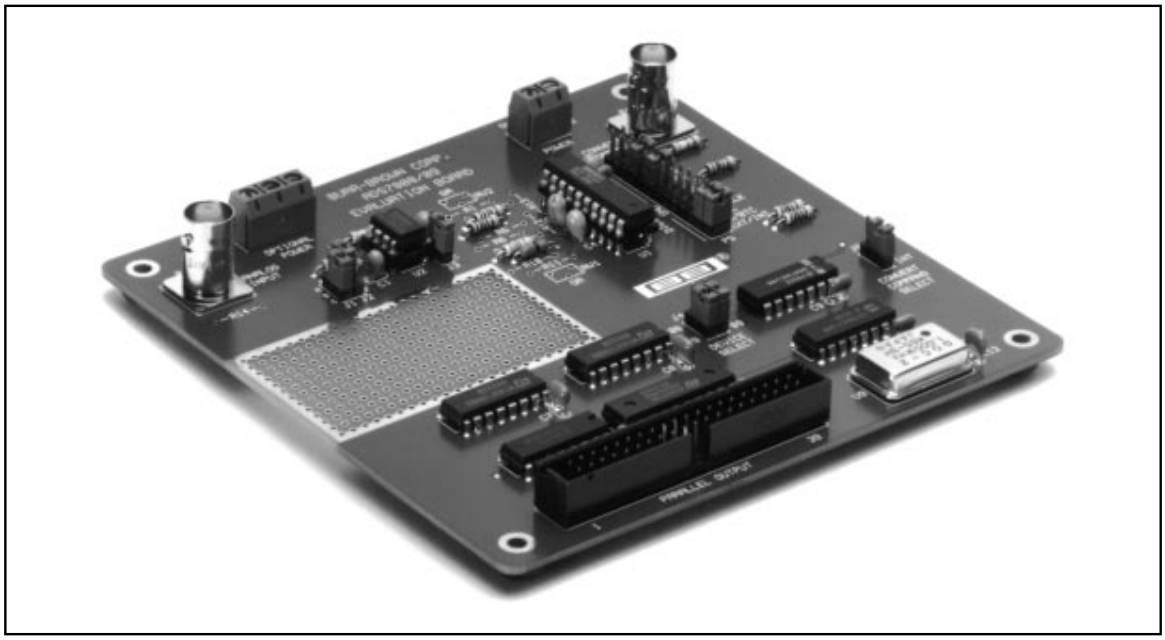
BURR - BROWN®

DEM-ADS7808/09C

EVALUATION FIXTURE



FEATURES

- **100kHz 12-BIT ADS7808P AND 16-BIT ADS7809P INCLUDED**
- **16-BIT BUFFERED PARALLEL OUTPUT**
- **CONNECTOR FOR ALL DIGITAL I/O PINS**
- **CRYSTAL OSCILLATOR BASED 100kHz CONVERT COMMAND GENERATOR**
- **EXTERNAL CONVERT COMMAND CONNECTOR**
- **PROTOTYPE AREA**

APPLICATIONS

- **EVALUATE ADS7808P AND ADS7809P PERFORMANCE**
- **BREADBOARD COMPLETE ANALOG SYSTEM**
- **EVALUATE SIMPLE TWO LAYER PCB LAYOUT**
- **INCOMING INSPECTION TEST FIXTURE**

DESCRIPTION

The DEM-ADS7808/09C Evaluation Fixture is a fully assembled printed circuit board intended to evaluate the ADS7808P and ADS7809P. This device incorporates an analog input amplifier (with provisions to bypass this amplifier), a parallel digital output buffer, a crystal oscillator based 100kHz convert command generator, an external convert command connector, and a 2.3" x 1.2" breadboard area. The DEM-ADS7808/09C achieves full converter performance on a two layer board.

This fixture requires only a single +5V power supply. An optional bipolar power supply connector is provided for the input amplifier and breadboarding.

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HOW TO USE THIS MANUAL

A table and diagrams are included in the “Factory Settings” section showing how the board is configured from the factory. A listing of other components, which are shipped with the board, is also included.

The Step-by-Step Basic Operations section describes all of the options. At the end of each step, a figure illustrates factory settings. Items installed are highlighted in these figures.

For further details on the OPA671, ADS7808P, ADS7809P or any other device on the DEM-ADS7808/09C, refer to the product data sheet for that device.

