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SYSTEMS INTERFACE

FOR 8000B SERIES COUNTERS

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1.1 INTRODUCTION.

1.2 This manual describes the use and operation of the Models 008 and 009 Systems Interface options, used on the Dana Series 8000B Electronic Counters. The options are internally mounted in the counter and receive all operational power from the counter. The options permit the instrument to be operated remotely by electrical input and provide data from the counter readout in Binary Coded Decimal (BCD) form for use by a digital recorder or other digitally operated device.

1.3 RECORDER.

1.4 The Recorder output from both options is the same and is in the form of BCD, positive-true, 1-2-4-8 code from TTL integrated circuits. The output supplies, in digital form, the numeric value of the readout, the annunciator displayed, and the position of the decimal.

1.5 Physically the output consists of a cable assembly connecting various points on the counters readout board to two edge-type connectors (J111, J112), located on the rear panel of the counter.

1.6 008 PROGRAMMING OPTION.

1.7 The programming portion of the 008 option consists of a cable assembly providing interconnection between programming edge connector J110 on the rear panel and the readout PC board, and interconnection from J110 through connector P8 to the signal control module.

1.8 The programming portion of the 008 option provides single line commands for the control of function, time base, external gate, +/- slope, hold, and reset. The single line inputs are held true by internal pull up resistors; commands are initiated on these lines by means of a contact closure to ground potential or low TTL level (inputs are TTL gates). Analog programming is available through programming connector J110. The analog inputs determine the trigger level of the signal control module circuitry. A synopsis of 008 capabilities is provided in table 1.1.

1.9 009 PROGRAMMING OPTION.

1.10 The programming portion of the 009 option also consists of a cable assembly and provides interconnection between a 50 pin programming connector J113 on the rear panel and the readout PC board. The cabling also includes interconnection from J113 and a specially modified version of the signal control module.

1.11 The programming portion of the 009 module provides binary encoded commands for the control of function, time base, channel range, and trigger level. It provides single line commands for external gate, +/- slope, hold, reset, separate/common, and ac/dc.

1.12 The digital input lines are held true by internal pull up resistors; commands are generated on these lines, for both single line commands or binary encoded, by contact closure to ground potential or low TTL level (inputs are TTL gates). Analog programming is also available through programming connector J113. The analog inputs are provided as an alternative to digitally selecting the trigger level of the signal control module or can be used in conjunction with the digital controlled input for continuous adjustment between the incremental steps. A synopsis of 009 capabilities is shown in table 1.2.

1.13 SPECIFICATIONS.

1.14 The specifications for all remote selected instrument functions, with the exception of trigger levels, are the same as for local selection and are provided in the counter manual. Specifications for remote selection of trigger levels are provided in table 1.3.

1.15 Miscellaneous.

1.16 ITEMS FURNISHED (008).

1.17 Included with instruments equipped with the 008 option are three edge-type mating connectors, Dana P/N 600698 (with hoods, Dana P/N 453890).

1.18 ITEMS FURNISHED (009).

1.19 Included with instruments equipped with the 009 option are two edge-type mating connectors, Dana P/N 600698 (with hoods, Dana P/N 453890), and one 50-pin connector, Dana P/N 600047.

1.20 REQUIRED TOOLS AND TEST EQUIPMENT.

1.21 No calibration is required for the 008 option. The calibration equipment needed and the tools used for the 009 option are a portion of the equipment used for the calibration of the counter. An aid for calibrating the 009 option consists of a 50-pin mating connector for programming connector J113 with certain pins interconnected. This is described in Section 4.

Table 1.1 - Option 008 Programming

Program Title	Program Mode	Applicable to Models:				
		8010B	8015B	8020B	8030B	8035B
Functions:						
Remote	Single Line Digital	X	X	X	X	X
Check	Single Line Digital	X	X	X	X	X
Period	Single Line Digital	X	X	X	X	X
Period Ave.	Single Line Digital	X	X	X	X	X
Frequency A	Single Line Digital	X	X	X	X	X
Frequency C	Single Line Digital			X	X	X
Totalize	Single Line Digital	X	X	X	X	X
A/B Ratio	Single Line Digital	X	X		X	X
Time Interval	Single Line Digital	X	X		X	X
Time Int. Ave.	Single Line Digital	X			X	
Input Controls:						
Slope A	Single Line Digital	X	X	X	X	X
Trig Level A	Single Line Analog	X	X	X	X	X
Slope B	Single Line Digital	X	X		X	X
Trig Level B	Single Line Analog	X	X		X	X
Time Base:						
10 ns	Single Line Digital		X			X
1+100 ns	Single Line Digital	X	X	X	X	X
10+1 μ s	Single Line Digital	X	X	X	X	X
10 ² +10 μ s	Single Line Digital	X	X	X	X	X
10 ³ +100 μ s	Single Line Digital	X	X	X	X	X
10 ⁴ +1 ms	Single Line Digital	X	X	X	X	X
10 ⁵ +10 ms	Single Line Digital	X	X	X	X	X
10 ⁶ +100 ms	Single Line Digital	X	X	X	X	X
10 ⁷ +1 sec	Single Line Digital	X	X	X	X	X
10 ⁸ +10 sec	Single Line Digital	X	X	X	X	X
10 ⁹ +100 sec	Single Line Digital	X	X	X	X	X
Program Functions:						
HOLD	Single Line Digital	X	X	X	X	X
RESET	Single Line Digital	X	X	X	X	X
Ext. Gate	Single Line Digital	X	X	X	X	X

Table 1.2 - Option 009 Programming

Program Title	Program Mode	Applicable to Models:			
		8010B	8015B	8030B	8035B
Functions:					
Remote	4-Line BCD	X	X	X	X
Check	4-Line BCD	X	X	X	X
Period	4-Line BCD	X	X	X	X
Period Ave.	4-Line BCD	X	X	X	X
Frequency A	4-Line BCD	X	X	X	X
Frequency C	4-Line BCD			X	X
Totalize	4-Line BCD	X	X	X	X
A/B Ratio	4-Line BCD	X	X	X	X
Time Interval	4-Line BCD	X	X	X	X
Time Int. Avg.	4-Line BCD	X		X	
Input Controls:					
Sep/Com	Single Line Digital	X	X	X	X
Slope A	Single Line Digital	X	X	X	X
AC/DC A	Single Line Digital	X	X	X	X
Range A	2-Line BCD	X	X	X	X
Anal. Trig. Level A	Single Line Analog	X	X	X	X
Dig. Trig. Level A	7-Line Binary	X	X	X	X
Slope B	Single Line Digital	X	X	X	X
AC/DC B	Single Line Digital	X	X	X	X
Range B	2-Line BCD	X	X	X	X
Anal. Trig. Level B	Single Line Analog	X	X	X	X
Dig. Trig. Level B	7-Line Binary	X	X	X	X
Time Base:					
10 ns	Single Line Digital		X		X
1+100 ns	4-Line BCD	X	X	X	X
10+1 μ s	4-Line BCD	X	X	X	X
10 ² +10 μ s	4-Line BCD	X	X	X	X
10 ³ +100 μ s	4-Line BCD	X	X	X	X
10 ⁴ +1 ms	4-Line BCD	X	X	X	X
10 ⁵ +10 ms	4-Line BCD	X	X	X	X
10 ⁶ +100 ms	4-Line BCD	X	X	X	X
10 ⁷ +1 sec	4-Line BCD	X	X	X	X
10 ⁸ +10 sec	4-Line BCD	X	X	X	X
10 ⁹ +100 sec	4-Line BCD	X	X	X	X
Program Functions:					
HOLD	Single Line Digital	X	X	X	X
RESET	Single Line Digital	X	X	X	X
Ext. Gate	Single Line Digital	X	X	X	X

Table 1.3 - Trigger Level Specifications

Analog (Options 008/009)	Supply Voltage (.1V per % of range) into 10 kohms to set desired level; Accuracy: $\pm 2\%$ of range $\pm .2\%$ of range per $^{\circ}\text{C}$ \pm Transient Error* \pm Attenuator Error**
Digital (Option 009)	7 Bit Code, 5% of range per step, $\pm 300\%$ of Range Span; Accuracy: $\pm 5\%$ of range $\pm .2\%$ of range/ $^{\circ}\text{C}$ \pm Transient Error* \pm Attenuator Error**

$$*\text{Transient Error} \leq \left[\frac{\text{Slope} \left(\frac{\text{V}}{\mu\text{S}} \right)}{\text{Range}} \right]^{1/2} \text{ Percent of Range}$$

**Attenuator Error

Frequency	Accuracy (% of Range)		
	Range		
	X1	X10	X100
0 \rightarrow 1 kHz	1	2	3
1 kHz \rightarrow 10 kHz	1	4	4
10 kHz \rightarrow 100 kHz	1	8	8
100 kHz \rightarrow 1 MHz	1	8	8

2.1 RECORDER OUTPUT.

2.2 The recorder output is provided at the back panel of the instrument on two edge-type connectors J111 and J112. The connectors are slotted between pins 2 and 3 of J111 and pins 3 and 4 of J112 to permit keying of the mating connectors.

2.3 The data from the two connectors is a Binary Coded Decimal (BCD), positive-true, 1-2-4-8 code. The logic levels for the output are defined as:

- “0” = 0 volts to +0.8 volts
- “1” = +2.4 volts to +5 volts

2.4 The recorder produces a binary coded representation of the instrument display. This includes the numeric readout, the decimal position and the annunciator as shown in figure 2.1.

2.5 Cabling.

2.6 Two mating connectors (Dana P/N 600698) come with the instrument for the RECORDER output. Pin identification for the connectors is provided in figure 2.2, and table 2.1. The outputs are described in the following paragraphs.

2.7 NUMERIC READOUT.

2.8 The numeric readout lines have the designations V1 through V9. The designators represent the corresponding

readout “windows” with V1 to the right, the least-significant bit. For example, a seven in the most-significant bit is shown as:

V9-8	logic 0
V9-4	logic 1
V9-2	logic 1
V9-1	logic 1

2.9 ANNUNCIATOR.

2.10 A separate line is provided for each unit on the annunciator. The units identify the units of time or frequency in which the measurement is expressed and is indicated when the particular output line is at logic true.

2.11 DECIMAL.

2.12 A separate line is provided for each of the eight decimal points. The designators DP1 through DP8 describe the number of places to the left of the least-significant digit the decimal is located. The decimal position is indicated by a logic true.

2.13 PRINT.

2.14 The print command indicates that the data is at the output connectors and is available for recording. The print pulse is a 0 to +5 volt pulse of 5 microsecond duration.

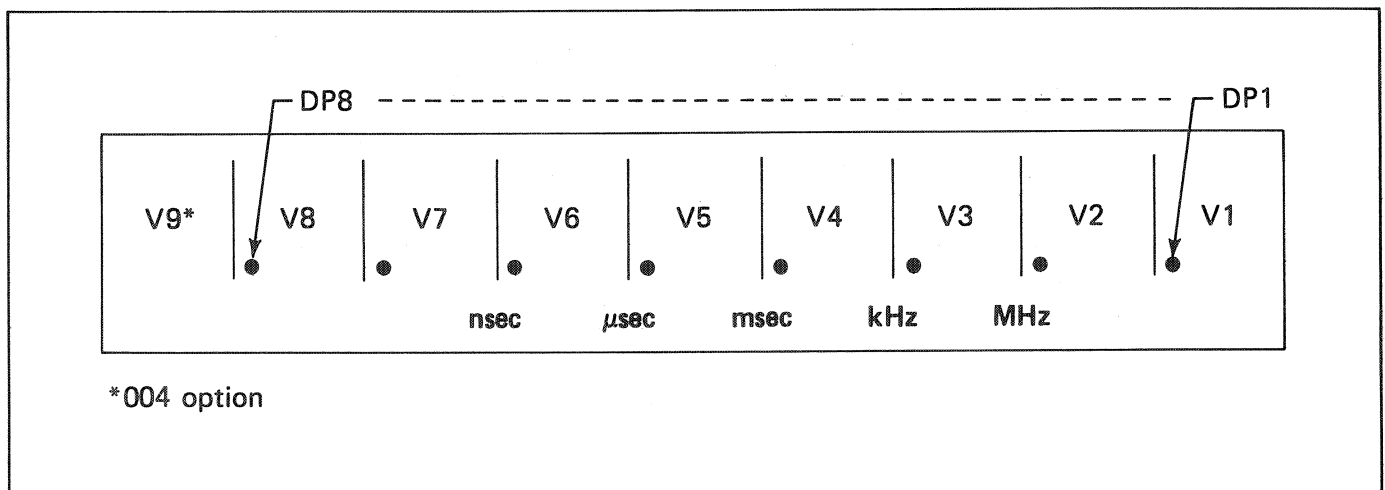


Figure 2.1

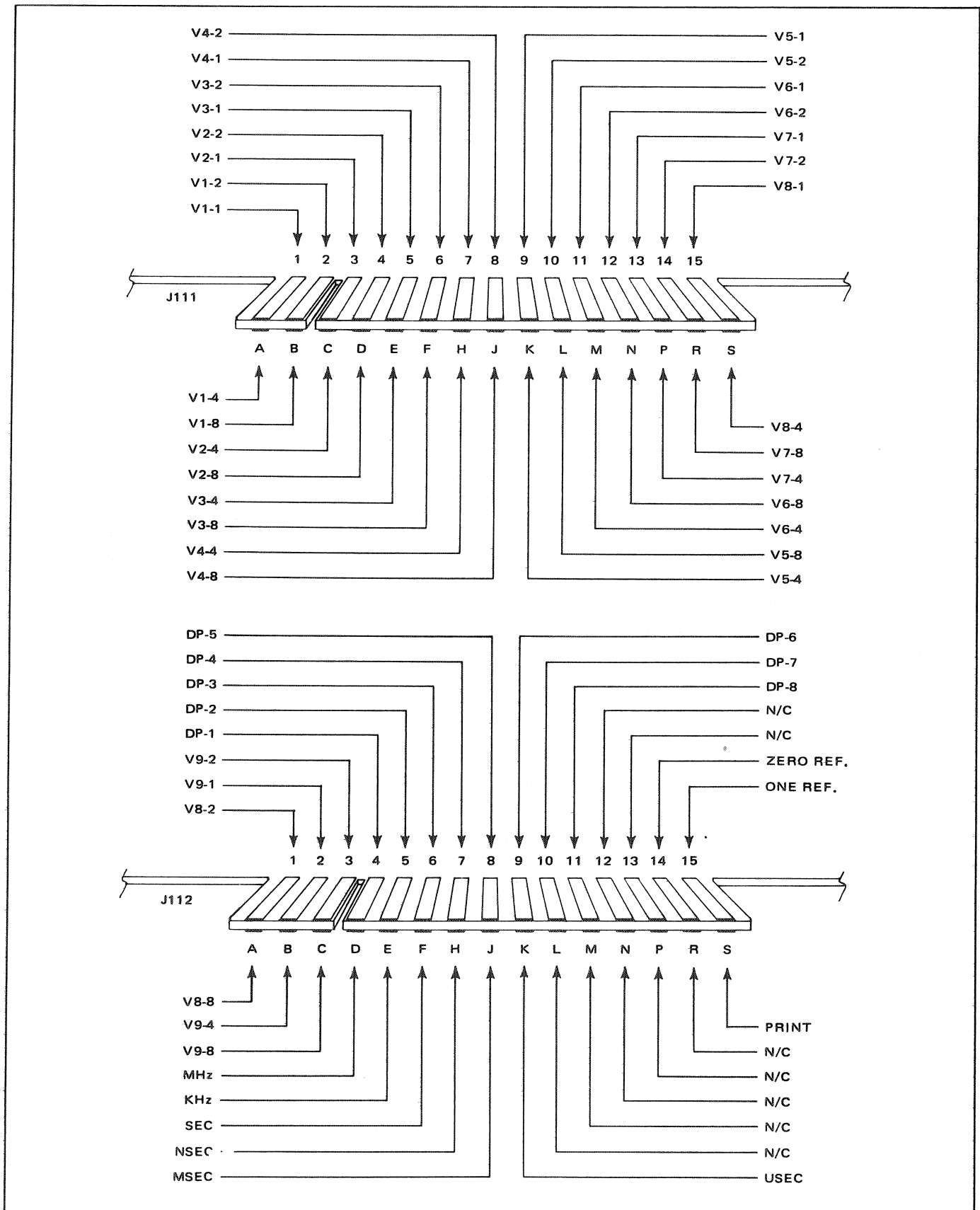


Figure 2.2 - J111 and J112 Recorder Outputs

Table 2.1 - Recorder Cabling Guide

Output	Designator	Connector	Pin No.	Output	Designator	Connector	Pin No.	
Numeric	V1-1	J111	1	Numeric	V7-4	J111	P	
	V1-2		2		V7-8		R	
	V1-4		A		V8-1		15	
	V1-8		B		V8-2	J112	1	
	V2-1		3		V8-4	J111	S	
	V2-2		4		V8-8	J112	A	
	V2-4		C		V9-1	2		
	V2-8		D		V9-2	3		
	V3-1		5		V9-4	B		
	V3-2		6		V9-8	C		
	V3-4		E		Decimal	J112	DP-1	4
	V3-8		F				DP-2	5
	V4-1		7	DP-3			6	
	V4-2		8	DP-4			7	
	V4-4		H	DP-5			8	
	V4-8		J	DP-6			9	
	V5-1		9	DP-7			10	
	V5-2		10	DP-8			7	
	V5-4		K	Unit	J112	MHz	D	
	V5-8		L			kHz	E	
	V6-1		11			SEC	F	
	V6-2		12			MSEC	H	
	V6-4		M			NSEC	J	
	V6-8		N			μ SEC	K	
	V7-1		13			Other	J112	PRINT
	V7-2		14	ONE REF.	15			
				ZERO REF.	14			

2.15 ONE REFERENCE.

2.16 The one reference is provided for those recorders requiring a reference voltage. The line supplies approximately +2.5 volts with an impedance of 1 kilohm $\pm 5\%$.

2.17 ZERO REFERENCE.

2.18 Zero reference is the recorder common line to which all of the other output lines are referenced.

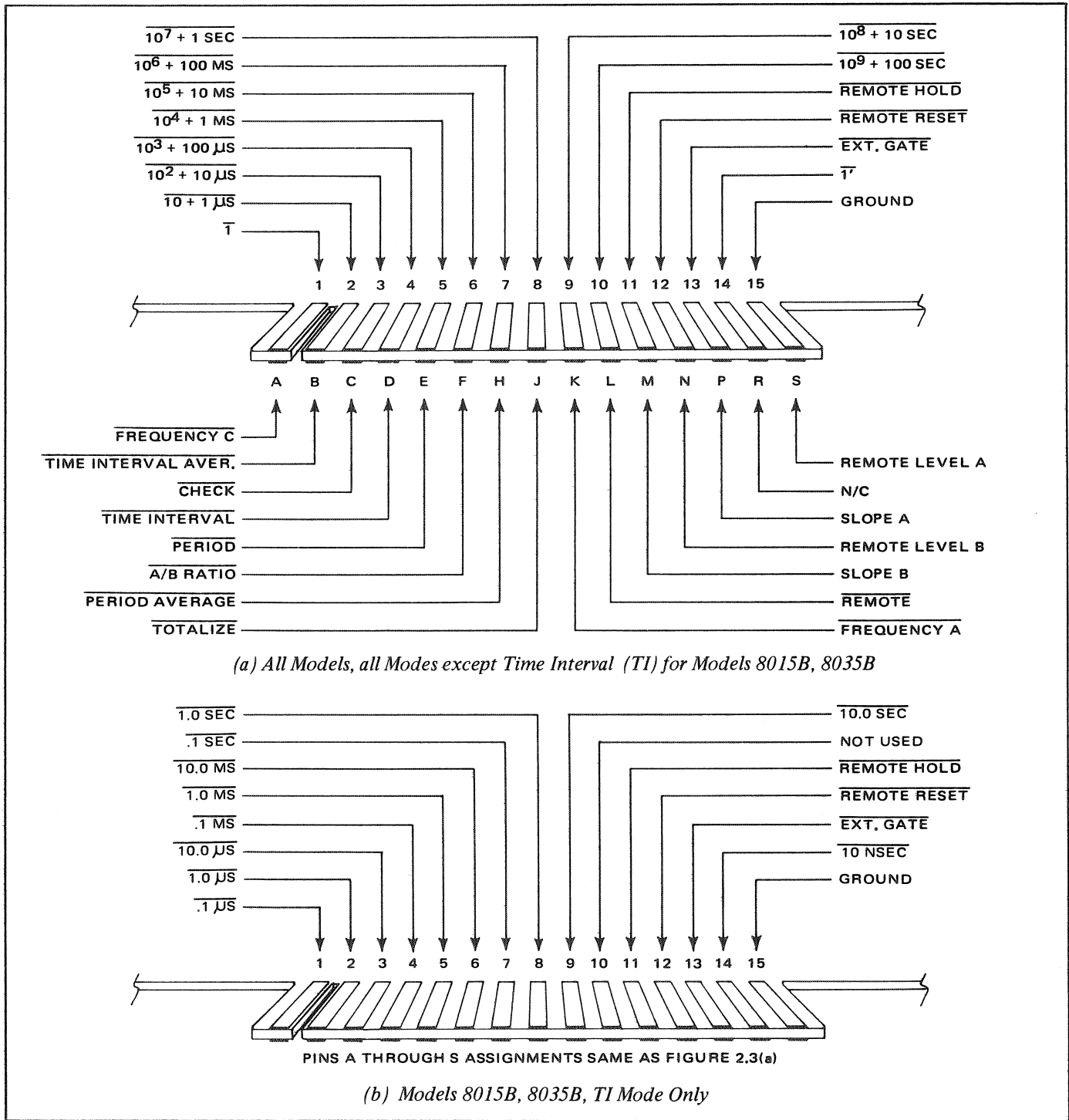


Figure 2.3 - REMOTE Connector J110 Pin Assignments

2.19 REMOTE PROGRAMMING, 008.

2.20 The Option 008 REMOTE input is connector J110, located on the rear panel of the instrument. A slot between pins 1 and 2 of the edge-type connector is provided for the

keying of the mating connector (Dana P/N 600698), supplied with the instrument.

2.21 Remote programming commands are received through the remote connector and are generated by a

Table 2.2 - 008 Programming Cabling Guide

Input	Designator	J110 Pin No.	Mode	Input	Designator	J110 Pin No.	Mode
Function	$\overline{\text{Freq. C}}$	A	Single Line	(Time Base 'Std.' cont.)	10^6+100 ms	7	Single Line
	$\overline{\text{TI Ave.}}$	B			10^7+1 sec	8	
	$\overline{\text{Check}}$	C			10^8+10 sec	9	
	$\overline{\text{TI}}$	D			10^9+100 sec	10	
	$\overline{\text{Period}}$	E		Time Base (for TI of 8015B, 8035B only)	10 ns	14	
	$\overline{\text{A/B Ratio}}$	F			100 ns	1	
	$\overline{\text{Period Avg.}}$	H			$1 \mu\text{s}$	2	
	$\overline{\text{Totalize}}$	J			$10 \mu\text{s}$	3	
	$\overline{\text{Freq A}}$	K			$100 \mu\text{s}$	4	
					1 ms	5	
Signal In	Slope A	P	Analog	10 ms	6		
	Level A	S		100 ms	7		
	Slope B	M	Single Line	1 sec	8		
	Level B	N	Analog	10 sec	9		
Time Base All Functions/ Models except TI of 8015B, 8035B	$\overline{1}$	14	Single Line	Other	$\overline{\text{REMOTE}}$	L	
	$\overline{1}$	1			$\overline{\text{HOLD}}$	11	
	$10+1 \mu\text{s}$	2			$\overline{\text{RESET}}$	12	
	$10^2+10 \mu\text{s}$	3			Ext. Gate	13	
	$10^3+100 \mu\text{s}$	4			$\overline{\text{GROUND}}$	15	
	10^4+1 ms	5					
	10^5+10 ms	6					

closure to the $\overline{\text{REMOTE}}$ line (pin L of J110). Pin assignments of J110 are listed in figure 2.3 and table 2.2. Typical programming timing is shown in figure 2.4. Programming requirements are as follows:

- Logic "1" is the passive state and is defined as +2 volts to +5 volts.
- Logic "0" is the command state and is defined as 0 to +0.8 volts.
- Output of programmer must be able to sink 3 milliamps.

2.22 FUNCTION.

2.23 Pins A through K of J110 are the input lines corresponding to the FUNCTION switch on the front panel. Note that the function lines are the complements of the corresponding function as indicated by a bar over the name. For example: with FREQ A function selected the line

marked Freq A should be low ($\overline{\text{Freq A}}$). To remotely program any of the operating modes, the front panel FUNCTION switch must be in the REMOTE position. The function is then programmed by a closure to J110 - pin L from the appropriate pin. Settling time for the function lines are 100 ns.

2.24 MULTIPLIER TIME BASE.

2.25 Pins 1 through 10 of J110 are lines corresponding to each of the MULTIPLIER/TIME BASE pushbutton switches. Settling time for the Multiplier Time Base lines is 100 ns.

2.26 INPUT CONTROLS.

2.27 The INPUT CONTROLS and the "+/-" slope switch on the front panel are duplicated by lines on pins M through S of J110. For remote programming of these input controls, the trigger level for input A and B must be in the PRESET

position. The channel A trigger level is then controlled by the voltage applied to J110, pin S; channel B trigger level is controlled by the voltage applied to pin N. The value of the external trigger level voltage applied to pins S and N can be calculated according to the following formula.

$$V_p = 10 \frac{TL}{R}$$

Where: V_p = external trigger level voltage

TL = desired trigger level

R = input voltage range

Example 1: to obtain a trigger level of .7 volts on the 1 volt range.

$$V_p = 10 \frac{.7}{1} = 7 \text{ volts to pin S or N}$$

Example 2: to obtain a trigger level of -50 volts on the 100 volt range.

$$V_p = 10 \frac{-50}{100} = -5 \text{ volts}$$

2.28 Both positive and negative trigger levels may be programmed into pins S or N. Settling time is 1 microsecond for the trigger level up to $\pm 300\%$ of the input range.

2.29 SLOPE.

2.30 The counter triggers on the positive slope unless there is a closure from pin M to pin L for channel B slope or (and) pin P to pin L for channel A slope. With a closure, a negative slope is programmed. Settling time is less than 1 microsecond.

2.31 HOLD.

2.32 The Hold line, pin 11 of J110, corresponds to the full clockwise position of the DISPLAY TIME control on the front panel. When the Hold line is low, the counter takes one reading and holds the measurement until the Reset is activated.

2.33 RESET.

2.34 Reset corresponds to the front panel RESET switch. The reset must be held low for a minimum of 100 nano-

seconds. The main gate opens in less than 1 millisecond after the positive edge of the reset closure.

2.35 EXTERNAL GATE.

2.36 The external gate line, pin 13 of J110, is used in the Totalize mode to externally establish a gate time during which Frequency A is counted. The external gate must be greater than 100 nanoseconds. Two contact closures are required per gate time or measurement. The gate is initiated in less than 50 nanoseconds after the falling edge of the first contact closure. The next contact closure terminates the gate and holds the accumulated reading. The next external gate continues the count and so on. The count may be cleared by pulling the Reset line low.

2.37 REMOTE PROGRAMMING, 009 (8010B, 8015B, 8030B, 8035B).

2.38 The Option 009 enables external electrical operation of all front panel controls (except POWER and DISPLAY TIME) and provides BCD output data including numeric value, annunciator and decimal position. All inputs* and outputs are in the form of logic levels with logic "1" levels defined as +2 volts to +5 volts and logic "0" levels defined as 0 volts to 0.8 volts.

2.39 Programming data is applied through a 50-pin blue ribbon connector (J113), located on the rear panel. All command lines* are initially biased at a logic "1" level, control settings are made by 'pulling' the appropriate control lines to GROUND (J113, pin 33). Pin locations are indicated in figure 2.5 and table 2.3.

