Model 3564

4-channel Strain Gage Signal Conditioner

INSTRUCTION MANUAL

May, 1991

SPECIAL OPTION

Model 3564-S001

4-channel Strain Gage Signal Conditioner

January, 1992

SPECIAL OPTION

The Model 3564-S001 is the same as the Model 3564-V1A except the bridge excitation source has been modified to be strap selectable for either six (6) or eight (8) volts. When strapped for +5 volts as described on page 5, the excitation source will be +6 volts. When strapped for +10 volts, the excitation source will be +8 volts.

RMF:rem(WP)

January 30, 1992

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FIGURES

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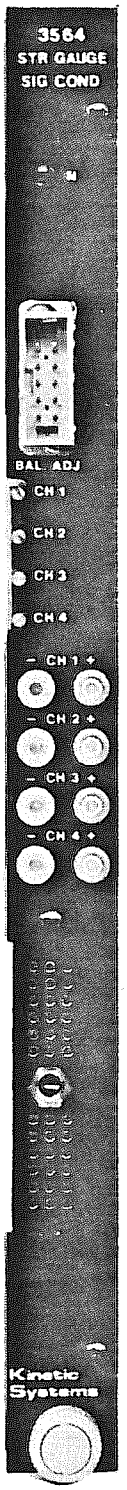
KineticSystems Corporation

Standardized Data Acquisition and Control Systems **3564**

4-channel Strain Gage Signal Conditioner

ADVANCE INFORMATION

(Rev. May 91)



FEATURES

- **4 channels**
- **Bridge measurements with one, two, or four active arms**
- **Programmable shunt calibration**
- **On-board excitation source**
- **Two-pole, lowpass filter per channel**
- **Multiplexer for use with 3518 ADC**

APPLICATIONS

- **Jet and rocket engine testing**
- **General-purpose data acquisition**

GENERAL DESCRIPTION

The Model 3564 is a single-width CAMAC module providing four channels of strain gage bridge completion and input filtering as well as four channels of input multiplexing. It is used with the Model 3518 Scanning A/D Converter Host module. The 3564 can accommodate transducers that represent one, two, or four active arms of a bridge circuit. This input module provides the remaining legs of the bridge (three, two, or none). Bridge completion (for one, two, or four active transducer elements) can be selected on a per-channel basis.

Each channel on the 3564 has a precision voltage source for bridge excitation. The excitation sources are strap-selectable for 5 or 10 volts. Calibration resistors are available that can be placed in parallel with one leg of the bridge. The switching of these resistors is programmable on a per-channel basis. Each channel also includes a bridge balance potentiometer accessible at the module front panel along with test points to monitor bridge output.

The Model 3564 is available in options with or without bridge completion resistor kits installed. Bridge completion resistor kits can be ordered separately on a per channel basis and are available for bridges with 120 ohms per leg or with 350 ohms per leg. Each kit also includes a resistor to limit the range of the balance adjustment as well as a shunt calibration resistor. All bridge completion resistors have a tolerance of $\pm 0.05\%$.

Wiring from the transducers is brought into the 3564 via an AMP, 36-contact, high-density, rectangular connector mounted on the front panel. This connector mates directly with the Model 5944-Z1A mating connectors and with the Model 5855-Series of cable assemblies. The multiplexer output and control signals are bussed between the front panel of the 3564, other signal conditioning modules, and the 3518 ADC module via the Model 5840 10-wire flat ribbon cable. The front panel also contains an N LED which flashes whenever the module is addressed.

FUNCTION CODES

Command		Q	Action
F(0)·A(0)	RD1	1	Reads the calibration selection pattern.
F(1)·A(0)	RD2	1	Reads the state of the channel selection switches.
F(16)·A(0)	WT1	1	Writes the calibration selection pattern.
Z·S2	ZED		Clears the calibration selection register.
Note: X = 1 for all valid addressed commands.			

