Model 3564-V2A,V2B,V2C

4-channel Strain Gage Signal Conditioner

INSTRUCTION MANUAL

September, 1992

*****Special Option*****

Model 3564-S002

4-channel Strain Gage Signal Conditioner

September, 1992

*****Special Option*****

Model 3564-S002

The Model 3564-S002 is the same as the Model 3564-V2C except that the filter sections are 2-pole Butterworth with pluggable resistor headers allowing cutoff frequencies of 1 Hz, 10 Hz, 100 Hz or 1 KHz as opposed to the 3564-V2C which has filter sections that are 4-pole Butterworth with a cutoff frequency of 10 Hz only.

September 30, 1992
RMF:rem

*****Special Option*****

Model 3564-S003

4-channel Strain Gage Signal Conditioner

July, 1998

*****Special Option*****

Model 3564-S003

The Model 3564-S003 is the same as the Model 3564-V2A except that the balance circuit is programmable between ±10 mv instead of ±100 mv.

July, 1998
PLM:rem

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KPG:rem(WP)

CAMAC

3564

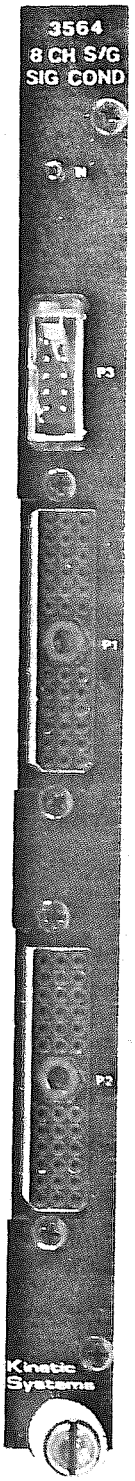
8-channel Strain Gage Signal Conditioner

FEATURES

- **8 channels**
- **Bridge measurements with one, two, or four active arms**
- **Programmable shunt calibration**
- **Programmable excitation source**
- **Four-pole Butterworth lowpass filter per channel**
- **Multiplexer for use with 3518 ADC**
- **Programmable bridge balance**

APPLICATIONS

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



GENERAL DESCRIPTION

The Model 3564 is a single-width CAMAC module providing eight channels of strain gage bridge completion and input filtering as well as eight 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 source is programmable between 0 and +10 volts, with a resolution of 12 bits (one part in 4096). The source is the same for all eight channels, but separate sense leads are provided for each channel. 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 circuit that is programmable between ±100 millivolts at the bridge, with a resolution of 12 bits.

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 ±0.05%.

Wiring from the transducers is brought into the 3564 via two AMP, 36-contact, high-density, rectangular connectors mounted on the front panel. This connectors mate 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.
F(16)·A(1)	WT1	1	Writes programmable excitation voltage DAC.
F(17)·A(i)	WT2	1	Writes bridge balance DAC for channel i.
Z·S2	ZED		Clears the calibration selection register.
Note: X = 1 for all valid addressed commands.			