2.40 System Control.

2.41 The SYSTEM CONTROL line (pin 37 of connector J113) programs remote operation when placed at logic 0 (pin 33 of J113); all front panel controls are inhibited (except POWER and DISPLAY TIME) when system control is selected. When system control is not selected, the instrument can be placed in remote operation by setting the front panel FUNCTION switch to the REMOTE position.

2.42 FUNCTION.

2.43 The remote selection of function is made by applying a binary code to the four function command lines located on J113. The remote selection duplicates the

*except ANALOG TRIGGER LEVEL inputs

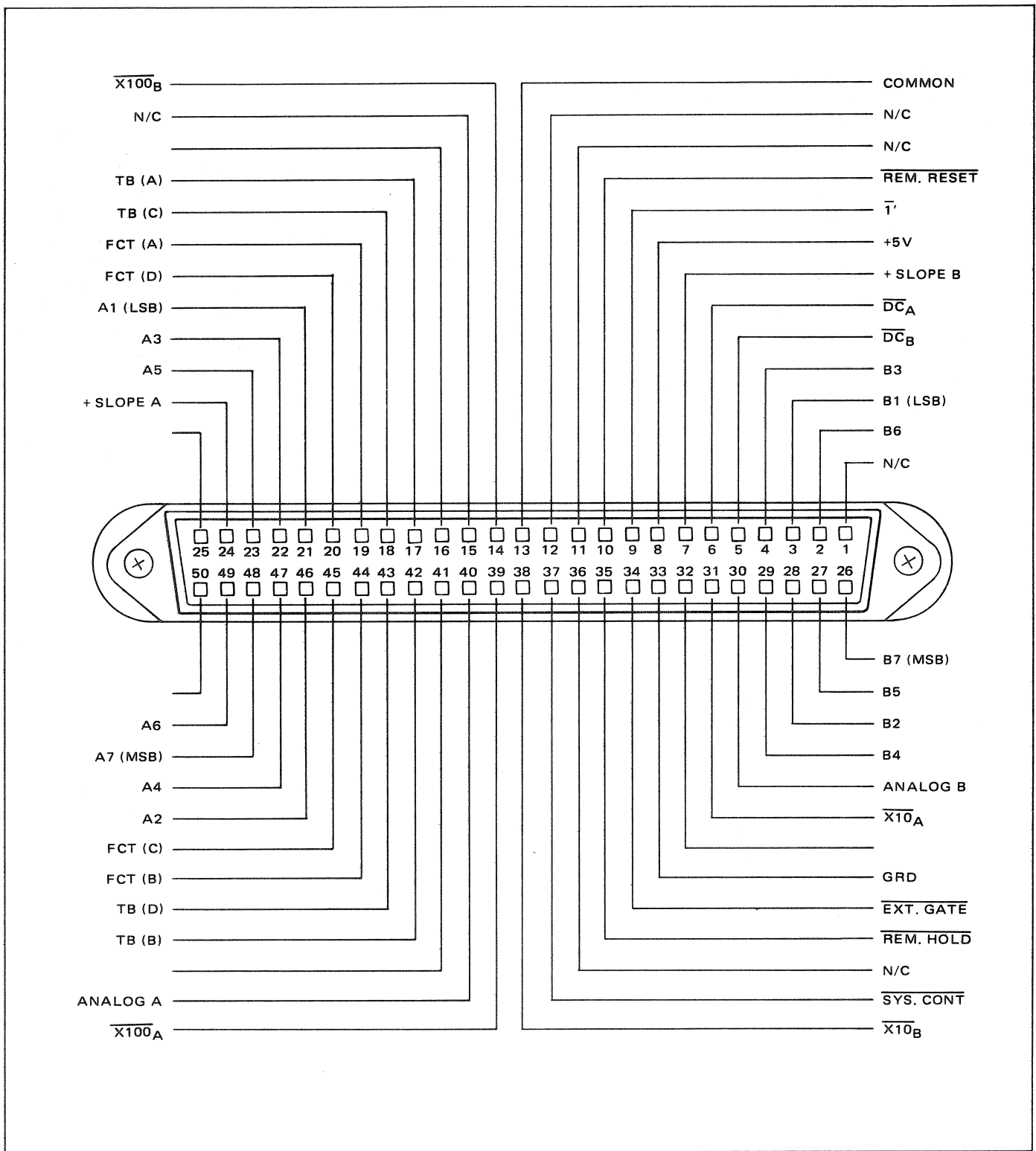


Figure 2.5 - Pin Location of J113 Programming Connector

Table 2.3 - 009 Programming Cabling Guide

Input	Designator	J113 Pin No.	Mode	Input	Designator	J113 Pin No.	Mode
Function	FCT A	19	4-Line	(A Trig cont.)	A7	48	7-Line
	FCT B	44		A Trig Analog	Analog A	40	Analog
	FCT C	45		B Range	$\overline{X10B}$	38	2-Line
	FCT D	20			$\overline{X100B}$	14	
Time Base	TB A	17	Single Line	B Slope	+B	7	
	TB B	42		B AC/DC	DC B	5	
	TB C	18		B Trigger (Binary)	B ₁	3	7-Line
	TB D	43			B ₂	28	
Sep/Com	Common	13	Single Line	B ₃	4		
				B ₄	29		
A Range	$\overline{X10A}$	31	2-Line	B ₅	27		
	$\overline{X100A}$	39		B ₆	2		
A Slope	+A	24	Single Line	B ₇	26		
A AC/DC	DC A	6		B Trig Analog	Analog B	30	Analog
A Trigger (Binary)	A ₁	21	7-Line	Other	\overline{RESET}	10	Single Line
	A ₂	46			\overline{HOLD}	35	
	A ₃	22			$\overline{System Contrl}$	37	
	A ₄	47			$\overline{External Gate}$	34	
	A ₅	23			+5 Volts	8	
	A ₆	49			GROUND	33	

operation of the front panel FUNCTION switch. Coding for each function is shown below.

Function	J113 Pin No.				BCD Weight
	20	45	44	19	
Check	0	0	0	0	0
Periodic	0	0	0	1	1
Periodic Avg	0	0	1	0	2
Frequency A	0	0	1	1	3
Frequency C	0	1	0	0	4
Total	0	1	0	1	5
Time Interval	0	1	1	0	6
A/B Ratio	0	1	1	1	7
Time Interval Avg	1	0	0	0	8

2.44 MULTIPLIER TIME BASE.

2.45 The remote selection of the multiplier time base is made by applying a binary code to the four time base command lines located on J113. The remote selection duplicates the operation of the front panel pushbuttons. Coding for each time base is shown below.

Timebase	J113 Pin No.				BCD Weight
	43	18	42	17	
1 + 100 ns	0	0	0	0	0
10 + 1 μs	0	0	0	1	1
10 ² + 10 μs	0	0	1	0	2
10 ³ + 100 μs	0	0	1	1	3
10 ⁴ + 1 ms	0	1	0	0	4
10 ⁵ + 10 ms	0	1	0	1	5
10 ⁶ + 100 ms	0	1	1	0	6
10 ⁷ + 1 sec	0	1	1	1	7
10 ⁸ + 10 sec	1	0	0	0	8
10 ⁹ + 100 sec	1	0	0	1	9

Input code for all functions except TI on 8015B & 8035B

Timebase	J113 Pin No.				BCD Weight
	43	18	42	17	
100 ns	0	0	0	0	0
1 μs	0	0	0	1	1
10 μs	0	0	1	0	2
100 μs	0	0	1	1	3
1 ms	0	1	0	0	4
10 ms	0	1	0	1	5
100 ms	0	1	1	0	6
1 sec	0	1	1	1	7
10 sec	1	0	0	0	8
10 ns	1	0	0	1	9

Input code for TI on 8015B & 8035B only

2.46 INPUT CONTROLS.

2.47 The remote operation of input controls for channels A and B consists of both single line and binary coded inputs. Coding for the input controls is provided below.

	J113 Pin No.
Separate/Common	13
Separate	1
Common	0

Channel A Range	39	31	BCD Weight
X100	0	1	1
X10	1	0	2
X1	1	1	3

Channel A Slope	J113 Pin No.	
	24	
+	1	
-	0	

Channel A AC/DC	J113 Pin No.	
	6	
AC	1	
DC	0	

Channel A Trigger Level	J113 Pin No.						
	48*	49	23	47	22	46	21
Codes provided in table 2.4							

*Most Significant Bit

Channel B Range	14	38	BCD Weight
X100	0	1	1
X10	1	0	2
X1	1	1	3

Channel B Slope	J113 Pin No.	
	7	
+	1	
-	0	

Channel B AC/DC	J113 Pin No.	
	5	
AC	1	
DC	0	

Channel B Trigger Level	J113 Pin No.						
	26*	2	27	29	4	28	3
Codes provided in table 2.4							

*Most Significant Bit

2.48 HOLD.

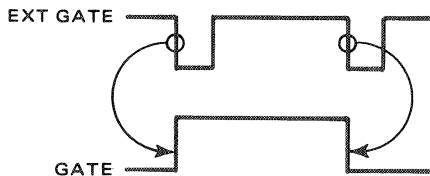
2.49 The Hold line, pin 35 of J113, corresponds to the full clockwise position of the DISPLAY TIME control on the front panel. When the Hold line is at logic 0, the counter takes one reading and holds the measurement until the Reset is activated.

2.50 RESET.

2.51 The reset corresponds to the front panel RESET switch. This is a single line control (pin 10 of J113) and is activated when set to logic 0. The line must be held at logic 0 for a minimum of 100 nanoseconds.

2.52 EXTERNAL GATE.

2.53 The external gate line (pin 34 of J113) is used in the Totalize mode to externally establish a gate time during which channel A signal is counted. The external gate command must be greater than 100 nanoseconds. Two commands are required per gate time or measurement. The gate is initiated in less than 50 nanoseconds after the following edge of the first command. The next command terminates the gate and holds the accumulated reading. The next external gate continues the count and so on. The count may be cleared by pulling the Reset line to logic 0.



2.54 TRIGGER LEVEL.

2.55 The trigger levels of channels A and B are capable of being independently set by external control with either an analog voltage level or a binary coded input.

2.56 Analog control of channel A is through pin 40 and control of channel B is through pin 30 of connector J113. Each 0.1 volt of input voltage adjusts the trigger level 1% of the selected range.

NOTE

When an analog level is used to set the trigger levels, in the Remote mode, J113 pins 48 and 26 must be grounded to J113 pin 33. If in the Local mode, the front panel trigger level pots are placed in the "Preset" position.

Example: A trigger level of -30 volts is desired.

1. The 100 range is selected.
2. The control voltage is equal to:

$$\left(\frac{\text{Desired trigger level}}{\text{Range}} \right) \times 10$$

3. Or: $\left(\frac{-30 \text{ volts}}{100} \right) \times 10$

4. Therefore the required control level is -3 volts.

The input impedance of the analog trigger level control inputs is 10 kilohms.

2.57 Digital control of the trigger levels for channels A and B requires the generation of digital command words for each channel. A separate command word is required for each level and 128 separate levels are available for each channel. Each command word consists of a 7-bit binary code. The available digitally programmable trigger levels along with the required 7-bit code is provided in table 2.4. Note that the available trigger levels listed in table 2.4 indicate the value of the analog signal generated within the instrument for each command word. To equate the available trigger level with the desired trigger level, the available trigger level value is multiplied by the range selected.

2.58 Also included in table 2.4 is the decimal representation for each trigger level. This value can be computed directly from the value of the trigger level by the relationship:

$$\text{Decimal Value} = 63 - 20 \left(\frac{\text{Desired trigger level}}{\text{Range}} \right)$$

Example: A trigger level of +5 volts is desired.

1. Select the 10 volt range.
2. The decimal value is then equal to:

$$63 - 20 \left(\frac{+5 \text{ Volts}}{10} \right)$$

3. The decimal value is 53.
4. From table 2.4, decimal value 53 is equal to +0.500 (available trigger level). +0.5 times the 10 range equals the desired +5 volts trigger level.

Table 2.4 - Trigger Level DAC Programming Information

Desired Trigger Level (VDC)	COMMAND WORD			
	Binary	Octal	Decimal	Hexidecimal
+3.150	0 000 000	000	000	00
+3.100	0 000 001	001	001	01
+3.050	0 000 010	002	002	02
+3.000	0 000 011	003	003	03
+2.950	0 000 100	004	004	04
+2.900	0 000 101	005	005	05
+2.850	0 000 110	006	006	06
+2.800	0 000 111	007	007	07
+2.750	0 001 000	010	008	08
+2.700	0 001 001	011	009	09
+2.650	0 001 010	012	010	0A
+2.600	0 001 011	013	011	0B
+2.550	0 001 100	014	012	0C
+2.500	0 001 101	015	013	0D
+2.450	0 001 110	016	014	0E
+2.400	0 001 111	017	015	0F
+2.350	0 010 000	020	016	10
+2.300	0 010 001	021	017	11
+2.250	0 010 010	022	018	12
+2.200	0 010 011	023	019	13
+2.150	0 010 100	024	020	14
+2.100	0 010 101	025	021	15
+2.050	0 010 110	026	022	16
+2.000	0 010 111	027	023	17
+1.950	0 011 000	030	024	18
+1.900	0 011 001	031	025	19
+1.850	0 011 010	032	026	1A
+1.800	0 011 011	033	027	1B
+1.750	0 011 100	034	028	1C
+1.700	0 011 101	035	029	1D
+1.650	0 011 110	036	030	1E
+1.600	0 011 111	037	031	1F
+1.550	0 100 000	040	032	20
+1.500	0 100 001	041	033	21

Table 2.4 - Trigger Level DAC Programming Information (continued)

Desired Trigger Level (VDC)	COMMAND WORD			
	Binary	Octal	Decimal	Hexidecimal
+1.450	0 100 010	042	034	22
+1.400	0 100 011	043	035	23
+1.350	0 100 100	044	036	24
+1.300	0 100 101	045	037	25
+1.250	0 100 110	046	038	26
+1.200	0 100 111	047	039	27
+1.150	0 101 000	050	040	28
+1.100	0 101 001	051	041	29
+1.050	0 101 010	052	042	2A
+1.000	0 101 011	053	043	2B
+0.950	0 101 100	054	044	2C
+0.900	0 101 101	055	045	2D
+0.850	0 101 110	056	046	2E
+0.800	0 101 111	057	047	2F
+0.750	0 110 000	060	048	30
+0.700	0 110 001	061	049	31
+0.650	0 110 010	062	050	32
+0.600	0 110 011	063	051	33
+0.550	0 110 100	064	052	34
+0.500	0 110 101	065	053	35
+0.450	0 110 110	066	054	36
+0.400	0 110 111	067	055	37
+0.350	0 111 000	070	056	38
+0.300	0 111 001	071	057	39
+0.250	0 111 010	072	058	3A
+0.200	0 111 011	073	059	3B
+0.150	0 111 100	074	060	3C
+0.100	0 111 101	075	061	3D
+0.050	0 111 110	076	062	3E
0.000	0 111 111	077	063	3F
-0.050	1 000 000	100	064	40
-0.100	1 000 001	101	065	41
-0.150	1 000 010	102	066	42
-0.200	1 000 011	103	067	43

Table 2.4 - Trigger Level DAC Programming Information (continued)

Desired Trigger Level (VDC)	COMMAND WORD			
	Binary	Octal	Decimal	Hexidecimal
-0.250	1 000 100	104	068	44
-0.300	1 000 101	105	069	45
-0.350	1 000 110	106	070	46
-0.400	1 000 111	107	071	47
-0.450	1 001 000	110	072	48
-0.500	1 001 001	111	073	49
-0.550	1 001 010	112	074	4A
-0.600	1 001 011	113	075	4B
-0.650	1 001 100	114	076	4C
-0.700	1 001 101	115	077	4D
-0.750	1 001 110	116	078	4E
-0.800	1 001 111	117	079	4F
-0.850	1 010 000	120	080	50
-0.900	1 010 001	121	081	51
-0.950	1 010 010	122	082	52
-1.000	1 010 011	123	083	53
-1.050	1 010 100	124	084	54
-1.100	1 010 101	125	085	55
-1.150	1 010 110	126	086	56
-1.200	1 010 111	127	087	57
-1.250	1 011 000	130	088	58
-1.300	1 011 001	131	089	59
-1.350	1 011 010	132	090	5A
-1.400	1 011 011	133	091	5B
-1.450	1 011 100	134	092	5C
-1.500	1 011 101	135	093	5D
-1.550	1 011 110	136	094	5E
-1.600	1 011 111	137	095	5F
-1.650	1 100 000	140	096	60
-1.700	1 100 001	141	097	61
-1.750	1 100 010	142	098	62
-1.800	1 100 011	143	099	63
-1.850	1 100 100	144	100	64
-1.900	1 100 101	145	101	65

Table 2.4 - Trigger Level DAC Programming Information (continued)

Desired Trigger Level (VDC)	COMMAND WORD			
	Binary	Octal	Decimal	Hexidecimal
-1.950	1 100 110	146	102	66
-2.000	1 100 111	147	103	67
-2.050	1 101 000	150	104	68
-2.100	1 101 001	151	105	69
-2.150	1 101 010	152	106	6A
-2.200	1 101 011	153	107	6B
-2.250	1 101 100	154	108	6C
-2.300	1 101 101	155	109	6D
-2.350	1 101 110	156	110	6E
-2.400	1 101 111	157	111	6F
-2.450	1 110 000	160	112	70
-2.500	1 110 001	161	113	71
-2.550	1 110 010	162	114	72
-2.600	1 110 011	163	115	73
-2.650	1 110 100	164	116	74
-2.700	1 110 101	165	117	75
-2.750	1 110 110	166	118	76
-2.800	1 110 111	167	119	77
-2.850	1 111 000	170	120	78
-2.900	1 111 001	171	121	79
-2.950	1 111 010	172	122	7A
-3.000	1 111 011	173	123	7B
-3.050	1 111 100	174	124	7C
-3.100	1 111 101	175	125	7D
-3.150	1 111 110	176	126	7E
-3.200	1 111 111	177	127	7F

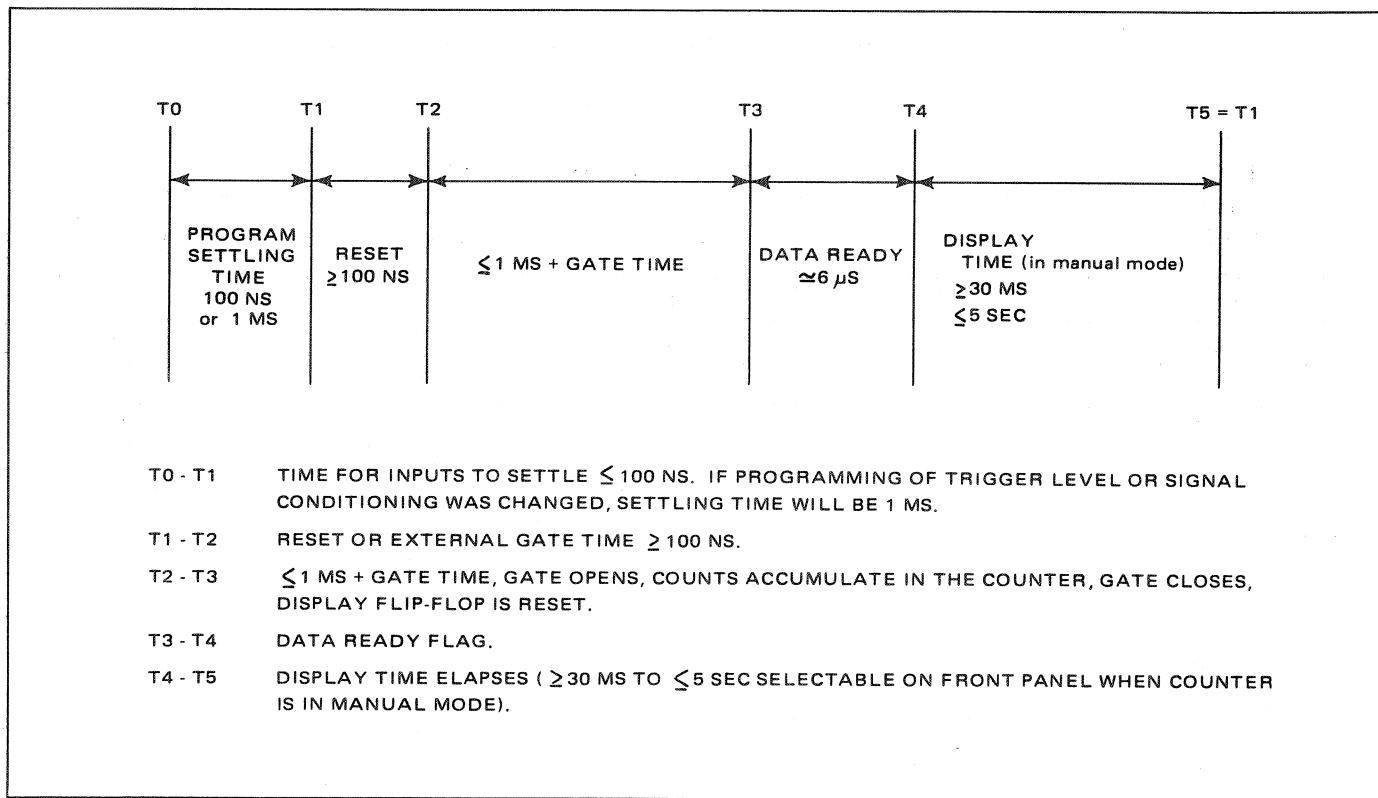


Figure 2.6 - Simplified Timing Diagram

2.59 Programming Sequence.

2.60 For computer-controlled operation the switch positions on the instrument front and rear panels should be set as indicated below.

Front Panel:

Function	REMOTE
Display Time	Any position
Time Base/Multiplier	Any position

Channel A and Channel B
Input Controls

Slope	Either position
AC/DC	Either position
Attenuators	Any position
Level	Any position
Sep/Com	Either position

Rear Panel:

Storage	ON
Ref	INT

2.61 TIMING.

2.62 Required information on timing for programming the instrument are provided in figure 2.6.

2.63 Local Control

2.64 When operating instruments equipped with the 009, option in local control, some remote lines are still capable of affecting instrument operation. These lines, shown below, should be allowed to float high while operating in local control to avoid interaction between the local and remote inputs.

J113 PIN	DESIGNATOR	J113 PIN	DESIGNATOR	NOTE
6	DCA	38	$\overline{X10B}$	All lines to remain floating when operating in local control
5	DCB	14	$\overline{X100B}$	
31	$\overline{X10A}$	34	External Gate	
39	$\overline{X100A}$	10	RESET	
13	Common	35	HOLD	

3.1 GENERAL.

3.2 The basic flow of information between the Series 8000B Counter and each of the interface options is shown in simplified form in figure 3.1. This figure and others in this section are provided as reference for the text and supplement the schematic drawings at the back of this manual and the Counter manual.

3.3 RECORDER.

3.4 The recorder output, in both options, is taken directly from the Readout Assembly. Physically, it consists of a cable from the readout to connectors J111 and J112 of the rear panel. Electrically, the output is taken from TTL integrated logic outputs. These outputs are also used to drive other logic on the Readout assembly. Typical Recorder drive circuits are shown in figure 3.2 and described in the following paragraphs.

3.5 Display.

3.6 The display output is supplied by eight sets of 4-line BCD output lines (or nine sets in instruments equipped with the 004 option). The lines are driven by the 7475 latches which also drive the BCD to 10-line converters.

3.7 Annunciators.

3.8 The annunciator data is carried on six individual lines, taken from inverter or logic gate outputs. These also control the annunciator drivers (Q5, Q6, Q7, Q8, Q9, and Q10).

3.9 Decimal.

3.10 The decimal output consists of eight single-line outputs taken from logic gate and inverter outputs that feed the decimal drivers of the display (Q15, Q17, Q18, Q19, Q20, Q21, Q22, and Q23).

3.11 Print.

3.12 The print line is picked up on the readout board at terminal E66 but the circuitry generating the signal is located on the switch board as shown in figure 3.3. The circuitry consists of a 6 microsecond one-shot generator. Normally, the output of the circuitry is at logic 0 with both inputs of NAND gate MC6 at logic 1. The falling edge of a

positive 1 microsecond pulse, generated by the counter control logic, initiates the positive 6 microsecond print pulse. The 1 microsecond pulse is used by the counter to transfer new data into the display logic at the end of a measurement (update pulse); the print pulse indicates the data transfer is complete.

3.13 Zero Reference.

3.14 The zero reference is the logic 0 or common line. It is the zero reference line for all outputs of the RECORDER connectors J111 and J112.

3.15 One Reference.

3.16 The one reference is an internally generated reference of approximately +2.5 volts and is required by some types of printers. The circuit consists of two 2 Kilohm resistors in series, connected between zero reference and the +5 volt power supply line, with the one reference taken from the junction of the two resistors.

3.17 REMOTE OPERATION (008).

3.18 The option 008 offers remote programming of the function, multiplier/time base, and the slope and trigger level of the input control. Programming is through remote lines or remote circuitry that operate in parallel with existing instrument circuitry. Interaction of local controls by remote inputs is eliminated by switching the remote input lines to the REMOTE line (pin L); the remote inputs will not energize unless the REMOTE line is at logic 0 (when the front panel Function switch is set to REMOTE).

3.19 Remote Function.

3.20 A portion of the remote function control lines and the corresponding front panel function control lines are illustrated in figure 3.4. In all cases except the Remote position, diodes separate the remote input lines from the instrument control lines. The Function switch is shown in the remote position causing the $\overline{\text{REMOTE}}$ line to be at logic 0. Remote lines are energized when they are electrically tied to pin L of J110.

