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IM-135-562-00 IDIM-TESTER INSTRUCTION MANUAL

for the 'TESTER FOR (135-562) ISOLATED DIGITAL INPUT MODULE' for SLC.*

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This unit is designed to provide all of the input levels and channels needed to perform complete production and maintenance testing of the SLC Isolated Digital Input Module (SLAC 135-562).

This manual includes the following sections:

1. Specifications
2. Front Panel, Lights and Connectors
3. Reference List
4. Functional Description
5. 82S100 Logic Equations
6. Test and Checkout Procedures
7. Appendix A, SLAC 82S100 Programming Data
8. Appendix B, JXK-FORTH 135-648 Program Listing

Module Specifications

1. Module width: single.
2. Number of output channels: 32, (numbered 0 through 31).
3. Output voltage levels: 0V (ground), +1VDC, +3VDC, +5VDC (Vcc), +24VDC (derived from the module under test), +30VDC, -30VDC, +60V pulsed.
4. Latching: all are outputs latched, except that 60 volt pulsed outputs reconnect to ground following the 1 second pulse period.
5. Response time: 100 microseconds maximum from Dataway to output.
- 6.
7. CAMAC codes, X and Q responses:
 - a. Read functions:
 1. F(0).A(0): Read selected drives 0-15. X=Q=1.
 2. F(2).A(1): Read selected drives 16-31. X=Q=1.
 3. F(1).A(0): Read control and status. X=Q=1.

R1 =1= C1 True
R2 =1= C2 True
R3 =1= C3 True
R4 =1= +60V pulse triggered (selected)
R5 =1= +60V pulse present
R6 =1= +60V not low
R7 =1= +60V not high
R8 =1= +60V not OK

R9 =1= M1 = Return rail ground selected
R10 =1= M2 = Signal rail ground selected
R11 =1= M3 = +1V selected
R12 =1= M4 = +3V selected
R13 =1= M5 = +5V (Vcc) selected
R14 =1= M6 = +24V selected
(from the Isolated Digital Input Module)
R15 =1= M7 = +30V selected
R16 =1= M8 = -30V selected
 - b.

Write Functions:

1. F(16).A(0): Write select drives 0-15. X=Q=1.
2. F(16).A(1): Write select drives 16-31. X=Q=1.
3. F(17).A(0): Write voltage control. X=Q=1. Uses 3 bits only; W1, W2 and W3, equivalent to C0, C1 & C2. Bits W4 through W24 are ignored.

The W1-W3 line octal value determines the module output voltage as follows:

- 0: 0 V (both signal and return grounded)
- 1: +1 V (Reference)
- 2: +3 V (Reference)
- 3: +5 V (Vcc)
- 4: J1&2-C9 (+24 from module under test)
- 5: +30 V (+24 if no external supply)
- 6: -30 V (-24 if no external supply)
- 7: +60 V pulse (+24 pulse if no external 60 V supply)

Note: The +60 Volt signal is internally limited to a one (1) second pulse, the signal line is grounded after the pulse period ends.

c. Command functions:

F(27).A(0): Test +60 volt supply present. X=1, Q=1 if 60.7V < Vin < 64.7V.

d. Other X and Q responses: X=Q=0 for all other codes and conditions.

e. C, Z, and I: C, or Z, with S2 will clear the module. I has no effect on this module.

8. CAMAC speed: the module will respond to all CAMAC cycles as defined in IEEE Standard 583-1978.
9. Power Required: + 6 volts, 700 mA. typ., 900 mA. max.
+24 volts, 60 mA. typ., 320 mA (max, when no +62V);
+62 volts (external input), 40 mA. typ., 700 mA. max,
(if all 32 channels are pulsed together)
10. Protection: The +6, +24 and +60 volt lines are each protected with a fuse consisting of a single strand of #36 tinned copper wire, fusing current is about 3.5 Amps.
11. Operating temperature range: 10 to 65 degrees C.

Front Panel

1. Front panel indicators: "H" & "X", red LED's,
"Q" & "Vok", green LED.

2. Front panel connectors: 1 each BNC, +62V input;

2 each, AMP P/N 204731-1, Pin assignments as follows:

CHAN #	SIGNAL	RETURN	OTHER SIGNALS CONNECTION / FUNCTION
00	J1-A1	J1-A2	
01	I-A3	I-A4	J1-C9 +24 Volts In
02	I-A5	I-A6	
03	I-A7	I-A8	J1-C10 Gnd
04	I-A9	I-A10	
05	I-A11	I-A12	J1-C11 N C
06	I-B1	I-B2	
07	I-B3	I-B4	J1-C12 Gnd
08	I-B5	I-B6	
09	I-B7	I-B8	
10	I-B9	I-B10	
11	I-B11	I-B12	
12	I-C1	I-C2	J2-C9 +24 Volts In
13	I-C3	I-C4	
14	I-C5	I-C6	J2-C10 Gnd
15	J1-C7	J1-C8	
16	J2-A1	J2-A2	J2-C11 N C
17	I-A3	I-A4	
18	I-A5	I-A6	J2-C12 Gnd
19	I-A7	I-A8	
20	I-A9	I-A10	
21	I-A11	I-A12	
22	I-B1	I-B2	NOTE: J1&2-C9 are
23	I-B3	I-B4	connected together
24	I-B5	I-B6	thru steering diodes
25	I-B7	I-B8	to provide the +24V
26	I-B9	I-B10	for the external
27	I-B11	I-B12	voltage input tests.
28	I-C1	I-C2	
29	I-C3	I-C4	
30	I-C5	I-C6	
31	J2-C7	J2-C8	

Reference List

1. Full drawing package: DL-135-648-00
2. Schematic only: SD-135-648-00
3. Test module: used with an Isolated Digital Input Module (SLAC 135-562).
4. IM-135-562-00, the IDIM Instruction Manual (SLAC TN-83-01).
5. 82S100 programming: PS-135-648-05 & 10 (also see Appendix A).

Functional Description

Reference: SD-135-648-00, the schematic drawing.

The unit may be considered in five basic sections. These are 1) the CAMAC decoder and control section, 2) the digital I/O section, 3) the level decode and pulse generator section, 4) the analog level generation section, and 5) the analog output switching section.