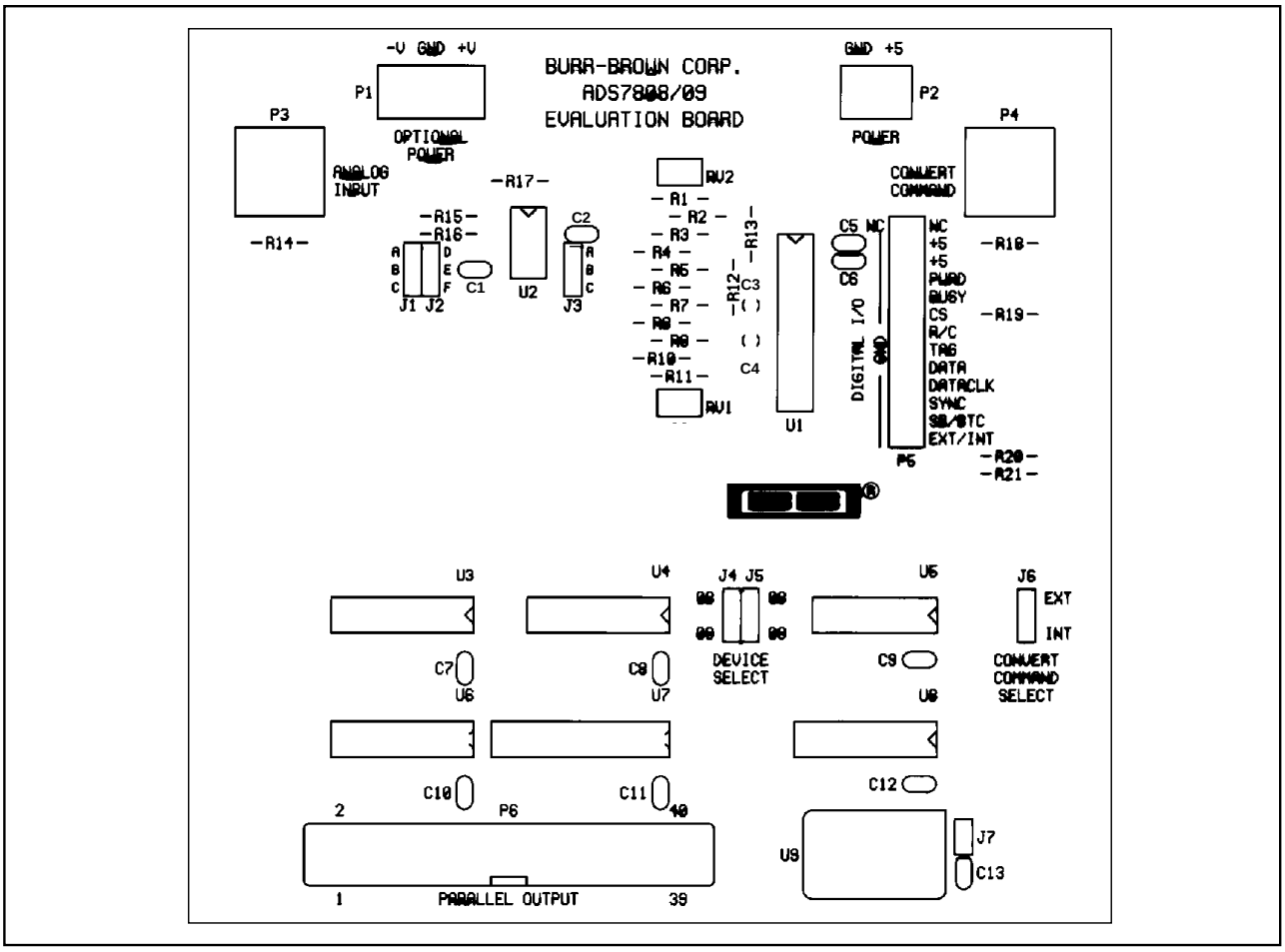


FIGURE 1. PCB Legend.

FACTORY SETTINGS

With a +5V supply connected to P2, the DEM-ADS7808/09C starts converting at 100kHz and is set for an input range of ±10V. Serial output can be read on P5, and buffered full-parallel output on P6. The following is a listing of "factory settings".

MAKE SELECTION FOR EACH STEP(1)	FACTORY SETTINGS	OTHER OPTIONS (requires alteration of the demo board, all needed components included.)
1. Device	ADS7809P installed.	ADS7808P included for installation. Switch jumper J4 and J5 to "08".
2. Input Amplifier	OPA671 bypassed.	Refer to step 2 for op amp configurations. Apply ±15V to P1.
3. Input Range	±10V	±5V, ±3.33V, 0-10V, 0-5V, 0-4V.
Offset Adjust	Trim circuit not installed.	Trim circuit resistors and potentiometer included for installation. See Step-by-Step Basic Operations, Step 3.
Gain Adjust	Trim circuit not installed.	Trim circuit resistors and potentiometer included for installation, See Step-by-Step Basic Operations, Step 3.
4. Convert Command	On-board 100kHz convert command generator connected to R/$\overline{C}$.	Apply external convert command generator, (≤100kHz) to P4 and switch J6 to "EXT".
5. Binary Format	Binary Two's Complement	Removing the SB/BTC jumper from P5 selects Straight Binary format.
6. Output Format	12/16-bit Buffered Full Parallel Output (P6)	12/16-bit Serial Output (P5)
7. Power Supplies	2-pin Power Block (P2) ready for +5V.	3-pin Power Block (P1) ready for ±15V (for use with bread-board and optional input amplifier).
NOTE: (1) Each of these steps is explained in the Step-by-Step Basic Operations Section.		

TABLE I. Quick Reference to Factory Settings and Other Options.

FACTORY SETTINGS (CONT)

Hardware	Installed	Comments
P1	Yes	3-pin Power Block
P2	Yes	2-pin Power Block
P3	Yes	PCB Mount BNC Connector
P4	Yes	PCB Mount BNC Connector
P5	Yes	13 X 2 Header
P6	Yes	20 X 2 Shrouded Header
U1	Yes	20-pin Socket for ADS7808P or ADS7809P
U2	Yes	8-pin Socket for OPA671
J1-J6	Yes	3x1 Headers
J7	No	Refer to Step-by-Step Basic Operations, Step 4B

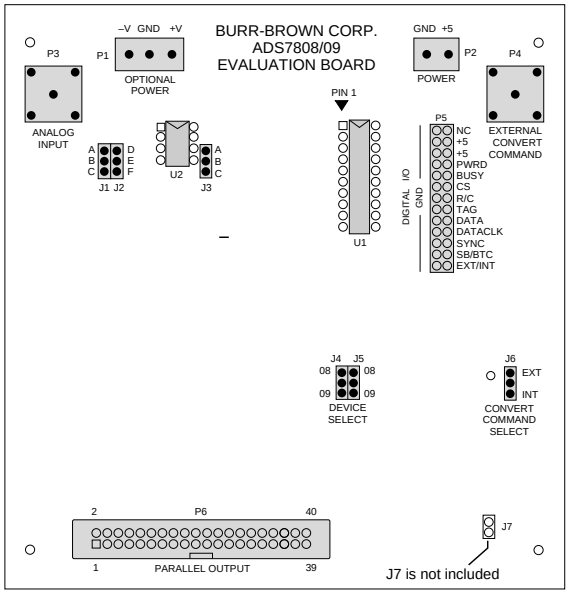


FIGURE 2. Hardware Installed.

Jumpers for:	Setting	Comments
J1, J2, J3	"BC", "DE", "BC"	U2 (Input Amplifier Socket) bypassed
J4, J5	"09"	Set for ADS7809P Operation
J6	"INT"	Crystal On-Board Convert Command Generator Selected (Outputs 100kHz to R/$\overline{C}$)
P5	Pin 19 to 20	PWRD Tied LOW
P5	Pin 15 to 16	$\overline{CS}$ Tied LOW
P5	Pin 3 to 4	SB/$\overline{BTC}$ Tied LOW
P5	Pin 1 to 2	Internal Data Clock Selected

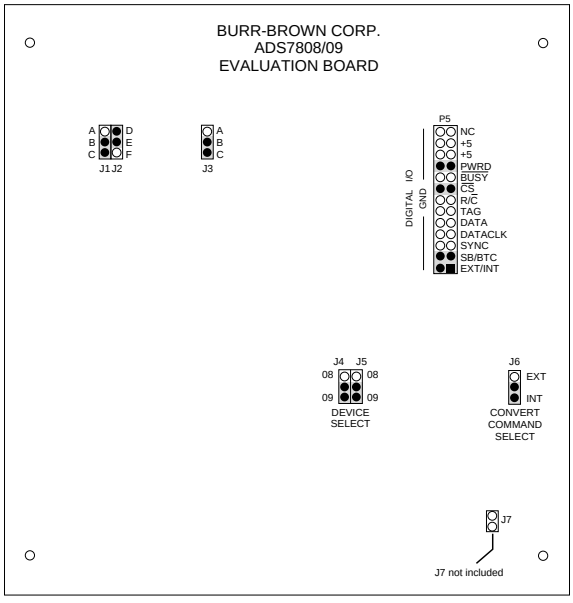


FIGURE 3. Jumpers Installed.

