D/A Converter Cards (SR9400 Series)

Smart Star Modular C-Programmable Control System

User's Manual

010417 - A

D/A Converter Cards User's Manual

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1. D/A CONVERTER CARDS

Chapter 1 describes the features of the D/A converter card, one of the I/O cards designed for the Smart Star embedded control system. The Smart Star embedded control system is described in complete detail in the ***Smart Star User's Manual***.

The Smart Star is a modular and expandable embedded control system whose configuration of I/O, A/D converter, D/A converter, and relay cards can be tailored to a large variety of demanding real-time control and data acquisition applications.

The typical Smart Star system consists of a rugged backplane with a power supply, a CPU card, and one or more I/O cards. The CPU card plugs into a designated slot on the backplane chassis, which has seven additional slots available for I/O cards to be used in any combination. A high-performance Rabbit 2000 microprocessor on the CPU card operates at 25.8 MHz to provide fast data processing.

1.1 D/A Converter Card Features

Three models of D/A converter cards are available, as shown in Table 1. Appendix A provides detailed specifications.

Table 1. Smart Star D/A Converter Cards

I/O Card	Model	Features
D/A Converter	SR9400	12-bit D/A converter, 8 channels, 0 V – 10 V
	SR9410	12-bit D/A converter, 8 channels, -10 V – +10 V
	SR9420	12-bit D/A converter, 8 channels, 4 mA – 20 mA

Appendix A provides detailed specifications.

1.2 Installing D/A Converter Cards

1. Orient the backplane with the CPU card already installed and facing towards you as shown in Figure 1.

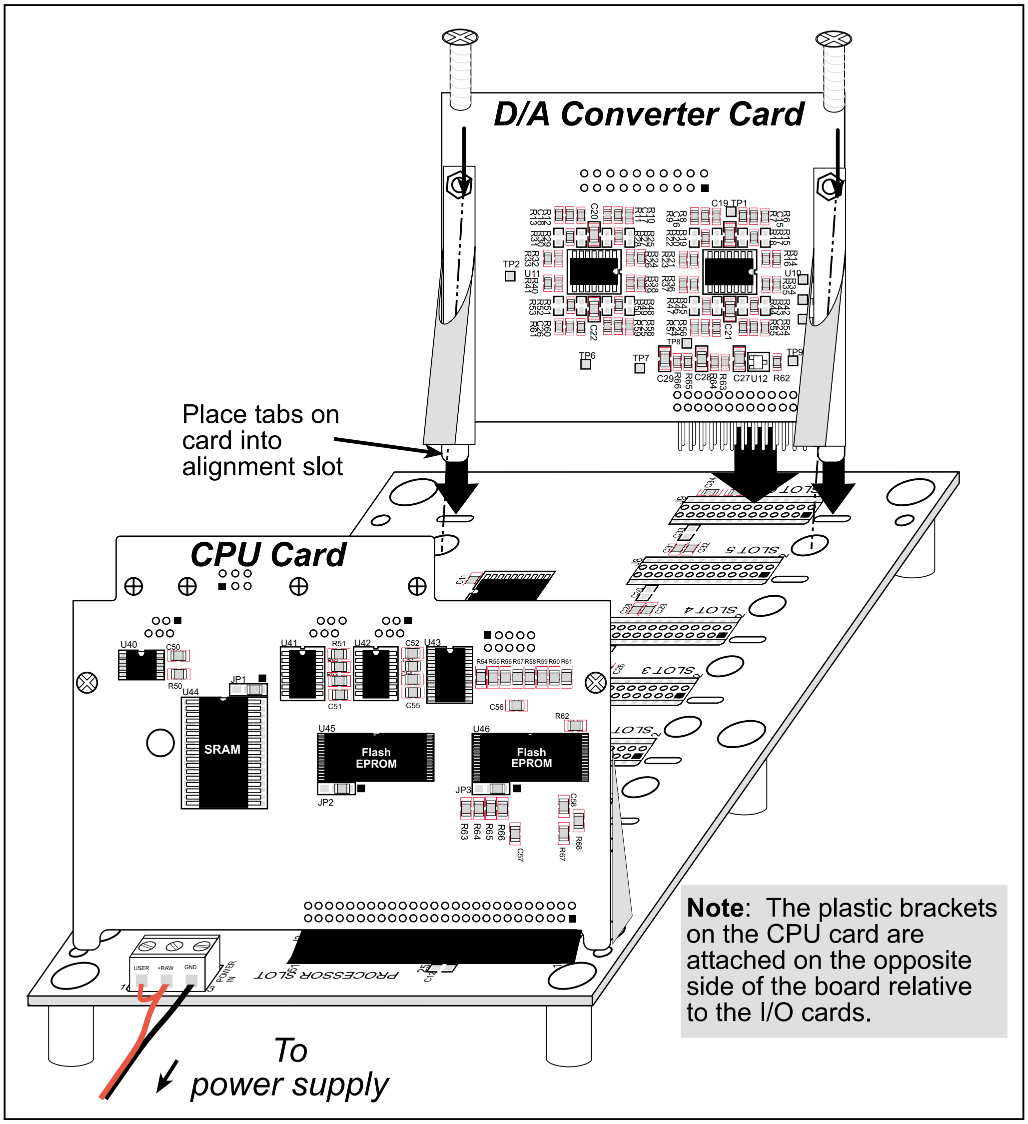


Figure 1. Installing D/A Converter Cards on the Backplane

2. Position the D/A converter card above the backplane over any unused slot position (**SLOT 0** to **SLOT 6**) as shown in Figure 1. Note the slot number and the type of I/O card since Dynamic C addresses the I/O cards by slot number.
3. Carefully insert the D/A converter card header into the slot on the backplane and line up the tabs on the card with the slots on the backplane as shown in Figure 1.
4. Use the two 4-40 screws supplied with the D/A converter card to ensure that the plastic brackets anchor the D/A converter card firmly on the backplane. Tighten the screws as needed.

1.3 User Interface

Figure 2 shows the D/A converter circuit. A buffer, U6, buffers the data signals D0–D7 from the Smart Star backplane, and sends them to the D/A converter, U2–U5. Signals D2–D5 are used to switch the chip select line to identify which D/A converter will perform the conversion. The model of D/A converter card determines the analog output ranges (0 V to 10 V, -10 V to +10 V, or 4–20 mA). The different voltage or current ranges are handled with different feedback resistors, as shown in Figure 2. A switching regulator provides a regulated power supply for the op-amps.

