MAINTENANCE MANUAL
DESKTOP STATION KEYPAD/FREQUENCY SELECT BOARD
(188D5771G1)

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GENERAL DESCRIPTION

The current 19A704686 tone and dc remote control boards used in the Universal Desktop Station have bitwise inputs and outputs. This information needs to be converted into the proper serial data protocol for the radio in the station. This function is performed within the 188D5771G1 Keypad / Frequency Select Board (KBFS). For Orion, this information must be integrated into the Orion's RS485 serial control network. The board was implemented in a very general way with much undedicated and easily available i/o, including an undedicated RS232 serial port.

For Orion applications, the KBFS board reads the frequency select lines and remote PTT information from the remote control board and sends it to the radio. It also controls the parallel update processes of the EDACS hardware by controlling the 2175 Hz tone generator on the 19A704686P8 EDACS remote control board. The Orion radio does not use the desktop station's telephone keyboard. The keyboard functions of entering LIDs and phone numbers are available by specifying the system control unit on the radio.

CONFIGURATION

The KBFS board needs to be configured for conventional or EDACS remote control applications. This is done with R54. The combinations are listed below:

R54	Voltage	Application
Open	5.0V	Conventional Orion
10.0K	2.5V	EDACS Orion

Note R54 is a critical resistor. If it is not set for the proper configuration, the KBFS board will appear rather inactive, if not dead. It may also behave in a strange manner. For example, a KBFS board set for conventional will not do the parallel updates of an EDACS system.

In addition, the proper serial port hardware must be selected. This is done with J403 and J404. The choice is between 5v open collector transistors or the RS485 driver. The jumpers must be on pins 2 and 3 for Orion. J406, which adds a pullup resistor on the Service Request Line, should have its jumper on pins 1 and 2. This has the pullup attached to the line.

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CIRCUIT DESCRIPTION

The KBFS Board is built around the Orion RCP processor. This was done to facilitate the integration of the remote control system into the Orion network of control units. Logically, the KBFS follows the Orion and MRK hardware arrangements. In particular, memory device addresses were fixed by the RCP. The external ram space was set up to handle 8k or 32k devices. The application specific program code needs to reside in a flash device starting at a fixed address. This socket was laid out in a manner that can accept 128k through 512k byte devices. Flashing is handled by program code masked in the RCP's internal ROM.

An extra serial port was implemented with an Orion ICP processor. This can be thought of more as a UART rather than a processor. It is very general purpose with programmable baud rate and data formats. Its lines are run through a MAX232 level converter IC to provide RS232 levels at the J407 connector. Unlike a general purpose UART, the ICP contains thirty-six bits of undedicated IO plus an extra eight bit A/D. There are no connectors for this I/O. They are accessed by holes in the board.

Note the functions of the desktop's remote control boards can be done entirely with the RCP processor. The ICP processor, the MAX232 chip, and its connectors are designed in but need not be installed.

All lines going off the board have series resistors and bypass capacitors. Additionally, 5v lines have back-to-back protection diodes. These are implemented with surface mount bridge devices. This allows one to protect two lines with one diode device. Lines that come from things touched by human hands such as the keypad and PTT lines are in particularly high need of this protection.

PROCESSOR CIRCUITRY

The RCP (U1) is a sixteen bit Hitachi H8/532 microprocessor run in expanded maximum mode four with a one megabyte address space. The internal ROM is masked with an operating system and a mechanism for programming the flash prom. The outside address space is split into places for flash, RAM, and the ICP processor. The "ASIC" IC used in the MRK and Orion products is not used on the KBFS board. Instead, discrete circuitry which duplicates its address decoding function is used.

The ICP (U12) is an eight bit Hitachi H8/330 microprocessor run in single chip mode with its dual port RAM enabled. It can be thought of as a peripheral device of the RCP. It is used to provide an auxiliary serial port and additional bitwise I/O. It is an optional device. It is not needed for the standard remote control functions of the Orion radio..

The flash memory (U10) needs to be above 64k (40000h and above). Its decode is done by combining A18 and A19 in OR gate U8A. This is then inverted by U2D. The output of this inverter is low if either A18 or A19 is high. The select is further qualified by AS in OR gate U8B so that it is only low on an external bus cycle. This provides the chip select to the flash memory. The processor read and write lines also go into the flash device.

The standard flash device is a 28F010 128 k byte device. A 256 k byte 28F020 may be installed with no further hardware changes. A 5v 28F040 512 k byte device can also be installed by removing R16 to isolate the Vpp voltage and installing R15 to connect address line A18 into the device. Only R15 or R16 should be mounted on the board. **Both resistors must never be installed at the same time**.

The RCP software dictates the remaining devices live in Page 0. This is when A16, A17, A18, and A19 are all low. Address lines A16 and A17 are run through OR gate U7A. Its output is low only if both inputs are low. This output of U7A then becomes one of the inputs for OR gate U7C. Addresses A18 and A19 have already been combined in OR gate U8A in order to detect the flash memory. The output of U8A is then connected to one input of OR gate U7B. U7B's second input is tied to the external address strobe line AS. This causes the output of U7B to be low only if A18 and A19 are low during an external address cycle. This output provides the second input to OR gate U7C. The output of U7C is then the Page 0 detect line. It is low only if A16, A17, A18, and A19 are all low during an external bus access cycle.

The Page 0 detect is the first part of these device decodes. The second part is provided by a pair of 74HC85 four bit arithmetic word comparitors. The "A" side of the devices is forced to 0xFA. The "B" side is connected to the upper address bus (A8 through A15). The outputs of the device with the least significant bits of the address (U6) are connected to the cascading inputs of the device with the most significant address bits (U5). The outputs of U5 then say if the upper byte bits of the address are greater than, less than, or equal to the value of 0xFA.

The positive going equal output from U5 is inverted by U2E and then combined with the Page 0 Select output line from U7C in OR gate U7D to produce the ICP select of 0x0FA00. This decode is used to talk to the ICP processor through its sixteen byte dual port RAM. The interrupt out of the ICP is brought to the RCP's IRQ0 interrupt input. The NMI interrupt on the RCP is not used and is tied to Vcc.

The greater than output from U5 is used as a select for the external RAM. It is inverted by U2F to give a zero level decode before being ORed with the Page 0 detect line from U7C in OR gate U8C. Note a select means the address on the bus was below 0FA00. The processor's internal ROM occupies address 0x00000 through 0x07FFF. There will be no AS strobe in this address range. This effectively sets the lower limit of the RAM space to 0x8000.

The RCP software expects this ram to start at 0x8000 and end at 0xF7FF. The board will use a 32k device. It also has the capability of using an 8k RAM by way of series 0 ohm resistors on pin 26 of the RAM. Pin 26 is tied to A13 by 0 ohm resistor R17 for a 32k device and Vcc by 0 ohm resistor R18 for an 8k device. Only R17 or R18 should be mounted on the board. **Both resistors must never be installed at the same time**.

Addresses above 0x0FA00 are not decoded. The less than output of U5 is not used. There is a selectable RAM space inside the processor from 0x0FB80 through 0X0FF7F and internal registers and ports between 0x0FF80 and 0x0FFFF. No AS strobe is generated within these address ranges.

