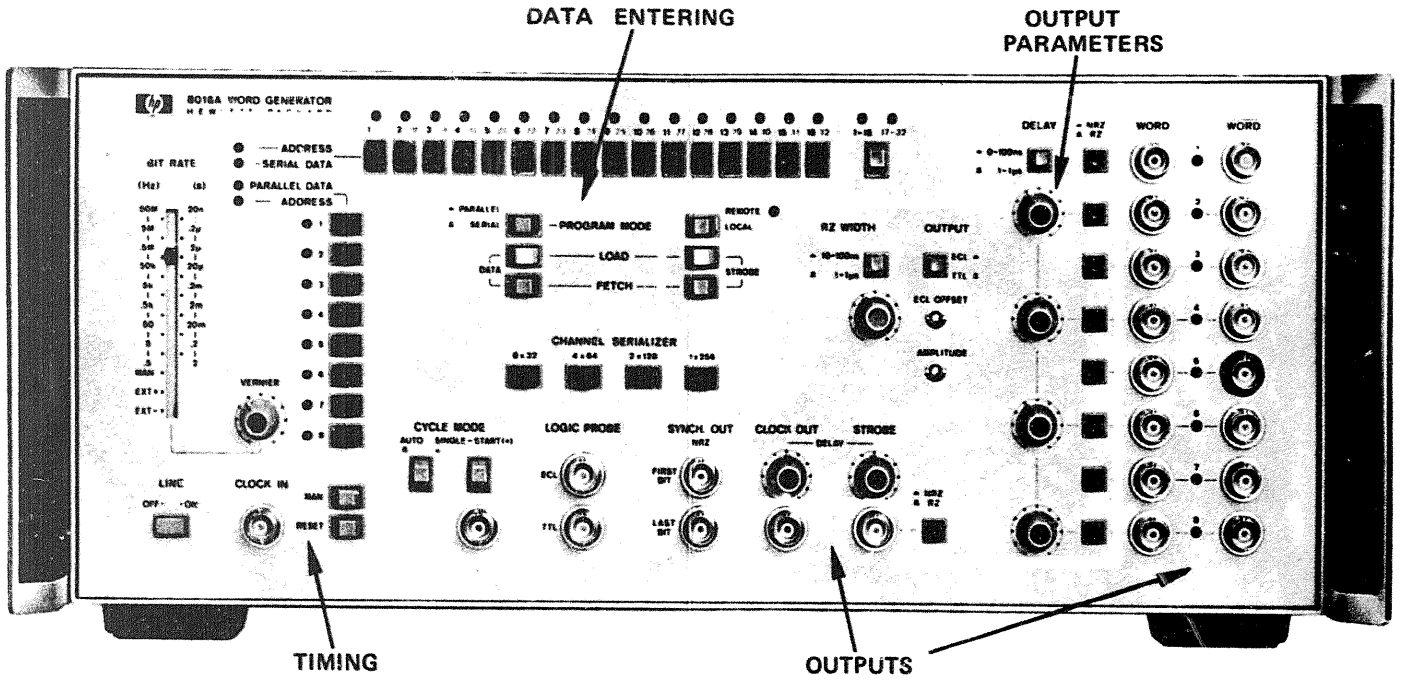
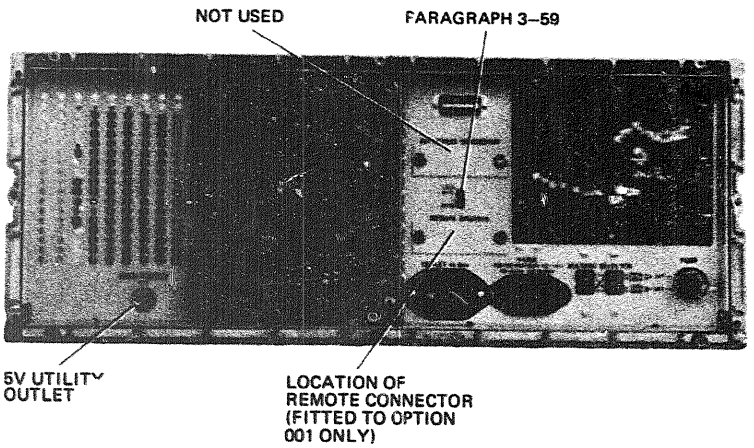


Front Panel — Functional Areas



Rear Panel — Controls and connectors

Figure 3–1. Controls and Connectors

3–1 GENERAL

3–2 The following instructions apply to model 8016A, 8016A – Option 001 and 8016A – Option 002. Ignore instructions which do not apply to your instrument.