The CAMAC decoder and control section consists of 2 FPLAs (U5 and U10), and the pulse extenders (1/2 of U19, and U20) used for the M, X, and Q LED displays on the front panel. U5 generates the gate, strobe and latch signals needed by the digital I/O section. U10, sharing identical parallel inputs with U5, generates the several M, X and Q signals, as well as the module CLEAR signal.

The digital I/O section consists of the CAMAC Read gates and Write latches. U4 and U3 buffer, and invert, the CAMAC Write-line signals, converting them to positive-true logic levels. U9 and U8, with the /WSEL-0-15 signal, latch the output pattern for channels 0-15. U14 and U13, with the /WSEL-16-31 signal, latch the output pattern for channels 16-31. U17, with the /MCONTROL signal, latches the 3 bits of data that are used to select the analog output level.

The S0-S31 output signals from the latches connect to both a set of four CAMAC Read-line gates, and the control inputs for the 32 analog channel-selector switches. U6 and U7 gate the 0-15 channel output pattern onto the CAMAC Read lines with an RSEL-0-15 signal [F(C)A(0)]. U1 and U2 do the same for channels 16-31 with an RSEL-16-31 [F(0)A(1)] signal. U11 is used to read out the state of the control and voltage indicator lines, and U12 gates the actual level select line to CAMAC, both under the control of the RCONSTAT signal [F(1)A(0)].

The level decode and pulse generator section consists of the decoder (U15), the pulse generator (U19), two sections of U18, used for Signal bus grounding control, and U16, used as an 8-line inverter. U15 converts the 3 control signals (C1-C3) into one-of-eight low-true logic signals corresponding to the eight selectable analog reference levels (see the F(17)A(0) CAMAC code in section 1). Octal codes 1 through 7 are inverted through 7 sections of U16, directly generating modes M3 through M8, the control signals for six of the reference level analog switches, and the TRIG signal for the pulse generator. (The eighth section of inverter is used to generate the /P signal during power turn-on, to clear the module).

The two special modes are M1 and M2. M1 is the ground switch command for the Return bus, and M2 is the ground switch command for the Signal bus. As the Return bus is grounded for all except octal code 6 (-30 V), the M1 control signal is taken as the high state of the /30V select line (M15-9). M2 needs to be generated for three separate codes. These are a) 1 (both Signal and Return busses grounded), b) 6 (-30V selected), and c) 7 (at the completion of the +60V pulse the signal bus is returned to the ground

state). One section of 74LS10 is used as a low-true input OR to generate the required output (U18-12). U81-2 is the input for code 0 (both grounded), and U81-1 is the input for code 6 (-30V). U18-13 is the input for code 7 (ground following the 60V pulse period) and the input signal generation is discussed below.

The control signal pulse for the 60V analog switch is generated using 1/2 of the dual one-shot U19. The one-shot is normally held in the clear state (U19-3 low). Code signals change at the CAMAC S1 signal's leading edge, when data is strobed into the command latch U15. A code 7 signal through the inverter (U16-11, 'TRIG') removes the clear, and the one-shot is enabled by the low signal on the A trigger (U19-1). At S2 time, 60VSTROBE is generated by the FPLA (U5-12) and triggers the one-shot (U19-2). The PULSE signal (U19-13) is the control for the 60 volt analog reference switch.

The TRIG signal (U16-11) and the /PULSE signal (U19-4) are NANDed in one section of U18, and generate the /pulse-M2 signal (U18-8) at the end of the pulse period.

The analog reference generation section consists predominantly of discrete components, and the LM224 quad operational amplifier U29. Vcc is derived through Q1. +12 volts is derived from the +24 volt supply, and is used only in the generation of the VMOS-FET (2N6661) control voltages. The +24 volt reference signal is derived through steering diodes CR6 and CR7 from the IDIM under test. The IDIM-TESTER +24 volts is used for reference voltages only in the absence of a +63-volt external supply.

+63 volts is fed to the module through the front panel BNC connector (J3), CR8 and Q5. Q5 is used for module protection. Turning off the CAMAC crate power, with the subsequent loss of +24 volts, removes the bias to Q5, thus disconnecting the +63-volt supply from the remainder of the module. The control bias for Q5 is derived through Q6 and CR10 from the +24 volt supply. CR9 protects Q6 from reverse bias when the +63-volt supply is removed with the CAMAC crate powered.

CR1 and Q2 generate the +31.5 volt reference used for both the +30 and -30 volt tests, from the +63-volt supply. (The -30-volt signal is generated by grounding the Signal bus, and connecting the Return bus to +31.5 volts.) R5 and R17 limits the power dissipation in Q2 when several channels are being tested simultaneously.

Steering diodes CR2 through CR5 are to provide a +23 supply to both the +62 and +31 volt lines in the absence of an external +63-volt supply. This allows the standard software to run a general set of performance tests without the presence of a +63-volt power supply. This is adequate for field testing of an IDIM, although the full tests should be run with the external +63-volt supply for production testing, or following maintenance operations upon the IDIM.

The +3.0 and +1.0 volt references are derived from the resistor divider chain (R23-R26). These two signals are buffered through 2/4ths of the LM224 (U29), and Q3 and Q4 respectively.

The remaining 2/4ths of U29 is connected as a window voltage comparator monitoring the +63-volt supply. The two resistor divider chains (R9 through R14) compare the +62 volt level with the CAMAC +24 volt supply. The not-low (U29-7, /VL) and not-high (U29-1, /VH) comparator output signals are NANDed in one section of U18 to generate the warning signal /VOK (U18-6). The /VOK signal is fed to both the status read buffer (U11-18) and the FPLAs (U5E10-20). The /VOK signal is also used to drive the green 'V' front panel LED, which indicates a correct +63-volts when lighted.

The analog output switching section consists of 41 VMOS analog switches, and the associated sections of DS88L12 drivers. Two of the switches (the 'A' circuits) contain only a single output FET, and are used for grounding the Signal and Return busses. The remaining 39 switches (the 'B' circuits) each use a pair of FETs connected in a zero offset configuration as the output switches. Seven of these circuits are used to connect the selected reference voltage to the appropriate bus. The other 32 circuits are used to connect the selected 'on' channels to the Signal bus.

