MODEL 137 LIQUID HELIUM LEVEL MONITOR

INSTALLATION, OPERATION, AND MAINTENANCE INSTRUCTIONS

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Introduction

The American Magnetics, Inc. (AMI) Model 137 Liquid Helium Level Instrument is an advanced, microprocessor-based, liquid helium level instrument utilizing AMI's patented sample-and-hold principle with automatic helium sensor vacuum burnout protection. The Model 137 is designed for unattended operation in systems where it is important to monitor liquid helium levels and minimize the liquid helium losses.

The Model 137 is designed to be used in conjunction with AMI liquid helium level sensors. The liquid helium level sensor consists of a small diameter NbTi filament in a hollow tube. A constant current is passed through this filament causing the portion of the filament in helium gas to become resistive, while the portion in the liquid helium remains superconducting. The resulting voltage across the resistive portion of the filament is read by the instrument, converted to a liquid level, and displayed on the front panel LED display.

Minimal liquid helium losses

In order to minimize liquid helium loss, the Model 137 automatically energizes the liquid helium level sensor at predetermined time intervals and monitors the normal (resistive) zone as it progresses from the top of the sensor toward the surface of the liquid helium. As soon as the normal zone reaches the liquid surface the level reading is saved and the sensor current is turned off until the next sample interval occurs. The SENSOR CURRENT LED is illuminated during each sample. Sample intervals are user programmable from the front panel and can be set between 0.0 (no delay between samples) to 600.0 minutes or hours. A sampling mode toggle switch provided on the front panel can be positioned for continuous readings during a helium transfer period or just a quick reading update.

Multiple sensor capability

The Model 137 has the capacity to monitor up to eight liquid helium sensors. Selection between the sensors is performed manually from the front panel of the instrument or remotely using a communication option. All non-selected sensors are electrically disconnected from the instrument.

Burnout protection

The Model 137 provides automatic helium sensor vacuum burnout protection. A sensor which is energized in a vacuum environment will self-heat to the point of burnout. AMI's innovative microprocessor-based circuitry detects incipient sensor burnout and de-energizes the sensor before damage can occur. A 5% increase in sensor resistance will trigger this protection, causing the current to be switched off for 6 seconds before attempting to resume normal operation.

Floating supply

Due to safety concerns, the high voltage power supply used for the sensor is a floating supply. This minimizes the possibility of personnel injury in the inadvertent event of someone who is grounded coming in contact with the energized sensor electrical wires.

Convenient display

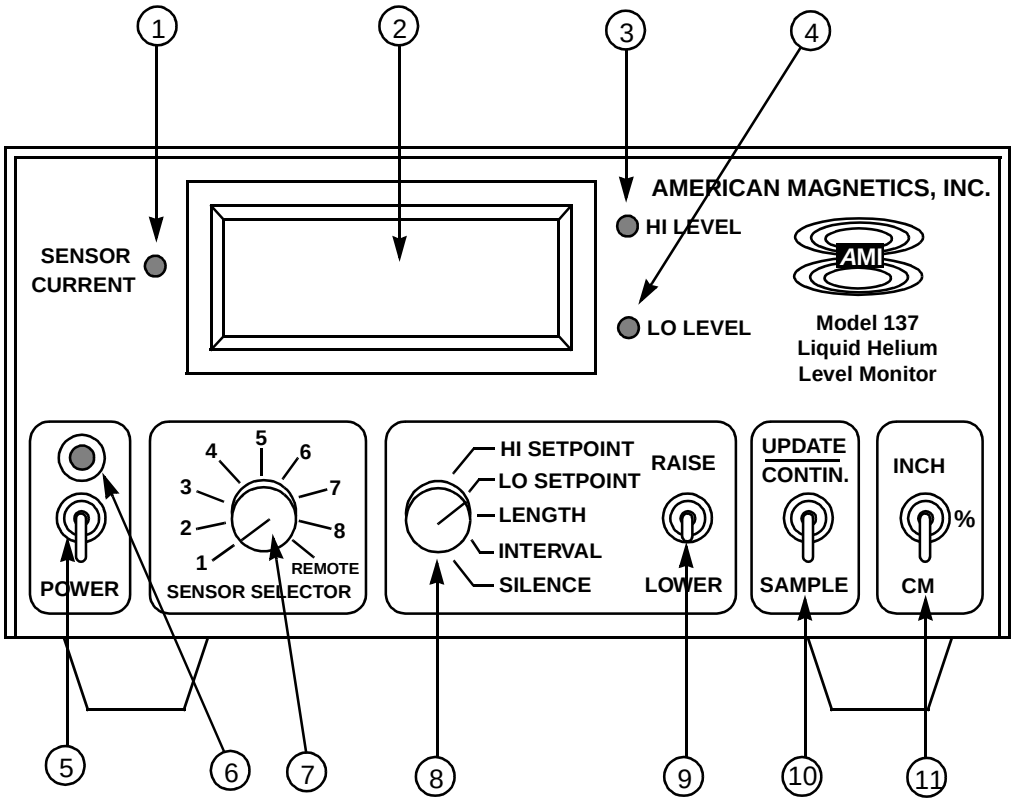
The Model 137 is equipped with a 4-digit LED digital display which provides liquid helium level indication in inches, centimeters or percent as selected by a front panel switch. A front panel switch allows the user to adjust the instrument quickly and easily for any length sensor up to 80 inches (203 cm). The sensor active length can be entered in either inches or centimeters.

Microprocessor-based electronics

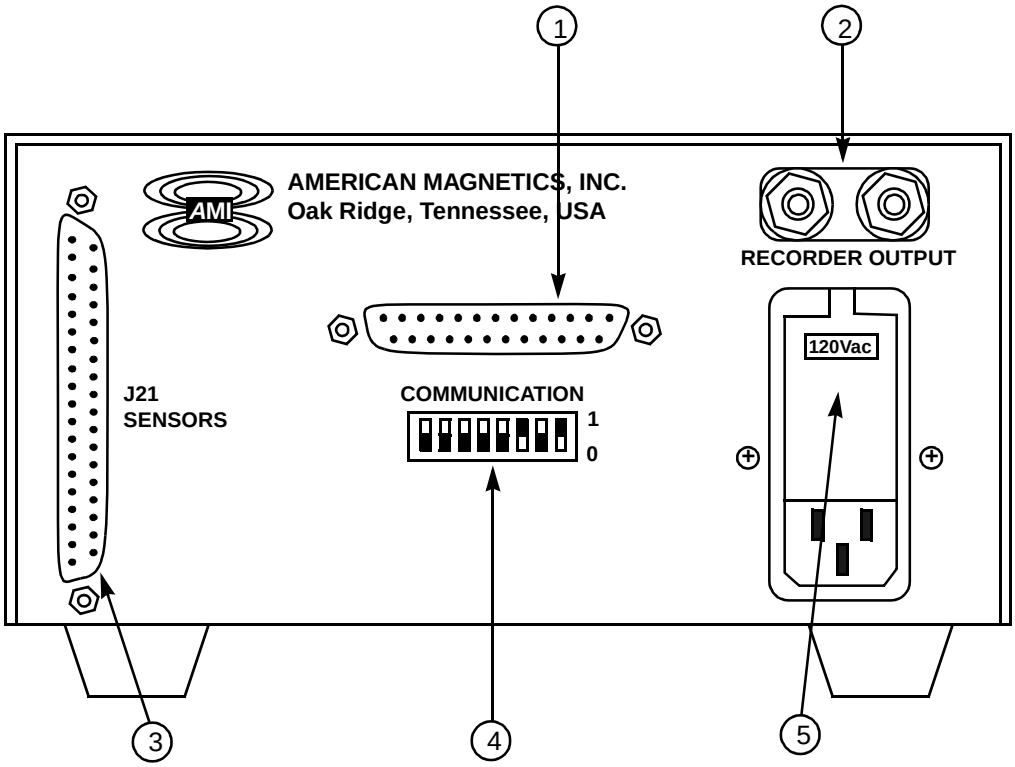
Microprocessor-based electronics provide 0.1% readout accuracy. Nonvolatile memory maintains instrument calibration without battery backup. Watchdog timer circuitry and low line voltage (brownout) detector prevent microprocessor lockup and provide fail-safe operation.

Remote computer monitoring or controlled operation

The Model 137 is provided with a 0-1 volt recorder output terminal. A 4-20 mA current loop option is available. Additional computer interface options including RS-232 Serial Port/Data Logger or IEEE-488 are also available.



1	Sensor current LED	**7**	Sensor selection rotary switch
2	LED display	**8**	Control mode rotary switch
3	Hi level LED	**9**	Raise/lower toggle switch
4	Lo level LED	**10**	Sampling mode toggle switch
5	Power toggle switch	**11**	Units mode toggle switch
6	Power ON LED		



1	RS-232 DB-25 female connector (GPIB female connector if GPIB option installed)	**4**	Communication DIP switches
2	0-1 VDC output (4-20 mA if current loop option installed)	**5**	Power-entry module
3	Sensor input DB-37 female connector (see Appendix for pinout diagram)		

Note

For the RECORDER OUTPUT: The red terminal is positive polarity. For the 4-20 mA option, the red terminal is loop positive and the black terminal is current output (loop return).

Input line voltage	100, 120, 220, 240 VAC ±10%
Input line frequency	50 - 60 Hertz, 1 phase
Linearity	0.1%
Sensor current	75 mA nominal (adjustable)
Sensor voltage	approx. 70 VDC @ 80" Active Sensor Length
Dimensions	4" H x 7.5" W x 11.25" D, Cabinet 3.5" H x 19" W x 13" D, Rack Mount
Weight	5 lbs. Cabinet; 7 lbs. Rack Mount
Operating environment	15 - 50°C non-condensing

Contents

1 Installation

Warning

Before energizing the instrument, the earth ground of the power receptacle must be verified to be at earth potential and able to carry the rated current of the power circuit. Using extension cords should be avoided, however, if one must be used, ensure the ground conductor is intact and capable of carrying the rated current.