FACTORY SETTINGS (CONT)

ICs	Installed	Comments
ADS7808P	No	Included in Package
ADS7809P	Yes	Plugged into 20-pin Socket (U1)
OPA671	Yes	Plugged into 8-pin Socket (U2)
U3, U4	Yes	4-bit Shift Register
U5	Yes	Hex Schmit Inverter
U6	Yes	8-bit Shift Register
U7	Yes	8-bit Latch
U8	Yes	Dual Decade Counter
U9	Yes	1.000MHz Crystal Oscillator

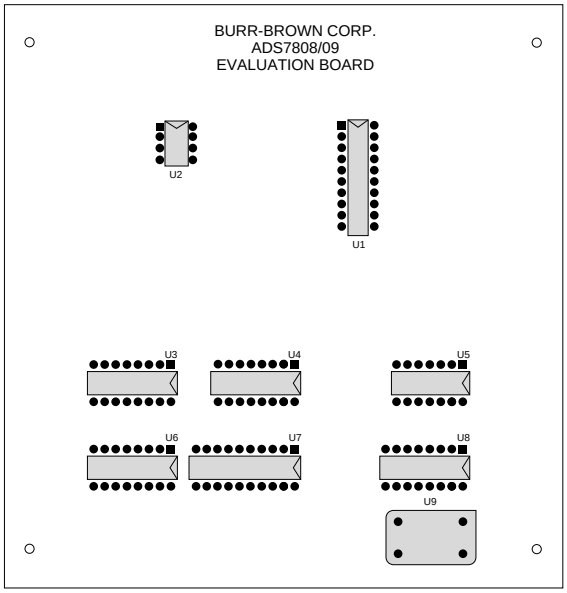


FIGURE 4. ICs Installed.

Resistors	Installed	Comments
R1	No	200Ω 1/4W 1% (1)
R2, R6, R12	No	33.2kΩ 1/4W 1% (1)
R7, R10	No	0Ω Jumper 1/4W (1)
R11	No	576kΩ 1/4W 1% (1)
R5, R13	No	100Ω 1/4W 1% (1)
R3	Yes	200Ω 1/4W 1% (1)
R4	Yes	100Ω 1/4W 1%
R8	Yes	33.2kΩ 1/4W 1%
R9	Yes	0Ω Jumper 1/4W
R14	No	Termination Resistor
R15-R17	Yes	4.99kΩ 1/4W 1%
R18	Yes	49.9Ω 1/4W 1%
R19-R21	Yes	10kΩ 1/4W 1%

Potentiometers	Installed	Comments
RV1, RV2	No	50kΩ 1/4" 10-turn (1)

Capacitors	Installed	Comments
C3, C4,	Yes	2.2µF (25V) Tantalum
C1, C2, C6 - C13	Yes	0.1µF (50V) Ceramic
C5	Yes	10µF (10V) Tantalum

NOTE: (1) Included in Package.

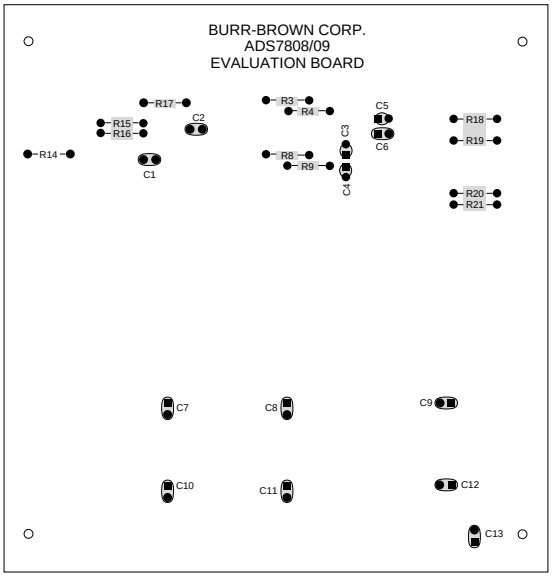


FIGURE 5. Resistors and Capacitors Installed.

STEP-BY-STEP BASIC OPERATIONS

Step 1 — ADS7808P or ADS7809P

A) To test the ADS7808P, set jumpers J4 and J5 to the "08" position and install an ADS7808P into U1.

B) To test the ADS7809P, set jumpers J4 and J5 to the "09" position and install an ADS7809P into U1.

Factory Setting: J4 and J5 set to "09", C3, C4, C5, C6 and 20-pin socket (U1) soldered to the board. ADS7809P plugged into socket (U1).

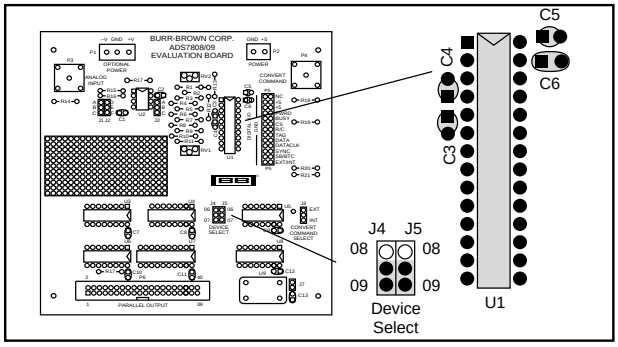


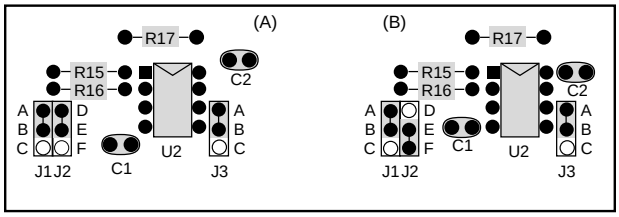
FIGURE 6. Factory Settings for Step 1.

Step 2 — On-Board Input Amplifier

To use the on-board input amplifier, supply P1 (Optional Power) with ±15V and move jumpers J1-J3 as follows:

Inverting Gain

Set jumpers J1 and J3 to AB and jumper J2 to DE (fig 6A) or EF (Fig 6B).