All 41 circuits operate in the same manner, with the exception of the single output FET of the two grounding switches. 1/6th of a DS88L12 (U22 through U28) takes a positive-true TTL level CONTROL signal as the input. In the quiescent state the CONTROL signal is low (false) and the 88L12 interface output is high (+12 volts). This signal holds Q1A/B 'on', with the drain at ground. The CR056 (CR1A/B) is a 0.56 milliamper FET current source connected to +62 volts. When Q1A/B is biased on, this current flows to ground through Q1A/B, and the gates of Q2A/B&Q3B are held at ground potential. At this time the output FETs are off, i.e. in a very high impedance state.

When a CONTROL signal is applied, the 88L12 output goes to the low state (0.2 volts). This turns off Q1A/B, removing the sink for the CR056 current. This current now pulls up the gate(s) of Q2A/B&Q3B, switching the 2N6661s to the low impedance state (3 Ohms each, typical). For the 39 'B' circuits, this connects the IN and OUT points with a series resistance of about 6 Ohms, low enough to be disregarded when considering the 3 KOhm input impedance of an IDIM channel.

The 2N6661 VMOS-FETs, in addition to the low on resistance, are extremely fast (100 MHz range) devices. This can cause transient noise generation problems when switching the voltage and current levels needed for parallel multiple channel testing of an IDIM. The solution selected was the inclusion of C1A/B as Miller integration capacitors, slowing the turn-on and turn-off times of the output signals.

PS-135-648-05, 82S100 Logic Equations

(I.C. # U-05 , PF-135-648-05)

FPLA100 0

AS OF 82-12-30 DATA-I/O LOGIC-PAK & 303A-101 ADAPTER

PF-135-648-05 FAMILY 96, PINOUT 01, RAM P1

LOGIC TO INTEL 0000 00F1 PIN ASSIGNMENTS:

;

;

; ALL INPUT AND OUTPUT TERMS ARE SHOWN AS POSITIVE TRUE LOGIC

;

; / IMPLIES LOW TRUE LOGIC, OR 'NOT' SIGNAL

;

; CAMAC CODES ARE SHOWN BELOW THE EQUATION LINES FOR INFORMATION

;

;

```

FE          ; PIN 1, NC
/C          ; PIN 2, INPUT 7
/A4         ; PIN 3, INPUT 6
/N          ; PIN 4, INPUT 5
/A2         ; PIN 5, INPUT 4
/A1         ; PIN 6, INPUT 3
/S1         ; PIN 7, INPUT 2
/Z          ; PIN 8, INPUT 1
/S2         ; PIN 9, INPUT 0
/RS16-31    ; PIN 10, OUTPUT 7
/WS0-15     ; PIN 11, OUTPUT 6
60VSTRB     ; PIN 12, OUTPUT 5
/RCONST     ; PIN 13, OUTPUT 4
GND         ; PIN 14, GROUND
/RS0-15     ; PIN 15, OUTPUT 3
/WCONT      ; PIN 16, OUTPUT 2
/WS16-31    ; PIN 17, OUTPUT 1
NC          ; PIN 18, OUTPUT 0
/CE         ; PIN 19, NOT CHIP-SELECT
/VOK        ; PIN 20, INPUT 15
/P          ; PIN 21, INPUT 14
/F16        ; PIN 22, INPUT 13
/F8         ; PIN 23, INPUT 12
/F4         ; PIN 24, INPUT 11
/F2         ; PIN 25, INPUT 10
/F1         ; PIN 26, INPUT 9
/A8         ; PIN 27, INPUT 8
VCC         ; PIN 28, +5 VOLTS

```

```

;
;
; PF-135-648-05 LOGIC EQUATIONS
;
MS0-15 = N#F1#F2#F4#F8#16#A1#A2#A4#A8#S1
;
MS16-31 = N#F1#F2#F4#F8#16#A1#A2#A4#A8#S1
;
; N.F(16).A(1).S1
MCONT = N#F1#F2#F4#F8#16#A1#A2#A4#A8#S1
;
; N.F(17).A(0).S1
MS0-15 = N#F1#F2#F4#F8#16#A1#A2#A4#A8
;
MS16-31 = N#F1#F2#F4#F8#16#A1#A2#A4#A8
;
; N.F(0).A(0)
MS0-15 = N#F1#F2#F4#F8#16#A1#A2#A4#A8
;
; N.F(0).A(1)
MS16-31 = N#F1#F2#F4#F8#16#A1#A2#A4#A8
;
RCONST = N#F1#F2#F4#F8#16#A1#A2#A4#A8
;
; N.F(1).A(0)
60VSTRB = N#F1#F2#F4#F8#16#A1#A2#A4#A8#S2
;
; N.F(17).A(0).S2

```

(I.C. # U-10 , PF-135-648-10)

FPLA100 0
 AS OF 82-12-30 DATA-I/O LOGIC-PAK & 303A-101 ADAPTER
 PF-135-648-10 FAMILY 96, PINOUT 01, RAM F1
 LOGIC TO INTEL 0000 0C*1 PIN ASSIGNMENTS:

ALL INPUT AND OUTPUT TERMS ARE SHOWN AS POSITIVE TRUE LOGIC

/ IMPLIES LOW TRUE LOGIC, OR 'NOT' SIGNAL

CAMAC CODES ARE SHOWN BELOW THE EQUATION LINES FOR INFORMATION

FE	;	PIN	1,	NC
/C	;	PIN	2,	INPUT 7
/A4	;	PIN	3,	INPUT 6
/N	;	PIN	4,	INPUT 5
/A2	;	PIN	5,	INPUT 4
/A1	;	PIN	6,	INPUT 3
/S1	;	PIN	7,	INPUT 2
/Z	;	PIN	8,	INPUT 1
/S2	;	PIN	9,	INPUT 0
NC	;	PIN	10,	OUTPUT 7
NC	;	PIN	11,	OUTPUT 6
/CLEAR	;	PIN	12,	OUTPUT 5
/QS1	;	PIN	13,	OUTPUT 4
GND	;	PIN	14,	GROUND
/XS1	;	PIN	15,	OUTPUT 3
/NS1	;	PIN	16,	OUTPUT 2
/X	;	PIN	17,	OUTPUT 1
/Q	;	PIN	18,	OUTPUT 0
/CE	;	PIN	19,	NOT CHIP-SELECT
/VOK	;	PIN	20,	INPUT 15
/P	;	PIN	21,	INPUT 14
/F16	;	PIN	22,	INPUT 13
/F8	;	PIN	23,	INPUT 12
/F4	;	PIN	24,	INPUT 11
/F2	;	PIN	25,	INPUT 10
/F1	;	PIN	26,	INPUT 9
/A8	;	PIN	27,	INPUT 8
VCC	;	PIN	28,	+5 VOLTS

```
;
;
; PF-135-648-10 LOGIC EQUATIONS
;
MS1 = N*S1
;
CLEAR = C*S2 + Z*S2 + /P
;
X1 = N*/F1*/F2*/F4*/F8*/A2*/A4*/A8
; = N.F(0+16).A(0+1)
;
X2 = N*F1*/F2*/F4*/F8*/A1*/A2*/A4*/A8
; = N.F(1+17).A(0)
;
X3 = N*F1*F2*/F4*F8*F16*/A1*/A2*/A4*/A8
; = N.F(27).A(0)
;
X = X1 + X2 + X3
;
XS1 = X1*S1 + X2*S1 + X3*S1
;
Q = X1 + X2 + X3*VOK
;
QS1 = X1*S1 + X2*S1 + X3*VOK*S1
;
```

;

Test and Checkout Procedure

a. Required equipment:

1. An LSI-11 test stand including a CAMAC crate and a dual floppy-disk drive.

Note: Insure that the LSI-11 system will operate with CAMAC crate power off, without having to HALT, or disconnect the CAMAC system.

2. A 135-562 module (IDIN) known to be working.
3. A CAMAC extender card.
4. An oscilloscope and probes
5. A digital volt-ohmmeter and test leads.
6. A 3 Kohm, 1 Watt, carbon composition resistor
7. A +63 Volt (0-70 volt adjustable), 100 milliampere, power supply, including an output current monitor (milliammeter).

Note: 100 milliamperes is adequate for complete single channel tests. Should simultaneous multiple pulsed outputs be desired, use a 0.5 Amp supply.

8. 2 each, 36-pin AMP connected test cables.
9. A FORTH-CAMAC source diskette.
10. A JXX-CAMAC source diskette.
11. A cable to connect the +63-volt power supply to the 135-648 +63-volt input BNC connector.
12. A copy of the reference schematic, SD-135-648-00.

b. Setup procedure.

1. Install the diskettes, FORTH-CAMAC in Unit-0, and JXX-CAMAC in Unit-1.
2. Install the 135-562 (IDIN) in the CAMAC crate.
3. Turn on the +63-volt power supply, and set the output to +63.0 +/-0.1 volts.
4. Turn off the +63-volt power supply.
5. Apply computer system power, and bootstrap FORTH.

6. Enter '500 LOAD' to load the JXX-FORTH system.
7. Enter 'SINGLE-CRATE' or 'MULTI-CRATE' to load the appropriate CAMAC drivers.
8. Enter '135-648' to load the IDIM-TESTER program.
9. Enter 'GO' or '135-648-TESTS' to enter the test menus.
10. Initialize and test the IDIM.
Select '135-562-TESTS'.
11. Select 'INITIALIZE-IDIM', and respond to the prompts with the crate and slot locations of the 135-562 (IDIM)
12. Select 'IDIM-TESTS'.
13. Select 'IDIM-MAPTEST'. The response should be 'MAPS COMPARE OK'. If not, re-initialize the IDIM and try again, or replace the IDIM.
14. Select 'EXIT-THIS-MENU'. Repeat the 'EXIT-THIS-MENU' command. This will return to the '135-648-TESTS' menu.

c. IDIM-TESTER test procedure.

1. In performing the following sequence of tests, each must be passed successfully before proceeding.

Should the unit fail any test, repair and retest before continuing.
2. Remove the component-side cover.
3. Production test preliminaries.

Visually inspect the unit for obvious problems. Compare with a known good unit if one is available.
4. With an Ohmmeter, measure between ground and +6V, +24V, +63V, and Vcc, checking for direct short circuits.
5. Insure that a properly programmed set of FPLAs are installed in the IDIM-TESTER (PF-135-648-05 in U5, and PF-135-648-10 in U10).

Note: if 82S100 FPLAs are installed, but not labeled with the correct PF numbers, there is a high probability that the units are NOT programmed. Remove the FPLAs and install programmed units.

6. IDIM-TESTER initialization.

Install the 135-648 (IDIM-TESTER) on the CAMAC extender, in the CAMAC crate.

7. Turn on the CAMAC crate power.

8. Select 'INITIALIZE-IDIM-TESTER', and respond to the prompts with the 135-648 crate and slot locations.

9. Basic X and Q (FPLA) tests.

Select 'TESTER-TESTS'.

10. Select 'TESTER-MAPTEST'. The correct response is 'MAPS COMPARE OK.'.

11. Bit pattern tests.

Select 'WALK-TESTER'. The correct response is none.

12. Select 'CONTROL-TEST'. The correct response is none.

13. Test the +63-volt protection circuit (Q5 and Q6).

If necessary, reset the +63-volt power supply to 63.0 volts, and then turn off the +63-volt power supply.

14. Connect the +63-volt power supply to the IDIM-TESTER.

15. Turn on the +63-volt power supply.

16. Observe the quiescent current being drawn from the +63-volt power supply. It should be about 45 milliamperes.

17. While observing the +63-volt power supply output current, turn off the CAMAC crate power. The +63-volt power supply output current should drop to zero.

If the current does not immediately drop to zero, quickly turn off the +63-volt supply to prevent over-dissipation damage to the IDIM-TESTER components.

18. Turn on the CAMAC crate power.

19. Set and test the +63-volt level monitor.

Measure and record the voltages VRH (U29-3) and VRL (U29-6).

Determine V_x , the average value of these two voltages. It should be 2.059 ± 0.040 volts.

20. Set the voltage at U29-2 to V_x (as determined above) ± 0.005 volts. Adjust using the trim-pot R10.

If the calibration range of the trim-pot is not sufficient to make this adjustment, find and correct the problem, then repeat the entire +63-volt test procedure before continuing.

21. Observe the 'V' LED on the front of the IDIM-TESTER. It should be lighted at this time.
22. Select '62-VOLT-TEST'. The response must be '62 VOLT INPUT OK'.
23. Set the +63-volt supply to +67.0 volts. The 'V' LED must go dark.