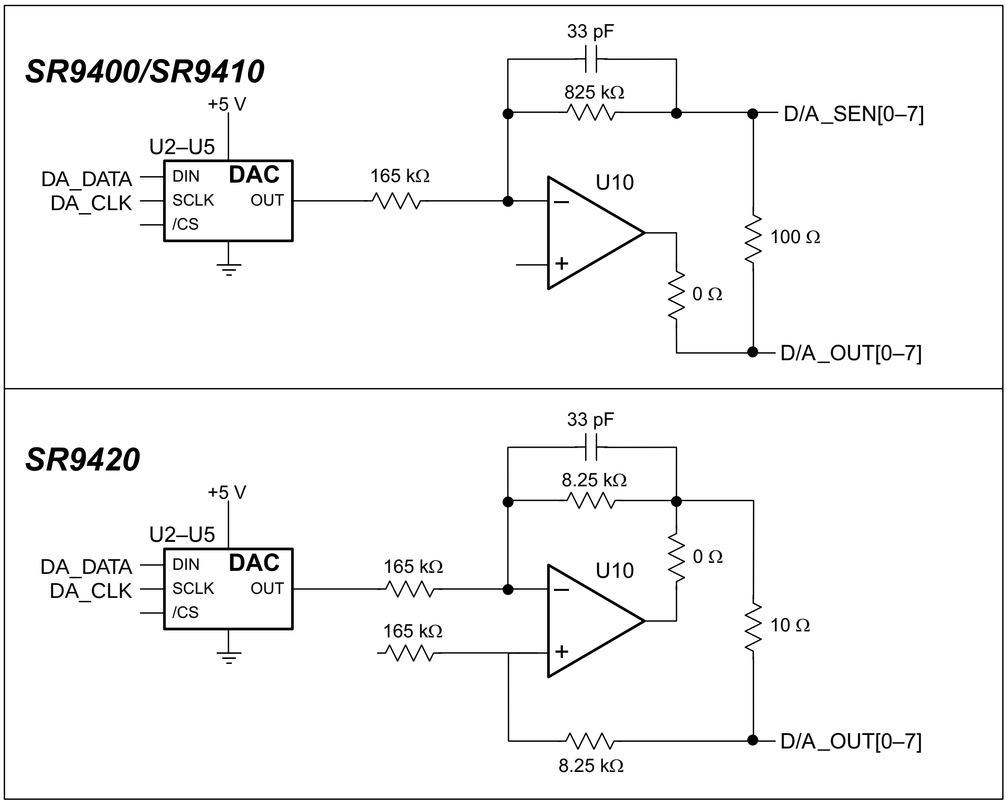


Figure 2. D/A Converter Card Circuit

The **D/A_SEN[0–7]** sensing inputs are not used when using the current source version (model SR9420) of the D/A converter card.

Figure 3 shows the complete pinout for the user interface on header J1. Note that pin 1 is indicated by a small arrow on the ribbon cable connector.

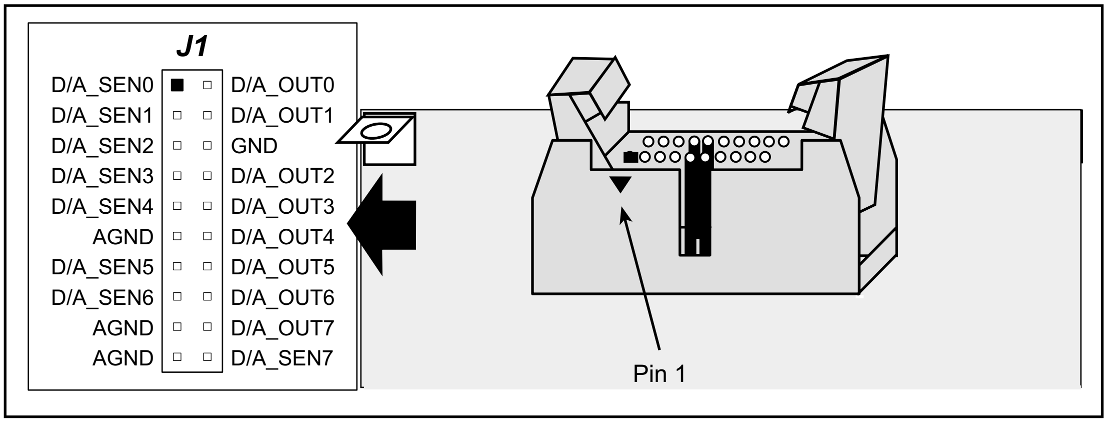


Figure 3. D/A Converter Card User Interface Pinout

The D/A converter card has eight analog output channels, **D/A_OUT[0–7]**, and is also equipped with a remote sensing capability through sensing inputs **D/A_SEN[0–7]** for the voltage-amplifier versions of the D/A converter card (models SR9400 and SR9410). These sensing inputs compensate for the voltage drop across the wire leads of low-impedance loads to provide a more precise output across the load.

Let’s look at Figure 4 to see how this happens. Assume the load is 500 Ω. If the impedance of the wire used to connect the load to the output terminal on the D/A converter card is 5 Ω, there will be a voltage drop of about 5 Ω/500 Ω = 1% across the wire. The voltage across the load will then be 1% less, which is about 40 counts for the SR9400. By connecting **D/A_SEN** as shown in Figure 4, the output driver will be able to sense the voltage drop across the wire and provide a more accurate voltage output across the load. If the load impedance is much greater than the impedance of the wire leads, simply leave the **D/A_SEN** sensing inputs open.

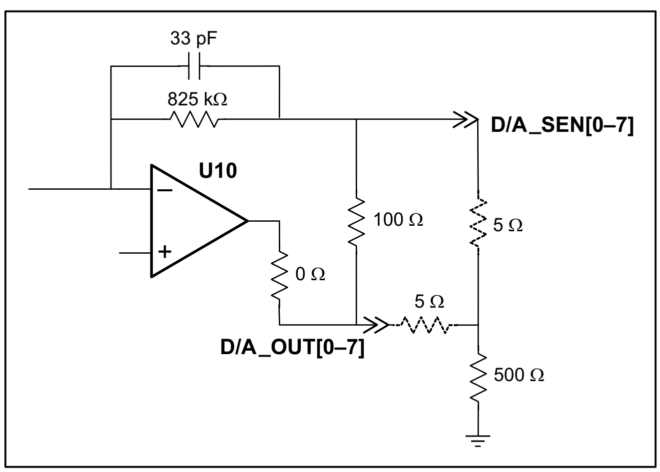
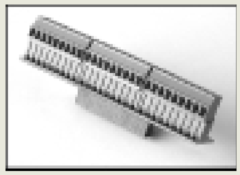
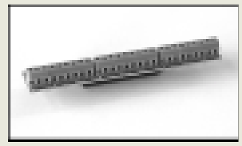


Figure 4. D/A Converter Output for Low-Impedance Loads

1.4 User Connections

Connections to the D/A converter cards are made via a ribbon cable connector or optional field wiring terminals that are either pluggable or have screw terminals. Table 2 lists the the Z-World part numbers for the FWTs.

Table 2. Guide to FWT Selection

FWT Description	I/O Cards	Z-World Part Number	
		Pluggable Terminals 	Screw Terminals 
FWT18	D/A Converter	101-0421	101-0425

Appendix B, “Field Wiring Terminals,” provides further information on FWTs, including their dimensions and pinouts.

1.5 Power Distribution

Figure 5 shows the power distribution on the D/A converter card.

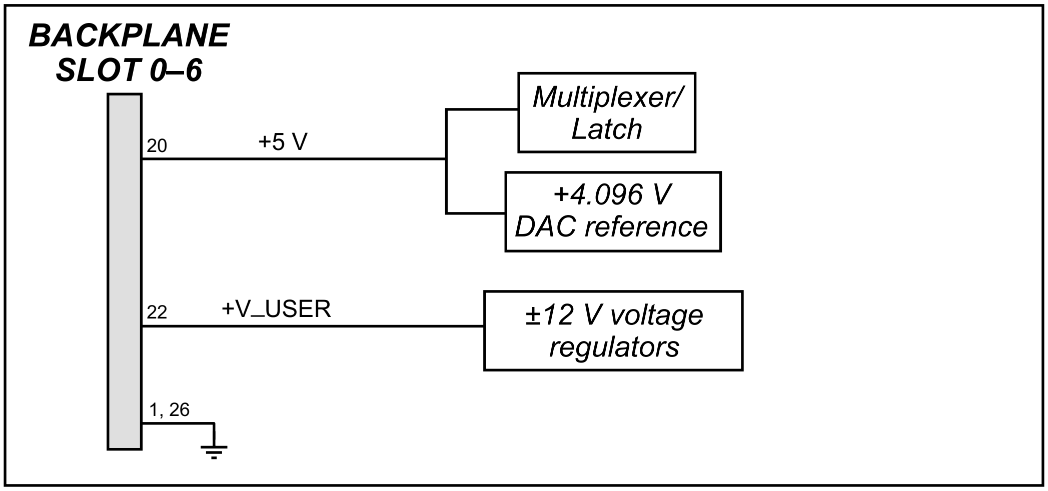


Figure 5. D/A Converter Card Power Distribution

Figure 6 shows the power supply for the op-amps used as voltage amplifiers/current sources.