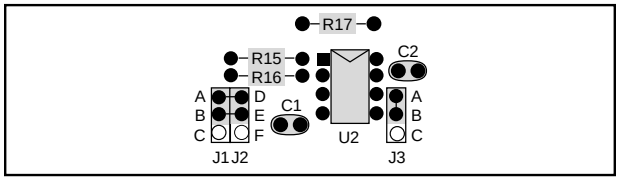
FIGURES 6a. and 6b.

The factory setting of the amplifier and resistors yields an inverting gain of two. Combinations of resistors R15, R16, and R17 will affect the gain as follows:

$$\text{Gain} = -(R17) / (R15 \parallel R16)$$

Non-Inverting Gain

Set jumber J3 to AB and combine J1 and J2 to connect B to E and A to D.



FIGURES 6c.

The factory setting of the amplifier and resistors yields a gain of three. Combinations of R15, R16, and R17 will affect the gain as follows:

$$\text{Gain} = \frac{\left[R17 + (R15 \parallel R16)\right]}{(R15 \parallel R16)}$$

NOTE: The on-board input amplifier may improve the quality of the signal reaching the ADS7808P or ADS7809P. This depends on the output characteristics of the signal generator.

Factory Setting: J1 and J3 set to BC and J2 to DE, bypassing the amplifier. R15, R16, R17, C1, C2 and 8-pin socket (U2) soldered to the board. OPA671 plugged into socket (U2).

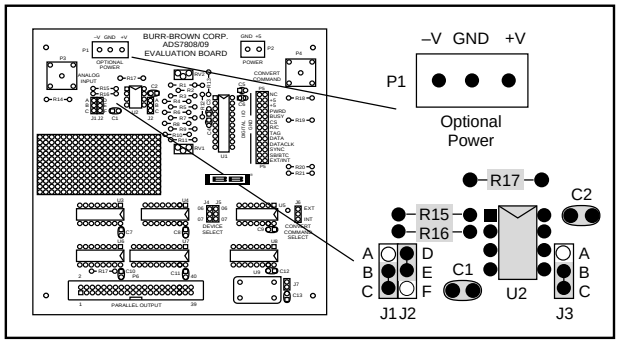


FIGURE 7. Factory Settings for Step 2.

Step 3 — Input Range, Offset/Gain Adjust

Input Range

A) Using Table II for bipolar ranges and Table III for unipolar ranges, choose the input voltage range for your application. Note that using the optional input amplifier will directly affect the input voltage seen at the converter input. (Refer to Step 2 for the gain of the amplifier in both the inverting and non-inverting configurations). Install the proper resistors.

Offset Adjust

B) To adjust offset, install the proper potentiometer and resistors, ground the input, then adjust the pot accordingly (see Table II and Figure 8).

Gain Adjust

C) To adjust gain, install the proper potentiometer and resistors, then adjust the pot accordingly. Do this for +FS and –FS (see Table II and Figure 8).

NOTE: Offset directly affects the gain. Always trim offset first. For maximum precision, more than one iteration of those adjustments may be required.

Factory Setting: ±10V input range without offset/gain trim, R3, R4, R8 and R9 soldered into board.

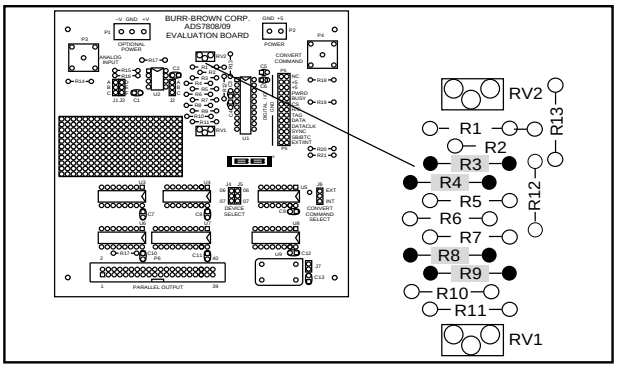


FIGURE 8. Factory Setting for Step 3.

	FOR ±10V INPUT RANGE		FOR ±5V INPUT RANGE		FOR ±3.33V INPUT RANGE	
Ref. Des. Value	With Trim	Without Trim	With Trim	Without Trim	With Trim	Without Trim
R1 (200Ω)			Install	Install		
R2 (33.2kΩ)			Install[2]			
R3 (200Ω)	Install	Install			Install	Install
R4 (100Ω)	Install	Install				
R5 (100Ω)			Install	Install	Install	Install
R6 (33.2kΩ)	Install[2]				Install[2]	
R7 (0Ω)						
R8 (33.2kΩ)		Install				Install
R9 (0Ω)	Install	Install	Install	Install	Install	Install
R10 (0Ω)						
R11 (576kΩ)	Install[1]		Install[1]		Install[1]	
R12(33.2kΩ)				Install		
R13 (100Ω)						
RV1 (50kΩ)	Install[1]		Install[1]		Install[1]	
RV2(50kΩ)	Install[2]		Install[2]		Install[2]	

NOTES: (1) Components associated with gain trim. (2) Components associated with offset trim.

TABLE II. Bipolar Input Ranges With and Without Trim.

Step 4 — On-Board or External Convert Command Generator?

A) J6 set to "INT" selects the on-board convert command generator operating at 100kHz (divided down from 1MHz by U8).

B) J6 set to "EXT" selects an external convert command generator. Apply a negative-going pulse, 100ns in duration, to P4 (External Convert Command). This connector is terminated on the board with a 50Ω resistor (R18). Adjust the voltage of the generator for a 0V to 5V swing and the pulse rate to the desired frequency (≤ 100kHz).

NOTE: When using an external convert command, the trace powering the on-board convert command generator can be cut to eliminate any noise contributions due to the oscillator. To reconnect the power, install a jumper at J7.

Factory Setting: J6 set to "INT", conversions synchronized to on-board convert command generator at 100kHz. P4, R18, C12, C13, U8 and U9 soldered to the board.

	FOR 0 TO 10V INPUT RANGE		FOR 0V TO 5V INPUT RANGE		FOR 0V TO 4V INPUT RANGE	
Ref. Des. Value	With Trim	Without Trim	With Trim	Without Trim	With Trim	Without Trim
R1 (200Ω)	Install	Install	Install	Install		
R2 (33.2kΩ)	Install[2]		Install[2]			
R3 (200Ω)					Install	Install
R4 (100Ω)			Install	Install	Install	Install
R5 (100Ω)	Install	Install				
R6 (33.2kΩ)					Install[2]	
R7 (0Ω)			Install	Install	Install	Install
R8 (33.2kΩ)						Install
R9 (0Ω)						
R10 (0Ω)	Install	Install				
R11 (576kΩ)	Install[1]		Install[1]		Install[1]	
R12(33.2kΩ)		Install		Install		
R13 (100Ω)						
RV1 (50kΩ)	Install[1]		Install[1]		Install[1]	
RV2(50kΩ)	Install[2]		Install[2]		Install[2]	

NOTES: (1) Components associated with gain trim. (2) Components associated with offset trim.

