

# DCX-127

## Multifunction Module

### User's Guide



#### **NOTICE TO EU CUSTOMERS**

This product is not updated to comply with RoHS Directive 2011/65/EU and, as of July 22, 2019, will not be shipped to the European Union (EU). Customers may be able to purchase products from inventory that were placed on the EU market prior to July 22, 2019 until supplies are depleted. Audio Precision is committed to assisting with your audio measurement needs. Please contact your local AP sales representative for further assistance or to determine if alternative product(s) are available.

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## Safety Information

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Do NOT service or repair this product unless properly qualified. Only a qualified technician or an authorized Audio Precision distributor should perform servicing.

Do NOT defeat the safety ground connection. This product is designed to operate only from a 50/60 Hz AC power source (250 Vrms maximum) with an approved three-conductor power cord and safety grounding. Loss of the protective grounding connection can result in electrical shock hazard from the accessible conductive surfaces of this product.

For continued fire hazard protection, fuses should be replaced ONLY with the exact value and type as indicated on the rear panel and in Section of this document. The AC voltage selector also must be set to the same voltage as the nominal power source voltage (100, 120, 230, or 240V rms) with the appropriate fuses installed.

The International Electrotechnical Commission (IEC 1010-1) requires that measuring circuit terminals used for voltage or current measurement be marked to indicate their *Installation Category*. The Installation Category is defined by IEC 664 and is based on the amplitude of transient or impulse voltage that can be expected from the AC power distribution network. This product is classified as INSTALLATION CATEGORY II, abbreviated “**CAT II**” on instrument front panels.

Do NOT substitute parts or make any modifications without the written approval of Audio Precision. Doing so may create safety hazards.

This product is for indoor use - pollution degree 2.

Use this equipment only for switching applications as described in this manual.

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## Safety Symbols

The following symbols may be marked on the panels or covers of equipment or modules:



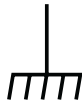
**WARNING!** - This symbol alerts you to a potentially hazardous condition, such as the presence of dangerous voltage that could pose a risk of electrical shock. Refer to the accompanying Warning Label or Tag, and exercise extreme caution.



**ATTENTION!** – This symbol alerts you to important operating considerations or a potential operating condition that could damage equipment. Refer to the User’s Manual or Operator’s Manual for precautionary instructions.



**FUNCTIONAL EARTH TERMINAL** – This symbol marks a terminal that is electrically connected to a reference point of a measuring circuit or output and is intended to be earthed for any functional purpose other than safety.



**PROTECTIVE EARTH TERMINAL** – This symbol marks a terminal that is bonded to conductive parts of the instrument. Confirm that this terminal is connected to an external protective earthing system.

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## Disclaimer

Audio Precision cautions against using their products in a manner not specified by the manufacturer. To do otherwise may void any warranties, damage equipment, or pose a safety risk to personnel.

## Description

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### Scope of This Manual

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This manual serves several purposes:

- It will help you install the DCX-127 Multifunction Module. In addition to the instrument capabilities, descriptions of all connectors are given.
- It presents specifications of the DCX-127.
- It contains some fundamental APWIN assistance relating to the use of the DCX-127.

### Introduction

---

The DCX-127 Multifunction Module contains an autoranging 4-1/2 digit dc voltmeter-ohmmeter, two 20-bit programmable dc voltage sources, 21 bits of digital I/O, and three 8-bit programmable auxiliary output ports for device control or status indicators. Typical applications include A/D and D/A converter testing, VCA gain control linearity, VCA distortion, amplifier dc offset and power supply checks, power amplifier load switching control, loudspeaker voice coil resistance measurements, temperature measurements, and test fixture control.

The DCX-127 also provides pulses and dc levels whose timing depend upon key software actions such as end of sweep, analyzer channel selection, or data settling. These may be used for synchronization and sequencing of external devices or portions of the test system such as the triggered sine burst generator.

The DCX-127 functions include:

- DC voltage and resistance measurement from 200 mV to 500 V and 200  $\Omega$  to 2 M $\Omega$  full scale, fully floating and guarded for accurate measurements in the presence of large common mode voltages. Readings can be offset and scaled by the software.

- Resistance measurements using either 4-wire or 2-wire techniques.
- Two independently programmable bipolar floating DC voltage outputs, each with a  $\pm 10.5$  V range, 20  $\mu$ V resolution and monotonicity to 40  $\mu$ V (19 bits). The software can sweep either dc source.
- Digital input of static or low-speed parallel input, word width up to 21 bits.
- Digital output of a parallel digital word of 21 bits.
- A simplified 8-bit program control interface that can be defined to execute any pre-defined keystroke sequence. This can be used to run different software procedures based upon switch closures.

All the DCX-127 output functions are controlled from APWIN software, and all of the inputs are displayed in APWIN software and may be displayed as bargraphs or plotted values during a sweep when appropriate.

The DCX-127 Multifunction Module is a separate unit packaged in a one-rack-unit high case that may be rack-mounted or used as a bench instrument.

The following sections describe the capabilities in greater detail. Complete specifications can be found at the end of this manual.

## DC Voltage Measurements

The DCX-127 includes a 4-1/2 digit autoranging dc voltmeter-ohmmeter. In voltage mode, the meter will automatically select among its 200 mV, 2 V, 20 V, 200 V, or 500 V ranges for best resolution of the measured signal. It may also be fixed on any of its ranges. The meter has selectable reading rates of 6 or 25 readings per second. The 6/second selection provides full 4-1/2 digital resolution (20,000 counts full scale). The 25/second selection also displays 4-1/2 digits, but the last digit will always be either 0 or 5. Normal mode rejection and common mode rejection also degrade by approximately a factor of

four when the 25/second reading rate is selected. Resolution versus range and reading rate are shown in Table 1.

*Table 1. Reading rate for various ranges*

Range	Resolution 6/s Rate	Resolution 25/s Rate
200 mV	10 $\mu$ V	50 $\mu$ V
2 V	100 $\mu$ V	500 $\mu$ V
20 V	1 mV	5 mV
200 V	10 mV	50mV
500 V	100 mV	500 mV