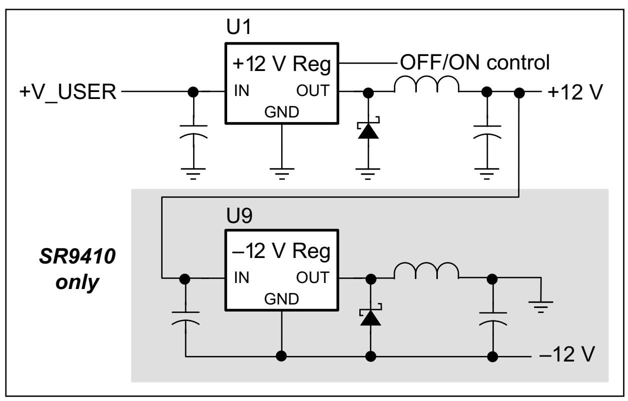


Figure 6. Op-Amp Power Supplies

There is provision in software using the **`anaOutDisable`** or the **`anaOutEnable`** function calls to turn the regulated ±12 V power supply off or on since pin 5 on U1 is connected to PE7 on the Rabbit 2000 microprocessor on the backplane. This type of disabling/enabling allows the analog output channels to float in a high-impedance state.

The voltage regulator on/off is disabled by default when there is a reset or when the D/A converter card is first used. All output channels must be configured to the required voltage or current outputs before calling the **`anaOutEnable`** function since unconfigured channels are automatically set to the maximum output.

The –12 V supply is provided only for the SR9410, which provides analog outputs up to ±10 V.

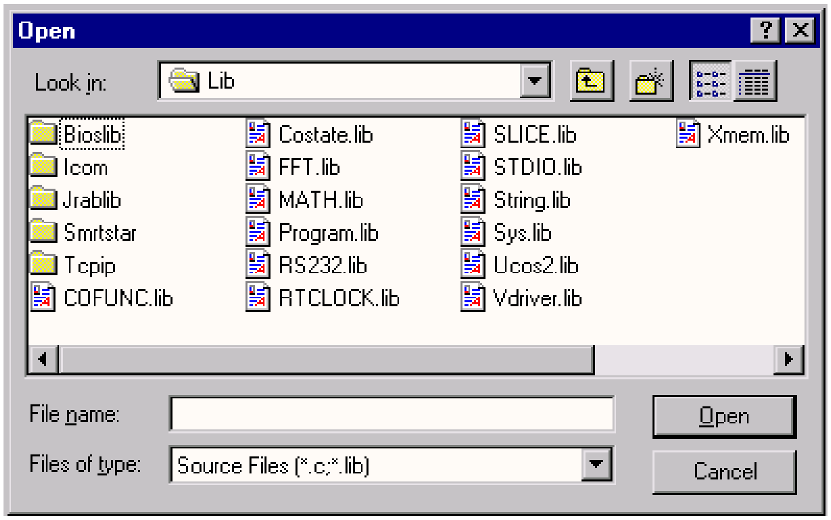
2. SOFTWARE

Dynamic C Premier is an integrated development system for writing embedded software. It runs on an IBM-compatible PC and is designed for use with Z-World controllers and other controllers based on the Rabbit microprocessor.

Chapter 2 provides the libraries, function calls, and sample programs related to the Smart Star D/A converter cards.

2.1 Dynamic C Libraries

With Dynamic C running, click **File** > **Open**, and select **`Lib`**. The following list of Dynamic C libraries and library directories will be displayed.



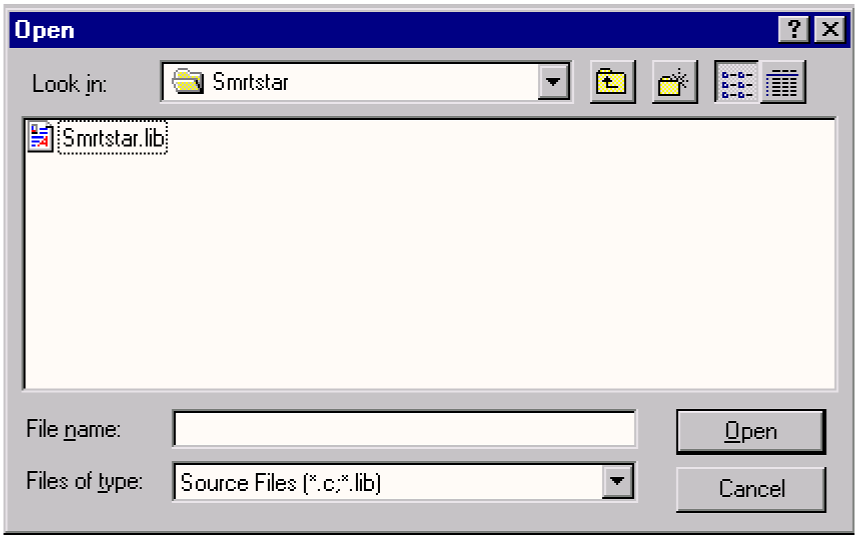
One library directory is specific to the Smart Star.

- **`SMRTSTAR`**—libraries associated with features specific to the Smart Star control system.

Other functions applicable to all devices based on the Rabbit 2000 microprocessor are described in the ***Dynamic C Premier User's Manual***.

2.1.1 Library Directories

The **`SMRTSTAR`** directory contains libraries required to operate the Smart Star control system.



- **`SMRTSTAR.LIB`**—This library supports all the functions needed by the Smart Star systems including digital I/O cards, relay cards, A/D converter and D/A converter cards, and serial communication.

Functions dealing with the D/A converter cards are described in this manual. Functions relevant to the other I/O cards are described in the manual specific to the I/O card. Functions dealing with the backplane and the CPU card are described in the ***Smart Star (SR9000) User's Manual***.

2.2 Smart Star D/A Converter Card Function APIs

`void anaOutDisable(void);`

Turns off (disables) voltage regulator for output-channel op-amps on ***all*** D/A converter cards, leaving all output channels in a high-impedance state.

Return Value

None.

See Also

`anaOutEnable, anaOut, anaOutVolts, anaOutmAmps`

`void anaOutEnable(void);`

Turns on (enables) voltage regulator for output-channel op-amps on ***all*** D/A converter cards.

The voltage regulator on/off is disabled (off) at power-up or reset. All output channels must be configured to the required voltage or current outputs before calling the **`anaOutEnable`** function since unconfigured channels will be set automatically to the maximum output.

Return Value

None.

See Also

`anaOutDisable, anaOut, anaOutVolts, anaOutmAmps`

`int anaOutEERd(int channel);`

The D/A converter card calibration constants, gain, and offset are stored in the factory in the upper half of the EEPROM on the D/A converter card. Use this function to read the D/A converter card calibration constants into the global table **`_dacCalib`**

Parameters

`channel` is the D/A converter output channel. **`channel`** should be passed as

`channel = (slotnumber * 128) + (channelnumber)`

where **`slotnumber`** is 0–6, and **`channelnumber`** is 0–7

or

`channel = ChanAddr(slotnumber, channelnumber)`

where **`slotnumber`** is 0–6, and **`channelnumber`** is 0–7.

Return Value

0 if successful.
–1—control command unacceptable.
–2—EEPROM address unacceptable.

See Also

`anaOutEEWr`

int anaOutCalib(int channel, int value1, float voltamp1, int value2, float voltamp2);

Calibrates the response of the desired D/A converter channel as a linear function using the two conversion points provided. Gain and offset constants are calculated and placed into global table **_dacCalib**.