TABLE III. Unipolar Input Ranges With and Without Trim.

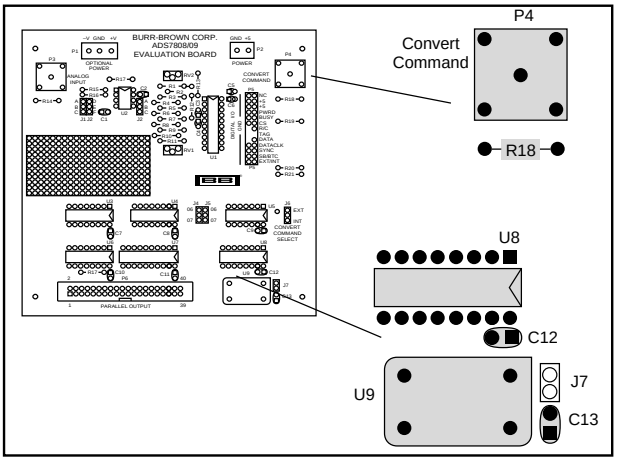


FIGURE 9. Factory Setting for Step 4.

Step 5 — SB or BTC Format?

A) To get data in Binary Two's Complement format, place a jumper from pin 3 to pin 4 on P5.

B) To get data in Straight Binary format, remove the jumper from pin 3 to pin 4 on P5.

Factory Setting: Pin 3 jumpered to pin 4 on P5, output format is Binary Two's Complement.

NOTE: Pins 1, 15 and 19 also have jumpers but are not involved in the binary output format.

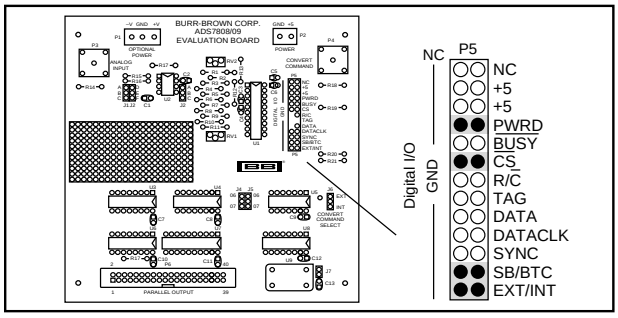


FIGURE 10. Factory Setting for Step 5.

Step 6 — Parallel or Serial Output?

Serial Output

A) To use the internal data clock, place a jumper from pin 1 to pin 2 on P5. Set J6 to "INT". Data from the last conversion will be clocked out on pin 9 of P5 at the start of a conversion synchronized to:

- 12 clock pulses output on pin 7 of P5 (ADS7808P)
- 16 clock pulses output on pin 7 of P5 (ADS7809P)

Data is valid on both the rising and falling edges of the internal data clock. Using the internal clock is preferred to optimize system performance.

B) To use an external data clock, remove the jumper from pin 1 to pin 2 on P5 and apply an external clock to pin 7 of P5. A positive SYNC pulse will follow a read command (rising edge on R/$\overline{C}$ with $\overline{CS}$ LOW or a falling edge on $\overline{CS}$ with R/$\overline{C}$ HIGH). The MSB will be valid on the first rising or falling edge of the external data clock after SYNC goes LOW. Data will be output on pin 9 of P5 synchronized to:

- 12 clock pulses input on pin 7 of P5 (ADS7808P)
- 16 clock pulses input on pin 7 of P5 (ADS7809P)

The frequency of the external clock must not exceed 10MHz. A duty cycle of 40% to 60% is suggested. $\overline{BUSY}$ (pin 17 of P5) can be used to latch the data. The data will always be from the most recently completed conversion.

Parallel Output

C) P6 outputs 16-bit buffered parallel data converted from serial to parallel via U3, U4, U6, and U7. Data can be acquired on pins:

- 1 (MSB), 3 ... 21, 23 (LSB) with pins 25, 27, 29 and 31 outputting LOWs for the ADS7808P
- 1 (MSB), 3 ... 29, 31 (LSB) for the ADS7809P

A rising edge pulse will be output on pin 33 (DATA VALID) of P6 signifying the end of a conversion and that data is valid. Data will be from the most recently completed conversion. Be sure pin 1 is tied to pin 2 of P5 with a jumper. This selects the internal data clock. Serial data will be converted to parallel.

Factory Setting: Pin 1 jumpered to pin 2 on P5. P5, P6, U3, U4, U6, and U7 soldered to the board.

NOTE: Pins 3, 15, and 19 of P5 have jumpers but are not involved with the output format. R21 is a pull-up resistor for the EXT/$\overline{INT}$ pin on the converter.

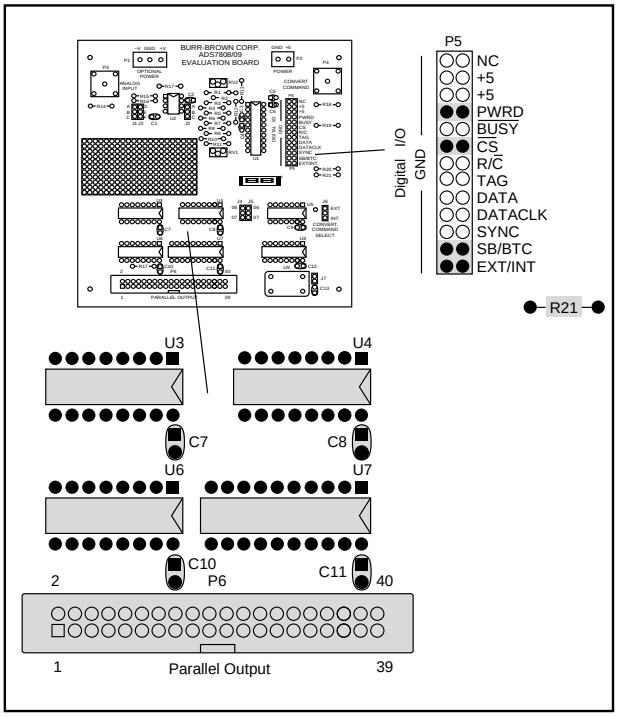


FIGURE 11. Factory Settings for Step 6.

Step 7 — Power Supplies?

A) A 5V power supply connected to P2 (POWER), is all that is required to operate the DEM-ADS7808/09C.