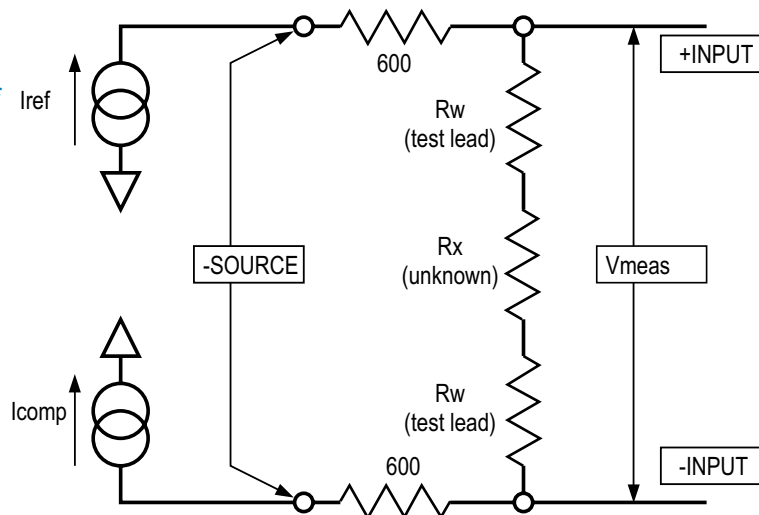
## Resistance Measurements

The resistance mode operates by forcing a calibrated value of current through the unknown resistance and measuring the consequent voltage drop. The ohmmeter is autoranging and will select either the 200  $\Omega$ , 2 k $\Omega$ , 20 k $\Omega$ , 200 k $\Omega$ , or 2 M $\Omega$  range depending on the value of the unknown resistance being measured. It may also be fixed on any range. Reading rates of 6 readings per second or 25 readings per second may be selected. Software features also permit displaying a computed value which is a function of resistance, using user-entered values of offset and scale parameters. The DCX-127 input configuration permits making these resistance measurements on either a 2-wire or 4-wire basis.



**Two-wire connection**

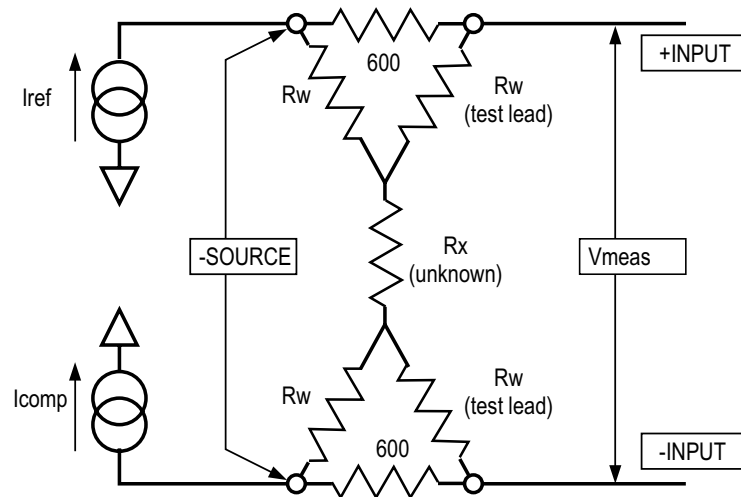
Figure 1.  
Simplified  
diagram of  
2-wire  
ohmmeter  
operation



If only one pair of test leads is used, connected from the (+) and (-) terminals of the DCX-127 to the unknown resistance, a 2-wire measurement results. Current from the internal current source flows through an internal resistor, through the test leads and resistance being measured, and through another internal resistor back to the current source. The two internal resistors are indicated schematically on the front panel of the DCX-127. Voltage drop across these internal resistors, produced by this current, is internally measured at the (+) and (-) terminals. The resistance of the two test leads is thus included in the measurement. For moderate and high values of unknown resistance, the additional error introduced by resistance of the test leads is usually negligible.

### Four-wire (Kelvin) connection

Figure 2.  
Simplified  
diagram of  
4-wire  
ohmmeter  
operation



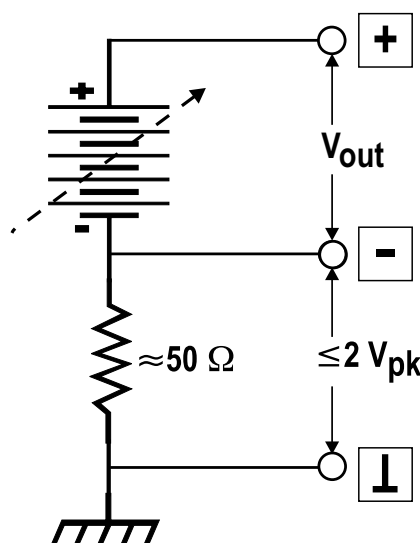
For the highest accuracy when measuring low values of resistance, we recommend a 4-wire measurement (Kelvin lead connection). For this measurement, connect one pair of test leads from the two current source connectors (marked SOURCE) to the unknown resistance. Connected a second pair of test leads from the voltmeter input terminals (+ and - jacks) to the unknown. Now current from the current source does not flow through the voltmeter leads, so the resistance of the test leads is not included in the measurement.

The resolution of the reading varies with the range and with the reading rate as shown in Table 1 on page 3.

## DC Voltage Outputs

Two independent dc voltage outputs are available at the DCX-127 front panel. Each output may be set with 20 microvolt resolution (approximately 20 bits equivalent) to any voltage in the  $\pm 10.5000$  volt range.

Figure 3.  
Equivalent  
circuit, DC  
Outputs 1 or 2



Example applications of the dc outputs include sweep control of the gain, offset, or both ports of voltage-controlled amplifiers (VCAs) while measuring their gain, distortion, or noise and plotting those values versus control voltage. The dc output can also be used to control the position of a dc-controlled turntable while measuring polar response patterns of a loudspeaker or microphone. Manually operated test equipment with a dc control port (such as the VCF input of a function generator) may be controlled by the dc outputs. Tape machines with dc-controllable bias oscillators may be connected, enabling MOL, SOL, sensitivity, and other data to be taken automatically.

The dc outputs may be floated up to 2 volts away from ground. See Figure 3 for the equivalent output circuit of both dc outputs. Maximum current sourced from each is 20 milliamperes. The maximum current that the DC outputs can sink is 10 milliamperes.

## Digital Input

A common application of the digital input is in static (DC) linearity testing of A/D converters. The digital input may also be used to interface readings from a BCD-display instrument such as a capacitance meter to the audio test system.

A parallel digital word of up to 21 bits plus sign bit, at LSTTL-compatible levels, may be connected to the digital input connector on the front panel of the DCX-127. The value of this word may be displayed in decimal or hexadecimal representations. A user-entered scale factor may be entered and a function of actual input displayed, multiplied by the scale factor. The digital word presented to the connector may be in either two's complement (binary plus a sign bit) or 8-4-2-1 binary coded decimal (BCD) format. The word at the connector may either be asynchronously sampled at any of four different selectable reading rates or, in external mode, displayed each time a "data good" or "conversion completed" pulse is presented at pin 25. The maximum sampling rate depends largely on computer speed.

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## Digital Output

An LSTTL-compatible parallel digital output word of up to 21 bits plus a sign bit may be created at the digital output connector. The value of the word may be entered into the software in either decimal or hexadecimal representations or scaled decimal. The format of the word (bit-to-pin relationship) may be selected as two's complement or 8-4-2-1 binary coded decimal (BCD). The strobe line (pin 25) will be pulsed low each time a new value is entered into the software panel or stepped to during a sweep.