In the event that the ground path of the instrument becomes less than sufficient to carry the rated current of the power circuit, the instrument should be disconnected from power, labeled as unsafe, and removed from place of operation.

This document contains operating instructions as well as calibration instructions. The calibration procedure is to be performed only by trained service personnel familiar with electrical safety precautions and proper energized electrical safety procedures. Do not perform any operations on any AMI equipment with the cover removed unless qualified to do so and another person qualified in first aid and CPR is present.

Do not operate this instrument in the presence of flammable gases. Doing so could result in a life-threatening explosion.

Do not modify this instrument in any way. If component replacement is required, return the instrument to AMI facilities as described in the Troubleshooting section of the manual.

1. Unpack the instrument

Carefully remove the instrument from the shipping carton and remove all packaging material. Inspect all contents for any physical damage that may have occurred during shipment.

If there is any shipping damage, save all packing material and contact the shipping representative to file a damage claim. Do not return the instrument to AMI without prior authorization.

2. Rack mount the instrument if appropriate

Install the instrument in a 19" rack, if the instrument has a rack mount chassis, by securing the front panel to the rail in each of the four corners with mounting hardware

supplied by the cabinet manufacturer. If the chassis is a table top model, place the instrument on a flat, secure surface.

3. Prepare the sensor(s) for connection

Prepare the sensor(s) to be connected to the instrument by soldering the sensor leads to a male 37-pin D-Sub connector which will connect to J21 on the rear panel of the instrument. Refer to the Appendix of this manual and the AMI sensor manual for the proper pinout and wire color connections. Connect the sensor(s) to connector J21 on the rear panel.

4. Connect any communications option

If a communication option has been installed in the instrument, prepare the mating end of the connector and plug it into the communication connector on the rear panel. Refer to the applicable section of this manual for a description of the communications connector wiring.

5. Configure input operating voltage *only if necessary*

Caution

The Model 137 instrument operates on 50-60 Hz power and may be configured for 100, 120, 220 or 240 VAC. The power requirements for each instrument can be verified by checking the setting of the power-entry module. Be sure your instrument is configured for your power source prior to plugging in the line cord. Do not fail to connect the input ground terminal securely to an external earth ground.

The Model 137 instrument is configured at the factory for the specific input voltage requirements. If a change of input voltage is desired, with the line-cord disconnected, open the hinged panel of the power-entry module on the rear panel, remove the voltage selector tumbler and re-insert with the correct voltage facing outward, and then close the hinged panel.

6. Plug unit into appropriate power receptacle

Ensure the front panel power switch is in the off position, connect the line-cord to the power-entry module on the rear panel and plug the line cord into the appropriate power receptacle.

2 Operation

Caution

Operating the sensor in a vacuum in the absence of liquid helium without protection may cause thermal damage and/or destruction of the superconducting filament. The Model 137 is equipped with circuitry that automatically prevents this type of damage from occurring when the sensor LENGTH setting is properly set to the active length of the sensor. If excessive sensor resistance is detected, the display will read zero and the sensor current will be turned off for a minimum of six seconds after which time the instrument attempts to resume normal operation. If the sensor is at room temperature and the sampling mode toggle switch is in the UPDATE/ CONTIN. position, the SENSOR CURRENT LED will flash briefly every six seconds. When the sensor cools down and liquid helium touches the bottom of the sensor, the current will be on continuously and the display will be continuously updated.

Normal Operational Mode

1. Turn on the power

Turn the POWER toggle switch to the on position. The green POWER LED located above the POWER switch will be lit. The display will show 'AAAA' for approximately one second upon power-up during the microprocessor reset routine and then show the liquid helium level.

Note

If the displayed level reading is below the LO SETPOINT level, an audible alarm will sound. To silence the alarm, rotate the control mode rotary switch on the front panel to the SILENCE position.

2. Select the desired sensor

Select the desired sensor using the sensor selection rotary switch. The Model 137 is only capable of saving one set of configuration data, therefore, the active sensor length, HI setpoint, LO setpoint, and sampling interval will apply to all connected sensors unless changed manually when each sensor is selected. Due to this limitation, AMI highly recommends the installation of a communications option which provides the capability of different remote configuration data for each sensor through software. The provided Model 137 virtual instruments include the multiple sensor configuration capabilities. If the sensor configuration data is provided through a communications option, set the sensor selection rotary switch to the REMOTE position and refer to the *Virtual Instruments Operation* section for initialization information.

3. Configure the active length setting

Initially the instrument must be adjusted for the active length of the sensor. Place the units mode toggle switch in either the INCH or CM position. Place the control mode rotary switch on the front panel to the LENGTH position. To view the present length setting, push and release the RAISE/LOWER toggle switch either up or down. The display will momentarily show the current length setting. To change the length setting, use the RAISE/LOWER toggle switch to move the setting up or down by continuously holding it in the up or down position. The display will move slowly at first and then faster. Once near the desired value, simply release the switch momentarily and then resume changing the setpoint at the slower speed. The new active sensor length is permanently stored in memory. Check the value by momentarily placing the toggle switch in either position from the center position.

> **Note**
>
> *The LENGTH adjustment can only be performed in the INCH or CM units modes. The LENGTH adjustment is inactive if the units are set for %.*

4. Configure the HI SETPOINT and the LO SETPOINT

To adjust the HI and LO setpoints, place the control mode rotary switch in the HI SETPOINT position or the LO SETPOINT position, respectively. Use the RAISE/ LOWER toggle switch to adjust the respective setpoint in the same manner as described in step 3. The setpoints may be located anywhere between 0 to 100% of the active sensor length. The HI and LO setpoint adjustments are compatible with the % units setting.

If the liquid helium level exceeds the HI SETPOINT, the HI LEVEL LED will illuminate. If the liquid helium level falls below the LO SETPOINT, the LO LEVEL LED will illuminate. If the LO LEVEL LED is illuminated, the alarm will also sound as long as the control mode rotary switch is not in the SILENCE position.

5. Configure the sampling time interval setting

To adjust the sampling time interval, place the control mode rotary switch in the INTERVAL position. Use the RAISE/LOWER toggle switch to adjust the time interval in the same manner as described in step 3. The instrument is shipped with the time interval set for 0.2 minutes. This value can be changed to any setting between 0 and 600 minutes.

Warning

Before removing the cover of the instrument, remove power from the instrument by disconnecting the power cord from the power receptacle. Failure to do this could expose the user to high voltages and could result in life-threatening electrical shock.

If desired, the sampling interval can be changed to hours. To accomplish this, the unit must be de-energized and the cover removed so that jumper W1 (located on the printed circuit board vertically mounted directly behind the front panel) can be moved from MIN to HR position. The jumper position can be determined from the front panel at any time. When the jumper is in the hour position, the display will briefly flash 'hhhh' when the RAISE/LOWER switch is moved out of the center position (with the control mode rotary switch in the INTERVAL position) and then will display the time to tenths of an hour. When the jumper is in the minute position, the display does not flash 'hhhh.'.

6. Select either continuous or sampled update configuration

Place the sampling mode toggle switch in the UPDATE/CONTIN. position for continuous level readings, or in the SAMPLE position for readings taken at time intervals according the INTERVAL setting. All sample time intervals are initialized from the time the instrument was last powered on.

If the sampling mode toggle switch is the UPDATE/CONTIN. position, the resistive zone of the sensor is kept in continuous contact with the surface of the liquid helium. This results in heating effects and an accelerated loss of liquid helium. The SAMPLE position allows the unit to perform a measurement and then de-energize the sensor, thereby minimizing the heating effects and loss of liquid helium.

7. Select the appropriate units display option

Place the units mode toggle switch in the position desired for the display output units. The % position displays the percentage of active sensor length that is immersed in liquid helium.

8. Connect the analog output signal to a remote device if desired

The recorder output binding posts on the rear of the instrument provide a 0-1 VDC analog signal corresponding to 0-100% of liquid level. The red binding post is the positive polarity and the black is the common.

Dirty Sensor Operational Mode

AMI expects the helium level sensor to be reasonably clean and free from oil, water, ice, etc. for proper operation. However, it is recognized that some experiments might result in some material being deposited on the sensor wire. Ice formation at some point on the sensor is a typical occurrence. Therefore, the Model 137 has the capability of increasing the current for a short period of time at the beginning of the measurement cycle to try and drive the resistive zone of the sensor wire past the dirty region. This operation may or may not be successful depending on the degree of sensor contamination. This mode should be viewed as a stopgap measure only. If correct readings cannot be reestablished, the only choice is to warm the sensor or remove for cleaning or replacement.

Note

Operation in the dirty sensor mode causes increased liquid helium losses. Consequently, operation in this mode should not be used unless the sensor is known or anticipated to become dirty or the helium level display is in question due to unclean operation.

Warning

Before removing the cover of the instrument, remove the power from the instrument by disconnecting the power cord from the power receptacle. Failure to do this could expose the user to high voltages and could result in life-threatening electrical shock.

To operate in this mode, de-energize the instrument and remove the cover. Place a jumper on W2 of the printed circuit board vertically mounted directly behind the front panel. Replace the cover. The operation in this mode is not detectable from the front panel. Be sure to remove jumper W2 (be sure to power off the instrument and disconnect it from the power receptacle before removing the jumper) when operation in this mode is no longer desired.

3 Calibration

Note

This instrument was calibrated at the factory for AMI sensors and should require no further adjustment. The following information is furnished in the event changes are desired.

Sensor Current Calibration

Warning

This calibration procedure is to be performed only by trained service personnel familiar with electrical safety precautions and proper energized electrical safety procedures. The Model 137 contains high voltages capable of producing life-threatening electrical shock. Do not perform any operations on any AMI equipment with the cover removed unless qualified to do so and another person qualified in first aid and CPR is present.