B) If the optional amplifier is used, P1 must be supplied with power (OPA671 requires at least ±15V for this application when using ±10V input range).

Factory Setting: P1 and P2 connectors soldered to the board and ready for connection to the appropriate power supplies.

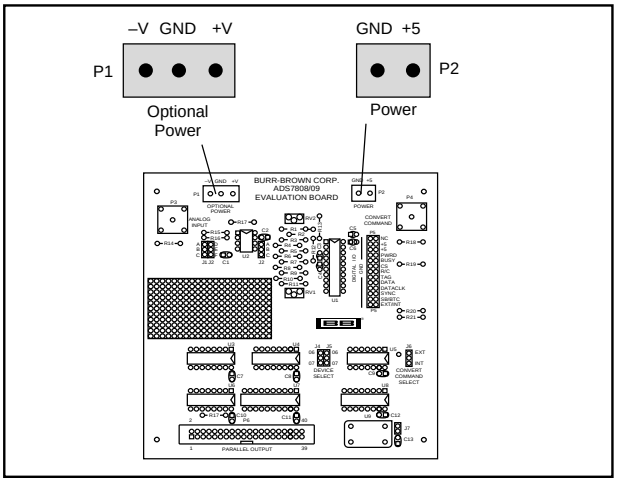


FIGURE 12. Factory Settings for Step 7.

OTHER OPTIONS

The following pins on P5 serve optional functions of the ADS7808P or ADS7809P:

PWRD	pin 19
CS	pin 15
TAG	pin 11

Refer to ADS7808P and ADS7809P product data sheets for the description of these options.

Factory Setting: PWRD tied LOW with jumper from pin 19 to pin 20. CS tied LOW with jumper from pin 15 to pin 16. TAG, no jumper.

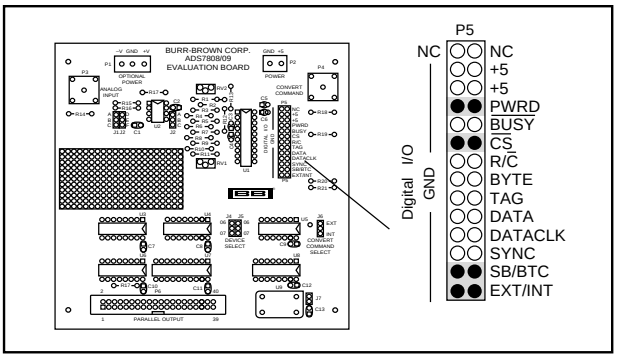


FIGURE 13. Factory Settings for Other Options.

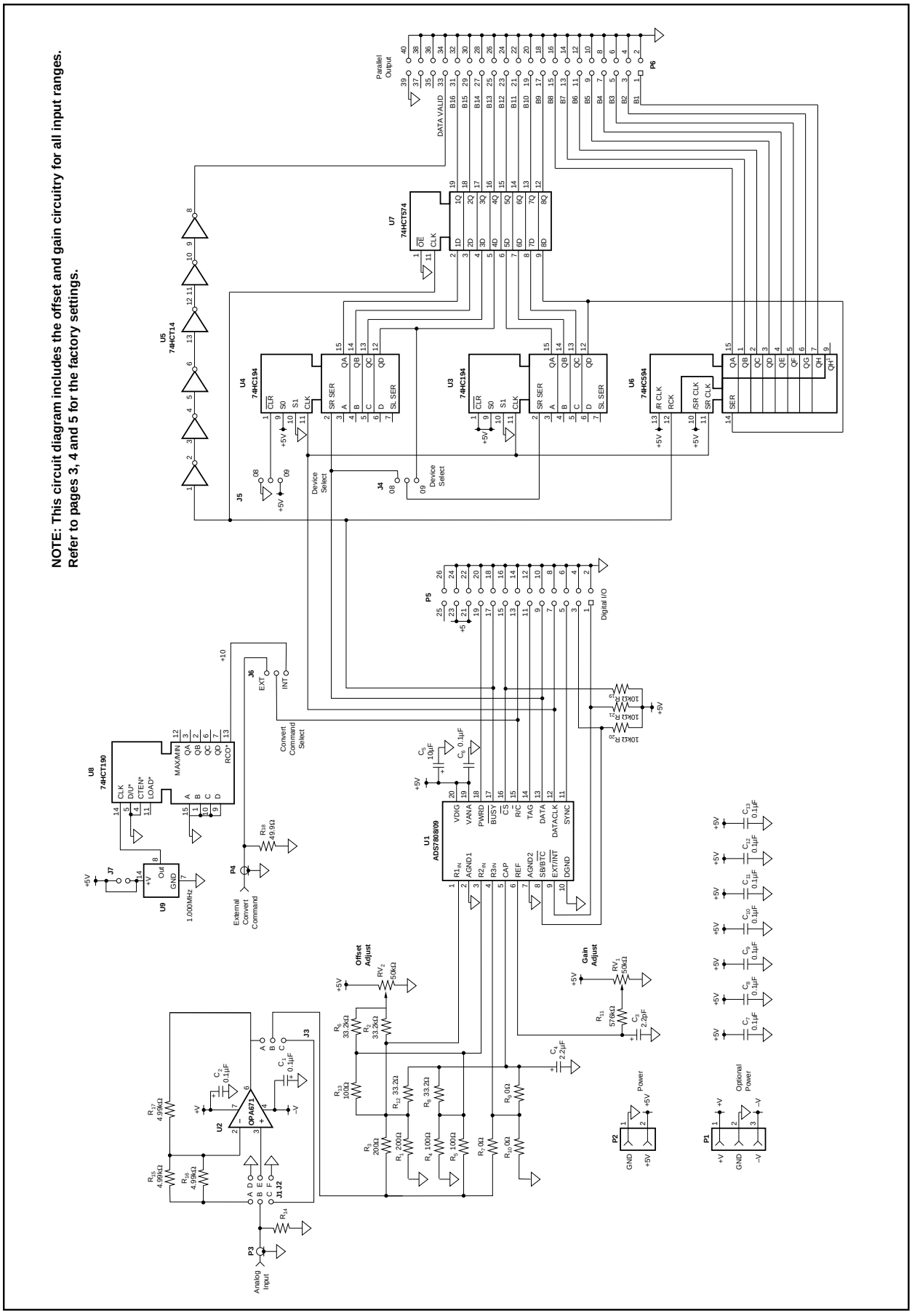


FIGURE 14. DEM-ADS7808/09C Circuit Diagram.

