Endevco®

INSTRUCTION MANUAL
For Model 133
PS/ISOTRON®
SIGNAL CONDITIONER
IM133, Revision H2

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SECTION 1: GENERAL DESCRIPTION

1.1   INTRODUCTION

ENDEVCO has remained a leader in the vibration measurement field since 1951, and has contributed many firsts in vibration sensor design. These include: the first piezoelectric accelerometer capable of continuous operation from cryogenic temperatures up to +750°F, the first shear design accelerometer and the world's smallest piezoelectric accelerometer. To support a broad family of vibration transducers, ENDEVCO has provided a wide variety of signal conditioners, including the first transistorized charge amplifier, the first computer-programmable charge amplifier and the first airborne vibration monitoring system that is based on a true digital tracking filter.

SIGNAL CONDITIONERS

To support the use of its sensors in large scale testing, ENDEVCO has developed several generations of signal conditioner systems. Until recently, a state-of-the-art vibration laboratory set up consisted of a rack of manually controlled signal conditioners. These signal conditioners have manually controlled switches and knobs, to set full scale ranges, sensitivity and filter corners and the set up information is recorded by hand.

COMPUTER CONTROLLED SIGNAL CONDITIONERS

To eliminate the risk of incorrect amplifier settings, ENDEVCO has pioneered the concept of computer controlled signal conditioners. The first generation was the Multi-channel Amplifier Control system (MAC). The second generation was the Computer Controlled Amplifier Systems (CCAS). The CCAS family consists of five different systems that use the same rack and digital interface assemblies with different analog boards. These units receive their setup commands over an IEEE-488 interface bus from a computer/controller, so that tests can be pre-programmed. In addition, these units provide comprehensive self-test and self-calibration capabilities, which greatly improves the reliability of the test data. User feedback is indicated that these units pay for themselves quickly by shortening test cycles, preventing retests and eliminating over-testing.

MANUAL/COMPUTER CONTROLLED SIGNAL CONDITIONERS

The experience gained in the first two generations of computer controlled amplifiers has now been applied to a third generation product line: the programmable bridge conditioner and the programmable laboratory signal conditioner. These units are independently controlled and each unit contains its own power supplies for single channel integrity.

The Model 133, has both manual and computer programmable features. This PE/ISOTRON® Signal Conditioner is an example of Endevco's commitment to improving the state-of-the-art in sensory measurements. The new generation is smaller with more features and will continue to be expanded to meet an ever widening range of application requirements.

1.2 DESCRIPTION

The ENDEVCO® Model 133 ISOTRON/Charge Amplifier is a three-channel signal conditioner designed for use with piezoelectric accelerometers, ISOTRON® (voltage type) accelerometers, and remote charge converters. The unit provides an AC output voltage proportional to the charge or AC voltage input, and it is designed to be powered by 90-240 VAC (9-18 VDC option also available).

The Endevco Model 133 Signal Conditioner has a fixed 10 Hz 4-pole Butterworth high-pass filter that can be selected or bypassed. It has a plug-in 4-pole low pass filter whose corner can be set by an internal header module, which offers optional filter types and multiple corner frequencies. {See Section 2.4.8 Filter Options and Installation and Appendix 1, (Endevco Model 31875-XXXX-Y)}. Filter options are available to meet the filter corner requirements for J211 and ISO6487. The specific filter corners available are: 300 Hz and 1,650 Hz (see Section 2.4.8 Filter Options and Appendix 1.)

Up to three (3) Model 133 units can be installed in a 19" rack using ENDEVCO Model 31979 Rack Mounting Kit.

Figure 4 shows a detailed circuit block diagram for the unit.

1.3 FUNCTIONAL CHARACTERISTICS

The Endevco Model 133 can be manually programmed from the front panel (Figure 1) by means of a "Select Channel" push-button, three (3) "Channel LEDs", a "Select Function" push-button, seven (7) "Function LEDs" indicating which function has been selected by the "Select Function" push-button (referred to in this document as the "function LEDs"), a four (4) character LED display to show the state of each function, four (4) "EDIT" push-buttons to change the entries in the LED display, and three (3) LEDs indicating if there are any faults in any of the channels (referred to in this document as the "Fault LEDs").

The unit has two modes of operation: (1) Normal and (2) Query/Programming. In the Normal mode of operation, the unit can be in (a) Monitoring State, or (b) No-Monitoring State. While in the Normal mode of operation, the selected state will apply to all three channels simultaneously.

The unit will store the settings for all of the function in its internal memory and at power-up it will automatically restore the settings from the last session.

1.4 KEY FEATURES

The following are some of the highlight features:

- Three-channel piezoelectric/ISOTRON signal conditioner
- 200 kHz Bandwidth (-3dB corner)
- 10 Volt Full Scale Output
- Built-in 10 Hz 4-pole Butterworth High Pass Filter
- Fault indicator for open/short at the ISOTRON input
- Gain range from 0 to 1000
- RS-232 Serial Interface
- Optional Low Pass filter corners available (Butterworth - the standard default filter is a 10 kHz Butterworth)
- Meets filter requirements of J211 and ISO6487.

SECTION 2:
INSTALLATION, FRONT AND REAR PANEL DESCRIPTION AND OPERATION

2.1   INSTALLATION

2.1.1   UNPACKING

The Endevco Model 133 PE/ISOTRON signal conditioner is shipped along with its instruction manual in one package. Carefully unpack and check all items for shipping damage. Report any obvious damage to the carrier immediately. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked mechanically and electrically. In any case, save the original packing materials for future shipments of the hardware. Check each item of the shipment against the packing list. Notify Endevco of any discrepancy.

The equipment has been inspected and tested at the factory and is ready for operation when received.

Unpack the Model 133 and set it on a level, firmly supported surface. Verify that all standard and ordered optional accessories are included.

2.1.2   FILTER MODULE INSTALLATION OR REPLACEMENT

For filter module installation or replacement, see Section 2.4.8 of this manual.

2.1.3   POWERING ON THE UNIT

For AC input power, install the EW599 power cord into the rear power connection of the Model 133. (See Figure 2, Rear Panel, AC input power.)

For optional DC input power (Model 133-1), install the +9-18 VDC input power source into the DC input power connector, located on the rear of the Model 133-1. (See Figure 3, Rear Panel, DC input power.)

2.1.4   KEY PARAMETERS

The standard unit has an AC input voltage requirement from 90 to 264 VAC, 50 to 60 Hz (Universal Input). No jumpers or changes to the unit's power supply is required for input power meeting this requirement.

The "-1" option is a DC powered version that accepts an input voltage range from +9 to 18 VDC.

Power dissipation for either the standard or -1 version is 9 Watts typical.

2.1.4.1   Physical Characteristics

Dimensions	5.57" x 2.52" x 12"
Weight	4 lbs typical
Case Material	Black Aluminum Cover, Medium Gray Plastic Bezel
Current	1 Amp maximum

2.2 FRONT PANEL DESCRIPTION

Shown in Figure 1 is the Model 133 front panel. The front panel is a mylar overlay, adhesively attached to the front panel aluminum plate. The mylar overlay has cutouts for the six push buttons, and clear windows for 13 LED's and the 4-digit panel meter. Each push button and LED are described as follows:

Figure 1 Item 1, is the "Select Function" push button that controls the functions listed below it. Pressing the Select Function push button scrolls through the LED's.   The function selected can be modified while the LED is flashing, located to the right of the associated function.

Figure 1 Item 2, is the "Select Channel" push button. Pressing this push button sequentially selects channels one to three, which is used for set up and display of data on the digital panel meter. The appropriate channel's LED remains illuminated until a different channel is selected.

Figure 1 Item 3, is the LED for channel one of the three channel unit. The LED illuminated corresponds to the channel that is actively being set up or data displayed on the DPM.