3.21 Remote Multiplier/Time Base.

3.22 Shown in figure 3.5 is a portion of the remote and local control of the multiplier/time base. To prevent front

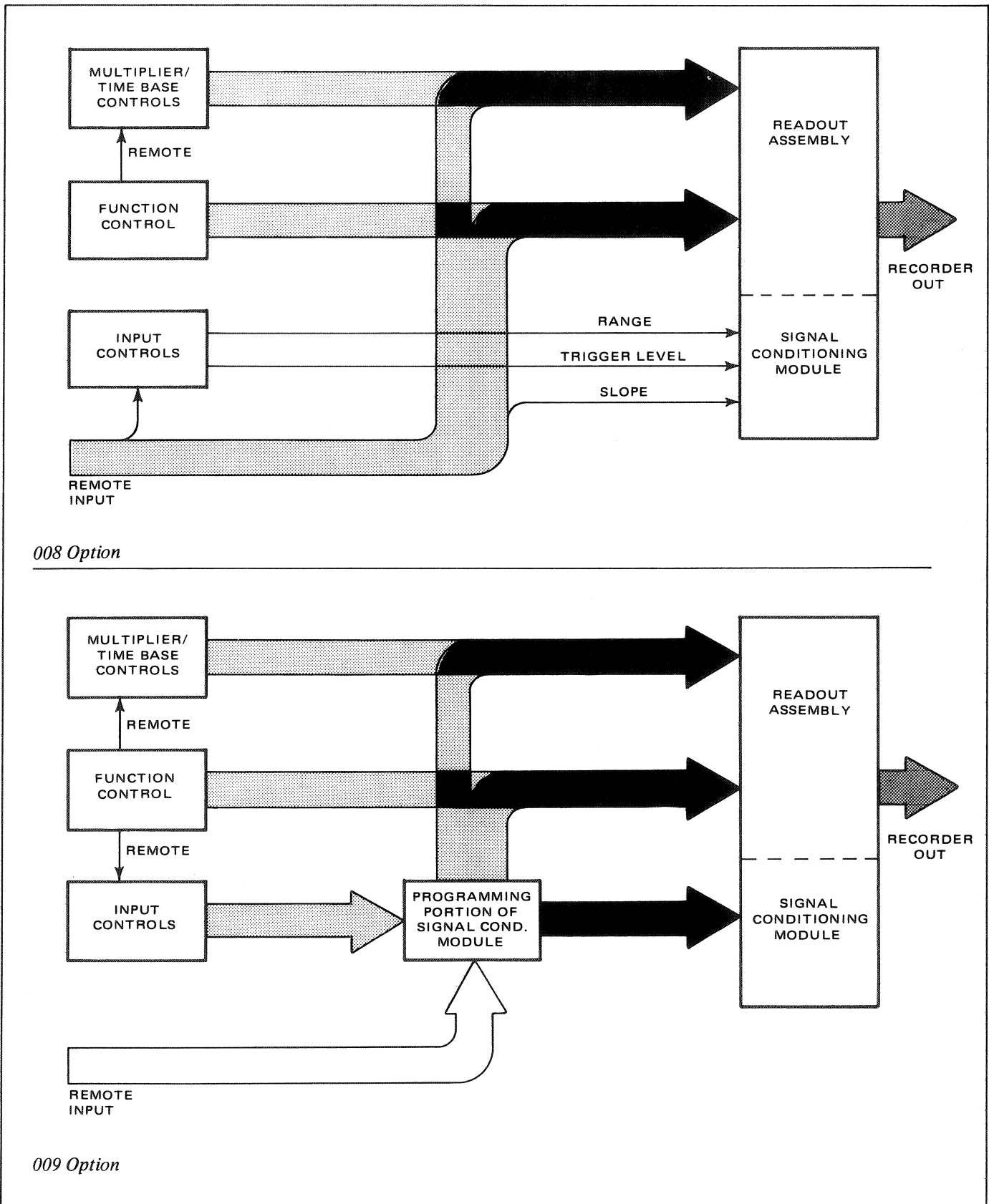


Figure 3.1 - 008/009 Programming, Block Diagram

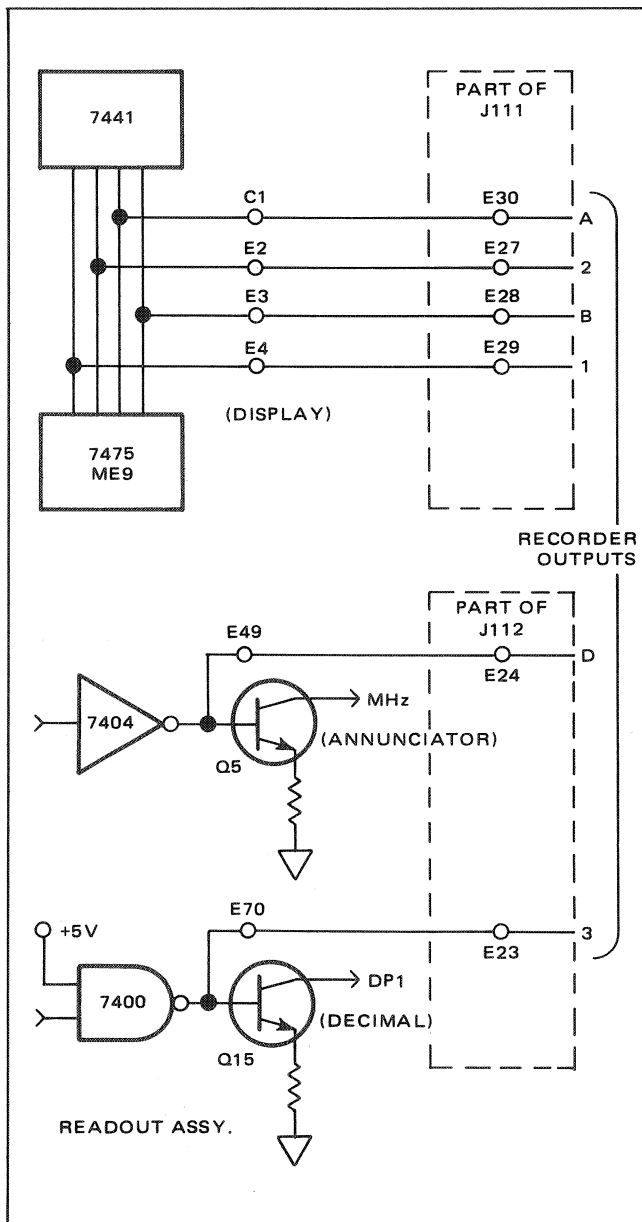


Figure 3.2 - Recorder Output Circuits

panel operation with Remote selected, inverter Q7 output is driven to logic 1, inhibiting the front panel pushbuttons from pulling any of the control lines down. Remote lines are energized when they are electrically tied to pin L of J110.

3.23 Remote Input.

3.24 The remote input (or inputs, depending on the counter model) selects the trigger level and slope of the input signal. The circuitry that controls these operations is part of the basic instrument. It is located on the signal conditioning module, and described in further detail in the 8000B Series manual; the remote programming portions of these circuits are described in the following paragraphs.

3.25 Remote Trigger Levels.

3.26 The remote trigger level circuitry, shown in figure 3.6, consists of a resistor (R27) tying the external control line (J110-S) to the trigger level circuitry. The front panel trigger level control consists of a potentiometer with a built-in switch that opens the circuit in the CCW position (PRESET). The control is placed in the PRESET position when the remote trigger level control is to be used. Because the remote trigger level control line is continuously in the circuit, it is recommended that it be externally opened when local control is used. Resistors R27 and R26 form a 10:1 voltage divider; a maximum input level of 30 volts, therefore, produces an input of 3 volts to the reference input of the amplifier.

3.27 Remote Slope Control.

3.28 The remote slope control is shown in figure 3.7. With remote selected, REMOTE is at logic 0. This causes transistor Q11 to be biased off and prevents the front panel SLOPE switch (S206) from pulling either of the two output lines down. Also, the emitter of transistor Q12 is held at logic 0. With J110-P open, Q12 is biased on through

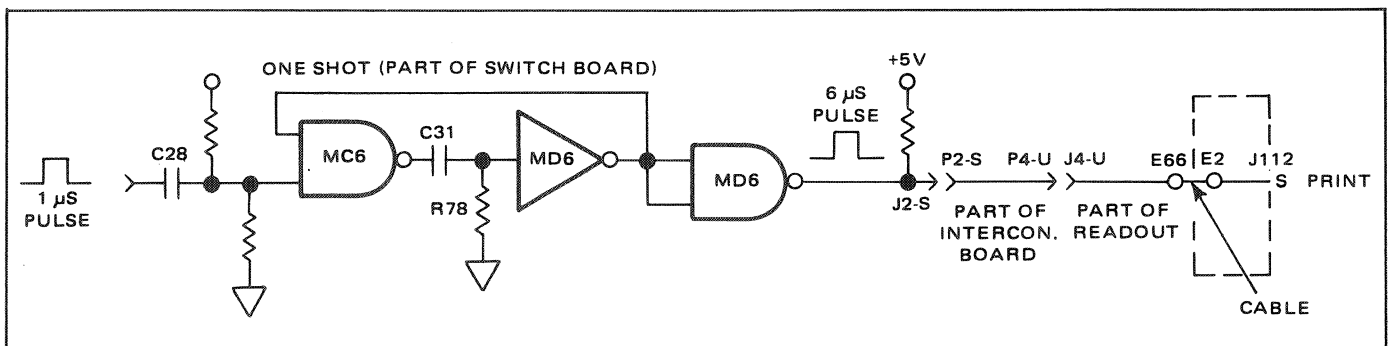


Figure 3.3 - Print Command Circuitry

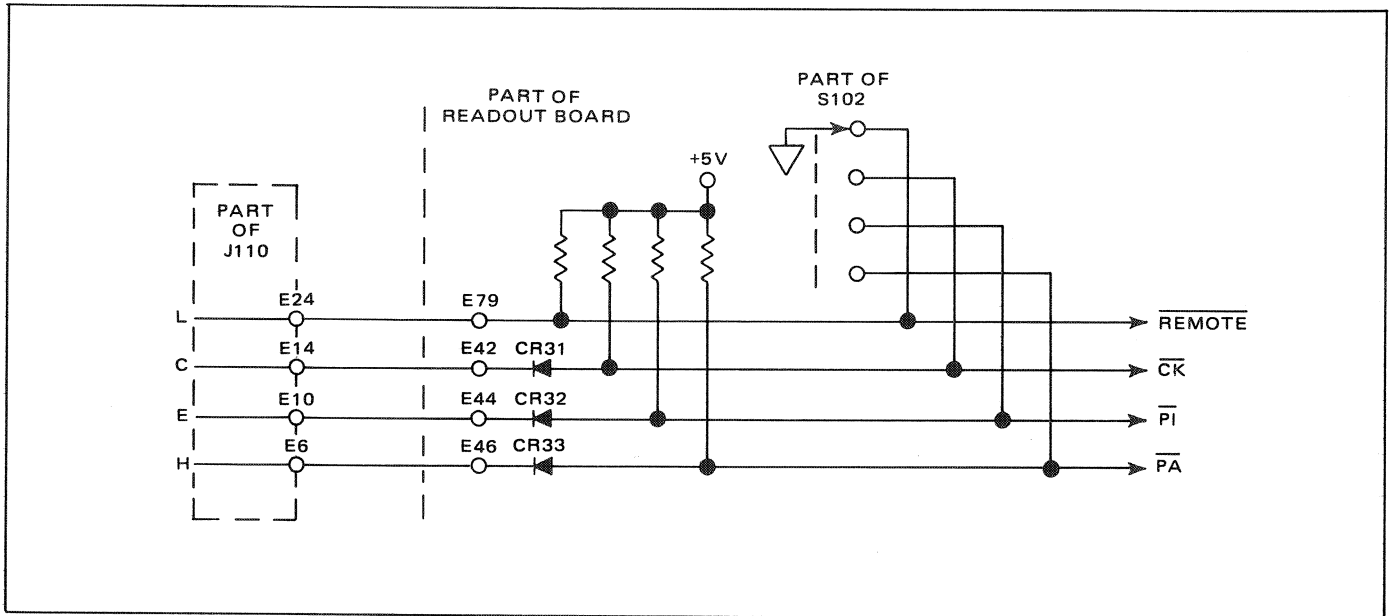


Figure 3.4 - Remote Function Select

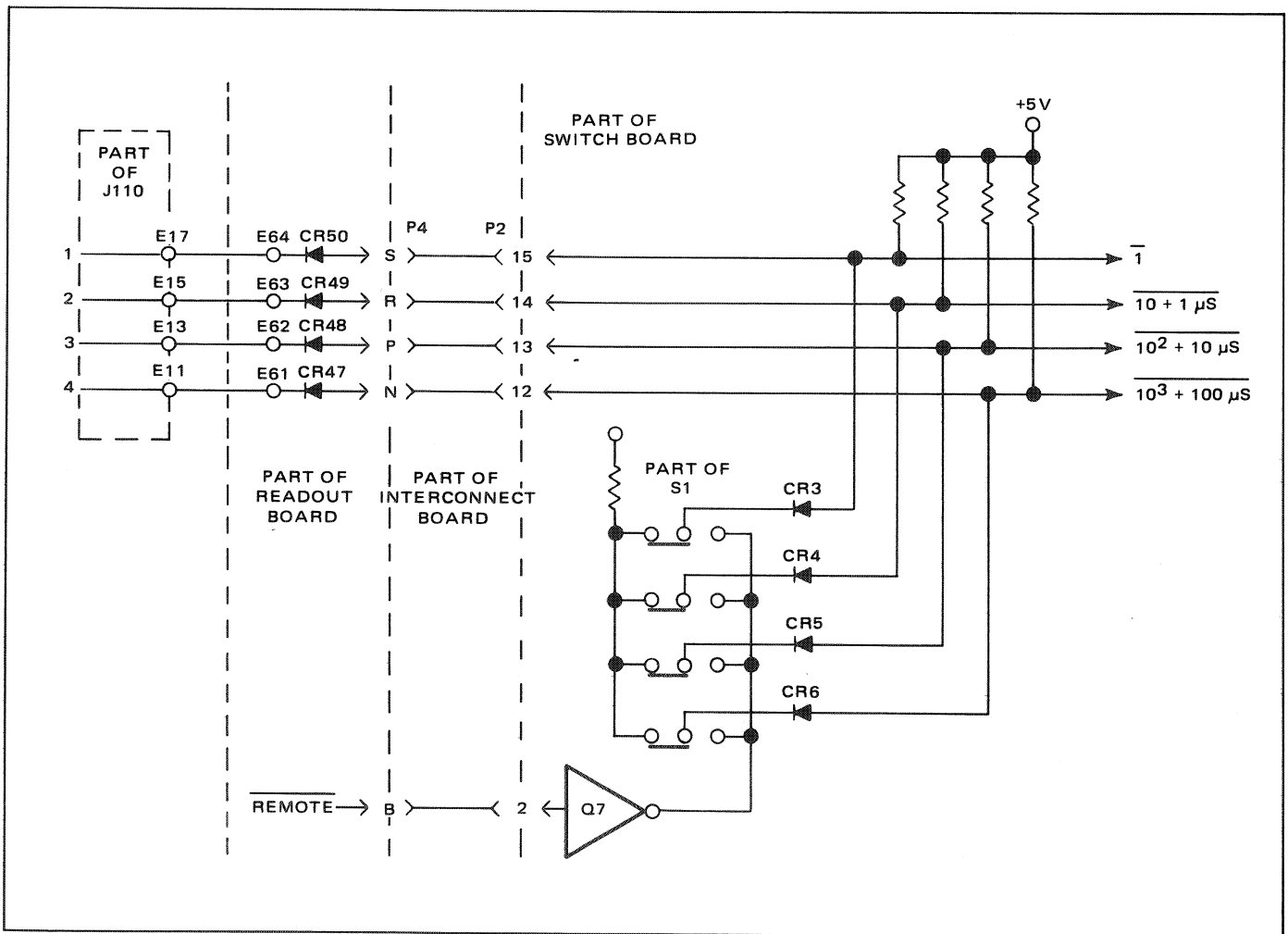


Figure 3.5 - Remote Multiplier/Time Base Select

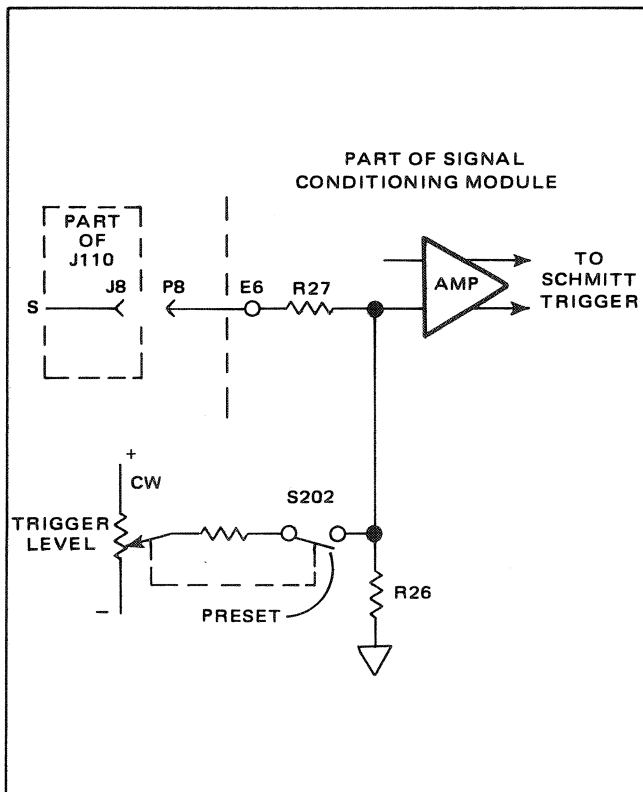


Figure 3.6 - Remote Trigger Level Control (008)

resistors R28, R37, and R32. Q12 thus pulls down the - slope line (inhibiting it) and allowing the signal on the + slope line to reach J6. When J110-P is pulled to logic 0, Q12 is biased off (allowing the - slope line to go positive) and the + slope line is pulled down through R37. The - slope signal is thus allowed to reach J6.

3.29 REMOTE OPERATION, 009.

3.30 The option 009 consists of a special signal conditioning module that replaces the standard conditioning module, a special rear panel that includes a fan, and certain changes in the standard circuitry that will be covered in the text.

3.31 The option offers remote programming of the function, multiplier/time base, and the slope and trigger level of the input control. In addition, it provides digital trigger level control, hysteresis compensation, range control and separate/common select. The option 009 is used on the 8010B, 8015B, 8030B, and the 8035B Series Counters.

3.32 Remote Function.

3.33 The functions are remotely selected by a 4-line, BCD, 1-2-4-8 code. The input lines are routed to a BCD-to-10 line converter located on the 009 Signal Conditioner

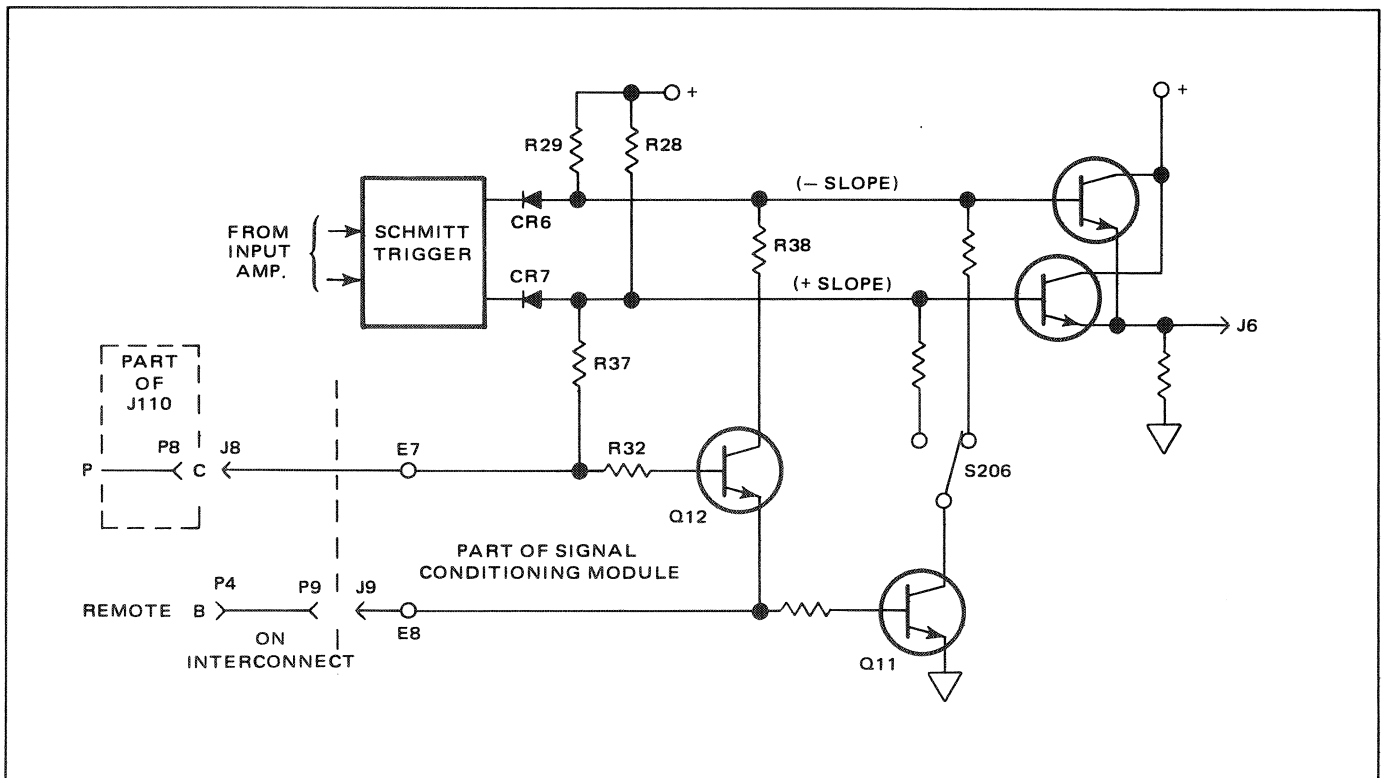


Figure 3.7 - Remote Slope Control (008)

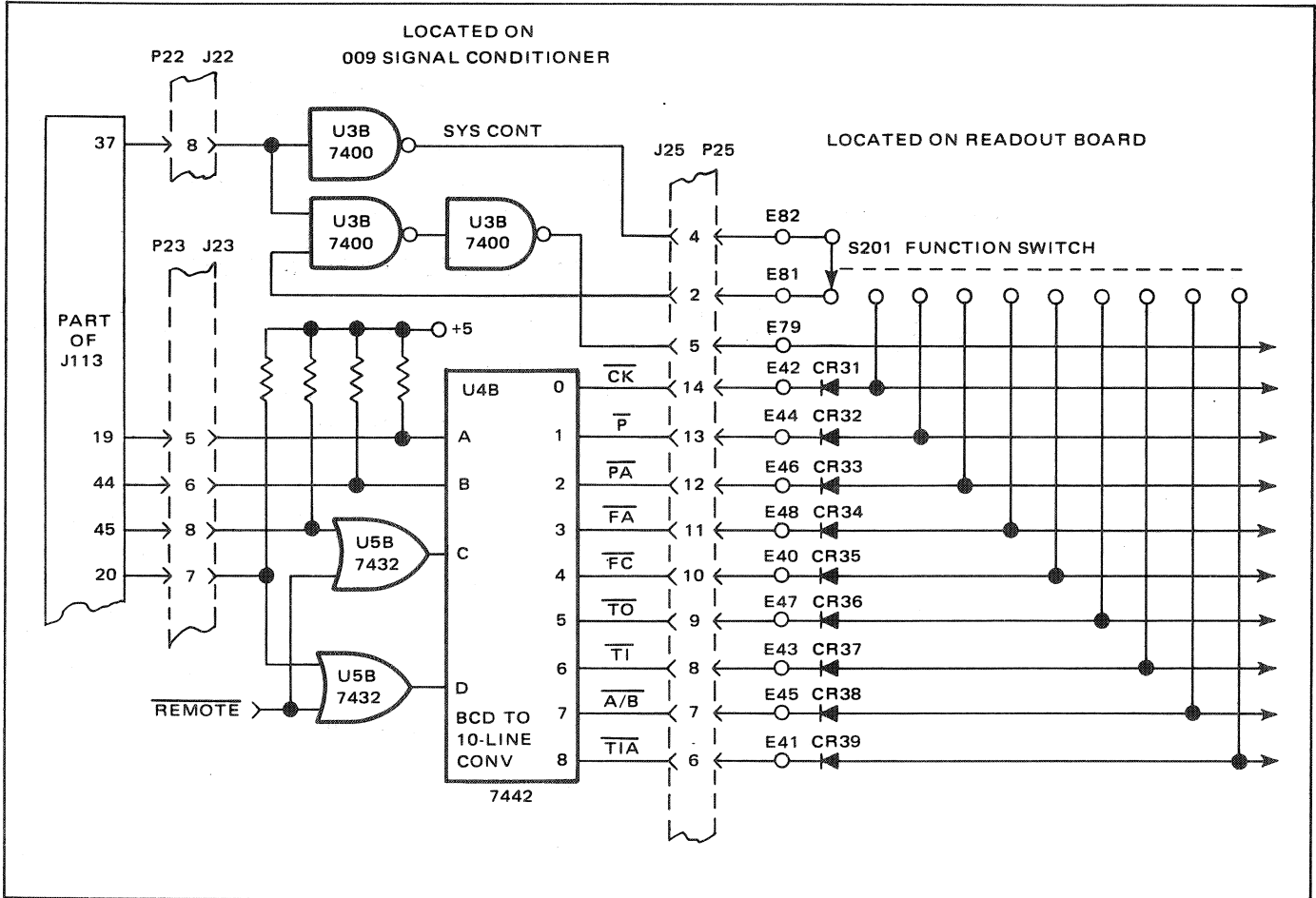


Figure 3.8 - Remote Function Decode

as shown in figure 3.8. With remote selected, the $\overline{\text{REMOTE}}$ signal appearing at the inputs of the two "OR" gates is at logic 0 and does not affect the operation of the converter. The coded function input is decoded to its numeric equivalent and appears as a logic 0 at the specified output terminal.

For Example: the input code for Time Interval (from Section 2) is 20 = 0, 45 = 1, 44 = 1, 19 = 0 for a BCD equivalent weight of 6. This input results in the $\overline{\text{TI}}$ output of the converter (which has a weight of 6) to be at logic 0 and all of the remaining outputs have an output of logic 1. The $\overline{\text{TI}}$ output selects the Time Interval function through diode CR37.

3.34 When Remote is not selected, the $\overline{\text{REMOTE}}$ line at the inputs of the "OR" gates is at logic 1 causing the C and D inputs of the converter to be at logic 1. This places the converter in an "impossible" code state and all output lines are held at logic 1 regardless of what BCD code is introduced at the input.

3.35 Remote Multiplier/Time Base.

3.36 The Multiplier/Time Base (M/TB) is remotely selected by 4-wire BCD 1-2-4-8 code and operates in much

the same manner as the remote function selection. The operation of the circuitry as well as operating differences between counter models are described in the following paragraphs.

3.37 8010B, 8030B.

3.38 As shown in figure 3.9 the remote BCD input is converted to 10-line by U4A and routed to the switching board. With remote selected, the $\overline{\text{REMOTE}}$ line is at logic 0. The two 'OR' gates (7432) are not affected but switch S1 is disabled (the logic 0 of the $\overline{\text{REMOTE}}$ is inverted to logic 1 by Q7, and S1 can not pull down any of the control lines to logic 0). The BCD input is converted to its numeric equivalent and appears as a logic 0 at the specified output terminal.

For Example: the input code for 10 + 1 μs is 43 = 0, 18 = 0, 42 = 0, 17 = 1 for a BCD equivalent weight of 1. This input results in the 10 + 1 μs line to be at logic 0 and all the remaining outputs to be at logic 1. The 10 + 1 μs output is selected in the instrument through diode CR49.

3.39 When remote is not selected, the $\overline{\text{REMOTE}}$ line is at logic 1. Switch S1 is enabled and U4A, through the two 'OR' gates, is inhibited (see paragraph 3.34).