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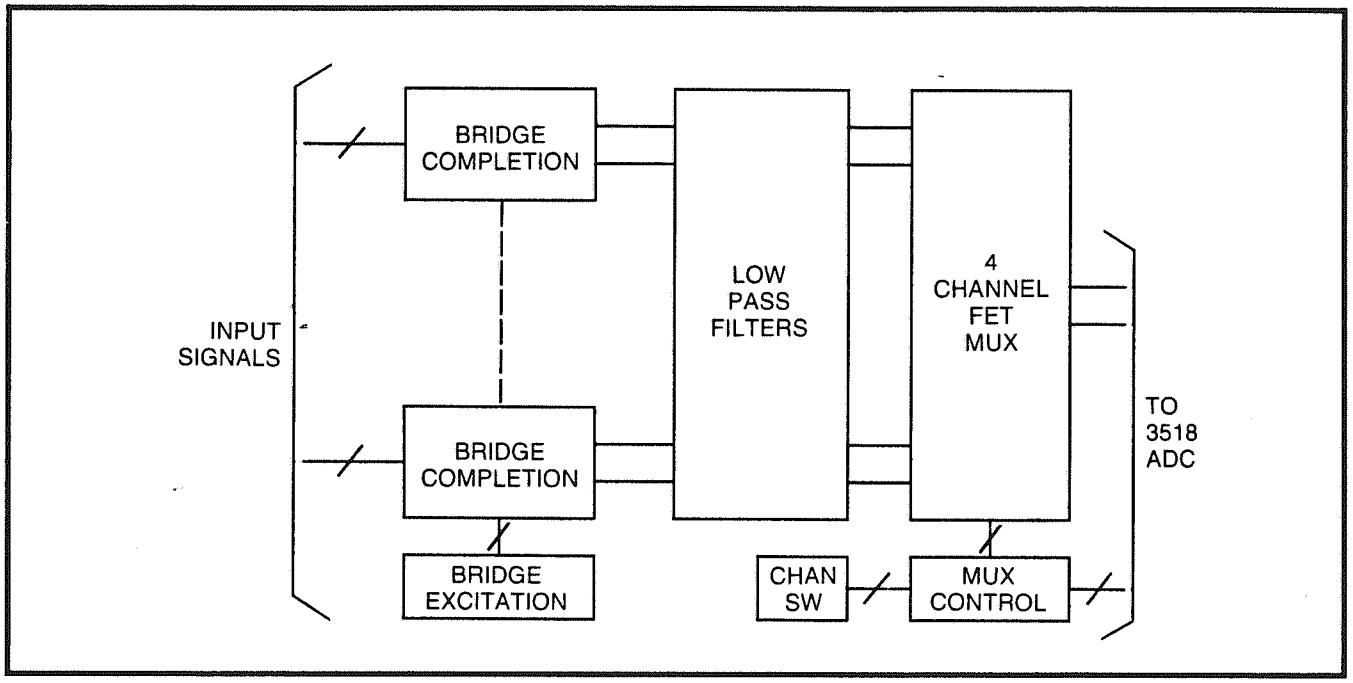
SIMPLIFIED BLOCK DIAGRAM



FILTERS

The 3564 contains a passive, lowpass filter per channel. These filters provide a nominal 3dB attenuation at 10 hertz with a rolloff of 12 dB per octave above 10 hertz. Contact KineticSystems Corporation for filters with other cutoff frequencies.

CHANNEL SELECTION

If the 3564 Channel Address switch is set to "0," then its first channel corresponds to the first channel of a 3518 scan. The Channel Address switch can be set from 0 to 7 (with the first channel of the 3564 in the appropriate four-channel group of the 3518). This allows maximum flexibility in configuring a system with multiple input modules connected to a 3518. The First Channel address can be read via the Dataway for verification.

POWER REQUIREMENTS

+6 volts — 615 mA
+24 volts — 160 mA
−24 volts — 45 mA

ORDERING INFORMATION

Weight: .62 kg. (1 lb. 6 oz.)

Model 3564-V1A — 4-channel Strain Gage Signal Conditioner without Resistor Kits

Model 3564-V1B — 4-channel Strain Gage Signal Conditioner with Four Resistor Kits for 120 ohm Bridges

Model 3564-V1C — 4-channel Strain Gage Signal Conditioner with Four Resistor Kits for 350 ohm Bridges

Accessories —
Model 3518-Z1A 16-bit Scanning A/D Converter Host
Model 5944-Z1A Mating Connector
Model 1854-A2A Termination Panel with 5855-B30J Cables
Model 5855-A30J Cable Assembly
Model 5840-Series Cable Assemblies
Model 3564-001 Resistor Kit for 120-ohm Bridges
(Includes bridge completion, shunt calibration and balance limit resistors for one channel)
Model 3564-002 Resistor Kit for 350-ohm Bridges
(Includes bridge completion, shunt calibration and balance limit resistors for one channel)

MODULE CONNECTIONS

Wiring from the transducers is brought into the 3564 via the Amp 36 position front panel connector P1. This connector mates directly with Model 5944-Z1A mating connectors and with the Model 5855-Series of cable assemblies. See Figure 7 for proper signal connections.

The multiplexer output and control signals are bussed between front panel connector P3 of the 3564, other signal conditioning modules and the 3518 ADC module via a 10-wire flat-ribbon cable (Model 5840 Series).

CHANNEL SELECTION REGISTER AND SWITCH SETTINGS

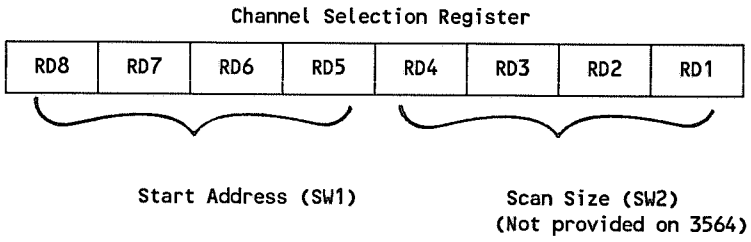
The 3564 is part of the 3518 family of signal conditioning modules. The 3518 acts as a signal conditioner host and interfaces to any combination of 3563, 3564, 3565 and 3569 modules through a single, 10-pin, front-panel connector. Since all of the signal conditioning modules share this common bus, address switches must be set on each module to enable the analog output onto the bus at the appropriate times. The 3518 is capable of digitizing 32 channels of analog input. The output from a given signal conditioning module may lie anywhere within the 3518's 32-channel spectrum. The starting channel and number of channels to be scanned are switch-selectable in groups of four at the signal conditioning module. Figure 1 shows a sample configuration involving multiple types of signal conditioning modules. Figure 2 shows the switch selections required for various starting address and scan sizes. When setting these switches at each signal conditioning module, care must be taken to insure that no two modules occupy the same portion of the 3518's address spectrum.