A typical application of digital output is in static (dc) linearity testing of digital-to-analog converters. The digital output word drives the converter; the analog output of the converter is measured with the DCX-127 DVM. For high-resolution converters at output voltages more than  $\pm 200$  mV away from zero, it will be desirable to use one of the DCX-127 dc outputs in conjunction with the DVM input in differential voltmeter fashion so that the DVM can be set on its highest resolution range. Another application of the digital output is control of digitally-controllable turntables during polar response testing of microphones and loudspeakers. Still another application is in testing multiplying digital-to-analog converters (MDACs) used as variable resistors, attenuators, or in other audio applications. Each bit output has a five-milliampere current drive capability and 390 ohms output impedance.

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## Program Control Outputs

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The Program Control Output connector provides six pulse or gate signals controlled by various actions of APWIN software. The pin assignments are shown in the Table above. All lines are LSTTL compatible.

The Reset output, pin 2, pulses high when the DCX-127 power is turned on and whenever a Util Restore menu command is executed. The Reset output would typically be used to normalize the condition of external logic devices connected to a System One or System Two test station at power up. It may also be invoked in a procedure by inserting a Util Restore command into the procedure.

The Data Acquired output, pin 3, pulses high each time that a set of data satisfies the settling algorithm. See the Sweep Settling section for full details on the settling algorithm. This signal could be used, for example, to cause a compact disc player to automatically advance to the next track whenever a successful set of measurements is completed on the preceding track. This is useful during an external frequency or external amplitude test across a series of tracks of a test disc.

The Trigger output, pin 4, pulses high at the end of each delay portion of the settling process. In a generator-based sweep, settling delay is the time after the generator steps to a new value but before the software starts examining data samples to see if they are settled. This signal could be viewed on a dual-trace oscilloscope along with the signal being measured, to verify that the delay has been optimally set to discard “left over” data from the previous generator step. This is useful when measuring systems such as 3-head tape recorders or satellite paths, which have significant time delays.

The Trigger output of the DCX-127 could also be connected to the trigger/gate input of the generator when the BUR-GEN module is present. This will synchronize tone bursts in the sine trig mode with the system’s readiness to make a measurement. The Trigger output could also be used to strobe an external device being tested, such as an analog-to-digital converter. This will help insure that the source is stable before the conversion takes place.


The Sweep Gate output, pin 6, drops low at the beginning of a sweep test and goes high at the completion of a test. In a nested sweep,

it will go high momentarily at the end of each Source-1 sweep and drop low again for the next Source-1 sweep after the Source-2 parameter is incremented. One example application of the Sweep Gate output is in testing of the attack characteristics of compressors, limiters, and similar audio processors. With the Sweep Gate connected to the trigger/gate input of the generator when the BUR-GEN module is present and the Burst-gated mode is selected, time zero on a time sweep graph and the start of the signal will be synchronized.

The Channel A/B output, pin 7, goes low whenever analog analyzer input channel A is selected and high whenever input channel B is selected. The level at this pin thus indicates which channel is being measured during a stereo sweep.

The Delay Gate output, pin 1, is similar to the Sweep Gate signal but with the addition of a user-settable delay time between the actual beginning of a sweep test and the leading edge of the gate output signal. This delay time is entered at the bottom of the DCX software panel, in the Gate Delay field.

An example application is power amplifier turn-on and turn-off transient (“thump”) testing. The amplifier power could be turned on by the sweep gate and off by the delayed gate. The output of the amplifier may be measured during a time sweep. To allow correct capture of transients, the Level meter should be used along with a fixed input range.

Another example application is to start a tape machine or turntable for run-up time testing. The basic measurement technique is to perform a time sweep while measuring frequency from a pre-recorded tape or disc. Use of the Delayed Sweep Gate to start the recorder or turntable permits the instrument to draw the graph when  is pressed, start the time sweep, and then start the machine at a predetermined time into the sweep when the software is ready to take continuous, rapid measurements.

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## Auxiliary Output Ports

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Three rear-panel 9-pin connectors are provided on the DCX-127 for digital control of external devices. These output ports are intended for direct interface to LSTTL circuitry, or via LSTTL-compatible drivers to relays. Control of power, lights, and annunciators are among the possible applications. The pin connections of these ports are shown below. The current drive capability of each bit line is five milliamperes; the output impedance is 390  $\Omega$ .

A fourth auxiliary output, J141, is similar to Ports A, B, and C, but has a 15-pin connector that also includes +5 V, +15 V, and -15 V power supplies.

# Installation

## Mounting

DCX-127 modules may be either rack-mounted or simply stacked with other instruments. They do not consume appreciable power, and therefore require no extraordinary ventilation considerations. The modules occupy one rack unit of height (1.75 inches). They are provided with bottom feet for tabletop use. The optional rack mount adapters available from Audio Precision (order number RAK-212) allow either conventional flush front mounting or setback mounting to prevent the front connectors from protruding from the rack.

## Primary Power Considerations

### Checking or Changing Power Line Voltage

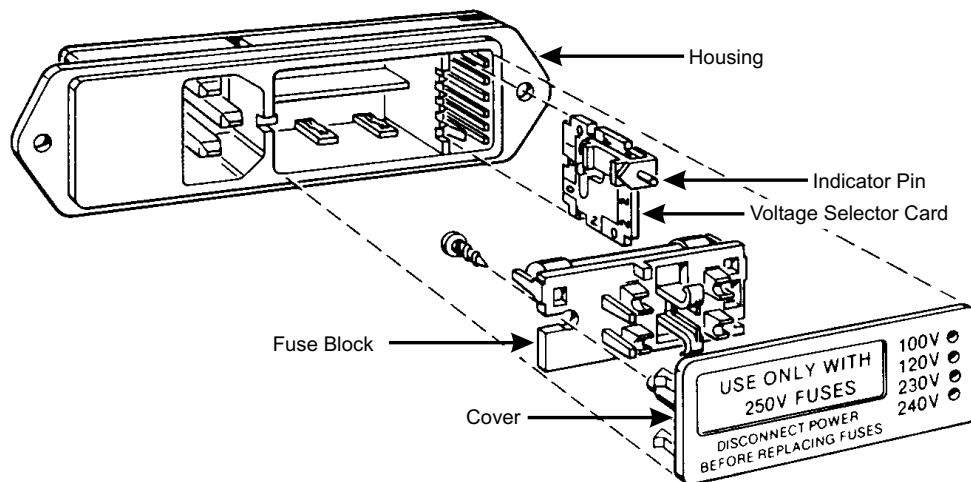


Figure 4. Changing power line voltage

The AC Mains input to each instrument is made through a connector/fuse block/voltage selector assembly. Before connecting the power cord, confirm that the input voltage selection is correct for your



power source. An indicator pin shows the selected input voltage in one of the four holes in the cover (see Figure 4).

To change the input voltage, refer to and proceed as follows:

1. Remove the AC power cord from the AC Mains Connector.
2. Open the cover, using a small blade screwdriver or similar tool. Set aside the cover/fuse block assembly.
3. Pull the voltage selector card straight out of the housing, using the indicator pin.
4. Orient the selector card so that the desired input voltage is readable at the bottom (see Figure 5). Then orient the indicator pin to point up when the desired voltage is readable at the bottom, with the indicator pin assembly seated in the notch on the board edge.

