MODEL 135/136 LIQUID HELIUM LEVEL INSTRUMENT

INSTALLATION, OPERATION, AND MAINTENANCE INSTRUCTIONS

American Magnetics, Inc.

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Rev. 3, December 2000

Declaration of Conformity

Application of Council Directives: Low Voltage Directive 72/23/EEC
EMC Directive 89/336/EEC

Manufacturer's Name: American Magnetics, Inc.

Manufacturer's Address: 112 Flint Road,
P.O. Box 2509
Oak Ridge, TN 37831-2509
U.S.A.

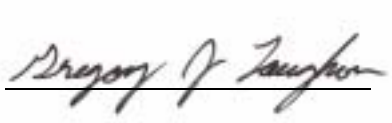
Type of Equipment: Liquid Level Instruments

Model Numbers: Model 135 and 136

Standards to which Conformity is Declared:

Safety:	EN 61010-1 (1993) w/A1, A2	
EMC:	EN55011 (1991) Group 1, Class A	
	EN50082-1 (1997) / EN61000-4-2 (1995)	8kV AD, 4kV CD
	EN50082-1 (1997) / EN61000-4-3 (1996)	3V/m
	EN50082-1 (1997) / EN61000-4-4 (1995)	1kV Power Supply 0.5kV I/O cables
	EN50082-1 (1997) / EN61000-4-5 (1995)	2kV CM, 1kV DM
	EN50082-1 (1997) / EN61000-4-6 (1996)	3V
	EN58082-1 (1997) / EN61000-4-11 (1994)	Voltage dips 30% - 10ms Voltage dips 60% - 100ms Short interruption >95% - 5s

I, the undersigned, hereby declare that the equipment specified above complies with the requirements of the aforementioned Directives and Standards and carries the "CE" mark accordingly.



Gregory J. Laughon
Quality Assurance Manager

September 12, 2002

American Magnetics, Inc.
Oak Ridge, TN, U.S.A.

Instrument Configuration

AMI Order Number:_____ Shipping Date:_____

Model/Serial #:_____ Firmware Revision:_____

Input Power Requirements:_____

Configuration Notes:

_____

_____

_____

_____

_____

_____

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_____

AMI 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.

Rev. 3

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Foreword

Purpose and Scope

This manual contains the operation and maintenance instructions for the American Magnetics, Inc. Model 135/136 Liquid Level Instrument. The manual outlines the instructions for instrument use in various system designs. Since it is impossible to cover all possible system/sensor designs, the most common configuration is discussed and the user is encouraged to contact an authorized AMI Technical Support Representative for information regarding specific configurations not explicitly covered in this manual.

Contents of This Manual

Introduction introduces the reader to the functions and characteristics of the instrument. It provides the primary illustrations of the front and rear panel layouts as well as documenting the performance specifications.

Installation describes how the instrument is unpacked and installed in conjunction with ancillary equipment in a typical cryogenic system.

Operation describes how the instrument is used to measure and control liquid level. *All* instrument controls are documented.

Remote Interface Reference documents all remote commands and queries available through the serial and IEEE-488 interfaces. A quick-reference summary of commands is provided as well as a detailed description of each.

Service provides guidelines to assist Qualified Service Personnel in troubleshooting possible system and instrument malfunctions. Information for contacting AMI Technical Support personnel is also provided.

The ***Appendix*** documents the rear panel connectors.

Applicable Hardware

The Model 135/136 has been designed to operate with an AMI Liquid Helium Level Sensor. Operation with other equipment is not recommended and may void the warranty.

General Precautions

Cryogen Safety

Personnel handling cryogenic liquids should be thoroughly instructed and trained as to the nature of the liquids. Training is essential to minimize accidental spilling. Due to the coldness of these materials, a cryogen spilled on many objects or surfaces may damage the surface or cause the object to shatter, often in an explosive manner.

Inert gases released into a confined or inadequately ventilated space can displace sufficient oxygen to make the local atmosphere incapable of sustaining life. Cryogenic liquefied gases are potentially extreme suffocation hazards since a small amount of liquid will vaporize and yield a very large volume of oxygen-displacing gas. Always ensure the location where the cryogen is used is well ventilated. Breathing air with insufficient oxygen content may cause unconsciousness without warning. If a space is suspect, purge the space completely with air and test before entry. If this is not possible, wear a forced-air respirator and enter only with a co-worker standing by wearing a forced-air respirator.

Cryogenic liquids, due to their extremely low temperatures, will burn the skin in a similar manner as would hot liquids. Never permit cryogenic liquids to come into contact with the skin or allow liquid nitrogen to soak clothing. Serious burns may result from careless handling. Never touch uninsulated pipes or vessels containing cryogenic liquids. Flesh will stick to extremely cold materials. Even nonmetallic materials are dangerous to touch at low temperatures. The vapors expelled during the venting process are sufficiently cold to burn flesh or freeze optic tissues. Insulated gloves should be used to prevent frost-bite when operating valves on cryogenic tanks. Be suspicious of valves on cryogenic systems; the extremes of temperature they undergo causes seals to fail frequently.

In the event a person is burned by a cryogen or material cooled to cryogenic temperatures, the following first aid treatment should be given pending the arrival and treatment of a physician or other medical care worker:

1. If any cryogenic liquid contacts the skin or eyes, immediately flush the affected area gently with tepid water (102°F – 105°F, 38.9°C – 40.5°C) and then apply cold compresses.

2. Do not apply heat. Loosen any clothing that may restrict circulation. Apply a sterile protective dressing to the affected area.

3. If the skin is blistered or there is any chance that the eyes have been affected, get the patient immediately to a physician for treatment.

Containers of cryogenic liquids are self pressurizing (as the liquid boils off, vapor pressure increases). Hoses or lines used to transfer these liquids should never be sealed at both ends (i.e. by closing valves at both ends).

When pouring cryogenic liquids from one container to another, the receiving container should be cooled gradually to prevent damage by thermal shock. The liquid should be poured slowly to avoid spattering due to rapid boil off. The receiving vessel should be vented during the transfer.

Introduction of a substance at or near room temperature into a cryogenic liquid should be done with great caution. There may be a violent gas boil off and a considerable amount of splashing as a result of this rapid boiling. There is also a chance that the material may crack or catastrophically fail due to forces caused by large differences in thermal contraction of different regions of the material. Personnel engaged in this type of activity should be instructed concerning this hazard and should always wear a full face shield and protective clothing. If severe spraying or splashing could occur, safety glasses or chemical goggles along with body length protective aprons will provide additional protection.

The properties of many materials at extremely low temperatures may be quite different from the properties that these same materials exhibit at room temperatures. Exercise extreme care when handling materials cooled to cryogenic temperatures until the properties of these materials under these conditions are known.

Metals to be used for use in cryogenic equipment application must posses sufficient physical properties at these low temperatures. Since ordinary carbon steels, and to somewhat a lesser extent, alloy steels, lose much of their ductility at low temperatures, they are considered unsatisfactory and sometimes unsafe for these applications. The austinetic Ni-Cr alloys exhibit good ductility at these low temperatures and the most widely used is 18-8 stainless steel. Copper, Monel®, brass and aluminum are also considered satisfactory materials for cryogenic service.

Safety Summary

Cryogenic storage systems are complex systems with the potential to seriously injure personnel or equipment if not operated according to procedures. Proper use of safety mechanisms (pressure relief valves,

rupture disks, etc.) included in the cryostat and top plate assembly are necessary.

Recommended Safety Equipment

- First Aid kit
- Fire extinguisher rated for class C fires
- Leather gloves
- Face shield
- Signs to indicate that there are potentially dangerous cryogens in use in the area.

Safety/Manual Legend

Instruction manual symbol: the product is marked with this symbol when it is necessary for you to refer to the instruction manual in order to protect against damage to the product or personal injury.

Hazardous voltage symbol.

Alternating Current (Refer to IEC 417, No. 5032).

Off (Supply) (Refer to IEC 417, No. 5008).

On (Supply) (Refer to IEC 417, No. 5007).

Warning

The Warning sign denotes a hazard. It calls attention to a procedure or practice, which if not correctly adhered to, could result in personal injury. Do not proceed beyond a Warning sign until the indicated conditions are fully understood and met.