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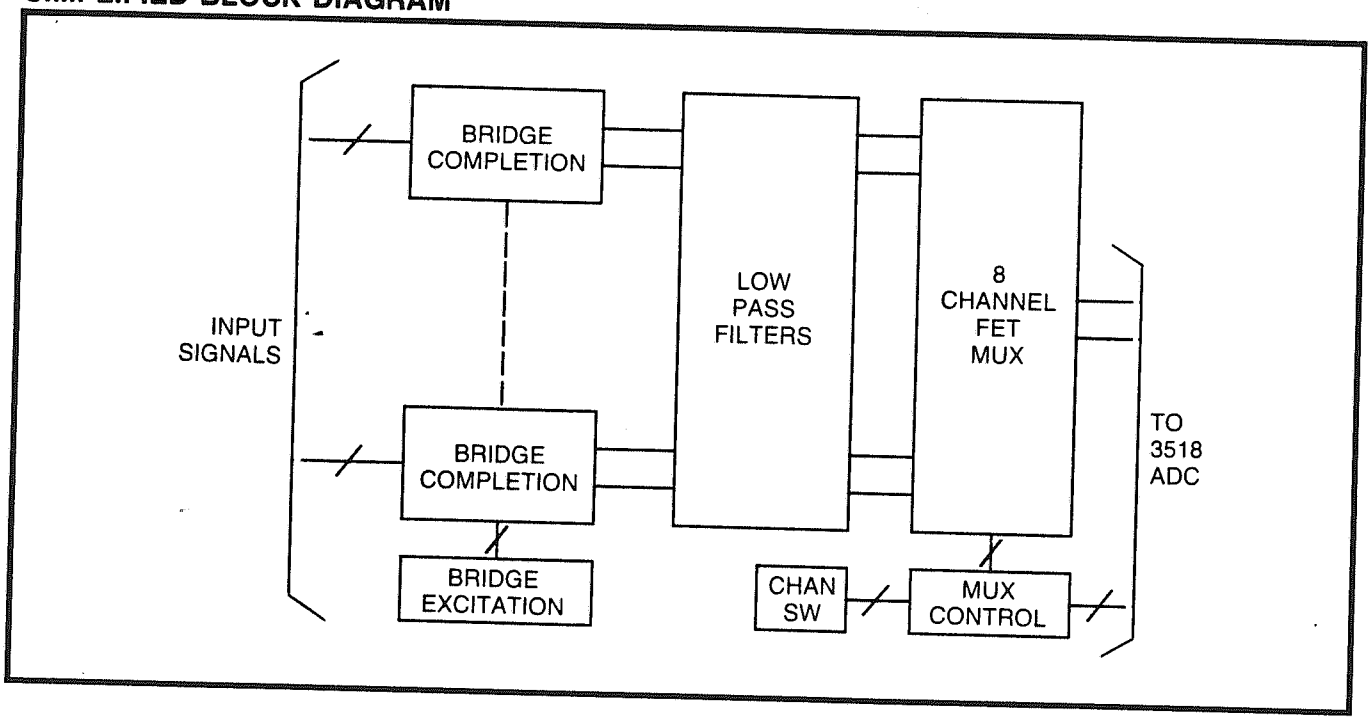
SIMPLIFIED BLOCK DIAGRAM



FILTERS

The 3564 contains a 4-pole Butterworth lowpass filter per channel. These filters provide a nominal 3dB attenuation at 10 hertz with a rolloff of 24 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). The number of scanned channels on the 3564 is also switch-selectable for either four or eight channels. 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-V2A — 8-channel Strain Gage Signal Conditioner without Resistor Kits

Model 3564-V2B — 8-channel Strain Gage Signal Conditioner with Four Resistor Kits for 120 ohm Bridges

Model 3564-V2C — 8-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 3564-021 Resistor Kit for 120-ohm Bridges
(Includes bridge completion and shunt calibration for one channel)
Model 3564-022 Resistor Kit for 350-ohm Bridges
(Includes bridge completion and shunt calibration for one channel)

MODULE CONNECTIONS

Wiring from the transducers is brought into the 3564 via the Amp 36 position front panel connectors P1 and P2. These connectors mate 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).

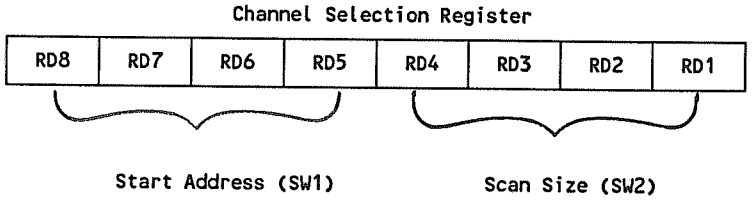
CHANNEL SELECTION REGISTER AND SWITCH SETTINGS

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 and the scan size switch is SW2. The first channel address and the number of channels scanned can be read via the Dataway for verification by using the CAMAC command F(1)A(0). See Figure 8 for switch locations.