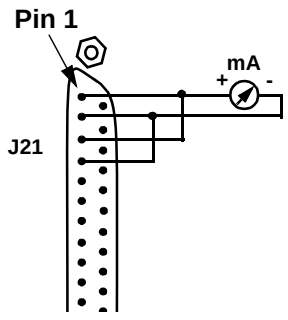
1. Ensure the instrument is de-energized by disconnecting the line cord from the power source.

2. Disconnect the signal cable from the sensor connector, J21, located on the rear panel of the instrument. Remove the instrument cover.

3. Rotate the sensor selection rotary switch to the sensor 1 position.

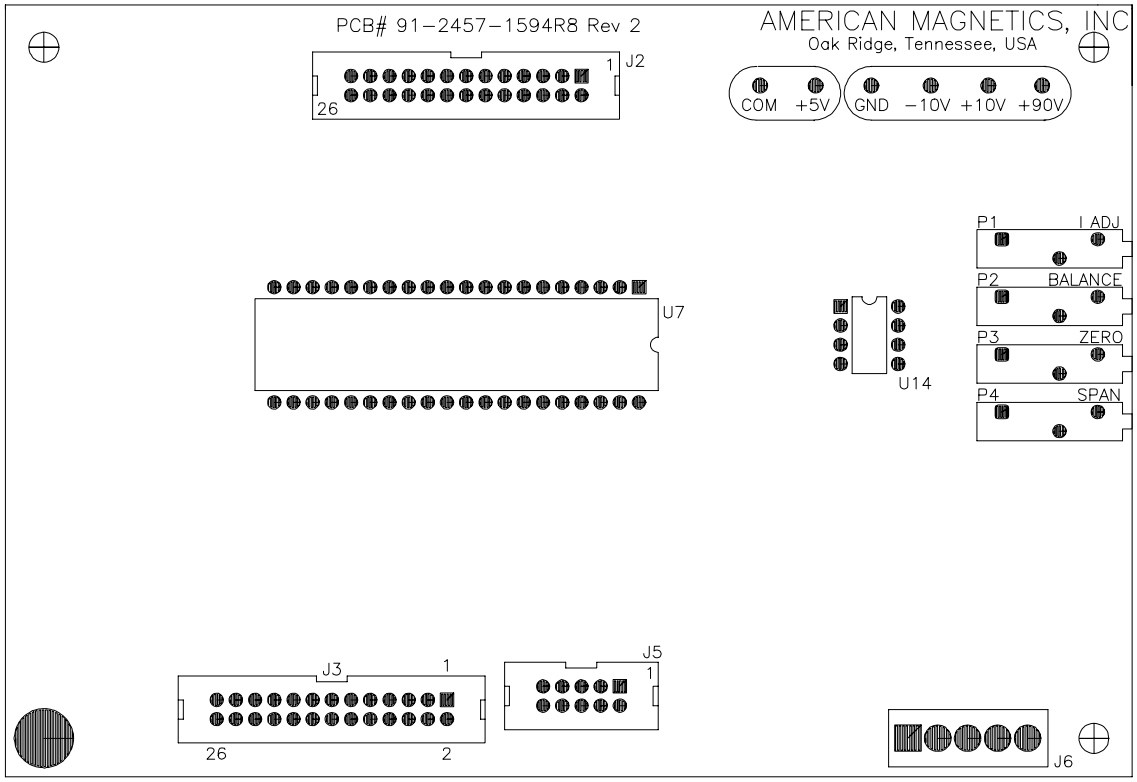
4. Short J21 pins 1 & 3 together. Short J21 pins 2 & 4 together.

5. Attach a milliammeter between the sensor current pins J21 pin 1 (+) and J21 pin 2 (-) located on the rear panel of the instrument. The sensor current pins and milliammeter should now be wired as shown below.



6. Place the sampling mode toggle switch in the UPDATE/CONTIN. position. Observe proper energized electrical equipment safety precautions and energize the instrument. Verify the sensor current is on by observing the illumination of the SENSOR CURRENT LED on the front panel.

7. Adjust the P1 (I ADJ) potentiometer (see figure below) on the printed circuit board until the milliammeter reads 75.0 mA. De-energize the instrument.



Caution

The instrument must always undergo a input circuit balance calibration after making the sensor current adjustment.

Input Circuit Balance Calibration

Warning

This calibration procedure is to be performed only by trained service personnel familiar with electrical safety precautions and proper energized electrical safety procedures. The Model 137 contains high voltages capable of producing life-threatening electrical shock. Do not perform any operations on any AMI equipment with the cover removed unless qualified to do so and another person qualified in first aid and CPR is present.

1. Ensure the instrument is de-energized by disconnecting the line cord from the power source.

2. Connect a frequency counter to test point TP1 (connect the ground of the frequency counter to the GND test point on the printed circuit board).

3. Rotate the sensor selection rotary switch to the sensor 1 position.

4. With the sensor cable removed from J21 on the rear panel, short all four sensor pins by placing a jumper across J21 pins 1, 2, 3, and 4. Observe proper energized electrical equipment safety precautions and then energize the instrument.

   Note

   The J21 jumper setup from steps 4 and 5 of the Sensor Current Calibration procedure can be used by placing a shorting jumper across the milliammeter.

5. Set sample interval > 0. Alternately place current through the shorted sensor 1 and remove the current by using the two positions of the sampling mode toggle switch. Verify that the current to the shorted sensor is being switched on and off by observing that the SENSOR CURRENT LED is illuminated when the sampling mode toggle switch is in the UPDATE/CONTIN. position and is off when in the SAMPLE position.

6. While alternating between sensor current on and off, observe the frequency counter. Adjust the P2 (BALANCE) potentiometer on the printed circuit board until no shift in frequency is observed. De-energize the equipment. If no other calibration is required, remove the jumpers on J21, reconnect the sensor cable to J21, and reinstall the instrument cover. The input circuit balance calibration is complete.

Recorder Output Calibration

Warning

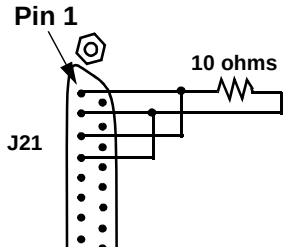
This calibration procedure is to be performed only by trained service personnel familiar with electrical safety precautions and proper energized electrical safety procedures. The Model 137 contains high voltages capable of producing life-threatening electrical shock. Do not perform any operations on any AMI equipment with the cover removed unless qualified to do so and another person qualified in first aid and CPR is present.

1. Ensure the instrument is de-energized.

2. Disconnect the sensor cable from the instrument by disconnecting J21.

3. Short J21 pins 1 and 3 together. Short J21 pins 2 and 4 together.

4. Connect a 10 Ohm, 1/4 Watt resistor between J21 pins 1 and 2. The sensor connector pins should now be wired as shown below.



5. Rotate the sensor selection rotary switch to the sensor 1 position.

6. Connect a voltmeter to the recorder output binding posts located on the back panel of the instrument. Place the sampling mode toggle switch in the UPDATE/CONTIN. position. Observe proper energized electrical equipment safety precautions and energize the instrument.

7. Place the units mode toggle switch in the CM position.

8. Place the control mode rotary switch to the LENGTH position and adjust the length setpoint to 1.0 cm.

9. The Model 137 will enter into the vacuum protection mode by the indication of the SENSOR CURRENT LED turning off and flashing approximately every 6 seconds. This condition is proper for the next step of the calibration procedure.

10. Adjust the P3 (ZERO) potentiometer to obtain an output voltage at the RECORDER OUTPUT connector of 0.000 volts. De-energize the Model 137 instrument.

11. Place a shorting jumper across the 10 Ohm test resistor. Re-energize the instrument. Place the units mode toggle switch to the % position. Verify that the front panel LED display reads 100%.

12. Adjust the P4 (SPAN) potentiometer to obtain an output voltage at the RECORDER OUTPUT connector of 1.000 volts.

13. Remove the shorting jumper from the 10 ohm test resistor. Repeat steps 9 through 12 until no further adjustment is required for either potentiometer P3 or P4.

14. When no further adjustment is required, de-energize the instrument, remove the shorting jumper and test resistor, reinstall the sensor cable to J21, and reinstall the instrument cover. The recorder output calibration is complete.

Note

The LENGTH setpoint was adjusted during the recorder output calibration procedure and must be reset to match the length of the connected sensor before the instrument is placed back in operation.

4 RS-232 Communication/Data Logger Option

The RS-232 communication/data logger option provides a 25-pin D-type connector on the rear panel of the instrument for serial communications and data logger function.

Serial port connector and cabling

An IBM-compatible computer's serial port can be directly connected to the Model 137 via a standard PC modem cable. Refer to your computer's documentation to determine which serial ports are available on your computer and the required connector type. The cable to connect two DB25 connectors is wired directly, i.e. pin 1 to pin 1, pin 2 to pin 2, etc. If a DB9 connector is required at the computer interface, the connector translation is provided in the Appendix.

The Model 137 uses only three wires of the rear-panel DB25 connector: pin 2 (transmit), pin 3 (receive), and pin 7 (common). There is no software or hardware handshaking. The Model 137 is classified as a DCE (Data Communication Equipment) device since it transmits data on pin 3 and receives data on pin 2. The instrument to which the Model 137 is attached must do the opposite, i.e., transmit on pin 2 and receive on pin 3 (the requirements for a DTE, or Data Terminal Equipment device). If a serial-to-parallel converter is used, it must be capable of receiving data on pin 3 or the cable connected to the Model 137 must interchange the wires between pins 2 and 3.

Command/return termination characters

All commands are transmitted and received as ASCII values and are case insensitive. The Model 137 always transmits <*CR*><*LF*> (i.e. a *carriage return* followed by a *linefeed*) at the end of an RS-232 transmission. The Model 137 can accept <*CR*>, <*LF*>, <*CR*><*LF*>, or <*LF*><*CR*> as termination characters from an external computer.