Figure 1 Item 4, is the digital panel meter (DPM). The DPM displays alpha-numerics for the appropriate "Select Channel" selected and is used to display the channel set up and for actual data display. The DPM has an accuracy of ±10%. (See Section 2.4, Operation and sub-sections contained, for specific push button abilities.)
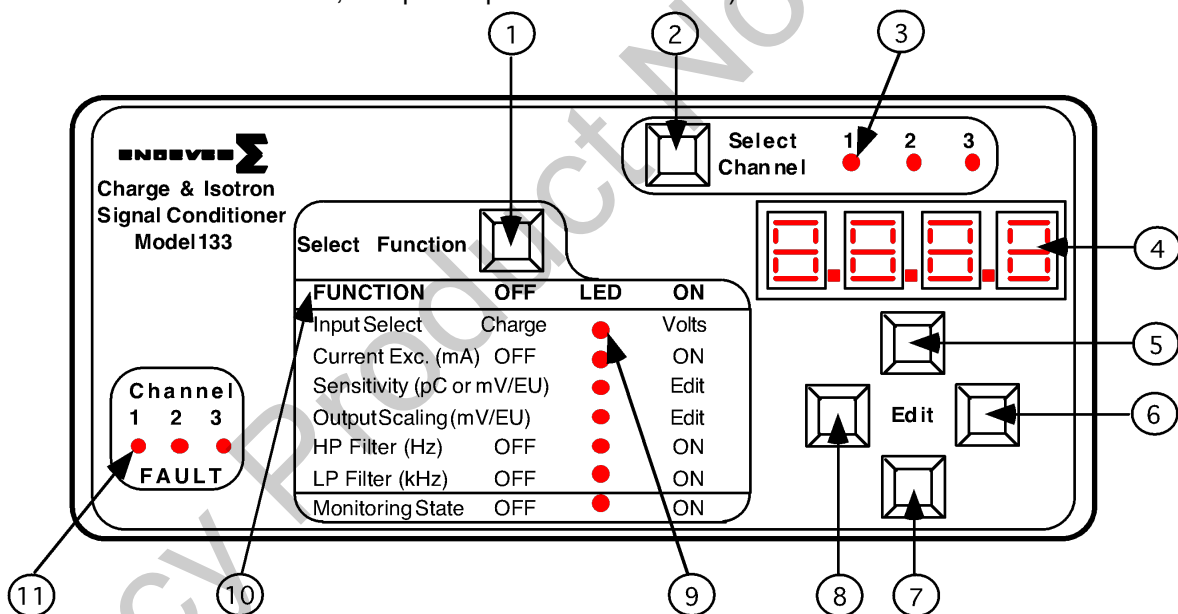
Figure 1

Figure 1 Items 5, 6, 7, and 8 correspond, respectively to the "Up", "Right", "Down" and "Left" Edit push buttons. These push buttons are used to change the entries on the digital panel meter and are used in conjunction with the appropriate "Select Function" parameter to be programmed. (See Section 2.4, Operation and sub-sections contained, for specific push button abilities.)

Figure 1 Item 9, is one of seven Function parameters LED's that is selectable/programmable. The flashing LED identifies the function that is actively capable of being set up or modified at that time.

Figure 1 Item 10, is a list of "Functions" that are programmable for each channel, which are selected by the "Select Function" push button and are set up or modified with the four "Edit" push buttons.

Figure 1 Item 11, are the "Fault" LED's. The illuminated LED indicates that particular channel is in the ISOTRON mode, the current excitation is on and there exists a short or open circuit for the input.

2.3   REAR PANEL DESCRIPTION

Shown in Figure 2 is the rear view of the Model 133.

Figure 2 Item 1, is the standard AC input power connector. The supplied Endevco power cable, PN EW599, is connected to this connector.   (Note: The acceptable input power is 90 to 264 VAC, 50/60 Hz. No jumpers or adjustment is required for input voltages within this range. There is no on/off power switch for the unit.)

Figure 2 Item 2, is the Single-Ended Piezoelectric (SEPE) input connector. This is a standard 10-32 connector, mating to Endevco's 3090 and 3060 series cables.

Figure 2 Item 3, is a blocked-off area for a single channel, depicted is channel 3. The channels correspond to the front panel channels 1, 2, and 3.

Figure 2 Item 4, is a standard BNC cable connection that is used to connect the input of ISOTRON or voltage type accelerometers. (10-32 connector style input cables can easily be used with the Endevco EJ21, a 10-32 to BNC adapter. The EJ21 mounts directly onto the BNC connector.)

Figure 2 Item 5, is a standard BNC connector used for the output from each channel.

Figure 2 Item 6, is the RJ-11 Modular Jack, Front View. (Please see Figures 5, 6 and Section 2.4.7. for the RS-232 information.)

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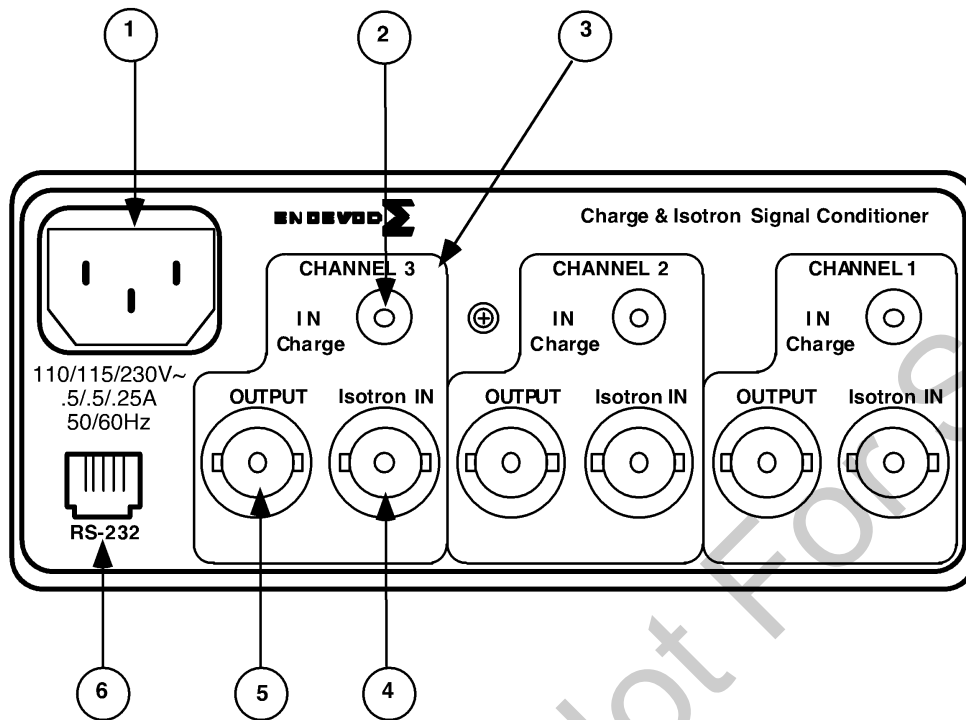
Figure 2

Figure 3 is the optional Model 133-1 Rear panel view. Item 1, is the DC input power connector. The input power requirements are: 9 to 18 volts DC and a maximum current of 1 amp. The input connector is a 760 Plug style.

Figure 3

Figure 4

Figure 4 is the Model 133 block diagram.

Figure 5

Figure 5 is the block diagram for the RJ-11 RS-232 computer control connector.