Channel	Input	Start Addr. Switch	Scan Size Switch
0 1 2 3 4 5 6 7	3564-V2A Filtered Strain Gage (8)	0	1
8 9 10 11 12 13 14 15	3563-V1D Filtered Thermocouple (8)	2	1
16 17 18 19 20 21 22 23	3565-V1A Filtered RTD (8)	4	1
24 25 26 27 28 29 30 31	3569-V1D Filtered Analog (8)	6	1

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

Example:

RD8	RD7	RD6	RD5	RD4	RD3	RD2	RD1
0	0	1	0	0	0	0	1

= Start at channel 8, scan 4 channels

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. Bridge completion resistor kits are available for bridges with 120 ohms per leg (Model 3564-021) or with 350 ohms per leg (Model 3564-022). The Model 3564-021 Resistor Kit contains three 120 ohm ±0.05% 5PPM/°C ultra precision bridge completion resistors and one 59.7K ohm ±0.1% 5PPM/°C ultra precision shunt calibration resistor. The Model 3564-022 Resistor Kit contains three 350 ohm ±0.05% 5PPM/°C ultra precision bridge completion resistors, and one 174K ohm ±0.1% 5PPM/°C Shunt calibration resistor. The resistors in these kits are loaded into sockets on the 3564 module to provide the desired bridge completion 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 12-bit (one part in 4096) Digital-to-Analog converter (DAC) that may be programmed from the Dataway to remove any offsets due to bridge imbalance. The output range of each DAC is ±5 volts bipolar. The DAC outputs are fed to a resistor divider/summing network which provides a 100 mv offset adjustment range reltive to the bridge. The CAMAC commands F(17)A(0) through F(17)A(7), where A is 0 to 7 for channels 1 to 8, write the zero balance (offset) voltage level.

SHUNT CALIBRATION

Each of the eight 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 the Model 3564-021 Resistor Kit for 120 ohm bridges and Model 3564-022 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 1-8 corresponding to channels 1-8. Setting a bit to a logic "1" will enable the Shunt Calibration resistor for the corresponding channel. The calibration selection pattern can be read by using the CAMAC command F(0)A(0).

Data Bits	8	7	6	5	4	3	2	1
Channel	Chan 8	Chan 7	Chan 6	Chan 5	Chan 4	Chan 3	Chan 2	Chan 1

Calibration Selection (16)A(0)

The calibration resistors are used to simulate a known deflection in the resistance of the strain gage. This may be used to calibrate the gain of the entire channel. The calibration resistor values provided in resistor kits Model 3564-021 and Model 3564-022 will produce an equivalent strain of approximately 1000 με (0.50mv/v) when switched in parallel with one leg of the bridge. See Figures 3 through 6 for bridge completion diagrams and Figure 8 for component locations.

BRIDGE EXCITATION

Bridge excitation for each channel is provided by a single 12-bit (one part in 4096) Digital-to-Analog converter with a 0 to +10 volt range programmable from the Dataway with the CAMAC command F(16)A(1). This configuration allows for a wide range of excitation voltage levels programmable in steps as small as 2.44 millivolts. Internal or external (remote) excitation voltage sensing is provided at each individual channel and is strap selectable. When strapping for internal or external sensing care must be taken to insure that both straps for an individual channel are either in the internal position or are in the external position.The excitation circuitry provides a current output of 110 milliamperes maximum per channel, short circuit protected. See Figures 3 through 6 for internal/external sensing configurations and Figure 8 for component locations.

GAIN AND FILTERING

An onboard gain of 10 is applied to each channel's bridge output prior to filtering. Additional gain of 1 to 1024 may be applied to the output signal at the 3518 Scanning A/D converter host module if desired. Each channel also includes a four-pole Butterworth filter section providing

a standard cutoff frequency of 10 hertz. Other cutoff frequencies may be available upon request and are established by a set of plug-in resistor headers.