If an overlap condition does occur, the 3518 will detect it and flash the error LED until the configuration is corrected. The 3518 will also disable all signal conditioners during the overlap period to protect the equipment. The first-channel-scanned switch (start address) is switch SW1. The first channel address can be read via the Dataway for verification by using the CAMAC command F(1)A(0).

NOTE: The Model 3564 is a four channel device so the number of channels scanned is always four and is not switch selectable. The scan-size switch SW2 is present on other signal conditioning modules in the 3518 family that support more than four channels. The portion of Figure 2 showing the scan-size switch selections is included as an aid when configuring the 3564 in a system with these modules.

Channel	Input	Start Addr. Switch	Scan Size Switch
0	3564-V1A		
1	Filtered Strain	0	N.A.
2	Gage (4)		
3			
4			
5			
6			
7			
8	3563-V1D		
9	Filtered		
10	Thermocouple	1	2
11	(12)		
12			
13			
14			
15			
16			
17			
18	3565-V1A		
19	Filtered	4	1
20	RTD (8)		
21			
22			
23			
24			
25			
26	3569-V1D		
27	Filtered	6	1
28	Analog (8)		
29			
30			
31			

FIGURE 1 - Sample Configuration



SW1 Switch Position	First Channel Scanned	Start Address RD8-RD5	SW2 Switch Position	Number of Channels Scanned	Scan Size RD4-RD1
0	0	0 0 0 0	0	4	0 0 0 0
1	4	0 0 0 1	1	8	0 0 0 1
2	8	0 0 1 0	2	12	0 0 1 0
3	12	0 0 1 1	3	16	0 0 1 1
4	16	0 1 0 0	4	20	0 1 0 0
5	20	0 1 0 1	5	24	0 1 0 1
6	24	0 1 1 0	6	28	0 1 1 0
7	28	0 1 1 1	7	32	0 1 1 1

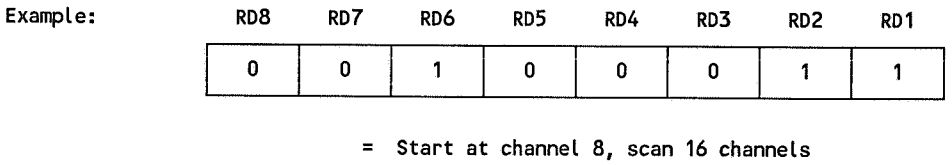


FIGURE 2 - Switch Selection for Starting Address and Scan Size

BRIDGE COMPLETION

The Model 3564 module can accommodate transducers that represent one, two, or four active arms of a bridge circuit. The module provides the remaining legs of the bridge (three, two, or none). Bridge completion for one, two, or four active transducer elements can be selected on a per-channel basis. The 3564 is available in options with or without 120 Ω or 350 Ω Bridge Completion Resistor Kits. Bridge completion resistor kits are also available separately on a per channel basis for bridges with 120 ohms per leg (Model 3564-001) or with 350 ohms per leg (Model 3564-002). The Model 3564-001 Resistor Kit contains three 120 ohm ±0.05% 5PPM/°C ultra precision bridge completion resistors, one 12K Ω ±0.05% 5PPM/°C balance adjustment limit resistor and one 59.7K Ω ±0.1% 5PPM/°C ultra precision shunt calibration resistor. The Model 3564-002 Resistor Kit contains three 350 Ω ±0.05% 5PPM/°C ultra precision bridge completion

completion resistors, one 35K Ω ±0.05% 5PPM/°C Balance Adjustment Limit Resistor, and one 174K Ω ±0.1% 5PPM/°C Shunt calibration resistor. The resistors in these kits must be loaded into sockets on the 3564 module to provide the desired bridge completion configuration. Models 3564-V1B and -V1C have Resistor Kits factory loaded in sockets for quarter bridge configuration. See Figures 3 through 6 for bridge completion diagrams and Figure 8 for component locations.