The simplest method for communicating with the Model 137 via RS-232 is by using the interactive mode of a commercially available terminal emulation program. The Model 137 transmits and receives information at various baud rates and uses 8 data bits, no parity, and 1 stop bit. When the Model 137 receives a terminated ASCII string, it always sends back a reply as soon as the string is processed. *When sending commands to the Model 137, you must wait for the reply from the Model 137 before sending another command even if the reply consists of only termination characters.* Otherwise, the shared input/output command buffer of the Model 137 may become corrupted.

Communication DIP Switch Settings

The 8 DIP switches located on the rear panel of the Model 137 are used to control various parameters of the RS-232 interface. Switches 6 through 8 control the baud rate of the interface. Switches 3 through 5 are unused. Switch 2 controls the echo feature and switch 1 controls the data logger function. Each of these features is fully discussed below.

Baud rate control

The Model 137 baud rate is controlled by switches 6 through 8 of the communication DIP switch on the rear panel. The unit is shipped with the baud rate set at 9600. The switch settings for various baud rates are (on = 1 or the up position):

DIP switch			
6	7	8	Baud rate
off	off	off	300
off	off	on	600
off	on	off	1200
off	on	on	2400
on	off	off	4800
on	off	on	9600

Echo function

The Model 137 has an *echo* feature which is enabled or disabled by communication DIP switch 2. When the echo function is enabled, the Model 137 will echo the incoming command characters back to the transmitting device. The echo feature is useful when using an interactive terminal program on a host computer for communicating with the Model 137. The settings are:

DIP switch 2	Function
on	Echo On
off	Echo Off

Data logger function

Switch 1 of the communications DIP switch controls the data logger function. This feature is normally used with a printer rather than a host computer, since a computer can be more usefully programmed utilizing the available command set. The data

logger function generates a time relative to instrument power-up and a corresponding helium level. The time and corresponding helium level are formatted and output to the host device at regular intervals as specified by the INTERVAL setting (the INTERVAL setting may be set via the front panel, see page 12). The host device can be a standard dot matrix printer connected via a serial-to-parallel converter, or directly with a printer capable of receiving serial data. Presumably, any serial-to-parallel converter which can be properly configured is acceptable. AMI has tested the Model 137 with a standard, low cost converter configured as a DTE device, 8 data bits, no parity, and 1 stop bit. In order to communicate with the host device, it is necessary to set the Model 137 to the identical baud rate of the host device. The settings for the data logger function are:

DIP switch 1	Function
on	Data Logger On
off	Data Logger Off

RS-232 Command Set Reference

All commands sent to the Model 137 are processed and the Model 137 responds with the answer. If the command is invalid, the Model 137 will respond with *-8*. All return values are terminated with *<CR><LF>* (i.e. a *carriage return* followed by a *linefeed*). For those commands that do not return a value, the Model 137 will return the *<CR><LF>* termination only.

Commands for controlling the units of measurement:

Command:	CM	Function:	Sets the units of measurement to centimeters	Returns:	*<CR><LF>*
Command:	INCH	Function:	Sets the units of measurement to inches	Returns:	*<CR><LF>*
Command:	PERCENT	Function:	Sets the measurement to % of sensor length	Returns:	*<CR><LF>*
Command:	UNIT	Function:	Returns the current units in use	Returns:	C, I, or % *<CR><LF>*

The CM command sets the units of measurement to centimeters and the INCH command selects inches. The PERCENT command sets the units of measurement to the percentage of active sensor length that is immersed in liquid helium. The units of measurement selected through the RS-232 interface are controlled independently from the units mode toggle switch used for controlling the front panel display. The default units are centimeters when the Model 137 is first powered on. The last unit command remains in effect until the unit is powered off. The setting is not saved in permanent

memory. The UNIT command returns a one character value (and termination) indicating the current units—C for centimeters, I for inches, or % for percentage.

Commands for configuring permanent memory:

Command:	HI=<value>	Function:	Configures the HI setpoint limit	Returns:	*<CR><LF>*
Command:	LO=<value>	Function:	Configures the LO setpoint limit	Returns:	*<CR><LF>*
Command:	INTERVAL=<value>	Function:	Configures the sampling interval	Returns:	*<CR><LF>*
Command:	LENGTH=<value>	Function:	Configures the active sensor length	Returns:	*<CR><LF>*
Command:	SAVE	Function:	Saves the configuration to permanent memory	Returns:	*<CR><LF>*

The HI and LO command configure the high and low setpoint limit values respectively. For example, HI=90.0 would configure the high setpoint limit to 90.0 in whichever units of measurement last selected through the RS-232 interface. The HI and LO commands are compatible with the percent units selection.

The INTERVAL command sets the sampling interval used if the instrument is set for sampling mode operation (as opposed to continuous update) via the sampling mode toggle switch. INTERVAL=0.1 would set the sampling interval to 0.1 minutes (or 0.1 hours if so configured, see page 12). The LENGTH command configures the active sensor length setting in the current units. LENGTH=35.0 would configure the active sensor length to 35.0 units of centimeters or inches.

Note

The LENGTH=<value> command will only function if CM or INCH are currently selected as the units of measurement. The LENGTH command does not configure the Model 137 if the units of measurement are PERCENT.

The SAVE command saves the HI, LO, INTERVAL, and LENGTH settings to permanent memory. These settings are then recalled each time the power is turned off and then reapplied to the instrument. If the configuration is changed from the front panel, the settings are automatically saved to permanent memory.

Commands for querying the configuration:

Command:	HI	Function:	Returns the HI setpoint limit in the current units	Returns:	<value> *<CR><LF>*
Command:	LO	Function:	Returns the LO setpoint limit in the current units	Returns:	<value> *<CR><LF>*
Command:	INTERVAL	Function:	Returns the sampling interval in the current units	Returns:	<value> *<CR><LF>*
Command:	LENGTH	Function:	Returns the active sensor length in the current units	Returns:	<value> *<CR><LF>*

The HI, LO, INTERVAL, and LENGTH commands return the current configuration of the instrument. Each return value is terminated with *<CR><LF>*.

Commands for selecting a sensor:

Command:	SENSOR= <value>	Function:	Sets the number of the currently selected sensor. Value can be from 1 to 8.	Returns:	*<CR><LF>*
Command:	SENSOR	Function:	Returns the number of the last remotely selected sensor.	Returns:	<value> *<CR><LF>*

The SENSOR=<value> command sets the REMOTE sensor selection. Valid values range from 1 to 8. The SENSOR command returns the number of the sensor last selected through the communications interface. All front panel readings apply either to the selected sensor (if the sensor selection rotary switch is not in the REMOTE mode), or to the last sensor selected through the communications interface (if the sensor selection switch is in the REMOTE mode). Please note that individual configuration data for each sensor is not stored for recall when changing the selected sensor via either the front panel or remotely. Individual configuration data for each sensor must be managed and recalled through the use of the communications interface and an external controlling program.

The default remote sensor selection is 1. The last remote sensor selection is not saved in permanent memory and, therefore, returns to the default value when the instrument is powered off and back on.

Commands for performing level measurements:

Command:	LEVEL	Function:	Returns the liquid helium level in the current units	Returns:	<value> <*CR*><*LF*>

Command:	HOLD	Function:	Immediately ceases level measurements	Returns:	<*CR*><*LF*>

Command:	MEASURE	Function:	Initiates level measurement in the current sampling mode	Returns:	<*CR*><*LF*>

The LEVEL command returns the liquid helium level in the current units selected. If a measurement is in progress when the instrument is queried for the LEVEL, then the LEVEL command (and in fact, all commands) will not return until the measurement is complete. The time required to complete a level measurement is variable and depends upon the active length of the sensor and the sampling mode. Measurement times normally range from several milliseconds to 15 seconds. Sampling in the UPDATE/ CONTIN. mode usually returns immediately since the resistive zone of the sensor is kept in continuous contact with the surface of the liquid helium. The return value (and termination characters) from the LEVEL command *must be received before sending another command to the Model 137.*

The HOLD command ceases level measurements regardless of the sampling mode selected. A new measurement will not be initiated until the MEASURE command is subsequently received. The MEASURE command resumes level measurement in the sampling mode as selected by the sampling mode toggle switch on the front panel of the instrument.

Note

The MEASURE command resumes measurement of the liquid helium level in the mode determined by the sampling mode toggle switch on the front panel. If the sampling mode toggle switch is in the UPDATE/CONTIN. position, the sensor current will turn on and the instrument will continually update. If the switch is in the SAMPLE position, the sensor current will briefly turn on to allow the instrument to perform an immediate measurement, then turn off. The instrument will then remain in the SAMPLE mode with the interval and start time of the sampling function undisturbed.

5 IEEE-488 Communication Option

The IEEE-488 communication option provides a GPIB connector on the rear panel of the instrument for IEEE-488 (GPIB, HPIB) communications.