Parameters

channel is the D/A converter output channel. **channel** should be passed as

channel = (slotnumber * 128) + (channelnumber)

where **slotnumber** is 0–6, and **channelnumber** is 0–7

or

channel = ChanAddr(slotnumber, channelnumber)

where **slotnumber** is 0–6, and **channelnumber** is 0–7.

value1 is the first D/A conversion data point. Use a value near 4095 to produce a lower output measurement.

voltamp1 is the voltage (volts) or current (milliamperes) measurement corresponding to the first D/A conversion data point.

value2 is the second D/A conversion data point. Use a value near 0 to produce a higher output measurement.

voltamp2 is the voltage (volts) or current (milliamperes) corresponding to the second D/A conversion data point.

rawcount	Approximate Output Equivalent		
	SR9400	SR9410	SR9420
0 (0000H)	+10 V	+10 V	20 mA
2047 (07FFH)	+5 V	0 V	12 mA
4095 (0FFFH)	0 V	–10 V	4 mA

Return Value

0 if successful.
–1 if not able to make calibration constants.

See Also

anaOut, anaOutVolts

`int anaSaveCalib(int boardtype);`

The calibration constants may also be saved in the flash memory on the Smart Star CPU card. Doing so will speed up D/A conversions since a memory access from flash memory will be faster than from EEPROM. Use **`anaSaveCalib`** to save the current set of calibration constants for the analog input or output channels in the Smart Star flash memory. The calibration constants stored in flash memory can then be accessed at any time with the **`anaLoadCalib`** function.

Calibration constants should first be established using **`anaOutCalib`** or obtained via **`anaOutEERd`**.

Parameter

`boardtype` is the type of board, which is 0 for the D/A converter card, 1 for the A/D converter card.

Return Value

0 if successful.
–1—attempt to write non-flash area, nothing written.
–2—**`rootSrc`** not in root.
–3—timeout while writing flash memory.
–4—attempt to write to ID block sector(s).

See Also

`anaLoadCalib, anaOutCalib`

`int anaLoadCalib(int boardtype);`

Reads a complete set of calibration constants for the analog output channels from the Smart Star flash memory on the CPU card. These should have been loaded to the flash memeory with the **`anaSaveCalib`** function.

Parameter

`boardtype` is the type of board, which is 0 for the D/A converter card, 1 for the A/D converter card.

Return Value

0 if successful.
–1—attempt to read from non-flash area.
–2—destination not all in root.

See Also

`anaSaveCalib, anaOutCalib`

int anaOut(unsigned int channel, unsigned int rawcount);

Sets the voltage of an analog output channel by serially clocking in 16 bits to a D/A converter using the following format:

- Program bits (D15…D12)
- New data (D11…D0)

D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
R1	SPD	PWR	R0	MSB	12 data bits MSB–LSB (0–4095)										LSB

SPD—Speed control bit: 1 = fast mode (default), 0 = slow mode

PWR—Power control bit: 1 = power down, 0 = normal operation (default)

The following table lists all the possible combinations of the register-selects bits R1 (Register 1) and R0 (Register 0)

R1	R0	Register
0	0	Write data to D/A converter channel B
0	1	Write data to buffer
1	0	Write data to D/A converter channel A
1	1	Reserved

Parameters

channel is the D/A converter output channel to write. **channel** should be passed as

`channel = (slotnumber * 128) + (channelnumber)`

where **slotnumber** is 0–6, and **channelnumber** is 0–7

or

`channel = ChanAddr(slotnumber, channelnumber)`

where **slotnumber** is 0–6, and **channelnumber** is 0–7.

rawcount is a value corresponding to the voltage on the analog output channel (0–4095). The following **rawcount** data correspond to the analog outputs indicated.

rawcount	Approximate Output Equivalent		
	SR9400	SR9410	SR9420
0 (0000H)	+10 V	+10 V	20 mA
2047 (07FFH)	+5 V	0 V	12 mA
4095 (0FFFH)	0 V	–10 V	4 mA

Return Value

0 if successful.
–1 if **rawcount** is greater than 4095.

See Also

anaOutVolts, anaOutCalib

void anaOutVolts(unsigned int channel, float voltage);

Sets the voltage of an analog output channel by using the previously set calibration constants to calculate correct data values.

Parameters

channel is the D/A converter output channel. **channel** should be passed as

```
channel = (slotnumber * 128) + (channelnumber)
```

where **slotnumber** is 0–6, and **channelnumber** is 0–7

or

```
channel = ChanAddr(slotnumber, channelnumber)
```

where **slotnumber** is 0–6, and **channelnumber** is 0–7.

voltage is the voltage desired on the output channel.

Return Value

None.

See Also

anaOut, anaOutCalib, anaOutmAmps

void anaOutmAmps(unsigned int channel, float current);

Sets the current of an analog output channel by using the previously set calibration constants to calculate correct data values.

Parameters

channel is the D/A converter output channel. **channel** should be passed as

```
channel = (slotnumber * 128) + (channelnumber)
```

where **slotnumber** is 0–6, and **channelnumber** is 0–7

or

```
channel = ChanAddr(slotnumber, channelnumber)
```

where **slotnumber** is 0–6, and **channelnumber** is 0–7.

current is the current (in mA) desired on the output channel.

Return Value

0 if successful.

–1 if not able to make calibration constants.

See Also

anaOut, anaOutVolts, anaOutCalib

`int anaOutEEWr(int channel);`

Writes the calibration constants, gain, and offset to the upper half of the EEPROM on the D/A converter card.

Parameters

`channel` is the analog input channel. **`channel`** should be passed as

```
channel = (slotnumber * 128) + (channelnumber)
```

where **`slotnumber`** is 0–6, and **`channelnumber`** is 0–10

or

```
channel = ChanAddr(slotnumber, channelnumber)
```

where **`slotnumber`** is 0–6, and **`channelnumber`** is 0–10.

Return Value

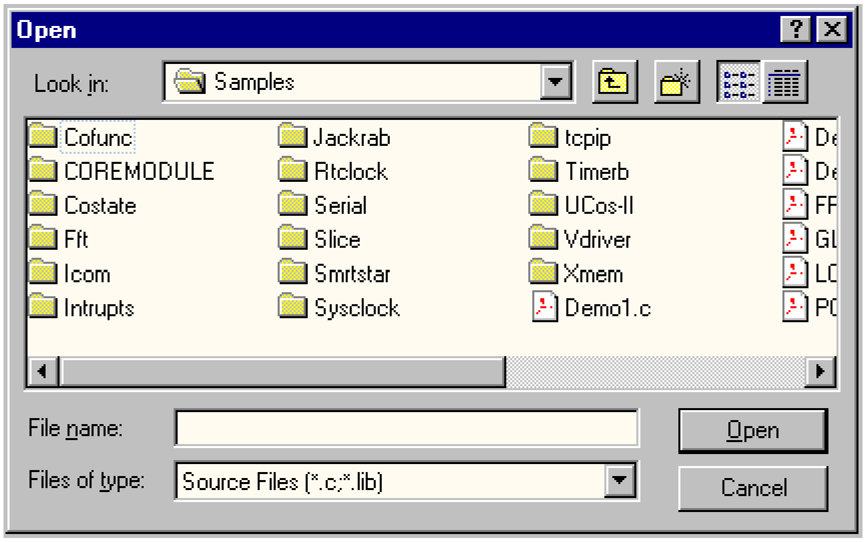
0 if successful.
-1—control command unacceptable.
-2—EEPROM address unacceptable.
-3—data value unacceptable.