BRIDGE BALANCE ADJUSTMENT

Each of the four channels on the Model 3564 has a 20-turn bridge balance potentiometer accessible at the module front panel. Bridge balance is accomplished by turning the potentiometer so that the bridge output is effectively zero volts. The bridge output may be monitored with a digital voltage meter at test points located on the 3564 front panel or by the 3518 ADC module. Each channel requires a balance adjustment limit resistor that is loaded into sockets located on the 3564. These limit resistors are available as part of Model 3564-001 resistor kit for 120 ohm bridges and Model 3564-002 resistor kit for 350 ohm bridges. The limit resistor for 120 ohm bridges is a 12K ohm ±0.05% 5PPM/°C and the limit resistor for 350 ohm bridges is a 35K ohm ±0.05% 5PPM/°C. See Figures 3 through 6 for bridge completion diagrams and Figure 8 for component locations.

SHUNT CALIBRATION

Each of the four channels on the 3564 has a location for a shunt calibration resistor that can be placed in parallel with one leg of the bridge. These calibration resistors are available as part of Model 3564-001 Resistor Kit for 120 ohm bridges and Model 3564-002 Resistor Kit for 350 ohm bridges. The calibration resistor for 120 ohm bridges is a 59.7K ohm ±0.1% 5PPM/°C, and the calibration resistor for 350 ohm bridges is a 174K ohm ±0.1% 5PPM/°C. The switching of these resistors is programmable on a per channel basis by using the CAMAC command F(16)A(0) with data bits 1-4 corresponding to channels 1-4. The calibration selection pattern can be read by using the CAMAC command F(0)A(0).

Data Bits	04	03	02	01
Channel	04	03	02	01

Calibration Selection Register
F(16)A(0)

The calibration resistors are used to determine equivalent strain; in other words, the strain required in a single gage to produce the same signal as is produced by the connection of the calibration resistor. The calibration resistor values provided in resistor kits Model 3564-001 and Model 3564-002 will produce an equivalent strain of 1000 $\mu\epsilon$ (0.50mv/v) when switched in parallel with one leg of the bridge (assuming gage factor of two). See Figures 3 through 6 for bridge completion diagrams and Figure 8 for component locations.

BRIDGE EXCITATION

Each of the four channels on the 3564 has a precision voltage source for bridge excitation. The excitation sources are strap-selectable for 5 or 10 volts on a channel-by-channel basis and provide

a maximum current output of 110 mA max/channel, short circuit protected. There are two straps associated with each channel's excitation source; one for selecting a +5 volt or +10 volt excitation output and one for selecting +5 volt or +10 volt remote sensing. Care must be taken to insure that both straps for an individual channel are either in the +5 volt position or are in the +10 volt position. See Figure 8 for Strap Locations.