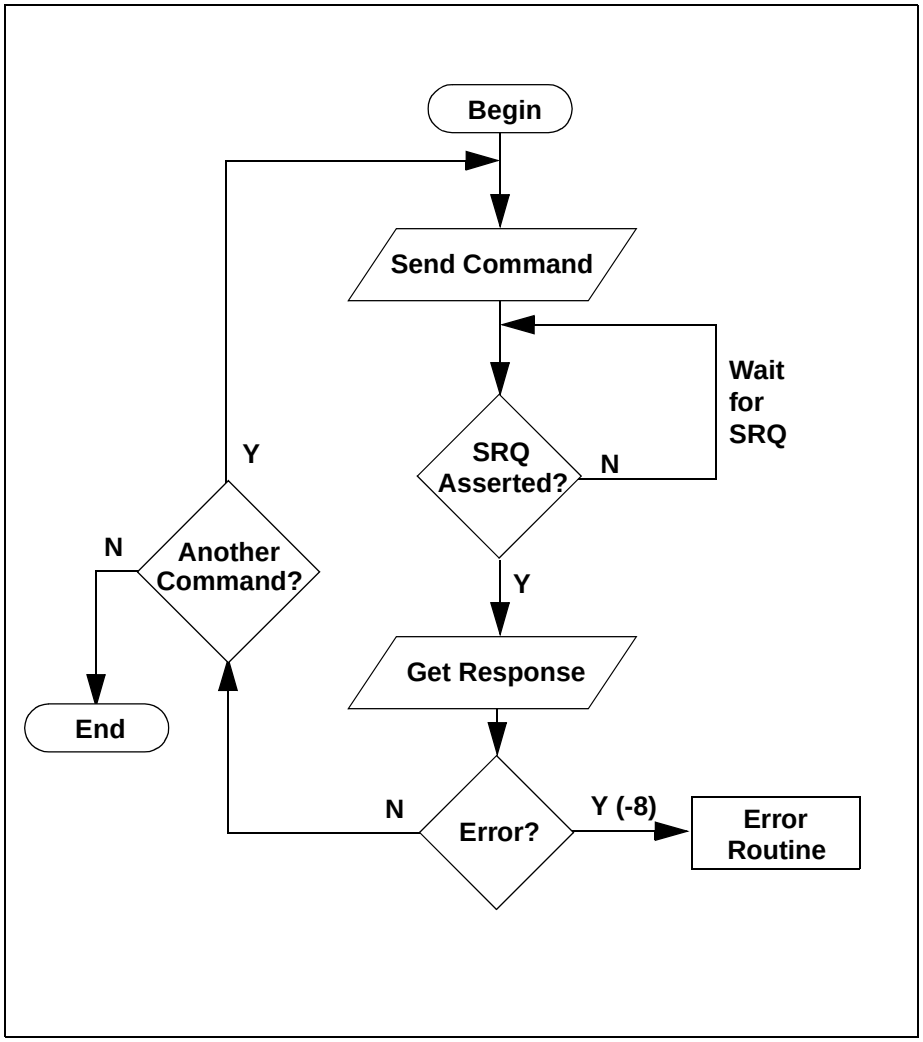
Command/return termination characters

All commands are transmitted and received as ASCII values and are case insensitive. The Model 137 always transmits <*LF*> and EOI as the termination for return data. The Model 137 can accept <*CR*>, <*LF*>, <*CR*><*LF*>, <*LF*><*CR*>, or <*LF*> with EIO as termination characters from an external IEEE-488 interface.

Only one command at a time is allowed to be transmitted by the external IEEE-488 interface. Thus the transmission of several commands separated by a semicolon is not allowed. The instrument uses a single 16 character buffer for input and output. Consequently, all input strings including terminations should not be longer than 16 characters. Any excess characters will be discarded. All alphabetical characters are case insensitive and character encoding is in accordance with IEEE 488.2.

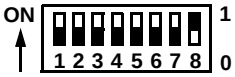
Communicating with the Model 137

The use of a single buffer for both input and output is a result of memory limitations in the Model 137. In order to keep the external IEEE-488 interface from sending successive commands faster than the Model 137 can respond, the Model 137 uses the Serial Poll Service Request (SRQ) to let the external computer know it has finished processing the last command received and is ready to send a response. This is true of all commands. Thus sending commands to the Model 137 using IEEE-488 protocol is a three step process: 1) send the ASCII command, 2) wait for SRQ, and 3) get the instrument response. A basic flow diagram for sending an ASCII command to the Model 137 and receiving a response is shown on the following page.



Basic communication flow diagram for IEEE-488 commands.

Communication DIP Switch Settings



The 8 DIP switches located on the rear panel of the Model 137 are used to control the IEEE-488 interface. Switches 4 through 8 control the IEEE-488 bus address of the unit. Switches 1 through 3 are unused.

IEEE-488 primary bus address

The Model 137 primary bus address is controlled by switches 4 through 8 of the communication DIP switch on the rear panel. Valid primary addresses are between 0 and 30. The Model 137 does not use secondary addressing. Note that many IEEE-488 controller cards in external computers will use address 0. The bus address for each *Model 137 should be unique* with respect to other Model 137 units or any other devices on the bus. The switch settings for the various addresses are (on = 1 or the up position):

DIP switch					Primary bus address
4	5	6	7	8	
off	off	off	off	off	0
off	off	off	off	on	1
off	off	off	on	off	2
off	off	off	on	on	3
off	off	on	off	off	4
off	off	on	off	on	5
off	off	on	on	off	6
off	off	on	on	on	7
off	on	off	off	off	8
off	on	off	off	on	9
off	on	off	on	off	10
off	on	off	on	on	11
off	on	on	off	off	12
off	on	on	off	on	13
off	on	on	on	off	14
off	on	on	on	on	15
on	off	off	off	off	16
on	off	off	off	on	17

DIP switch					Primary bus address
4	5	6	7	8	
on	off	off	on	off	18
on	off	off	on	on	19
on	off	on	off	off	20
on	off	on	off	on	21
on	off	on	on	off	22
on	off	on	on	on	23
on	on	off	off	off	24
on	on	off	off	on	25
on	on	off	on	off	26
on	on	off	on	on	27
on	on	on	off	off	28
on	on	on	off	on	29
on	on	on	on	off	30

IEEE-488 Command Set Reference

All commands sent to the Model 137 are processed and the Model 137 responds with the answer. If the command is invalid, the Model 137 will respond with *-8*. All return values are terminated with *<LF>* (*linefeed*) and EOI asserted. For those commands that do not return a value, the Model 137 will echo the command string in the return message. The Model 137 does not implement a full complement of IEEE 488.2 commands, nor does it conform to the Standard Commands for Programmable Instruments (SCPI) protocol. These limitations are due to memory constraints in the microprocessor board design.

Device clear (DCL) command

The Model 137 responds to the device clear (DCL) command from a host IEEE controller. The device clear resets the instrument. The default units are centimeters and the permanently saved configuration settings are restored.

Commands for controlling the units of measurement:

Command:	CM	Function:	Sets the units of measurement to centimeters	Returns:	CM
Command:	INCH	Function:	Sets the units of measurement to inches	Returns:	INCH
Command:	PERCENT	Function:	Sets the measurement to % of active sensor length	Returns:	%
Command:	UNIT	Function:	Returns the current units in use	Returns:	C, I, or %

The CM command sets the units of measurement to centimeters and the INCH command selects inches. The PERCENT command sets the units of measurement to the percentage of the active sensor length that is immersed in liquid helium. The units of measurement selected through the IEEE-488 interface are controlled independently from the units mode toggle switch used for controlling the front panel display. The default units are centimeters when the Model 137 is first powered on. The last unit command remains in effect until the unit is powered off. The setting is not saved in permanent memory. The UNIT command returns a one character value (and termination) indicating the current units—C for centimeters, I for inches, or % for percentage.

Commands for configuring permanent memory:

Command:	HI=<value>	Function:	Configures the HI setpoint limit	Returns:	HI=<value>
Command:	LO=<value>	Function:	Configures the LO setpoint limit	Returns:	LO=<value>
Command:	INTERVAL=<value>	Function:	Configures the sampling interval	Returns:	INTERVAL=<value>
Command:	LENGTH=<value>	Function:	Configures the active sensor length	Returns:	LENGTH=<value>
Command:	SAVE	Function:	Saves the configuration to permanent memory	Returns:	SAVE

The HI and LO command configure the high and low setpoint limit values respectively. For example, HI=90.0 would configure the high setpoint limit to 90.0 in

whichever units of measurement last selected through the IEEE-488 interface. The HI and LO commands are compatible with the percent units selection.

The INTERVAL command sets the sampling interval used if the instrument is set for sampling mode operation (as opposed to continuous update) via the sampling mode toggle switch. INTERVAL=0.1 would set the sampling interval to 0.1 minutes (or 0.1 hours if so configured, see page 12). The LENGTH command configures the active sensor length setting in the current units. LENGTH=35.0 would configure the active sensor length to 35.0 units of centimeters or inches.

Note

The LENGTH=<value> command will only function if CM or INCH are currently selected as the units of measurement. The LENGTH command does not configure the Model 137 if the units of measurement are PERCENT.

The SAVE command saves the HI, LO, INTERVAL, and LENGTH settings to permanent memory. These settings are then recalled each time the power is turned off and then reapplied to the instrument. If the configuration is changed from the front panel, the settings are automatically saved to permanent memory.

Commands for querying the configuration:

Command:	HI	Function:	Returns the HI setpoint limit in the current units	Returns:	<value>
Command:	LO	Function:	Returns the LO setpoint limit in the current units	Returns:	<value>
Command:	INTERVAL	Function:	Returns the sampling interval in the current units	Returns:	<value>
Command:	LENGTH	Function:	Returns the sensor length in the current units	Returns:	<value>

The HI, LO, INTERVAL, and LENGTH commands return the current configuration of the instrument. Each return value is terminated with *<LF>* and EOI.

Commands for selecting a sensor:

Command:	SENSOR=<value>	Function:	Sets the number of the currently selected sensor. Value can be from 1 to 8.	Returns:	<CR><LF>

Command:	SENSOR	Function:	Returns the number of the last remotely selected sensor.	Returns:	<value> *<CR><LF>*

The SENSOR=<value> command sets the REMOTE sensor selection. Valid values range from 1 to 8. The SENSOR command returns the number of the sensor last selected through the communications interface. All front panel readings apply either to the selected sensor (if the sensor selection rotary switch is not in the REMOTE mode), or to the last sensor selected through the communications interface (if the sensor selection switch is in the REMOTE mode). Please note that individual configuration data for each sensor is not stored for recall when changing the selected sensor via either the front panel or remotely. Individual configuration data for each sensor must be managed and recalled through the use of the communications interface and an external controlling program.

The default remote sensor selection is 1. The last remote sensor selection is not saved in permanent memory and, therefore, returns to the default value when the instrument is powered off and back on.