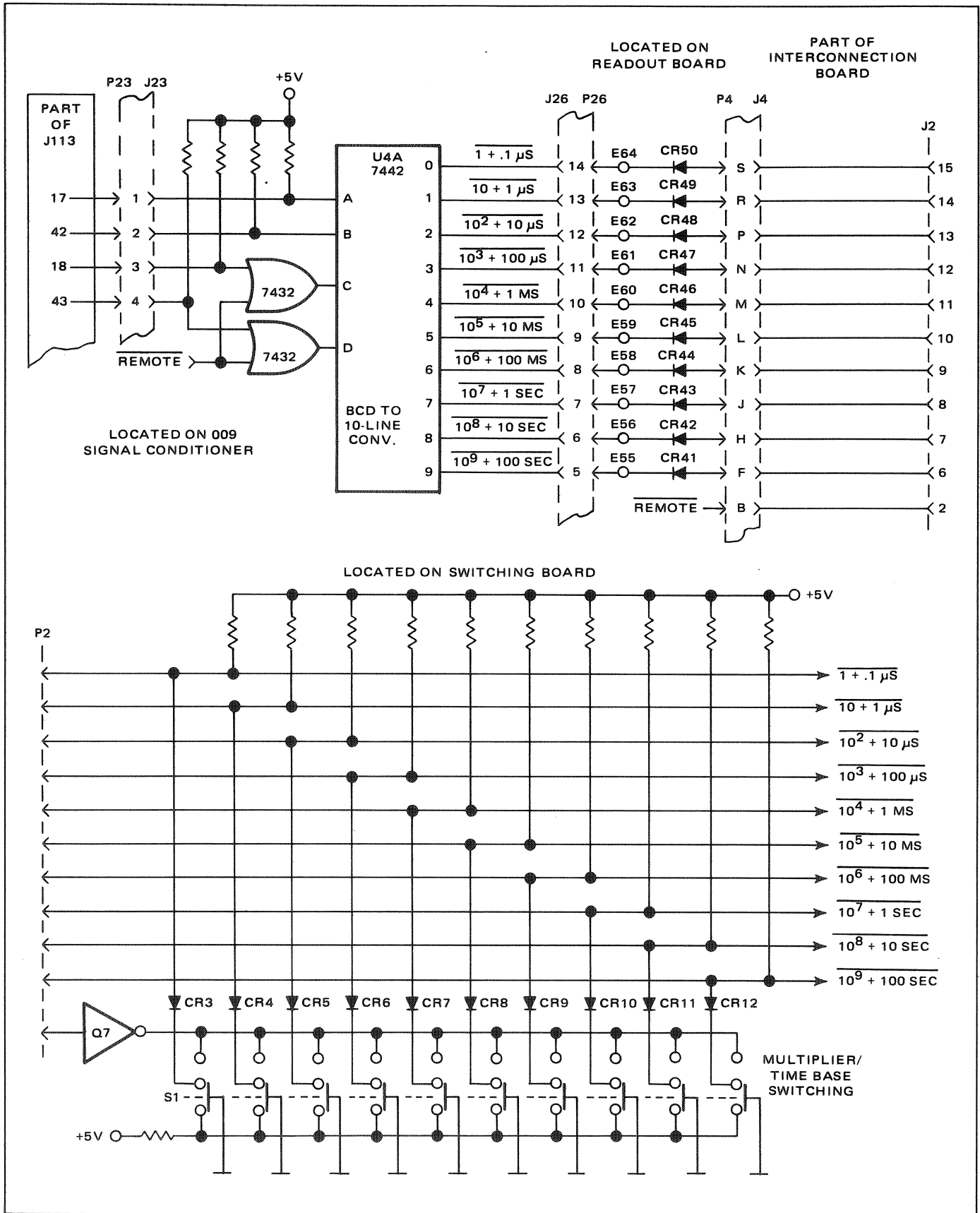


Figure 3.9 - Remote Multiplier/Time Base Decode (8010B, 8030B)

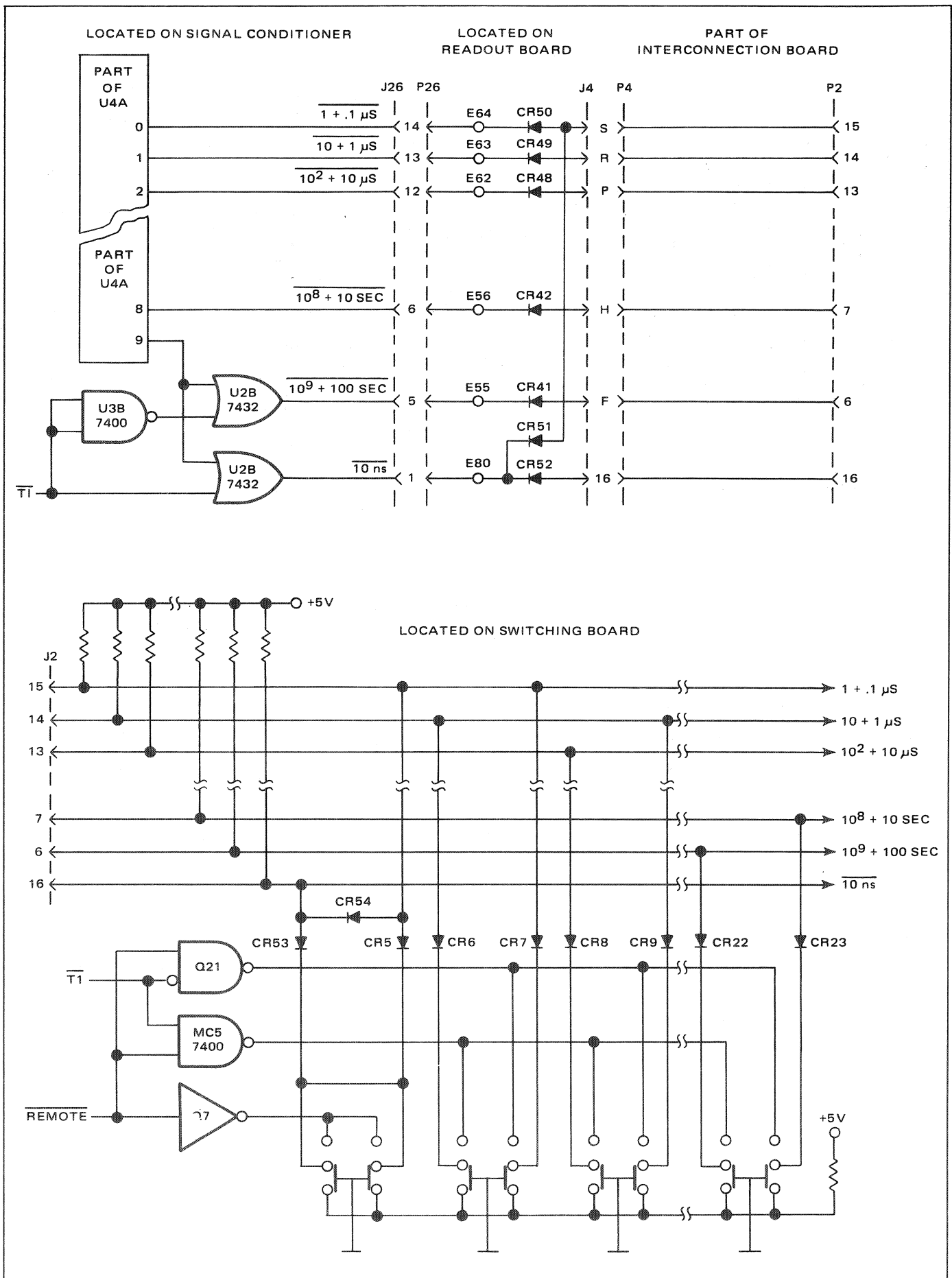


Figure 3.10 - 009 Remote Multiplexer/Time Base Decode (8015B, 8035B)

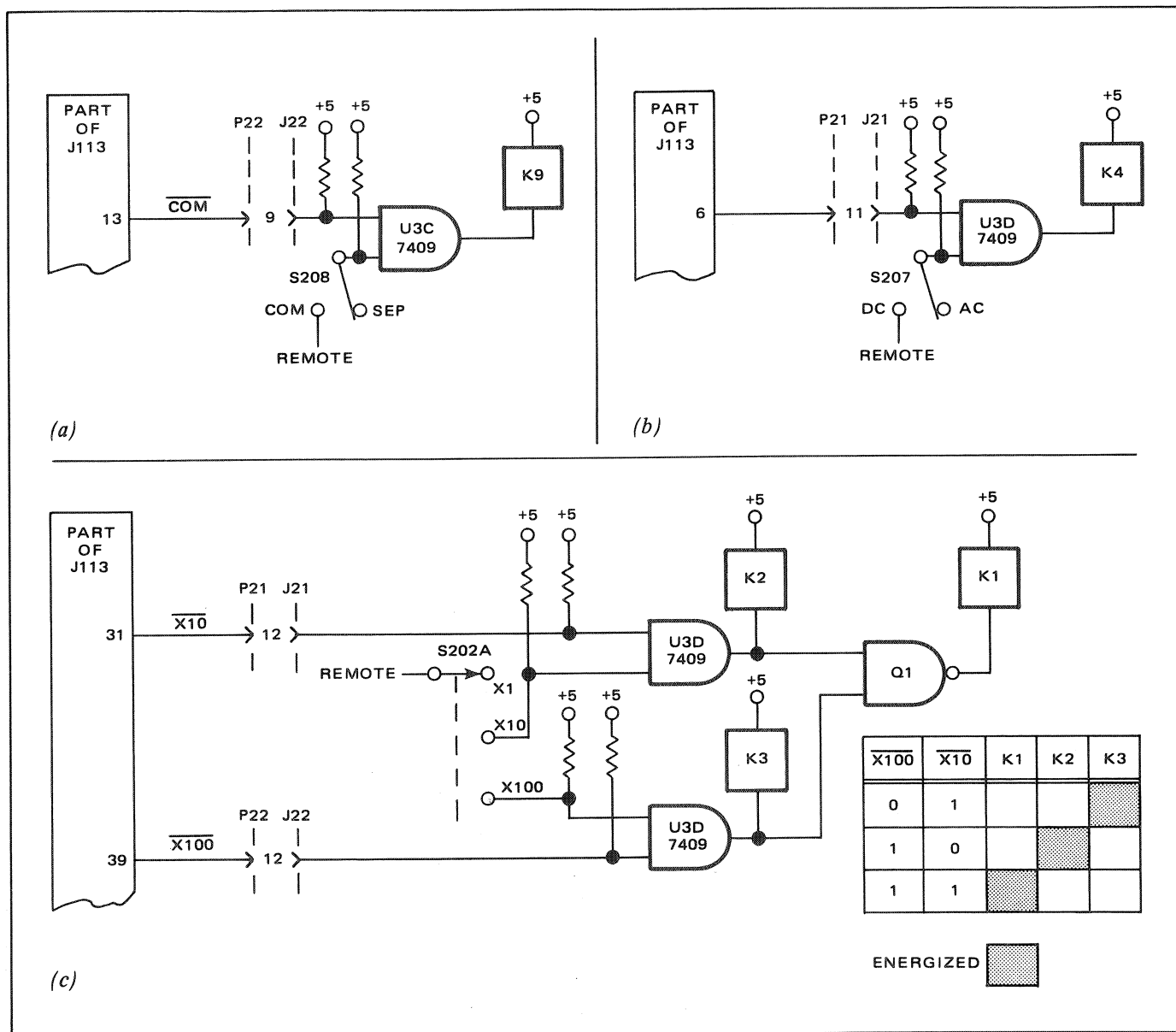


Figure 3.11 - Sep/Com, AC/DC Range Remote Inputs (009)

3.40 8015B, 8035B.

3.41 In all functions except Time Interval, the multiplier/time base of these instruments is programmed and operates in the same manner as the 8010B and 8030B counters. That is, the input BCD code is converted to 10-line by converter U4A and U4A is inhibited while the instrument is in local control. As shown in figure 3.10, additional logic is provided for the TI function and includes two 'OR' gates (U2B) and a NAND gate (U3B). In all but the TI function, the \overline{TI} line (from the function converter, U4B) is logic 1, U3B output is logic 0, and the 9 output of U4A, when selected, appears at J26-5. In the TI function, \overline{TI} is

logic 0, the output of U3B is logic 1 and the 9 output of U4A, when selected, appears at J26-1 (10 ns line). Also shown in figure 3.10 is the interconnection of the remote and local multiplier/time base circuitry.

3.42 Remote Input Operation.

3.43 The control of the input circuitry (or inputs) includes remote selection of separate/common, input range, and AC/DC. The signal conditioning module of the 009 option uses relays in place of the standard instrument switches to permit remote operation. The circuitry is described in the following paragraphs.

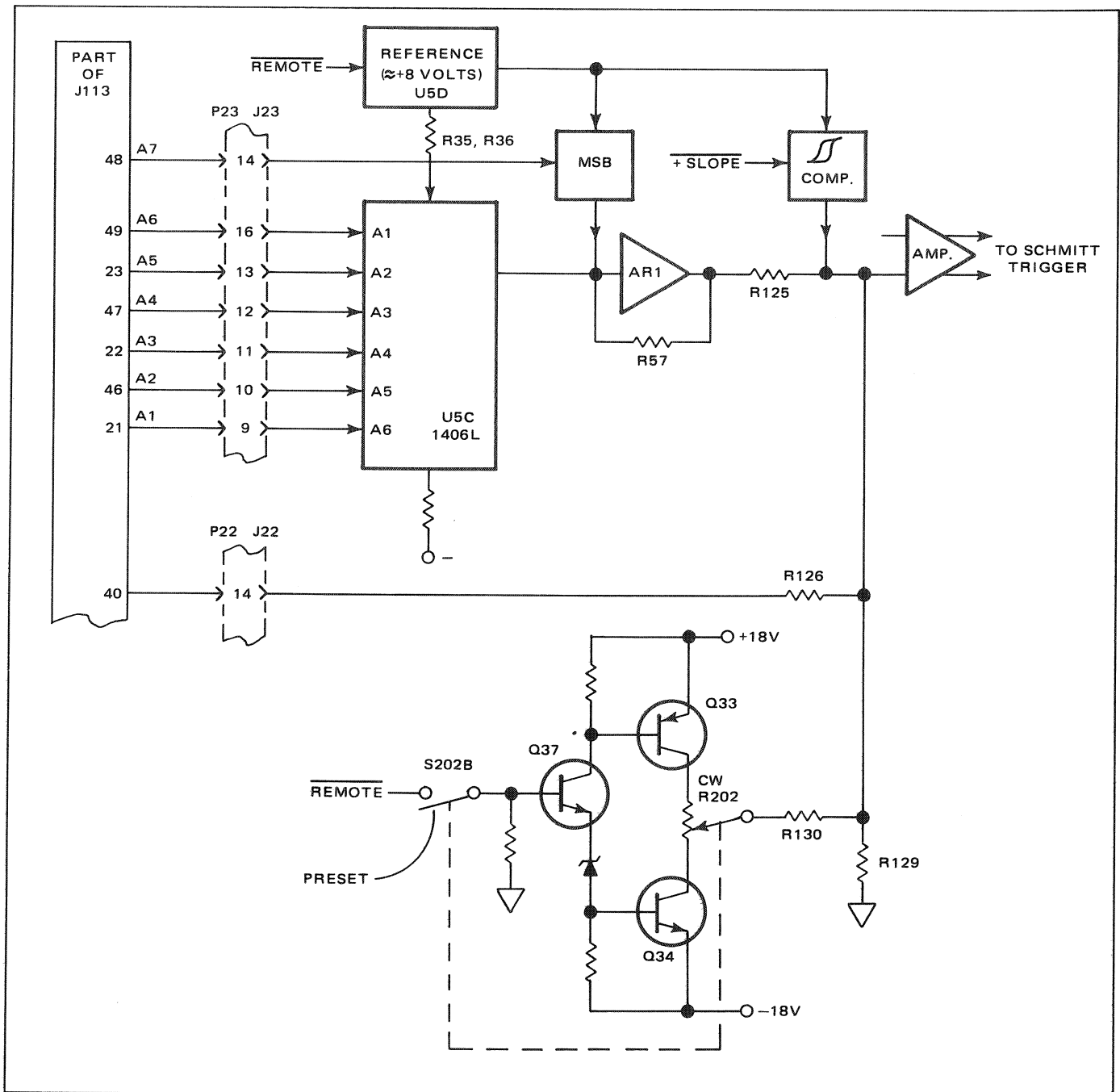


Figure 3.12 - Remote Trigger Level Control (009)

3.44 SEPARATE/Common.

3.45 This circuit, shown in figure 3.11(a) uses an AND gate driving a relay (K9). With remote not selected REMOTE is at logic 0 and the remote COM line is at logic 1. When S208 is in the (SEP) position, the output of the AND gate is at logic 1 and the relay is not energized; when S208 is in the (COM) position the output of the gate is at logic 0 and the relay is energized. In remote operation, the

REMOTE line is at logic 1 and the switch S208 is inhibited. A logic 0 on the remote COM line (J113-13) causes the relay to energize.

3.46 AC/DC.

3.47 This circuit shown in figure 3.11(b) operates in the same manner as the Separate/Common circuit (paragraph 3.44). The circuit is remotely energized by a logic 0 on J113-6.

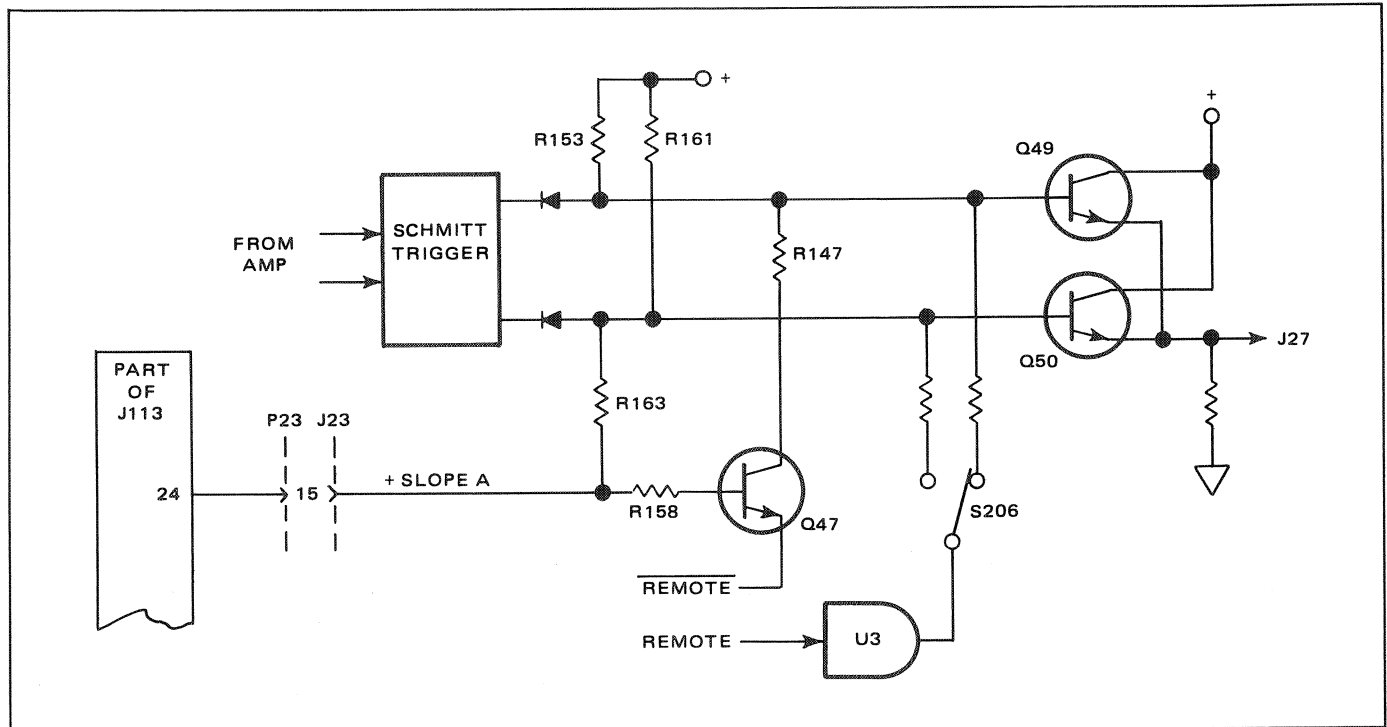


Figure 3.13 - Remote Slope Control (009)

3.48 RANGE.

3.49 The range control circuitry, figure 3.11(c), consists of two AND gates (U3D), a NAND gate and three relays. In local operation, the REMOTE line is logic 0 and S202 is capable of pulling the X10 and X100 lines down. In remote operation S202A is inhibited and selection is through the remote lines J113-31 and J113-39. The input code for selecting each of the three relays is provided in the table.

3.50 TRIGGER LEVEL CONTROL.

3.51 The circuitry shown in figure 3.12 illustrates the methods used to provide the three separate means of setting the input signal trigger level. The three methods are: Front panel control, analog input, and digital input control. All the circuitry shown is located on the 009 Signal Conditioning Module.

3.52 The front panel control circuitry basically consists of potentiometer R202 and resistor R130 working in conjunction with resistors R125 and R129 to generate a positive or negative control level. The control level is applied to the reference side of the amplifier and determines the trigger level of the Schmitt trigger. The remainder of the circuitry is used to switch the potentiometer 'in' and 'out' of the circuit. This 'pot' is in the circuit when the instrument is

in local control and R202 is not in the PRESET position. In this instance, REMOTE is at logic 1 and through Q37 and CR28, biases Q34 ON. The collector current of Q37 also biases Q33 ON. This electrically connects the CW end of R202 to the +18 volt line and the CCW end of R202 to the -18 volt line. The pot is switched out of the circuit when R202 is placed in the extreme CCW position (PRESET), causing S202B to open, or when remote is selected, causing REMOTE to be at logic 0.

3.53 The analog input operates precisely as it does in the 008 option. The input (pin 40 of J113) feeds current into the circuitry through R126 and provides $\pm 300\%$ of the trigger range. It is used with R202 in the PRESET position or in Remote Programming.

3.54 The digital trigger level control is used only in remote operation. The circuit shown in simplified form in figure 3.12 provides 128 separate, digitally-selected, trigger levels through seven control lines. The circuitry consists of a 6-bit Digital-to-Analog converter (U5C) a seventh discrete-component bit (MSB), an 8-volt reference source (U5D), an operational amplifier (AR1), and a hysteresis compensation circuit.

3.55 The Digital-to-Analog converter generates 64 discrete output current levels from 0 to -2 milliamps. The output is fed to operational amplifier AR1 where it is

converted at the output to a voltage level of zero to +6.3 volts. The voltage is fed through resistor R125 to the input of the amplifier. A full scale output results in a trigger level of +3.150 volts.

3.56 The MSB (most-significant bit) circuit consists of a positive current source that can be switched in or out of the circuit and supplies slightly more than +2 milliamps. This current is converted to a voltage by the operational amplifier and fed through R125 to the amplifier. Its output results in a trigger level of -3.200 volts. The 6 bit Digital-to-Analog integrated logic circuit and the discrete component MSB circuit operate in conjunction to produce all of the available digitally selected trigger levels. These are shown in table 2.4.

3.57 The eight volt reference source supplies a fixed stable voltage level for the MSB and hysteresis compensation circuits and also provide a required +5 milliamp reference via R35, R36 to U5C. The reference is on only in remote operation and, by this fact, inhibits all the digital trigger level select circuitry when the instrument is in local control. The reference circuit itself consists of an integrated 5-transistor matrix (U5D) with three of the transistors used

as diodes, one as an emitter follower, and one (reversed biased) as a zener diode. The output is a very stable voltage of approximately +8 volts.

3.58 The hysteresis compensation circuit provides a correcting supply of positive current to the input of the amplifier to compensate for an inherent voltage shift that occurs in the Schmitt trigger for changes in input signal polarity. This correction is necessary to enable the accurate selection of a trigger level of either + or - slope. The circuit is energized by a logic 1 signal generated by Q47, the remote + slope select transistor.

3.59 SLOPE CONTROL.

3.60 Shown in figure 3.13 is the circuitry used in the selection of the trigger slope. With remote selected, the front panel slope switch S206 is inhibited and remote + slope select transistor Q47 emitter is at logic 0. With + slope selected at J113-24 (logic 1), transistor Q47 is biased on through R158, R163, and R161, inhibiting the - slope line. With J113 at logic 0, transistor Q47 is biased off and the + slope line is biased off.

4.1 CALIBRATION.

4.2 The option 008 requires no calibration; the calibration of the 009 option is performed following the normal calibration of the 8000B Series Counter. The equipment required is listed in table 4.1 and with the exception of an optional jumper assembly is a portion of the equipment used for calibrating the Model 8000B. Calibration points are provided in figures 4.2 and 4.3.

4.3 Jumper.

4.4 The jumper assembly consists of a mating connector (Dana P/N 600047) for programming connector J113 having the required pins hard-wired together for the various calibration steps. This same operation can be performed with individual clip leads but with considerably more difficulty. The wiring of the jumper assembly is shown in figure 4.1.

4.5 Calibration Procedure.

WARNING

Removal of covers exposes potentially lethal voltages. Avoid contact with internal electrical connections while unit is connected to AC power source.

- a. Set the FUNCTION switch to REMOTE. Allow all programming lines to remain open.
- b. On the Programmable Signal Conditioner assembly, monitor R125 (channel A) and adjust potentiometer R47 for a reading of -2.88 volts DC; monitor R127 (channel B) and adjust potentiometer R50 for a reading of -2.88 volts DC. (Reference measurements to E29.)
- c. Connect jumper strings #1 and #2 as shown in figure 4.1 to pin 33 (GRD) of J113. Monitor R125 (channel A) and adjust potentiometer R35 for a reading of +2.84 volts DC; monitor R127 (channel B) and adjust potentiometer R37 for a reading of +2.84 volts.

- d. Remove jumper string #1 from J113-33 (GRD) and attach jumper string #3 to J113-33 (GRD).
- e. Connect a signal generator output to both the INPUT A of the counter and the vertical input of the oscilloscope (channel 1, 2V/cm). Connect the rear panel MARKER output of the counter to the Z AXIS input of the oscilloscope.
- f. Adjust the signal generator for an output of 100 Hz, 4V P-P sinewave. With channel 2 of the oscilloscope (DC coupled, .5V/cm) monitor MD1-12 and MD2-8 on the SWITCH board assembly (reference to E1). Adjust potentiometer R113 for equal logic levels at MD1-12 and MD2-8.
- g1. (Models 8010B, 8030B.) Monitor ME0-6 and MC1-8 on the Switch board and adjust potentiometer R114 for equal logic levels.
- g2. (Models 8015B, 8035B.) Monitor ME1-1 and ME1-2 on the Switch board and adjust potentiometer R114 for equal logic levels.
- h. Decrease the output level of the signal generator to 1 volt P-P and set the oscilloscope channel 1 gain to 20 mV/cm. Adjust potentiometer R102 so that marker initiation is within 10 mV of zero; adjust potentiometer R103 so that marker termination is within 10 mV of zero.

Table 4.1 - Required Calibration Equipment

Instrument Type	Required Specification	Recommended Equipment
Oscilloscope	100 Hz BW, 20 mV/cm	TEK 454
Voltmeter	10V, 4 digit accuracy	Dana 4300
Sinewave Generator	100 Hz @ 4V P.P.	Dana 7010
Jumper Assembly - see figure 4.1		

4.6 MAINTENANCE.

4.7 The fan on the rear panel assembly, Dana P/N 406732, used with the 009 option requires oil periodically. The location of the oil pad is indicated in figure 4.4.