Caution

The Caution sign denotes a hazard. It calls attention to an operating procedure or practice, which if not adhered to, could cause damage or destruction of a part or all of the product. Do not proceed beyond a Caution sign until the indicated conditions are fully understood and met.

Model 136 This marking in the left margin of the manual designates a feature, procedure, or specification that is unique to the Model 136.

1 Introduction

1.1 Model 135/136 Features

The American Magnetics, Inc. (AMI) Model 135/136 Liquid Helium Level Instrument is an advanced, microprocessor-based instrument utilizing AMI's patented sample-and-hold principle with automatic helium sensor vacuum burnout protection. The instruments are designed for unattended operation in systems where it is important to monitor and/or control the liquid helium levels and minimize the liquid helium losses.

The Model 135/136 is designed to be used in conjunction with an AMI liquid helium level sensor. 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.

1.1.1 Minimal liquid helium losses

In order to minimize liquid helium loss, the Model 135/136 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 toggled for continuous readings during a helium transfer period or for just a quick level reading update.

1.1.2 Automatic Level Control

Model 136 The Model 136 provides automatic level control capabilities. Two independent setpoints, A and B, are provided for determining a control band to activate/deactivate a power receptacle on the rear panel. The Model 136 is designed for unattended operation in systems where automated refills are required.

1.1.3 Burnout protection

The Model 135/136 provides automatic helium sensor vacuum burnout protection. A sensor which is energized in a vacuum environment without contact with liquid helium 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.

1.1.4 Floating supply

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

1.1.5 Convenient display

The Model 135/136 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.

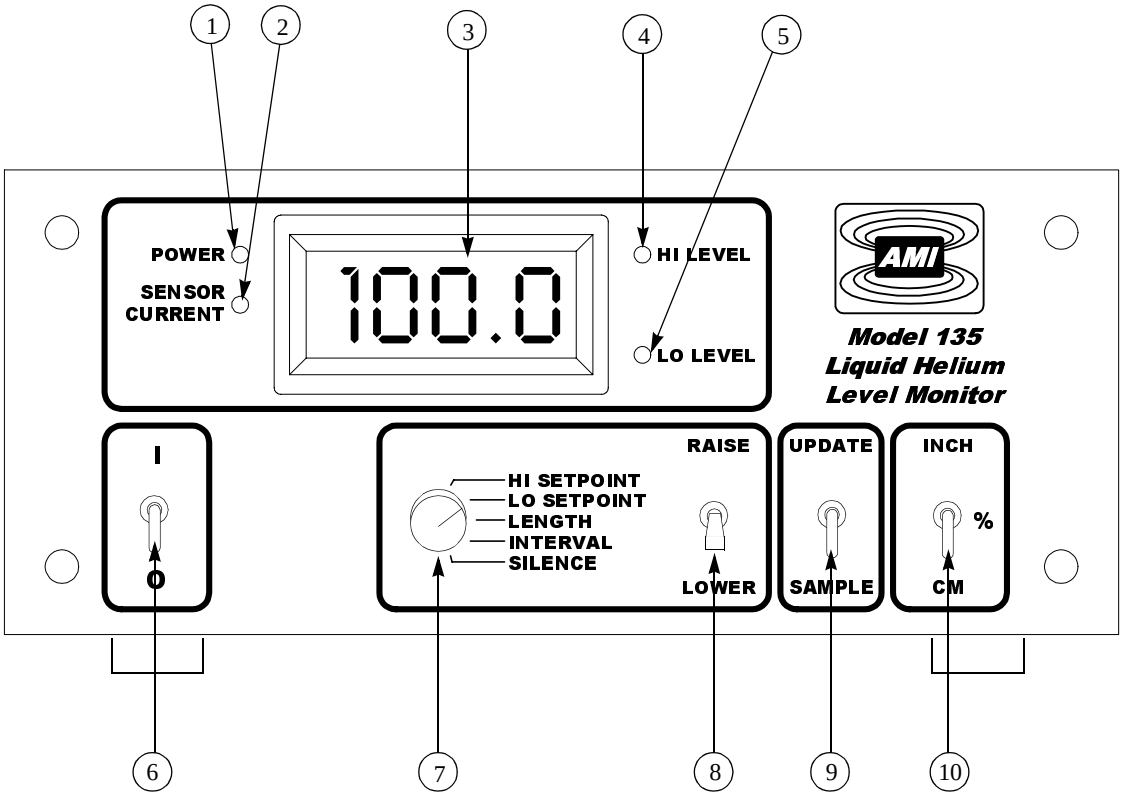
1.1.6 Microprocessor-based electronics

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.

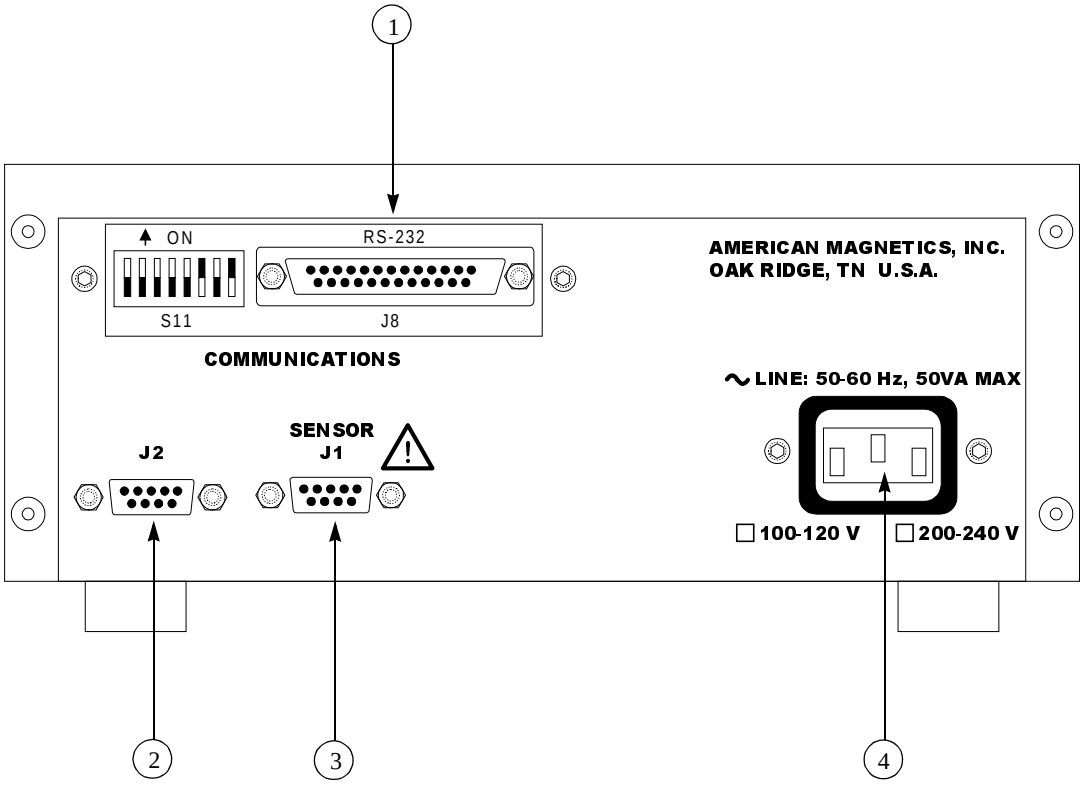
1.1.7 Remote computer monitoring or controlled operation

The Model 135/136 is provided with a 0-10 volt recorder output. A 4-20 mA current loop option is available in lieu of the recorder output. Available computer interface options include RS-232/422 Serial Port/Data Logger or IEEE-488.