3–3 CONTROL FUNCTIONS

3–4 The 8016A front panel can be divided into 4 main control functions:

- Data Entering
- Outputs
- Output Parameters
- Timing

3–5 Figure 3–1 clearly illustrates each functional area. The controls/indicators within each area are fully described in the following text.

3–6 DATA ENTERING

3–7 Figure 3–2 shows the relevant front panel area for data entering. (The REMOTE/LOCAL switch is only relevant to option 001 described in appendix A.)

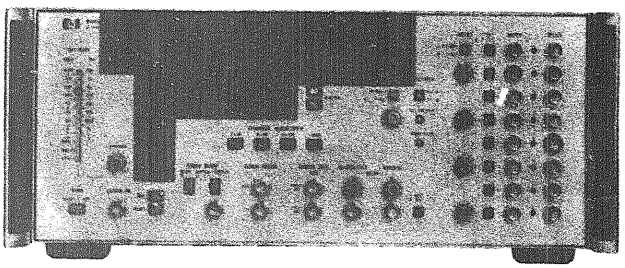
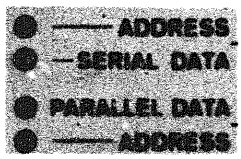


Figure 3–2. 8016A – Data Entering

3–8 Data can be loaded in parallel or serial form selectable via the PARALLEL/SERIAL pushbutton switch. If PARALLEL is selected, then the pushbutton column is used for data-setting, and the pushbutton row for memory addressing. If SERIAL is selected, then the functions of the pushbutton row and column are reversed i.e. row for data-setting, column for memory addressing. A group of 4 LEDs located to the left of the pushbutton column/row arrangement provide a visual indication of the functions, the top 2 LEDs relating to the row function, the bottom 2 LEDs relating to the column function e.g.



The illuminated first and third LEDS provide a visual indication that the pushbutton row is being used for addressing memory, and the pushbutton column for data-setting.

3–9 Each pushbutton controls a one-bit buffer register, and the status of each register is indicated by an LED located alongside (column) or above (row) the corresponding pushbutton i.e. illuminated for a logic "1".

3–10 Parallel Loading

3–11 Data can be loaded one word (8 bits parallel) at a time into one or more of 32 word locations in the memory. The pushbutton column is utilized for data-setting and the pushbutton row for memory addressing. Each pushbutton in the row can address two memory word locations, dependent on the selection of the 17th pushbutton which assigns the 16 pushbuttons to the appropriate half of the row i.e. "1–16" or "17–32". LEDs provide a visual indication of the range selected.

3–12 When the address(es) is selected and the data is set into the buffer registers, the LOAD DATA pushbuttomust be operated to transfer the data from the buffer registers to the selected memory location(s).

3–13 If data in any memory location needs to be checked or transferred, there is a 'fetch' facility which provides a non-destructive read-out from the memory to the display register. To operate this facility, first select the required memory address (via the pushbutton row), then depress the FETCH DATA pushbutton. The data in the selected word address will be indicated by the LED

column adjacent to the pushbutton column. If more than one word address is selected prior to operating the FETCH DATA pushbutton, only the word with the highest address number is displayed, e.g. word addresses, 1, 3 and 5 selected, only one word address 5 is displayed. To transfer data, select the new word address and operate the LOAD DATA pushbutton.

3–14 Serial Loading

3–15 Data can be loaded 16 bits at a time into one or more of 8 word locations in the memory, each word location corresponding to a channel. The pushbutton column is utilized for memory addressing and the pushbutton row for data-setting. Each pushbutton in the row can set two bits in the 32-bit word dependent to the selection of the 17th pushbutton i.e. "1–16" or "17–32".

3–16 When the address(es) is selected and the data is set into the buffer registers, the LOAD DATA pushbutton must be operated to transfer the data from the buffer registers to the selected memory location(s).