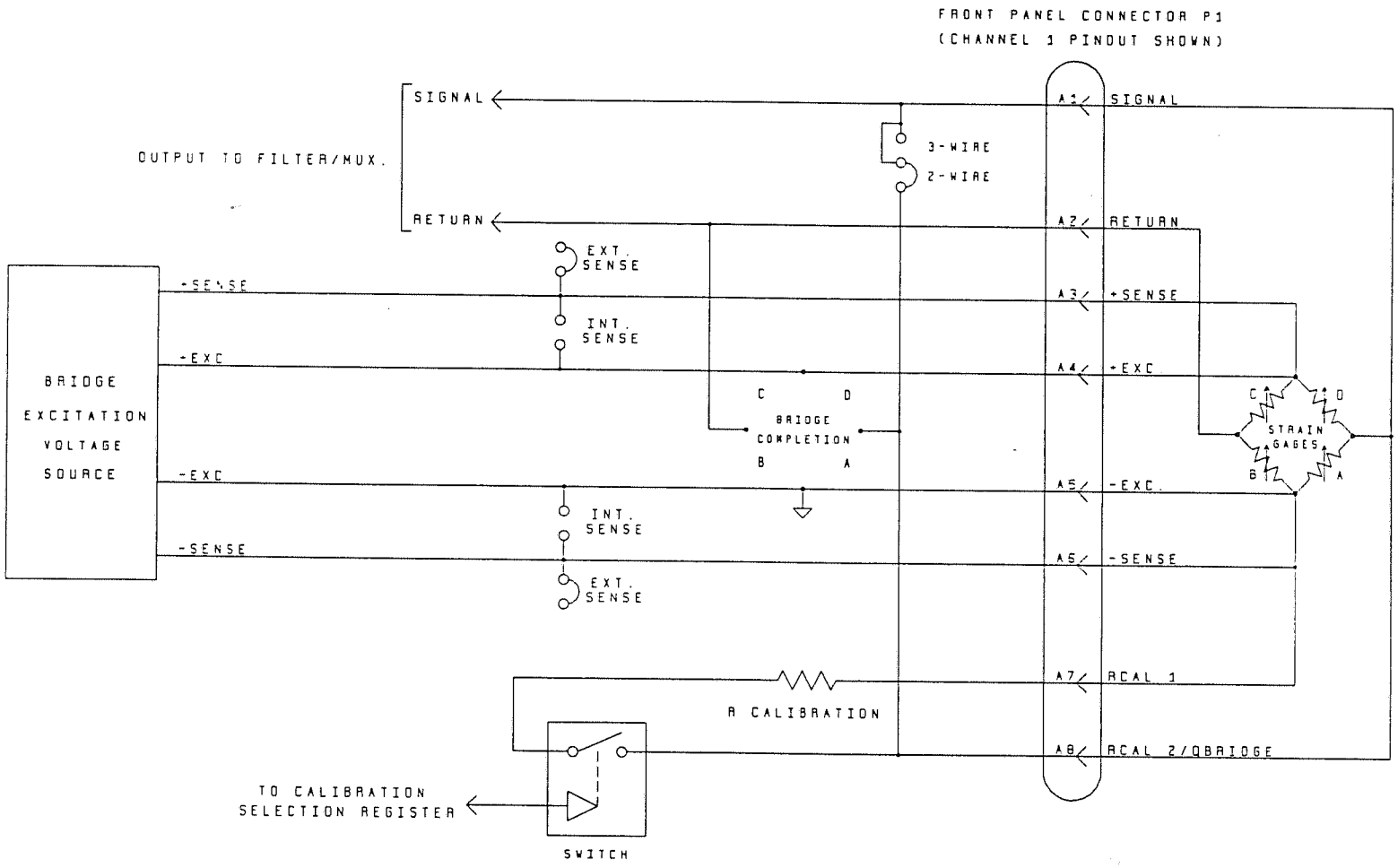


FIGURE 3 - Six-wire Full-bridge Configuration

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 two remaining inputs shown are for the connection of a shunt calibration resistor.