The RCP processor runs off of 9.8304 MHz crystal X1. Balance resistor R1 and loading capacitors C3 and C4 are used to set its frequency. The micro has a pin that can be used to provide a divide-by-two output (P10/CLK or Pin 72). This output is also the frequency that the ICP processor needs to see. Hence one can generate the ICP's master clock without additional hardware and without an additional crystal.

Most of the port pins of the RCP and ICP processors can be used as general purpose input or output bits. When used as an output, the devices have a totem pole transistor arrangement. When used as an input, a port pin will appear as a high impedance device. An open input pin will return a "0" value. Pull-ups to 5V should be used on all input lines. There are pull-up resistors on the input pins on the RCP. There are no pull-ups on the unused pins of the ICP.

The RCP's reset is provided by the reset circuit out of the L387 (U3) 5v regulator. It's duration is controlled by C6. This is also the reset line into the ICP processor. Both processor's active low standby pins are also wired high. C5 and C7 provide filtering for the power lines.

SERIAL PORTS

The RCP processor's serial port is dedicated to providing access to the radio. Two sets of interface hardware is provided. One is a 5V open collector transistor arrangement. The output to the radio is through Q1. 74HC04 inverter U2C compensates for the transistor's inversion. Inverter sections U2A and U2B are used to isolate the data from the radio to the processor. This interface is selected when three pin jumpers J403 and J404 are set on pins 1 and 2.

In the case of Orion, the serial port is a RS485 interface. This is done with a 75176 interface chip (U4). The RS485 interface is on a single balanced line. An additional output from the RCP processor is needed to control whether the interface IC's transmitter. It should be low only when the micro is sending data out on the lines. The standard Orion baud rate is 38.4 k baud. This interface is selected when jumpers J403 and J404 are set to pins 2 and 3.

A third serial port control line is called Service Request. It is tied directly to the RCP's port pin, allowing the software to decide if it should be an input, output, or both. On Orion, the line needs to be bi-directional. The KBFS board both needs to read and set it. Timing of when to hold and when to release is very critical. The line also has a selectable 4.7k pull-up controlled by jumper J406. Typically, this jumper is in place to use the pull-up.

The ICP processor can be used to provide a second industry standard ASYNC serial port. Its baud rate and the meaning of two handshake lines are controlled from the RCP processor. The ICP serial lines go through a RS232 converter chip (U11) before being made available on a new board connector of J407. Its usage is not supported by standard software.

PARALLEL I/O

For MDX, the desktop provided a telephone keypad. This is a one of twelve static keyboard. An unpressed key is open. A pressed key ties the proper line to ground. The KBFS board provided J401 for this keyboard. However, the Orion radio does not make use of it. In a more general case, five of these lines are digital bit inputs. The remaining seven are tied to the micro's on board A/D converter. The A/D will report an eight bit value between Vcc and ground. Setting a useful comparison value in software allows these pins to be used as digital inputs.

The KBFS board must also support the DC and tone remote control boards. Up to five frequency select lines are brought on the micro board at J402. The control boards use open collector transistor lines to drive these inputs. In tone applications, these lines indicate the detected function tone. Note they are also direct processor pins.

Other remote control lines go off the micro board to the interconnect board on P207 or P208 before making their way to the control board by way of the remote interface board. These signals include the remote PTT input and the remote channel guard input. Remote PTT can also generate an interrupt. In EDACS applications, the remote channel guard disable line is tied to the control board's Secur-it tone detect output. The micro board uses this as the start of the next change function.

The remote boards use three open collector outputs. One, called RUS, is used to control the direction of the remote board's line audio drivers. It is high when the radio is unsquelched. On EDACS boards, it is also used to break the intercom loopback path during tone signaling sequences. The other two lines are called Handshake and LPTT. They are used to control the remote update hardware on the EDACS remote control board. They are not needed on the conventional remote boards.

The micro board makes use of desktop station lines brought up on P207 and P208 of the Interconnect board. One is the Remote Off switch. When it is low, activity from the remote control boards is basically ignored. The micro board also has access to Desk Mic PTT and PTT. They are set as inputs, but they are currently not used. The remote transmissions are keyed either from remote PTT through logic on the remote interface board or via serial messages from the micro board. The radio arbitrates the two PTT choices.

OPERATION

There are major differences between conventional and EDACS remote control operation. Remote channel guard disable in conventional is Secur-it tone detect in EDACS. There is no parallel status updates in conventional operation.

The KBFS board also needs to know what type of radio it is connected to. This is the main task of Mode Select resistor R54. It is part of a voltage divider with R9 from 5V. The divider is fed into one of the RCP's A/D inputs. The use of the divider and A/D allows a selection of many choices from one processor pin. The a/d voltage value currently determines the choice of EDACS vs Conventional operation. The A/D is read only at power-up. Open and shorted conditions can also be considered "states".

REMOTE CONTROL STATION OPERATION

All remote controlled EDACS Desk Top Stations are equipped with Tone Remote Board l9A704686P8. This board contains the tone decode and encode (generation) circuitry necessary for EDACS remote control applications. The decode circuitry decodes the Secur-It Tone/function tone sequences originating from the EDACS RCN-1000(s). The decoders' outputs drive the Keypad/Frequency Select Board's frequency select inputs at J402. The tone encode circuitry generates 2175 Hz tone bursts used for remote handshaking and update signaling. This tone generation circuitry is directly controlled by the KeyPad/Frequency Select Board.

Two (2) output control lines from microprocessor U1 connect to the Tone Remote Board. These output lines control the Tone Remote Board's 2175 Hz tone generator. They are identified as LOCAL PTT (P207 pin 6) and HANDSHAKE (P207 pin 7). The HANDSHAKE line provides on/off tone control and the LOCAL PTT line provides high/Low level tone control. Pull-up resistors are located on the Tone Remote Board for the open-collector transistor inverters, Q3 and Q4.

In a EDACS Desk Top Station, the Keypad/Frequency Select Board does not process any remote input (SF lines or PTT (FROM REMOTE) line) until it receives a Secur-It tone validation pulse on the SEC DET line (P207 pin 12). The Tone Remote Board pulls this line low when the Secur-It tone is present on the transmit phone line (line from RCN-1000). SF or PTT (FROM REMOTE) input changes not preceded by a SEC DET pulse are considered invalid and are thus not acted upon by the Keypad/Frequency Select Board.

Immediately after the Secur-It tone is detected (SEC DET transitions low), microprocessor U1 brings LOCAL PTT and HANDSHAKE high. With LOCAL PTT and HANDSHAKE high, the Tone Remote Board outputs a high-level 2175 Hz handshake tone burst to the EDACS RCN-1000(s) via the receive phone line pair. This tone burst informs the initiating EDACS RCN-1000 that the Desk Top Station received its Secur-It tone. It also informs any paralleled EDACS RCN-1000(s) that a control function is occurring from another (the initiating) EDACS RCN-1000. This temporarily prevents any paralleled remote from transmitting a Secur-It/function or Secur-it/function/hold tone sequence. The high-level 2175 Hz tone burst lasts approximately 140 milliseconds and it is sent out at a level equal to the Secur-It tone (approximately +10 dBm). See Figure 1.

Microprocessor U1 reads the SF inputs at J402 twenty (20) milliseconds after the Secur-It tone drops. This is exactly in the center of the 40 millisecond function tone, thus ensuring an accurate function tone decoder read.