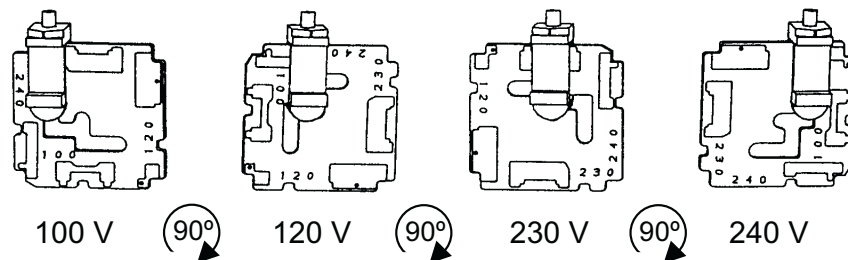


Figure 5. Voltage selector card positions

5. Insert the voltage selector card into the *housing with the printed side of the card facing toward the connector*, and the edge indicating the desired voltage first.
6. Confirm that the correct fuse is installed for the intended input voltage (refer to fuse ratings marked on the rear panel or in the manual). If necessary, change the fuse type as described in the following section.
7. Replace the cover and verify that the indicator pin shows the desired voltage.

## Fuse Information

The connector/fuse block/voltage selector assembly allows two fusing arrangements: North American (see Figure 6) and European (see Figure 7). The North American fusing arrangement uses a single type 3AG (0.25 x 1.25 in.) SB (“slow blow”) fuse; the European fusing arrangement uses two 5 x 20 mm IEC-approved type T fuses. Both types should be rated 250 V. Fuse current ratings are 200 mA for 100 – 120 V inputs, or 100 mA for 230 – 240 V inputs. Confirm this information on the label on rear panel.

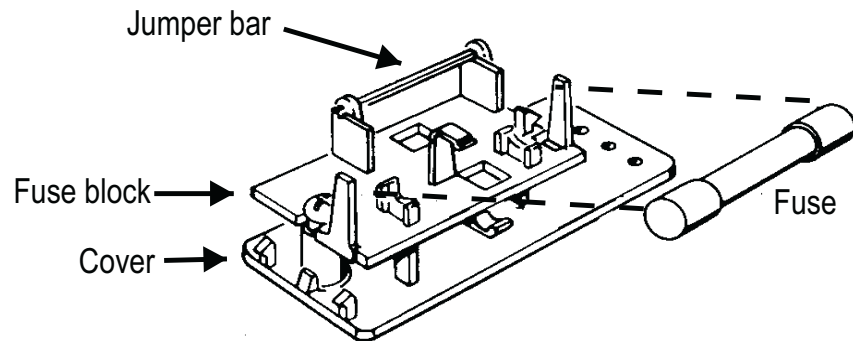


Figure 6. North American fusing arrangement

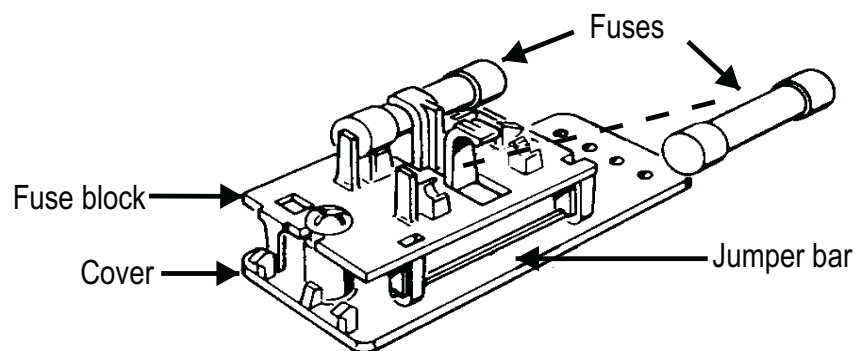
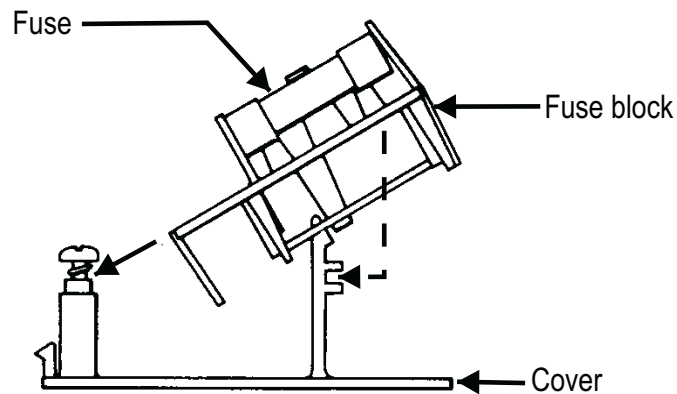


Figure 7. European fusing arrangement

## Changing Fusing Arrangement

To change from one fusing arrangement to the other: j

1. Remove the AC power cord from the AC Mains Connector.
2. Open the cover of the connector/fuse block/voltage selector assembly with a small blade screwdriver or similar tool.
3. On the back of the cover, loosen the Philips screw two turns, then remove the fuse block by sliding up, then away from the screw and lifting from pedestal at the other end (refer to Figure 8).



*Figure 8. Changing fuse types*

4. Invert the fuse holder and reassemble it on the Philips screw and pedestal, and tighten the screw.
5. Change or add the correct fuses as necessary (again, refer to rear panel for the correct fuse current rating).
6. Confirm the line voltage setting as described in the previous section, then replace the cover.

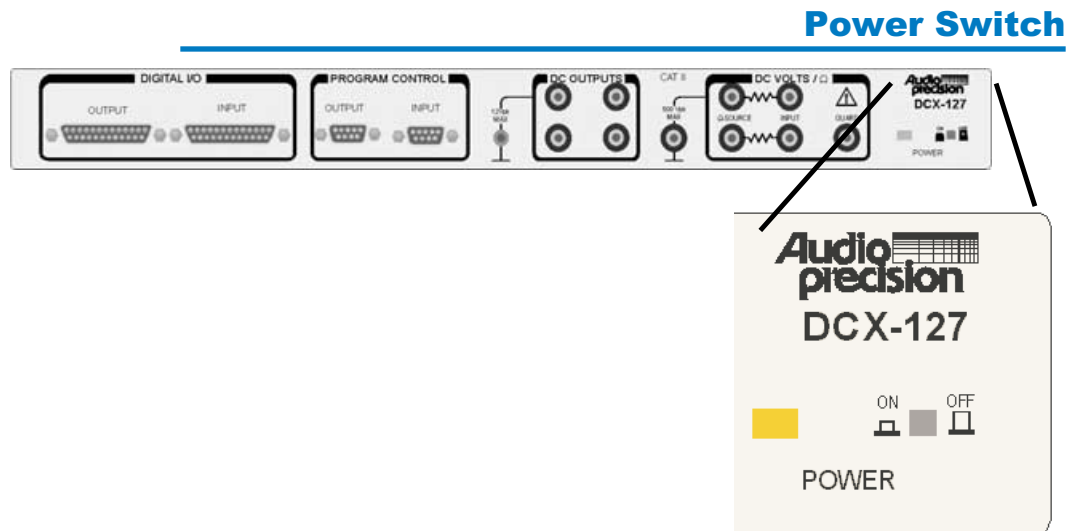


Figure 9. DCX-127 Power switch

The DCX-127 POWER switch is a push-on, push-off button located on the right end of the front panel (see Figure 9). An LED indicator next to the switch shows when power is applied.