4.8 Use premium grade SAE20 or 30 oil at 2 to 6 month intervals, depending on frequency of use.

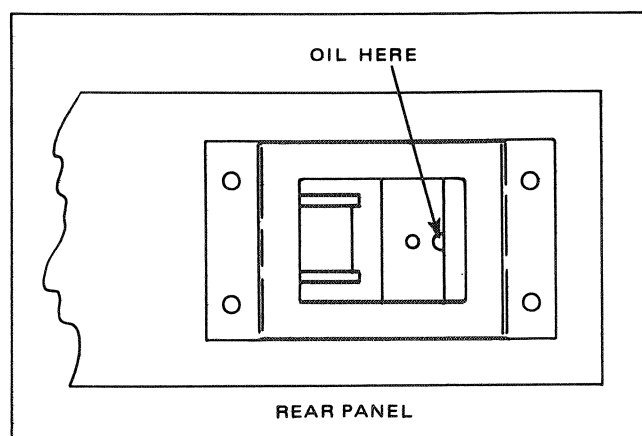


Figure 4.4 - Oil Pad Location

Figure	Title	Page
<u>Option 009</u>		
5.1	Assembly, Full Systems Interface (406737)	5-2
5.2	Layout, Rear Panel (406732)	5-4
5.3	Layout, Interconnect (406128)	5-6
5.4	Assembly, Programmable Signal Conditioner Module (406738)	5-7
5.5	Layout, Programmable Signal Conditioner (406741)	5-8
5.6	Schematic, Programmable Signal Conditioner	5-9
5.7	Assembly, Remote Programming Cable (600762)	5-10
5.8	Assembly, Interface Harness (406756)	5-11
5.9	Assembly, Remote and Recorder Harness (406733)	5-12
<u>Option 008</u>		
5.10	Layout, Systems Interface (406664)	5-14
5.11	Assembly, Remote & Recorder Harness (406563)	5-15

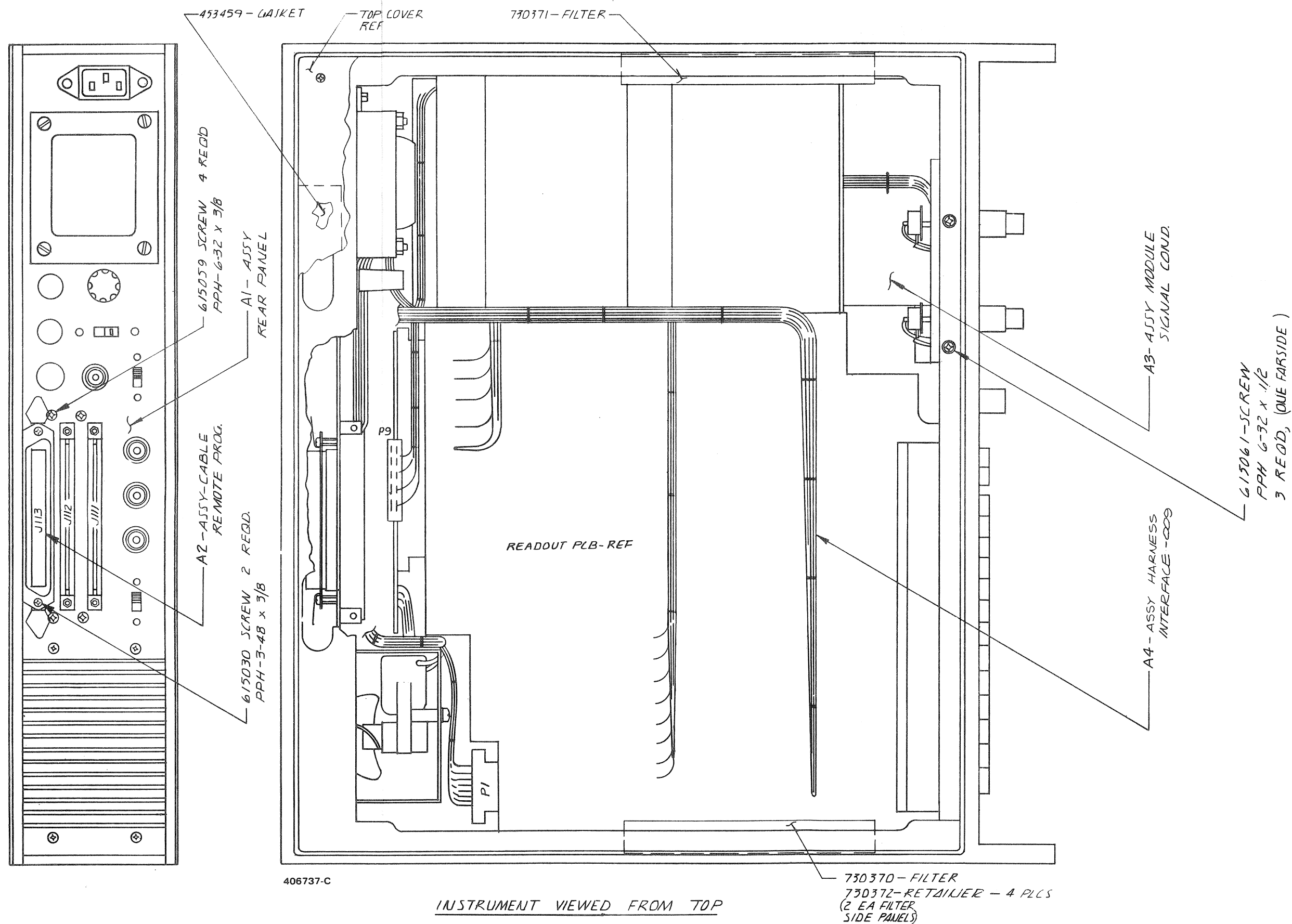


Figure 5.1 - Assembly, Full Systems Interface (406737)

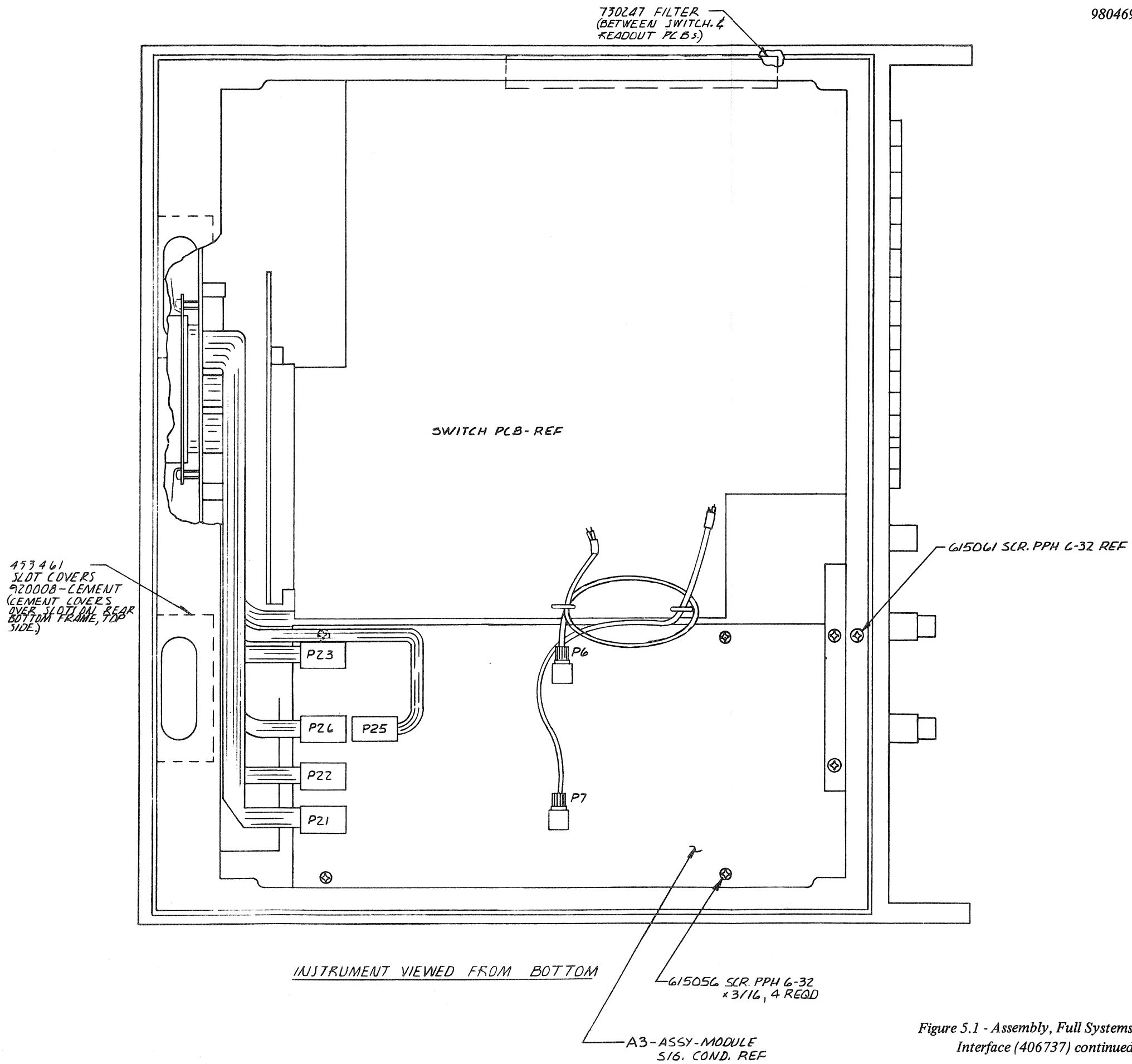
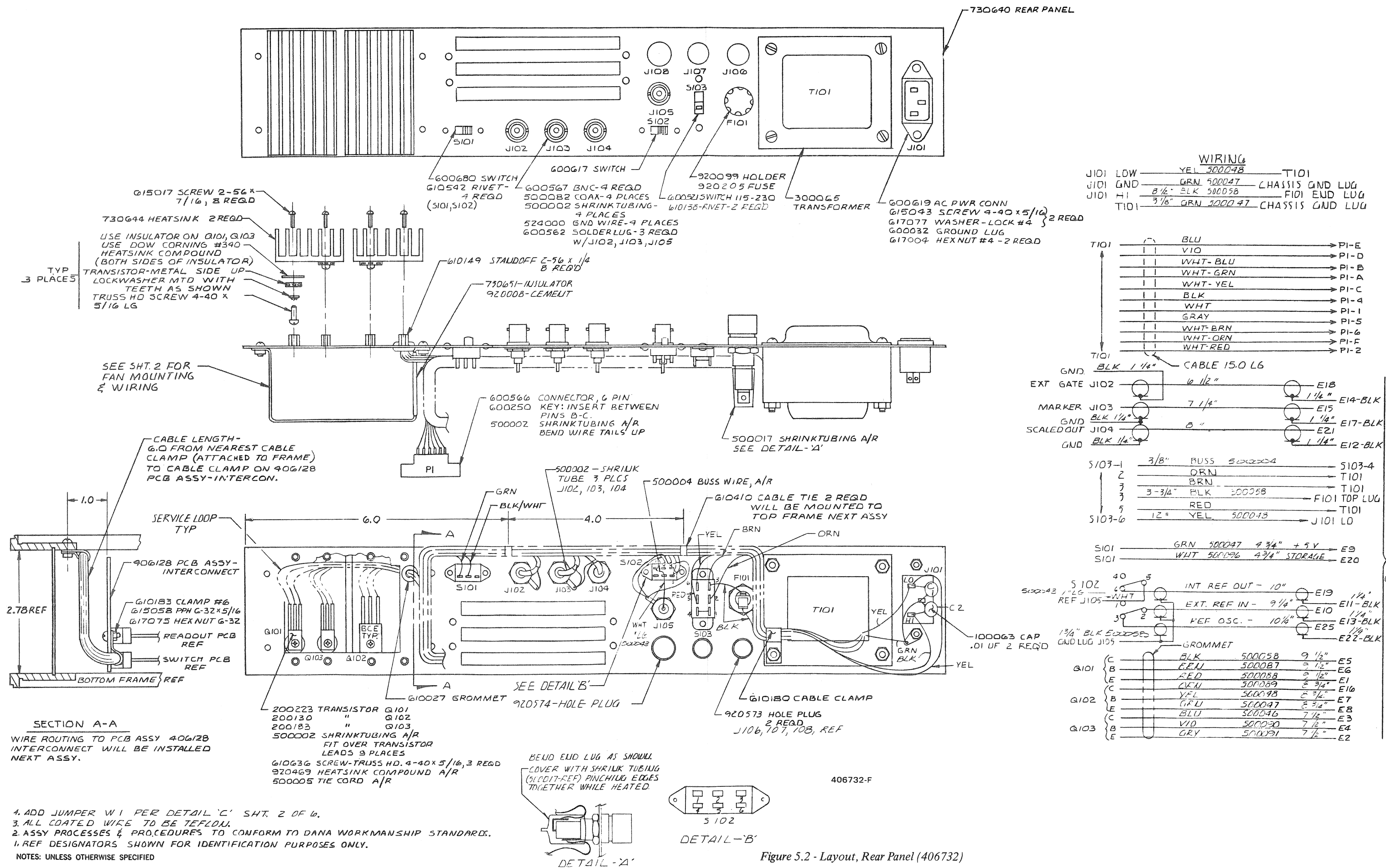
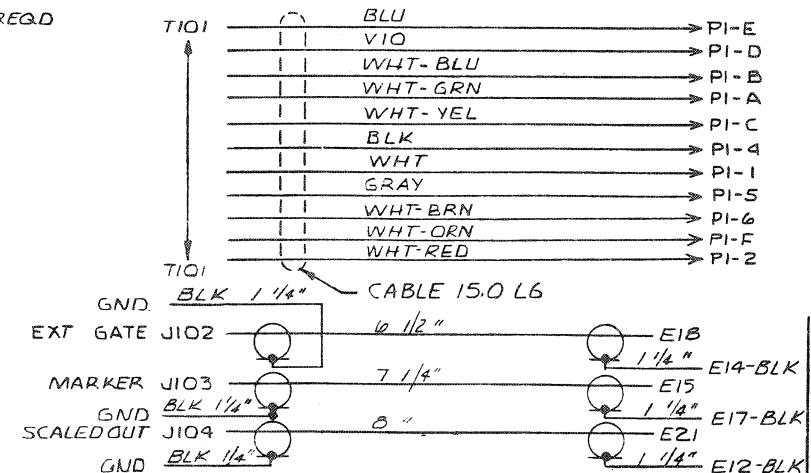


Figure 5.1 - Assembly, Full Systems Interface (406737) continued



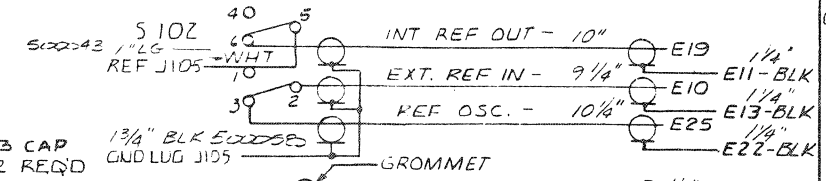
WIRING

J101 LOW	YEL 500048	T101
J101 GND	GRN 500047	CHASSIS GND LUG
J101 HI	8 1/2" BLK 500058	F101 END LUG
T101	3 1/8" GRN 500047	CHASSIS GND LUG



S103-1	3/8" BRN 500024	S103-4
2	ORN	T101
3	BRN	T101
3	3-3/4" BLK 500058	F101 TOP LUG
5	RED	T101
S103-6	12" YEL 500018	J101 LO

S101	GRN 500047	4 3/4" + 5V	E9
S101	WHT 500096	4 3/4" STORAGE	E20

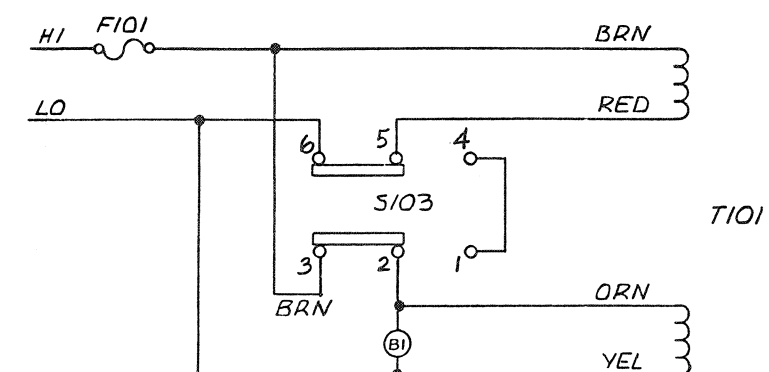
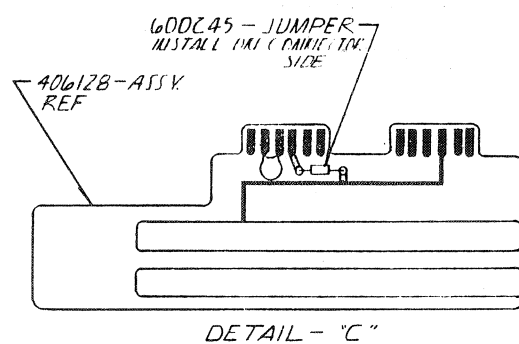


Q101	C	BLK 500058	9 1/2"	E5
	B	RED 500087	9 1/2"	E6
	E	RED 500058	9 1/2"	E1
Q102	C	GRN 500069	8 3/4"	E10
	B	YEL 500048	8 3/4"	E7
	E	GRN 500047	8 3/4"	E8
Q103	C	BLU 500046	7 1/2"	E3
	B	VIO 500030	7 1/2"	E4
	E	GRY 500091	7 1/2"	E2

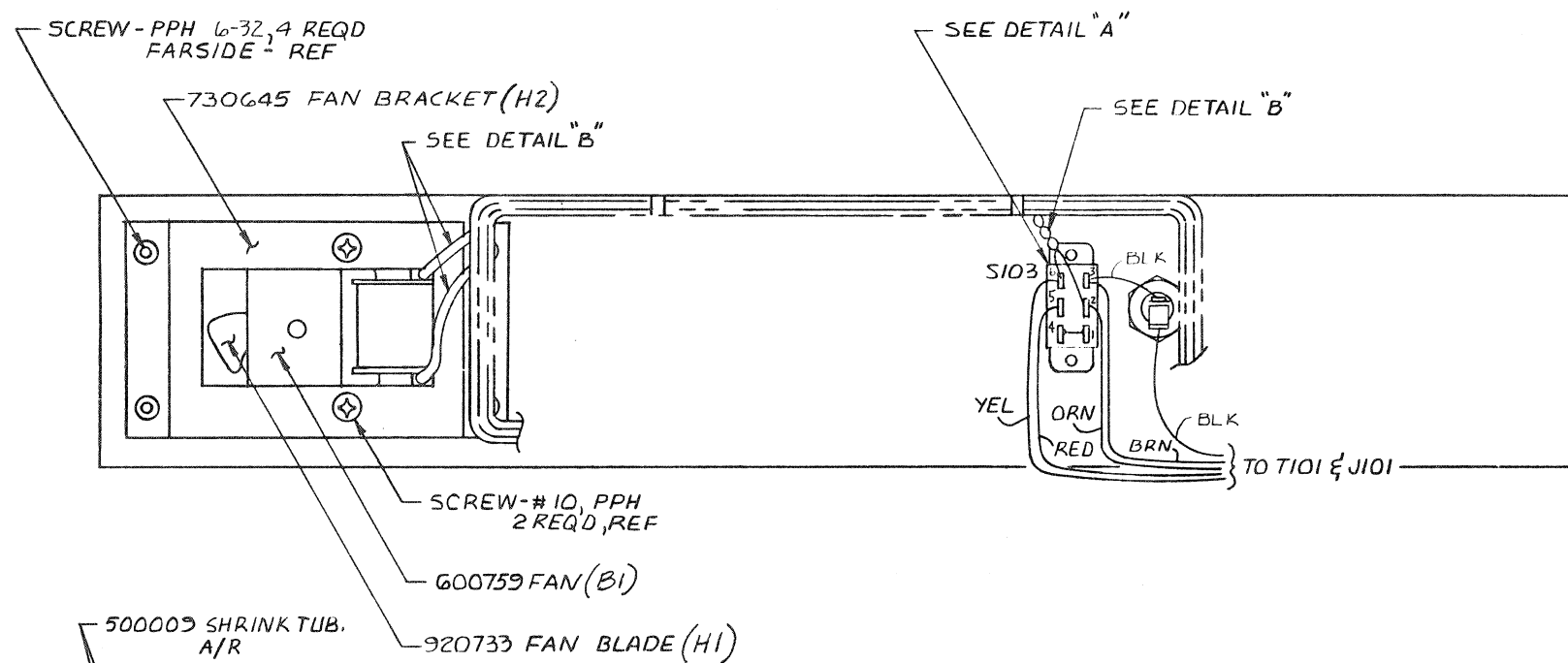
SECTION A-A
 WIRE ROUTING TO PCB ASSY 406128
 INTERCONNECT WILL BE INSTALLED
 NEXT ASSY.

1. REF DESIGNATORS SHOWN FOR IDENTIFICATION PURPOSES ONLY.
 2. ASSY PROCESSES & PROCEDURES TO CONFORM TO DANA WORKMANSHIP STANDARDS.
 3. ALL COATED WIRE TO BE TEFLON.
 4. ADD JUMPER W1 PER DETAIL 'C' SHT. 2 OF 6.
- NOTES: UNLESS OTHERWISE SPECIFIED

Figure 5.2 - Layout, Rear Panel (406732)

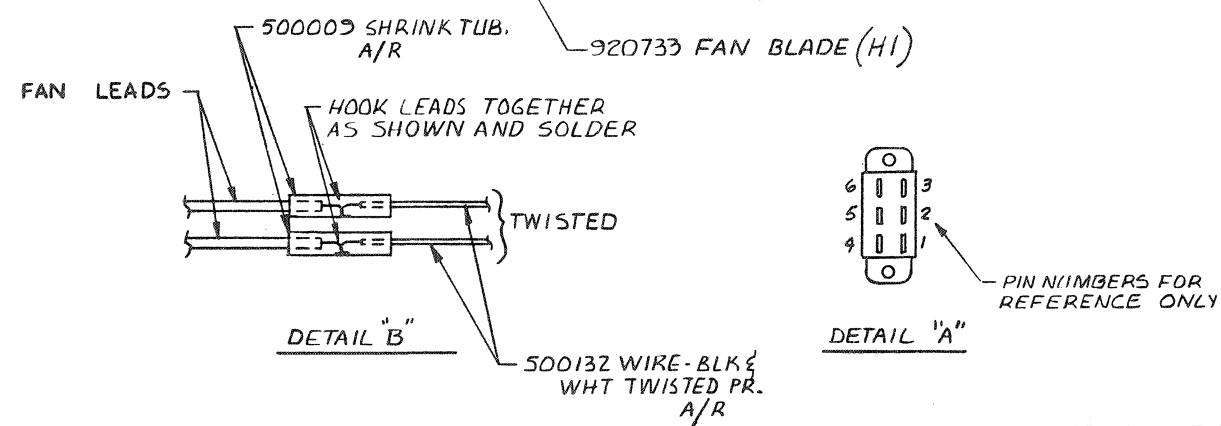


WIRING DIAGRAM FOR FAN & P5



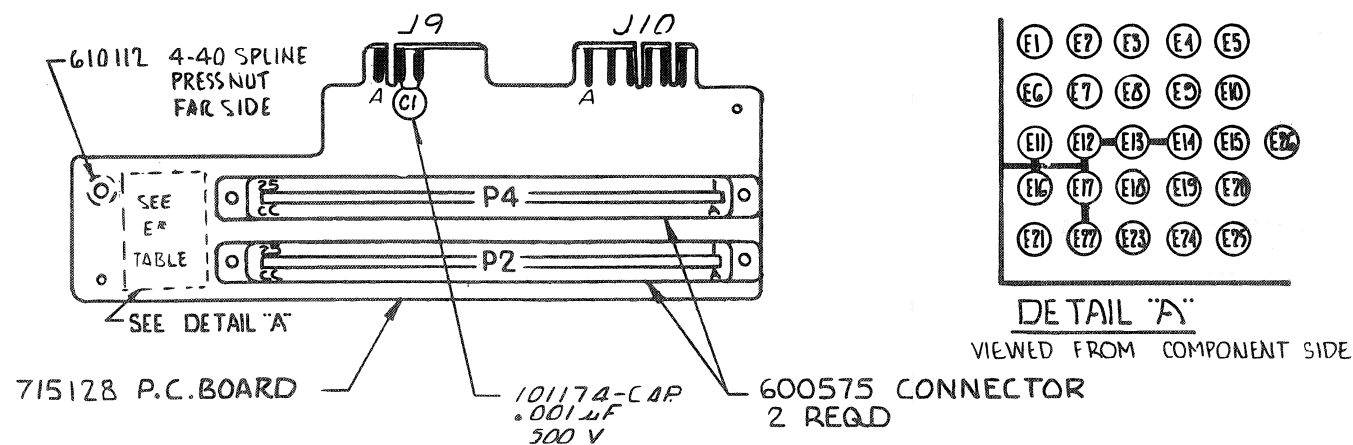
FAN LEAD SOLDERED TO TWISTED BLK & WHT WIRE

WIRING LIST			
FAN	BLK	4.5"	S103-6
FAN	WHT	4.5"	S103-2
500132 TWISTED PR.			



FAN MOUNTING DETAIL

Figure 5.2 - Layout, Rear Panel (406732) continued



P2 PIN ASSIGNMENTS (SWITCH)			
PIN #	E #	PIN #	E #
1		A	$\overline{P_a}$
2		B	$\overline{P_i}$
3		C	A/B
4	E18	D	$\overline{T_o}$
5		E	$\overline{T_{iA}}$
6		F	$\overline{T_i}$
7		H	Dic
8		J	Dio
9		K	Dia
10		L	Dib
11		M	$f_a/10$
12		N	UPDATE
13		P	$\overline{T_2}$ CLEAR
14		R	REMOTE HOLD
15		S	PRINT
16		T	ARM
17		U	REMOTE RESET
18		V	$\overline{F_z}$
19		W	-18VDC
20		X	+5VDC E9
21		Y	GND. E11-E14, E16, E17
22		Z	MARKER OUT E15
23		AA	REF OUT E19
24		BB	E20
25	E10	CC	f/n (SCALED OUT) E21

P4 PIN ASSIGNMENTS (READOUT)			
PIN #	E #	PIN #	E #
1		A	TCXO (REF OSC)
2		B	REMOTE
3		C	$\overline{T_k}$
4		D	GATE
5		E	$\overline{F_a}$
6		F	$10^3 + 100S$
7		H	$10^8 + 10S$
8		J	$10^7 + 1S$
9		K	$10^6 + 100mS$
10		L	$10^5 + 10mS$
11		M	$10^4 + 1mS$
12		N	$10^3 + 100uS$
13		P	$10^2 + 10uS$
14		R	$10 + 1uS$
15		S	T
16		T	REMOTE HOLD
17		U	PRINT
18		V	REMOTE RESET
19		W	+18V
20	E9	X	+28V
21	E11-E14, E16, E17	Y	Q102 E11-E14, E16, E17
22	E1	Z	Q101 E5
23	E2	AA	Q101 E6
24	E3	BB	Q102 E7
25	E4	CC	Q102 E8

E # ASSIGNMENTS TO REAR PNL.	
E #	FUNCTION
E1	Q101 EMITTER
E2	Q103 EMITTER
E3	Q103 COLLECTOR
E4	Q103 BASE
E5	Q101 COLLECTOR
E6	Q101 BASE
E7	Q102 BASE
E8	Q102 EMITTER
E9	+5
E10	EXT REF IN
E11	GND SHD FROM COAX AT E19
E12	GND SHD FROM COAX AT E10
E13	GND SHD FROM COAX AT E10
E14	GND SHD FROM COAX AT E18
E15	MARKER
E16	Q102 COLLECTOR
E17	GND SHD FROM COAX AT E15
E18	GATE
E19	REF OUT
E20	STORAGE
E21	SCALED OUT
E22	GND SHD FROM COAX AT E2F
E23	CHAN A REMOTE LEVEL
E24	+28VDC
E25	REF. OSC.
E26	CHAN B REMOTE LEVEL

J10 PIN ASSIGNMENTS	
PIN #	(R-F BOARD)
A11	
B12	$\overline{F_c}$
C13	
D14	+5V
E15	-18V
F16	+18V

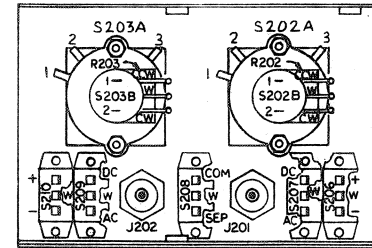
J9 PIN ASSIGNMENTS	
PIN #	(SIGNAL COND)
A11	REMOTE LEVEL 'A'
B12	REMOTE LEVEL 'B'
C13	GND
D14	REMOTE
E15	-18V
F16	+18V

406128-F

Figure 5.3 - Layout, Interconnect (406128)

Signal Conditioning Module Wire List

TO	FROM	WIRE COLOR
S202A-1	E-21	BRN
S202A-2	E-15	GRN
R202-CCW	E-4	YEL
R202-W	E-1	BRN
R202-CW	E-5	GRN
S203A-1	E-20	BLK
S203A-2	E-19	WHT
R203-CCW	E-11	BRN
R203-W	E-7	VIO
R203-CW	E-10	BLK
S202B-1	E-6	BLU
S203B-1	E-12	RED
S202B-2	S203B-2	WHT
S203B-2	E-22	WHT/RED
S206 +	E-2	RED
S206 -	E-3	ORG
S207-W	E-14	YEL
S208-W	E-18	GRY
S209-W	E-13	ORG
S210 +	E-8	GRY
S210 -	E-9	WHT
S206-W	S210-W	BLU
S210-W	E-16	BLU
S207-DC	S202A-3	WHT/BLK
S202A-3	S207-COM	WHT/BLK
S208-COM	S203A-3	WHT/BLK
S203A-3	S209-DC	WHT/BLK
S209-DC	E-17	WHT/BLK
J201	E-23	WHT
J202	E-24	WHT
E-29	P9-3	BLK
E-30	P9-0	GRN
E-31	P9-5	BLU
E-32	P9-6	RED