3–17 As in 'parallel loading", if data in any word location needs to be checked or transferred, the 'fetch' facility provides a non-destructive read-out from the memory to the display register. To operate the fetch facility, select the required memory address (via the pushbutton column) and the required half of the word (via the 17th pushbutton), then depress the FETCH DATA pushbutton. The data in the selected word address will be indicated by the LED row location above the pushbutton row. If more than one address is selected prior to operating the FETCH DATA pushbutton, the contents of the selected word addresses are gated (OR'ed) to produce the LED display.

3–18 Loading 00, 01, 10, 11 Pattern

3–19 This facility provides a useful means for fast memory loading e.g. 256 bit checker-board pattern set by operating 29 pushbuttons only.

3–20 The method is best described by taking a single pattern i.e. "0" as an example. Hold the last two buffer registers (15–31 and 16–32 to "00" and simultaneously depress the FETCH DATA pushbuttons. On release, all buffer registers in the row will be set to "0". Operate the DATA LOAD pushbutton to transfer the pattern to memory.

3–21 Similarly for patterns "01", "10" or "11", except that the last two buffer registers are held to the required pattern.

3–22 OUTPUTS

3–23 Figure 3-3 shows the front panel area which is relevant to the following description of the outputs.

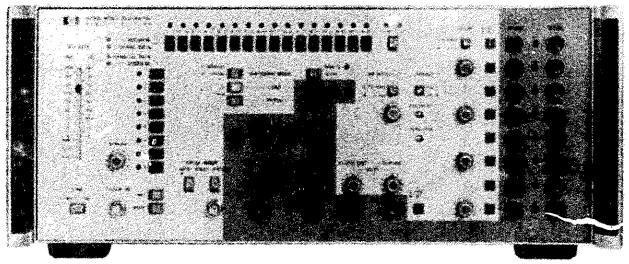


Figure 3–3. 8016A – Outputs

3–24 The outputs of the 8016A can be divided into two main categories:

– Data Outputs
– Auxiliary Outputs

3–25 Data Outputs

3–26 Normally, there are 8 data output channels, each channel providing normal and complement 32-bit signals. When the CHANNEL SERIALIZER is in the 8 x 32 position, the strobe output is a ninth data output channel.

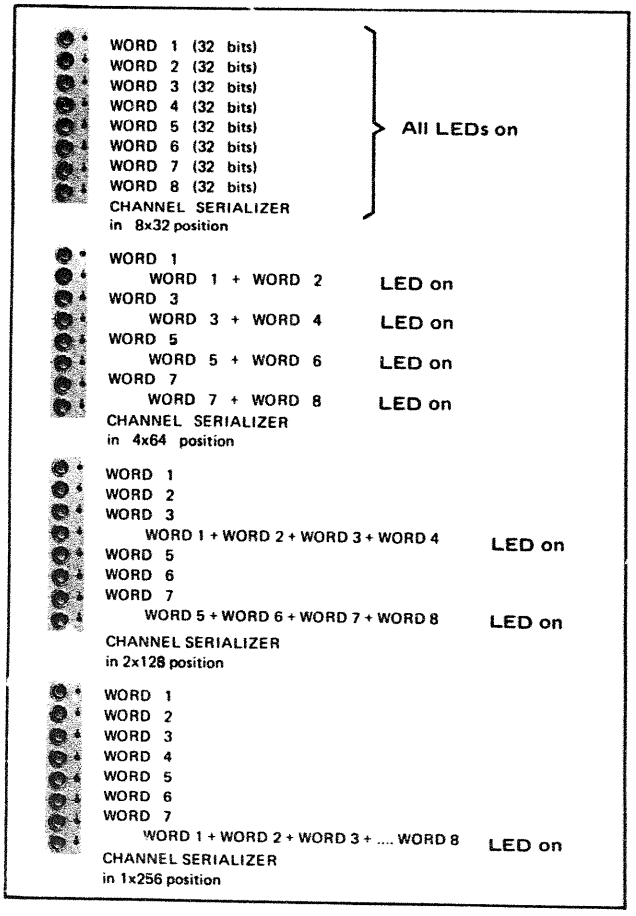


Figure 3–4. Channel Serializer

3–27 **Data Serialization.** The 8 output channels can be serialized (multiplexed) to give four channels each outputting a 64-bit word, two channels each outputting a 128-bit word or one channel outputting a 256-bit word. The channels outputting the serialized data are indicated by an illuminated LED, whilst the other channels continue to output a 32-bit word repetitively.