## Proper Environment

All Audio Precision products are intended for use indoors, in a normal environment. Refer to the specifications for temperature range and humidity specifications.

## Connecting the APIB Interface

The DCX-127 has two APIB connectors on its rear panel. They permit connecting instruments in a “daisy-chain” fashion between the computer’s APIB card connector and the System One, System Two, or System Two Cascade APIB connector. The connectors pass the APIB lines through, and instruments respond only when specifically addressed, as described below. Normally, the computer will be connected to the first instrument with a digital interface cable, the first instrument connects to the second, etc, and the last instrument

connects to the system digital interface (APIB) connector. A typical installation is shown in Figure 10.

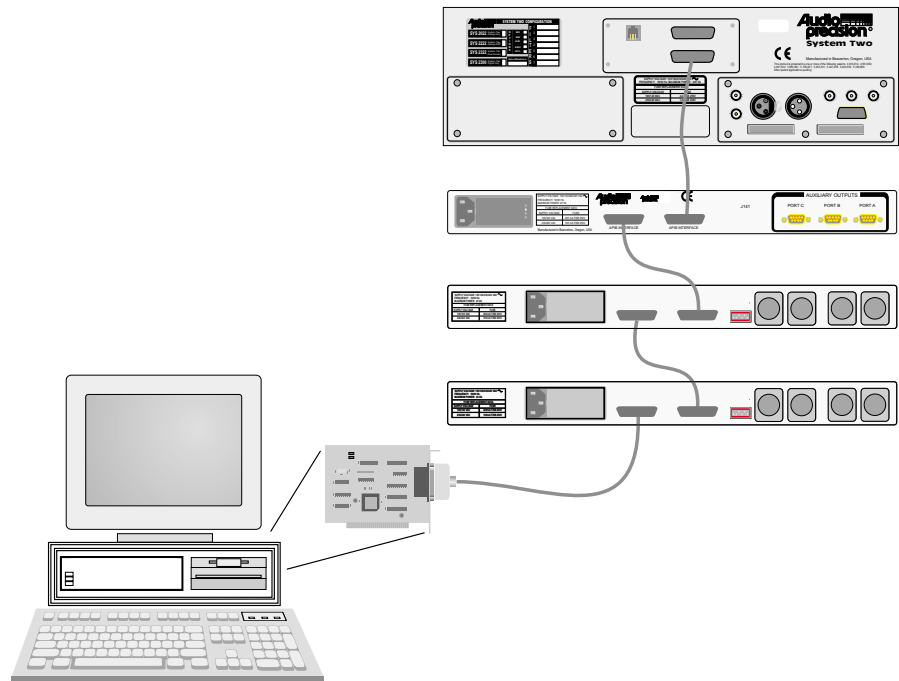


Figure 10. APIB connections block diagram (typical; shown with DCX-127 and two switchers)

# Operation

## Panel

When APWIN is running, there are two ways to bring the DCX panel to the screen:





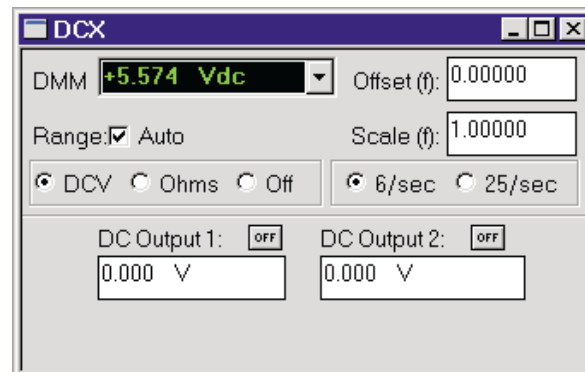

- Mouse: Click on the DCX-127 icon  on the toolbar or select Panels DCX via the menu bar
- Keyboard: Type    (for Panels DCX-127).

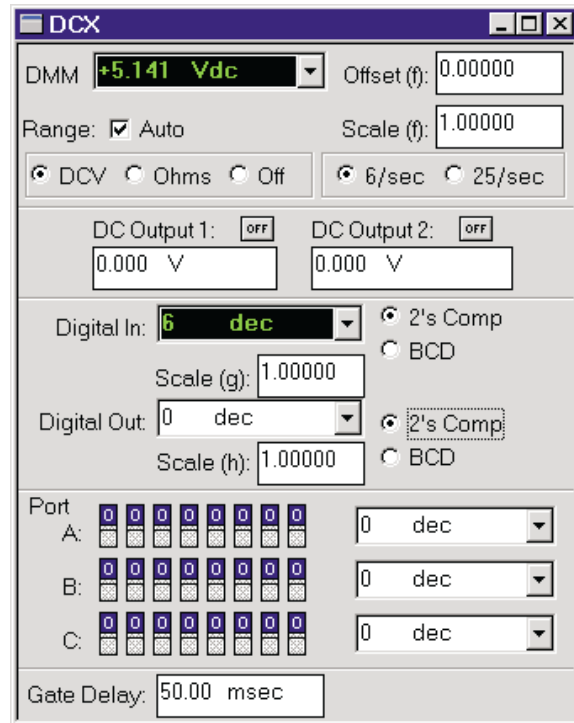
Figure 11. DCX-127 panel, small version



The DCX-127 Panel can be viewed in both large and small versions. Clicking on the panel icon on the Panels Toolbar brings up the small version panel, shown in Figure 11. Holding down the  key while clicking on the toolbar icon brings up the large version, shown in Figure 12. You can also click the Maximize button to toggle the two sizes.

In addition to bringing the panels on screen manually as described here, all parameters can be set by APWIN BASIC commands. Refer to your APWIN BASIC Extensions Reference Manual for full details.