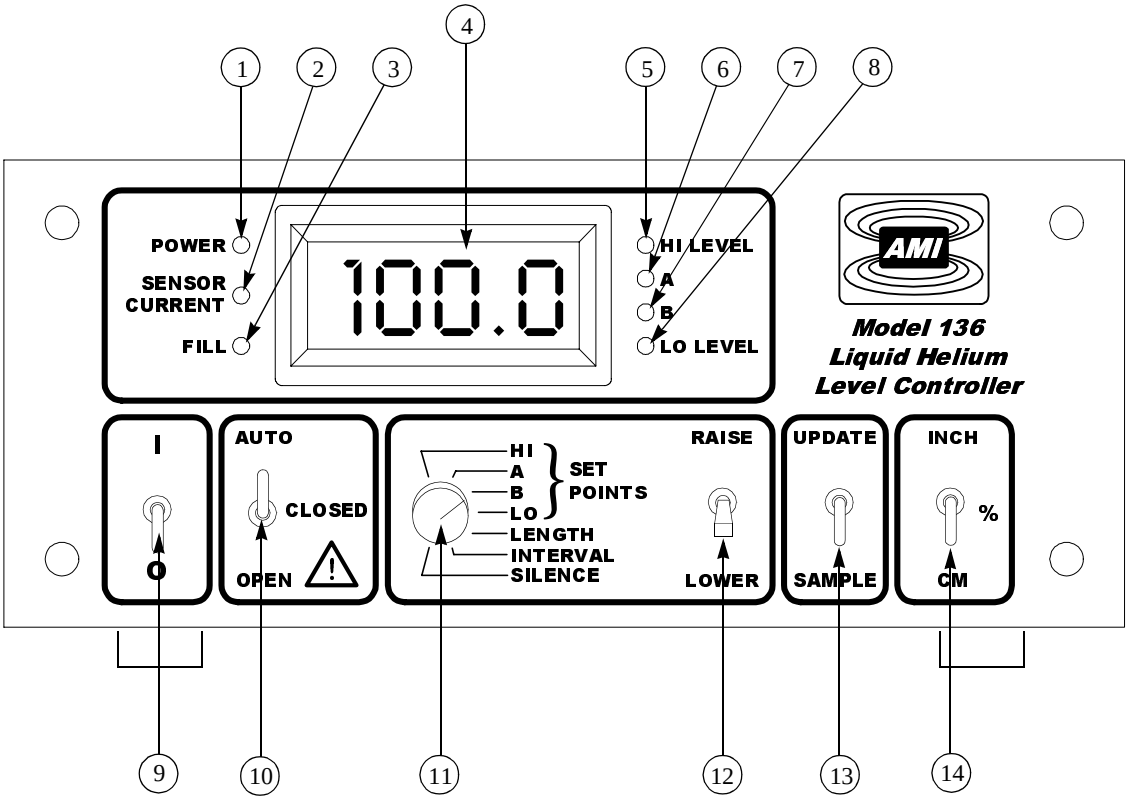
The Model 135/136 may be optionally configured for a maximum of one analog output option and one computer interface option.



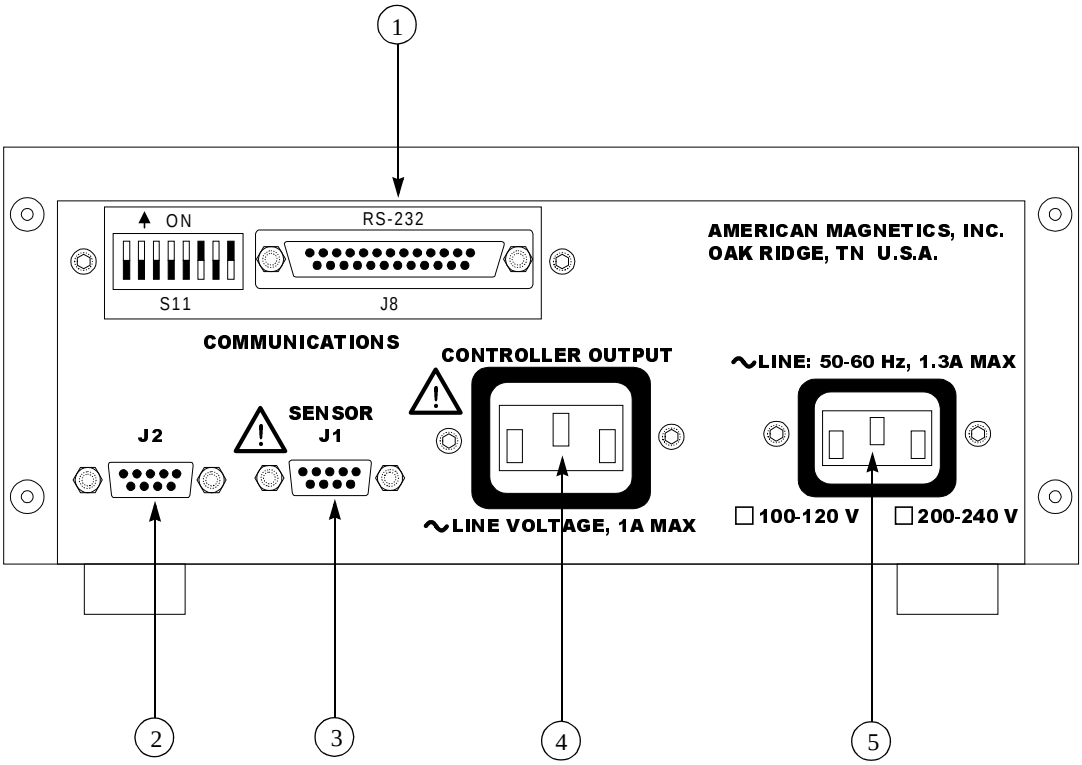
1	Power ON LED	**6**	Power toggle switch
2	Sensor current LED	**7**	Control mode rotary switch
3	LED level display	**8**	Raise/lower toggle switch
4	Hi level LED	**9**	Sampling mode toggle switch
5	Lo level LED	**10**	Units mode toggle switch



1	Optional RS-232 or GPIB communications port (RS-232 shown)	**3**	Sensor input DB-9 female connector (see the *Appendix* for the pinout diagram)
2	Auxiliary DB-9 male connector (see *Appendix* for pinout)	**4**	Power cord connector



1	Power ON LED	**8**	Lo level LED
2	Sensor current LED	**9**	Power toggle switch
3	Fill indication LED	**10**	Fill toggle switch
4	LED level display	**11**	Control mode rotary switch
5	Hi level LED	**12**	Raise/lower toggle switch
6	A level LED	**13**	Sampling mode toggle switch
7	B level LED	**14**	Units mode toggle switch



1	Optional RS-232 or GPIB communications port (RS-232 shown)	**4**	Controller output receptacle
2	Auxiliary DB-9 male connector (see *Appendix* for pinout)	**5**	Power cord connector
3	Sensor input DB-9 female connector (see the *Appendix* for the pinout diagram)		

1.6 Model 135/136 Specifications @ 25 °C

Level Measurements

Resolution:	0.1%, 0.1 cm, or 0.1 in
Accuracy[a]:	± 0.5% of active sensor length
Linearity:	± 0.1%
Sensor Current:	75 mA nominal
Sensor Voltage:	approx. 70 VDC for 80" active sensor length

Operating Parameters

HI and LO Alarms:	0% to 100% adjustable
HI/LO Alarm Relay Contact Ratings:	10 VA, 30 VAC or 60 VDC, 0.5 A (normally open, closed on alarm)
Sample-and-Hold Period:	0.1 to 600.0 minutes or hours
Model 136 A and B Control Setpoints:	0% to 100% adjustable
Model 136 Controller Output:	AC line voltage @ 1A max current
Model 136 Fill Timer:	0.1 to 600.0 minutes or hours

0-10 Volt Analog Output

Integral Non-linearity:	± 0.012%
Resolution:	16 bits
Total Error:	± 1.1% for 0-10 V output
Voltage Drift (0-10 V):	100 ppm / °C

4-20 mA Analog Output @ 24 V

V_{ext} Supply Range:	13-32 VDC (see *Appendix* for diagram)
Integral Non-linearity:	± 0.012%
Resolution:	16 bits
Total Error:	± 0.25% for 4-20 mA output
Current Drift (4-20 mA):	75 ppm / °C
PSRR:	10 µA / V

Power Requirements

Primary[b]:	100-120 or 200-240 VAC ±10% 50 - 60 Hz
Maximum Current:	50 VA for Model 135 1.3 A for Model 136

Physical

Dimensions (Standard):	97 mm H x 213 mm W x 273 mm D (3.8" H x 8.4" W x 10.75" D)
Weight (Standard):	1.8 kg (4.0 lbs.) for Model 135 2.0 kg (4.3 lbs.) for Model 136
Dimensions (Rack Mount):	89 mm H x 483 mm W x 273 mm D (3.5" H x 19" W x 10.75" D)
Weight (Rack Mount):	2.3 kg (5.0 lbs.)