PIN	ADS7808/09P FUNCTION	PIN	ADS7808/09P FUNCTION
1	EXT/$\overline{INT}$	2	GND
3	SB/$\overline{BTC}$	4	GND
5	SYNC	6	GND
7	DATACLK	8	GND
9	DATA	10	GND
11	TAG	12	GND
13	R/$\overline{C}$	14	GND
15	$\overline{CS}$	16	GND
17	$\overline{BUSY}$	18	GND
19	PWRD	20	GND
21	+5	22	GND
23	+5	24	GND
25	NC	26	NC

TABLE III. Pinout of the Digital I/O Connector (P5).

PIN	ADS7808/09P FUNCTION	PIN	ADS7808/09PFUNCTION
1	Bit 1 (MSB)	2	GND
3	Bit 2	4	GND
5	Bit 3	6	GND
7	Bit 4	8	GND
9	Bit 5	10	GND
11	Bit 6	12	GND
13	Bit 7	14	GND
15	Bit 8	16	GND
17	Bit 9	18	GND
19	Bit 10	20	GND
21	Bit 11	22	GND
23	Bit 12	24	GND
25	Bit 13	26	GND
27	Bit 14	28	GND
29	Bit 15	30	GND
31	Bit 16 (LSB)	32	GND
33	DATA VALID	34	GND
35	NC	36	GND
37	NC	38	GND
39	GND	40	GND

NOTE: (1) Tag data will appear when clocking out more than 12 bits of data for the ADS7808P, or 16 bits of data for the ADS7809P, using an external data clock. Refer to the product data sheet.

TABLE IV. Pinout of the Buffered Parallel Output Connector (P6).