See Also

`anaOutEERd`

2.3 Sample Programs

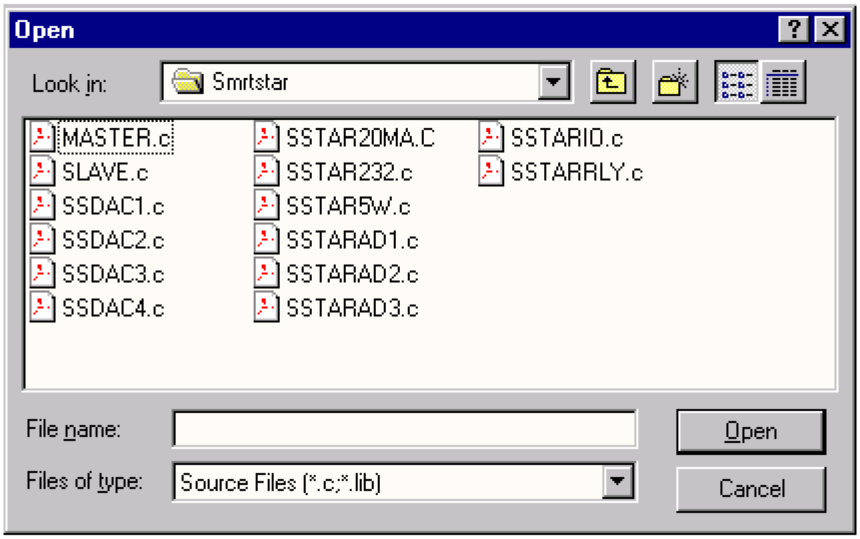
Sample programs are provided in the Dynamic C **Samples** folder, which is shown below.



The various folders contain specific sample programs that illustrate the use of the corresponding Dynamic C libraries. For example, the sample program **PONG.C** demonstrates the output to the **STDIO** window.

The **SMRTSTAR** folder provides sample programs specific to the Smart Star control system. Each sample program has comments that describe the purpose and function of the program. Follow the instructions at the beginning of the sample program.

Let's take a look at sample programs for the relay card in the **SMRTSTAR** folder.



- **SSDAC1.C**—Demonstrates how to recalibrate a D/A converter channel using two known voltages, and shows how to define the two coefficients, gain and offset, that will be rewritten into the D/A converter card's EEPROM.
- **SSDAC2.C**—Demonstrates how to recalibrate a D/A converter channel using an A/D converter card andtwo known voltages. Shows how to define the two coefficients, gain and offset, that will be rewritten into the D/A converter card's EEPROM.
- **SSDAC3.C**—Demonstrates how to recalibrate a D/A converter channel using two known currents, and shows how to define the two coefficients, gain and offset, that will be rewritten into the D/A converter card's EEPROM.
- **SSDAC4.C**—Demonstrates how to recalibrate a D/A converter channel using an A/D converter card,two known currents. Shows how to define the two coefficients, gain and offset, that will be rewritten into the D/A converter card's EEPROM.

2.4 Using Dynamic C

To run a sample program, open it with the **File** menu (if it is not still open), compile it using the **Compile** menu, and then run it by selecting **Run** in the **Run** menu. The CPU card must be in Program Mode (see Section 3.1, "Switching Between Program Mode and Run Mode," in the ***Smart Star (SR9000) User's Manual***) and must be connected to a PC using the programming cable as described in Section 2.3, "Programming Cable Connections," in the ***Smart Star (SR9000) User's Manual***.

More complete information on Dynamic C is provided in the ***Dynamic C Premier User's Manual***.

Appendix A. D/A Converter Card Specifications

Appendix A provides the specifications for the Smart Star D/A converter card.

A.1 Electrical and Mechanical Specifications

Figure A-1 shows the mechanical dimensions for the D/A converter card.

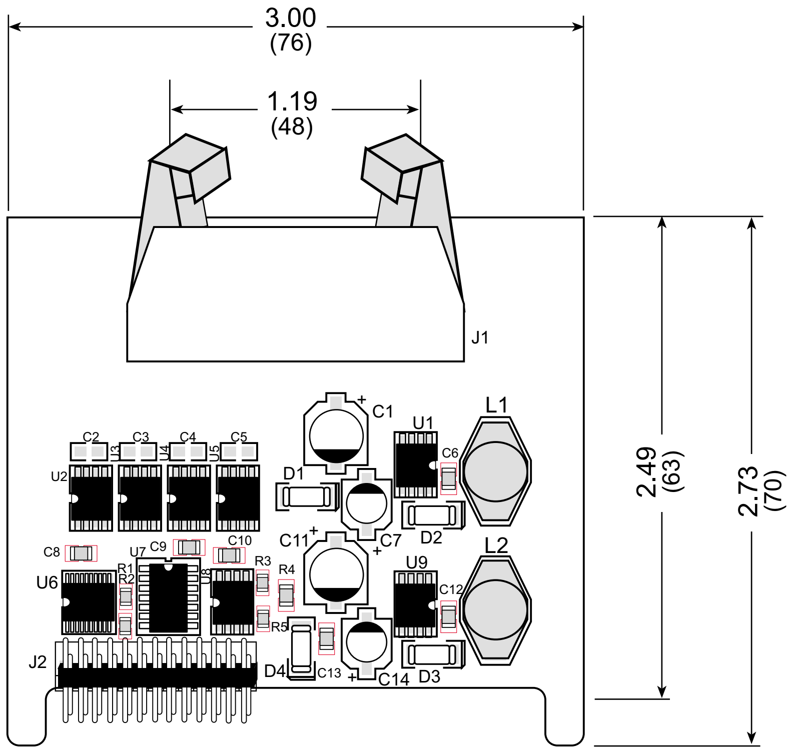


Figure A-1. D/A Converter Card Dimensions

All diagram and graphic measurements are in inches followed by millimeters enclosed in parentheses.

Table A-1 lists the electrical, mechanical, and environmental specifications for the D/A converter card.

Table A-1. D/A Converter Card Specifications

Parameter	Specification
Board Size	2.73" × 3.00" × 0.44" (70 mm × 76 mm × 11 mm)
Connectors	one 2 × 10 latch/eject ribbon connector, 0.1 inch pitch
Operating Temperature	–40°C to +70°C
Humidity	5% to 95%, noncondensing
Power Requirements	5 V DC at 50 mA typical from backplane (+5 V supply) 15 V to 30 V DC, 30 mA at 24 V DC, **+RAW/+V_USER** from backplane
Number of Outputs	8 channels
Analog Output Ranges	SR9400: 0 V to +10 V, 20 mA/channel (maximum) SR9410: –10 V to +10 V, 20 mA/channel (maximum) SR9420: 4 mA to 20 mA, 10 V (maximum)
Resolution	12 bits (0–4095)
Conversion Time (including Dynamic C)	0.2 ms/channel
Output Stability	±½ count
Output Impedance	SR9400: < 1 Ω, SR9410: < 1 Ω, SR9420: > 100 kΩ

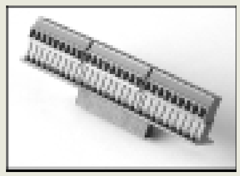
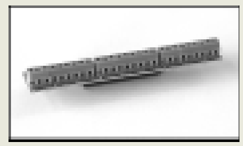
APPENDIX B. FIELD WIRING TERMINALS

Appendix B explains how to prepare the connector on an I/O card to accept a field wiring terminal, and how to secure the field wiring terminal to the I/O card. The dimensions for the field wiring terminals are included.

B.1 Selecting and Installing a Field Wiring Terminal

Connections to the I/O cards are made via a ribbon cable connector or optional field wiring terminals that are either pluggable or have screw terminals. Three different Field Wiring Terminals (FWTs) are available. Table B-1 lists the I/O cards and the Z-World part numbers for the corresponding FWTs.

Table B-1. Guide to FWT Selection

FWT Description	I/O Cards	Z-World Part Number	
		Pluggable Terminals 	Screw Terminals 
FWT27	Digital I/O (SR9200 series) Relay (SR9510)	101-0420	101-0424
FWT18	A/D Converter (SR9300 series) D/A Converter (SR9400 series)	101-0421	101-0425
FWT18R	Relay (SR9500)	101-0422	101-0426

Before you can install the FWT you selected for your I/O card, you must remove the tabs from the connector on the I/O card. To do so, move the tab inwards as shown in Figure B-1. Then insert a screwdriver into the space below the tab on the side of the connector and gently nudge the tab up and out. If you are careful, the tab will remain intact to be saved and snapped back in place for future use.