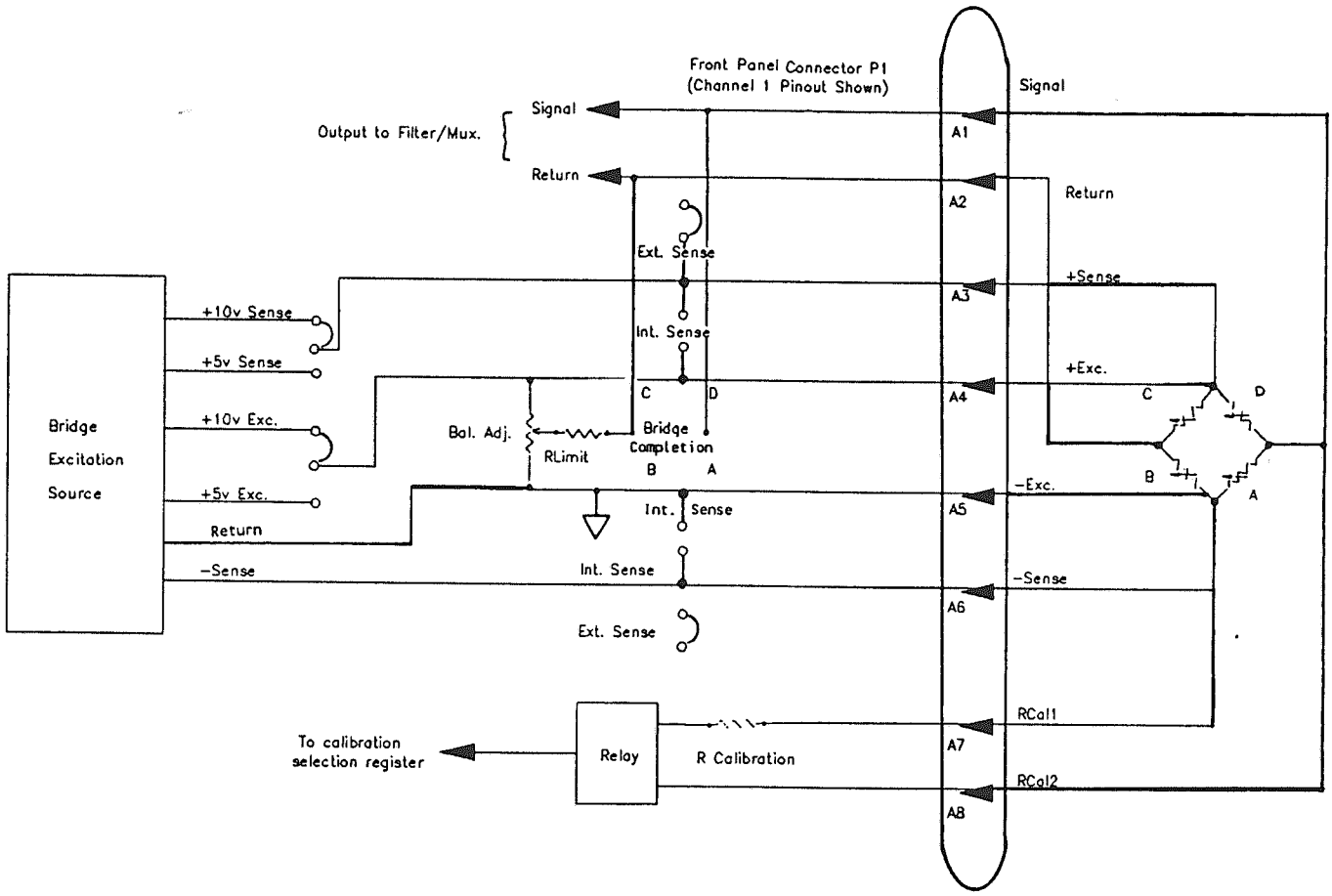


FIGURE 3 - Six-wire Full-bridge Configuration

An example of a six-wire full-bridge configuration is shown in Figure 3. In this configuration, all bridge arms are active and no bridge completion resistors are required. In a six-wire configuration, the sense inputs are connected to compensate for cable resistances, maintaining the excitation voltage at its nominal level *at the bridge*. The sense straps should be placed in the *external* position. The excitation source is shown strapped for +10 volts. The two remaining inputs shown are for the connection of a shunt calibration resistor.