Note: in no case exceed +70 volts from the supply.

24. Select '62-VOLT-TEST'. The correct response is '62 VOLT INPUT HIGH'.
25. Set the +63-volt supply to +59.0 volts. The 'V' LED must be dark.
26. Select '62-VOLT-TEST'. The correct response is '62 VOLT INPUT LOW'.
27. Observing the 'V' LED on the front of the IDIM-TESTER, increase the +63-volt power supply SLIGHTLY to the mid-range point of the lighted 'V' LED.

Note: again, do not exceed +70 volts from the supply.

28. Full IDIM-TESTER stand-alone test.

Select 'FULL-TESTER-TEST'. This is a repeat of the above individual tests, and the unit should exhibit no problems at this time.

29. Output level tests.

Install the 3 Kohm test resistor between J1-A1 and J1-A2, (Signal and Return for channel 0).

30. Set the voltmeter to a safe range for 60 VDC measurements.

31. Connect the voltmeter across the 3 KOhm test resistor, with the positive lead to J1-A1.
32. Select 'OUTPUT-PATTERN-SET'.
33. Select 'TURN-ONE-ON'. Respond to the channel number prompt with '0'.
34. Select 'OUTPUT-VOLTAGE-SET'.
35. Select '0-VOLTS-OUT'. The voltmeter should read less than +/- 0.010 volts.
36. Select '+1-VOLT-OUT'. The meter should read slightly above +1.000 volts.

Note: should the voltage remain at zero, select a different channel, and move the test resistor and voltmeter to the output connections for that channel.

If the meter still fails to read the correct voltage, the problem may be in either the reference voltage or channel control area.

If the reading is now correct, the problem is probably in the channel control or channel analog switch output area.

37. Select '+3-VOLTS-OUT'. The meter should read slightly below +3.000 volts.
38. Select '+5-VOLTS-OUT'. The meter should read Vcc (5.0 to 5.2 volts).
39. Select '+24-VOLTS-OUT'. The meter should read zero, as this voltage is derived from an IDIM, which is not presently connected.
40. Select '+30-VOLTS-OUT'. The meter should read between +31 and +33 volts.
41. Select '-30-VOLTS-OUT'. The meter should read between -31 and -33 volts. The actual value should be the negative equivalent of the positive value read in the previous test.
42. Turn off the +63-volt power supply.
43. Output pulse test and set.

Connect the oscilloscope across the 3 KOhm test resistor in place of the voltmeter.

44. Select 'OUTPUT-PULSES'. The program will begin a loop generating pulses in the +20 to +24 volt range. Pulses are triggered at an approximately 1.5 second rate.

Note: stroke any key to terminate the loop.

45. Set the scope to trigger on the leading edge of the positive output pulse, and measure the actual pulse width.
46. The pulse width should be 1.1 seconds. An acceptable value is between 1.0 and 1.2 seconds.

If it is not correct, change R34 (68 KOHms as manufactured) to obtain the correct width.

$$R\text{-new (KOHms)} = \frac{1.1 \times R\text{-old (KOHms)}}{\text{Time-now (seconds)}}$$

47. Again, select 'OUTPUT-PULSES'.
48. While observing the scope, turn on the +63-volt power supply.
- The 20+ volt pulse amplitude should increase to approximately +61.5 volts. The amplitude must be greater than +60 volts.
49. Turn off the +63-volt power supply, and stop the pulse loop.

Note: again, stroke any key to terminate the loop.

50. Output channel tests.

Select '+5-VOLTS-OUT'.

51. Select 'EXIT-THIS-MENU'.
52. Select 'ALL-ON'.
53. With the voltmeter connected across the 3 KOhm test resistor, check each of the 32 output channels for Vcc out.

In addition, check that measured value is consistent for all 32 channels, within a few (about 10) millivolts. A larger variation probably indicates a bad analog switch.

54. Select 'ALL-OFF'.
55. Select 'EXIT-THIS-MENU'.

56. 'OFF' channel leakage tests.

The following four steps check the leakage values of the 'off' channel analog output switches.

57. Select '+30-VOLTS-OUT'.

58. Again, measure all outputs with the voltmeter and 3 μ Ohm load. All readings should be zero (less than 10 millivolts).

59. Select '-30-VOLTS-OUT'.

60. Measure all outputs with the voltmeter and 3 KOhm load. Again, all readings should be zero (less than 10 millivolts).

61. 'ON' channel impedance.

Select '0-VOLTS-OUT'.

62. Select 'EXIT-THIS-MENU'.

63. Select 'ALL-ON'.

64. Using a length of wire, connect one end of the 3 KOhm test resistor to the CAMAC crate +24-volt monitor point. Connect the voltmeter between the other end of the test resistor and ground (chassis).

65. Using the common resistor-voltmeter connection as a test probe, measure each of the 32 'Signal' lines.

The voltage should be less than 84 millivolts (equal to about 9 Ohms through the 'on' analog channel-switch and the Signal bus grounding analog switch). Typical values are about 42 millivolts (or slightly under 6 Ohms).

66. As above, measure any one of the 'Return' lines.

The voltage should be less than 40 millivolts (equal to about 4 Ohms through the single Return bus grounding FET). The typical value is about 19 millivolts (or slightly under 2 Ohms).

67. At this point, the only analog circuit that has not been fully tested is the +24 volt reference switch. As the reference voltage for this switch is derived from the IDIM module, the test of this switch is made under full load conditions as a part of the following test sequence.

68. Select 'EXIT-THIS-MENU'. Repeat the command. This will return to the '135-648-TESTS' menu.

69. Full tests with the IDIM.

Select '135-562-TESTS'.

70. Select 'IDIM-TESTS'.
71. Connect J1 and J2 of the IDIM-TESTER to the same connectors of the IDIM.
72. Turn on the +63-volt power supply.
73. Select 'TEST-ALL'. The program will indicate if there are any problems.
74. If the system passes the 'TEST-ALL' routine, the IDIM-TESTER is good, and no further testing is required.

Should the system fail the 'TEST-ALL' routine, maintenance is required.

Note that problems may develop in the IDIM that could appear as a fault in the IDIM-TESTER under test.