Next, U1 starts a serial communication sequence with the radio. The function tone selection is then passed to the radio. Next, the radio checks its personality memory to see if the new SF selection information is a valid system/group. It then responds with a serial communication sequence to U1 on the Keypad/Frequency Select Board.

At this point, the Keypad/Frequency Select Board sends a 5-bit SF update word to the EDACS RCN-1000(s) via the receive phone line pair(s) using the 2175 Hz tone generator on the Tone Remote Board. This word updates the SF selection LED indicators at any paralleled EDACS RCN-1000s and it communicates valid/invalid SF selection (per radio SF personality programming) to the initiating EDACS RCN-1000. If the selection is not valid, the initiating remote will return to the previous SF selection and any paralleled remotes will never change their SF selections.

The 5-bit SF update word is generated by switching the 2175 Hz tone generator on the Tone Remote Board on and off. As shown in Figure 1, a logic 1 is represented by a high level 2175 Hz tone and a logic 0 is represented by a quiet line. Each bit period lasts 50 milliseconds. The start bit is 0, three data bits follow, and the stop bit is 1. The LOCAL PTT (P207 pin 6) and HANDSHAKE (P207 pin 7) outputs from the Keypad/Frequency Select Board control the tone generator circuit on the Tone Remote Board. Both are high when a high-level 2175 Hz tone is present (logic 1) and both are low during a quiet line (logic 0) period.

The chart in Figure 1 defines the Special Function selections that the three data bits within the 5-bit update word correspond to. The left column is the octal code of the three data bits. Codes 1 through 5 correspond to the desired system/group SF selection (SF1 - SF5 respectively). Codes 0 and 7 are not valid. Figure 1 shows update sequences SF4 and SF5.

Code 6 indicates the selection does not correspond to a programmed system or group in the DeskTop Station's mobile radio. This can occur if the system or group is reprogrammed at the radio or if not all five (5) system/group selections are programmed into the radio. If an EDACS RCN-1000 receives a code 6, it considers it as a "no valid system/group selection" and it turns off all of its SF selection LED indicators.

System/group changes or ptts is made at the EDACS Desk Top Station also causes the 5-bit SF update sequence to occur. The update sequence also occurs when the station is powered up.

REMOTE TRANSMIT FUNCTION

The previous circuit analysis includes information on the control signaling sequences that occur for both a remote (non-transmit) function selection and a remote transmit function. As shown in Figure 1, additional control signaling is required between the EDACS RCN-1000(s) and the Desk Top Station for a remote transmit function. This additional signaling is described in the following paragraphs.

As in a conventional system, the 2175 Hz transmit hold tone sent out from an EDACS RCN-1000 is present on the transmit phone line (line from RCN-1000) until the PTT is unkeyed. This hold tone signals the Desk Top Station that the remote is keyed. During the hold tone period, Tone Remote Board l9A704686P8 pulls the PTT (FROM REMOTE) input at P207 pin 11 low. Microprocessor U1 reads this low and thus recognizes the keyed EDACS RCN-1000.

As shown in Figure 1, after the 5-bit SF update word is sent out, a low-level 2175 Hz tone is applied to the receive phone line pair (line to RCN-1000). This tone, generated by the Tone Remote Board, signals the EDACS RCN-1000's that the Desk Top Station is waiting for a channel assignment from the EDACS site. As with the initial high-level 2175 Hz handshake and the 5-bit SF update, the Keypad/Frequency Select Board uses its LOCAL PTT (P207 pin 6) and HANDSHAKE (P207 pin 7) outputs to control the 2175 Hz tone generator circuit on the Tone Remote Board. LOCAL PTT is high and HANDSHAKE is low when the low-level 2175 Hz tone is present on the receive phone line pair.

Next, the initiating EDACS RCN-1000 must be notified when the Desk Top Station receives a working channel assignment from the EDACS site. This is accomplished, as shown in Figure 1, by a 50-millisecond high-level 2175 Hz tone burst sent to the EDACS RCN-1000 via the receive phone line pair. This tone burst is known as the "OK to talk" burst. HANDSHAKE switches high for 50 milliseconds to switch the tone generator on the Tone Remote Board to a high-level output.

When the initiating EDACS RCN-1000 receives the "OK to talk" tone burst, it opens its mic audio path and sounds its "OK to talk" beep. After the high-level 2175 Hz "OK to talk" burst occurs, the Keypad/Frequency Select Board switches the tone generator back to a low-level for the duration of the remote key. This is accomplished by switching HANDSHAKE back to a low level and leaving LOCAL PTT high for the remainder of the key.

If the Desk Top Station does not receive a working channel assignment from the EDACS site within five seconds, the "OK to talk" burst will not be generated. The Keypad/Frequency Select Board will re-initialize itself for another Secur-It/function/hold tone sequence.

CONVENTIONAL DESK TOP STATIONS

The KBFS Board monitors the five (5) SF lines and the PTT (FROM REMOTE) line at P207 pin 11 from the Conventional DC/Tone Remote Board. The SEC DET line at P207 pin 12 goes to the KBFS board but is not used.. The DC/Tone Remote Board pulls PTT (FROM REMOTE) low when a remote control unit signals for a station key. The SEC DET (Secur-It tone detect) line from the DC/Tone Remote Board is really a Channel Guard disable line; it does not signal the presence or absence of the Secur-It tone in a conventional tone remote controlled system.

Upon reading a change in one of the input lines, microprocessor U701 starts a serial communication sequence with the radio. This sequence transfers the new channel or function information to the mobile radio.

There is much variety in the operation of tone control systems. For example, many remote control units do not send the tone sequence for a channel change until there is a PTT. If a KBFS board does not respond to a frequency change from a remote, verify the remote actually sends a tone sequence for the board to act upon.

FLASHING OPERATIONS

The 12v Vpp voltage for the flash comes onto the board on P208 pin 9. This is an unused pin on the current KBFS Board. It is also an unused pin on the combined Orion/MDX Desktop Interconnect board. Vpp is protected by a low value resistor and a 15v zener diode. Vpp also happens to be A18 on the 5v only 512k byte flash device. Zero ohm series resistors are used to decide which signal goes to the device's pin. The RCP serial port lines on J208 can be used to tie to the flashing computer through a TQ3370 box through the J401 keypad and display serial lines. J403 and J404 must be jumpered for the open collector transistor hardware (Pins 1 and 2) to bring the serial port to this connector.

The board must be removed from the desktop to flash by J208. The reason for this is the KBFS board's serial port sense is opposite that of the radio. This is a consequence of being able to talk to the radio. The personality/flash capabilities from the mic connector of the desktop are also meant to talk to the radio. It is the same sense of the KBFS board. Therefore, connecting TXD to TXD and RXD to RXD results in no communications.

Flashing can also be done by connecting a flashing cable to J408 and J401. This can be done with the KBFS board mounted in the desktop. Vpp is on flashing connector J408 pin 6. Jumpers J403 and J404 must either be removed or in the Orion position to flash from this connector. The serial lines connecting the KBFS board and the computer are on J408 pins 4 and 5. Pin 2 of J408 is tied to ground in the TQ3370 box. It is used to disable the RS485 receiver's output so that only the computer drivers the RCP's receive line. Flashing is done with the computer software and protocol developed for the MRK/Orion radios.