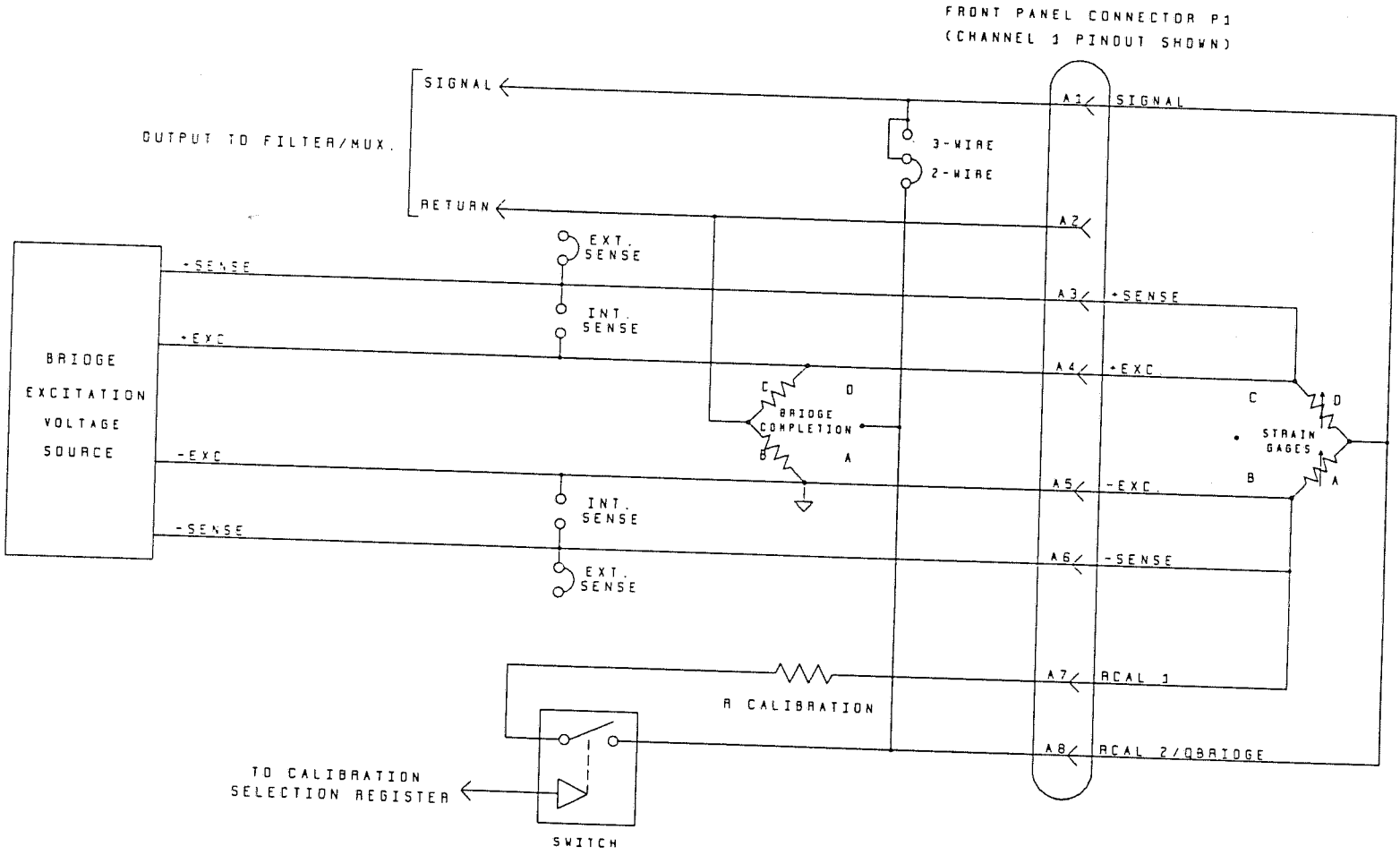


FIGURE 4 - Five-wire Half-bridge Configuration

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.