If the maintenance is to be done at this time, proceed to the 'Maintenance procedure' section.

75. Test close-out.

Turn off the +63-volt power supply.

76. Turn off the CAMAC crate power.
77. Return to the '135-648-TESTS' menu.
78. Disconnect the test cables, and remove the IDIM-TESTER.
79. Replace any module covers that have been removed.

d. Maintenance procedure.

1. Perform the setup and test procedures as outlined above.
2. Select between 'TESTER-TESTS', 'OUTPUT-PATTERN-SET' and 'OUTPUT-VOLTAGE-SET' to obtain a detailed selection of available module tests, as needed.

3. When troubleshooting in conjunction with an IDIM, many of the IDIM test routines may also prove very useful in debugging the IDIM-TESTER.
4. Should it be necessary to return to FORTH to perform additional specific tests to aid in the determination of a problem, a return to the test menus is easiest done by entering the FORTH command 'GO'.
5. Listed below are explanations of some of the tests available through the test menus. The definitions are given in the order of appearance on the various menus.

The tests not listed below are believed to be self-explanatory.

- a. ALL-ON turns on all outputs to the selected voltage.
- b. ALL-OFF sets all outputs to the floating ('off') state.
- c. WALK-INIT initializes all the walking bit tests.
- d. WALK-ONE-ON walks a '1' bit through all 32 channels, outputting signals at the selected voltage.
- e. WALK-ONE-OFF turns all channels on to the selected voltage, and then walks a '0' bit through all 32 channels.
- f. OUTPUT-LOW-PATTERN asks for, and then outputs, a pattern to the J1 channels (0 through 15).
- g. OUTPUT-HIGH-PATTERN, as above, to the J2 channels (16 through 31). TURN-ONE-ON asks for, and then turns on one channel.
- h. TURN-ONE-OFF, as above, turning one off.
- i. TESTER-MAPTEST checks the module X and Q responses for all combinations of function code and subaddress.
- j. CONTROL-TEST tests all 8 combinations of the 3 voltage control bits, writing and reading back the command and status registers.
- k. WALK-TESTER does a full walking bit test, on and off, at the previously selected voltage.
- l. 648-LED runs the M, X and Q front pannel LEDs for a visual inspection.

Appendix A. SLAC 82S100 Programming Data.

```

AS OF 82-12-30      DATA-I/O LOGIC-PAK C 303A-101 ADAPTER
PF-135-648-05      FAMILY 96,      PINOUT 01,      RAM F1
*****
      * *
      *
FE      * 1*      *28*      VCC
      *
      * P L A 1 0 0
      *
      *
/C      * 2*      *27*      /A8
      *
      *
      *
/A4     * 3*      *26*      /F1
      *
      *
      *
/N      * 4*      *25*      /F2
      *
      *
      *
/A2     * 5*      *24*      /F4
      *
      *
      *
/A1     * 6*      *23*      /F8
      *
      *
      *
/S1     * 7*      *22*      /F16
      *
      *
      *
/Z      * 8*      *21*      /P
      *
      *
      *
/S2     * 9*      *20*      /VOK
      *
      *
      *
/RS16-31 *10*      *19*      /CE
      *
      *
      *
/WS0-15  *11*      *18*      NC
      *
      *
      *
60VSTRB  *12*      *17*      /WS16-31
      *
      *

```

```

      *
      ****
/RCONST *13*      *16*      /WCONT
      ****      ****
      *
      ****      ****
      GND *14*      *15*      /RS0-15
      ****      ****
      *****

```

PF-135-648-05

```

ACTIVE (82S100/1)  LLHLLLLH
111111 (INPUT)    (OUTPUT)
5432109876543210 76543210

```

```

00 --LHHHHH-HLHHL-- .A..... WS0-15
01 --LHHHHH-HLHLL-- .....A. WS16-31
02 --LHHHLH-HLHHL-- .....A. WCONT
03 --HHHHHH-HLHHL-- .....A... RS0-15
04 --HHHHHH-HLHLL-- A..... RS16-31
05 --HHHHHL-HLHH-- ...A.... RCONST
06 --LHHHLH-HLHH--L ..A..... 60VSTRB

```


AS OF 82-12-30
PF-135-648-10

DATA-I/O LOGIC-PAK & 303A-101 ADAPTER
FAMILY 96, PINOUT 01, RAM F1

```

*****
#
# #
FE # 1* #28* VCC
#*
# F P L A 1 0 0
#*
/C # 2* #27* /A8
#*
#*
/A4 # 3* #26* /F1
#*
#*
/H # 4* #25* /F2
#*
#*
/A2 # 5* #24* /F4
#*
#*
/A1 # 6* #23* /F8
#*
#*
/S1 # 7* #22* /F16
#*
#*
/Z # 8* #21* /P
#*
#*
/S2 # 9* #20* /VOK
#*
#*
NC #10* #19* /CE
#*
#*
NC #11* #18* /Q
#*
#*
/CLEAR #12* #17* /X
#*
#*

```

/QS1	*13*	*16*	/HS1
	****	****	
	*	*	
	****	****	
GND	*14*	*15*	/XS1
	****	****	

PF-135-648-10

ACTIVE (82S100/1) HHLLLLL
 11111 (INPUT) (OUTPUT)
 5432109876543210 76543210

00 -----L--L--A.. HS1
 01 -----L-----L ..A..... CLEAR
 02 -----LL ..A.....
 03 -H----- ..A.....
 04 ---HHHHH-HLH---AA X=Q
 05 ---HHHLH-HLHH---AA
 06 --LLHLLH-HLHH---A. X
 07 ---HHHHH-HLH-L-- ...AA... XS1=QS1
 08 ---HHHLH-HLHHL-- ...AA...
 09 --LLHLLH-HLHHL--A... XS1

10 L-LLHLLH-HLHH---A Q
 11 L-LLHLLH-HLHHL-- ...A... QS1

JXX-FORTH 135-648 Program Listing

Note: see also Appendix B of IM-135-562-00.