The RCP's internal ROM software controls the flashing process. It makes assumptions about the MRK/Orion hardware that are not valid in the KBSF board. One of these is that J401 pin 5 must be high and J401-13 must be pulled low. This is accomplished with the flashing cable's J401 connector.

Another situation involves the RCP's power-up process. Part of the power-up sequence is to look for a display or Orion control unit which is not there on the KBSF board. This creates an error condition which hangs the software in an exception handling loop. In the radio, this would be cleared by a watchdog timer in the modem. However, the KBSF board has no modem IC hence no watchdog reset. The board will appear to die. The flash program will not run any further.

The solution is to manually reset the RCP. A reset after power-up is somewhat different than a reset at power-up. In this situation, the lack of a display or control head will not hang the micro. Because of this, the reset line is brought out on flashing connector J408-3. The flashing cable ties this line to the momentary PTT switch in the TQ3370 box. If the KBFS board does not flash immediately after power-up, press the PTT switch and try flashing again. It may take several attempts to get the board's attention.

An alternate method of determining if one is in flash mode is to check for a specific pattern on A0. When in flash mode, there should be address pulses for about half a millisecond every three milliseconds. Constant or no pulses on A0 indicate the board is not in flash mode. The board will be in program mode on every second reset.

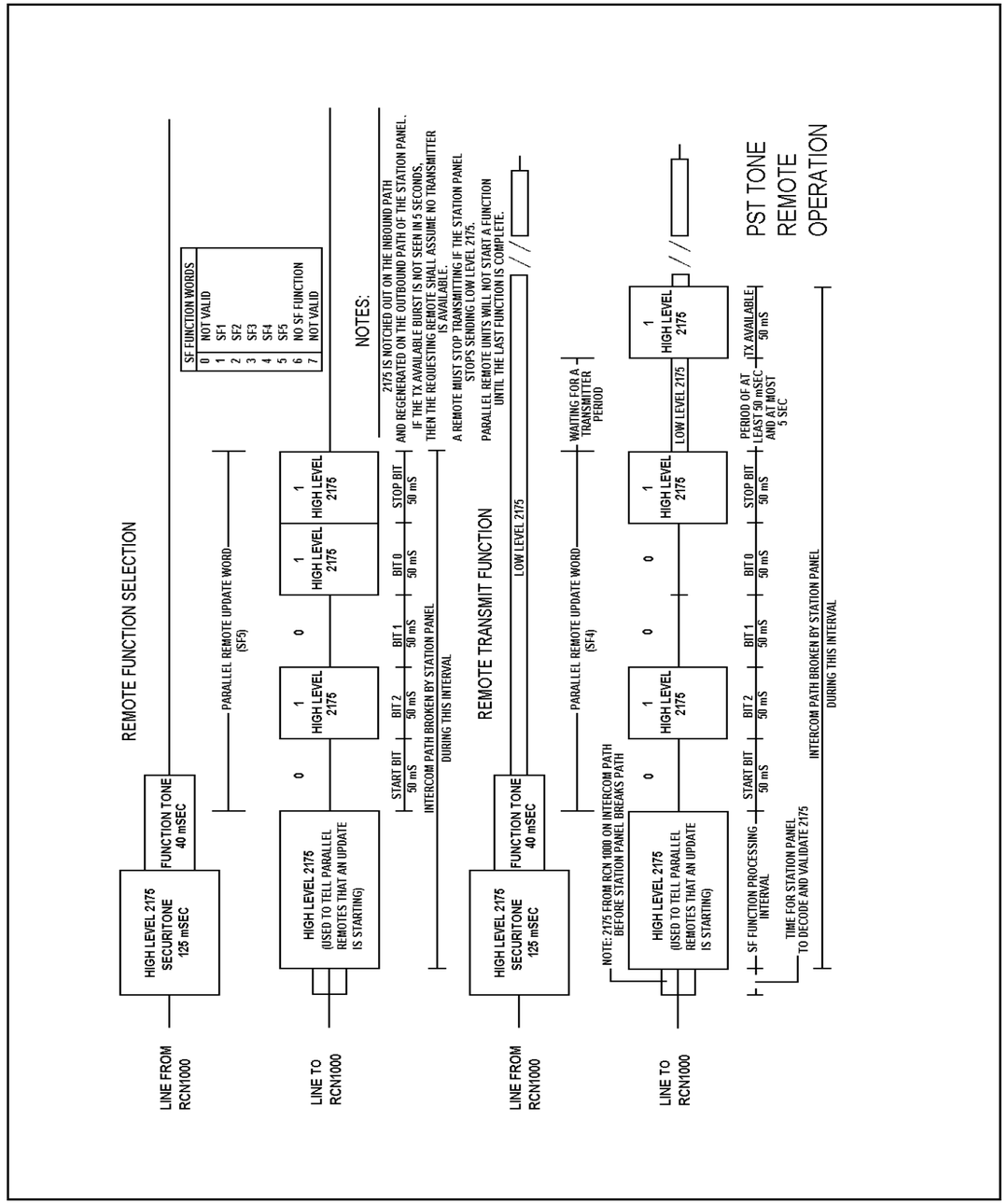
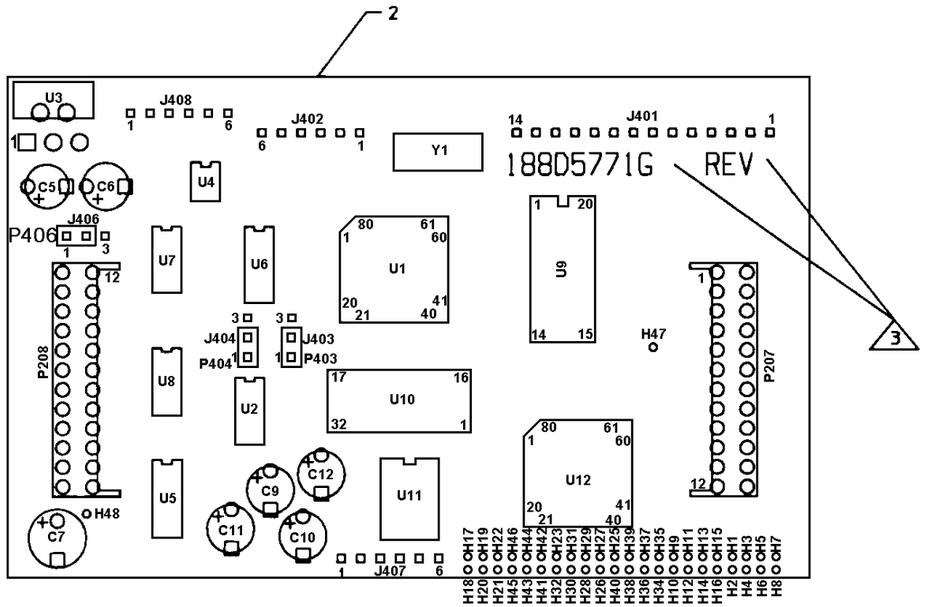
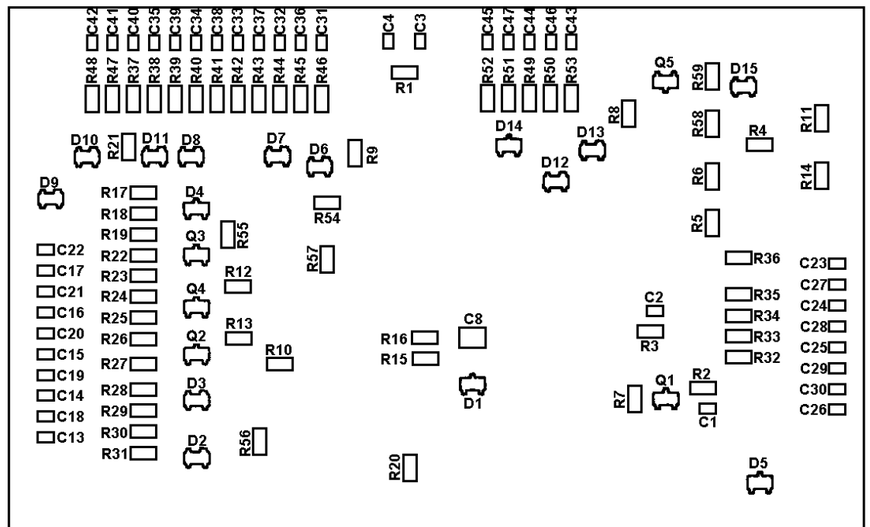