3–28 When the CHANNEL SERIALIZER is in operation, both the normal signals and the complement signals are serialized.

3–29 Auxiliary Outputs

3–30 The auxiliary outputs include the synch. outputs (first, last bit), clock output, strobe output and the probe power outputs.

3–31 **Synch Outputs.** There are two synch. outputs, one corresponding to the first bit of the data word, and the other corresponding to the last bit of the serial data frame, the data frame being 32 bits, 64 bits, 128 bits or 256 bits long depending on the CHANNEL SERIALIZER selection. Both outputs are in NRZ format (seeparagraph 3–38 for description of NRZ format).

3–32 **Clock Output.** This provides an output pulse at the rate set by the BIT RATE controls. The format is RZ.

3–33 **Strobe Output.** The strobe channel has 2 functions depending on the position of the channel serializer. It can function either as a ninth data channel, or as a 32-bit trigger word which can be assigned via the pushbutton column to the words with the serialized data frame. Figure 3–5 relates the position of the channel serializer to the data words available for assigning the strobe word.

3–34 Independent of both the strobe function and the PARALLEL/SERIAL switch setting, the strobe word is programmed via the pushbutton row, and transferred to memory by operation of the LOAD STROBE pushbutton. In addition, a FETCH STROBE facility, which is operated by simply pressing the FETCH STROBE pushbutton, shows both the strobe content (LED row) and the strobe assignment (LED column).

3–35 **Probe Power.** A unique feature of the 8016A is the LOGIC PROBE facility. This facility provides power sources for the HP 10525 E (ECL) logic probe, the HP 10525 T (TTL) logic probe, the HP 10526 T logic pulser or any other comparable instrument.

CHANNEL SERIALIZER SELECTION	OPERATIONAL 'COLUMN' PUSHBUTTONS	COMMENT
8 x 32	NONE	The strobe cannot be assigned to any 'data word' but functions as a ninth data channel. Data is set via the pushbutton row and transferred to memory via the LOAD STROBE pushbutton.
4 x 64		The strobe word can be assigned to one or both of data words 1 and 2 in the serialized data frame. Pushbuttons 3 – 8 have no control over strobe assignment.
2 x 128		The strobe word can be assigned to any or all of words 1 – 4 within the serialized data frame. Pushbuttons 4 – 8 have no control over strobe assignment.
1 x 256		The strobe word can be assigned to any or all of words 1 – 8 within the serialized data frame.
N.B.	Word 1 is the normal 32-bit output from Channel 1, Word 2 the normal 32-bit output from Channel 2, etc.	

Figure 3–5. Channel Serializer/Strobe Assignment

3–36 OUTPUT PARAMETERS

3–37 Figure 3–6 shows the front panel area which is relevant to the following description of the output parameters.

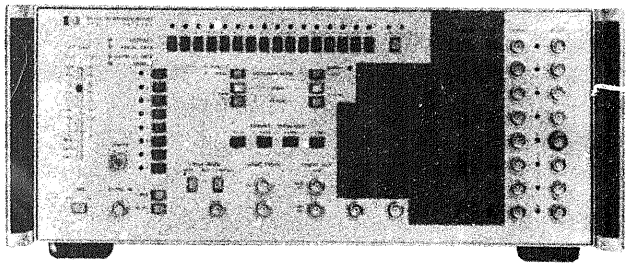


Figure 3–6. 8016A – Output Parameters

3–38 RZ/NRZ Formats

3–39 Each data channel and the strobe channel is provided with an independent RZ/NRZ format pushbutton switch. When a switch is set to "RZ", a logic "1" output from the associated channel returns to zero before the bit period ends. If the switch is set to "NRZ" then the associated output signal does not return to zero unless the following bit is zero. The significance of "return to zero" and "non-return to zero" is shown in Figure 3–7.