Commands for performing level measurements:

Command:	LEVEL	Function:	Returns the liquid helium level in the current units	Returns:	<value>

Command:	HOLD	Function:	Immediately ceases level measurements	Returns:	HOLD

Command:	MEASURE	Function:	Initiates level measurement in the current sampling mode	Returns:	MEASURE

The LEVEL command returns the liquid helium level in the current units selected. If a measurement is in progress when the instrument is queried for the LEVEL, then the LEVEL command (and in fact, all commands) will not return a value until the measurement is complete. The time required to complete a level measurement is variable and depends upon the active length of the sensor and the sampling mode. Measurement times normally range from several milliseconds to 15 seconds. Sampling in the UPDATE/CONTIN. mode usually returns immediately since the resistive zone of the sensor is kept in continuous contact with the surface of the liquid

helium. The return value (and termination characters) from the LEVEL command *must be received before sending another command to the Model 137.*

The HOLD command ceases level measurements regardless of the sampling mode selected. A new measurement will not be initiated until the MEASURE command is subsequently received. The MEASURE command resumes level measurement in the sampling mode as set by the sampling mode toggle switch on the front panel.

Note

The MEASURE command resumes measurement of the liquid helium level in the mode determined by the sampling mode toggle switch on the front panel. If the sampling mode toggle switch is in the UPDATE/CONTIN. position, the sensor current will turn on and the instrument will continually update. If the switch is in the SAMPLE position, the sensor current will briefly turn on to allow the instrument to perform and immediate measurement, then turn off. The instrument will then remain in the SAMPLE mode with the interval and start time of the sampling function undisturbed.

Serial Poll Status Byte

The serial poll status byte (or spoll byte) can be used to obtain information about the state of the instrument. Bit 7 of the status byte is reserved for SRQ. The remaining bits are used to provide custom information as shown in the table below.

Bit	ON	OFF
1	HI relay on	HI relay off
2	Not used	Not used
3	Not used	Not used
4	LO relay on	LO relay off
5	Not used	Not used
6	Data ready	No data available
7	Service Request (SRQ)	No SRQ
8	Not used	Not used

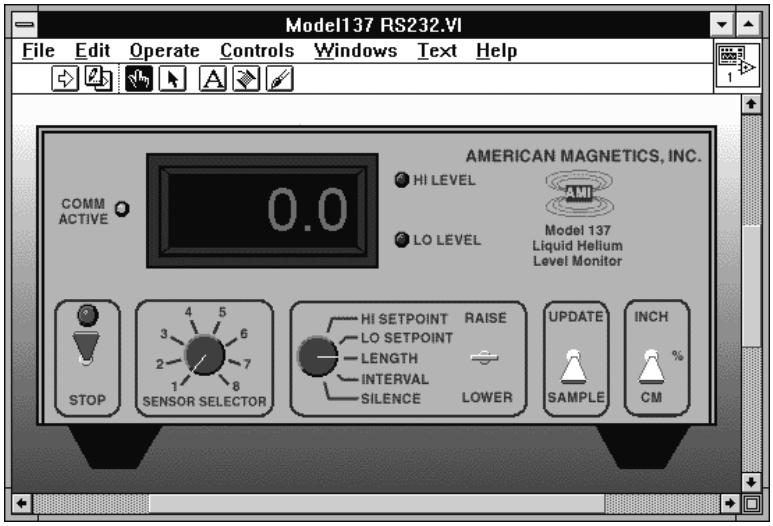
6 Virtual Instrument Operation

In order to make the communications options easier to use for the customer, AMI provides a LabVIEW-based interface for remote monitoring and control of the Model 137. LabVIEW® is a virtual instrument (VI) development and deployment software tool produced and marketed by National Instruments. LabVIEW is available on several platforms including Microsoft Windows™, Microsoft Windows NT™, Apple Macintosh™, Sun Solaris™, and HP-UX™. The AMI provided VI's are developed and tested under Microsoft Windows 3.1 and 3.11, however, they should be portable with only minor modifications across all LabVIEW-supported platforms. Please contact National Instruments for detailed information on the available products and specifications.

The AMI provided VI's are supplied on one 3.5" 1.44 MB diskette. ***The VI's require version 3.1 (or above) of LabVIEW and a minimum of a 256 color display.*** The VI's are stored in one LabView VI Library (LLB) file which contains the multiple VI's needed for operation of the instrument as a whole. AMI's provided VI's are designed for continuous operation under the control of LabVIEW, and do not conform to the instrument driver specifications to which National Instruments' own instrument drivers adhere. Any additional functionality gained by conforming to such specifications was deemed of minimal value by AMI due to the relative simplicity of communicating with the Model 137 instrument.

RS-232 Virtual Instrument

The figure below illustrates the front panel of the Model 137 virtual instrument (VI). The front panel appears nearly identical to the front panel of the actual instrument. The functionality of the VI is very similar to that of the actual instrument as well.



When running the VI it is important to operate the instrument using the VI and not via the actual instrument front panel. Otherwise, the VI and the actual instrument may not be synchronized. The only exception to this rule is operation of the sampling mode toggle switch. The sampling mode toggle switch should be set via the front panel of the actual instrument to the mode desired by the operator. The VI's representation of the sampling mode toggle switch overrides any actual front panel setting by forcing the actual instrument to perform an immediate measurement when placed in the UPDATE position.

Launching and initializing the RS-232 VI

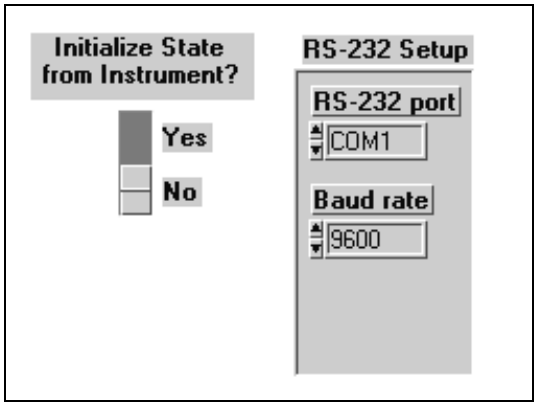
First, make sure the Model 137 is connected to a COM port on the host computer and that the instrument is powered on. The VI library, provided in the file MODEL137.LLB, for the RS-232 virtual instrument contains the following files:

VI	Description
ConvertFromCM.vi	Internal subVI needed to display various units.
Init Model137 RS232.vi	Internal subVI for initializing from the actual instrument.
Model137 RS232.vi	Main VI containing the front panel controls. This is the VI the user should open and run.
SendRS232.vi	Internal subVI for sending and receiving commands to/from the actual instrument.

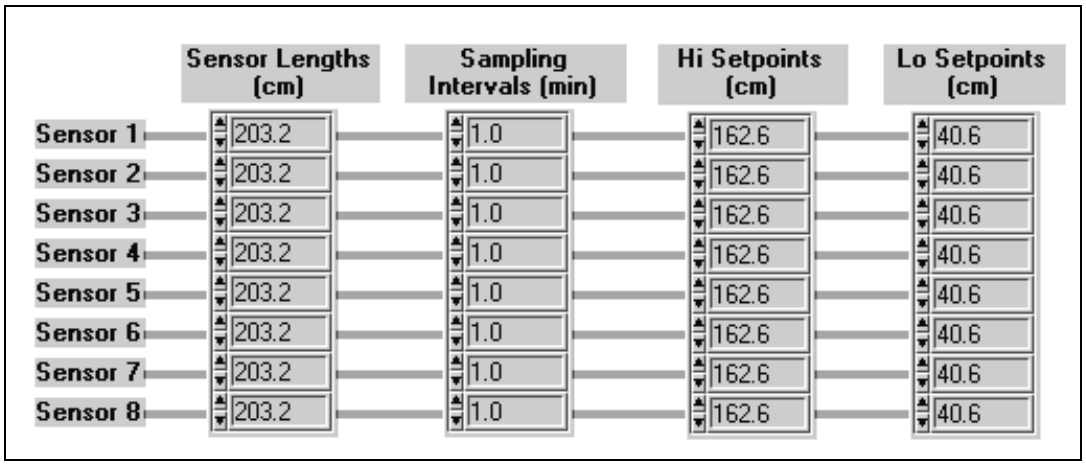
Open the *Model 137 RS232.vi*. Before running the VI, the user must select an initialization option and provide any necessary settings. In order to initialize the VI, scroll to the area above and below the virtual front panel. Several controls are visible for setup by the user. The figures on the following page illustrate the available controls. The *Initialize State from Instrument?* switch allows the user to select whether the virtual instrument is initialized from the current settings of the actual instrument or from the individual controls for each sensor available from the VI. If the *Yes* option is selected, the VI will initialize all settings *for all sensors* from the current configuration of the actual instrument. If the *No* option is selected, the user should enter all data for each connected sensor in the indicated units in the control fields (*Sensor Length*, *Hi Setpoint*, etc.) located below the virtual front panel The user should also select the correct RS-232 port and baud rate, according to the port to which the Model 137 is connected and the baud rate to which the Model 137 is set (see page 22 for instructions on setting the Model 137 baud rate). The user may then start the VI. Please refer to your LabVIEW documentation for instructions on how to start and control the execution of VI's.

Interacting with the running VI

While the VI is running the user may manipulate the virtual toggle and rotary switches in the same manner as required for the front panel operation of the actual instrument.



Control fields located above the virtual front panel.



Control fields for each sensor located below the virtual front panel.

See the Operation section of this manual for instructions on operating the front panel controls, however, please note that there are some minor differences discussed below.

The RAISE/LOWER toggle switch functions slightly different in the VI. If the RAISE/LOWER toggle switch is moved from the center position to the RAISE or LOWER position, then the display changes to show the appropriate parameter. After approximately 4 seconds in the RAISE or LOWER position, the display will begin incrementing or decrementing by tenths. After approximately 12 additional seconds, the display will begin incrementing/decrementing by ones. Move the RAISE/LOWER toggle switch back to the center position to stop the incrementing or decrementing function.