Environmental

Ambient Temperature:	Operating: 0 °C to 50 °C (32 °F to 122 °F) Nonoperating: –20 °C to 60 °C (–4 °F to 140 °F)
Relative Humidity:	0 to 95%; non-condensing

a. Under extreme radiated electromagnetic field conditions (3V/m at 150 MHz to 170 MHz), the accuracy may be degraded to an absolute error of ±0.3 cm.
b. Maximum active sensor length is limited to 64 inches for input line voltages below 105 VAC or 210 VAC.

2 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.

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 Service section of this manual.

If the instrument is used in a manner not specified by AMI, the protection provided by the equipment may be impaired.

2.1 Unpacking the Instrument

Carefully remove the instrument, sensor, and interconnecting coaxial cables from the shipping carton and remove all packaging material. A rack mounting kit is supplied if the instrument was purchased with the rack mount option.

Note

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 unless prior authorization has been received.

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

2.2 Rack Mounting the Instrument

If the instrument has a rack mount chassis, follow the following procedure:

a. Attach the rack mount adapter pieces to the instrument by first removing the four screws on the side of the instrument that attach the cover to the chassis. Attach the rack mount adapter pieces to the sides of the instrument by reinstalling the screws.

b. Install the instrument in a 19" rack by securing the front panel to the rail in each of the four corners with mounting hardware supplied by the cabinet manufacturer.

Warning

Do not remove the cabinet feet and then reinsert the original screws. Doing so could present a severe life-threatening electrical hazard. If removal of the cabinet feet is desired, replace the original screws with screws not to exceed 1/4" in length. Screws longer than 1/4" will contact and damage the printed circuit board inside the unit.

2.3 Preparing the Sensor for Connection

Prepare the sensor to be connected to the instrument by soldering the sensor leads to a male 9-pin D-Sub connector which will connect to J1 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 to connector J1 on the rear panel.

Warning

Although the sensor connector terminals are isolated from earth ground and therefore touching one terminal is not hazardous, the voltage between terminals is at a hazardous potential. The sensor connector is for use with an AMI LHe sensor and the wiring for the sensor is to have no live parts which are accessible. Conductors connected to its terminals must be insulated from user contact by basic insulation rated for 150 VAC (Category I).

The lead wire for the sensor may be sized by the following equations. For input line voltages greater than or equal to 105 VAC or 210 VAC:

$$R = 420 - 5.21L$$

For input line voltages less than 105 VAC or 210 VAC:

$$R = 337 - 5.21L$$

where R is the maximum allowable resistance (in ohms) for each lead wire from the instrument to the sensor, and L is the active length of the connected helium level sensor in inches. Please note that the maximum allowable active sensor length for input line voltages less than 105 VAC or 210 VAC is 64 inches. Tables for active sensor length vs. lead wire distance are provided below.

Minimum recommended gauge for stranded, tinned-copper lead wire for input line voltages greater than or equal to 105 VAC or 210 VAC.

Distance	*R*=367 *L*=10”	*R*=315 *L*=20”	*R*=263 *L*=30”	*R*=211 *L*=40”	*R*=107 *L*=60”	*R*=3.2 *L*=80”
10 ft.	36 AWG	36 AWG	36 AWG	36 AWG	36 AWG	34 AWG
20 ft.						30 AWG
30 ft.						
40 ft.						28 AWG
50 ft.						27 AWG
100 ft.						24 AWG
200 ft.						22 AWG
500 ft.					32 AWG	16 AWG

Minimum recommended gauge for stranded, tinned-copper lead wire for input line voltages less than 105 VAC or 210 VAC.

Distance	*R*=284 *L*=10”	*R*=232 *L*=20”	*R*=180 *L*=30”	*R*=128 *L*=40”	*R*=24 *L*=60”
10 ft.	36 AWG	36 AWG	36 AWG	36 AWG	36 AWG
20 ft.					
30 ft.					
40 ft.					
50 ft.					
100 ft.					34 AWG
200 ft.					30 AWG
500 ft.			34 AWG	34 AWG	26 AWG

2.4 Installing the Optional Solenoid-Operated Fill Valve

Model 136 Install the solenoid-operated fill valve by connecting the valve power cable to the AC controller output receptacle on the rear panel of the instrument. The standard AMI supplied valve has a 9/32 inch orifice and the input and output are tapped for 3/8 NPT.

Caution

When using a solenoid-operated control valve with the Model 136, ensure the valve is configured for the operating voltage of the Model 136. Failure to do so will result in faulty operation and may also result in valve damage.

Warning

Before touching any of the controller output receptacle terminals or touching the wiring connected to these terminals, remove power to the instrument by unplugging it or turning the power switch to the off position.

The controller output receptacle conducts hazardous AC line voltage potentials. It is for use with equipment which has no live parts which are accessible. Conductors connected to its terminals must be insulated from user contact by reinforced or double insulation capable of withstanding 4250 V (impulse) for a 230 VAC Category II installation, or 2550 V (impulse) for a 120 VAC Category II installation.

This instrument is designed for operation from a single-phase power source for maximum safety. The controller output receptacle circuitry only switches the "line" ("hot") connection to the AC mains. If two-phase power is applied, any equipment connected to the controller output receptacle conducts hazardous AC voltage even when the controller output receptacle is not energized.

2.5 Connecting 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.

2.6 Connecting the Instrument to Power

Warning

The Model 135/136 operates on 50-60 Hz power and may be configured for 100-120 or 200-240 VAC ±10%. The power requirements for the instrument is marked on the calibration sticker on the bottom of the instrument. Verify that 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.

Verify that the instrument is configured for the proper operating voltage by referring to the calibration sticker affixed to the bottom of the instrument. If the operating voltage is correct, plug the line cord into the appropriate power receptacle.

Caution

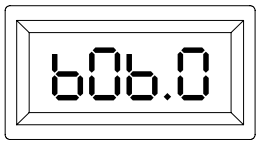
Do not install the instrument in a manner that prevents removal of the line cord from the rear panel of the instrument.

3 Operation

This section describes the front panel display and control functions for the Model 135/136. In addition to the front panel operation described, the remote communication ports provide methods for performing similar operations and querying the current state of the instrument. Refer to the Remote Interface Reference section beginning on page 21 for more details regarding the communication functions.

3.1 Sensor-Burnout Protection Mode

Operating the sensor in a vacuum without contact with liquid helium can cause thermal damage and/or destruction of the superconducting filament. The Model 135/136 is equipped with circuitry that automatically prevents this type of damage from occurring, if the instrument's LENGTH setting is properly set to the active length of the connected sensor. If excessive sensor resistance is detected, the Model 135/136 display will read:



(indicating burnout protection is in effect) and the sensor current will be turned off for a minimum of six seconds after which time the instrument will attempt to resume normal operation. No relay or alarm states are affected.

If an attached sensor is not actually installed in a cooled cryostat, then the sensor burnout protection will activate as soon as the Model 135/136 is powered-on. Please refer to the Service section for more information on checking the function of the Model 135/136 and attached helium level sensor before installation in a cryostat.

3.2 Normal Operational Mode

3.2.1 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. Also during power-up, all LEDs will briefly be energized and the alarm will briefly sound as a self-test procedure.

Note

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

3.2.2 Configure the active length setting

Note

The Model 135/136 instrument is calibrated at the factory. No further calibration is required, however the length setting of the instrument must be matched with the active length of the sensor that is attached for proper operation.

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 present 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 automatically 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 %.

3.2.3 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 for the LENGTH adjustment in paragraph 3.2.2. The setpoints may be located anywhere between 0% to 100% of the active sensor length. The HI and LO setpoint adjustments are compatible with all three units modes.

a. When the measured liquid level exceeds the HI setpoint, the HI LEVEL LED on the front panel is energized and a set of relay contacts are closed on the 9-pin D connector J2 on the rear panel (see the *Appendix* for the pinout). When the level reaches or falls below the HI setpoint, the LED is extinguished and the relay contacts open.

b. When the measured liquid level falls below the LO setpoint, the LO LEVEL LED on the front panel is energized and a set of relay contacts are closed on the 9-pin D connector J2 on the rear panel (see the *Appendix* for the pinout). When the level reaches or exceeds the LO setpoint, the LED is extinguished and the contacts open.

Note

The HI and LO contacts are both closed on power-off of the instrument which is a state unique to the power-off condition.