Figure 1





(1) NOTES:
1. SOLDER ALL ELECTRICAL CONNECTIONS.
2. COMPONENT LEADS TO PROTRUDE .06 MAX. BELOW SOLDER SIDE OF BOARD.
3. MARK APPLICABLE GROUP NUMBER AND REVISION LETTER PER 19A115740P1 CHARACTERS .12 HIGH, COLOR BLACK FOR LATEST REVISION LETTER SEE 19C852060 INDEX

CAUTION
OBSERVE PRECAUTIONS FOR HANDLING
ELECTROSTATIC SENSITIVE DEVICES

KEYPAD/FREQUENCY SELECT BOARD
188D5771G1

(188D5771, Rev. 0)

UNIVERSAL DESKTOP MICRO BOARD

RADIO TYPE SELECTION

RADIO AND MODE SELECTION ARE DONE VIA R54. THIS IS A RESISTOR THAT FORMS A VOLTAGE DIVIDER ON ONE OF THE RCP PROCESSOR'S A/D INPUTS. CURRENTLY, THERE ARE FOUR STATES. BECAUSE OF THE NATURE OF THE A/D, THIS NUMBER COULD EASILY BE EXPANDED.

1) EDACS MDX
2) CONVENTIONAL MDX
3) EDACS ORION
4) CONVENTIONAL ORION

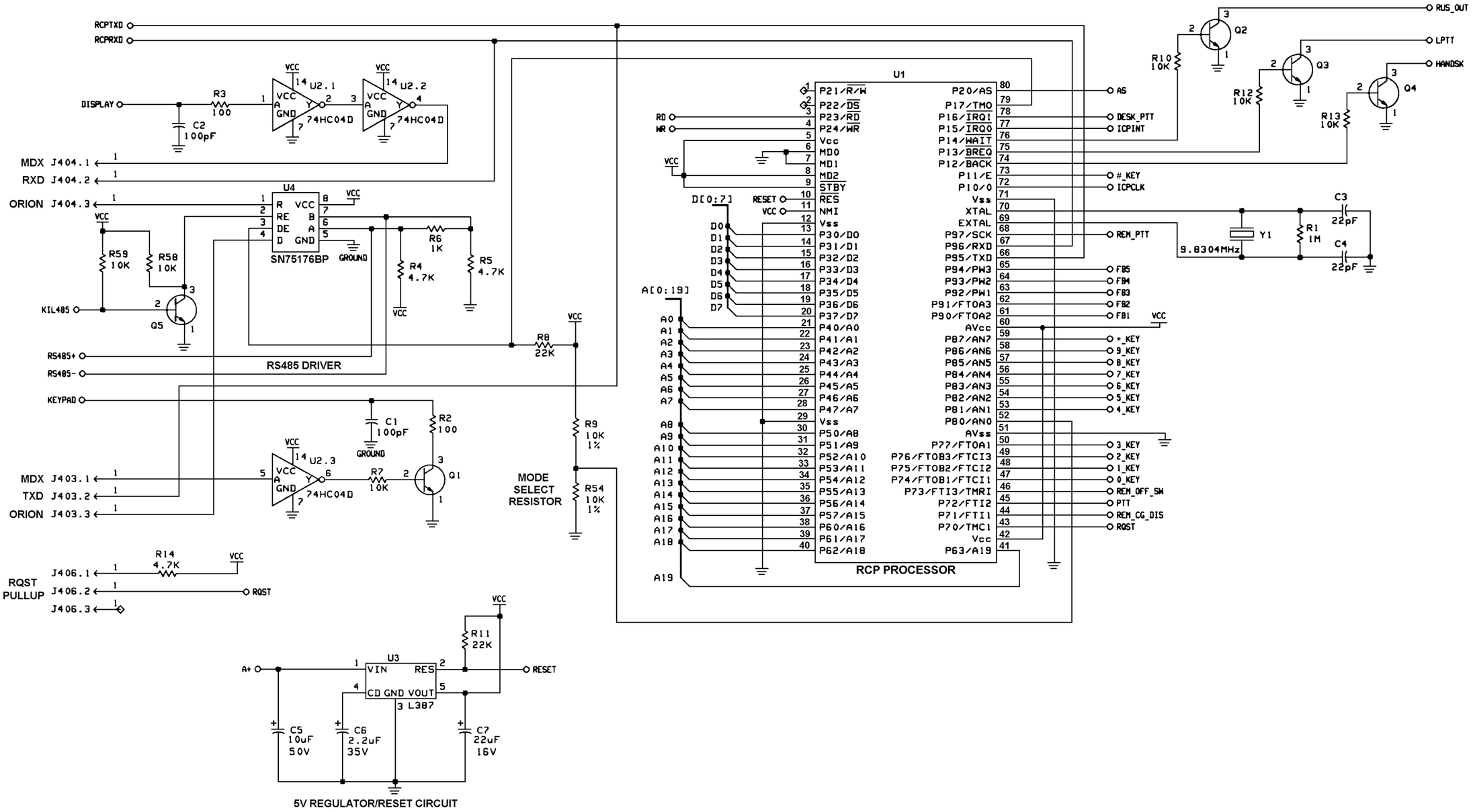
SERIAL PORT TYPE JUMPERS

MDX USES AN OPEN COLLECTOR SERIAL PORT. ORION USES A RS485 INTERFACE. JUMPER J403 SELECTS THE SERIAL TRANSMIT CIRCUIT WHILE J404 SELECTS THE SERIAL RECEIVE CIRCUIT. BOTH JUMPERS ARE SET FROM 1 TO 2 FOR MDX AND 2 TO 3 FOR ORION.