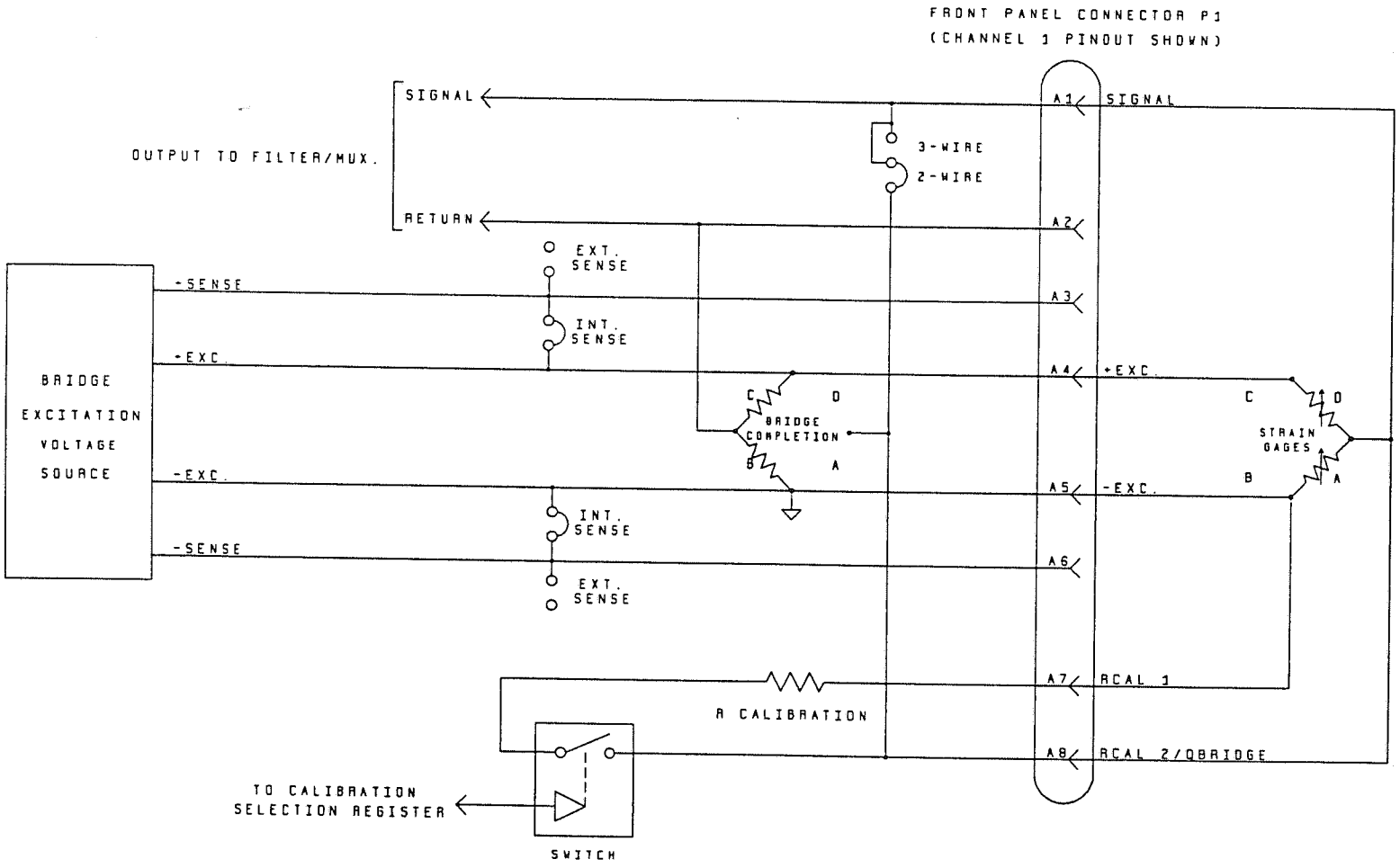


FIGURE 5 - Three-wire Half-bridge Configuration

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 two additional inputs shown are for the connection of a shunt calibration resistor.