Note

If the LENGTH is adjusted subsequent to configuring the various setpoints, the percentage of active length will be maintained for all setpoints. For example, if the LENGTH is set to 100 cm and the HI SETPOINT is set to 80 cm, then adjusting the LENGTH to 150 cm will result in the HI SETPOINT being automatically scaled to 120 cm—i.e. the setting of 80% of active length is maintained.

3.2.4 Configure the A SETPOINT and the B SETPOINT

Model 136 To adjust the A and B setpoints which specify the upper and lower limits for the liquid level control band, place the control mode rotary switch in the A SETPOINT position or the B SETPOINT position, respectively. Use the RAISE/LOWER toggle switch to adjust the respective setpoint in the same manner as described for the LENGTH adjustment in paragraph 3.2.2. The A and B setpoint adjustments are compatible with all three units modes.

a. When the measured liquid level reaches or exceeds the A setpoint, the A LEVEL LED on the front panel is energized. When the level falls below the A setpoint, the LED is extinguished.

b. When the measured liquid level falls below the B setpoint, the B LEVEL LED on the front panel is energized. When the level reaches or exceeds the B setpoint, the LED is extinguished.

c. In addition to the LED functions, the controller output receptacle may be energized and de-energized as discussed in step 5 below.

Note

The A setpoint must always be above the B setpoint. The firmware does not allow these setpoints to be reversed. Both setpoints may be set from 0% to 100% of the LENGTH setting as long as A > B.

3.2.5 Select the operational mode of the controller output receptacle

Model 136

The operation of the CONTROLLER OUTPUT receptacle of the instrument is controlled by the fill toggle switch. Operation of the fill toggle switch is as follows:

a. **CLOSED** (or **OFF**)**:** With the power on and the fill switch in the CLOSED position, the instrument serves only as a level monitor, giving a level reading on the digital display and providing data via any analog or communication options installed. All four setpoint LEDs (and associated J2 connector relay contacts) operate normally, however, the controller output receptacle on the rear panel will *always* be de-energized.

b. **OPEN** (or **ON**)**:** With the fill switch in the OPEN position, the rear panel CONTROLLER OUTPUT receptacle will become energized, thereby initiating flow if the solenoid-operated fill valve is properly connected. The FILL LED on the front panel will light indicating the presence of power at the controller output receptacle. **The operator is solely responsible for terminating the fill flow.**

c. **AUTO:** With the fill switch in the AUTO position, the instrument is capable of automatically initiating and terminating liquid fill via the control valve, thereby maintaining the level between the selected A and B setpoints. If the liquid level falls below the B setpoint, the rear panel CONTROLLER OUTPUT receptacle and front panel FILL LED are energized. When the liquid level subsequently reaches or exceeds the A setpoint, the controller output receptacle is de-energized and the FILL LED is extinguished.

Note

The Model 136 has precautionary measures programmed for cases where the sensor may be accidently disconnected. If the sensor is disconnected, the level reading will be 100% after the next measurement, which effectively de-energizes the controller output if operating in the AUTO mode.

3.2.6 Configure the sample time interval setting

To adjust the sample 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 paragraph 3.2.2. The instrument is shipped with the time interval set for 1.0 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 sample 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 'hhh.h' 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 'hhh.h'.

3.2.7 Select either continuous or sampled update configuration

Place the sampling mode toggle switch in the UPDATE 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 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.

3.2.8 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.

3.2.9 Connect the optional analog output signal

If the instrument was purchased with an analog output option, the auxiliary connector J2 on the rear of the instrument provides a 0-10 VDC

or 4-20 mA analog signal corresponding to 0-100% of liquid level. Refer to the *Appendix* for the pinout diagram of connector J2.

3.3 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 135/136 has the capability of increasing the current for a short period of time at the beginning of the measurement cycle (in the SAMPLE mode only) 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 increases 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 measurement is in question due to unclean operation.*

The procedure for configuring the Model 135/136 for the dirty sensor operational mode is documented on page 52 in the Service section of this manual.

4 Remote Interface Reference

4.1 Serial Communication/Data Logger Option

The serial 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.

4.1.1 Serial port connector and cabling

An IBM-compatible computer's serial port can be directly connected to the Model 135/136 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 135/136 uses only three wires of the rear-panel DB25 connector: pin 2 (receive), pin 3 (transmit), and pin 7 (common). There is no software or hardware handshaking. The Model 135/136 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 135/136 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 135/136 must interchange the wires between pins 2 and 3.

Optional RS-422 connector pinout is provided on page 58.

4.1.2 Command/return termination characters

All commands are transmitted and received as ASCII values and are case insensitive. The Model 135/136 always transmits <*CR*><*LF*> (i.e. a *carriage return* followed by a *linefeed*) at the end of an RS-232 transmission. The Model 135/136 can accept <*CR*>, <*LF*>, <*CR*><*LF*>, or <*LF*><*CR*> as termination characters from an external computer.

The simplest method for communicating with the Model 135/136 via RS-232 is by using the interactive mode of a commercially available terminal emulation program. The Model 135/136 transmits and receives information at various baud rates and uses 8 data bits, no parity, and 1 stop bit. When the Model 135/136 receives a terminated ASCII string, it always sends back a reply as soon as the string is processed. *When sending commands to the Model 135/136, you must wait for the reply from the Model 135/136 before sending another command even if the reply consists*

of only termination characters. Otherwise, the shared input/output command buffer of the Model 135/136 may become corrupted. No other form of flow control is supported.

4.1.3 Serial Communication DIP Switch Settings

The 8 DIP switches located on the rear panel of the Model 135/136 are used to control various parameters of the serial 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.

4.1.3.1 Baud rate control

The Model 135/136 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			Baud rate
6	7	8	
off	off	off	300
off	off	on	600
off	on	off	1200
off	on	on	2400
on	off	off	4800
on	off	on	9600

4.1.3.2 Echo function

The Model 135/136 has an *echo* feature which is enabled or disabled by communication DIP switch 2. When the echo function is enabled, the Model 135/136 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 135/136 (however, most terminal programs support a local echo feature). The settings are:

DIP switch 2	Function
on	Echo On
off	Echo Off

4.1.3.3 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 3). 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 135/136 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 135/136 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

4.1.4 Serial Command Set Reference

All commands sent to the Model 135/136 are processed and the Model 135/136 responds with the answer. If the command is invalid, the Model 135/136 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 135/136 will return the *<CR><LF>* termination only.

4.1.4.1 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 units of 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 serial interface are controlled independently from the units mode toggle switch used for controlling the front panel display.** The remote units setting is saved in permanent memory by the SAVE command and is restored at power-up. The UNIT command returns a one character value (and termination) indicating the current units—C for centimeters, I for inches, or % for percentage.

4.1.4.2 Commands for configuring permanent memory

	Command:	LENGTH=*<value>*	Function:	Configures the active sensor length	Returns:	<CR> <LF>
	Command:	HI=*<value>*	Function:	Configures the HI setpoint limit	Returns:	<CR> <LF>
	Command:	LO=*<value>*	Function:	Configures the LO setpoint limit	Returns:	<CR> <LF>
Model 136	Command:	A=*<value>*	Function:	Configures the A setpoint (control band upper limit)	Returns:	<CR> <LF>
Model 136	Command:	B=*<value>*	Function:	Configures the B setpoint (control band lower limit)	Returns:	<CR> <LF>
	Command:	INTERVAL=*<value>*	Function:	Configures the sampling interval	Returns:	<CR> <LF>
	Command:	SAVE	Function:	Saves the configuration to permanent memory	Returns:	<CR> <LF>

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 135/136 if the units of measurement are PERCENT.

The HI and LO commands 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 serial interface. The A and B commands configure the upper limit and lower limit of the control band, respectively. The HI, LO, A, and B 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 53). The SAVE command saves the HI, LO, A, B, INTERVAL, LENGTH, and current remote units 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.

4.1.4.3 Commands for querying the configuration

Command:	LENGTH	Function:	Returns the active sensor length in the current units	Returns:	<value> <CR> <LF>

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>

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Command:	A	Function:	Returns the A setpoint limit in the current units	Returns:	<value> <CR> <LF>

Model 136

Command:	B	Function:	Returns the B 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>

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

4.1.4.4 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 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 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 135/136.*

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.

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 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.

4.2 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.