Figure 6

Figure 6 is the RJ-11, Modular Jack, Front View RS-232

Pin 1:   Analog Ground

Pin 2:   TX (connects to RX in computer)

Pin 3:   Not Used

Pin 4:   RX (connects to TX in computer)

Pin 5:   Digital Ground

Pin 6:   Digital Ground

2.4 OPERATION

The Endevco Model 133 can be manually programmed from the front panel (See Figure 1) by means of a "Select Channel" push-button, three (3) "Channel LEDs"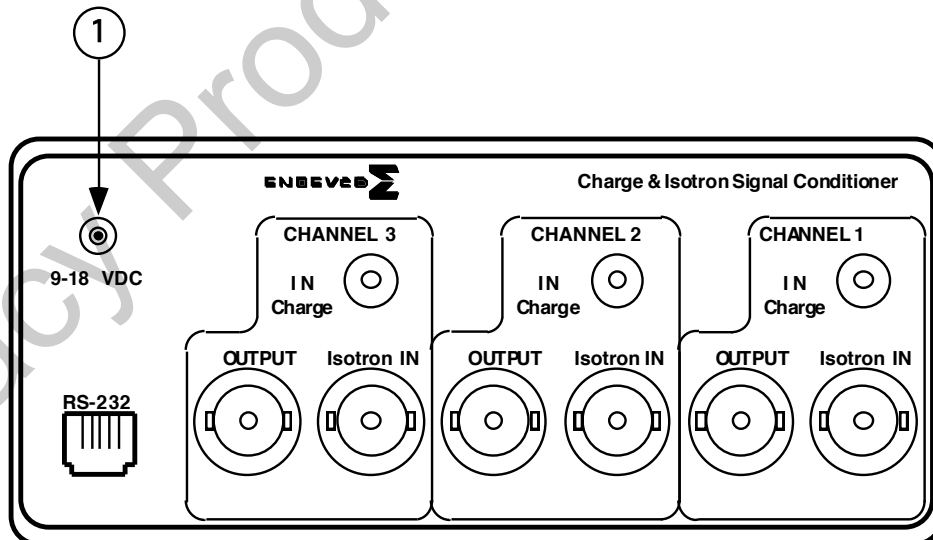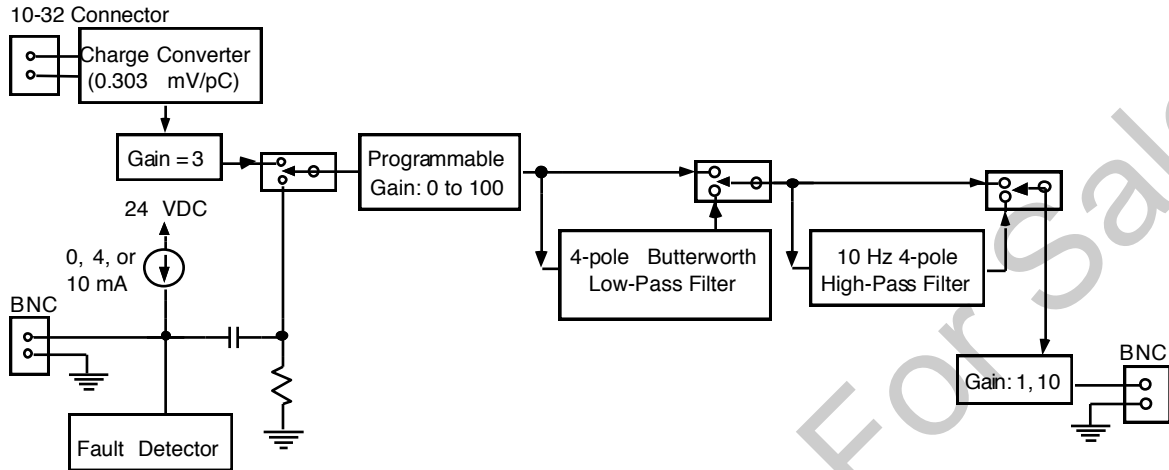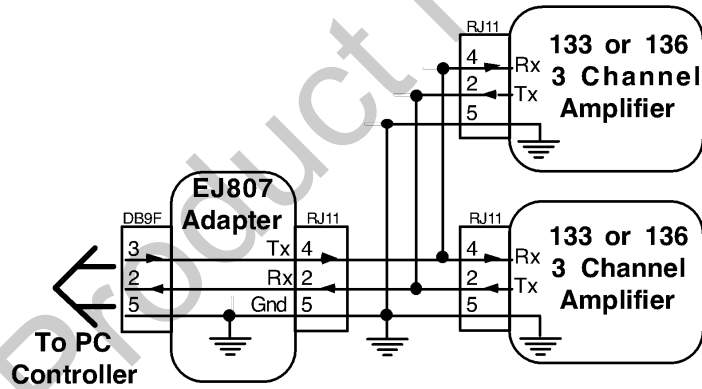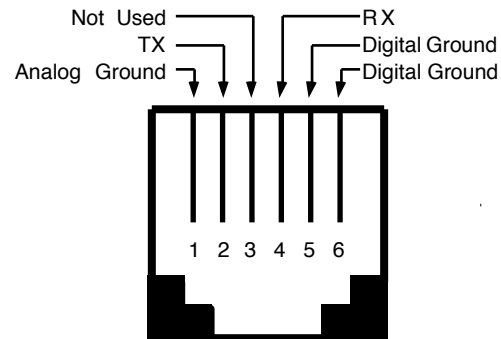, a "Select Function" push-button, seven (7) "Function LEDs" indicating which function has been selected by the "Select Function" push-button (referred in this document as the "function LED's"), a four (4) character LED display to show the state of each function, four (4) "EDIT" push-buttons to change the entries in the LED display, and three (3) LEDs indicating if there are any faults in any of the channels (referred in this document as the "Fault LED's").

The unit has two modes of operation: (1) Normal and (2) Query/Programming. In the Normal mode of operation, the unit can be in (a) Monitoring State, or (b) No-Monitoring State. While in the Normal mode of operation, the selected state will apply to all three channels simultaneously.

The unit will store the settings for all of the function in its internal memory and at power-up it will automatically restore the settings from the last session.

2.4.1 Channel Selection

The user selects which channel is being programmed by pressing the "Select Channel" push-button. Each press of the "Select Channel" push-button will sequentially turn-on one of the 3 "Channel LED's" located to the right of the "Select Channel" push-button indicating the channel number selected for programming.

The unit will remain in the selected mode/state of operation (normal or query/programming) while pressing the "Select Channel" push-button.

2.4.2 Normal Mode

1. Monitoring State

In the Monitoring state of operation the unit takes an RMS reading of the signal present at the output of the selected channel every 500 mSec and displays the value on the LED display in Engineering Units (EU: the physical variable in RMS being measured by the transducer) or V out in RMS. This state is activated by selecting either the "EU" or "V out" entry in the "Monitor" Function selection.

Pressing the "Select Channel" push-button while in the Monitoring state allows the user to quickly view (sequentially) the signal levels at the output of each channel.

2. No-Monitoring State

The No-Monitoring state allows for low noise operation. This is accomplished by not taking A/D readings from the outputs, and by placing the CPU in idle mode in order to minimize power consumption and digital noise in the unit. The LED display will be turned OFF. This state is activated by selecting the "OFF" entry in the "Monitor" Function selection.

2.4.3 Query/Programming Mode

The Query/Programming Mode allows for manual programmability and querying of the programmable functions. This Mode is activated by pressing the "Select Function" push-button.

A function is queried by selecting it using the "Select Function" push-button. The current setting for the selected function will be displayed on the LED display. The entry in the LED display is edited by using the four EDIT push-buttons (located just below the LED display.)

The new setting will be implemented into the unit hardware as soon as the entry shown on the LED display is modified. The unit returns to the Normal mode of operation after 20 seconds of inactivity (no push-buttons pressed) or after pressing the "Select Function" push-button while the "Monitoring State" function LED is flashing.

2.4.4 Function Selection

The user selects which function is being programmed by pressing the "Select Function" push-button. Each press of the "Select Function" push-button will sequentially make one of the "Function LEDs" blink indicating that the function is selected for programming.

The first press of the "Select Function" push-button selects the function LED that was selected the last time that the unit was in Query/Programming Mode. The selected Function LED will be blinking and the current setting will be displayed on the LED display. Each additional press of the "Select Function" push-button selects the next function (corresponding Function LED blinking) and the corresponding setting is displayed on the LED display. Pressing the "Select Function" push-button while the "Monitoring State" function LED is flashing puts the unit immediately back into Normal mode.