Figure 12. DCX-127 panel, large version



### Volts/Ohms Measurements

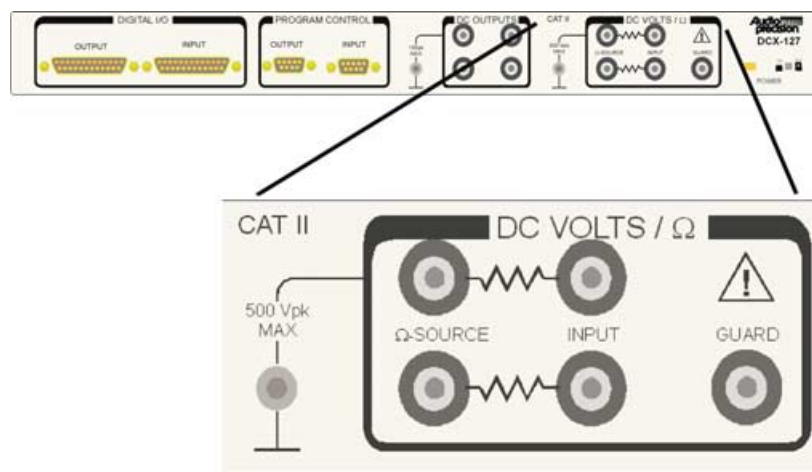




Figure 13. Connectors for volt/ohms measurements

### ***DMM Units***

In DC Volts function, the reading may be displayed either in absolute volts or as f(V), a function of volts, after modification by Offset and Scale factors. Similarly, resistance readings may be displayed in ohms or as f(O) with Offset and Scale. The “available units” list includes only units valid for the presently-selected function (DC V or ohms).


### ***Auto/Fixed Range Checkbox***

The voltmeter/ohmmeter may operate in autoranging mode or may be fixed on any one of its full-scale ranges. When the DMM Autoranging function is disabled (no check mark in Auto box), a Range field is displayed and active for manual range selection. New entries may be typed in or existing entries edited from the keyboard, and completed by pressing the  key. When  is pressed, APWIN software will select and display the most-sensitive range that can handle the entered value.

### ***Offset and Scale Values for f(V), f(O)***

When f(V) (function of volts) or f(O) (function of ohms) units are selected for the DMM, APWIN software computes the value to display from the formula

$$\text{display} = (\text{measurement} + \text{Offset}) * \text{Scale}.$$

The “measurement” term is the value which would be displayed in volts or ohms units. The “Offset” and “Scale” values are the contents of the fields with those names, at the top right of the DCX-127 panel. New entries may be typed into either field, or the existing entry edited, from the keyboard followed by pressing the  key.

### ***DCV/Ohms/Off Selection***

The DMM (digital multimeter) can measure dc volts or ohms, or be turned off, by use of the three buttons below the Auto Range check box.



### **Reading Rate**

The DMM can operate at 6 or 25 readings per second. Resolution is a full 4-1/2 digits at 6 readings per second. At 25 readings per second, the number of digits displayed is the same but the least significant digit is always 5 or 0.

### **Guard**

The Guard terminal is connected to a shield enclosing the DMM board. Connecting the Guard terminal may improve some voltage and resistance measurement accuracy and reduce noise under certain conditions:

- When operating the DMM in the presence of high-level radiated noise (most commonly, stray fields at line frequency);
- When long test leads are used to measure a high signal source impedance;
- When floating measurements are made in the presence of a high common-mode voltage, or frequency, or both.

To use the Guard, connect its terminal to the DUT's ground, common point, or to the – terminal of the DCX-127, in that order of preference. The peak voltage applied to the guard should not exceed  $\pm 500$  V.

### DC Output 1 and 2 On/Off

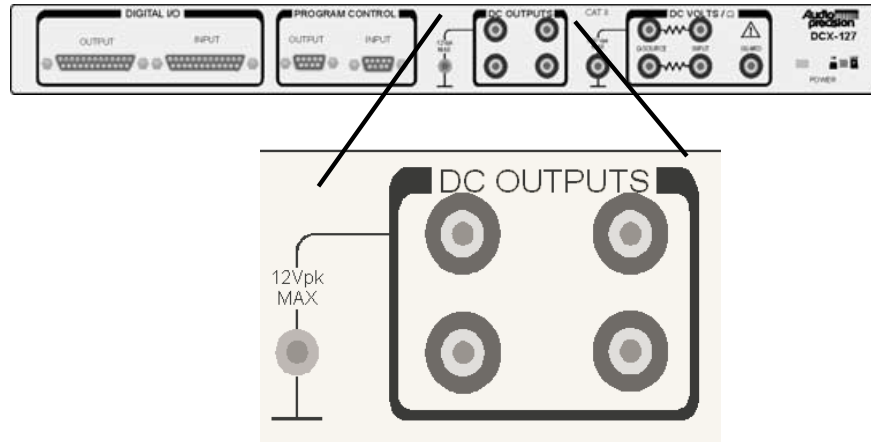


Figure 14. Connectors for DC Outputs

Either of the DC outputs (front panel double banana jacks) may be turned on and off individually.

### DC Output 1 and 2 Value

Either DC output may be independently set to any voltage in the range  $\pm 10.5$  Vdc. A new value may be entered or the existing value may be edited from the keyboard, followed by the **ENTER** key.

## Digital Input and Output

### Digital Input Display and Units

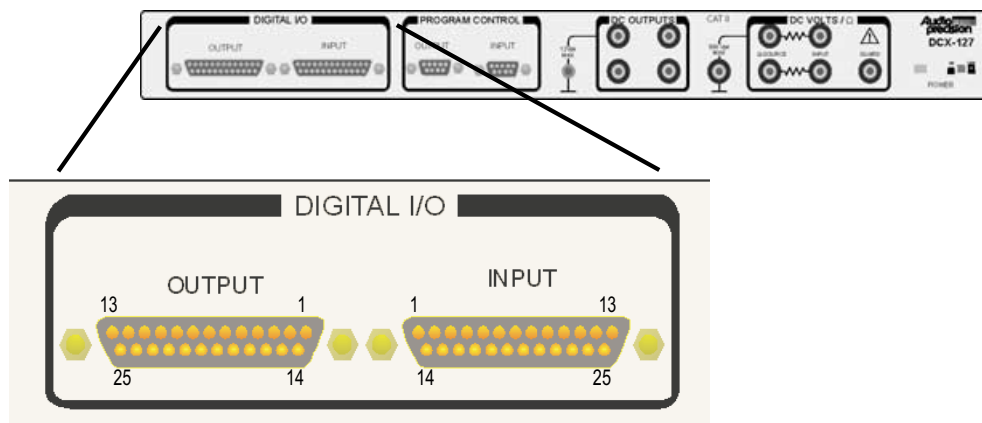


Figure 15. Connectors for Digital Inputs and Outputs, showing pin numbering

The 21-bit digital input word connected to the DCX front panel DB25 Digital Input connector may be displayed in decimal, hexadecimal, or octal units or as a scaled function  $g(x)$  of the decimal value at the digital input. See Table 2 for connector pin assignments.

### Digital Input Data Format Selection


The binary values at the 21 active points of the Digital Input connector may be interpreted as 2's complement or in 8-4-2-1 BCD (binary coded decimal) format.

### Scale Factor, Digital Input

When  $g(x)$  units are selected at the Digital In display, APWIN software computes the displayed value from the relationship

$$\text{display} = \text{measurement} * \text{Scale (g)}$$

where “measurement” is the decimal value of the binary data in the selected format and “Scale (g)” is the value entered in the Scale (g) field just below the Digital In display. A new Scale value may be

entered or the present value edited from the keyboard, followed by pressing the  key.