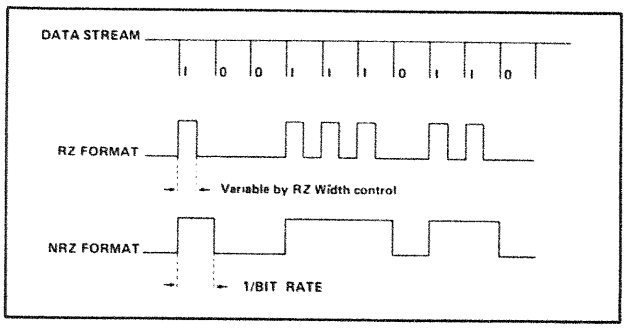


Figure 3–7. Comparison of RZ and NRZ Formats

3–40 RZ Width

3–41 An additional control is provided for varying the RZ width. All output channels in RZ format and the clock output are changed simultaneously by this one RZ width control. The width can be varied up to a maximum of 50% of the bit period. At high frequencies, this maximum is reduced to 40% of the bit period. (A bit period scale is provided adjacent to the BIT RATE slider).

3–42 A pushbutton located above the RZ WIDTH control enables one of two RZ width ranges to be selected i.e. 10ns – 100ns or .1μs – 1μs.

3–43 Delay

3–44 Data channels 2, 4, 6, 8, the strobe channel and the clock output can be delayed independently with respect to the fixed data channels 1, 3, 5 and 7, **within a common range.**

3–45 Two delay ranges are provided, 0 – 100ns, or .1μs – 1μs selectable via a single pushbutton switch.

3–46 The delay is also limited by the bit rate period. The maximum delay is 40% of the bit period. In the higher frequency range, the maximum delay is reduced to 10% of the bit period.

3–47 TTL or ECL Levels

3–48 All outputs (data, strobe, clock and synch) are simultaneously at TTL levels or ECL levels, selectable via a single pushbutton switch.

3–49 A screw vernier is also provided to vary the amplitude of the output signals (again simultaneously), irrespective of whether TTL or ECL is selected.

3–50 For ECL, an additional screw vernier (common to all outputs) is provided for adjusting the ECL offset independently of the amplitude.

3–51 These controls can be combined to produce:

- pulse levels as specified for most TTL (0V/3V)
- worst case levels for TTL (0.8V/2.0V)
- pulse levels for ECL powered form 0V/ –5.2V
- pulse levels for ECL powered from +2V/ –3.2V.

3–52 Figure 3–8 illustrates TTL and ECL signals and their associated parameters.

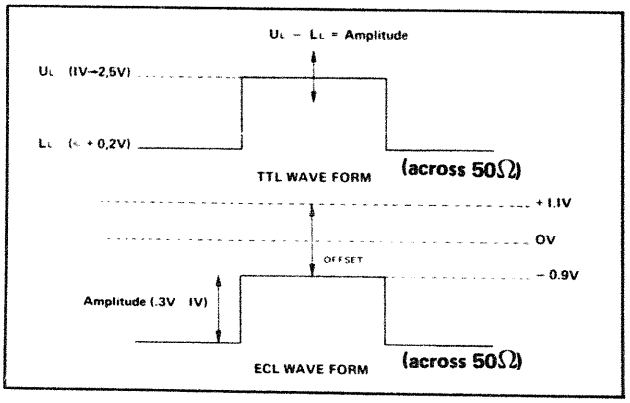


Figure 3–8. ECL and TTL Waveforms.

3–53 TIMING

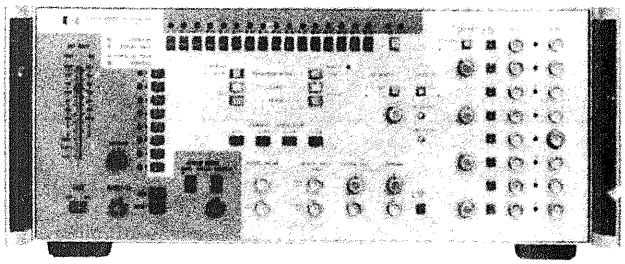


Figure 3–9. 8016A – Timing

3–54 Figure 3–9 shows the relevant front panel area for the following description of the timing controls.

3–55 Single/Auto Cycle

3–56 A pushbutton switch selects the auto mode or single cycle mode.