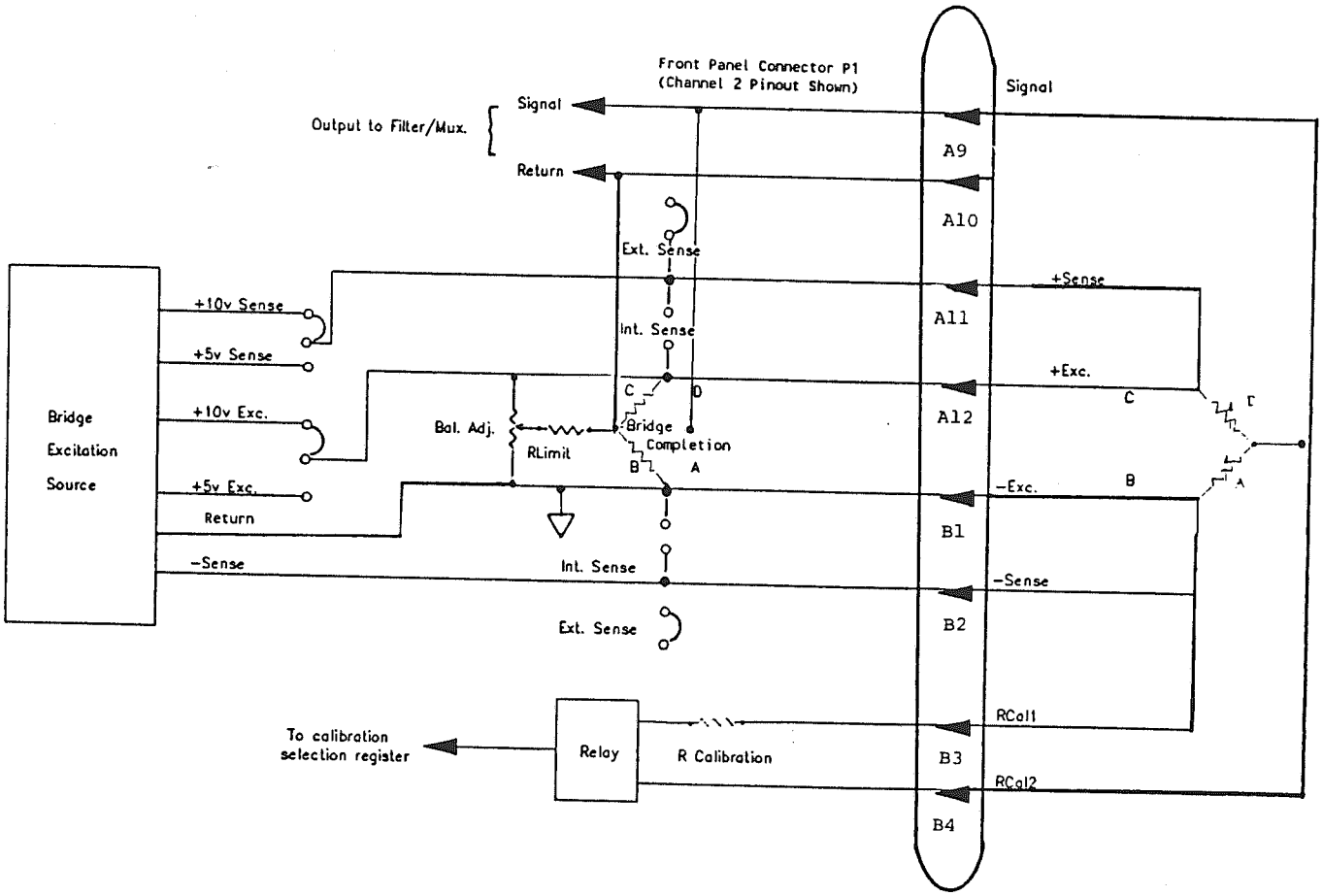


FIGURE 4 - Five-wire Half-bridge Configuration

An example of a five-wire half-bridge configuration with two active arms is shown in Figure 4. Bridge completion resistors are loaded in locations B and C. The two additional inputs shown are for the connection of a shunt calibration resistor.

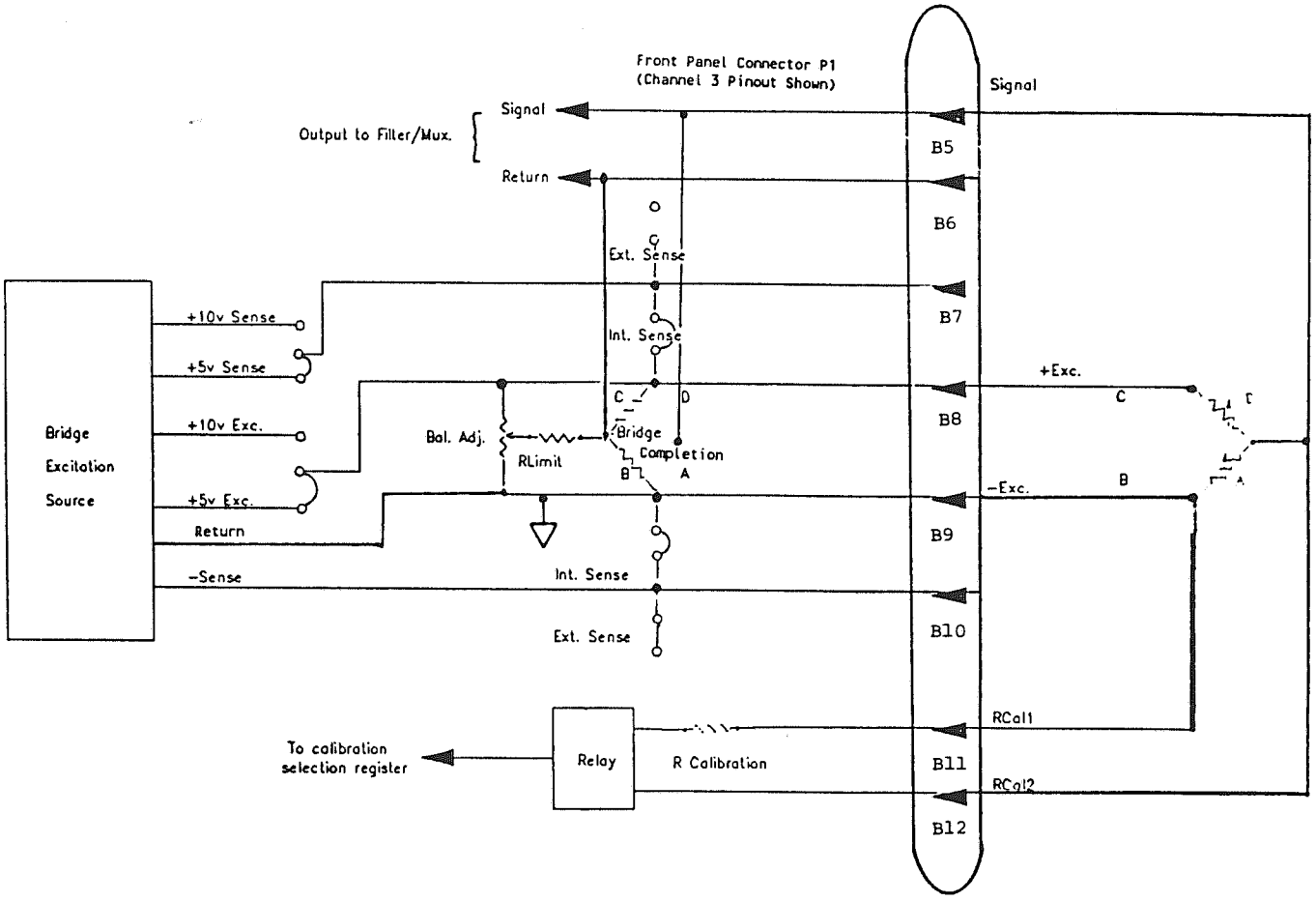


FIGURE 5 - Three-wire Half-bridge Configuration

Figure 5 shows a three-wire half-bridge configuration. The sense inputs are not connected so the sense straps must be placed in the internal position. The excitation source is shown strapped for +5 volts. The two additional inputs shown are for the connection of a shunt calibration resistor.