BOARD CONNECTORS

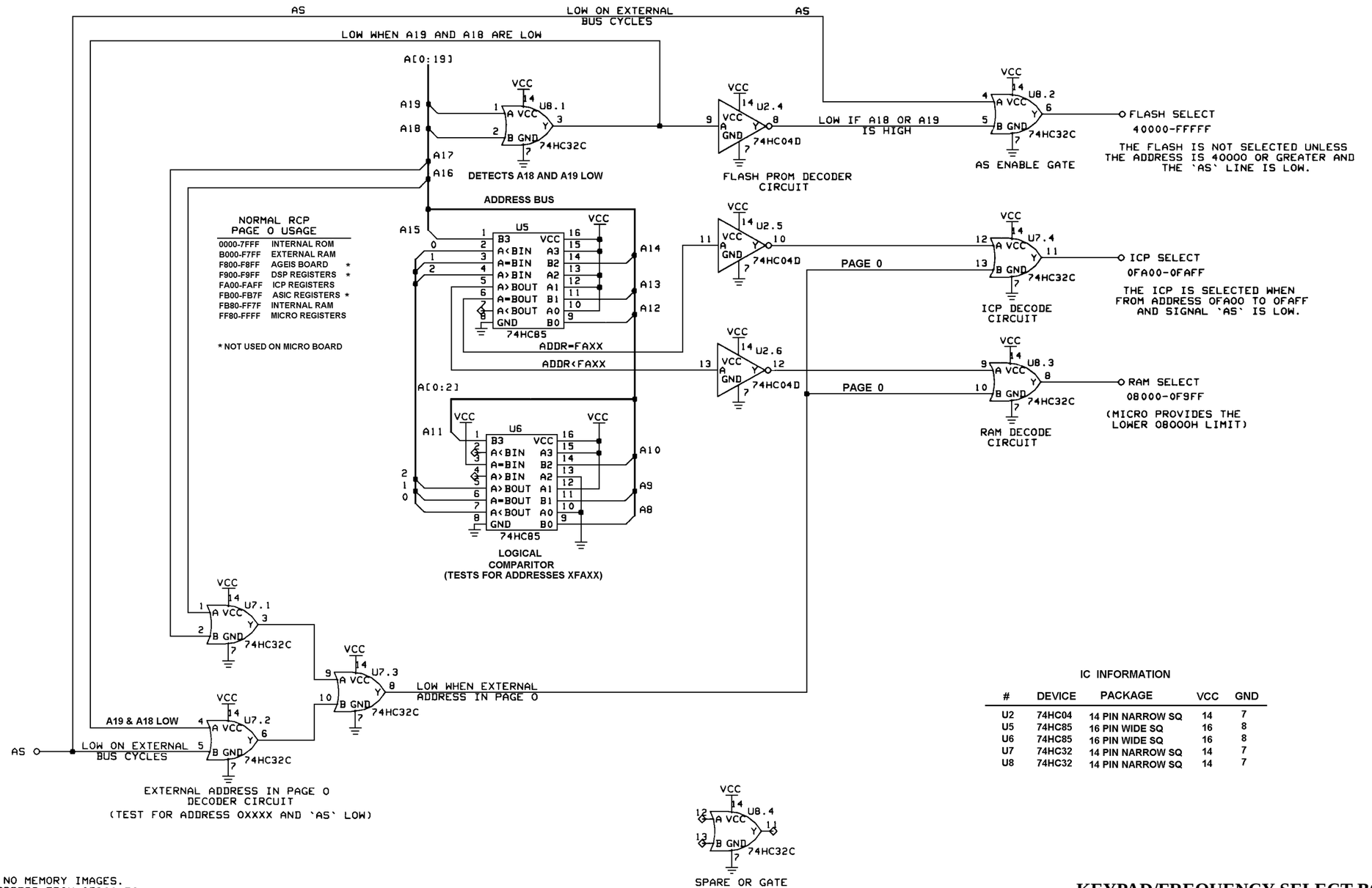
J401	14	PIN CONNECTOR FOR MDX KEYPAD
J402	6	PIN CONNECTOR FOR IDA BOARD FREQUENCY SELECTS
J403	3	PIN TXD HARDWARE SELECTION JUMPER
J404	3	PIN AXD HARDWARE SELECTION JUMPER
J406	3	PIN PULLUP ON SERIAL REQUEST LINE JUMPER
J407	3	PIN ICP RS232 SERIAL PORT CONNECTOR
J408	6	PIN FLASH PROGRAMING CONNECTOR
P207	12	PIN CONNECTOR TO INTERCONNECT BOARD
P208	12	PIN CONNECTOR TO INTERCONNECT BOARD

KEYPAD/FREQUENCY SELECT BOARD
188D5771G1
(188D5772, Sh. 1, Rev. 1)



KEYPAD/FREQUENCY SELECT BOARD
188D5771G1

(188D5772, Sh. 2, Rev. 1)