3–57 In the auto mode, data is recycled continuously.

3–58 In the single cycle mode, each cycle command from the START pushbutton (or an electrical trigger at the cycle command input) generates one cycle per channel, the length of this cycle depending on the selected position of the CHANNEL SERIALIZER. e.g. with the CHANNEL SERIALIZER in the 2 x 128 position, a 32-bit word is output from channels 1, 2, 3, 5, 6, 7, and a 128-bit word is output from channels 4 and 8. If the cycle command is from an external source, one cycle or multiple cycles per channel are generated, dependent on the selected position of switch A6S1 (Figure 3–12). One cycle is generated if position "1" is selected; multiple cycles are generated if position "2" is

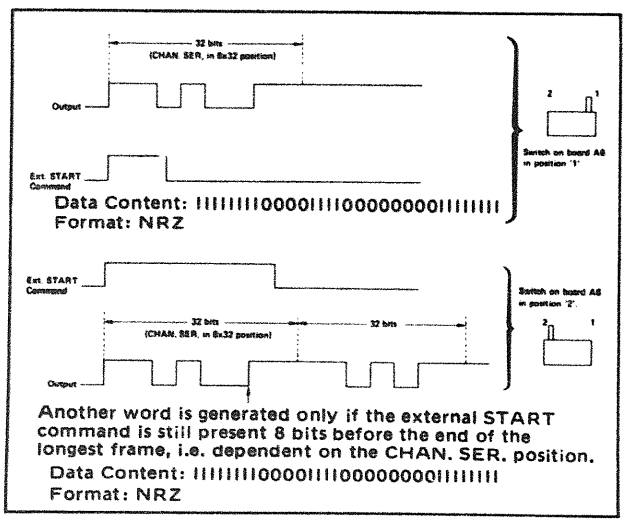


Figure 3–10. External Command/Single Cycle Mode

selected. The last cycle is always completed even if the cycle command ends during the cycle.

3–59 Also in the single cycle mode, a slide switch at the rear of the 8016A selects the output level during the pause between cycles. The level can either remain at the level of the last bit output (unless the format is RZ, in which case the last bit is output one more), or it will return to "0", as illustrated in Figure 3–11.

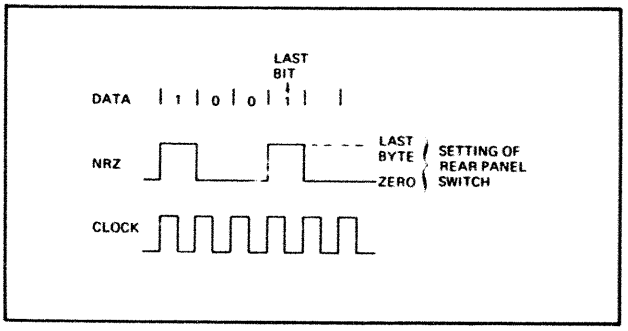


Figure 3–11. Pause level in RZ

3–60 Internal Clock

3–61 The internal clock is set via the BIT RATE and VERNIER controls and runs at 50 MHz down to 0.5 Hz, being digitally divided down in decades.

3–62 The BIT RATE control is provided with two scales i.e. a bit rate scale and a corresponding bit period scale.

3–63 External Clock

3–64 There are two BIT RATE control settings for an external clock, external positive (EXT +) and external negative (EXT –).

3–65 The EXT + setting allows the clock to be provided from TTL levels. An internal switch (A5S1, Figure 3–12) changes the input resistance from 50Ω – GND to 1kΩ – GND. The factory setting of this switch is 50Ω – GND, but by putting this switch to the 1kΩ – GND position, the external clock can be fed directly from TTL gates.

3–36 The EXT – setting is mainly for ECL levels. An internal switch (A5S2) changes the input resistance from 50Ω → –2V to 50Ω → GND. For the 50Ω → GND setting, which is the factory setting, the threshold level may also be varied between ± 1V via a potentiometer (A5 R114) located alongside the switch. By varying the threshold level, the external clock can be provided by any ECL level.

3–67 Manual Clock

3–68 When the BIT RATE control is set to MAN, a bit is output from each channel every time the MANUAL button is pressed.