*Table 2. Digital I/O Connector Pin Assignments*

Pin Number	Function, Two's complement mode	Function, BCD mode
1	Ground	Ground
2	Bit 0 (LSB)	LS digit, 1
3	Bit 1	LS digit, 2
4	Bit 2	LS digit, 4
5	Bit 3	LS digit, 8
6	Bit 4	5th digit, 1
7	Bit 5	5th digit, 2
8	Bit 6	5th digit, 4
9	Bit 7	5th digit, 8
10	Bit 8	4th digit, 1
11	Bit 9	4th digit, 2
12	Bit 10	4th digit, 4
13	Ground	Ground
14	Bit 11	4th digit, 8
15	Bit 12	3rd digit, 1
16	Bit 13	3rd digit, 2
17	Bit 14	3rd digit, 4
18	Bit 15	3rd digit, 8
19	Bit 16	2nd digit, 1
20	Bit 17	2nd digit, 2
21	Bit 18	2nd digit, 4
22	Bit 19	2nd digit, 8
23	Bit 20 (LSB)	MS digit, 1
24	Sign	Sign

### ***Digital Output and Units***

The 21-bit digital output word presented to the DCX front panel DB25 Digital Output connector may be controlled in decimal, hexadecimal, or octal units or as a scaled function  $h(x)$  of the decimal value entered in the Digital Out field.

The value sent to the Digital Output connector, in the unit selected, is determined by the value entered into the Digital Out field but may also be swept from the Sweep Panel.


### ***Digital Output Data Format***

The value and units entered in the Digital Out field will be presented to the front panel Digital Output connector in either 2's complement or 8-4-2-1 BCD (binary coded decimal) format.

### ***Scale Factor for Digital Output***

When  $h(x)$  units are selected at the Digital Output control field, APWIN software computes the actual transmitted value from the relationship

$$\text{output value} = \text{entry value} * \text{Scale (h)}$$

where "entry value" is the decimal value entered into the Digital Out numeric field and "Scale (h)" is the value entered in the Scale (h) field just below the Digital Out control field. A new Scale value may be entered or the present value edited from the keyboard, followed by pressing the  key.

### Program Control, Gate Delay

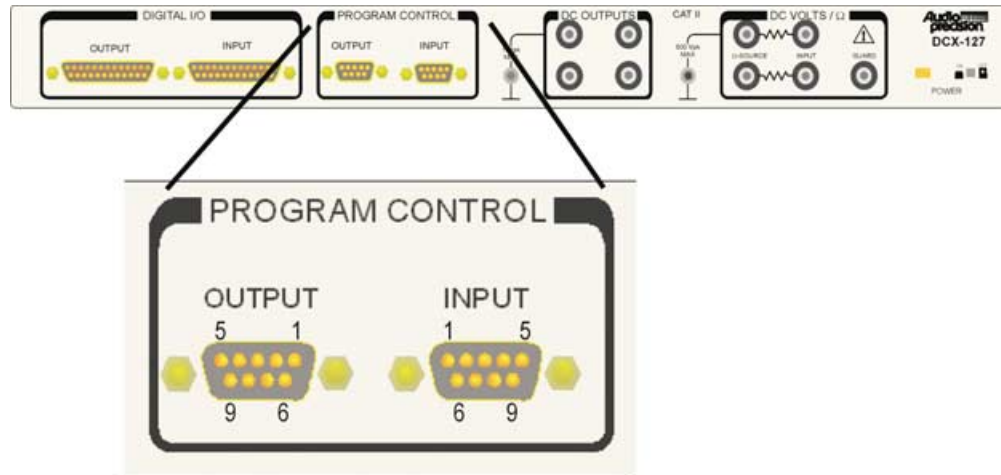


Figure 16. Program Control connectors, showing pin numbering

The front-panel Program Control Output DB9 connector provides several pulse or gate signals controlled from APWIN software. Pin 6 on this connector is a sweep gate which goes high at the beginning of each APWIN sweep and drops low at the end of the sweep. Pin 1 is a delayed sweep gate, similar to pin 6 but with an additional user-settable delay time between sweep start and the leading edge of the gate signal. That delay time is controlled by the Gate Delay field at the bottom of the DCX panel. See Table 3 for Program Control Input and Output connector pin assignments.

#### Gate Delay Control for Delayed Trigger

The delayed sweep gate (pin 1) is similar to the sweep gate (pin 6) in that it goes low during a sweep and returns high at the completion of the sweep. However, the delayed sweep gate does not go low until the Gate Delay time has elapsed after the beginning of a sweep.

Table 3. Program Control Output and Input connectors pin assignments

Pin Number	Program Control Output		Pin Number	Program Control Input
1	Delayed Sweep Rate		1	Bit 7 (MSB)
2	Reset		2	Bit 6
3	Data Acquired		3	Bit 5
4	Trigger		4	Bit 4
5	Undefined		5	Bit 3
6	Sweep Gate		6	Bit 2
7	Channel A/B		7	Bit 1
8	Ground		8	Bit 0 (LSB)
9	Ground		9	Ground

### Auxiliary Outputs

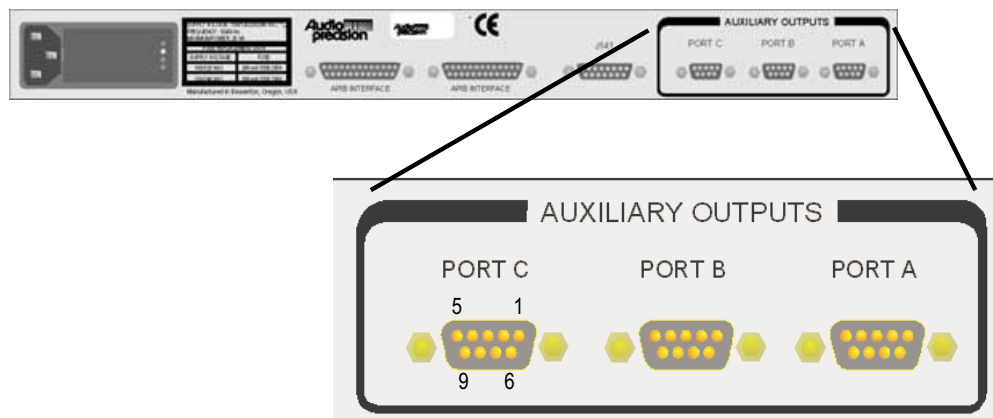



Figure 17. Connectors for Auxiliary Outputs, showing pin numbering

### Ports A, B, and C

Auxiliary Output Ports A, B, and C are independent 8-bit digital control ports at separate DB9 connectors on the rear of the DCX-127. The settings of the 8 bits may be controlled from the DCX software panel or they may be swept over a range via the Sweep Panel. Settings from the DCX software panel may be made as binary (mouse only), octal, decimal, or hexadecimal numbers. The binary control and display button-indicators are functionally in parallel with the octal-decimal-hexadecimal field. Any change made to the binary buttons is immediately reflected in the octal-decimal-hex field, and vice-versa. To change a value using octal, decimal, or hex units, the desired unit must first be selected (or the present unit accepted). A new value may be entered into the field from the keyboard or the existing value edited, followed by the  key.

