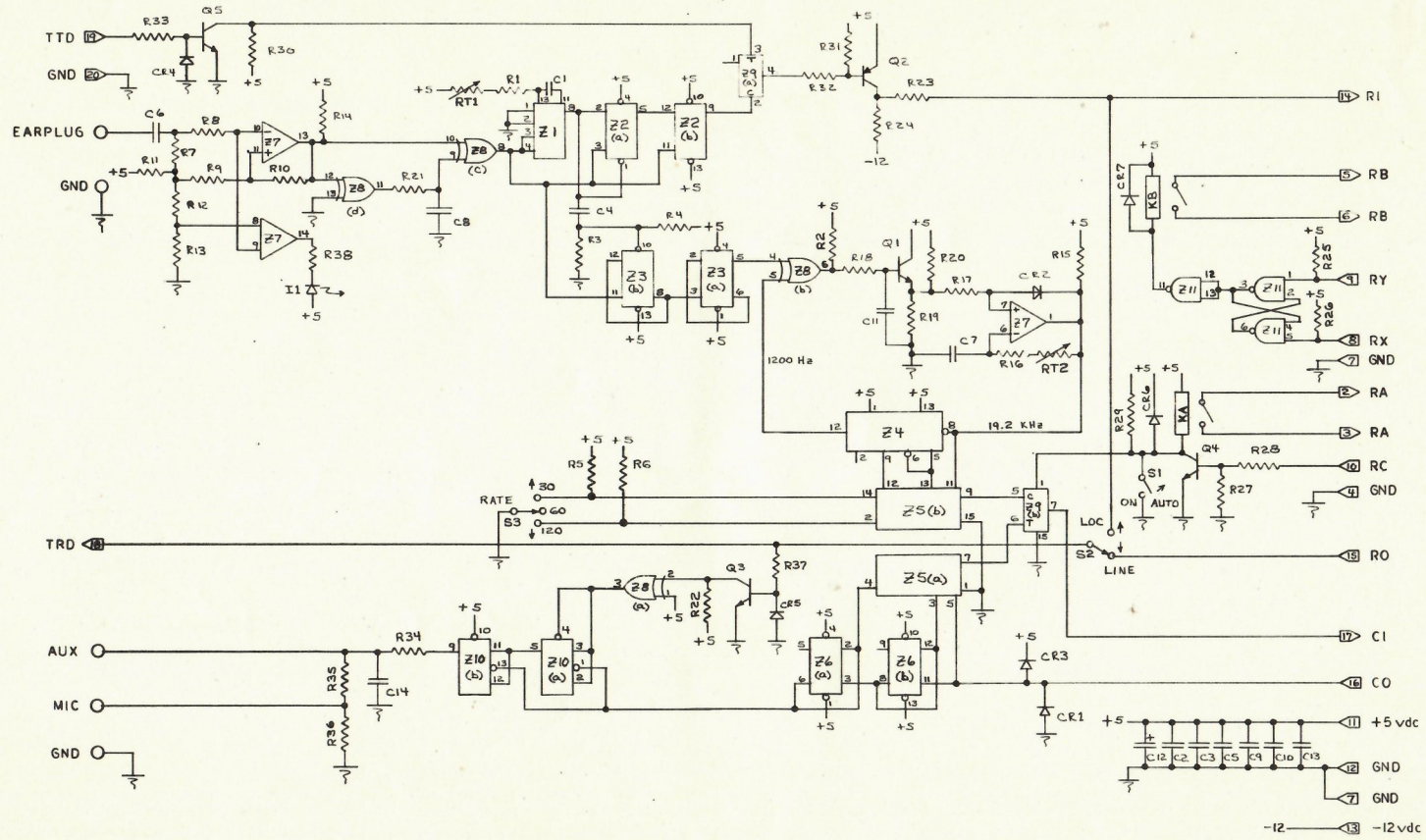
LIST OF MATERIALS - PERCOM CIS-3Ø+ CASSETTE/TERMINAL INTERFACE

ITEM	DESCRIPTION	PART NO.	DESIGNATOR	QTY
1	PRINTED CIRCUIT CARD	CIS-3Ø		1
2	RESISTORS 1ØØOHM ¼W	CC OR CF	R23	1
3	" 18Ø "		R13,38	2
4	" 47Ø "		R36	1
5	" 82Ø "		R12	1
6	" 1K "		R2,11,14,21	4
7	" 2.7K "		R24	1
8	" 4.7K "		R1,15,27,28 R32,33,35,37	8
9	" 1ØK "		R4,5,6,8,9,17,19 R22,29,3Ø,31	11
1Ø	" 27K "		R3	1
11	" 47K "		R2Ø,34	2
12	" 62K "		R16	1
13	" 1ØØK "		R7,1Ø,18	3
14	DIODE	IN914	CR1,2,3,4,5,	5
15	CAPACITOR .Ø47UF	MYLAR	C1,6,11	3
16	" 25UF	ELECTROLYTIC	C12	1
17	" 36ØPF	DIPPED MICA	C7	1
18	" 75ØPF	DISC	C4,C8	2
19	" .Ø1UF	DISC	C2,3,5,9 C1Ø,13,14	7
2Ø	TRANSISTOR	PN3565	Q1	1
21	"	PN5138	Q2	1
22	"	PN5135	Q3,4,5	3
23	INTEGRATED CIRCUIT	LM339	Z7	1
24	" "	74LS74	Z2,3,6	3
25	" "	74LS86	Z8	1
26	" "	74LS113	Z1Ø	1
27	" "	74LS122	Z1	1
28	" "	74LS153	Z5	1
29	" "	74LS157	Z9	1
3Ø	" "	74LS197	Z4	1
31	TRIM POT	22K TRIMMER	RT1	1
32	TOGGLE SWITCH (2 POS)	MTA 1Ø6D-VRA	S1,2	2
33	" " (3 POS)	MTA 1Ø6E-VRA	S3	1

PERCOM DATA CO.

LIST OF MATERIALS - PERCOM CIS-3Ø+ CASSETTE/TERMINAL INTERFACE

ITEM	DESCRIPTION	PART NO.	DESIGNATOR	QTY
34	VLED	TIL-2Ø9A	L1	1
35	CONNECTOR STRIP	Ø9-52-31Ø1		2
36	PLUG STRIP	Ø9-64-11Ø1		3
37	AUDIO CABLE			2
38	CABLE TIES			2
39	CHASSIS & COVER			1
4Ø	THREADED SPACER	4-4Ø X ½		4
41	MACHINE SCREW	4-4Ø X ¼		8
42	SELF THREADING SCREW	#4 X ¼		4
43	RUBBER BUMPERS			4
44	INSTRUCTION MANUAL			1
45	TRIM POT	47K TRIMMER	RT2	1



CIE-30+ CASSETTE I/O (SWTP)		
SCALE:	APPROVED BY:	DRAWN BY
DATE: 3-17-77		REVISED 4-1-77
PERCOM DATA CO.		
SCHEMATIC		DRAWING NUMBER