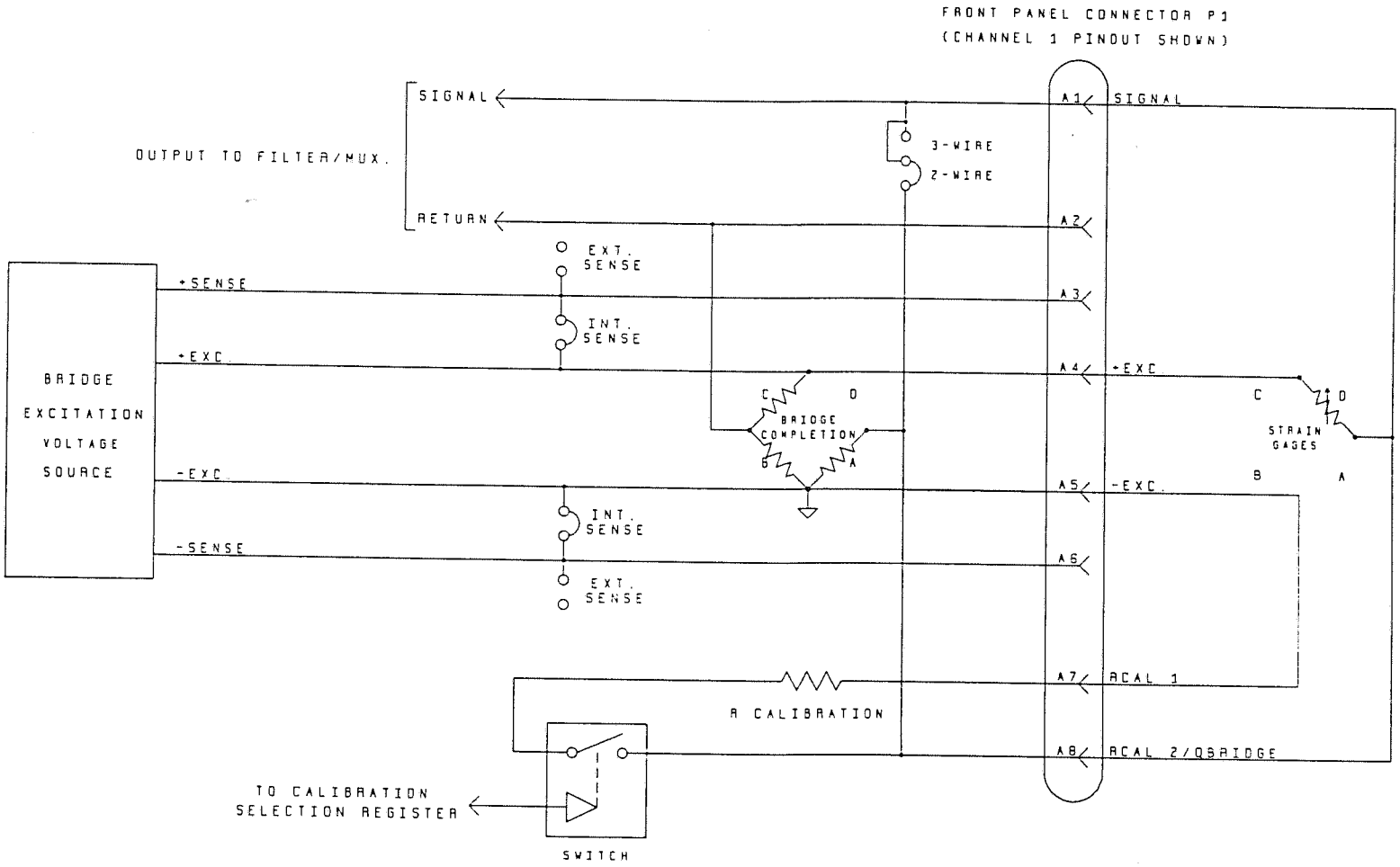


FIGURE 6 - Two-wire Quarter-bridge Configuration

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. A three-wire quarter bridge configuration can be configured by moving the 2-wire/3-wire strap to the 3-wire position. The third wire then acts as a sense lead reducing the effects of lead resistance.