As previously discussed, *only the sampling mode toggle switch should be manipulated via the front panel of the actual instrument while the VI is running*. The VI

representation of the sampling mode toggle switch forces the actual instrument to perform an immediate measurement when placed in the UPDATE position. When placing the VI switch in the UPDATE position, it must be left in the UPDATE position for at least a couple of seconds in order to be recognized. Simply place the switch back in the SAMPLE position to return to the operational mode specified via the actual instrument's sampling mode toggle switch.

The sensor selection rotary switch on the actual instrument should be set to the REMOTE position in order to enable the remote sensor selection available from the virtual panel.

As a more convenient option for controlling the settings, the user may scroll to the area below the VI and enter the values for the Sensor Length, Hi Setpoint, Lo Setpoint, and Interval directly in the control fields for each sensor (please observe the specified units). Any changes in the fields are recognized and sent to the actual instrument in the form of the appropriate command string. Any configuration settings changed by the VI virtual panel toggle switches or control fields are saved in permanent memory in the actual instrument.

The VI may be gracefully stopped by using the STOP toggle switch in the lower left corner of the VI. After stopping the VI, this switch must be placed back in the up position in order to restart the VI.

IEEE-488 Virtual Instrument

The IEEE-488 (or GPIB) VI functions nearly identically to the RS-232 VI with a few exceptions. The VI library, provided in the file MODEL137.LLB, for the IEEE-488 virtual instrument contains the following files:

VI	Description
ConvertFromCM.vi	Internal subVI needed to display various units.
GPIB Error Report.vi	Internal error reporting VI.
Init Model137 GPIB.vi	Internal subVI for initializing from the actual instrument.
Model137 GPIB.vi	Main VI containing the front panel controls. This is the VI the user should open and run if the Model 137 is the only device on the GPIB bus.
Non-exclusive loop control.vi	Example VI demonstrating how to execute the *Non-exclusive Model 137 GPIB.vi* with other devices present on the GPIB bus.

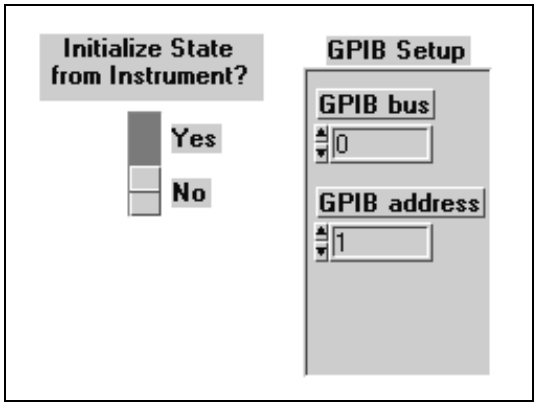
VI	Description
Non-exclusive Model 137 GPIB.vi	A “building-block” version of the *Model137 GPIB.vi* which can co-exist with multiple devices on the GPIB bus. Acts as a slaved subVI to the *Non-exclusive loop control.vi*.
SendGPIB.vi	Internal subVI for sending and receiving commands to/from the actual instrument.

The *Model137 GPIB.vi* should be used if the Model 137 has exclusive control of the GPIB bus, i.e. is the only device present and operating on the bus. The *Non-exclusive loop control.vi* and the *Non-exclusive Model 137 GPIB.vi* together form a control example which can be customized to coexist with multiple devices on one GPIB bus. The exact design of the non-exclusive operation is dependent upon the specific devices you may have connected to the bus.

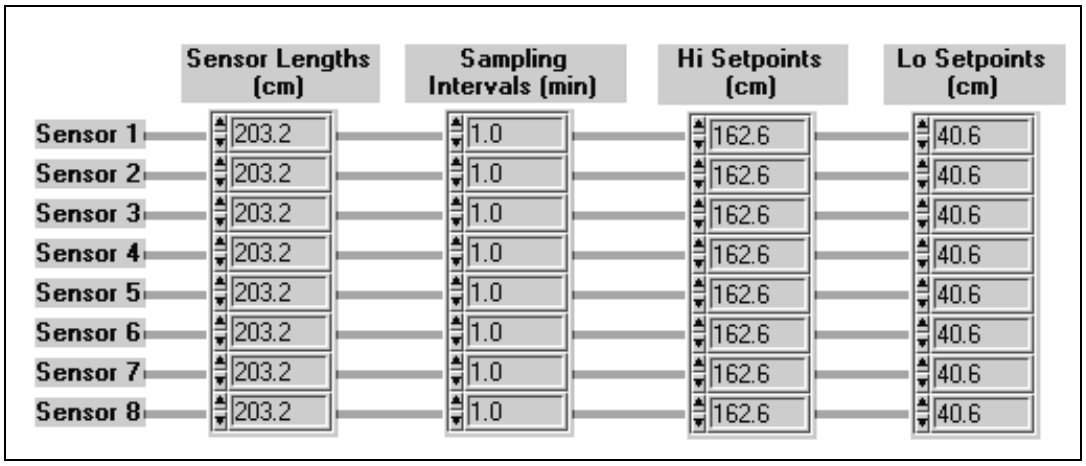
When running the VI it is important to operate the instrument using the VI and not via the actual instrument front panel. Otherwise, the VI and the actual instrument may not be synchronized. The only exception to this rule is operation of the sampling mode toggle switch. The sampling mode toggle switch should be set via the front panel of the actual instrument to the mode desired by the operator. The VI’s representation of the sampling mode toggle switch overrides any actual front panel setting by forcing the actual instrument to perform an immediate measurement when placed in the UPDATE position.

Launching and initializing the GPIB VI

First, make sure the Model 137 is connected to the GPIB bus and that the unit is powered on. Independent of whether you use the exclusive or non-exclusive mode of execution, the initialization method of the Model 137 should be determined. To set the initialization method, scroll to the area above or below the virtual front panel and observe the virtual controls as illustrated on the following page. The *Initialize State from Instrument?* switch allows the user to select whether the virtual instrument is initialized from the current settings of the actual instrument or from the individual controls for each sensor available from the VI. If the *Yes* option is selected, the VI will initialize all settings *for all sensors* from the current configuration of the actual instrument. If the *No* option is selected, the user should enter all data for each connected sensor in the indicated units in the control fields (*Sensor Length*, *Hi Setpoint*, etc.) located below the virtual front panel. The user should also select the correct GPIB bus and primary address (see page 29 for instructions on setting the Model 137 primary address). If only one GPIB interface is present in the host computer, the GPIB bus is normally set to 0. Refer to your LabVIEW documentation for more information on how to determine the GPIB bus setting appropriate for your computer. After setting the initialization parameters, the user may then start the VI. Please refer to your LabVIEW documentation for instructions on how to start and control the execution of VI’s.



Control fields located above the virtual front panel.



Control fields for each sensor located below the virtual front panel.

Interacting with the running VI

While the VI is running the user may manipulate the virtual toggle and rotary switches in the same manner as required for the front panel operation of the actual instrument. See the Operation section of this manual for instructions on operating the front panel controls, however, please note that there are some minor differences discussed below.

The RAISE/LOWER toggle switch functions slightly different in the VI. If the RAISE/LOWER toggle switch is moved from the center position to the RAISE or LOWER position, then the display changes to show the appropriate parameter. After approximately 4 seconds in the RAISE or LOWER position, the display will begin incrementing or decrementing by tenths. After approximately 12 additional seconds, the display will begin incrementing/decrementing by ones. Move the RAISE/LOWER toggle switch back to the center position to stop the incrementing or decrementing function.

As previously discussed, *only the sampling mode toggle switch should be manipulated via the front panel of the actual instrument while the VI is running*. The VI representation of the sampling mode toggle switch forces the actual instrument to perform an immediate measurement when placed in the UPDATE position. When placing the VI switch in the UPDATE position, it must be left in the UPDATE position for at least a couple of seconds in order to be recognized. Simply place the switch back in the SAMPLE position to return to the operational mode specified via the actual instrument's sampling mode toggle switch.

The sensor selection rotary switch on the actual instrument should be set to the REMOTE position in order to enable the remote sensor selection available from the virtual panel.

As a more convenient option for controlling the settings, the user may scroll to the area above the VI and enter the values for the Sensor Length, Hi Setpoint, Lo Setpoint, and Interval directly in the control fields for each sensor (please observe the specified units). Any changes in the fields are recognized and sent to the actual instrument in the form of the appropriate command string. Any configuration settings changed by the VI virtual panel toggle switches or control fields are saved in permanent memory in the actual instrument. The control fields and toggle switches function whether the VI is run exclusively or non-exclusively on the GPIB bus.

If the VI is executed exclusively, then the VI may be gracefully stopped by using the STOP toggle switch in the lower left corner of the VI. After stopping the VI, this switch must be placed back in the up position in order to restart the VI. If you are executing the VI in a non-exclusive polling loop on the GPIB bus, then the STOP toggle switch has no function and the user should control the execution of the VI from the controlling parent VI(s).

Running Multiple Virtual Instruments

The *Model137 RS232.vi* is designed to communicate through a designated COM port available on the host computer. In order to run multiple devices on one host computer, the host computer must have an additional COM port available for connection to each additional instrument. For example, one Model 137 may be connected to COM1, while another Model 137 may be connected to COM2. In order to execute the VI's simultaneously, the user should use the **File|Save A Copy As...** menu command in LabVIEW to create two copies of the *Model137 RS232.vi*. As an example, these copies could be named *Model137 COM1.vi* and *Model137 COM2.vi*. The new copies can be executed simultaneously as long as they are initialized to use separate COM ports.