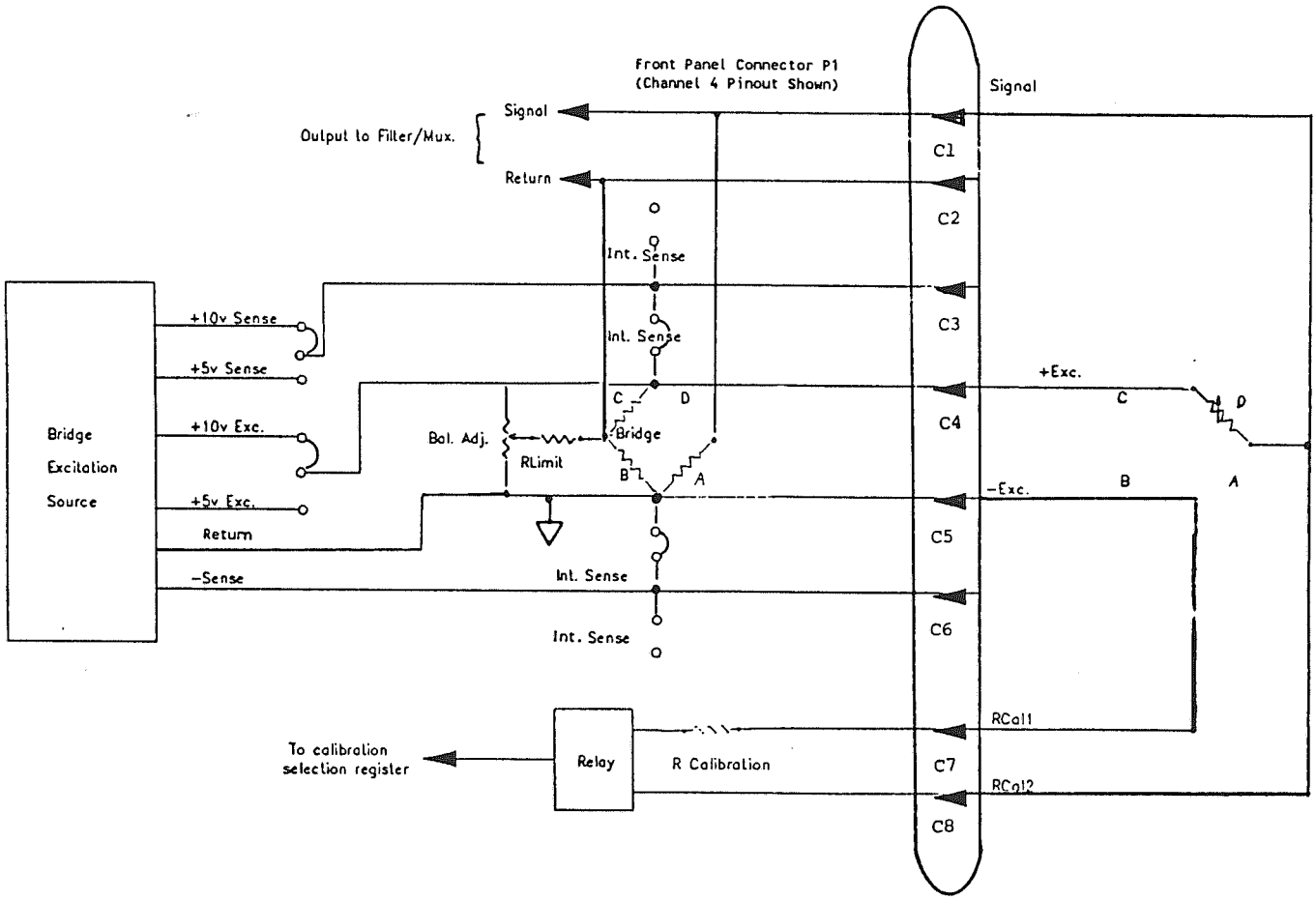


FIGURE 6 - Two-wire Quarter-bridge Configuration

Figure 6 illustrates a two-wire quarter-bridge configuration. Bridge completion resistors are loaded in locations A, B, and C. The remaining leg of the bridge is the single active arm. The two additional inputs shown are for the connection of a shunt calibration resistor.

3564

CHANNEL	Nomenclature	Pin No.
1	Signal	A 1
	Return	A 2
	+Sense	A 3
	+Excitation	A 4
	-Excitation	A 5
	-Sense	A 6
	R Calibration 1	A 7
	R Calibration 2	A 8
2	Signal	A 9
	Return	A10
	+Sense	A11
	+Excitation	A12
	-Excitation	B 1
	-Sense	B 2
	R Calibration 1	B 3
	R Calibration 2	B 4
3	Signal	B 5
	Return	B 6
	+Sense	B 7
	+Excitation	B 8
	-Excitation	B 9
	-Sense	B10
	R Calibration 1	B11
	R Calibration 2	B12
4	Signal	C 1
	Return	C 2
	+Sense	C 3
	+Excitation	C 4
	-Excitation	C 5
	-Sense	C 6
	R Calibration 1	C 7
	R Calibration 2	C 8
No Channel	Ground	C 9
	Ground	C10
	Ground	C11
	Ground	C12