3564-V2A

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

FIGURE 7 - Connector P1 Pinout

3564-V2A

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

FIGURE 7A - Connector P2 Pinout

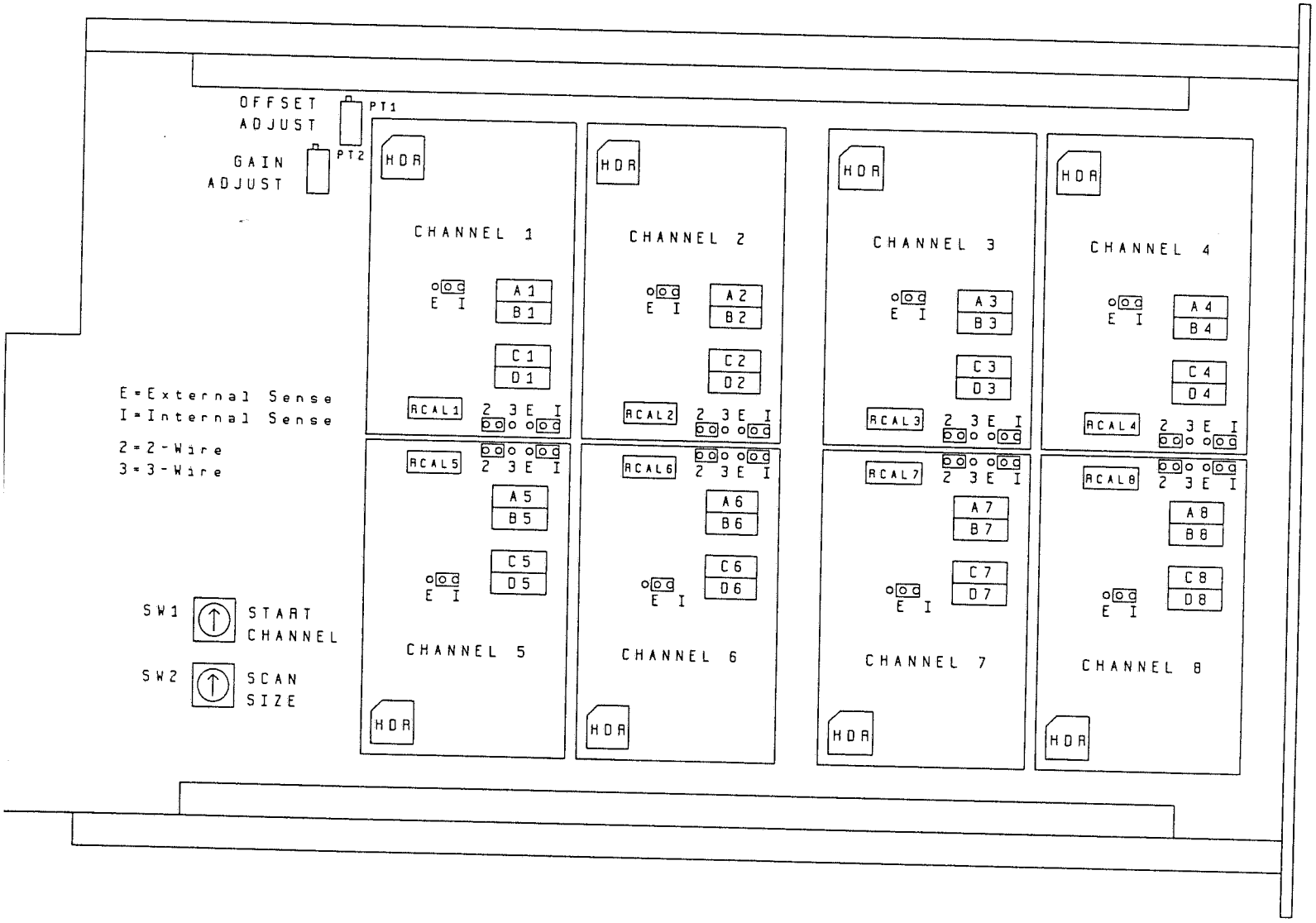


FIGURE 8 - COMPONENT AND STRAP LOCATIONS

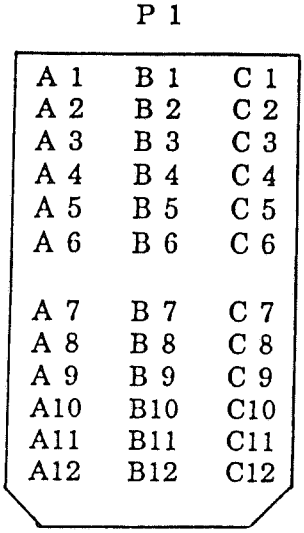


FIGURE 9 - Connector P1 and P2 Contact Layout

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