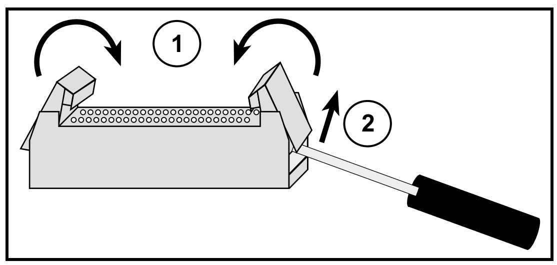


Figure B-1. Remove Tabs from Connector on I/O Card

Plug the FWT connector into the connector on the A/D converter card. Position the FWT so that the header pins on the FWT printed circuit board are towards you, as shown in Figure B-2. When you look at this assembly, pin 1 on the FWT and the pin 1 mark on the D/A converter card will then both be to the left, as shown in Figure B-2.

Position the mylar insulator above the header pins on the FWT printed circuit board and secure the FWT using the two 4-40 × ¼ screws supplied.

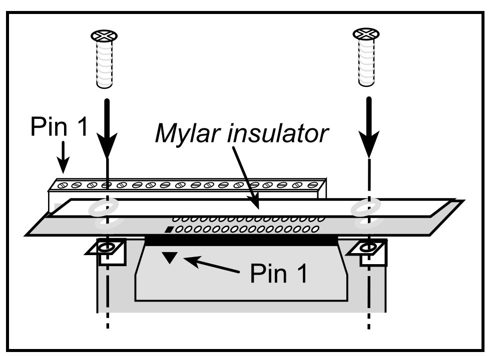


Figure B-2. Secure FWT to I/O Card

B.2 Dimensions

Figure B-3 shows the FWT dimensions.

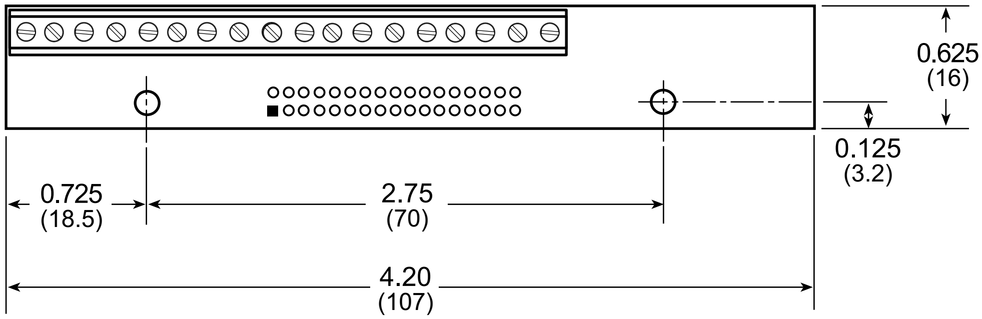


Figure B-3. FWT Dimensions

All diagram and graphic measurements are in inches followed by millimeters enclosed in parentheses.

B.3 Pinouts

Figure B-4 shows the pinout for the FWTs used on the D/A converter cards.

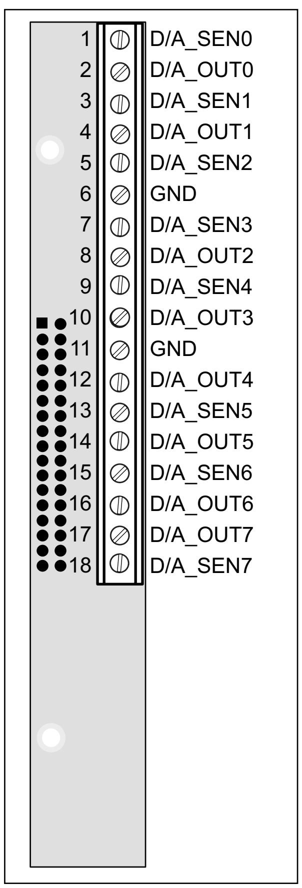


Figure B-4. FWT Pinout for D/A Converter Cards

APPENDIX C. SMART STAR SLOT ADDRESS LAYOUT

Appendix C provides information about the register addresses for the various I/O card slots on the backplane. The information in this appendix will be of interest to more advanced users.

The slots on the Smart Star backplane are accessed as external registers via the Rabbit 2000's assembly **`IOE`** prefix or via standard Rabbit BIOS functions. More convenient functions specific to the Smart Star control system have been written to provide more flexibility; for example, there is now a provision for the automatic update of shadow registers for each slot and for each register.

The Smart Star design routes four address bits to each slot, providing 16 register addresses for each slot. These bits are passed through as bits 0–3 of the register address. The slot number itself is assigned to bits 6–8 of the address. In addition, the backplane design requires that bits 13 and 14 be high and that bit 9 be low. The simplest way to enforce this is to use a base address of 0x6000. Table C-1 provides the address layout for accessing the Smart Star backplane slots, where S*n* is the binary representation of the slot number (0–6), R*n* is the binary representation of the register numbers (0–15), and *X* means the value does not matter.

Table C-1. Smart Star External Register Address Bitmap

A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1	A0
0	1	1	0	*X*	*X*	0	S2	S1	S0	*X*	*X*	R3	R2	R1	R0

This bit mapping of the external register address provides the register addresses for each slot as listed in Table C-2.

Table C-2. Slot External Register Addresses

Slot Number	Address Range
0	0x6000–0x600F
1	0x6040–0x604F
2	0x6080–0x608F
3	0x60C0–0x60CF
4	0x6100–0x610F
5	0x6140–0x614F
6	0x6180–0x618F

C.1 D/A Converter Card Channel Layout

The D/A converter card contains four two-channel 12-bit D/A converters, TLV5618, to produce 8 analog output channels. Each channel is accessed by the slot, channel and device addressing scheme. The D/A converter card also has an EEPROM to store calibration constants.

Table C-3. D/A Converter Card Control Registers

Address	Data Bits	Value	Description
0x0	D0	0	D/A converter clock line low
		1	D/A converter clock line high
	D1	X	D/A converter data input line
	D2	0	D/A converter chip select channels 0 and 1
	D3	0	D/A converter chip select channels 2 and 3
	D4	0	D/A converter chip select channels 4 and 5
	D5	0	D/A converter chip select channels 6 and 7
	D6	0	EEPROM clock line low
		1	EEPROM clock line high
	D7	X	EEPROM data line

External reads and writes (/IORD and /IOWR) control the data direction.

C.2 Channel Numbers

The numbering strategy calls for each I/O to be addressed with a channel number. There are seven slots for the I/O cards, and each slot has 16 accessable addresses of one byte each, so the decision was made to number each slot with a maximum 128 possible channels since there are then 128 directly addressable bits per slot. The existing I/O cards sold by Z-World all use less than 128 channels. Figure C-1 shows the channel numbers associated with each slot.