REFERENCE VIEW FOR WIRING POINT IDENTIFICATION

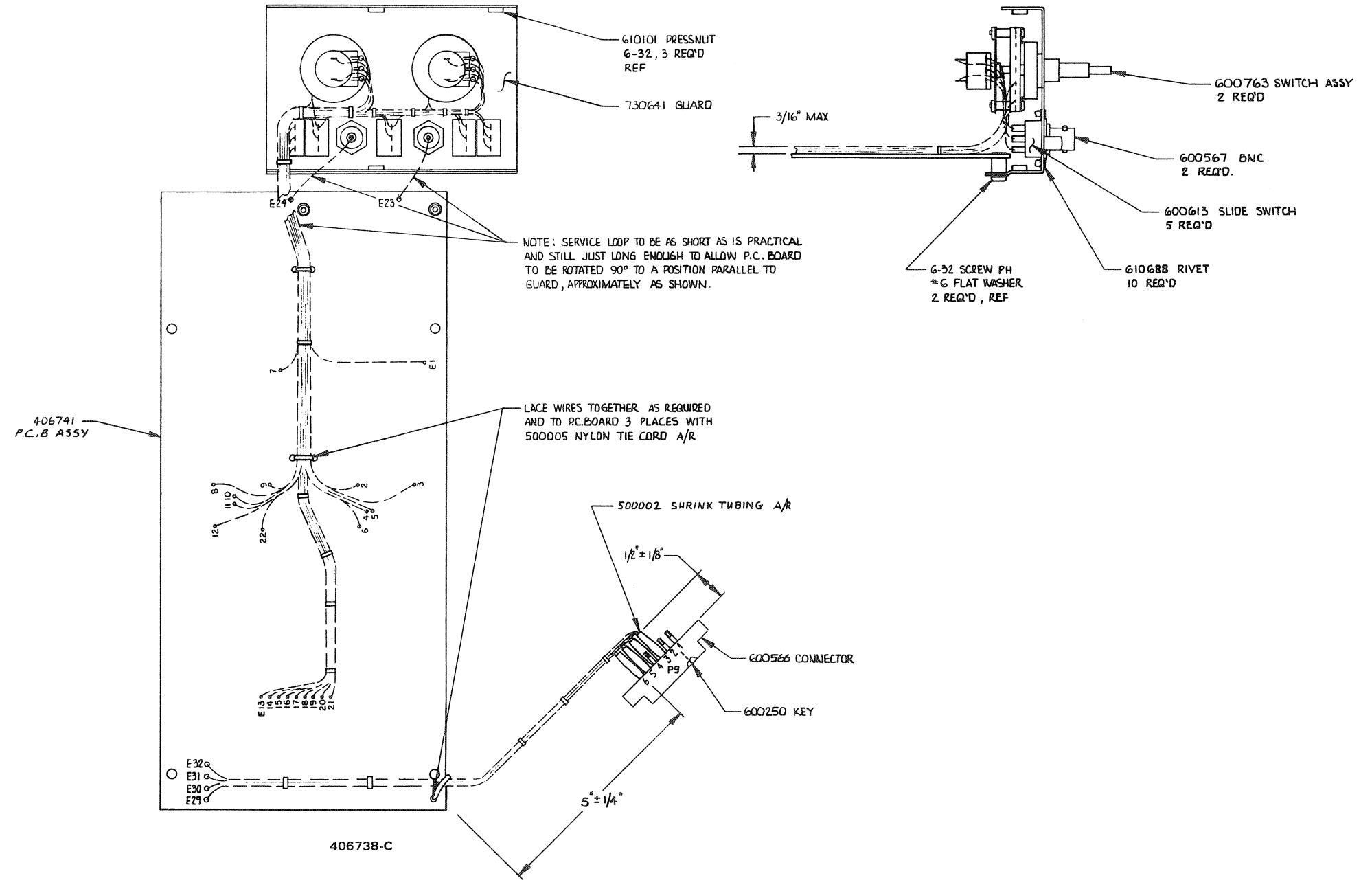
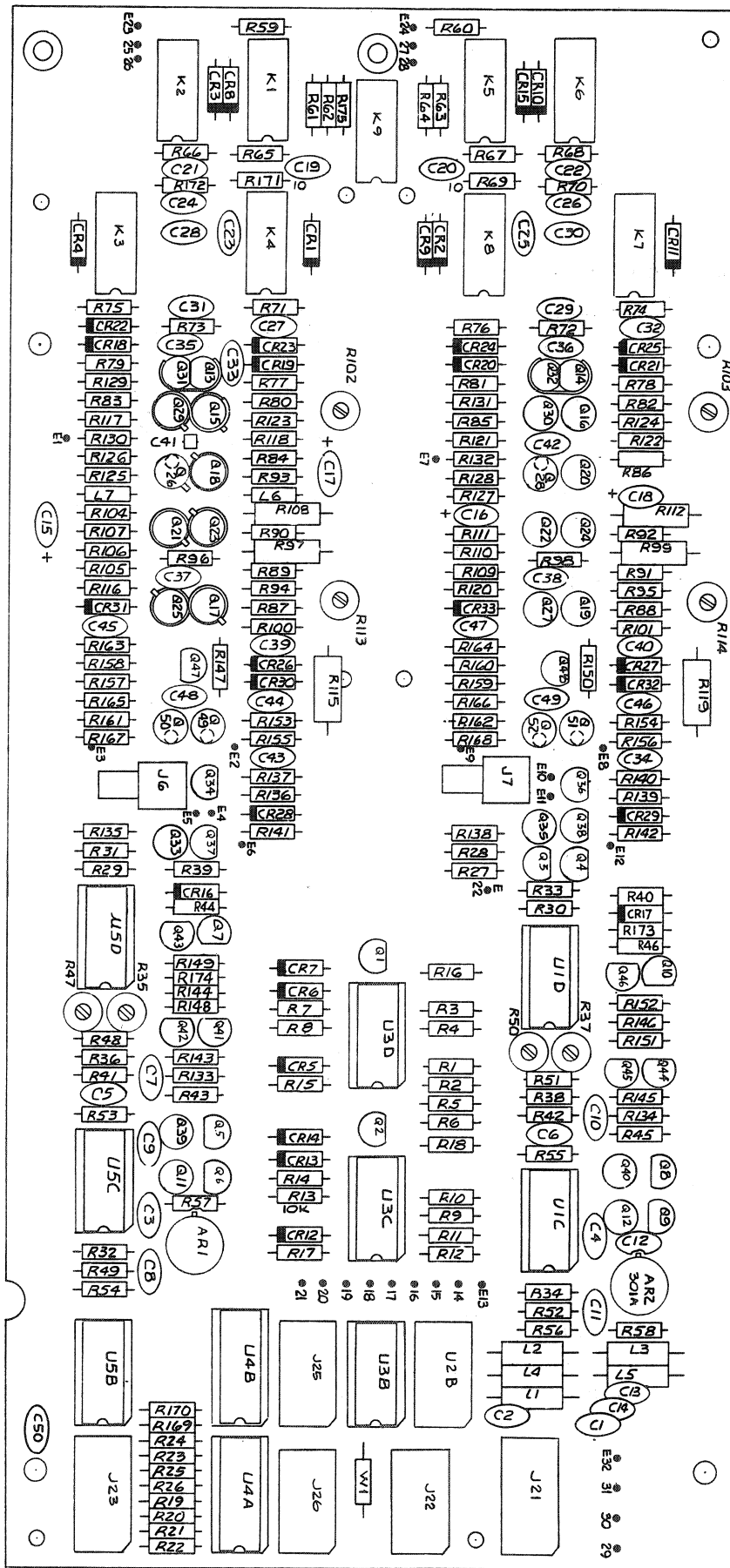
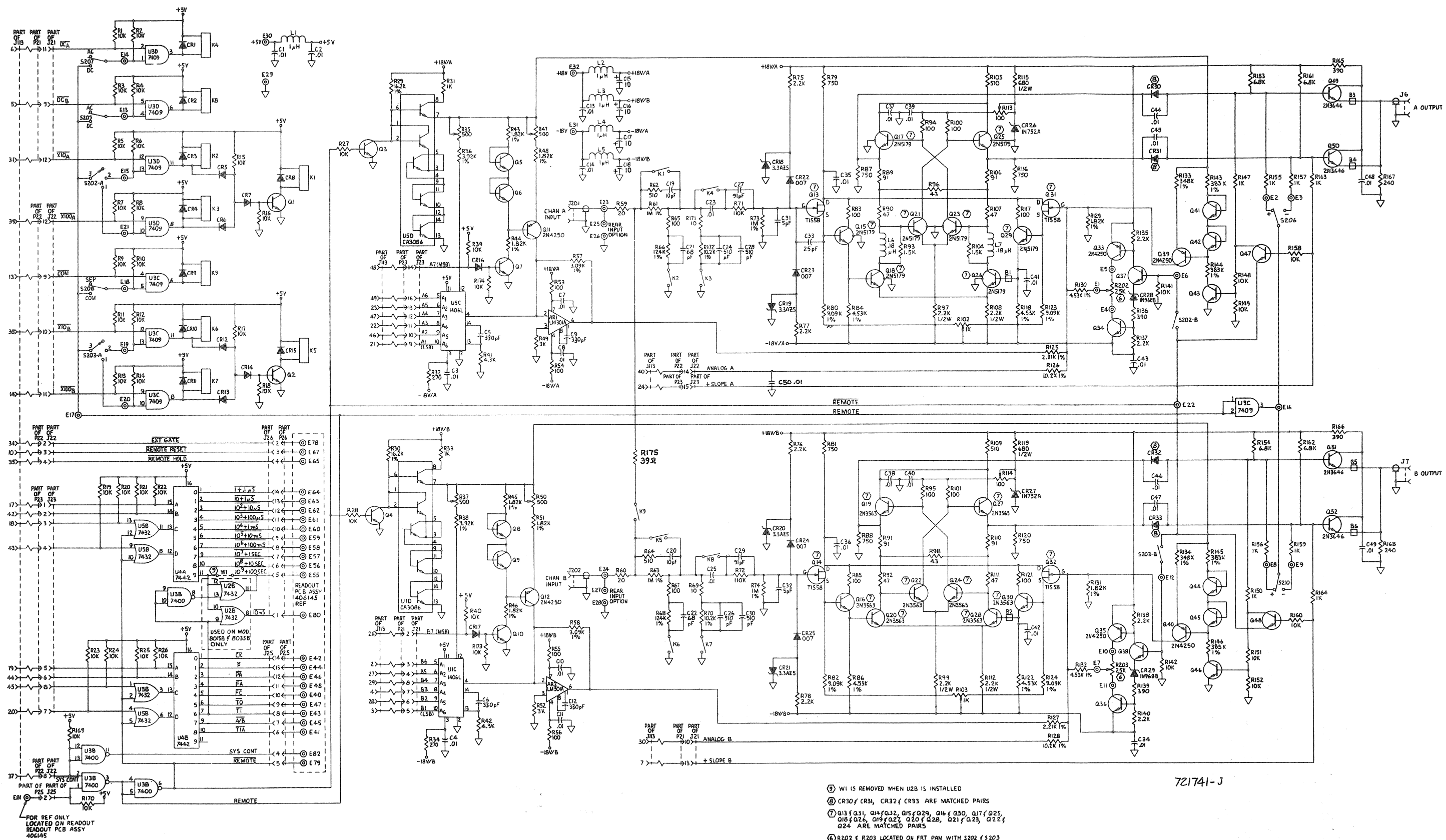


Figure 5.4 - Assembly, Programmable Signal Conditioner Module (406738)



406741-K

Figure 5.5 - Layout, Programmable Signal Conditioner (406741)

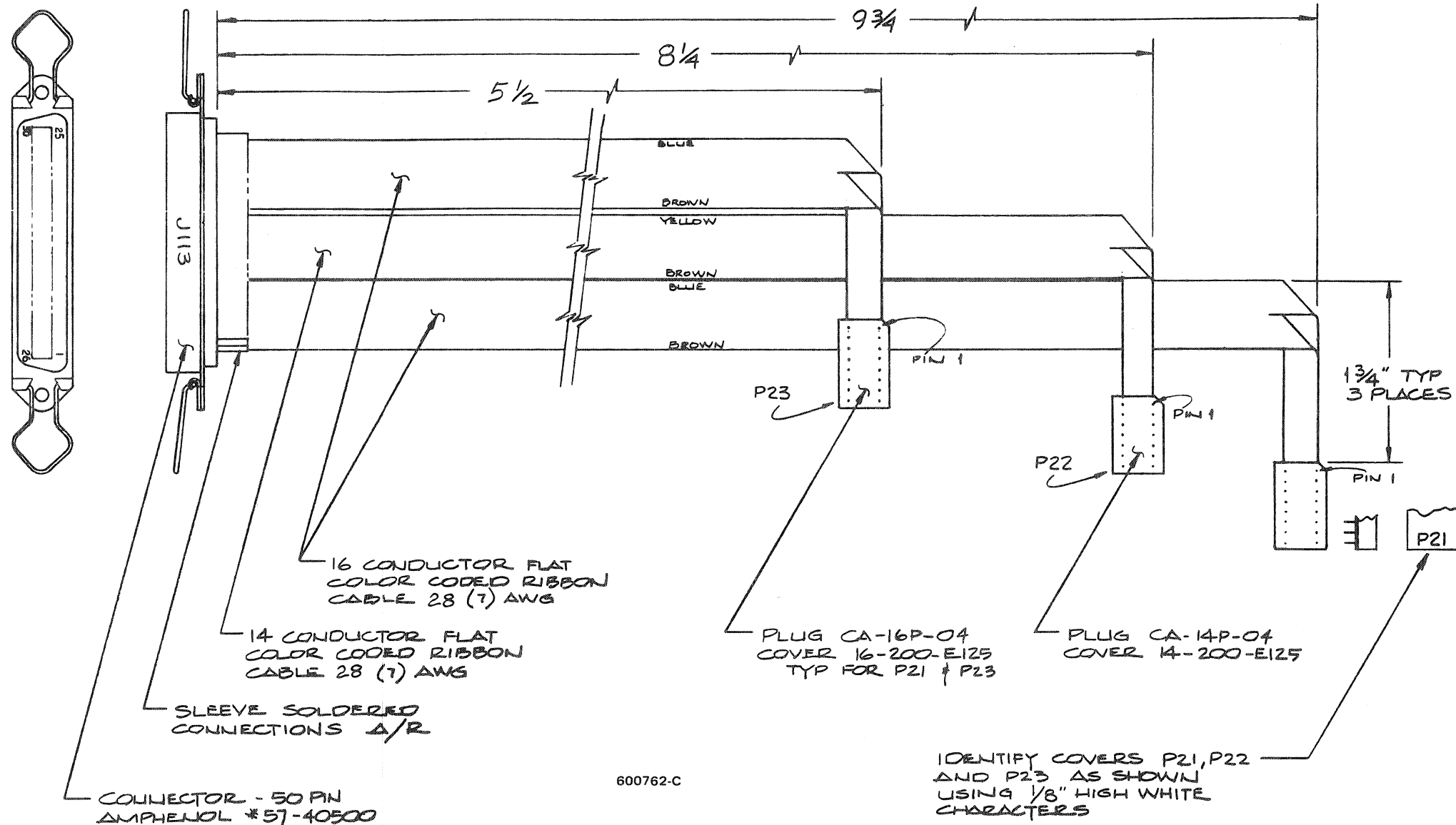


- ① W1 IS REMOVED WHEN U2B IS INSTALLED
 - ② CR30/CR31, CR32/CR33 ARE MATCHED PAIRS
 - ③ Q13/Q31, Q14/Q32, Q15/Q29, Q16/Q30, Q17/Q25, Q18/Q26, Q19/Q27, Q20/Q28, Q21/Q23, Q22/Q24 ARE MATCHED PAIRS
 - ④ R202 & R203 LOCATED ON FR1 PAN WITH S202/S203
 - 5. RELAYS ARE 310123
 - 4. TRANSISTORS ARE 200200
 - 3. DIODES ARE 018
 - 2. CAPACITORS ARE IN MFD
 - 1. RESISTORS ARE IN OHMS ±5%, 1/4 W.
- NOTE: UNLESS OTHERWISE SPECIFIED

721741-J

Figure 5.6 - Schematic, Programmable Signal Conditioner

WIRE LIST		
FROM	TO	WIRE COLOR
J21-1	J113-1	BRN
2	26	RED
3	2	ORG
4	27	YEL
5	3	GRN
6	28	BLU
7	4	VIO
8	29	GRY
9	5	WHT
10	30	BLK
11	6	BRN
12	31	RED
13	7	ORG
14	32	YEL
15	8	GRN
J21-16	J113-33	BLU
J22-1	J113-9	BRN
2	34	RED
3	10	ORG
4	35	YEL
5	11	GRN
6	36	BLU
7	12	VIO
8	37	GRY
9	13	WHT
10	38	BLK
11	14	BRN
12	39	RED
13	15	ORG
J22-14	J113-40	YEL
J23-1	J113-17	BRN
2	42	RED
3	18	ORG
4	43	YEL
5	19	GRN
6	44	BLU
7	20	VIO
8	45	GRY
9	21	WHT
10	46	BLK
11	22	BRN
12	47	RED
13	23	ORG
14	48	YEL
15	24	GRN
J23-16	J113-49	BLU



TOLERANCE NOTE:
FRACTION - ± 1/4

Figure 5.7 - Assembly, Remote Programming Cable (600762)

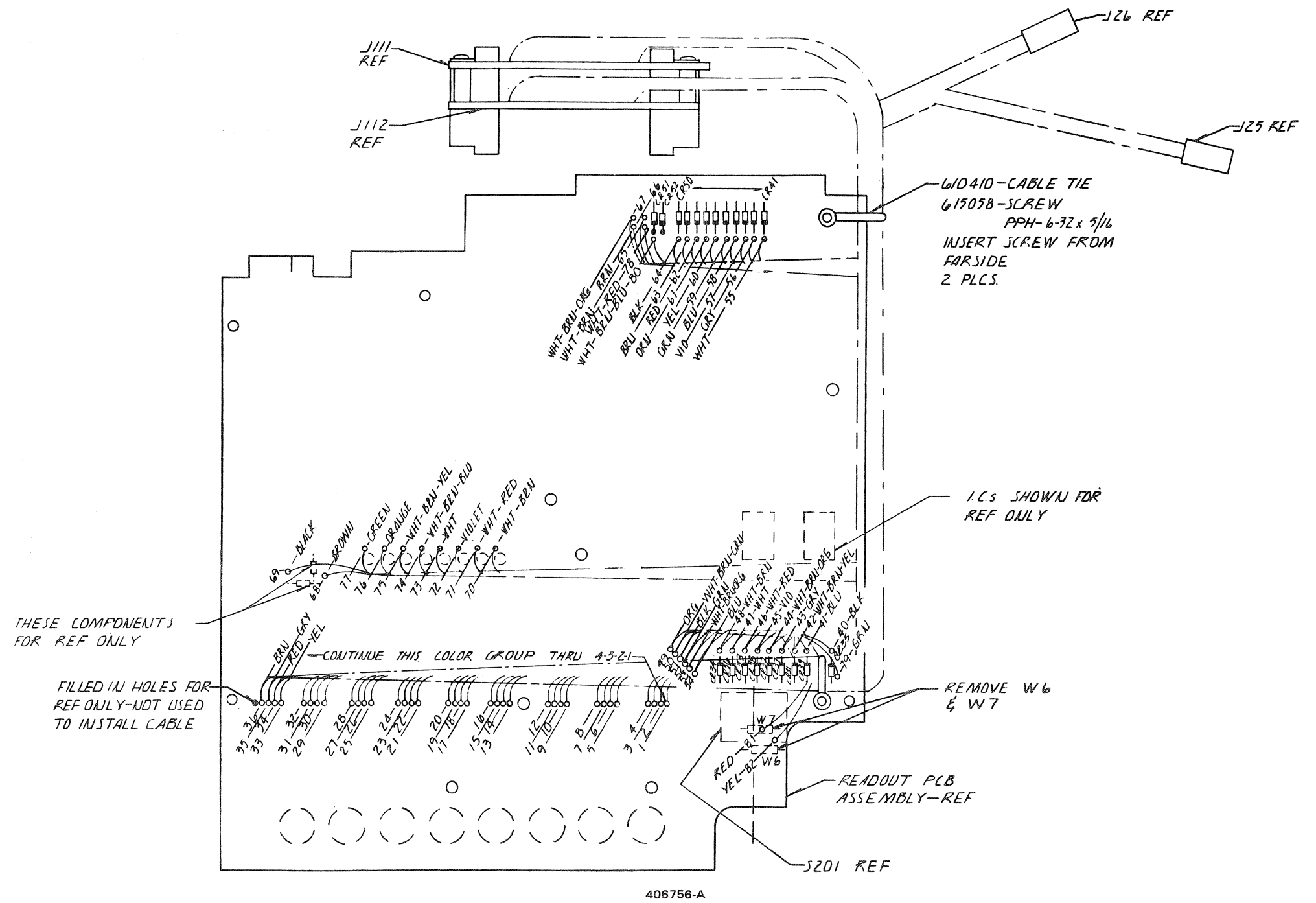
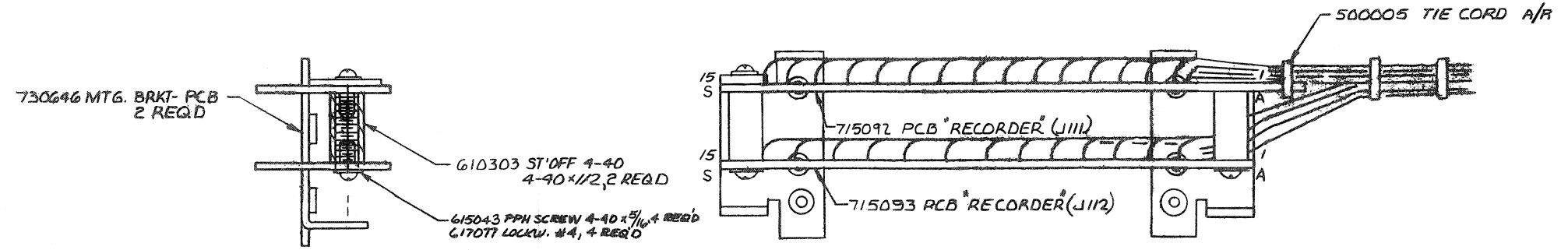


Figure 5.8 - Assembly, Interface Harness (406756)



WIRING
ALL WIRES 24 GA, COATED

406738 ASSY- SIG. COND. MODULE	COLOR	FUNCTION	
P25 - 10	0	EC	E40
6	6	TTA	E41
14	9-1-4	CR	E42
8	8	FT	E43
13	9-1-3	PT	E44
7	7	ATB	E45
12	9-2	PA	E46
9	9	TO	E47
11	9-1	EA	E48
5	5	EDMOT	E79
2	2		E81
P25 4	4	SYSTEM CONTROL	E82
P26 14	0	T	E64
13	1	10 ¹ + 1μS	E63
12	2	10 ² + 10μS	E62
11	3	10 ³ + 100μS	E61
10	4	10 ⁴ + 1μS	E60
9	5	10 ⁵ + 10μS	E59
8	6	10 ⁶ + 100μS	E58
7	7	10 ⁷ + 1μS	E57
6	8	10 ⁸ + 10μS	E56
5	9	10 ⁹ + 100μS	E55
4	9-1	REM HOLD	E65
3	9-1-3	REM RESET	E67
2	9-2	EXT GATE	E78
P26 1	9-1-6	T	E80

READOUT PCB 715145

PCB 715092 RECORDER	COLOR	FUNCTION	
J111 - A	4	V1-4	E1
B	8	V1-8	E3
C	4	V2-4	E5
D	8	V2-8	E7
E	4	V3-4	E9
F	8	V3-8	E11
H	4	V4-4	E13
J	8	V4-8	E15
K	4	V5-4	E17
L	8	V5-8	E19
M	4	V6-4	E21
N	8	V6-8	E23
P	4	V7-4	E25
R	8	V7-8	E27
S	4	V8-4	E29
1	1	V1-1	E4
2	2	V1-2	E8
3	1	V2-1	E8
4	2	V2-2	E6
5	1	V3-1	E6
6	2	V3-2	E12
7	1	V4-1	E10
8	2	V4-2	E16
9	1	V5-1	E14
10	2	V5-2	E20
11	1	V6-1	E18
12	2	V6-2	E24
13	1	V7-1	E22
14	2	V7-2	E28
J111 - 15	1	V8-1	E26

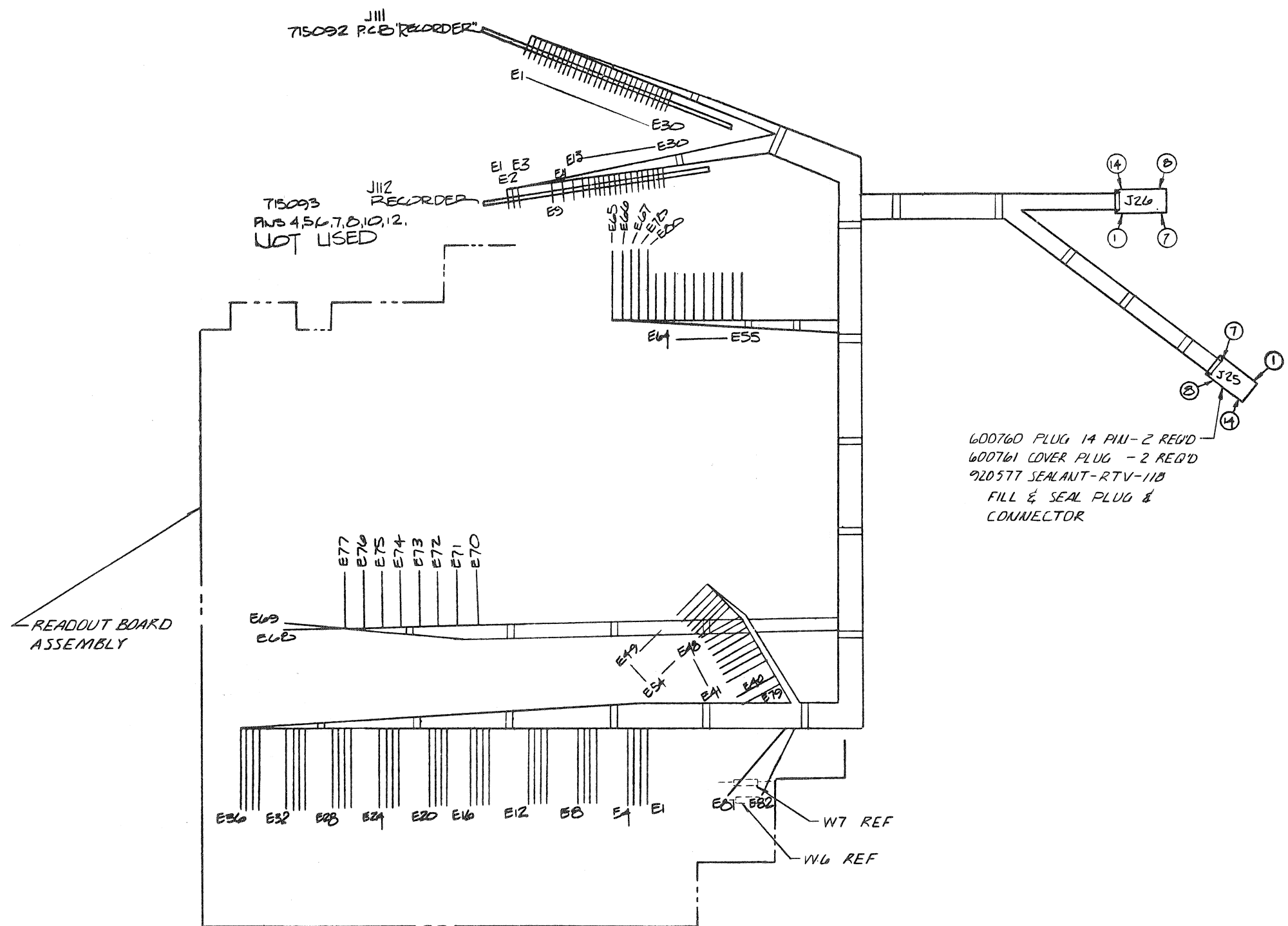
READOUT PCB 715145

PCB 715093 RECORDER	COLOR	FUNCTION	
J112 - A	8	V8-8	E31
B	4	V9-4	E33
C	8	V9-8	E35
D	3	MHR	E49
E	9-1-3	KHR	E53
F	0	SEC	E51
H	5	N SEC	E52
J	9-1-5	M SEC	E50
K	6	M SEC	E54
L			
M			
N			
P			
R			
S			
1	2	PRINT	E66
2	3	V8-2	E30
3	1	V9-1	E36
4	2	V9-2	E34
5	9-2	DP1	E70
6	7	DP2	E71
7	9	DP3	E72
8	9-1-6	DP4	E73
9	9-1-4	DP5	E74
10	3	DP6	E75
11	5	DP7	E76
12	9	DP8	E77
13	N/C		
14	0	ZERO REF	E69
J112 - 15	1	ONE REF	E68