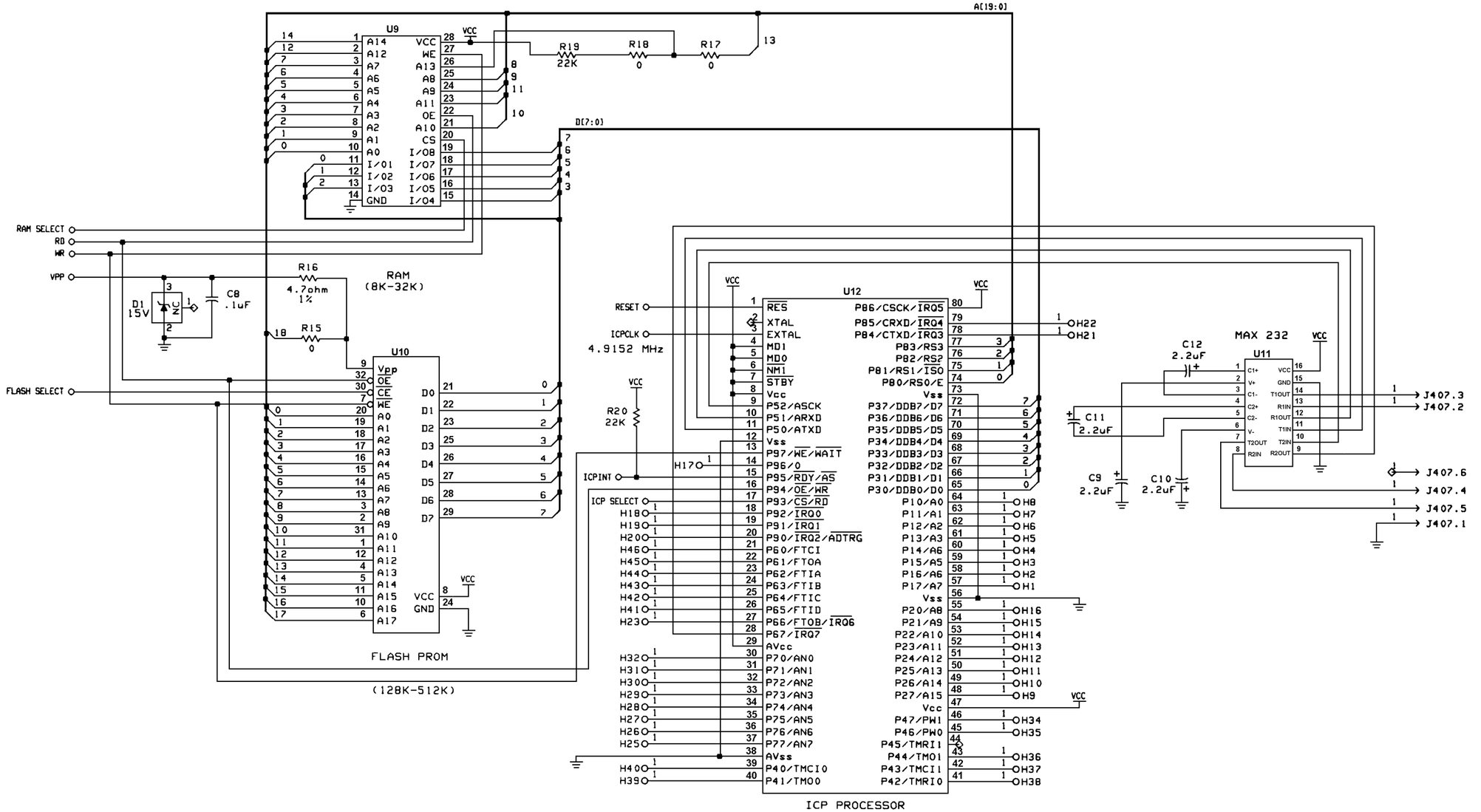
IC INFORMATION

#	DEVICE	PACKAGE	VCC	GND
U2	74HC04	14 PIN NARROW SQ	14	7
U5	74HC85	16 PIN WIDE SQ	16	8
U6	74HC85	16 PIN WIDE SQ	16	8
U7	74HC32	14 PIN NARROW SQ	14	7
U8	74HC32	14 PIN NARROW SQ	14	7

THIS APPROACH HAS NO MEMORY IMAGES. HOWEVER, DEVICE ADDRESS FROM 0F800 TO 0F9FF WILL MAP TO THE UPPER ADDRESS SPACE OF THE RAM. ALL DEVICES ARE ALSO UNSELECTED UNLESS IN A BUS CYCLE. (SIGNAL `AS` LOW)

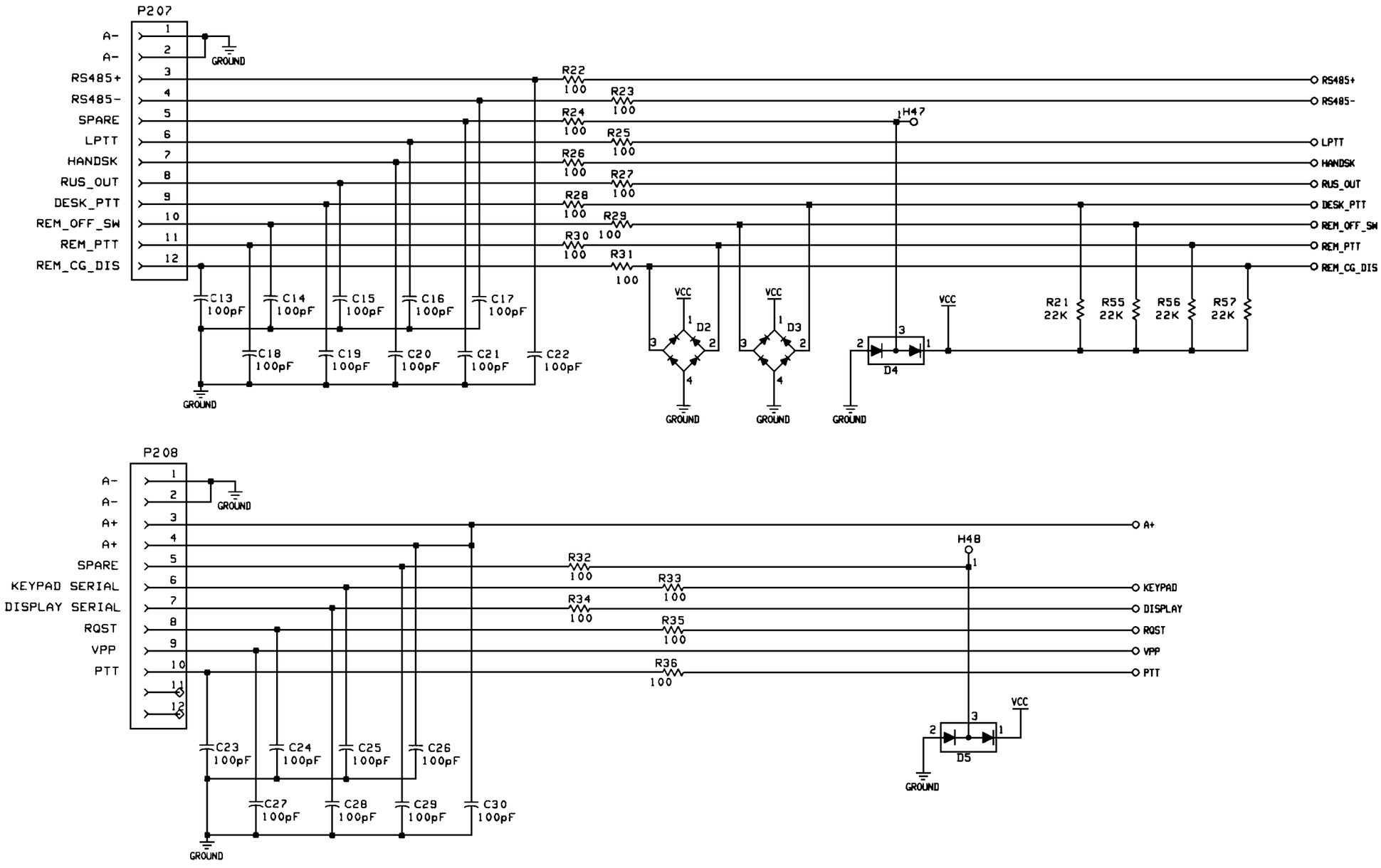
KEYPAD/FREQUENCY SELECT BOARD
188D5771G1

(188D5772, Sh. 3, Rev. 1)