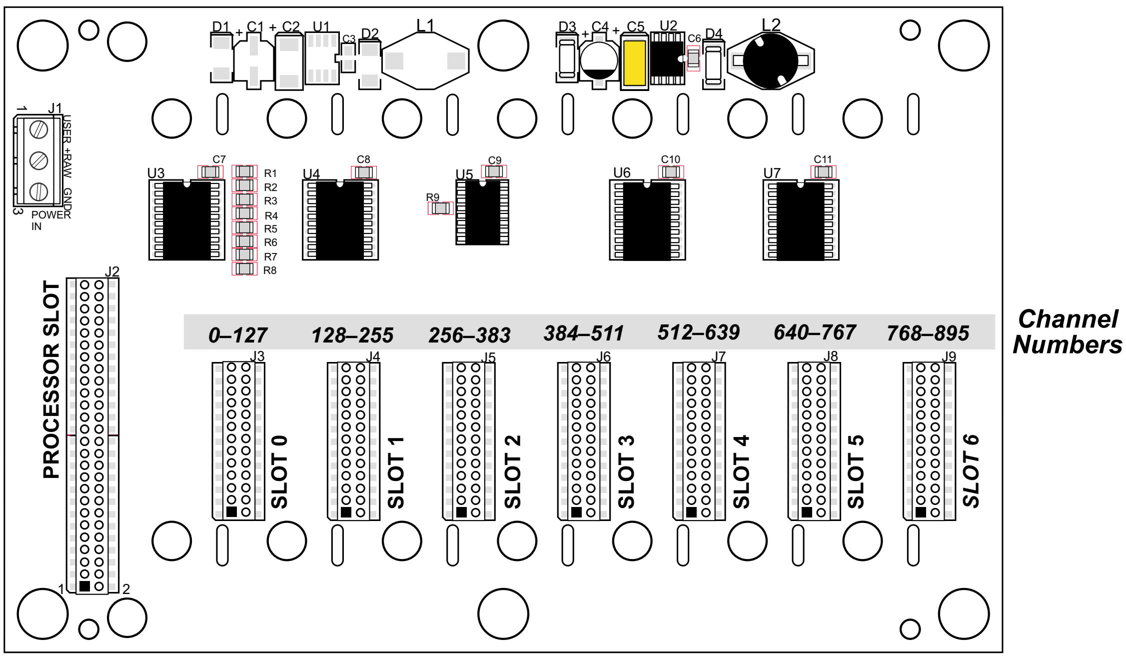


Figure C-1. Smart Star Channel Numbers

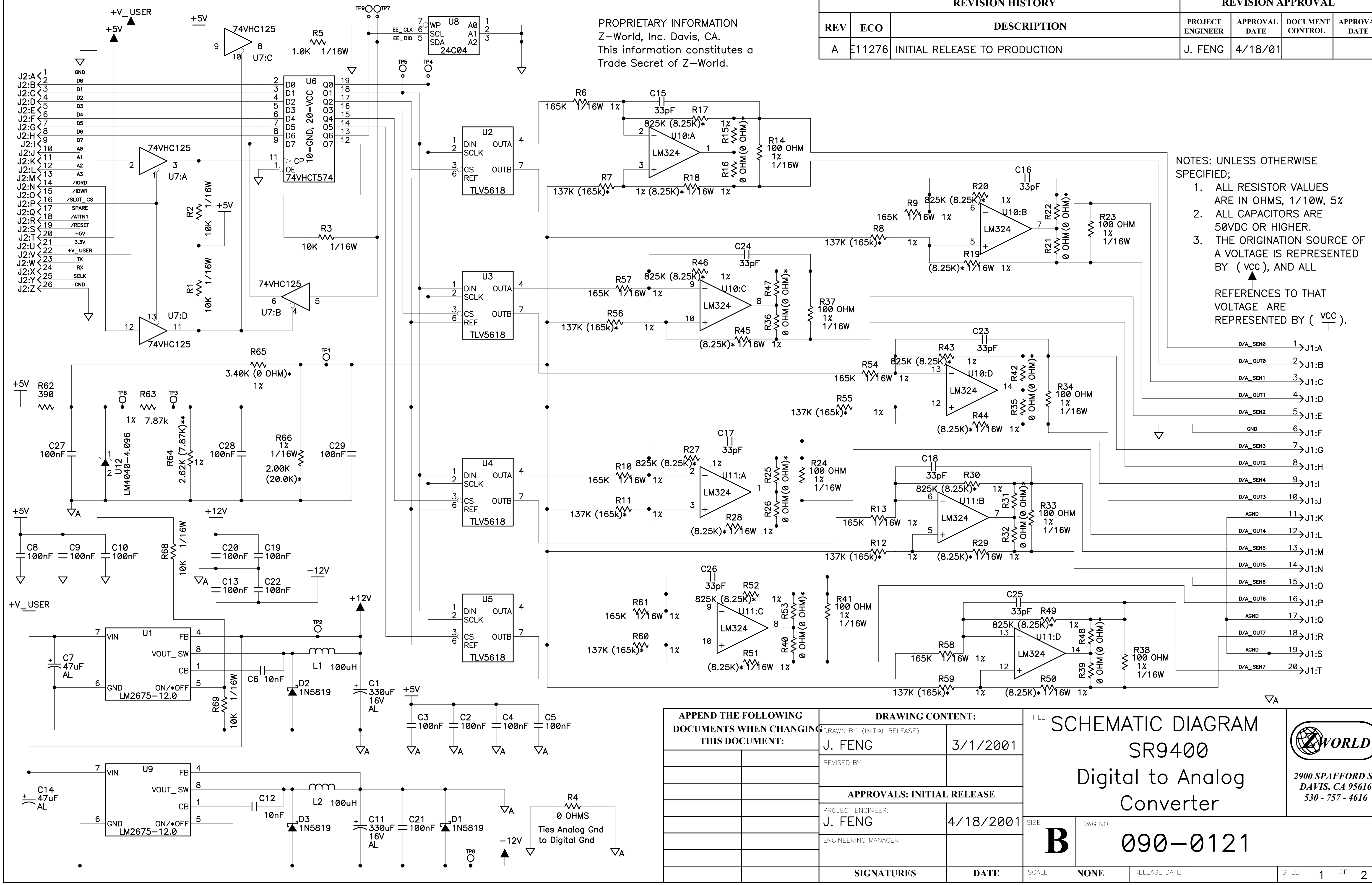
INDEX

SCHEMATICS

090-0121 D/A Converter Card (SR9400) Schematic

090-0102 FWT18 Schematic

REVISION HISTORY			REVISION APPROVAL			
REV	ECO	DESCRIPTION	PROJECT ENGINEER	APPROVAL DATE	DOCUMENT CONTROL	APPROVAL DATE
A	E11276	INITIAL RELEASE TO PRODUCTION	J. FENG	4/18/01		



NOTES: UNLESS OTHERWISE SPECIFIED;

1. ALL RESISTOR VALUES ARE IN OHMS, 1/10W, 5%
2. ALL CAPACITORS ARE 50VDC OR HIGHER.
3. THE ORIGINATION SOURCE OF A VOLTAGE IS REPRESENTED BY (VCC), AND ALL REFERENCES TO THAT VOLTAGE ARE REPRESENTED BY (VCC).

APPEND THE FOLLOWING DOCUMENTS WHEN CHANGING THIS DOCUMENT:	DRAWING CONTENT:	
	DRAWN BY: (INITIAL RELEASE) J. FENG	3/1/2001
	REVISED BY:	
	APPROVALS: INITIAL RELEASE	
	PROJECT ENGINEER: J. FENG	4/18/2001
	ENGINEERING MANAGER:	
	SIGNATURES	DATE