The following functions can be selected for programming: (1) Input Select, (2) ISOTRON Current Excitation, (3) Sensor Sensitivity, (4) Output Scaling, (5) High pass Filter, (6) Low pass Filter, and (7) Monitoring State.

When the function is selected, the corresponding "Function LED" will stay blinking until the "Select Function" push-button is pressed again to select the next function. The LED display will show the current setting for the selected function. The EDIT push-buttons can then be used to change the setting. If no buttons are pressed after 20 seconds, then the "Function LED" will stop blinking and the unit will return to the normal mode of operation (monitoring or non-monitoring state).

Each "Function LED" will remain OFF or ON during the normal mode of operation (and also immediately after selecting the next function) depending on the setting selected by the user for the corresponding function.

The user can select a function, and then use the "Select Channel" push-button to view/edit the current setting for the selected function for each channel.

1. Input Select

This function is used for selecting the type of input to be enabled. The up-down EDIT push buttons are used to select the input type. The following messages will be shown sequentially on the LED display each time the up-down EDIT push buttons are pressed: (1) "Chrg", and (2) "Volt".

1. "Chrg": Piezoelectric (PE) input is enabled.
2. "Volt": ISOTRON input is enabled.

The "Function LED" corresponding to the Input Select function will remain OFF or ON during the normal mode of operation if the user selected the "Chrg" or "Volt" setting respectively.

2. Current Excitation

This function is used for setting the excitation current connected at the ISOTRON (Voltage) input. **This setting is applied to all three (3) channels simultaneously (each channel can not have its own setting).** The up-down EDIT push buttons are used to select the excitation current level in mA. The following messages will be shown sequentially on the LED display each time the up-down EDIT push buttons are pressed: (1) "0.0", (2) "4.0" and (2) "10.0".

1.   "0.0": Excitation current disabled.
2.   "4.0": Excitation current set to 4.0 mA.
3.   "10.0": Excitation current set to 10.0 mA.

The "Function LED" corresponding to the Current Excitation function will remain OFF during the normal mode of operation if the user selected the "0.0" setting (excitation current disabled). The function LED will remain ON if the excitation current was enabled by selecting any of the other settings listed in the table above.

3. Sensor Sensitivity

This function selection provides for programming the sensitivity of the transducer (in mV/EU for Voltage input, or pC/EU for Charge input). The Endevco Model 133 uses this information to determine the gain needed to achieve the required output scaling. The left-right EDIT push buttons select the number position in the LED display, and the up-down EDIT push buttons increment or decrement the selected number.

The user can enter four significant digits ranging from 0.001 to 9999.

4. Output Scaling

This function selection provides for programming the desired scaling of the amplifier's output (in mV/EU). The left-right EDIT push-buttons select the number position in the LED display, and the up-down EDIT push-buttons increment or decrement the selected number. The Endevco Model 133 determines the gain needed to achieve the required output scaling by using the following equation:

Amplifier's Gain = Output Scaling / Sensor Sensitivity

The gain of the amplifier will be set to within the resolution specified in the Performance Specification. The entry in Output Scaling depends on the Sensor Sensitivity setting and it will automatically change to the lowest or highest limit if the current entry violates the following constraint:

$0 \leq$ Output Scaling / Sensor Sensitivity ≤ 1000

The user can enter four significant digits ranging from 0.001 to 9999 limited by the above constraint.

The "Function LED" corresponding to the Output Scaling function will be set to OFF when the unit returns to the normal mode of operation.

5. High Pass Filter

This function selection provides for enabling or disabling the built-in 10 Hz 4-pole Butterworth High-Pass filter. The following messages will be shown sequentially on the LED display each time the up-down EDIT push buttons are pressed: (1) "OFF", and (2) "10.0".

1.   "OFF": High-pass filter disabled.
2.   "10.0": 10 Hz high-pass filter enabled.

The "Function LED" corresponding to the High-Pass Filter function will remain OFF during the normal mode of operation if the user selected the "OFF" setting (filter disabled). The function LED will remain ON if the high-pass filter was enabled by selecting the "10.0" setting.

6. Low Pass Filter

This function selection provides for enabling or disabling the built-in 4-pole Butterworth Low-Pass filter (set by header module 31875). The following messages will be shown sequentially on the LED display each time the up-down EDIT push buttons are pressed: (1) "OFF", and (2) "XX.XX".

1.   "OFF": Low-pass filter disabled.
2.   "XX.XX": Low-pass filter enabled. XX.XX represents the corner frequency in kHz.

The "Function LED" corresponding to the Low-Pass Filter function will remain OFF during the normal mode of operation if the user selected the "OFF" setting (filter disabled). The function LED will remain ON if the low-pass filter was enabled by selecting the "XX.XX" setting. XX.XX could be a value from 0.01 (10 Hz) to 80.00 (80 kHz). The unit displays the actual corner frequency in each channel by reading an ID Voltage (V_{ID}) set by the header module that sets the -3dB corner frequency of the low-pass filter. V_{ID} ranges from 0 to 2 VDC. The unit uses the table shown in section 10.0 to convert the ID Voltage into the corner frequency (in Hz).

7. Monitoring State

This function selection provides for programming the desired state of the amplifier while in the normal mode of operation. The following messages will be shown sequentially on the LED display each time the up-down EDIT push buttons are pressed: (1) "EU", (2) "V out" and (3) "OFF".

1.   "EU": RMS voltage at V out is monitored and shown on the LED display in EU at the rate of approximately two (2) times per second. The values displayed on the LED display range from 0.000 to 9999. The value shown on the LED display is computed as follows:

Display (EU) = VRMS at Output / Output Scaling

2.   "V out": RMS voltage at V out is monitored and shown on the LED display in VRMS at the rate of approximately two (2) times per second. The values displayed on the LED display range from 0.00 to 9.99. The value shown on the LED display is computed as follows:

Display (VRMS) = VRMS at Output

3.   "OFF": The LED display will be turned OFF. This setting provides the lowest noise performance.

The "Function LED" corresponding to the Monitor function will remain OFF during the normal mode of operation if the user selected the "OFF" setting. The function LED will remain ON if monitoring was enabled by selecting any of the other settings listed in the table above.

2.4.5 Special Modes

The special modes are not frequently used and they may be selected by pressing the "Select Function" push button while simultaneously pressing a combination of multiple EDIT push buttons. The unit must be in the normal mode of operation to enter any of the special modes of operation. The table below shows the combination of the EDIT push buttons that need to be pressed to obtain the desired special mode.

Mode	EDIT push-buttons
Addressing	RIGHT
Error List	LEFT
Reset	UP
Store Setup in EEPROM	DOWN
Test Display	UP & LEFT
Recall Default Setup	DOWN & RIGHT
Calibration	LEFT & RIGHT
Troubleshooting	UP & DOWN
Not Assigned	UP & RIGHT
Not Assigned	DOWN & LEFT

1. Addressing

This special mode selection provides for programming the address of the unit used for computer control through the RS-232 serial communication. The unit's address applies to all 3 channels (same address regardless of the channel selection).

The unit determines its address at power up by using the following algorithm:

1) VID: Address determined by ID voltage set in hardware
2) MEM: Address stored in non-volatile memory
3) READ VID
4) IF VID = 0 THEN Address = MEM
5) IF VID > 0 THEN Address = VID = MEM

This special mode is selected by pressing the "Select Function" push button while simultaneously pressing the RIGHT EDIT push button. The unit returns to the normal mode of operation (Monitoring or Non-monitoring state) after pressing the "Select Function" push button one more time.

When this special mode is selected the first "Function LED" will be blinking and the serial communication baud rate for the unit will be shown on the LED display. The baud rate can be modified by using the EDIT buttons. An additional Press of the "Select Function" button will make the second "Function LED" blink and the address of the unit will be shown on the LED display. The address can be modified by using the EDIT buttons only if VID = 0. The new address will be set and stored into the internal non-volatile memory when the unit returns to the normal mode of operation.