4.2.1 Command/return termination characters

All commands are transmitted and received as ASCII values and are case insensitive. The Model 135/136 always transmits <LF> and EOI as the termination for return data. The Model 135/136 can accept <CR>, <LF>, <CR><LF>, <LF><CR>, or <LF> with EIO as termination characters from an external IEEE-488 interface.

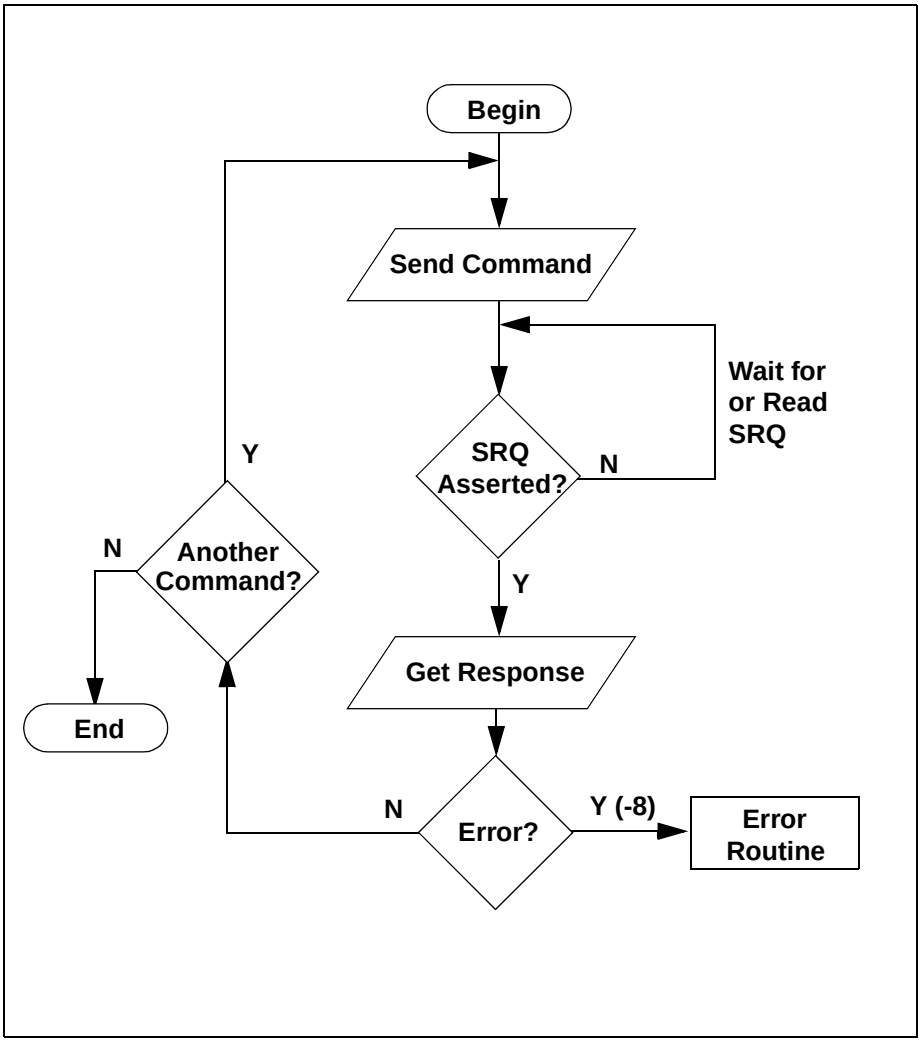
Only one command at a time is allowed to be transmitted by the external IEEE-488 interface. Thus the transmission of several commands separated by a semicolon is not allowed. The instrument uses a single 16 character buffer for input and output. Consequently, all input strings including terminations 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.

4.2.2 Communicating with the Model 135/136

The use of a single buffer for both input and output is a result of memory limitations in the Model 135/136. In order to keep the external IEEE-488 interface from sending successive commands faster than the Model 135/136 can respond, the Model 135/136 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 135/136 using IEEE-488 protocol is a three step process: 1) send the ASCII command, 2) wait for SRQ, and 3) get the instrument response.

> **Note**
>
> *API's for some manufacturer's cards require you to use different functions to check for SRQ and read the serial poll status (spoll) byte. Invoking the command to read the spoll byte may be required to actually clear the SRQ status.*

A basic flow diagram for sending an ASCII command to the Model 135/136 and receiving a response is shown on the following page. It is not necessary to wait exclusively for the SRQ status from the instrument. Other bus commands can be processed while waiting for the SRQ status from the instrument.



Basic communication flow diagram for IEEE-488 commands.

4.2.3 IEEE-488 Communication DIP Switch Settings

The 5 DIP switches located on the rear panel of the Model 135/136 are used to control the IEEE-488 interface. Switches 1 through 5 control the IEEE-488 bus address of the unit.

4.2.3.1 IEEE-488 primary bus address

The Model 135/136 primary bus address is controlled by switches 1 through 5 of the communication DIP switch on the rear panel. Valid primary addresses are between 0 and 30. The Model 135/136 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 135/136 *should be unique* with respect to other Model 135/136 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
1	2	3	4	5	
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
1	2	3	4	5	
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

4.2.4 IEEE-488 Command Set Reference

All commands sent to the Model 135/136 are processed and the Model 135/136 responds with the answer. If the command is invalid, the Model 135/136 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 135/136 will echo the command string in the return message. The Model 135/136 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 (subject to change in the future).

4.2.4.1 Device clear (DCL) command

The Model 135/136 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.

4.2.4.2 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 remote units setting is saved in permanent memory by the SAVE command and is restored at power-up. The UNIT command returns a one character value (and termination) indicating the current units—C for centimeters, I for inches, or % for percentage.

4.2.4.3 Commands for configuring permanent memory

	Command:	LENGTH=<*value*>	Function:	Configures the active sensor length	Returns:	LENGTH=<*value*>
	Command:	HI=<*value*>	Function:	Configures the HI setpoint limit	Returns:	HI=<*value*>
	Command:	LO=<*value*>	Function:	Configures the LO setpoint limit	Returns:	LO=<*value*>
Model 136	Command:	A=<*value*>	Function:	Configures the A setpoint (control band upper limit)	Returns:	HI=<*value*>
Model 136	Command:	B=<*value*>	Function:	Configures the B setpoint (control band lower limit)	Returns:	LO=<*value*>
	Command:	INTERVAL=<*value*>	Function:	Configures the sampling interval	Returns:	INTERVAL=<*value*>
	Command:	SAVE	Function:	Saves the configuration to permanent memory	Returns:	SAVE

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 135/136 if the units of measurement are PERCENT.

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 A and B commands configure the upper limit and lower limit of the control band, respectively. The HI, LO, A, and B 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 53). The SAVE command saves the HI, LO, A, B, INTERVAL, LENGTH, and current remote units 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.

4.2.4.4 Commands for querying the configuration

	Command:	LENGTH	Function:	Returns the sensor length in the current units	Returns:	<value>
	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>
Model 136	Command:	A	Function:	Returns the A setpoint limit in the current units	Returns:	<value>
Model 136	Command:	B	Function:	Returns the B setpoint limit in the current units	Returns:	<value>
	Command:	INTERVAL	Function:	Returns the sampling interval in the current units	Returns:	<value>

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

4.2.4.5 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 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 135/136.*

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 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.

4.2.5 Serial Poll Status Byte

The IEEE-488 serial poll status byte (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 (LSB)	HI relay on	HI relay off
Model 136	2	A relay on	A relay off
Model 136	3	B relay on	B relay off
	4	LO relay on	LO relay off
Model 136	5	Fill mode on (controller output energized)	Fill mode off (controller output de-energized)
	6	Data ready for this unit	No data available
	7	Service Request (SRQ)	No SRQ
	8	Not used	Not used

Note

The fill mode indication is only accurate if the fill toggle switch on the front panel is in the AUTO position. There is no remote indication or control available for the OPEN or CLOSED manual override selections.

4.3 Error Codes

The Model 135/136 returns specific error codes for invalid commands and/or arguments. If an error condition is returned, the command is not processed and the configuration of the instrument is *not* modified. The table below provides a list of error codes, their meaning, and any associated limits. The error codes are common to both the serial and IEEE-488 communication options.