READOUT PCB 715145

3. REMOVE JUMPERS W6&W7 ON READOUT ASSEMBLY.
 2. HARNESS ROUTING DWG. IS SHEET 2 OF THIS DWG.
- ⚠ WILL BE HARD WIRED NEXT ASSEMBLY.
- NOTES: UNLESS OTHERWISE SPECIFIED

Figure 5.9 - Assembly, Remote and Recorder Harness (406733)



406733-B

Figure 5.9 - Assembly, Remote and Recorder Harness (406733) continued

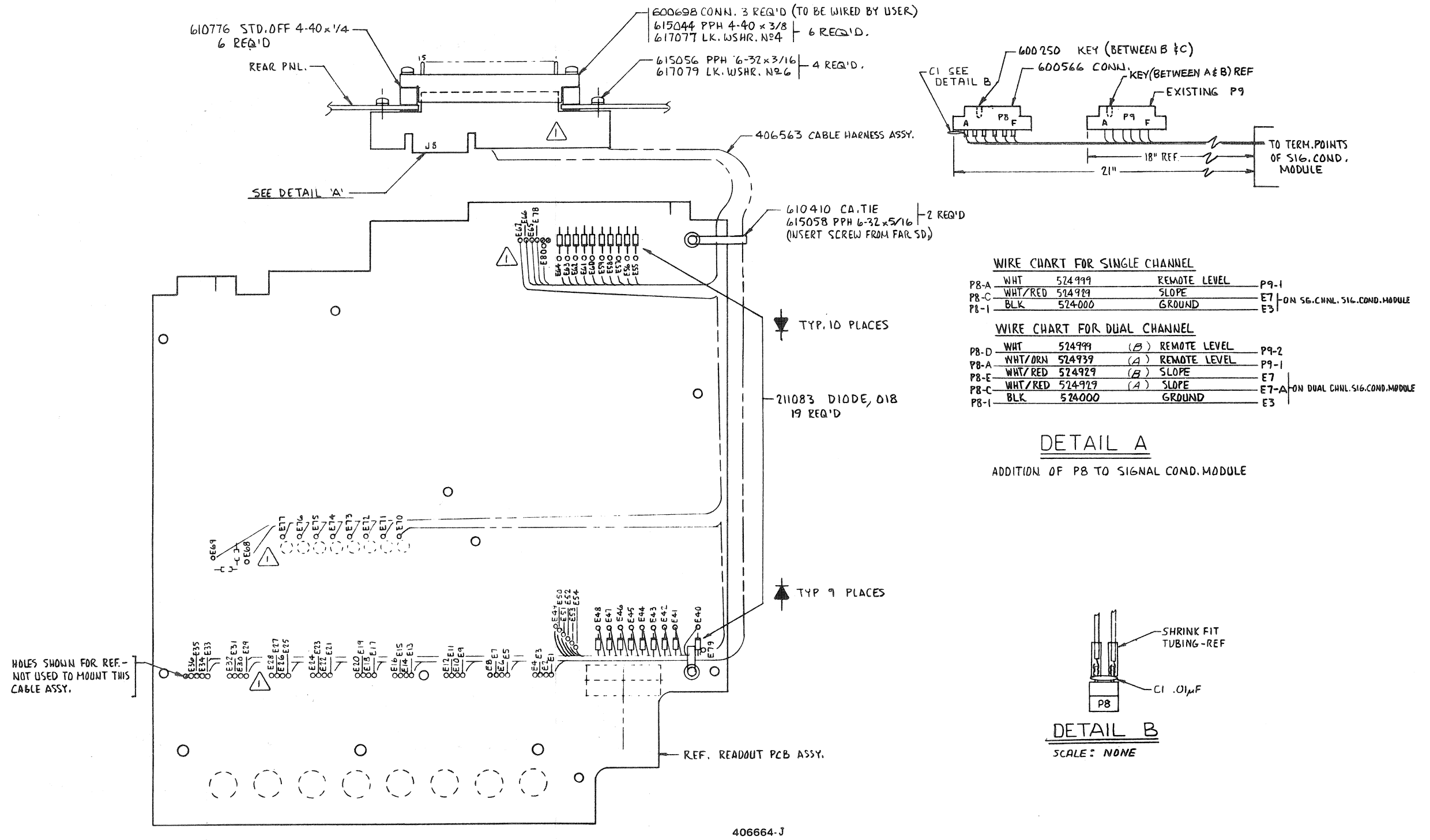
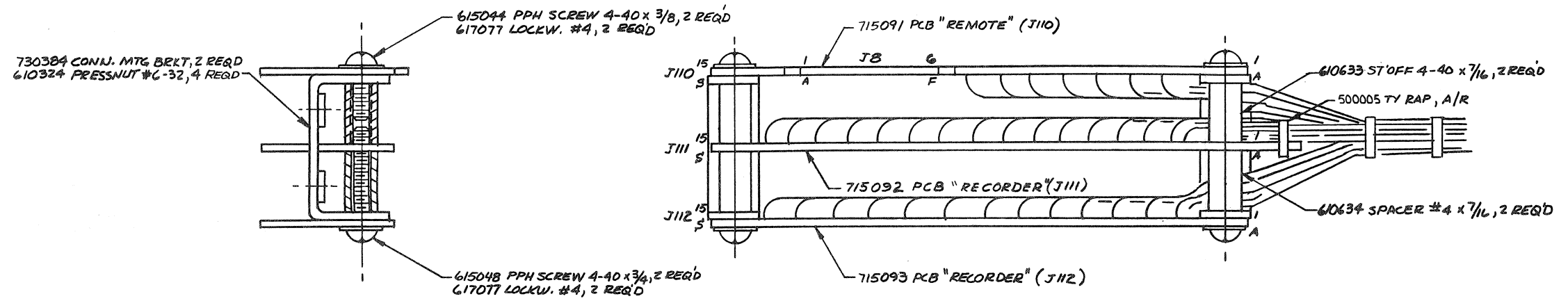


Figure 5.10 - Layout, Systems Interface (406664)



WIRING

ALL WIRES 24 GA, COATED

PCB 715091 REMOTE

		COLOR	FUNCTION	
J110 - A	E 18	9-0	EC	E40
B	E 16	9-1	77A	E41
C	E 14	9-2	CK	E42
D	E 12	9-2-3	77	E43
E	E 10	9-3-4	BT	E44
F	E 8	9-3-5	A/B	E45
H	E 6	9-3-6	PA	E46
J	E 4	9-1-7	70	E47
K	E 2	9-1-8	FA	E48
L	E 24	9-1-4	REMOTE	E79
M		J8-E		
N		J8-D		
P		J8-C		
R		J8-B		
S		J8-A		
1	E 1	0	T	E64
2	E 15	1	10 ¹ + 1μS	E63
3	E 13	2	10 ² + 10μS	E62
4	E 11	3	10 ³ + 100μS	E61
5	E 9	4	10 ⁴ + 1μS	E60
6	E 7	5	10 ⁵ + 10μS	E59
7	E 5	6	10 ⁶ + 100μS	E58
8	E 3	7	10 ⁷ + 1μS	E57
9	E 1	8	10 ⁸ + 10μS	E56
10	E 23	9-2-0	10 ⁹ + 100μS	E55
11	E 21	9-2-1	REM HOLD	E65
12	E 19	9-1-3	REM RESET	E67
13	E 17	9-2-4	EXT GATE	E78
14	E 15	9-1-6	1	E80
J110 - 15		J8-1		

READOUT PCB 715085

PCB 715092 RECORDER

		COLOR	FUNCTION	
J111 - A	E 30	4	V1-4	E 1
B	E 28	8	V1-8	E 3
C	E 26	4	V2-4	E 5
D	E 24	8	V2-8	E 7
E	E 22	4	V3-4	E 9
F	E 20	8	V3-8	E 11
H	E 18	4	V4-4	E 13
J	E 16	8	V4-8	E 15
K	E 14	4	V5-4	E 17
L	E 12	8	V5-8	E 19
M	E 10	4	V6-4	E 21
N	E 8	8	V6-8	E 23
P	E 6	4	V7-4	E 25
R	E 4	8	V7-8	E 27
S	E 2	4	V8-4	E 29
1	E 29	1	V1-1	E 4
2	E 27	2	V1-2	E 7
3	E 25	1	V2-1	E 8
4	E 23	2	V2-2	E 6
5	E 21	1	V3-1	E 10
6	E 19	2	V3-2	E 10
7	E 17	1	V4-1	E 14
8	E 15	2	V4-2	E 14
9	E 13	1	V5-1	E 20
10	E 11	2	V5-2	E 18
11	E 9	1	V6-1	E 24
12	E 7	2	V6-2	E 22
13	E 5	1	V7-1	E 28
14	E 3	2	V7-2	E 26
J111 - 15	E 1	1	V8-1	E 32

READOUT PCB 715085

PCB 715093 RECORDER

		COLOR	FUNCTION	
J112 - A	E 30	8	V8-8	E 31
B	E 28	4	V9-4	E 33
C	E 26	8	V9-8	E 35
D	E 24	9-1-1	MHE	E 49
E	E 22	9-1-2	KHE	E 53
F	E 20	9-2-3	SEC	E 51
H	E 18	9-2-4	N SEC	E 52
J	E 16	9-1-5	M SEC	E 50
K	E 14	9-2-6	M SEC	E 54
L	E 12			
M	E 10			
N	E 8	N/C		
P	E 6			
R	E 4			
S	E 2	1	PRINT	E 66
1	E 29	2	V8-2	E 30
2	E 27	1	V9-1	E 36
3	E 25	2	V9-2	E 36
4	E 23	9-1	DP1	E 70
5	E 21	9-2	DP2	E 71
6	E 19	9-2-3	DP3	E 72
7	E 17	9-3-4	DP4	E 73
8	E 15	9-3-5	DP5	E 74
9	E 13	9-3-6	DP6	E 75
10	E 11	9-1-7	DP7	E 76
11	E 9	9-1-8	DP8	E 77
12	E 7	N/C		
13	E 5	9-2-2	DATA OVERFLOW	E 83
14	E 3	0	ZERO REF	E 69
J112 - 15	E 1	1	ONE REF	E 68

READOUT PCB 715085

406563-H

Figure 5.11 - Assembly, Remote & Recorder Harness (406563)

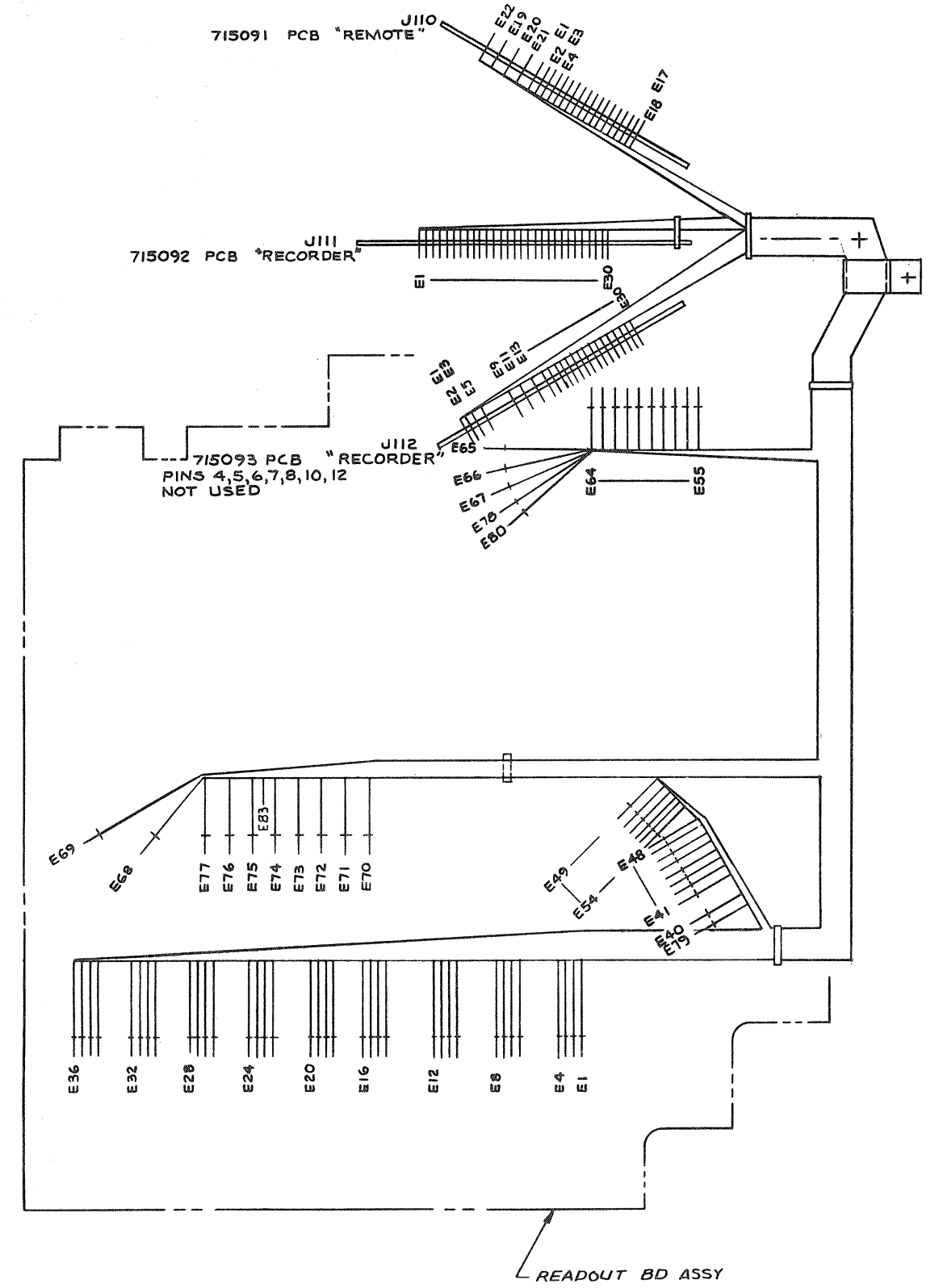


Figure 5.11 - Assembly, Remote & Recorder Harness (406563) continued

6.1 This section contains lists of replaceable parts arranged in the order of the following subassemblies:

Option 009	Page
Full Systems Interface	6-3
Rear Panel	6-4
Interconnect	6-5
Programmable Signal Conditioner Module	6-6
Programmable Signal Conditioner PCB	6-7
Interface Harness	6-16
Remote and Recorder Harness	6-17
Option 008	
Systems Interface	6-18
Remote and Recorder Harness	6-19

6.2 Manufacturers are identified by FSC numbers listed in table 6.2, "List of Suppliers". The code numbers are

from the Federal Supply Code for Manufacturers Cataloging Handbooks H4-1, H4-2, and their supplements.

6.3 Certain parts having 21793 (Dana) listed in the "FSC" column are specially-selected semiconductors. For some of these, standard commercial parts will serve as satisfactory replacements. These Dana parts are identified in table 6.1 along with the commercial equivalent.

Table 6.1

Semiconductor Type:	Equivalent:
007 Diode	Fairchild FD300
018 Diode	Fairchild 1N916B

Table 6.2 - List of Suppliers

FSC	NAME	FSC	NAME
02114	FERROXCUBE CORPORATION SAUGERTIES, NEW YORK	04713	MOTOROLA, INC. (Semiconductor Products Division) PHOENIX, ARIZONA
02660	AMPHENOL CORPORATION BROADVIEW, ILLINOIS	05397	UNION CARBIDE CORP. (Materials Systems Division) CLEVELAND, OHIO
04222	AEROVOX CORP. (Hi-Q Division) MYRTLE BEACH, SOUTH CAROLINA	05624	BARBER & COLMAN CO. ROCKFORD, ILLINOIS

Table 6.2 - List of Suppliers continued

FSC	NAME	FSC	NAME
07263	FAIRCHILD SEMICONDUCTOR MOUNTAIN VIEW, CALIFORNIA	72136	ELECTRO MOTIVE MFG. CO., INC. WILLIMANTIC, CONNECTICUT
11237	CTS KEENE, INC. PASO ROBLES, CALIFORNIA	72982	ERIE TECHNOLOGICAL PRODUCTS, INC. ERIE, PENNSYLVANIA
15636	ELECTROL, INC. SAUGUS, CALIFORNIA	73138	BECKMAN INSTRUMENTS, INC. FULLERTON, CALIFORNIA
21793	DANA LABORATORIES, INC. IRVINE, CALIFORNIA	75915	LITTELFUSE, INC. DES PLAINES, ILLINOIS
23095	AZTEC ELECTRONICS, INC. ANAHEIM, CALIFORNIA	79727	C-W INDUSTRIES WARMINSTER, PENNSYLVANIA
27014	NATIONAL SEMI-CONDUCTOR CORP. SANTA CLARA, CALIFORNIA	80131	ELECTRONICS INDUSTRIES ASSOC. WASHINGTON, D.C.
52072	CIRCUIT ASSY. CORP. COSTA MESA, CALIFORNIA	81349	MILITARY SPECIFICATION
52792	THORGREN TOOL & MOLDING CO. VALPARAISO, INDIANA	82389	SWITCHCRAFT, INC. CHICAGO, ILLINOIS
56289	SPRAGUE ELECTRIC CO. (Pacific Division) LOS ANGELES, CALIFORNIA	86884	RADIO CORP. OF AMERICA (Electronics Components Division) HARRISON, NEW JERSEY
71471	AEROVOX CORPORATION (Cinema Plant) MONCKS CORNER, SOUTH CAROLINA	98291	SEAELECTRO CORPORATION MAMARONECK, NEW YORK
71785	TRW ELECTRONIC COMPONENTS (Cinch Division) ELK GROVE VILLAGE, ILLINOIS	99800	AMERICAN PRECISION INDUSTRIES, INC. (Delevan Division) EAST AURORA, NEW YORK

406737 – Assy., FULL SYSTEMS INTERFACE

REF DES	DANA P/N	DESCRIPTION	FSC	MANU P/N
A1	406732	REAR PANEL ASSY	21793	406732
A2	406736	REMOTE PROGRAMMING CABLE ASSY	21793	406736
A3	406738	SIGNAL CONDITIONING MODULE ASSY	21793	406738
A4	406756	INTERFACE HARNESS ASSY	21793	406756

406732 -- Assy., REAR PANEL, OPTION 009

REF DES	DANA P/N	DESCRIPTION					FSC	MANU P/N
B1	600759	FAN MOTOR	TYPE AYAA	115 V		05624	Type AYAA	
C1	100063	CAP	CERAM	.01 MFD	500V	20%	56289	C023B501E103M
C2	100063	CAP	CERAM	.01 MFD	500 V	20%	56289	C023B501E103M
F101	920205	FUSE	GLASS	.75 AMP	250 V	(115V Operation)	75915	3AG3/4ASB
	920204	FUSE	SLOW	.50 AMP	250 V	(220V Operation)	75915	3AG1/2ASB
H1	920733	FAN BLADE	4 BLADES	.125 MTG HOLE			52792	
H2	730645	FAN BRACKET					21793	730645
J101	600619	CONN	RECEPTACLE		EAC-301		82389	EAC-301
J102	600567	CONN	RECEPTACLE		31-236		02660	31-236
J103	600567	CONN	RECEPTACLE		31-236		02660	31-236
J104	600567	CONN	RECEPTACLE		31-236		02660	31-236
J105	600567	CONN	RECEPTACLE		31-236		02660	31-236
P1	600566	CONN	6 PIN		251-0630160		71785	251-0630160
Q101	200223	TRANS		NPN	MJE521		04713	MJE521
Q102	200130	TRANS	SILICO	NPN	MJE3055		04713	MJE3055
Q103	200183	TRANS	SILICO	PNP	MJE371		04713	MJE371
S101	600680	SWITCH	SLIDE	SPDT	GF-124		79727	GF-124
S102	600617	SWITCH	SLIDE	DPDT	G126		79727	G126
S103	600521	SWITCH	SLIDE	DPDT	46256LFE		82389	46256LFE
T101	300065	TRANS	POWER	115 V	11824		23095	11824

406128 – Assy., PCB, INTERCONNECT

REF DES	DANA P/N	DESCRIPTION					FSC	MANU P/N
C1	101174	CAP	CERAM	.001 MFD	500 V	10%	04222	SCD-DI-2X5F-1000
P2	600575	CONN	25 PIN				71785	252-25-30-160
P4	600575	CONN	25 PIN				71785	252-25-30-160

406738 – Assy., SIGNAL CONDITIONING MODULE (009 OPTION)

REF DES	DANA P/N	DESCRIPTION				FSC	MANU P/N
J201	600567	CONN	RECEPTLE		31-236	02660	31-236
J202	600567	CONN	RECEPTLE		31-236	02660	31-236
P9	600566	CONN	6 PIN		251-0630160	71785	251-0630160
S202	600763	SWITCH			X5P6081	11237	X5P6081
S203	600763	SWITCH			X5P6081	11237	X5P6081
S206	600613	SWITCH	SLIDE	SPDT	GF-124	79727	GF-124
S207	600613	SWITCH	SLIDE	SPDT	GF-124	79727	GF-124
S208	600613	SWITCH	SLIDE	SPDT	GF-124	79727	GF-124
S209	600613	SWITCH	SLIDE	SPDT	GF-124	79727	GF-124
S210	600613	SWITCH	SLIDE	SPDT	GF-124	79727	GF-124

406741 – Assy., PCB, PROGRAMMABLE SIGNAL CONDITIONER (009 OPTION)

REF DES	DANA P/N	DESCRIPTION					FSC	MANU P/N
C1	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C2	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C3	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C4	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C5	101098	CAP	CERAM	330 PFD	500 V	10%	71471	C016B102E331K
C6	101098	CAP	CERAM	330 PFD	500 V	10%	71471	C016B102E331K
C7	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C8	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C9	101098	CAP	CERAM	330 PFD	500 V	10%	71471	C016B102E331K
C10	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C11	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C12	101098	CAP	CERAM	330 PFD	500 V	10%	71471	C016B102E331K
C13	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C14	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C15	110158	CAP	TANTA	10 MFD	50 V	10%	05397	T362C106K050A
C16	110158	CAP	TANTA	10 MFD	50 V	10%	05397	T362C106K050A
C17	110158	CAP	TANTA	10 MFD	50 V	10%	05397	T362C106K050A
C18	110158	CAP	TANTA	10 MFD	50 V	10%	05397	T362C106K050A
C19	130151	CAP	MICA	0.5 PFD	500 V		72136	DM15CD100D04CR
C20	130151	CAP	MICA	0.5 PFD	500 V		72136	DM15CD100D04CR
C21	130156	CAP	MICA	68 PFD	500 V	1%	72136	DM15ED068F04CR
C22	130156	CAP	MICA	68 PFD	500 V	1%	72136	DM15ED068F04CR
C23	100063	CAP	CERAM	.01 MFD	500 V	20%	56289	C023B501E103M
C24	130155	CAP	MICA	510 PFD	500 V	1%	72136	DM15ED511F04CR
C25	100063	CAP	CERAM	.01 MFD	500 V	20%	56289	C023B501E103M
C26	130155	CAP	MICA	510 PFD	500 V	1%	72136	DM15ED511F04CR
C27	130153	CAP	MICA	91 PFD	500 V	1%	72136	DM15ED910F04CR
C28	130155	CAP	MICA	510 PFD	500 V	1%	72136	DM15ED511F04CR
C29	130153	CAP	MICA	91 PFD	500 V	1%	72136	DM15ED910F04CR
C30	130155	CAP	MICA	510 PFD	500 V	1%	72136	DM15ED511F04CR
C31	130150	CAP	MICA	0.5 PFD	500 V		72136	DM15CD050D04CR
C32	130150	CAP	MICA	0.5 PFD	500 V		72136	DM15CD050D04CR
C33	100041	CAP	CERAM	25 PFD	1 KV	5%	56289	C030B102F250J
C34	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C35	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C36	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C37	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C38	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C39	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C40	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C41	100062	CAP	CERAM	.01 MFD	100 V	10%	72982	8121-100-W5R0-103K
C42	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M

406741 – Assy., PCB, PROGRAMMABLE SIGNAL CONDITIONER (009 OPTION) *continued*

REF DES	DANA P/N	DESCRIPTION					FSC	MANU P/N
C43	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C44	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C45	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C46	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C47	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C48	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C49	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C50	100063	CAP	CERAM	.01 MFD	500 V	20%	56289	C023B501E103M
CR1	211083	DIODE	SILICO		018		21793	211083
CR2	211083	DIODE	SILICO		018		21793	211083
CR3	211083	DIODE	SILICO		018		21793	211083
CR4	211083	DIODE	SILICO		018		21793	211083
CR5	211083	DIODE	SILICO		018		21793	211083
CR6	211083	DIODE	SILICO		018		21793	211083
CR7	211083	DIODE	SILICO		018		21793	211083
CR8	211083	DIODE	SILICO		018		21793	211083
CR9	211083	DIODE	SILICO		018		21793	211083
CR10	211083	DIODE	SILICO		018		21793	211083
CR11	211083	DIODE	SILICO		018		21793	211083
CR12	211083	DIODE	SILICO		018		21793	211083
CR13	211083	DIODE	SILICO		018		21793	211083
CR14	211083	DIODE	SILICO		018		21793	211083
CR15	211083	DIODE	SILICO		018		21793	211083
CR16	211083	DIODE	SILICO		018		21793	211083
CR17	211083	DIODE	SILICO		018		21793	211083
CR18	220031	DIODE	SILICO	ZENER	3.3 V		04713	1/4M3.3AZ5
CR19	220031	DIODE	SILICO	ZENER	3.3 V		04713	1/4M3.3AZ5
CR20	220031	DIODE	SILICO	ZENER	3.3 V		04713	1/4M3.3AZ5
CR21	220031	DIODE	SILICO	ZENER	3.3 V		04713	1/4M3.3AZ5
CR22	211236	DIODE	SILICO		007		21793	211236
CR23	211236	DIODE	SILICO		007		21793	211236
CR24	211236	DIODE	SILICO		007		21793	211236
CR25	211236	DIODE	SILICO		007		21793	211236
CR26	220019	DIODE	SILICO	ZENER	1N752A		81349	1N752A
CR27	220019	DIODE	SILICO	ZENER	1N752A		81349	1N752A
CR28	220011	DIODE	SILICO	ZENER	1N968B		81349	1N968B
CR29	220011	DIODE	SILICO	ZENER	1N968B		81349	1N968B
CR30	210064	DIODE	Matched Pair with CR31		018 TYPE		21793	210064
CR31	210064	DIODE	Matched Pair with CR30		018 TYPE		21793	210064
CR32	210064	DIODE	Matched Pair with CR33		018 TYPE		21793	210064
CR33	210064	DIODE	Matched Pair with CR32		018 TYPE		21793	210064