2. Error List

This special mode selection allows the user to retrieve a listing of all of the errors that may be causing the failure LED to be ON.

This special mode is selected by pressing the "Select Function" push button while simultaneously pressing the LEFT EDIT push button. The unit returns to the normal mode of operation (Monitoring or Non-monitoring state) after pressing the "Select Function" push buttons one more time.

After the mode is selected, all of the "Function LEDs" will be off and the first error code will be shown on the LED display. The user may scroll through the list by using the UP and DOWN EDIT push buttons.

3. Reset

This special mode selection allows the user to reset the unit (equivalent to a power-up initialization).

This special mode is selected by pressing the "Select Function" push button while simultaneously pressing the UP EDIT push button. The unit returns to the normal mode of operation (Monitoring or Non-monitoring state) immediately after initialization.

4. Store Setup in EEPROM

This special mode selection allows the user to force the unit to store all of the function settings into non-volatile memory.

This special mode is selected by pressing the "Select Function" push button while simultaneously pressing the DOWN EDIT push button. The unit returns to the normal mode of operation (Monitoring or Non-monitoring state) immediately after writing all of the function settings into non-volatile memory.

5. Test Display

This special mode selection allows the user to test the display board by displaying a different pattern on the LED indicators and the LED display every time any one of the front panel push buttons is pressed.

This special mode is selected by pressing the "Select Function" push button while simultaneously pressing the UP and LEFT EDIT push buttons. The unit returns to the normal mode of operation (Monitoring or Non-monitoring state) after pressing the "Select Function" push button one more time.

6. Recall Default Setup

This special mode selection allows the user to recall the default function settings.

This special mode is selected by pressing the "Select Function" push button while simultaneously pressing the DOWN and RIGHT EDIT push buttons. The unit returns to the normal mode of operation (Monitoring or Non-monitoring state) immediately after restoring all of the default function settings.

Function	Factory Default Setting
1. Input Select	Volt (ISOTRON)
2. Current Exc. (mA)	0.0 (off)
3. Sensitivity	1.000
4. Output Scaling	1.000
5. HP Filter	10.0 (on)
6. LP Filter	XX.XX (on)
7. Monitoring State	V out

7. Calibration

This special mode selection allows the user to manually calibrate the unit.

This special mode is selected by pressing the "Select Function" push button while simultaneously pressing the LEFT and RIGHT EDIT push buttons. When this special mode is selected the first "Function LED" will be blinking and the first calibration constant for the selected channel will be shown on the LED display. The settings of all of the functions will be saved in non-volatile memory when entering this mode.

The user selects which calibration constant is being set by subsequently pressing the "Select Function" push button. Each press of the "Select Function" push button will sequentially make one of the "Function LEDs" blink indicating that the calibration constant is selected for programming and the corresponding calibration constant will be shown on the LED display.

Pressing the "Select Function" push-button while the "Monitoring State" function LED is flashing places the unit back into Normal mode. The calibration constants will be stored into the internal non-volatile memory when the unit returns to the normal mode of operation. The settings for all of the functions will be restored using the new calibration constants when the unit returns to the normal mode of operation.

A checksum for the calibration constants is also stored in non-volatile memory. The unit will use this checksum at power up to verify that all calibration constants are good. The unit will declare an error if the checksum test for the calibration constants fails.

A cross-reference table between the calibration constants and the "Function LEDs" is shown below (the input select and gain settings for each calibration constant is also shown).

Function LED	Calibration Constant	Input Select	Gain
1. Input Select	k1 for $100 \leq Gain \leq 1000$	Volt	200
2. Current Exc. (mA)	k2 for $10 \leq Gain < 100$	Volt	20
3. Sensitivity	k3 for $0 \leq Gain < 10$	Volt	2
4. Output Scaling	k4 for $0 \leq Gain < 10$	Chrg	2
5. HP Filter	k7 for $0 < Gain < 10$	Chrg	2
6. LP Filter	k5 to calib. slope of A/D	Chrg	2 & 1
7. Monitoring State	k6 to calib. offset of A/D	Chrg	2

a)   Gain Calibration

Calibration constants k1 through k4 and k7 are used to calibrate the gain of the unit. This is accomplished by applying a 300 Hz calibration signal into the ISOTRON input for k1, k2, and k3, or into the Charge input for k4, and adjusting the calibration constant displayed on the LED display until the desired output (input signal multiplied by gain) is obtained. The amplitude of the input signal should be set to 30.0 mVRMS for k1, 0.300 VRMS for k2, 3.00 VRMS for k3, 3000 pC-RMS for k4 and k7 (3.0 VRMS into a 1000 pF series capacitor).

b)   A/D Calibration

Calibration constants k5 and k6 are used to calibrate the Analog to Digital converter of the unit. The following procedure must be followed to accomplish this calibration:

1.   Select Function LED # 6 (LP Filter) and apply an approximately 3 Vrms at 300 Hz calibration signal into the Charge and adjust the calibration signal amplitude input so that the output signal is set to 6.0 VRMS.

2.   Press the LEFT or RIGHT edit push-buttons. The unit will display the raw (uncalibrated) voltage read by the A/D for about 3 seconds (a number between 5 and 7). Then, waiting for about 5 seconds, the unit will change the gain to 1, and will display the calibration constant for the slope of the A/D.

3.   Select Function LED # 7 (Monitoring State). The unit will display the calibration constant for the offset of the A/D.

8. Trouble Shooting Mode

This special mode selection allows the user to control any digital I/O port for troubleshooting purposes.

This special mode is selected by pressing the "Select Function" push button while simultaneously pressing the UP and DOWN EDIT push buttons. Pressing the "Select Function" push-button while the "Monitoring State" function LED is flashing places the unit back into Normal mode.

2.4.6 Fault Indication

There are three (3) fault indicators (red LEDs) for each channel located on the front panel. The fault indicator will turn on if the ISOTRON input is either open or short circuited, while the input select function for the corresponding channel is set to ISOTRON, and the Current Exc. is turned on (4 or 10 mA).

2.4.7 RS-232 Serial Communication

The unit has a standard RS-232 serial interface available through an RJ-11 connector located on the rear panel (see Figures 3, 5 and 6).

In the accessories section of this manual lists all options available options for serial communication. The Serial Communication Kit contains the necessary items to control up to three units. Should additional units be added for serial communication additional cables and RJ-11 adapters would be required.

Figure 5 shows how to connect a computer to control up to 16 Model 133 amplifiers. The following functions can be executed through the serial interface from a controller:

1. Identification of the unit: Model Number (133, 136, etc.), firmware revision, address.
2. Send settings for all of the 7 functions programmable through the front panel.
3. Query settings for all of the 7 functions programmable through the front panel.
4. Send calibration constants. The new calibration constant will take effect immediately and it will be stored into non-volatile memory.
5. Query calibration constants.
6. Query raw and calibrated output RMS data from A/D.
7. Query corner frequency of installed low pass filter.
8. Query error list.
9. Reset the unit.

2.4.8 Filter Options and Installation

1.   Introduction

The ENDEVCO Model 31875 plug in, Low Pass Filter Modules are optional Butterworth filters designed for use with the Endevco Model 133, PE and ISOTRON Signal Conditioner and Model 136, DC Amplifier.   The filters are low-cost designs with sufficient corner frequencies to accommodate most test requirements.

The self-identifying feature allows quick verification of the filter installed in a particular channel for the model 133 or model 136. Each channel will display the filter corner frequency on the LED digital panel meter. Only the filter corner frequency is displayed. The filter type (Butterworth) can only be visually verified by removing the outer cover.