KEYPAD/FREQUENCY SELECT BOARD
188D5771G1

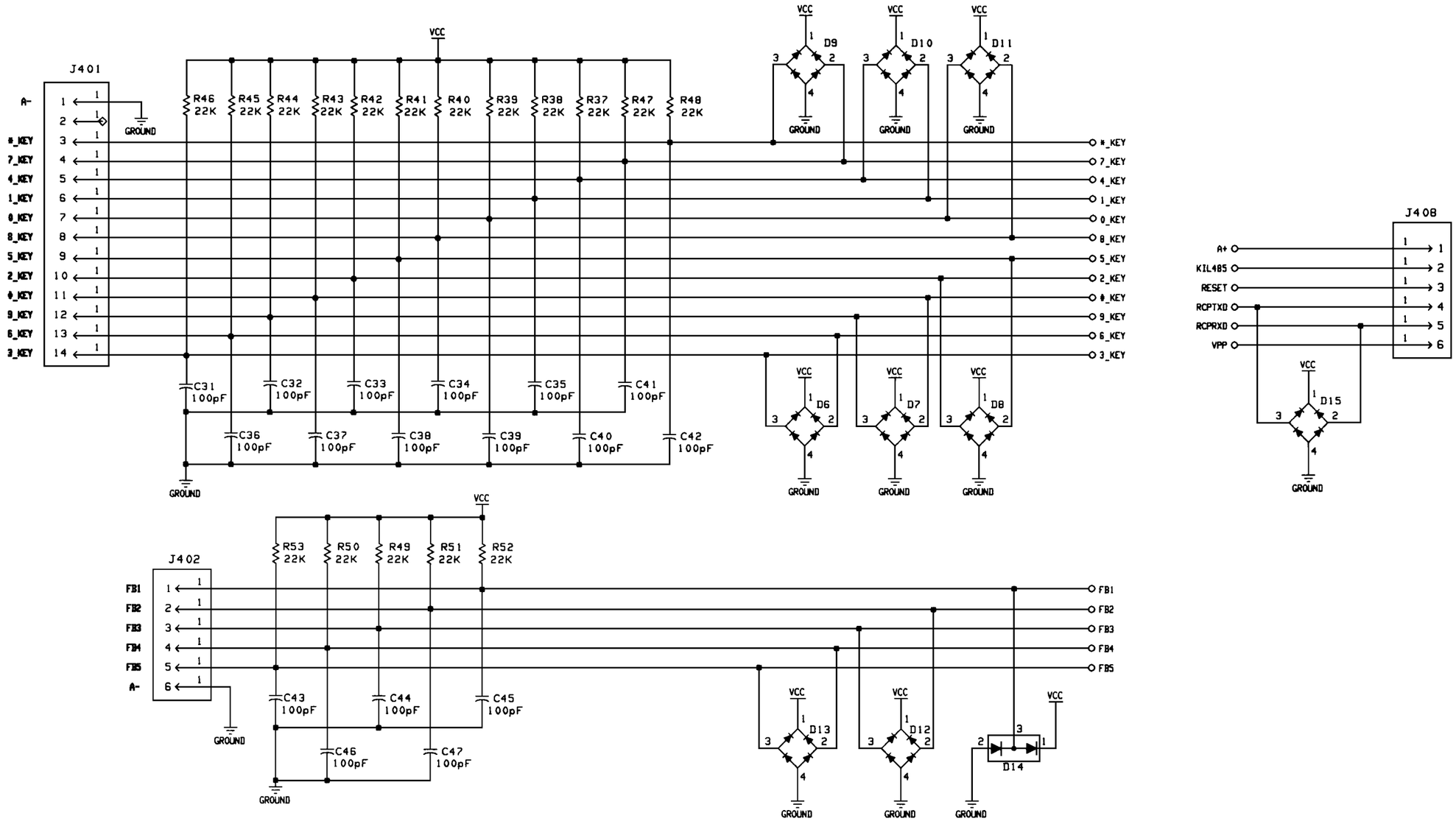
(188D5772, Sh. 4, Rev. 1)



DESKTOP INTERCONNECT
BOARD CONNECTORS

KEYPAD/FREQUENCY SELECT BOARD
188D5771G1

(188D5772, Sh. 5, Rev. 1)



KEYPAD/FREQUENCY SELECT BOARD
188D5771G1

(188D5772, Sh. 6, Rev. 1)

PARTS LIST
KEYPAD/FREQUENCY SELECT BOARD
188D5771G1

SYMBOL	PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1 and C2	19A702061P61	Ceramic: 100 pF + or - 5%, 50 VDCW, temp coef 0 + or - 30 PPM.
C3 and C4	19A702061P29	Ceramic: 22 pF + or - 5%, 50 VDCW, temp coef 0 + or - 30 PPM.
C5	19A703314P10	Electrolytic: 10 uF -10+50%, 50 VDCW; sim to Panasonic LS Series.
C6	19A701534P5	Tantalum: 2.2 uF, + or -20%, 35 VDCW.
C7	19A701534P8	Tantalum: 22 uF + or -20%, 16 VDCW.
C8	19A702052P26	Ceramic: 0.1uF + or - 10%, 50 VDCW
C13 thru C47	19A702061P61	Ceramic: 100 pF + or - 5%, 50 VDCW, temp coef 0 + or - 30 PPM.
		- - - - - - - - - - DIODES - - - - - - - - - -
D1	19A700083P108	Silicon, Zener: 15 Volt; sim to BZX84-C15.
D2 and D3	19A149615P1	Silicon: Diode Bridge; sim to BGX50A.
D4 and D5	19A700053P2	Silicon: 2 Diodes in Series; sim to BAV99.
D6 thru D13	19A149615P1	Silicon: Diode Bridge; sim to BGX50A.
D14	19A700053P2	Silicon: 2 Diodes in Series; sim to BAV99.
D15	19A149615P1	Silicon: Diode Bridge; sim to BGX50A.
		- - - - - - - - - - JACKS - - - - - - - - - -
J401 thru J404	19A703248P11	Post: Gold Plated, 10 mm length.
J406 thru J408	19A703248P11	Post: Gold Plated, 10 mm length.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P207 and P208	19A704779P11	Connector; sim to Molex 22-17-2122.
P403 and P404	19A702104P2	Connector: Shorting Jumper, Gold Plated. (Housing Color: White).
P406	19A702104P2	Connector: Shorting Jumper, Gold Plated.
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q1 thru Q5	19A700076P2	Silicon, NPN: sim to MMBT3904, low profile.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	19B800607P105	Metal film: 1M ohms + or -5%, 1/8 w.
R2 and R3	19B800607P101	Metal film: 100 ohms + or -5%, 1/8 w.
R4 and R5	19B800607P472	Metal film: 4.7K ohms + or -5%, 1/8 w.
R6	19B800607P102	Metal film: 1K ohms + or -5%, 1/8 w.
R7	19B800607P103	Metal film: 10K ohms + or -5%, 1/8 w.
R8	19B800607P223	Metal film: 22K ohms + or -5%, 1/8 w.
R9	19A702931P301	Metal film: 10K ohms + or -1%, 200 VDCW, 1/8 w.
R10	19B800607P103	Metal film: 10K ohms + or -5%, 1/8 w.
R11	19B800607P223	Metal film: 22K ohms + or -5%, 1/8 w.
R12 and R13	19B800607P103	Metal film: 10K ohms + or -5%, 1/8 w.
R14	19B800607P472	Metal film: 4.7K ohms + or -5%, 1/8 w.
R16	REP645621/47	Metal film: 4.7K ohms + or -1%, 1/8 w.
R17	19B800607P1	Metal film: Jumper.
R19 thru R21	19B800607P223	Metal film: 22K ohms + or -5%, 1/8 w.
R22 thru R36	19B800607P101	Metal film: 100 ohms + or -5%, 1/8 w.
R37 thru R53	19B800607P223	Metal film: 22K ohms + or -5%, 1/8 w.
R54	19A702931P301	Metal film: 10K ohms + or -1%, 200 VDCW, 1/8 w.
R55 thru R57	19B800607P223	Metal film: 22K ohms + or -5%, 1/8 w.
R58 and R59	19B800607P103	Metal film: 10K ohms + or -5%, 1/8 w.
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - -
U1	344A4707P2	Microprocessor.
U2	19A703483P304	Digital: Hex Inverter; sim to 74HC04.
U3	19A704970P1	Linear: 5 Volt Regulator with Reset Output; sim
U4	19A705980P101	Transceiver, differential Bus; sim to SN751768.
U5 and U6	19A703483P319	Digital: 4-Bit Magnitude Comparator; sim to 74HC85.
U7 and U8	19A703483P311	Digital: CMOS Quad 2-Input OR Gate; sim to 74HC32.
U9	RYT1196005/4C	RAM: 32K x 8 bit.
U10	RYT1186036/2C	EPROM, 1 MB, 128K x 8 bit.
		- - - - - - - - - - CRYSTALS - - - - - - - - -
Y1	19A702511G70	Crystal unit, quartz.