Error Code	Meaning	Valid Range
–1	LO setpoint out of range	0 ≤ LO ≤ LENGTH
–2	B setpoint out of range	0 ≤ B < A
–3	A setpoint out of range	B < A ≤ LENGTH
–4	HI setpoint out of range	0 ≤ HI ≤ LENGTH
–5	Attempted to set or query for LENGTH in PERCENT units mode	
–6	Invalid argument, *value* out of maximum calibration range	1 cm ≤ *value* ≤ 203.2 cm
–7	INTERVAL setting out of range	0 ≤ INTERVAL≤ 600 min
–8	Unrecognized command	
–9	Invalid argument, value was negative or non-numeric	

5 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 135/136. 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 135/136 instrument.

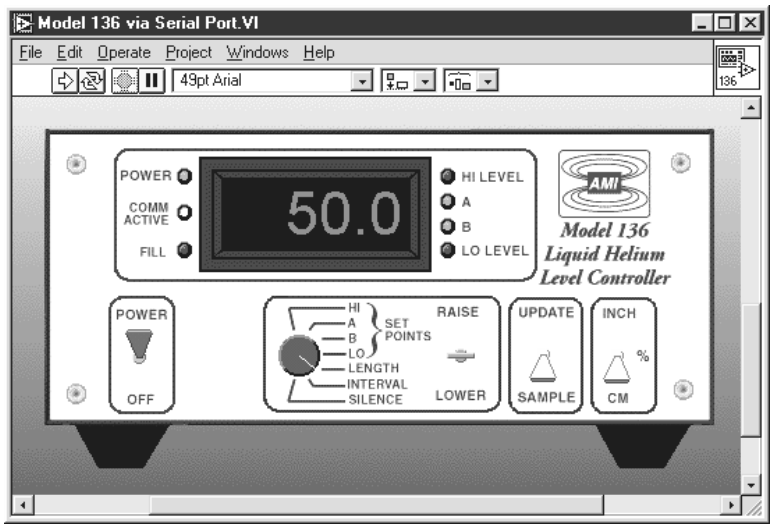
Note

Virtual instrument names which are common to both the Model 135 and Model 136 drivers are noted as "13X" in this section. The actual model number "135" or "136" is used in the LabVIEW VI's.

5.1 RS-232 Virtual Instrument

The figure below illustrates the front panel of the Model 136 virtual instrument (VI). The front panel appears nearly identical to the front panel of the actual instrument. The Model 135 virtual instrument is similar in appearance. The functionality of the VI's is very similar to that of the actual instruments 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 exceptions to this rule are operation of the sampling mode toggle switch or operation of the relay control rotary switch if manual override becomes necessary. 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.

5.1.1 Launching and initializing the RS-232 VI

First, make sure the Model 135/136 is connected to a COM port on the host computer and that the instrument is powered on. The VI library, provided in the file MODEL13X.LLB, for the RS-232 virtual instrument contains the following files:

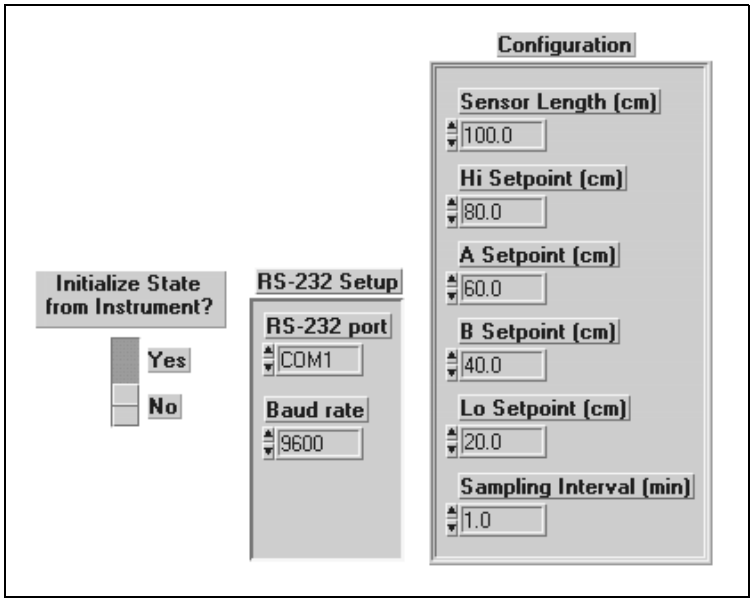
VI	Function
13X Alarms.vi	Manages alarm functions for 135/136.
Config 13X via Serial Port.vi	Initializes actual instrument from VI configuration.
Convert from CM.vi	Displays inches or percentage given input in cm.
Counter.vi	Timer function for the virtual display.
Get 13X Level via Serial Port.vi	Updates virtual display with current level.
Init from 13X via Serial Port.vi	Initializes VI configuration from actual instrument.
Model 13X via Serial Port.vi	The main VI containing the configuration and front panel controls. This is the VI the user should open and execute.

VI	Function
Serial Port Send.vi	Manages sending and receiving of ASCII strings from the actual instrument.
Set 136 A via Serial Port.vi	Configures the A setpoint.
Set 136 B via Serial Port.vi	Configures the B setpoint.
Set 13X Interval via Serial Port.vi	Configures the sampling interval setting.
Set 13X HI via Serial Port.vi	Configures the HI setpoint.
Set 13X Length via Serial Port.vi	Configures the sensor length.
Set 13X LO via Serial Port.vi	Configures the LO setpoint.

Model 136

Model 136

Open the *Model 13X via Serial Port.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 the virtual front panel. Several controls are visible for setup by the user. The figure below illustrates the available controls. The *Initialize State from Instrument?* switch allows the user to select whether the instrument is initialized from the current settings of the actual instrument or from the controls available from the VI. If the *Yes* option is selected, the VI will initialize all settings



from the actual instrument. If the *No* option is selected, the user should enter all data in the control fields (*Sensor Length*, *Hi Setpoint*, etc.) in the indicated units.The user should also select the correct RS-232 port and baud rate, according to the port to which the Model 135/136 is connected

and the baud rate to which the Model 135/136 is set (see page 22 for instructions on setting the 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.

5.1.2 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 or fill 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 virtual instrument's FILL LED indicator is only accurate if the fill toggle switch is in the AUTO position. There is no remote monitoring or control of the manual override states of the fill toggle switch available through the communication command set.

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 (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 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.

5.2 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 MODEL13X.LLB, for the IEEE-488 virtual instrument contains the following files:

VI	Function
13X Alarms.vi	Manages alarm functions for 135/136.
Config 13X via GPIB.vi	Initializes actual instrument from VI configuration.
Convert from CM.vi	Displays inches or percentage given input in cm.
Counter.vi	Timer function for the virtual display.
Get 13X Level via GPIB.vi	Updates virtual display with current level.
Init from 13X via GPIB.vi	Initializes VI configuration from actual instrument.
Model 13X via GPIB.vi	The main VI containing the configuration and front panel controls. This is the VI the user should open and execute.
Non-exclusive loop control.vi	This VI, *which is only available in the COMP13X.LLB library*, should be modified and executed for non-exclusive GPIB operation.
GPIB Send.vi	Manages sending and receiving of ASCII strings from the actual instrument.
Set 136 A via GPIB.vi	Configures the A setpoint.
Set 136 B via GPIB.vi	Configures the B setpoint.
Set 13X Interval via GPIB.vi	Configures the sampling interval setting.
Set 13X HI via GPIB.vi	Configures the HI setpoint.
Set 13X Length via GPIB.vi	Configures the sensor length.
Set 13X LO via GPIB.vi	Configures the LO setpoint.

Model 136

Model 136

The *Model 13X via GPIB.vi* in the MODEL13X.LLB library should be used if the Model 135/136 has exclusive control of the GPIB bus, i.e. is the only device present and operating on the bus.