There are 20 corner frequencies available, ranging from 10 Hz to 80 kHz in 1, 2, 4, 6, and 8 steps for each of the three filter types. The 31875 must be specified in the following manner: 31875-XXXX-Y. The "XXXX" is the -3 dB corner frequency, determined by multiplying XXXX by 10. If the "XXXX" is left blank, the standard 10 kHz filter is supplied (-1000). The Y indicates the filter type desired, -0 for the Butterworth if the "Y" is left blank the standard Butterworth filter is supplied.

The filter options of 400 Hz and 2,000 Hz are not valid. The 400 Hz option has been replaced by 300 Hz. The 2,000 Hz option has been replaced by 1,650 Hz. These two lower frequency options are specifically made to comply with the filter corner requirements of J211 and ISO6487.

If no filter is specified at time of order entry, the standard default filter installed is a 10 kHz low pass Butterworth.

See Appendix 1 for the Model 31875 Low Pass filter data sheet and corner frequency selections.

2.   Filter Change/Replacement

Place the model 133 on a level, firmly supported surface. Remove the two front panel screws. Leave the front panel connector connected to the main board. Carefully slide the black cover from the unit.

Reference Figure 7 for the location of the three filter modules. Carefully pry off the metal grounding shield and locate the existing filter module(s) and gently pry it off (as you would an IC in a socket) and store it for future use.

Observing the correct orientation of the new filter module(s), install it in the correct channel location desired. Reinstall the grounding shield.

Ensure the front panel connector is firmly connected and re-assemble the cover and front panel.

CAUTION: Ensure that the two front panel mounting screws are not over tightened or cross threaded. The aluminum rail screws mount into soft metal that can easily be damaged. Should the rail become damaged, simply locate a replacement screw of a 1/2 inch longer length and install into the damaged rail. (The screws are 4-40, stainless steel, self-tapping.)
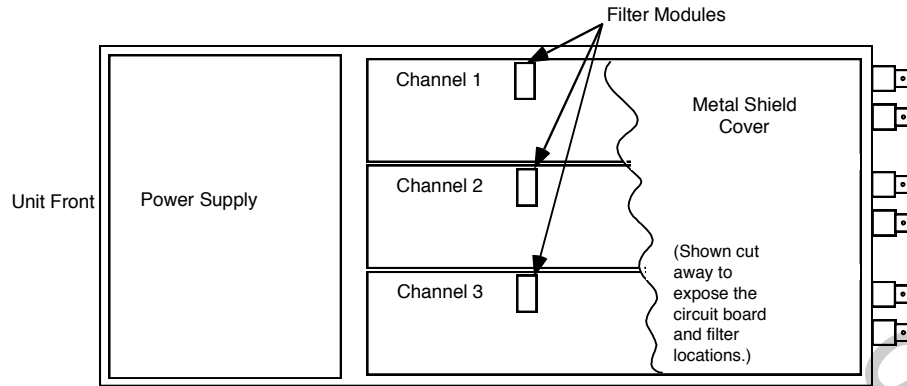
Figure 7

2.4.9 Sample Set Up

The following information is intended for the first time or infrequent user of this amplifier.

A. Using figure 1 as a reference, perform the following initial setups:

1. Using the "Select Channel" button, select channel 1. (The LED illuminated is the channel that is being monitored by the DPM.)

2. Using the "Select Function" button, select the appropriate sensor type. While the LED is flashing for the Input Select function, press the "Edit" button directly above or below the word "Edit" on the front panel. This will cause the DPM to display either "Chrg" or "Volt". Once the appropriate sensor type is selected, press the "Select Function" button to save that configuration of input and the "Select Function" LED will automatically advance to the next function. (Assume a PE accelerometer is used with a sensitivity of 10.04 pC/g.)

3. With the "Current Exc. (mA)" LED flashing, use the button directly above or below the word "Edit" to select either 0, 4 or 10 mA. If, in step two above, the configuration was set for a "Chrg" type input then the current level will not affect the charge-type accelerometer. If a voltage or ISOTRON accelerometer was selected, then it is acceptable to set the current level to 4 mA as a starting point. (Only one common current level may be set for all three channels.) (Assume a PE accelerometer is used, so any selection is acceptable.)

4. Press the "Select Function" button to advance to "Sensitivity (pC or mV/EU)". While the LED is flashing, enter the correct sensitivity value of the sensor being used. (This is accomplished with the top and bottom "Edit" buttons to increase or decrease the value. The left and right "Edit" buttons move the digiton the DPM to be changed. The actual value must be within the range of 0.001 to 9999.) Using the same assumption, input 10.04 on the DPM.)

5. Press the "Select Function" button to advance to "Output Scaling (mV/EU)". While the LED is flashing, enter in an appropriate value, which must be within the following limits: (The scaling value entered is valid for 0.001 to 9999 along with the following limitation: $0 \leq$ Output Scaling / Sensor sensitivity ≤ 1000.

To better understand the correct scaling value to enter, the following questions must be answered:
   a. What is the desired full scale output voltage?
   b. What is the maximum g range to be measured (in g's or EU)?
   c. What is the sensor sensitivity?

Example1.

The desired full scale output voltage is 1.0 volt; The desired full scale input range is 2 g's; The sensor sensitivity is entered is10.04 pC/g. The value to enter for output scaling is: 500. Therefore, when the output is 1 volt, the input to the unit is equivalent to 2 g's.

Example 2.

The desired full scale output voltage is 10.0 volts; The desired full scale input range is 5 g's; The sensor sensitivity is entered as 0.95 pC/g. The correct scaling factor is: 2000. The output is equivalent to 2 volts per g. At full scale of 10 volts the output is 5 g's.

The same requirements hold true for a voltage or ISOTRON type accelerometer.

6. Press the "Select Function" button to advance to "HP Filter (Hz)". The options are OFF or 10.   (Assume OFF.)

7. Press the "Select Function" button to advance to "LP Filter (kHz)". The options are OFF or 10.00 for the standard default 10 kHz filter module. (Assume OFF.)

8. Press the "Select Function" button to advance to "Monitoring State". The options are EU, V out or OFF. (Assume V out, which monitors the vibration from the accelerometer and displays the RMS voltage on the DPM.)

9. Connect the PE accelerometer cable to the small 10-32 connector of channel 1, on the rear of the Model 133. Attach the accelerometer to a known vibration source, such as a shaker, as a means to verify the input vibration level and verify the output with various input g levels.

10. Connect an oscilloscope or other monitoring devices to visually see the input signal or reference the DPM on the front of the Model 133.

11. Channels two and three are controlled in a similar manner.

2.5   RACK MOUNTING KIT

A. Description

The optional rack mounting kit, PN 31979, is an optional kit that can be purchased to mount from one to three of the Model 133/136 units (the Model 136 is a three-channel DC amplifier using the same package as the Model 133). The kit consists of the two blank panels, the front panel mount and the support bracket. The kit is designed to mount to standard 19" rack enclosures.

B. Mounting Instructions

To install one or more model 133/136 units, first remove the two front panel screws from the Model 133. Gently remove the plastic frame from the Model 133 front panel (store the panel for future use and for return of the unit to Endevco when required). Hold the Model 133 behind the front panel mount, (the part with three cut-out rectangular holes), gently insert the Model 133's front panel through the correct position to be mounted. Reinstall the Model 133's using the longer 3/4" front panel screws provided in the 31979 Rack Mount Kit, sandwich between the Model 133's front panel and the Model 133's main body. In a similar manner, install the other units. The blank panels are used only when one or two Model 133's are used.

Section 3: ROUTINE MAINTENANCE AND HANDLING

3.1 INTRODUCTION

The Model 133 PE/ISOTRON Amplifier is self-contained electronic instrument that requires minimal maintenance.

The Model 133 is designed to require no component-level repair by the user. However, detailed schematics are available upon request.

The only periodic function performed by the user is quality calibration. Any component failures simply require the user to return the unit to Endevco for repair/replacement.

Should a faulty unit be returned to Endevco, it is suggested that the original or equivalent packaging be used. This will reduce damage to the equipment during shipment.