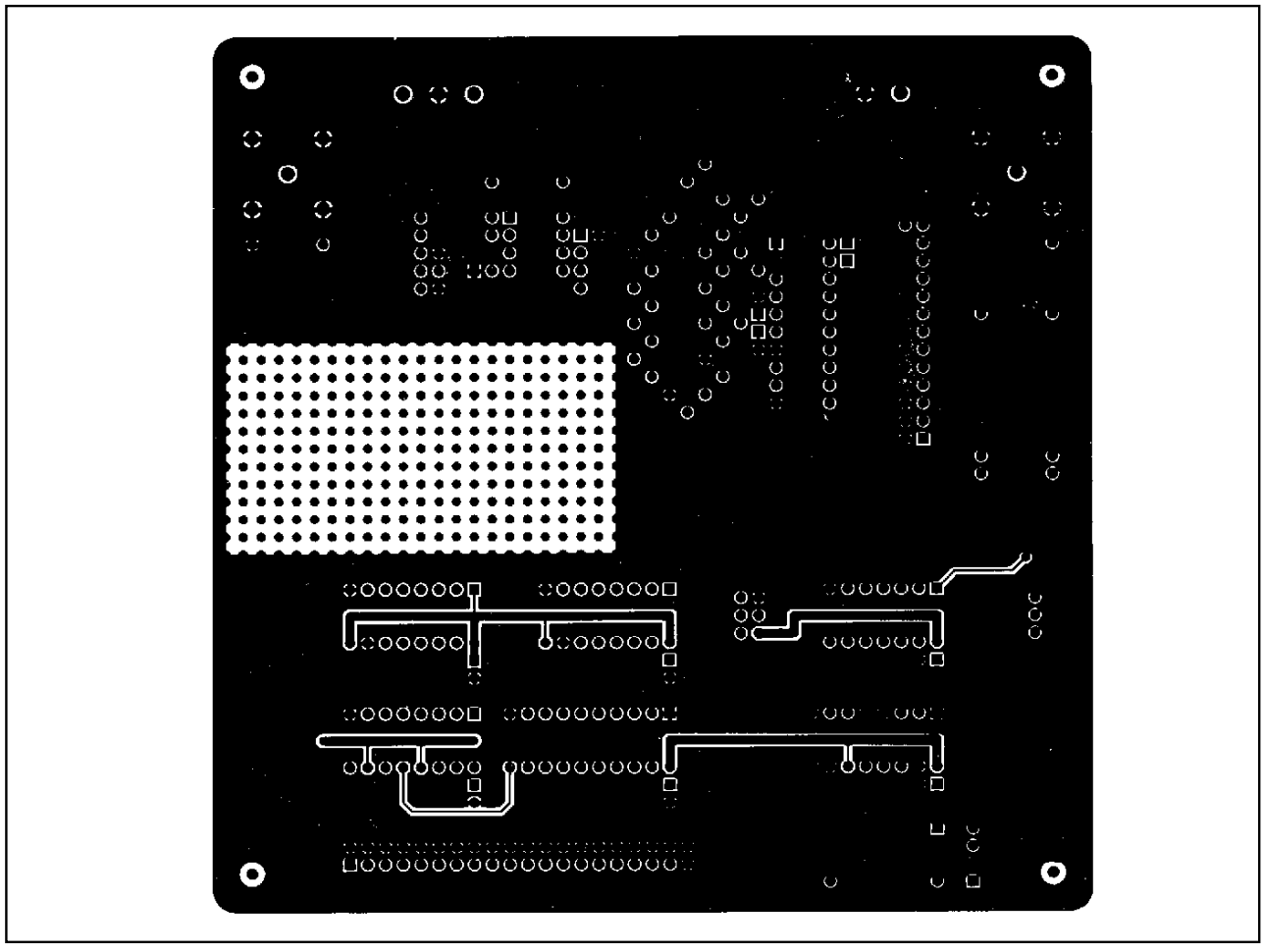


FIGURE 15. PCB Component Side

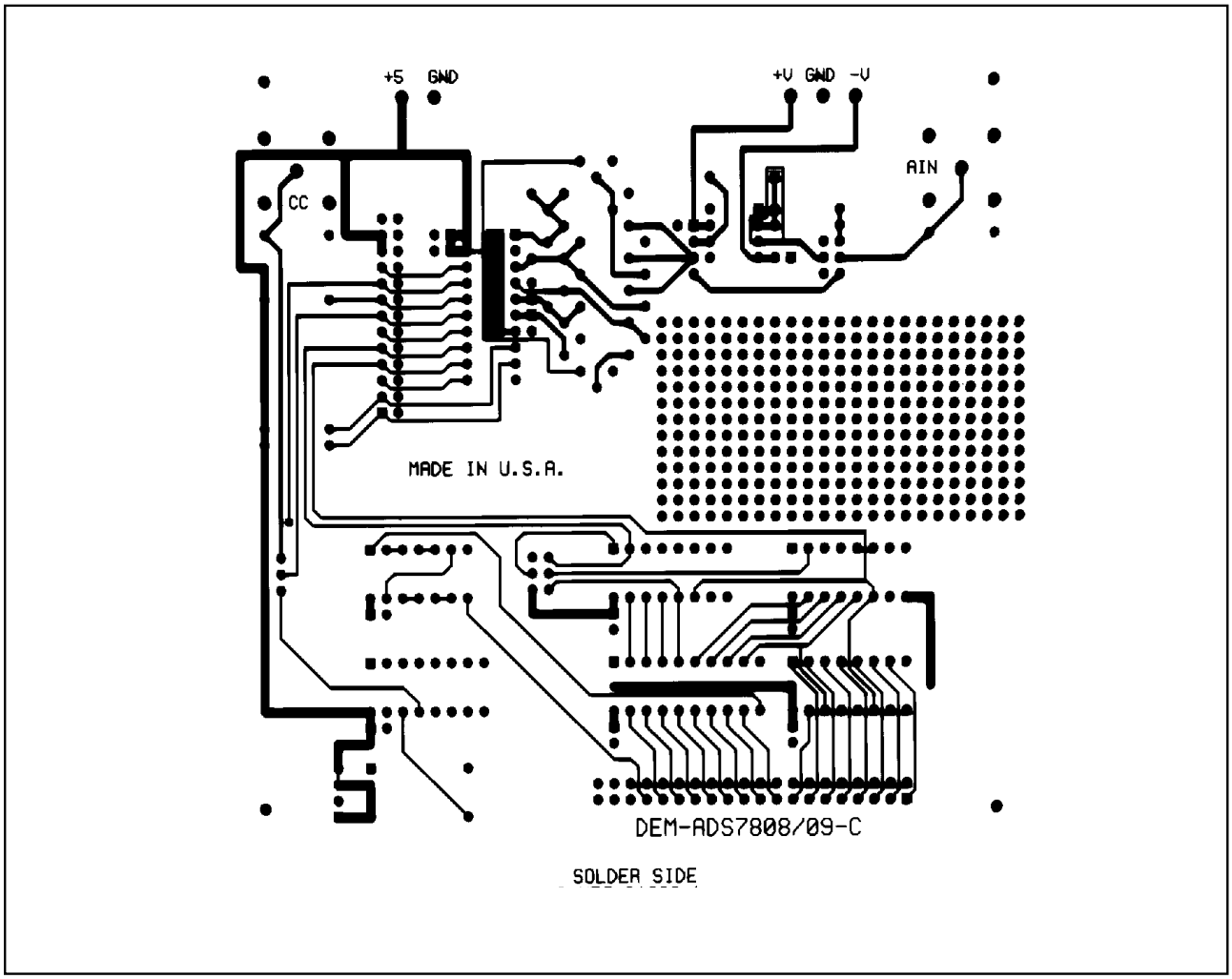


FIGURE 16. PCB Solder Side.

INSTALLED COMPONENT LIST

REFERENCE	QUANTITY	PART NUMBER	DESCRIPTION	MANUFACTURER(1)
C3, C4	2	TAP225K025SCS	2.2µF 25V Tantalum Capacitor	AVX
C1, C2, C6-C13	10	SR205C104KAA	0.1µF 50V X7R Ceramic Capacitor	Kemet
C5	1	TAP106KO10SCS	10µF 10V Tantalum Capacitor	AVX
J1-J6	6	NSH-3SB-S1-T	3x1 0.1" Header	Robinson Nugent
P1	1	ED500/3DS	3-Terminal Power Block	On-Shore Tech.
P2	1	ED500/2DS	2-Terminal Power Block	On-Shore Tech.
P3,P4	2	KC-79-274-M06	PC Mount BNC Connector	Kings
P5	1	NSH-26-DB-S1-T	13 x 2 0.1" Header	Robinson Nugent
P6	1	IDH-40LP-S3-TG	20 x 2 0.1" Shrouded Header	Robinson Nugent
R8	1	SFR55	33.2kΩ 1/4W 1% MF Resistor	Philips
R3	1	SFR55	200Ω 1/4W 1% MF Resistor	Philips
R15-R17	3	SFR55	4.99kΩ 1/4W 1% MF Resistor	Philips
R18	1	SFR55	49.9Ω 1/4W 1% MF Resistor	Philips
R19-R21	3	SFR55	10kΩ 1/4W 1% MF Resistor	Philips
R9	1	FRJ-55	0Ω Jumper (1/4W size)	Dale
R4	1	SFR55	100Ω 1/4W 1% MF Resistor	Philips
U1	1	ADS7809P	16-Bit 100kHz Sampling ADC	Burr-Brown
U2	1	OPA671AP	Op Amp	Burr-Brown
U3, U4	2	74HC194	4-Bit Shift Register DIP	T.I.
U5	1	74HCT14	Hex Schmitt Inverter DIP	T.I.
U6	1	74HC594	8-Bit Shift Register DIP	T.I.
U7	1	74HCT574	8-Bit Latch DIP	T.I.
U8	1	74HCT190	Decade Counter DIP	T.I.
U9	1	DOC-2-1.000MHz	1.000MHz Crystal Oscillator (4-Pin)	Dawia
U2	1	DIP308-11B	8-Pin DIP Socket	McKenzie
U1	1	DIP320-11B	20-Pin DIP Socket	McKenzie
	4	SJ-5003	Bumpon Hemisphere 0.44 x 0.20 Black	3M
	10	ME151-8001	0.1" Shunt Block	Mouser

NOTE: (1) For reference only. Equivalent components may be used.

PACKING LIST

REFERENCE	QUANTITY	ITEM	DESCRIPTION	MANUFACTURER(1)
Demo Board	1	DEM-ADS7808/09C	Fully assembled printed circuit board with ADS7809P installed	Burr-Brown
ADS7808P	1	PDS-1155A	ADS7808 Product Data Sheet	Burr-Brown
ADS7809P	1	PDS-1154A	ADS7809 Product Data Sheet	Burr-Brown
Demo Board Info	1	LI-457	DEM-ADS7808/09C Manual	Burr-Brown
R2, R6, R12	3	SFR55	33.2kΩ 1/4W 1% MF Resistor	Philips
R1	1	SFR55	200Ω 1/4W 1% MF Resistor	Philips
R7, R10	2	FRJ-55	0Ω Jumper (1/4W size)	Dale
R11	1	SFR55	576kΩ 1/4W 1% MF Resistor	Philips
R5, R13	2	SFR55	100Ω 1/4W 1% MF Resistor	Philips
RV1, RV2	2	RJ26FW503	50kΩ 1/4" Ten-Turn Pot	Bourns
U1	1	ADS7808P	12-Bit 100kHz Sampling ADS	Burr-Brown

NOTE: (1) For reference only. Equivalent components may be used.