406741 – Assy., PCB, PROGRAMMABLE SIGNAL CONDITIONER (009 OPTION) *continued*

REF DES	DANA P/N	DESCRIPTION			FSC	MANU P/N	
J6	600610	CONN	RECEPTACLE	50-053-0000	98291	50-053-0000	
J7	600610	CONN	RECEPTACLE	50-053-0000	98291	50-053-0000	
J21	920735	SOCKET	16 PIN	133-51-02-006	71785	133-51-02-006	
J22	920734	SOCKET	14 PIN	133-51-02-003	71785	133-51-02-003	
J23	920735	SOCKET	16 PIN	133-51-02-006	71785	133-51-02-006	
J25	920734	SOCKET	14 PIN	133-51-02-003	71785	133-51-02-003	
J26	920734	SOCKET	14 PIN	133-51-02-003	71785	133-51-02-003	
K1	310123	RELAY	REED	RA30381051-02	15636	RA30381051-02	
K2	310123	RELAY	REED	RA30381051-02	15636	RA30381051-02	
K3	310123	RELAY	REED	RA30381051-02	15636	RA30381051-02	
K4	310123	RELAY	REED	RA30381051-02	15636	RA30381051-02	
K5	310123	RELAY	REED	RA30381051-02	15636	RA30381051-02	
K6	310123	RELAY	REED	RA30381051-02	15636	RA30381051-02	
K7	310123	RELAY	REED	RA30381051-02	15636	RA30381051-02	
K8	310123	RELAY	REED	RA30381051-02	15636	RA30381051-02	
K9	310123	RELAY	REED	RA30381051-02	15636	RA30381051-02	
L1	310068	CHOKE	RF	1 μ H	10%	99800	1537-12
L2	310068	CHOKE	RF	1 μ H	10%	99800	1537-12
L3	310068	CHOKE	RF	1 μ H	10%	99800	1537-12
L4	310068	CHOKE	RF	1 μ H	10%	99800	1537-12
L5	310068	CHOKE	RF	1 μ H	10%	99800	1537-12
L6	310108	CHOKE		.18 μ H	10%	99800	1025-02
L7	310108	CHOKE		.18 μ H	10%	99800	1025-02
Q1	200200	TRANS	NPN	200200		21793	200200
Q2	200200	TRANS	NPN	200200		21793	200200
Q3	200200	TRANS	NPN	200200		21793	200200
Q4	200200	TRANS	NPN	200200		21793	200200
Q5	200200	TRANS	NPN	200200		21793	200200
Q6	200200	TRANS	NPN	200200		21793	200200
Q7	200200	TRANS	NPN	200200		21793	200200
Q8	200200	TRANS	NPN	200200		21793	200200
Q9	200200	TRANS	NPN	200200		21793	200200
Q10	200200	TRANS	NPN	200200		21793	200200
Q11	200068	TRANS	PNP	2N4250		80131	2N4250
Q12	200068	TRANS	PNP	2N4250		80131	2N4250
Q13	200189	TRANS	Matched Pair with Q31			21793	200189
Q14	200189	TRANS	Matched Pair with Q32			21793	200189
Q15	200186	TRANS	Matched Pair with Q29			21793	200186
Q16	200219	TRANS	Matched Pair with Q30	2N3563		21793	200219

406741 – Assy., PCB, PROGRAMMABLE SIGNAL CONDITIONER (009 OPTION) *continued*

REF DES	DANA P/N	DESCRIPTION				FSC	MANU P/N
Q17	200186	TRANS	Matched Pair with Q25			21793	200186
Q18	200186	TRANS	Matched Pair with Q26			21793	200186
Q19	200219	TRANS	Matched Pair with Q27	2N3563	21793	200219	
Q20	200219	TRANS	Matched Pair with Q28	2N3563	21793	200219	
Q21	200186	TRANS	Matched Pair with Q23			21793	200186
Q22	200219	TRANS	Matched Pair with Q24	2N3563	21793	200219	
Q23	200186	TRANS	Matched Pair with Q21			21793	200186
Q24	200219	TRANS	Matched Pair with Q22	2N3563	21793	200219	
Q25	200186	TRANS	Matched Pair with Q17			21793	200186
Q26	200186	TRANS	Matched Pair with Q18			21793	200186
Q27	200219	TRANS	Matched Pair with Q19	2N3563	21793	200219	
Q28	200219	TRANS	Matched Pair with Q20	2N3563	21793	200219	
Q29	200186	TRANS	Matched Pair with Q15			21793	200186
Q30	200219	TRANS	Matched Pair with Q16	2N3563	21793	200219	
Q31	200189	TRANS	Matched Pair with Q13			21793	200189
Q32	200189	TRANS	Matched Pair with Q14			21793	200189
Q33	200068	TRANS	PNP	2N4250	80131	2N4250	
Q34	200200	TRANS	NPN	200200	21793	200200	
Q35	200068	TRANS	PNP	2N4250	80131	2N4250	
Q36	200200	TRANS	NPN	200200	21793	200200	
Q37	200200	TRANS	NPN	200200	21793	200200	
Q38	200200	TRANS	NPN	200200	21793	200200	
Q39	200068	TRANS	PNP	2N4250	80131	2N4250	
Q40	200068	TRANS	PNP	2N4250	80131	2N4250	
Q41	200200	TRANS	NPN	200200	21793	200200	
Q42	200200	TRANS	NPN	200200	21793	200200	
Q43	200200	TRANS	NPN	200200	21793	200200	
Q44	200200	TRANS	NPN	200200	21793	200200	
Q45	200200	TRANS	NPN	200200	21793	200200	
Q46	200200	TRANS	NPN	200200	21793	200200	
Q47	200200	TRANS	NPN	200200	21793	200200	
Q48	200200	TRANS	NPN	200200	21793	200200	
Q49	200037	TRANS	SILICO	NPN	2N3646	80131	2N3646
Q50	200037	TRANS	SILICO	NPN	2N3646	80131	2N3646
Q51	200037	TRANS	SILICO	NPN	2N3646	80131	2N3646
Q52	200037	TRANS	SILICO	NPN	2N3646	80131	2N3646
B1	920563	BEAD	SHIELDING	56-59065/4B	02114	56-59065/4B	
B2	920563	BEAD	SHIELDING	56-59065/4B	02114	56-59065/4B	
B3	920563	BEAD	SHIELDING	56-59065/4B	02114	56-59065/4B	
B4	920563	BEAD	SHIELDING	56-59065/4B	02114	56-59065/4B	

406741 – Assy., PCB, PROGRAMMABLE SIGNAL CONDITIONER (009 OPTION) *continued*

REF DES	DANA P/N	DESCRIPTION				FSC	MANU P/N
B5	920563	BEAD	SHIELDING		56-59065/4B	02114	56-59065/4B
B6	920563	BEAD	SHIELDING		56-59065/4B	02114	56-59065/4B
R1	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R2	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R3	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R4	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R5	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R6	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R7	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R8	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R9	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R10	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R11	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R12	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R13	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R14	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R15	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R16	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R17	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R18	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R19	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R20	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R21	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R22	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R23	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R24	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R25	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R26	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R27	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R28	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R29	010719	RES	METAL	16.2 K	1% 1/10W	81349	RN55C1622F
R30	010719	RES	METAL	16.2 K	1% 1/10W	81349	RN55C1622F
R31	000102	RES	CARBON	1 K	5% 1/4W	81349	RC07GF102J
R32	000271	RES	CARBON	270 OHM	5% 1/4W	81349	RC07GF271J
R33	000102	RES	CARBON	1 K	5% 1/4W	81349	RC07GF102J
R34	000271	RES	CARBON	270 OHM	5% 1/4W	81349	RC07GF271J
R35	040115	POT	CERMET	500 OHM	10%	73138	62PR500
R36	010874	RES	METAL	3.92 K	1% 1/10W	81349	RN55C3921F
R37	040115	POT	CERMET	500 OHM	10%	73138	62PR500
R38	010874	RES	METAL	3.92 K	1% 1/10W	81349	RN55C3921F
R39	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J

406741 – Assy., PCB, PROGRAMMABLE SIGNAL CONDITIONER (009 OPTION) *continued*

REF DES	DANA P/N	DESCRIPTION				FSC	MANU P/N
R40	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R41	000432	RES	CARBON	4.3 K	5% 1/4W	81349	RC07GF432J
R42	000432	RES	CARBON	4.3 K	5% 1/4W	81349	RC07GF432J
R43	010555	RES	METAL	1.82 K	1% 1/10W	81349	RN55C1821F
R44	010555	RES	METAL	1.82 K	1% 1/10W	81349	RN55C1821F
R45	010555	RES	METAL	1.82 K	1% 1/10W	81349	RN55C1821F
R46	010555	RES	METAL	1.82 K	1% 1/10W	81349	RN55C1821F
R47	040115	POT	CERMET	500 OHM	10%	73138	62PR500
R48	010555	RES	METAL	1.82 K	1% 1/10W	81349	RN55C1821F
R49	000302	RES	CARBON	3 K	5% 1/4W	81349	RC07GF302J
R50	040115	POT	CERMET	500 OHM	10%	73138	62PR500
R51	010555	RES	METAL	1.82 K	1% 1/10W	81349	RN55C1821F
R52	000302	RES	CARBON	3 K	5% 1/4W	81349	RC07GF302J
R53	000101	RES	CARBON	100 OHM	5% 1/4W	81349	RC07GF101J
R54	000101	RES	CARBON	100 OHM	5% 1/4W	81349	RC07GF101J
R55	000101	RES	CARBON	100 OHM	5% 1/4W	81349	RC07GF101J
R56	000101	RES	CARBON	100 OHM	5% 1/4W	81349	RC07GF101J
R57	010880	RES	METAL	3.09 K	1% 1/10W	81349	RN55C3091F
R58	010880	RES	METAL	3.09 K	1% 1/10W	81349	RN55C3091F
R59	000200	RES	CARBON	20 OHM	5% 1/4W	81349	RC07GF200J
R60	000200	RES	CARBON	20 OHM	5% 1/4W	81349	RC07GF200J
R61	010879	RES	METAL	1 M	1% 1/10W	81349	RN55D1004F
R62	000511	RES	CARBON	510 OHM	5% 1/4W	81349	RC07GF511J
R63	010879	RES	METAL	1 M	1% 1/10W	81349	RN55D1004F
R64	000511	RES	CARBON	510 OHM	5% 1/4W	81349	RC07GF511J
R65	000101	RES	CARBON	100 OHM	5% 1/4W	81349	RC07GF101J
R66	010875	RES	METAL	124 K	1% 1/10W	81349	RN55C1243F
R67	000620	RES	CARBON	62 OHM	5% 1/4W	81349	RC07GF620J
R68	010875	RES	METAL	124 K	1% 1/10W	81349	RN55C1243F
R69	000100	RES	CARBON	10 OHM	5% 1/4W	81349	RC07GF100J
R70	010631	RES	METAL	10.2 K	1% 1/10W	81349	RN55C1022F
R71	000114	RES	CARBON	110 K	5% 1/4W	81349	RC07GF114J
R72	000114	RES	CARBON	110 K	5% 1/4W	81349	RC07GF114J
R73	010879	RES	METAL	1 M	1% 1/10W	81349	RN55D1004F
R74	010879	RES	METAL	1 M	1% 1/10W	81349	RN55D1004F
R75	000222	RES	CARBON	2.2 K	5% 1/4W	81349	RC07GF222J
R76	000222	RES	CARBON	2.2 K	5% 1/4W	81349	RC07GF222J
R77	000222	RES	CARBON	2.2 K	5% 1/4W	81349	RC07GF222J
R78	000222	RES	CARBON	2.2 K	5% 1/4W	81349	RC07GF222J
R79	000751	RES	CARBON	750 OHM	5% 1/4W	81349	RC07GF751J
R80	010630	RES	METAL	9.09 K	1% 1/10W	81349	RN55C9091F
R81	000751	RES	CARBON	750 OHM	5% 1/4W	81349	RC07GF751J

406741 – Assy., PCB, PROGRAMMABLE SIGNAL CONDITIONER (009 OPTION) *continued*

REF DES	DANA P/N	DESCRIPTION				FSC	MANU P/N
R82	010630	RES	METAL	9.09 K	1% 1/10W	81349	RN55C9091F
R83	000101	RES	CARBON	100 OHM	5% 1/4W	81349	RC07GF101J
R84	010705	RES	METAL	4.53 K	1% 1/10W	81349	RN55C4531F
R85	000101	RES	CARBON	100 OHM	5% 1/4W	81349	RC07GF101J
R86	010705	RES	METAL	4.53 K	1% 1/10W	81349	RN55C4531F
R87	000751	RES	CARBON	750 OHM	5% 1/4W	81349	RC07GF751J
R88	000751	RES	CARBON	750 OHM	5% 1/4W	81349	RC07GF751J
R89	000910	RES	CARBON	91 OHM	5% 1/4W	81349	RC07GF910J
R90	000470	RES	CARBON	47 OHM	5% 1/4W	81349	RC07GF470J
R91	000910	RES	CARBON	91 OHM	5% 1/4W	81349	RC07GF910J
R92	000470	RES	CARBON	47 OHM	5% 1/4W	81349	RC07GF470J
R93	000152	RES	CARBON	1.5 K	5% 1/4W	81349	RC07GF152J
R94	000101	RES	CARBON	100 OHM	5% 1/4W	81349	RC07GF101J
R95	000101	RES	CARBON	100 OHM	5% 1/4W	81349	RC07GF101J
R96	000430	RES	CARBON	43 OHM	5% 1/4W	81349	RC07GF430J
R97	001100	RES	CARBON	2.2 K	5% 1/2W	81349	RC20GF222J
R98	000430	RES	CARBON	43 OHM	5% 1/4W	81349	RC07GF430J
R99	001100	RES	CARBON	2.2 K	5% 1/2W	81349	RC20GF222J
R100	000101	RES	CARBON	100 OHM	5% 1/4W	81349	RC07GF101J
R101	000101	RES	CARBON	100 OHM	5% 1/4W	81349	RC07GF101J
R102	040123	POT	CERMET	1 K	62-1-1-102	73138	62-1-1-102
R103	040123	POT	CERMET	1 K	62-1-1-102	73138	62-1-1-102
R104	000152	RES	CARBON	1.5 K	5% 1/4W	81349	RC07GF152J
R105	000511	RES	CARBON	510 OHM	5% 1/4W	81349	RC07GF511J
R106	000910	RES	CARBON	91 OHM	5% 1/4W	81349	RC07GF910J
R107	000470	RES	CARBON	47 OHM	5% 1/4W	81349	RC07GF470J
R108	001100	RES	CARBON	2.2 K	5% 1/2W	81349	RC20GF222J
R109	000511	RES	CARBON	510 OHM	5% 1/4W	81349	RC07GF511J
R110	000910	RES	CARBON	91 OHM	5% 1/4W	81349	RC07GF910J
R111	000470	RES	CARBON	47 OHM	5% 1/4W	81349	RC07GF470J
R112	001100	RES	CARBON	2.2 K	5% 1/2W	81349	RC20GF222J
R113	040110	POT		100 OHM	62PR100	73138	62PR100
R114	040110	POT		100 OHM	62PR100	73138	62PR100
R115	001874	RES	CARBON	680 OHM	5% 1/2W	81349	RC20GF681J
R116	000751	RES	CARBON	750 OHM	5% 1/4W	81349	RC07GF751J
R117	000101	RES	CARBON	100 OHM	5% 1/4W	81349	RC07GF101J
R118	010705	RES	METAL	4.53 K	1% 1/10W	81349	RN55C4531F
R119	001874	RES	CARBON	680 OHM	5% 1/2W	81349	RC20GF681J
R120	000751	RES	CARBON	750 OHM	5% 1/4W	81349	RC07GF751J
R121	000101	RES	CARBON	100 OHM	5% 1/4W	81349	RC07GF101J
R122	010705	RES	METAL	4.53 K	1% 1/10W	81349	RN55C4531F
R123	010630	RES	METAL	9.09 K	1% 1/10W	81349	RN55C9091F

406741 - Assy., PCB, PROGRAMMABLE SIGNAL CONDITIONER (009 OPTION) *continued*

REF DES	DANA P/N	DESCRIPTION				FSC	MANU P/N
R124	010630	RES	METAL	9.09 K	1% 1/10W	81349	RN55C9091F
R125	010873	RES	METAL	2.21 K	1% 1/10W	81349	RN55C2211F
R126	010631	RES	METAL	10.2 K	1% 1/10W	81349	RN55C1022F
R127	010873	RES	METAL	2.21 K	1% 1/10W	81349	RN55C2211F
R128	010631	RES	METAL	10.2 K	1% 1/10W	81349	RN55C1022F
R129	010555	RES	METAL	1.82 K	1% 1/10W	81349	RN55C1821F
R130	010705	RES	METAL	4.53 K	1% 1/10W	81349	RN55C4531F
R131	010555	RES	METAL	1.82 K	1% 1/10W	81349	RN55C1821F
R132	010705	RES	METAL	4.53 K	1% 1/10W	81349	RN55C4531F
R133	010878	RES	METAL	348 K	1% 1/10W	81349	RN55C3483F
R134	010878	RES	METAL	348 K	1% 1/10W	81349	RN55C3483F
R135	000222	RES	CARBON	2.2 K	5% 1/4W	81349	RC07GF222J
R136	000391	RES	CARBON	390 OHM	5% 1/4W	81349	RC07GF391J
R137	000222	RES	CARBON	2.2 K	5% 1/4W	81349	RC07GF222J
R138	000222	RES	CARBON	2.2 K	5% 1/4W	81349	RC07GF222J
R139	000391	RES	CARBON	390 OHM	5% 1/4W	81349	RC07GF391J
R140	000222	RES	CARBON	2.2 K	5% 1/4W	81349	RC07GF222J
R141	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R142	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R143	010892	RES	METAL	383 K	1% 1/10W	81349	RN55C3833F
R144	010892	RES	METAL	383 K	1% 1/10W	81349	RN55C3833F
R145	010892	RES	METAL	383 K	1% 1/10W	81349	RN55C3833F
R146	010892	RES	METAL	383 K	1% 1/10W	81349	RN55C3833F
R147	000102	RES	CARBON	1 K	5% 1/4W	81349	RC07GF102J
R148	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R149	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R150	000102	RES	CARBON	1 K	5% 1/4W	81349	RC07GF102J
R151	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R152	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R153	000682	RES	CARBON	6.8 K	5% 1/4W	81349	RC07GF682J
R154	000682	RES	CARBON	6.8 K	5% 1/4W	81349	RC07GF682J
R155	000102	RES	CARBON	1 K	5% 1/4W	81349	RC07GF102J
R156	000102	RES	CARBON	1 K	5% 1/4W	81349	RC07GF102J
R157	000102	RES	CARBON	1 K	5% 1/4W	81349	RC07GF102J
R158	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R159	000102	RES	CARBON	1 K	5% 1/4W	81349	RC07GF102J
R160	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R161	000682	RES	CARBON	6.8 K	5% 1/4W	81349	RC07GF682J
R162	000682	RES	CARBON	6.8 K	5% 1/4W	81349	RC07GF682J
R163	000102	RES	CARBON	1 K	5% 1/4W	81349	RC07GF102J
R164	000102	RES	CARBON	1 K	5% 1/4W	81349	RC07GF102J
R165	000391	RES	CARBON	390 OHM	5% 1/4W	81349	RC07GF391J

406741 – Assy., PCB, PROGRAMMABLE SIGNAL CONDITIONER (009 OPTION) *continued*

REF DES	DANA P/N	DESCRIPTION				FSC	MANU P/N
R166	000391	RES	CARBON	390 OHM	5% 1/4W	81349	RC07GF391J
R167	000241	RES	CARBON	240 OHM	5% 1/4W	81349	RC07GF241J
R168	000241	RES	CARBON	240 OHM	5% 1/4W	81349	RC07GF241J
R169	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R170	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R171	000100	RES	CARBON	10 OHM	5% 1/4W	81349	RC07GF100J
R172	010631	RES	METAL	10.2 K	1% 1/10W	81349	RN55C1022F
R173	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R174	000103	RES	CARBON	10 K	5% 1/4W	81349	RC07GF103J
R175	000390	RES	CARBON	39 OHM	5% 1/4W	81349	RC07GF390J
AR1	230110	INTEGRATED CIRCUIT		OP AMP		27014	LM301A
AR2	230110	INTEGRATED CIRCUIT		OP AMP		27014	LM301A
U1C	230187	INTEGRATED CIRCUIT		MC1406L		04713	MC1406L
U1D	230118	INTEGRATED CIRCUIT		NPN CA3086		86884	CA3086
U2B*	230116	INTEGRATED CIRCUIT		7432		07263	7432
U3B	230028	INTEGRATED CIRCUIT		CERAM 7400		07263	7400
U3C	230115	INTEGRATED CIRCUIT		7409		07263	7409
U3D	230115	INTEGRATED CIRCUIT		7409		07263	7409
U4A	230074	INTEGRATED CIRCUIT		7442		07263	7442
U4B	230074	INTEGRATED CIRCUIT		7442		07263	7442
U5B	230116	INTEGRATED CIRCUIT		7432		07263	7432
U5C	230187	INTEGRATED CIRCUIT		MC1406L		04713	MC1406L
U5D	230118	INTEGRATED CIRCUIT		NPN CA3086		86884	CA3086
W1	600245	JUMPER		L-2007-1LP		01295	L-2007-1LP

*Used on 8015B and 8035B Units only

406756 - Assy., HARNESS INTERFACE

REF DES	DANA P/N	DESCRIPTION	FSC	MANU P/N
A1	406733	CABLE HARNESS ASSY	21793	406733
CR31	211083	DIODE SILICO 018	21793	211083
CR32	211083	DIODE SILICO 018	21793	211083
CR33	211083	DIODE SILICO 018	21793	211083
CR34	211083	DIODE SILICO 018	21793	211083
CR35	211083	DIODE SILICO 018	21793	211083
CR36	211083	DIODE SILICO 018	21793	211083
CR37	211083	DIODE SILICO 018	21793	211083
CR38	211083	DIODE SILICO 018	21793	211083
CR39	211083	DIODE SILICO 018	21793	211083
CR40	211083	DIODE SILICO 018	21793	211083
CR41	211083	DIODE SILICO 018	21793	211083
CR42	211083	DIODE SILICO 018	21793	211083
CR43	211083	DIODE SILICO 018	21793	211083
CR44	211083	DIODE SILICO 018	21793	211083
CR45	211083	DIODE SILICO 018	21793	211083
CR46	211083	DIODE SILICO 018	21793	211083
CR47	211083	DIODE SILICO 018	21793	211083
CR48	211083	DIODE SILICO 018	21793	211083
CR49	211083	DIODE SILICO 018	21793	211083
CR50	211083	DIODE SILICO 018	21793	211083
CR51	211083	DIODE SILICO 018	21793	211083
CR52	211083	DIODE SILICO 018	21793	211083

406733 – Assy., REMOTE & RECORDER, OPTION 009

REF DES	DANA P/N	DESCRIPTION	FSC	MANU P/N
J111	715092	PCB FINGER BOARD, RECORDER	21793	715092
J112	715093	PCB FINGER BOARD, RECORDER	21793	715093
P25	600760	PLUG 14 PIN CA-14P-05	52072	CA-14P-05
P26	600760	PLUG 14 PIN CA-14P-05	52072	CA-14P-05

406664 – Assy., PCB, SYSTEMS INTERFACE, OPTION 008

REF DES	DANA P/N	DESCRIPTION					FSC	MANU P/N
A1	406563	HARNESS ASSY					21793	406563
C1	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
CR31	211083	DIODE	SILICO		018		21793	211083
CR32	211083	DIODE	SILICO		018		21793	211083
CR33	211083	DIODE	SILICO		018		21793	211083
CR34	211083	DIODE	SILICO		018		21793	211083
CR35	211083	DIODE	SILICO		018		21793	211083
CR36	211083	DIODE	SILICO		018		21793	211083
CR37	211083	DIODE	SILICO		018		21793	211083
CR38	211083	DIODE	SILICO		018		21793	211083
CR39	211083	DIODE	SILICO		018		21793	211083
CR41	211083	DIODE	SILICO		018		21793	211083
CR42	211083	DIODE	SILICO		018		21793	211083
CR43	211083	DIODE	SILICO		018		21793	211083
CR44	211083	DIODE	SILICO		018		21793	211083
CR45	211083	DIODE	SILICO		018		21793	211083
CR46	211083	DIODE	SILICO		018		21793	211083
CR47	211083	DIODE	SILICO		018		21793	211083
CR48	211083	DIODE	SILICO		018		21793	211083
CR49	211083	DIODE	SILICO		018		21793	211083
CR50	211083	DIODE	SILICO		018		21793	211083
P8	600566	CONN	6 PIN		251-0630160		71785	251-0630160
P110	600698	CONN	15 PIN		251-15-30-260		71785	251-15-30-260
P111	600698	CONN	15 PIN		251-15-30-260		71785	251-15-30-260
P112	600698	CONN	15 PIN		251-15-30-260		71785	251-15-30-260

406563 – Assy., REMOTE & RECORDER HARNESS

REF DES	DANA P/N	DESCRIPTION	FSC	MANU P/N
J110	715091	FINGER BOARD, REMOTE	21793	715091
J111	715092	FINGER BOARD, RECORDER	21793	715092
J112	715093	FINGER BOARD, RECORDER	21793	715093

Steckerbelegung DATA OUT (50-pol. Stecker)

Pin:	Funktion:
1	lo ⁰ A
2	lo ⁰ B
3	lo ¹ A
4	lo ¹ B
5	lo ² A
6	lo ² B
7	lo ³ A
8	lo ³ B
9	lo ⁴ A
10	lo ⁴ B
11	lo ⁵ A
12	lo ⁵ B
13	lo ⁶ A
14	lo ⁶ B
15	lo ⁷ A
16	lo ⁷ B
17	Dimension " MHz "
18	Dimension " KHz "
19	Dimension " Sec "
20	Dimension " nsec "
21	Dimension " msec "
22	Dimension " usec "
23	Print - Kommando
24	
25	Ground (0 Volt)
26	lo ⁰ C
27	lo ⁰ D
28	lo ¹ C
29	lo ¹ D
30	lo ² C
31	lo ² D
32	lo ³ C
33	lo ³ D
34	lo ⁴ C
35	lo ⁴ D
36	lo ⁵ C
37	lo ⁵ D
38	lo ⁶ C
39	lo ⁶ D
40	lo ⁷ C
41	lo ⁷ D
42	Dezimalpunkt 1
43	Dezimalpunkt 2
44	Dezimalpunkt 3
45	Dezimalpunkt 4
46	Dezimalpunkt 5
47	Dezimalpunkt 6
48	Dezimalpunkt 7
49	Dezimalpunkt 8
50	+ 5 Volt (Reference only)

DANA Counter

Steckerbelegung PROGR. (36-pol. Stecker)

Pin:	Funktion:
1	FC (Frequency C)
2	TIA (Time Interval Average)
3	SC (Self Check)
4	TI (Time Interval)
5	PI (Period)
6	A/B (Frequency Ratio)
7	PA (Period Average)
8	TO (Totalize)
9	FA (Frequency A)
10	REM (Remote)
11	Chan. B Slope
12	Chan. B Triggerlevel
13.	Chan. A Slope
14	Chan. A Triggerlevel
15	10^0
16	10^1
17	10^2
18	10^3
19	10^4 Timebase
20	10^5
21	10^6
22	10^7
23	10^8
24	10^9
25	Hold
26	Reset
27	Ext. Gate
36	Ground