Also, the latest FORTH source code for these programs is contained in the dataset 'BUyyymmdd FORTH', on the VM minidisk 'JXKPUB 200', on the main SLAC computer complex. 'yyymmdd' is a 6-digit number listing the date that the backup (BU) file was created. The highest number is the latest version on VM.

```
617 0 HERE-LOADS 135-648 ( {IDIM-TSTR} TESTER FOR 135-562 {IDIM} )
617 1
617 2      VCLEAR
617 3
617 4      DEBUGGER          JXX-USER-LOAD
617 5
617 6      JXX-CAMAC-CODE      SINGLE-CRATE
617 7
617 8      CANAC-EXTRAS      CANAC-TESTS          JXX-CAMAC
617 9
617 10     FORTH DEFINITIONS      HERE : 135-648 ;
617 11
617 12 1--> JXX-821203
617 13
617 14
617 15

618 0 --> ( 135-648 ... initialize )
618 1     VARIABLE 135-648-C
618 2     VARIABLE 135-648-N
618 3
618 4     0 135-648-C ! ( SET NOMINAL CRATE # )
618 5     12 135-648-N ! ( SET NOMINAL SLOT # )
618 6
618 7 : 135-648@ 135-648-C @ 135-648-N @ ;
618 8 : 135-648! 135-648-N ! 135-648-C ! ;
618 9
618 10 1--> JXX-821115
618 11
618 12
618 13
618 14
618 15
```

```

619 0 --> ( 135-648 ... initialize & variables )
619 1
619 2 : XNAME ." 135-648 " ;
619 3 : MNAME LD-CALL MODULE-NAME XNAME ;
619 4 : INITIALIZE-IDIM-TESTER ( Get new C and N. ) MNAME '135-6480
619 5 ASK-CHN 2DUP 135-648! DROP DUP %CC %CZ ;
619 6 DARIABLE PATT ( PATTERN AS WRITTEN )
619 7 DARIABLE OPATT ( READBACK OF THE PATTERN OUTPUT )
619 8 VARIABLE ch# 0 ch# !
619 9 : CHN ( CHN => n , get the current channel # ) ch# @ ;
619 10 : CHN-SET ch# ! ;
619 11 : SHOW-CHN ." SET-CHANNFL, NOW = " CHN . ;
619 12
619 13 1--> JXK-830118
619 14
619 15

620 0 --> ( 135-648 ... OUTSAVE OUTSET ALL-CHN ALL-OFF PATT? )
620 1 FORTH DEFINITIONS
620 2 : OUTSAVE 2DUP 0= 1 LSH PATT + ! ;
620 3 : OUTSET ( n1 n2 OUTSET => , set lo {n2=0} or hi {n2=1} outputs
620 4 to pattern n1. ) OUTSAVE 135-6480 ROT %16 %XW ;
620 5 : ALL-ON -1 DUP 0 OUTSET 1 OUTSET ;
620 6 : ALL-OFF 0 0 OUTSET 0 1 OUTSET ;
620 7 : PATT? PATT D0 ROT IF SWAP DROP ELSE DROP THEN ;
620 8
620 9 1--> JXK-821217
620 10
620 11
620 12
620 13
620 14
620 15

621 0 --> ( 135-648 ...cont )
621 1 : HILO? ( n1 {0-31} HILO? => n2, n2=0or1 ) %16 / ;
621 2 : READOUT? ( n1 READOUT => n2, SA n1 returns present output
621 3 pattern n2 ) 135-6480 ROT 0 %XR ;
621 4 : SETONE ( n {0-31} => , turn on one output )
621 5 DUP HILO? DUP PATT? ROT BITON SWAP OUTSET ;
621 6 : CLEARONE ( turn one off, as above )
621 7 DUP HILO? DUP PATT? ROT BITOFF SWAP OUTSET ;
621 8
621 9 : ASK-CHN ( ASK-CHN => , ) MNAME CHN ASK-CHN CHN-SET ;
621 10 : OUTPATT CR BELL ." INPUT THE PATTERN VALUE = "
621 11 ?SASK 1 < IF 0 THEN ;
621 12 : SHOW-OUTPUTS CR 0 READOUT? 0 . 0.
621 13 4 SPACES 1 READOUT? 1 . 0. ;
621 14 1--> JXK-830118
621 15

```

```

622 0  --> ( 135-648 ...cont )
622 1
622 2 : WALK-ONE-ON                won D# 2DUP 1 OUTSET
622 3                               0 OUTSET 1 DLROT won D! ;
622 4 : WALK-ONE-OFF              woff D# 2DUP 1 OUTSET
622 5                               0 OUTSET 1 DLROT woff D! ;
622 6 : TURN-ON CHN SETONE ;
622 7 : TURN-OFF CHN CLEARONE ;
622 8 : TURN-ONE-ON ASK-CHN TURN-ON ;
622 9 : TURN-ONE-OFF ASK-CHN TURN-OFF ;
622 10 : OUTPUT-HIGH-PATTERN OUTPATT 1 OUTSET ;
622 11 : OUTPUT-LOW-PATTERN OUTPATT 0 OUTSET ;
622 12
622 13 1--> JXK-830118
622 14
622 15

623 0  --> ( 135-648 ... outputs )
623 1      FORTH DEFINITIONS
623 2 : V-OUT ( n VOUT => , set the IDIM voltage command to n )
623 3           135-648# 0 X17 $XW ;
623 4 : VSET ( n VSET => , if n is a valid 135-648 output voltage, )
623 5           0 CASE 0 ELSE 1 CASE 1 ELSE 3 CASE 2 ELSE
623 6           5 CASE 3 ELSE X24 CASE 4 ELSE X30 CASE 5 ELSE
623 7           X-30 CASE 6 ELSE X60 CASE 7 ELSE
623 8           BELL CR ." VOLTS INVALID ENTRY TO VSET. " CR ABORT
623 9           THEN THEN THEN THEN THEN THEN THEN THEN
623 10          V-OUT ;
623 11 : CONT-ERROR ( n1 n2 CONT-ERROR => , n1=readback, n2=output )
623 12          CR ." IDIM-TESTER CONTROL ERROR, OUTPUT = "
623 13          SWAP ." , READBACK = " . ;
623 14 1--> JXK-821217
623 15

624 0  --> ( 135-648 ... CONTROL-TEST n-VOLTS-OUT & -PULSE )
624 1
624 2 : CONTROL-TEST
624 3       8 0 DO I V-OUT 135-648# 0 1 $XR 7 AND DUP I =
624 4       IF DROP ELSE I CONT-ERROR THEN LOOP 0 V-OUT ;
624 5 : 0-VOLTS-OUT 0 VSET ;
624 6 : +1-VOLT-OUT 1 VSET ;
624 7 : +3-VOLTS-OUT 3 VSET ;
624 8 : +5-VOLTS-OUT 5 VSET ;
624 9 : +24-VOLTS-OUT X24 VSET ;
624 10 : +30-VOLTS-OUT X30 VSET ;
624 11 : -30-VOLTS-OUT X-30 VSET ;
624 12 : +60-VOLT-PULSE X60 VSET ;
624 13
624 14 1--> JXK-821217
624 15