*Table 4. Auxilliary Port A, B, and C Connector pin assignments*

Pin Number	Port A, B, & C
1	Bit 7 (MSB)
2	Bit 6
3	Bit 5
4	Bit 4
5	Bit 3
6	Bit 2
7	Bit 1
8	Bit 0 (LSB)
9	Ground

### J 141 (Port D)

Connector J141 is an auxiliary output “Port D,” similar to Auxiliary Output Ports A, B, and C. However, it also provides +5 V, +15 V, and -15 V supplies. J141 is a DB-15 connector. You can control the J141 Port D with the following OLE command:

```
AP.DCX.PortDOutput
```

Table 5 shows the J141 connector pin assignments.



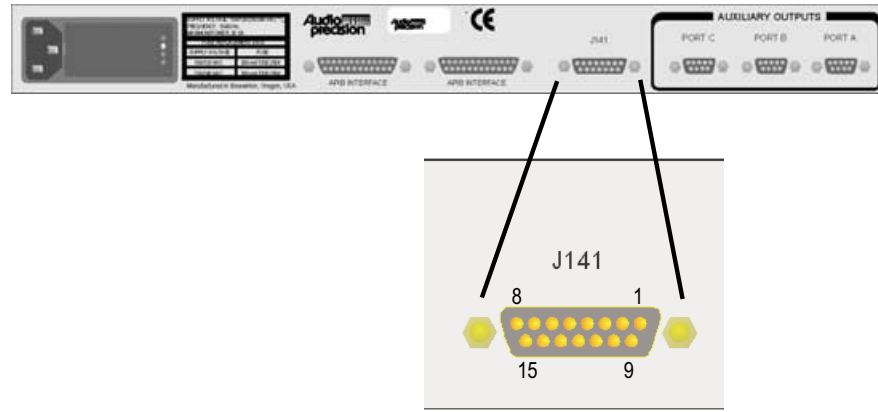


Figure 18. Connector J141 , showing pin numbering

Table 5. J141 (Auxiliary Output D) connector pin assignments

Pin Number	J141		Pin Number	J141
1	Ground		9	Bit 0 (LSB)
2	Bit 7 (MSB)		10	+5 V
3	Bit 6		11	+5 V
4	Bit 5		12	+15 V
5	Bit 4		13	-15 V
6	Bit 3		14	Ground
7	Bit 2		15	Ground
8	Bit 1			

## Specifications

### DC VOLTS MEASUREMENT RELATED

Accuracy <sup>1</sup>	6 rdg/sec	25 rdg/sec
200 mV range	0.05% + 0.03 mV	0.05% + 0.1 mV
2 V range	0.05% + 0.1 mV	0.05% + 1 mV
20 V range	0.05% + 1 mV	0.05% + 10 mV
200 V range	0.05% + 10 mV	0.05% + 100 mV
500 V range	0.05% + 100 mV	0.05% + 1 V
Resolution		
200 mV--200 V ranges	0.005% of range	0.025% of range
500 V range	100 mV	500 mV
Input Resistance	10 MW , $\pm$ 1% (all ranges)	
Common Mode Rejection	>120 dB, at dc and 50 Hz to 20 kHz	
Common Mode Range	500 V <sub>peak</sub>	
Normal Mode Rejection	>60 dB, 50 Hz to 60 HZ	

- 1 Valid from + 15°C to +30°C, <80% RH, for 1 year. Derate linearly to 2 times indicated values at + 5°C and +40°C.

**OHMS MEASUREMENT RELATED**

Accuracy <sup>1, 2</sup>	6 rdg/sec	25 rdg/sec
200Ω range	0.05% + 0.04 Ω	0.05% + 0.1 Ω
2 kΩ range	0.05% + 0.2 Ω	0.05% + 1 Ω
20 kΩ range	0.05% + 1 Ω	0.05% + 10 Ω
200 kΩ range	0.05% + 10 Ω	0.05% + 100 Ω
2 MΩ range <sup>3</sup>	0.15% + 100 Ω	0.15% + 1 kΩ
Resolution	0.005% of range	0.025% of range
Open Circuit Voltage	<6 Vdc	

**DC OUTPUT RELATED**

Range	± 10.500 V (bipolar output)
Resolution	20 μV (20 bits equivalent)
Accuracy <sup>1, 4</sup>	±(0.05% + 0.2 mV), absolute ±40 μV, relative to best fit line
Maximum Output Current	20 mA source; 10 mA sink
Residual Noise	< 10 μV rms, 10 Hz to 80 kHz bw
Output Floating Characteristics	Electronically balanced to allow low output (-) terminal to float up to 2 Vpk. Common mode rejection is typically >54 dB (500:1).

- 2 With both 2-wire or 4-wire configurations. When using 4-wire configuration, lead resistance must be ≤ 1.5 Ω.
- 3 Full scale on the 2 MΩ range is 2.50 MΩ.
- 4 Load current must be ≤ 1 mA for specified accuracy. Output resistance is typically <0.1 Ω.

## Specifications

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### PROGRAM CONTROL INPUT/OUTPUT

Input Configuration	8-bit parallel input. Input bits are software definable to execute any valid keystroke sequence. An 8-byte FIFO buffer allows asynchronous inputs.
Output Configuration	
Pin 1	Delayed Gate. High-low transition occurs 50 ms to 12.75 s (in 50-ms steps) after sweep start.
Pin 2	Reset pulse, high during UTILITY RESTORE command or following power cycling to the DCX-127.
Pin 3	2 ms pulse when data is settled
Pin 4	2 ms pulse at end of settling delay
Pin 6	Sweep Gate, low during sweeps
Pin 7	A/B Gate; high when LVF is measuring channel A
Connectors	9-pin D-subminiature

### DIGITAL INPUT/OUTPUT RELATED

Configuration	22-bit (21 bits data + sign) words, plus data valid/new data strobes. 25-pin D-subminiature connectors.
Maximum data rate	Approximately 8 msec/transfer, limited by computer speed

### AUXILIARY OUTPUT PORTS

Configuration	Three independent 8-bit parallel output ports. 9-pin female D subminiature connectors
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MISCELLANEOUS

All digital input/output is LSTTL/CMOS compatible. Outputs in series with 390  $\Omega$  resistors. Input resistance typically 100 k $\Omega$ . Maximum rated input 0 – 5V. Output drive +5mA/bit maximum.

Dimensions	17 in. Wide, 1.75 in. High, 10.5 in. deep
Operating temperature	+ 5°C to +40°C, <80% relative humidity
Power requirements	100/120/220/240 Vac + 5/-10%); 48-63 Hz; 20 VA maximum