3.2 FACTORY SERVICE

A. FACTORY SERVICE

Endevco maintains factory service repair for all Endevco instruments. To obtain repair or replacement of a defective instrument, place a call to Endevco to obtain a return material authorization number (RMA) , then return the instrument to the factory at the following address:

Endevco
www.endevco.com
Tel: +1 (866) ENDEVCO [+1 (866) 363-3826]

To return an instrument, please:

1. Ensure proper packaging, preferably the original shipping cartons.
2. Prepay shipping and insurance charges.
3. Attach the Return Material Authorization (RMA) number from Endevco and include any information that may be pertinent to the description of the failure/problem.

B. WARRANTY

Endevco warrants each new electronic instrument to be free from defects in material and workmanship. Please refer to the appropriate Warranty Policies for the terms and warranty period. Instruments returned under warranty will be repaired or replaced at no charge, If the failure is due to defective material or workmanship; and the unit is returned within the time period and conditions of Endevco's warranty policy.

C. OUT-OF-WARRANTY RETURNS

Enclose a purchase order not to exceed $300.00, authorizing repair/calibration along with a full explanation of the failure or symptoms observed to help in fixing the problem.   The instrument will be repaired/calibrated, returned and invoiced for the actual repair charges. If the instrument cannot be repaired for $300.00 or less, Endevco will submit a written quotation for the cost of the repair and/or replacement of the unit.

Endevco®

3.3 Ordering Information and Accessories

ENDEVCO® Model 133 must be specified in the following manner: 133-X

If no filter is specified at time of order entry, the standard default filter installed is a 10 kHz low pass Butterworth.

If X is left blank, the standard 90-240 VAC Power is supplied. If X = 1, then the 9-18 VDC Power is supplied.

Description	Endevco Part No	Quantity Supplied
IEC 320 AC Power Cord	EW599	1
Instruction Manual	IM133	1
10-32 to BNC adapter	EJ21	0
Filter Module 4-pole Low Pass Filter Options	31875-XXXX-Y	0
Serial DB9F to RJ-11 Adapter	EJ807	0
7 ft. 6P4C Cable with RJ-11 Modular Plugs, Straight Pinning	EW1027	0
Rack Mounting Kit	31979	0
Auto Lighter to 760 Plug Cord Assembly (133-1 only)	EHM1409	1
12 VDC Power Supply, 26 Watts	EHM1413	0
Serial Communication Kit, Containing the following: Software, three EJ822, one EJ807 and one EW1027.	32009	0
Modular Splitter Adapter M-F (6 x 4)	EJ822	0
Application Software	35933	0
Inline Coupler, RJ11 (6 x 4)	EJ847	0
Cable, 6P4C, Straight, w/RJ11 (2 ft.)	EW1077	0

WARNING! Use of RJ11 cable other than that specified herein will cause catastrophic failure of the unit

SECTION 4:

APPENDIX 1 FILTER MODULE MODEL 31875 DATA SHEET

APPENDIX 1 FILTER MODULE MODEL 31875 DATA SHEET

The choices of Butterworth filter corner frequencies are as follows:

f_0 (Hz)	Part number to order
10	31875-0001-0
20	31875-0002-0
40	31875-0004-0
60	31875-0006-0
80	31875-0008-0
100	31875-0010-0
200	31875-0020-0
300	31875-0030-0
600	31875-0060-0
800	31875-0080-0
1000	31875-0100-0
1650	31875-0165-0
4000	31875-0400-0
6000	31875-0600-0
8000	31875-0800-0
10,000	31875-1000-0
20,000	31875-2000-0
40,000	31875-4000-0
60,000	31875-6000-0
80,000	31875-8000-0

APPENDIX 2 SERIAL COMMUNICATION

Communication Protocol - Each transmission is of the form: [Header] [;] [Body]

The Header and Body are separated by a semi-colon and are each made up of several components separated by one space. Square brackets, [], indicate a mandatory component. Curly brackets,{}, indicate a conditional component. The Header is of the form;

[Model/Unit] [space] [Channel] [space] [Command]

The Body is of the form;

{data} [checksum] [Terminator]

Each transmission to a 13x unit will invoke a response of this same form.

Each component of the transmission is decimal integer ASCII text.

Model/Unit (Required) is a two byte value in which the upper byte indicates the model type (0=133, 1=136) and the lower byte indicates a Unit number in the range 1-20. However, commands 0,6 & 8 allow 0 to indicate the command and it's associated data, if any, applies to the specified channel of all units with the identified Model Type.

In Rack mount systems the Unit address of each 3 channel device is determined by the rack. For standalone systems the address is programmable through the front panel. All units will receive all serial transmissions. However, only the unit with the same unit address will respond.

Channel (Required) is in the range 1-3. However, commands 0,2,3,4,5 & 7 allow 0 to indicate the command and it's associated data, if any, applies to all channels.

Command: (Required) is one of the following:

    0x00 - [Channel x] {Setup data} {checksum} follows - (13x Receives)
    0x01 - [Channel x] {Cal Constant Data}{checksum} follows - (13x Receives)
    0x02 - [Channel x] Send {Setup/Status data} - (13x Sends)
    0x03 - [Channel x] Send {Calibration Constant Data} - (13x Sends)
    0x04 - [Channel x] Send data - (13x Sends)
    0x05 - [Channel x] Send Raw data - (13x Sends)
    0x06 - [Channel x] Stop Sending data (unit # = 0 indicates all units are to stop)
    0x07 - [Channel x] {Data Interval in seconds (0=single shot)}
    0x08 - Reset Unit (unit # = 0 indicates all units of this model type are to reset)
    0x09 - Send Unit ID (13x Sends)
    0x0A - Send LP Corners (13x Sends for all channels)
    0x0B - Send Error List (13x Sends for all channels)

Data: The Setup Data, Cal Constant Data and Data Interval - commands (0,1&7) require additional information to accompany the command. The format of these data packets is as follows;

Channel Setup Data - This packet consists of 7 items. These items correspond exactly to the 7 items associated with the Programming Mode Function LEDs on the front panel of the 13x units. If the unit number indicated in the transmission header equals zero (0) then data will be applied to all units for the specified channel(s). If the channel number indicated in the transmission header equals zero (0) then data will be applied to all three channels of the addressed unit. The following must be adhered to for proper reception by the 13x units:

1) The order of these items is fixed. For Model 133 the order is Input Select to Monitoring, for Model 136 the order is Voltage Excitation to Monitoring. For the range of possible settings for each item see the sections below on model specific hardware control.

2) Only complete setups are accepted (all 7 items sent even if only 1 changes).

3) Each item's setting must be converted to a decimal integer string scaled to accommodate the transmission of floating point values with resolutions to 1/1000. (ie all item settings are multiplied by 1000 and converted to ASCII).

4) Each item is separated by 1 space character (0x20)

Channel Calibration Constant Data - This packet consists of 7 items. These items correspond exactly to the 7 items associated with the Function LEDs on the front panel of the 13x units while in Calibration Mode. The specifics of these are detailed in the section specifying Calibration Mode. Their method of transmission is identical to that of the channel setup transmission.

Data Interval - This is an unsigned integer value (16 bits) which represents the number of seconds between data transmissions, calibrated or raw, after either of the 'Send Data' commands is sent to a 13x unit. A value of 0 indicates a single sample of data is requested. The 13x firmware will terminate the Send Data condition after 1 sample of data (per enabled channel) is sent. To accomplish single transmissions easily set the Data Interval to 0 first then send Send Data commands at will. One data sample per Send Data command will be returned with this scenario. The firmware default is 0 - Single Shot mode.

Checksum (Required) A one byte summation of the entire transmission, header and data (if any) without the terminator, is required on all transmissions sent to the 13x.

Terminator (Required) The last item in the transmission, A Line Feed character (0x0A).