TITLE

SCHEMATIC DIAGRAM SR9400 Digital to Analog Converter

SIZE B

DWG NO. 090-0121

SCALE NONE

RELEASE DATE

SHEET 1 OF 2

Z-WORLD
2900 SPAFFORD ST.
DAVIS, CA 95616
530 - 757 - 4616

STUFFING TABLE

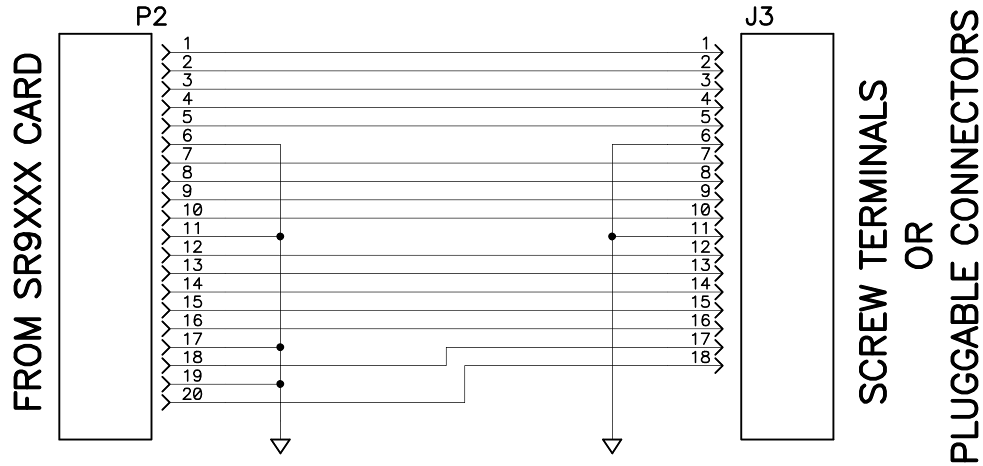
PART	SR9400 0 – +10.24V D/A CONVERTER	SR9410 –10.24 – +10.24V D/A CONVERTER	SR9420 4 – 20mA D/A CONVERTER
R63	7.87K 1% 0603	7.87K 1% 0603	15.8K 1% 0603
R64	2.62K 1% 0603	7.87K 1% 0603	10.7K 1% 0603
R65	2.80K 1% 0603	2.80K 1% 0603	0 ohm 0603
R66	2.00K 1% 0603	2.00K 1% 0603	NOT INSTALLED
R7	137K 1% 0603	137K 1% 0603	165K 1% 0603
R8	137K 1% 0603	137K 1% 0603	165K 1% 0603
R11	137K 1% 0603	137K 1% 0603	165K 1% 0603
R12	137K 1% 0603	137K 1% 0603	165K 1% 0603
R55	137K 1% 0603	137K 1% 0603	165K 1% 0603
R56	137K 1% 0603	137K 1% 0603	165K 1% 0603
R59	137K 1% 0603	137K 1% 0603	165K 1% 0603
R60	137K 1% 0603	137K 1% 0603	165K 1% 0603
R17	825K 1% 0603	825K 1% 0603	8.25K 1% 0603
R18	NOT INSTALLED	NOT INSTALLED	8.25K 1% 0603
R19	NOT INSTALLED	NOT INSTALLED	8.25K 1% 0603
R20	825K 1% 0603	825K 1% 0603	8.25K 1% 0603
R27	825K 1% 0603	825K 1% 0603	8.25K 1% 0603
R28	NOT INSTALLED	NOT INSTALLED	8.25K 1% 0603
R29	NOT INSTALLED	NOT INSTALLED	8.25K 1% 0603
R30	825K 1% 0603	825K 1% 0603	8.25K 1% 0603
R43	825K 1% 0603	825K 1% 0603	8.25K 1% 0603
R44	NOT INSTALLED	NOT INSTALLED	8.25K 1% 0603
R45	NOT INSTALLED	NOT INSTALLED	8.25K 1% 0603
R46	825K 1% 0603	825K 1% 0603	8.25K 1% 0603
R49	825K 1% 0603	825K 1% 0603	8.25K 1% 0603
R50	NOT INSTALLED	NOT INSTALLED	8.25K 1% 0603
R51	NOT INSTALLED	NOT INSTALLED	8.25K 1% 0603
R52	825K 1% 0603	825K 1% 0603	8.25K 1% 0603

PART	SR9400 0 – +10.24V D/A CONVERTER	SR9410 –10.24 – +10.24V D/A CONVERTER	SR9420 4 – 20mA D/A CONVERTER
R15	NOT INSTALLED	NOT INSTALLED	0 ohm 0603
R22	NOT INSTALLED	NOT INSTALLED	0 ohm 0603
R25	NOT INSTALLED	NOT INSTALLED	0 ohm 0603
R31	NOT INSTALLED	NOT INSTALLED	0 ohm 0603
R42	NOT INSTALLED	NOT INSTALLED	0 ohm 0603
R47	NOT INSTALLED	NOT INSTALLED	0 ohm 0603
R48	NOT INSTALLED	NOT INSTALLED	0 ohm 0603
R53	NOT INSTALLED	NOT INSTALLED	0 ohm 0603
R16	0 ohm 0603	0 ohm 0603	NOT INSTALLED
R21	0 ohm 0603	0 ohm 0603	NOT INSTALLED
R26	0 ohm 0603	0 ohm 0603	NOT INSTALLED
R32	0 ohm 0603	0 ohm 0603	NOT INSTALLED
R35	0 ohm 0603	0 ohm 0603	NOT INSTALLED
R36	0 ohm 0603	0 ohm 0603	NOT INSTALLED
R39	0 ohm 0603	0 ohm 0603	NOT INSTALLED
R40	0 ohm 0603	0 ohm 0603	NOT INSTALLED
C13	0 ohm 0805	100nF 0805	0 ohm 0805
C21	0 ohm 0805	100nF 0805	0 ohm 0805
C22	0 ohm 0805	100nF 0805	0 ohm 0805
U9	NOT INSTALLED	LM2675–12, IC	NOT INSTALLED
D1	NOT INSTALLED	1N5819, DIODE	NOT INSTALLED
D3	NOT INSTALLED	1N5819, DIODE	NOT INSTALLED
D4	NOT INSTALLED	1N5819, DIODE	NOT INSTALLED
C11	NOT INSTALLED	330 uF 16V CAP	NOT INSTALLED
C12	NOT INSTALLED	10nF 0805	NOT INSTALLED
C14	NOT INSTALLED	47uF 50V CAP	NOT INSTALLED
L2	NOT INSTALLED	100uH, IND	NOT INSTALLED
R14	100 ohm 0603	100 ohm 0603	10.0 ohm 0603
R23	100 ohm 0603	100 ohm 0603	10.0 ohm 0603
R24	100 ohm 0603	100 ohm 0603	10.0 ohm 0603
R33	100 ohm 0603	100 ohm 0603	10.0 ohm 0603
R34	100 ohm 0603	100 ohm 0603	10.0 ohm 0603
R37	100 ohm 0603	100 ohm 0603	10.0 ohm 0603
R38	100 ohm 0603	100 ohm 0603	10.0 ohm 0603
R41	100 ohm 0603	100 ohm 0603	10.0 ohm 0603

POWER TABLE

REF DES	DEVICE	DEVICE VOLTAGE INFORMATION						DEVICE: FILTER CAP REF DES(s)
		AGND	GND	+5V	+12V	–12V	NO CONNECTS	
U8	24C04		4	8				C10
U10	LM324A				4	11		C19, C21
U6	74VHC574		10	20				C8
U2	TLV5618	5		8				C2
U7	74VHC125		7	14				C9
U3	TLV5618	5		8				C3
U4	TLV5618	5		8				C4
U11	LM324A				4	11		C20, C22
U5	TLV5618	5		8				C5

REVISION HISTORY			REVISION APPROVAL			
REV	ECO	DESCRIPTION	PROJECT ENGINEER	APPROVAL DATE	DOCUMENT CONTROL	APPROVAL DATE
A	E11217	INITIAL RELEASE				
B	E11450	CONNECTED P2 PIN1 TO J3 PIN1, REMOVED GND	DM	15MAR01		



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	DRAWN BY: (INITIAL RELEASE) KEITH HOEK	08DEC99
	REVISED BY: DARREN MUSGROVE	15MAR01
	APPROVALS: INITIAL RELEASE	
	PROJECT ENGINEER:	
	ENGINEERING MANAGER:	
	SIGNATURES	DATE

TITLE SCHEMATIC DIAGRAM
SR9XXX
18 POSITION
FIELD WIRING TERMINAL

Z-WORLD
2900 SPAFFORD ST.
DAVIS, CA 95616
530 - 757 - 4616

SIZE	DWG NO.
A	090-0102

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