FIGURE 7 - Connector P1 Pinout

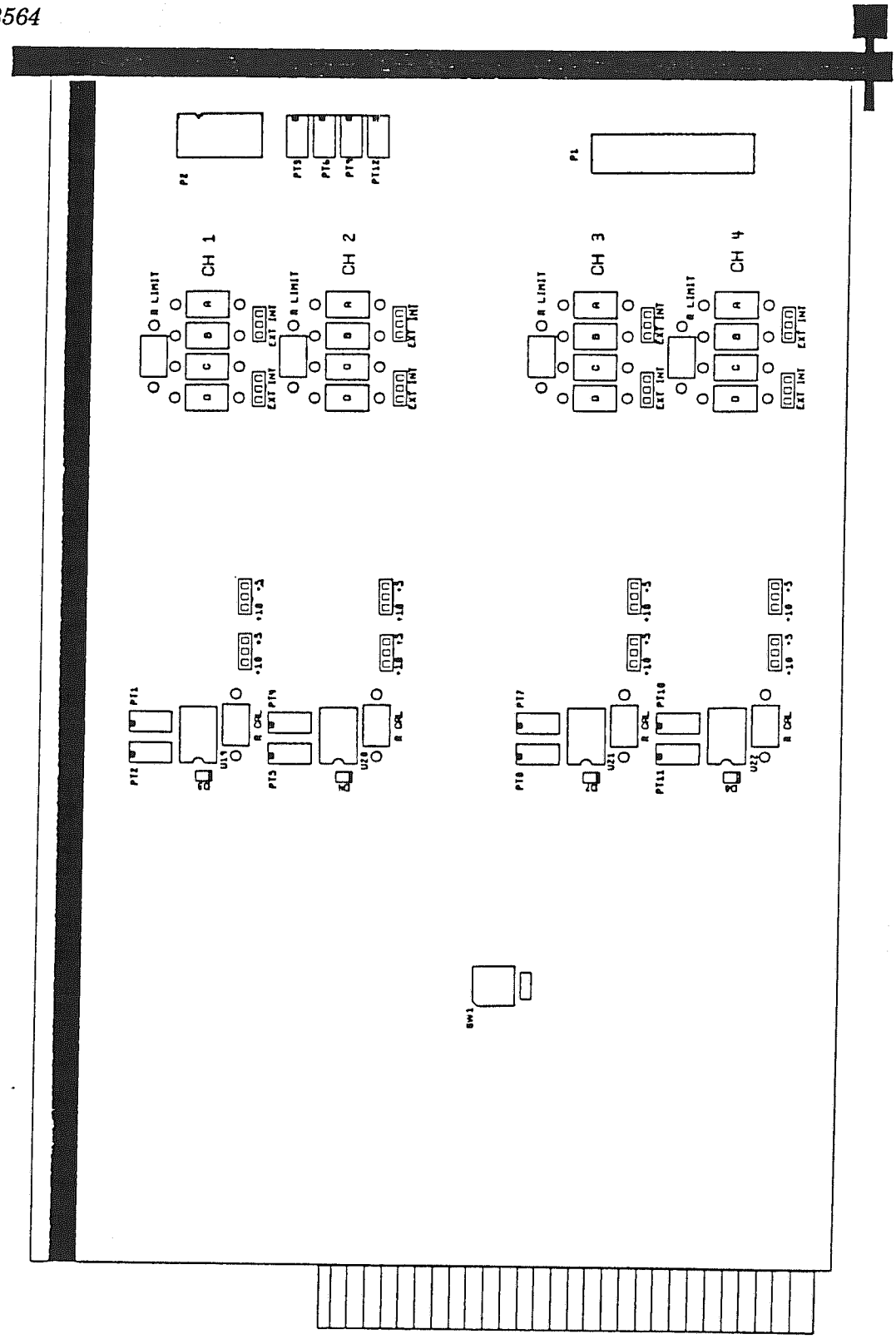


FIGURE 8 - COMPONENT AND STRAP LOCATIONS

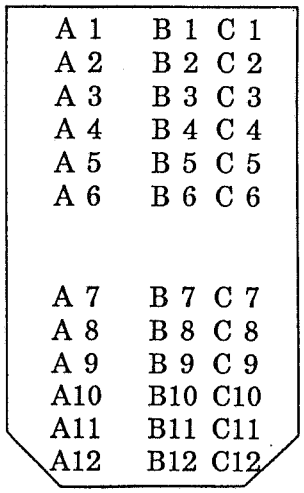


FIGURE 9 - Connector P1 Contact Layout

Pin No.	Nomenclature
1	Ground
2	Signal
3	Return
4	Ground
5	Ground
6	Unused
7	Increment
8	Clear Channel
9	Error
10	Overlap Detect

FIGURE 10 - Connector P2 Pinout