The *Model137 GPIB.vi* is designed to have exclusive control of the GPIB bus. AMI recognizes this is generally not the case for a GPIB bus configuration. Therefore, the *Non-exclusive loop control.vi* example is provided to demonstrate how the *Non-exclusive Model137 GPIB.vi* can be cooperatively executed on a GPIB bus with multiple devices connected. In order to use multiple Model 137 instruments from the same host computer and GPIB bus, each Model 137 should be set to a unique primary address. In order to execute the VI's simultaneously, the user should use the **File|Save A Copy As...** menu command in LabVIEW to create two copies of the *Non-exclusive Model137 GPIB.vi*. As an example, these copies could be named *Model137 GPIB1.vi* and *Model137 GPIB2.vi*. The user should then modify the *Non-exclusive loop control.vi* to both initialize and then execute the two VI's at a regular interval. The longer the interval between execution, the less responsive the VI's will appear. This is due to the fact that the VI's assume periodic execution in order to poll the virtual switches and control fields for user-initiated changes. The suggested period between execution is 1 second in order to exhibit a reasonable level of responsiveness from the VI. The requirement to constantly poll a virtual panel for changes is an unfortunate requirement for running these types of continuously executing interfaces within LabVIEW.

7 Troubleshooting

No Level Reading

1. Ensure that the instrument is energized from a live power source of proper voltage. The unit configured voltage is indicated on the power-entry module on the rear panel.

   Warning

   If the instrument has been found to have been connected to an incorrect power source, return the instrument to AMI for evaluation to determine the extent of the damage. Frequently, damage of this kind is not visible and must be determined using test equipment. Nevertheless, connecting the instrument to an incorrect power source could damage the internal insulation and/or the ground requirements, thereby, possibly presenting a severe life-threatening electrical hazard.

2. Verify continuity of both fuses inside the power-entry module.

   Warning

   This procedure is to be performed only when the instrument is completely de-energized by removing the power-cord from the power receptacle. Failure to do so could result in personnel coming in contact with high voltages capable of producing life-threatening electrical shock.

   a. Ensure the instrument is de-energized by disconnecting the power-cord from the power source. Disconnect the power-cord from the power-entry module located on the rear panel of the instrument.

   b. Open the hinged panel on the rear of the power-entry module and remove the two fuses. Check the fuses for continuity.

   c. If fuses are bad, replace with fuses of identical ratings.

   Caution

   Installing fuses of incorrect values and ratings could result in damage to the instrument in the event of component failure.

   d. Replace fuses and securely close power-entry module. Reconnect power-cord.

3. Ensure that the sensor is immersed in liquid helium.

> **Note**
>
> *When the sensor is not cooled, the instrument will enter into the vacuum protection mode and turn off the sensor current. Refer to the note near the beginning of the Operation section for a description of this mode.*

Erratic or Erroneous Level Reading

1. Ensure that the sensor is connected properly to the rear panel SENSOR connector, J21 (see Rear Panel Layout on page 4 and the pinout in the Appendix on page 48).

> **Note**
>
> *A significant number of trouble calls are the result of the sensor not properly connected to J21 on the rear panel. The proper positioning of the sensor wires and proper solder connections are critical to the proper operation of the Model 137.*

2. Ensure there are no ice formations on the sensor. Ice formations on the sensor inhibit sensing element thermal propagation thereby producing incorrect readings. If ice formation has occurred, the ice must be removed. If ice formation of the sensor is likely to reoccur, refer to the operation section of the manual under dirty sensor operation.

3. Check for dirty sensors. If a sensor collects oil, water, etc., the sensor could possibly not operate correctly. Refer to the Operation section of the manual under dirty sensor operation.

4. Ensure the sensor is not installed in a restricted area which prohibits the level of helium around the area of the sensor to be an accurate representation of the level to be measured. The gas produced by the sensor when the sensor current is on can depress the liquid level.

5. Ensure the sensor is installed with lead wires at the top. Due to the physical construction of the AMI LHe sensor, a reading of 100% will always result if the sensor is installed upside down.

If the cause of the problem cannot be located, contact an AMI customer service representative for assistance. DO NOT SEND A UNIT BACK TO AMI WITHOUT PRIOR RETURN AUTHORIZATION.

Unit not Responding to Communications

1. Verify your communications cable integrity and wiring. See the Appendix for DB-25 to DB-9 translation for RS-232 cables.

2. Check to make sure you are sending the correct termination to the instrument. If you are using the RS-232 option, make sure the echo feature is set correctly for your application and the baud rate matches the setting of the host device. If you are using the IEEE-488 option, check the primary address setting and make sure the controller software is set to query the instrument at the primary address selected.

3. Check your host communications software and make sure it is recognizing the return termination characters from the instrument. For RS-232 communication, the return termination characters are <*CR*><*LF*>. For IEEE-488, the return message termination characters are <*LF*> with EOI.

4. If the instrument is responding repeatedly with *-8* as the return message, try a device clear command (DCL) or powering the instrument off and then back on. Be sure you are sending valid commands.

5. If you experience continued trouble with the IEEE-488 option, you may have an incompatible IEEE-488 card in your host computer. In the past, AMI has found subtle differences between manufacturers of IEEE-488 cards that have introduced communication errors. AMI attempts to establish compatibility with as many products as possible, however, it is difficult to test every card available. Contact AMI directly if you have thoroughly checked your setup and continue to experience problems with the IEEE-488 option.

6. Version 2.6 of the NI-488.2 drivers from National Instruments has known bugs that prevent the correct operation of the IEEE-488 interface when executed from LabVIEW. Contact National Instruments for workarounds appropriate for your configuration.

WARRANTY

All products manufactured by AMI are warranted to be free of defects in materials and workmanship and to perform as specified for a period of one year from date of shipment. In the event of failure occurring during normal use, AMI, at its option, will repair or replace all products or components that fail under warranty, and such repair or replacement shall constitute a fulfillment of all AMI liabilities with respect to its products. Since, however, AMI does not have control over the installation conditions or the use to which its products are put, no warranty can be made of fitness for a particular purpose, and AMI cannot be liable for special or consequential damages. All warranty repairs are F.O.B. Oak Ridge, Tennessee, USA.

RETURN AUTHORIZATION

Items to be returned to AMI for repair (warranty or otherwise) require a return authorization number to ensure your order will receive proper attention. Please call an AMI representative at (865) 482-1056 for a return authorization number before shipping any item back to the factory.

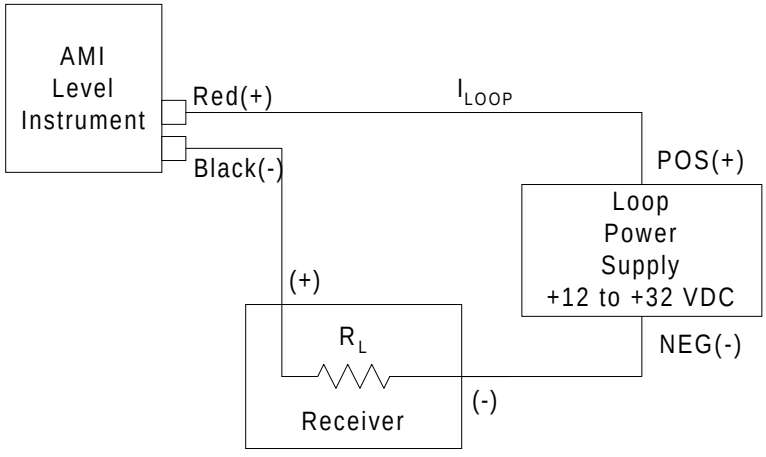
Appendix

4-20 mA Current Loop Option

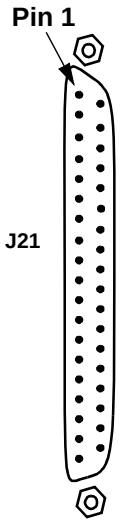
The 4-20 mA output uses the same binding posts as the recorder output for the 0-1 V option. Consequently, when the Model 137 is configured for the 4-20 mA current loop option, the 0-1 VDC analog output is not available. The figure below shows the wiring diagram and the voltage requirements for the power supply and receiver.

Caution

It is extremely important to observe all polarities and to not exceed +32 VDC for the loop power supply in order to prevent damage to the 4-20 mA driver circuit.



Sensor Connector J21 Wiring:



Pin	Function	Pin	Function
1	Sensor 1 I+ (Red)	20	Sensor 5 V- (Yellow)
2	Sensor 1 I- (Black)	21	Sensor 6 I+ (Red)
3	Sensor 1 V+ (Blue)	22	Sensor 6 I- (Black)
4	Sensor 1 V- (Yellow)	23	Sensor 6 V+ (Blue)
5	Sensor 2 I+ (Red)	24	Sensor 6 V- (Yellow)
6	Sensor 2 I- (Black)	25	Sensor 7 I+ (Red)
7	Sensor 2 V+ (Blue)	26	Sensor 7 I- (Black)
8	Sensor 2 V- (Yellow)	27	Sensor 7 V+ (Blue)
9	Sensor 3 I+ (Red)	28	Sensor 7 V- (Yellow)
10	Sensor 3 I- (Black)	29	Sensor 8 I+ (Red)
11	Sensor 3 V+ (Blue)	30	Sensor 8 I- (Black)
12	Sensor 3 V- (Yellow)	31	Sensor 8 V+ (Blue)
13	Sensor 4 I+ (Red)	32	Sensor 8 V- (Yellow)
14	Sensor 4 I- (Black)	33	LO Level Contact
15	Sensor 4 V+ (Blue)	34	LO Level Contact
16	Sensor 4 V- (Yellow)	35	HI Level Contact
17	Sensor 5 I+ (Red)	36	HI Level Contact
18	Sensor 5 I- (Black)	37	Unused
19	Sensor 5 V+ (Blue)		

The HI level and LO level contacts are provided for external use by the customer. When a HI or LO level condition exists for the selected sensor, the respective contact pairs are closed. The following table provides the specifications for the contacts:

Max switching VA	10
Max switching voltage	200 VDC
Max switching current	0.5 A
Max continuous current	1.5 A
Dialectric between contacts	200 VDC minimum

RS-232 Cable DB-25 to DB-9 Translation:

DB-25 Pin	DB-9 Pin
2	3
3	2
4	7
5	8
6	6
7	5
8	1
20	4
22	9

All other pins on the DB-25 connector are unused. This is standard PC modem cable wiring.

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