3–69 In the Auto Cycle Mode, the RESET pushbutton puts all outputs to zero thus ensuring that the first operation of the MANUAL pushbutton outputs the first bit. In the Single Cycle Mode, the RESET pushbutton puts all outputs to the pause level defined by the switch at the rear of the 8016A (see para 3–42).

N.B. The MANUAL and RESET pushbuttons are only operational when the BIT RATE slider is set to the MAN position.

3–70 A feature of the manual clocking mode is that the LEDs associated with the row/column arrangement of data-setting pushbuttons indicate both the address (row LEDs), and the data content (column LEDs), of the output byte. This feature, together with the logic probe, can be used for truth-table testing of combinatorial networks.

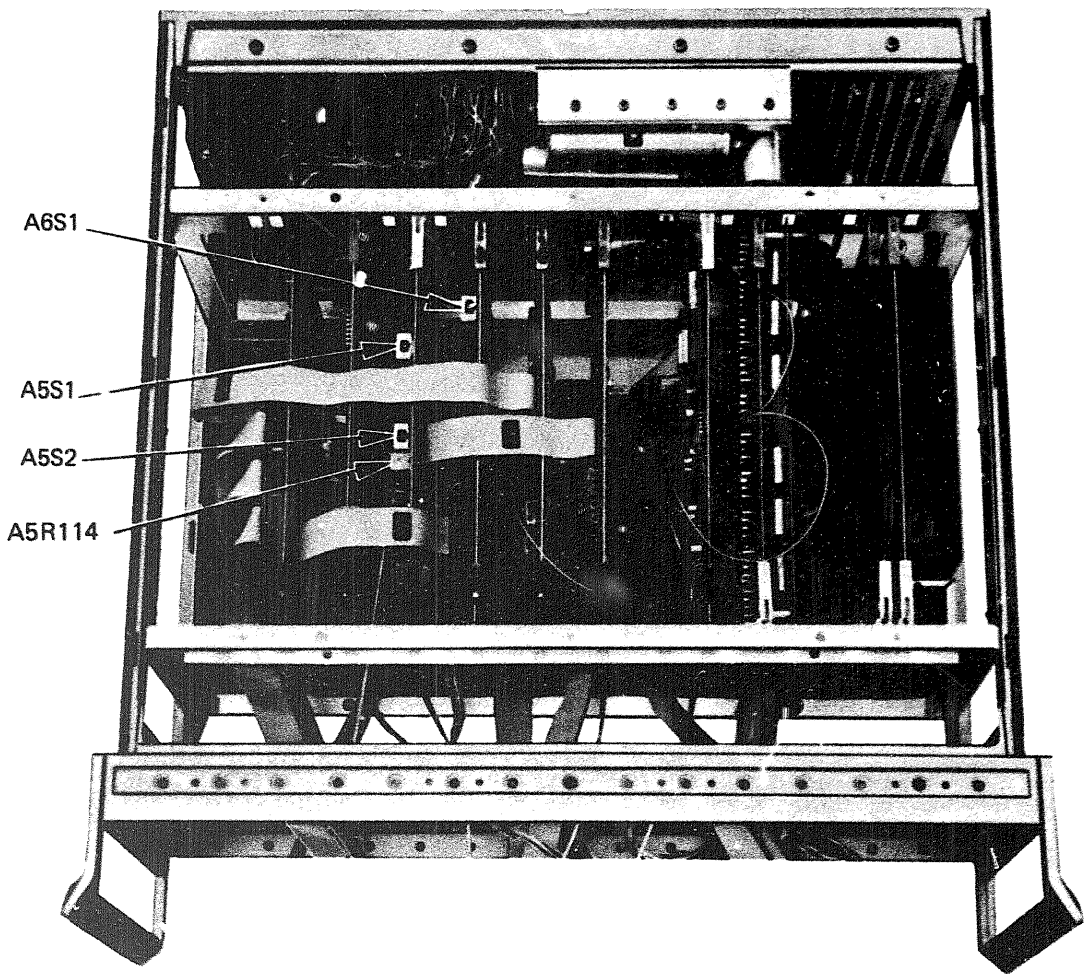


Figure 3–12. Location of internal controls.