```

```

625 0  --> ( 135-648 ... TXT- 62-VOLT-TEST 648-LED )
625 1
625 2 : TXT-OK ." OK " ;
625 3 : TXT-QR ." , Q-RESPONSE " ;
625 4 : TXT-BAD ." BAD " ;
625 5 : Q-TST 135-6480 DROP ?Q TXT-QR ;
625 6 : Q-HI Q-TST IF TXT-OK ELSE TXT-BAD THEN ;
625 7 : Q-LO Q-TST IF TXT-BAD ELSE TXT-OK THEN ;
625 8 : Q27 135-6480 Q %27 %XCOM ;
625 9 : 62-VOLT-TEST CR ." 62 VOLT INPUT "
625 10 135-6480 0 1 %XR %340 AND %40 / ( 5 RSH ) 5 CASE
625 11 ." HIGH " Q27 Q-LO ELSE 6 CASE ." LOW " /27 Q-LO ELSE
625 12 3 = IF TXT-OK Q-HI ELSE TXT-BAD Q-LO THEN THEN THEN ;
625 13 : 648-LED 135-6480 TEST-LED ;
625 14
625 15 1--> JXK-830107

626 0 BLK @ 2+ LOAD ( --> ) ;S ( 135-648 ...cont )
626 1
626 2 VARIABLE 135-648-MAP
626 3 : OUTPUT-PULSES BEGIN %60 VSET 1500 MSEC ?TER UNTIL ;
626 4 : O-READ 0 READOUT? 1 READOUT? OPATT D! ;
626 5 : O-PRINT O-READ OPATT D0 DO. ;
626 6 : TEST-OUT O-READ PATT D0 OPATT D0 ROT - ROT2 - OR IF CR
626 7 ." TESTER FAILED, OUTPUT = " PATT D0 DO.
626 8 ." , READBACK = " OPATT D0 DO. THEN ;
626 9 : WALK-TESTER ALL-OFF WALK-INIT 32 0 DO WALK-ONE-ON TEST-OUT
626 10 WALK-ONE-OFF TEST-OUT LOOP ;
626 11 BLK @ DUP 1+ 135-648-MAP ! 2+ 1BLOAD
626 12
626 13 ;S JXK-830118
626 14
626 15

627 0 XQXQ XQ
627 1
627 2
627 3
627 4
627 5
627 6
627 7
627 8 XQXQ XQ
627 9
627 10
627 11
627 12
627 13 X-
627 14
627 15

```

```
628 0 --> ( 135-648 ... 648-TESTMAP TESTER-TESTMAP FULL-TESTER )
628 1
628 2          BUFINIT          VARIABLE BUFMAP
628 3
628 4 : NOBUF ( NO BUFFER SPACE AVAILABLE ) 23 U-ERROR ;
628 5 : 648-TESTMAP 135-6480 BUFMAP 0 NMAP! 135-648-MAP 0 BLOCK
628 6          MAP-COMPARE ;
628 7 : TESTER-MAPTEST X1024 BUFGET ?DUP IF BUFMAP !
628 8          648-TESTMAP BUFMAP 0 BUFRER ELSE NOBUF THEN ;
628 9 : FULL-TESTER-TEST TESTER-MAPTEST 648-LED
628 10          CONTROL-TEST WALK-TESTER 62-VOLT-TEST ;
628 11
628 12 1--> JXK-830107
628 13
628 14
628 15

629 0 --> ( 135-648 ... Menu )
629 1
629 2 DEF-MENU OUTPUT-VOLTAGE-SET          0-VOLTS-OUT +1-VOLT-OUT
629 3          +3-VOLTS-OUT +5-VOLTS-OUT +24-VOLTS-OUT +30-VOLTS-OUT
629 4          -30-VOLTS-OUT +60-VOLT-PULSE OUTPUT-PULSES M;
629 5 DEF-MENU OUTPUT-PATTERN-SET          ALL-ON ALL-OFF WALK-INIT
629 6          WALK-ONE-ON WALK-ONE-OFF OUTPUT-LOW-PATTERN
629 7          OUTPUT-HIGH-PATTERN TURN-ONE-ON TURN-ONE-OFF
629 8          OUTPUT-VOLTAGE-SET SHOW-OUTPUTS M;
629 9 DEF-MENU TESTER-TESTS          INITIALIZE-IDIM-TESTER
629 10          TESTER-MAPTEST CONTROL-TEST WALK-TESTER 648-LED
629 11          62-VOLT-TEST FULL-TESTER-TEST SHOW-OUTPUTS
629 12          OUTPUT-PATTERN-SET CAMAC-MENU DEBUG M;
629 13 1--> JXK-830107
629 14
629 15

630 0 --> ( 135-648 ...cont )
630 1
630 2
630 3 DEF-MENU 135-648-TESTS          INITIALIZE-IDIM-TESTER
630 4          SHOW-OUTPUTS OUTPUT-PATTERN-SET OUTPUT-VOLTAGE-SET
630 5          TESTER-TESTS 135-562-TESTS M;
630 6
630 7 1--> JXK-821221
630 8
630 9
630 10
630 11
630 12
630 13
630 14
630 15
```

```
631 0 --> ( 135-648 ...cont )
631 1
631 2 135-562 ( Loads the IDIM program if not already loading. )
631 3
631 4 FORTH DEFINITIONS : GO 135-648-TESTS ;
631 5
631 6 VCLEAR CR ." 135-548 " HERE LOADLENGTH
631 7
631 8 CR CR ." ENTER 'GO or 135-648-TESTS' TO INVOKE TESTS. "
631 9 BELL CR
631 10
631 11 ;S JXK-821221
631 12
631 13
631 14
631 15
```