Response (Required) The following table illustrates the response to the received command and the error responses;

Command #	Command	13x Response
0x00	Setup to 13x	ACK
0x01	Cal Constants to 13x	ACK
0x02	Setup from 13x	Cmd <data>
0x03	Cal Constants from 13x	Cmd <data>
0x04	Calibrated Vout data	ACK ....Cmd <data>
0x05	Raw Vout data	ACK ....Cmd <data>
0x06	Stop Data	ACK
0x07	Data Interval to 13x	ACK
0x08	Reset Unit	ACK
0x09	Unit ID from 13x	Cmd <data>
0x0A	LP Corners from 13x	Cmd <data>
0x0B	Error List from 13x	Cmd <data>
0x0C	ACK	
	Reason	**13x Error Responses**
0x0D	Bad CS or Not enough data	NAK
0x0E	Channel # too high	Bad Channel
0x0F	Setup value out of range	Bad Setup
0x10	Hw setup unit reports error	Setup Error
0x11	Setup value out of range	Bad Cal Constant

Response Data (conditional): The following sections describe the response of the 13x to commands that require it to send data (all data described below follows a transmission Header identical to that described above).

Channel Setup Data - The data sent in response to the 'Setup from 13x' command (0x02) is identical to the format of the Setup to 13x' command (0x00) described above. If the channel number indicated in the header equals zero (0) then data will be sent for all three channels.

Calibration Constant Data - The data sent in response to the 'Cal Constants from 13x' command (0x03) is identical to the format of the Cal Constants to 13x' command (0x01) described above. If the channel number indicated in the header equals zero (0) then data will be sent for all three channels.

Calibrated Vout Data - The data sent in response to the 'Calibrated Vout Data 'command (0x04) will be for the channel indicated in the transmission header. If the channel number equals zero (0) then data will be sent for all three channels. The transmission of data for the indicated channel(s) will continue at the rate specified by the 'Data Interval to 13x' command. The data will be one or three values formatted to be a decimal integer string. To render it back to a floating point number it should first be converted from a string to an integer and then divided by 1000.
  NOTE: If the unit is not in the 'Normal' mode of operation at the time it is scheduled to output data remotely, that data transmission will be skipped.

Raw Vout Data - The format of the data sent in response to the 'Raw Vout Data ' command (0x05) is identical to the Calibrated Vout Data discussed above.

Unit ID Data - The data sent in response to the 'Unit ID from 13x ' command (0x09) is a string which states the Model number and the firmware revision (i.e 133 REV A).

LP Corners Data - This data, sent in response to the 'LP Corners from 13x', command (0x0A) is a three item packet in the Decimal Integer String format which represents the Low Pass Filter corner frequency (in kHz) for each channel. To convert this integer to a floating point number divide by 100. (The internal 13x representation of this data is a 4 character string with an implied decimal point after the 2nd MS digit. This is why the division is by 100 and not 1000 used elsewhere).

Channel Error Data - This data, sent in response to the 'Error List from 13x', command (0x0B) is a three item packet in the Decimal Integer String format which represents the 13x errors on a per channel basis. This data should be converted from the string format to an integer format (no division). The three items are bit maps representing errors for each channel. The bit maps for each model are as follows:

Model 133

Bit 0 = 1 = EEPROM Write Error
Bit 1 = 1 = EEPROM Channel Setup Read Error
Bit 2 = 1 = EEPROM Calibration Constant Read Error
Bit 3 = 1 = Function Error
Bit 4 = 1 = Input Select Error

Model 136

Bit 0 = 1 = EEPROM Write Error
Bit 1 = 1 = EEPROM Channel Setup Read Error
Bit 2 = 1 = EEPROM Calibration Constant Read Error
Bit 3 = 1 = Function Error
Bit 4 = 1 = Auto Zero Error

Transmission Error Responses - In the event of a transmission error or data packet parameter errors one of the following may be sent by the 13x unit.

NAK (0x0C) - This response indicates either a bad checksum was calculated or there was not enough data transferred to satisfy the command requirements (i.e. a setup command with less that 7 items).

Bad Channel (0x0D) - This response indicates a channel number greater than 3 was received.

4.2.7.4.8.8.3   Bad Setup (0x0E) - This response indicates a Setup parameter received was out of range.

Setup Error (0x0F) - This response indicates that when a setup was implemented it resulted in an error.

Bad Calibration Constant (0x10) - This response indicates that a calibration constant received was out of range.

Serial Port Communication Parameters - Each unit has two parameters, Baud Rate and Address. These parameters are accessible from the Serial Mode which is entered by holding down the right arrow key and pressing the Function Select key (see the section on Other Modes).

Model 136 Serial Port Communication Example

ASCII String to send the Receive Unit ID command to a hypothetical Model 136, unit =20, Channel 1, command 9 - Receive Unit ID)

276\s1\s9;132

Where;
1. ASCII '276' (50,55,54) is the result of the binary operation ((1 << 8) | 20). Where 1=Model 136 and 20 is the unit number (this binary number is then converted to an ASCII string).

2. '\s' is a space (ASCII 32decimal)
3. ASCII '1' (49) is the binary channel # 1 converted to ASCII.
4. '\s' is a space (ASCII 32decimal)
5. ASCII '9' (57) is the binary command # 9 (Receive Unit ID) converted to ASCII.
6. ';' (ASCII 59decimal) is a header separator
7. ASCII '132' is the checksum of the command string. It is an ASCII representation of a binary summation of bytes. A checksum is required for all data sent to the unit. It is calculated as follows;

    checksum calculation = 50+55+54+32+49+32+57+59=388=184hex → checksum = lower byte only 84hex=132decimal

ASCII String to send the following configuration data to a hypothetical Model 136, unit =1, Channel ALL (0), Command =0 - Send Setup);

   Voltage Excitation = 5.0 = 3 (selected from the enumerated type def {0.0,15.0,10.0,5.0})
   Sensitivity=2.123 (floating Point value)
   Output Scaling =3.456 (floating Point value)
   Low Pass Filter = 10.0 = 1 (selected from the enumerated type def {OFF,10.0})
   Auto Zero = AUTO = 2 (selected from the enumerated type def {OFF,ON,AUTO})
   Shunt Calibration = RSH- = 1 (selected from the enumerated type def {OFF,RSH-,RSH+ })
   Monitoring Option = VOUT = 1 (selected from the enumerated type def {OFF,VOUT,EU})
   ASCII Representation of string;
   257\s0\s0;3000\s2123\s3456\s1000\s2000\s1000\s1000\s187

   Binary Representation of ASCII string (these are the bytes actually transmitted via rs-232 in decimal);
   50,53,55, 32,48,32,48,59,51,48,48,48,32,50,49,50,51,32,51,52,53,54,32,49,48,48,48,32,
   50,48,48,48,32,49,48,48,48,32,49,48,48,48,32,49,53,56,55

Where;
1. ASCII '257' (50,53,55) is the result of the binary operation ((1 << 8) | 1). Where 0=Model 136 and 1 is the unit number (this binary number is then converted to an ASCII string).
2. '\s' is a space (ASCII 32decimal)
3. ASCII '0' (48) is the binary channel # 0 (all channels) converted to ASCII.
4. '\s' is a space (ASCII 32decimal)
5. ASCII '0' (48) is the binary command # 0 (Send Setup) converted to ASCII.
6. ';' (ASCII 59decimal) is a header separator.
7. ASCII '3000' (51,48,48,48) is the Voltage Excitation option 3 (5.0) multiplied by 1000. This multiplication is done to normalize all of the data. Some values are floating point others are integer. All items in the setup are multiplied by 1000 to scale the floats to a fixed point number with the desired resolution.
8. The next 6 items are processed the same as the input select item.
9. ASCII '187' is an ASCII representation of a binary summation of bytes. A checksum is required for all data sent to the unit. It is calculated as shown above.
10. The response to the string will be an ACK (0x0C)

Questions

If you have any questions regarding the use of this or any Endevco product, please contact Endevco Application Engineering at 1-866-363-3826 in North America, or your local sales representative.