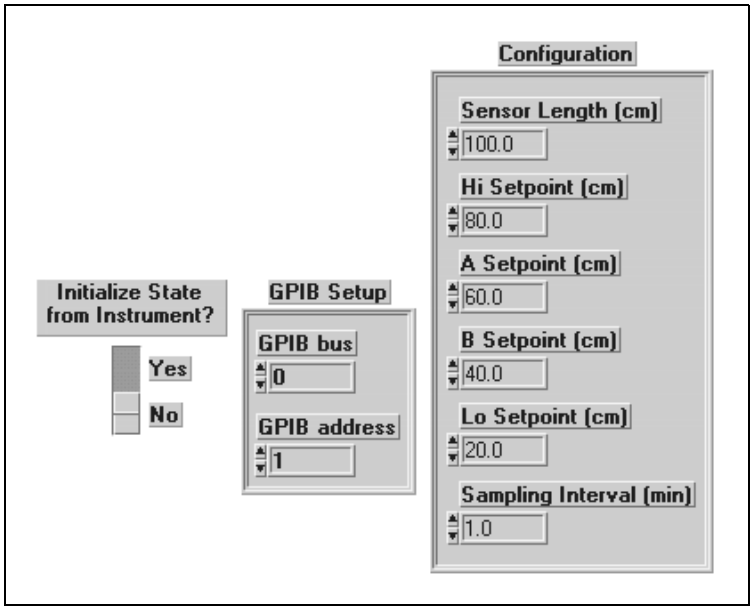
An additional library provided on the LabVIEW floppy disk, COMP13X.LLB, contains all the VI's included in the MODEL13X.LLB library along with the additional *Non-exclusive loop control.vi* and reusable version of the *Model 13X via GPIB.vi*. The *Non-exclusive loop control.vi* provides a control example 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 exceptions to this rule are operation of the sampling mode toggle switch or operation of the relay control rotary switch if manual override becomes necessary. 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.

5.2.1 Launching and initializing the GPIB VI

First, make sure the Model 136 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 135/ 136 should be determined. To set the initialization method, scroll to the area above the virtual front panel and observe the virtual controls as illustrated below (the version of the *Model 13X via GPIB.vi* provided in



COMP13X.LLB provides inputs for the initialization method and input/ output for the configuration). The *Initialize State from Instrument?* switch allows the user to select whether the instrument is initialized from the current settings of the actual instrument or from the controls available from the VI. If the *Yes* option is selected, the VI will initialize all settings from the actual instrument. If the *No* option is selected, the user should

enter all data in the control fields (*Sensor Length*, *Hi Setpoint*, etc.) in the indicated units. The user should also select the correct GPIB bus and primary address (see page 30 for instructions on setting the Model 135/136 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.

5.2.2 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 or fill 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 virtual instrument's FILL LED indicator is only accurate if the fill toggle switch is in the AUTO position. There is no remote monitoring or control of the manual override states of the fill toggle switch available through the communication command set.

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 (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 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).

5.2.3 Running multiple GPIB devices

The *Model 13X via GPIB.vi* in the MODEL13X.LLB library 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 in the COMP13X.LLB library to demonstrate how the *Model 13X via GPIB.vi* can be cooperatively executed on a GPIB bus with multiple devices connected.

In order to use multiple devices from the same host computer and GPIB bus, the Model 135/136 should be set to a unique primary address. In addition to modifications required to use other devices present on the bus, the user should modify the *Non-exclusive loop control.vi* to both initialize and then execute the *Model 13X via GPIB.vi* at a regular interval. The longer the interval between execution, the less responsive the VI will appear. This is due to the fact that the VI assumes 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 using LabVIEW.

6 Service Guide

The procedures in this section should only be performed by Qualified Service Personnel (QSP).

6.1 Troubleshooting Procedures

The following paragraphs serve as an aid to assist QSP in troubleshooting a potential problem with the Model 135/136. If the QSP is not comfortable with troubleshooting the system, you may contact an Authorized AMI Technical Support Representative for assistance. Refer to “Additional Technical Support” on page 53.

This instrument contains CMOS components which are susceptible to damage by Electrostatic Discharge (ESD). Take the following precautions whenever the cover of the instrument is removed.

1. Disassemble the instrument only in a static-free work area.
2. Use a conductive workstation or work area to dissipate static charge.
3. Use a high resistance grounding wrist strap to reduce static charge accumulation.
4. Ensure all plastic, paper, vinyl, Styrofoam® and other static generating materials are kept away from the work area.
5. Minimize the handling of the instrument and all static sensitive components.
6. Keep replacement parts in static-free packaging.
7. Do not slide static-sensitive devices over any surface.
8. Use only antistatic type solder suckers.
9. Use only grounded-tip soldering irons.

6.1.1 No level reading

1. Ensure that the sensor is immersed in liquid helium. If the sensor is immersed and/or cooled, then proceed to step 2.

   Note

   When the sensor is not cooled, the instrument will enter into the sensor burnout protection mode and turn off the sensor current. Refer to paragraph 3.1 of the Operation section for a description of this mode.

2. Check the sensor connections. With the sensor at room temperature, check the following resistances between sensor leads:

   RED to BLUE = approximately 5 ohms
   BLUE to YELLOW = 13.75 ohms x Active Length (inches)
   YELLOW to BLACK = approximately 0.7 ohms
   RED to BLACK = (RED to BLUE) + (BLUE to YELLOW)

   If the indicated conditions do not exist, contact an Authorized AMI Technical Support Representative.

   Note

   If sensor lead wires in excess of few feet are connected, the above figures may not be applicable.

3. Ensure that the instrument is energized from a live power source of proper voltage. The unit configured voltage is indicated 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.

4. Verify continuity of the line fuse, F2, located on the instrument printed circuit board.

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 connector located on the rear panel of the instrument.

b. Remove the instrument top cover and check the fuse F2 for continuity.

c. If the fuse is bad, replace with a 500 mA IEC 127-2 Type F Sheet II 5x20mm fuse.

Warning

Installing fuses of incorrect values and ratings could result in damage to the instrument in the event of component failure and/or a safety hazard.

d. Replace the fuse(s) and securely fasten the instrument top cover. Reconnect the power-cord.

6.1.2 Erratic or erroneous level reading

1. Ensure that the sensor is connected properly to the rear panel SENSOR connector, J1 (see the Rear Panel Layout on page 4 and the pinout diagram in the *Appendix* on page 56).

Note

A significant number of trouble calls are the result of the sensor not properly connected to J1 on the rear panel. The proper positioning of the sensor wires and proper solder connections are critical to the proper operation of the Model 135/136.

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 a dirty sensor. If the sensor collects oil, water, etc., the sensor could possibly not operate correctly. Refer to page 20 for a discussion of the optional dirty sensor operational mode.

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.

6.1.3 Controller output does not energize

Warning

Model 136

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.

1. Verify continuity of controller output fuses, F1 and F3, located on the instrument printed circuit board.

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

   b. Remove the instrument top cover and check the fuses F1 and F3 for continuity.

   c. If the fuse is bad, replace with a 1.25 A IEC 127-2 Type F Sheet II 5x20mm fuse.

   d. Check your connected equipment for compliance with the output receptacle rating.

   Caution

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

2. Replace the fuse and securely fasten the instrument top cover. Reconnect the power-cord.

6.1.4 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.

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.

6.2 Custom Instrument Configurations

6.2.1 Modifying the line voltage requirements

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.

Caution

The Model 135/136 instrument operates on 50-60 Hz power and may be configured for 100-120 VAC or 200-240 VAC ±10%. The power requirements for each instrument are marked on the rear panel. Be sure the instrument's power requirements match 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.

If the instrument operating voltage needs to be changed, ensure the instrument is de-energized by disconnecting the power cord from the power source. Remove the instrument cover and slide the voltage selector switch on the main printed circuit board to the proper voltage. Replace the instrument cover and *indelibly mark the rear panel indications to match the new configuration.*

6.2.2 Enabling dirty sensor operational mode

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 and energize the instrument. The operation in this mode is not detectable from the front panel. Each time the sensor current is energized in the SAMPLE mode, a high current is briefly shunted to the sensor before the actual level measurement cycle is initiated.

6.2.3 Changing time adjustments from minutes to hours

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.

The Model 135/136 can be configured to use hours for the time settings, as opposed to the factory setting of minutes. To configure for hours operation, de-energize the instrument and remove the cover. Place a jumper between pins 1 and 2 of W1 (HR position) on the printed circuit board vertically-mounted directly behind the front panel. Replace the cover and energize the instrument. All time-based settings should now operate in hours mode.

6.3 Additional Technical Support

If the cause of a problem cannot be located, contact an AMI Technical Support Representative at (865) 482-1056 for assistance. The AMI technical support group may also be reached by Internet e-mail at **support@americanmagnetics.com**. Additional technical information, latest software releases, etc. are available at the AMI World Wide Web site at:

http://www.americanmagnetics.com

Do not return the Model 135/136 or other liquid helium level system components to AMI without prior return authorization.

6.4 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.

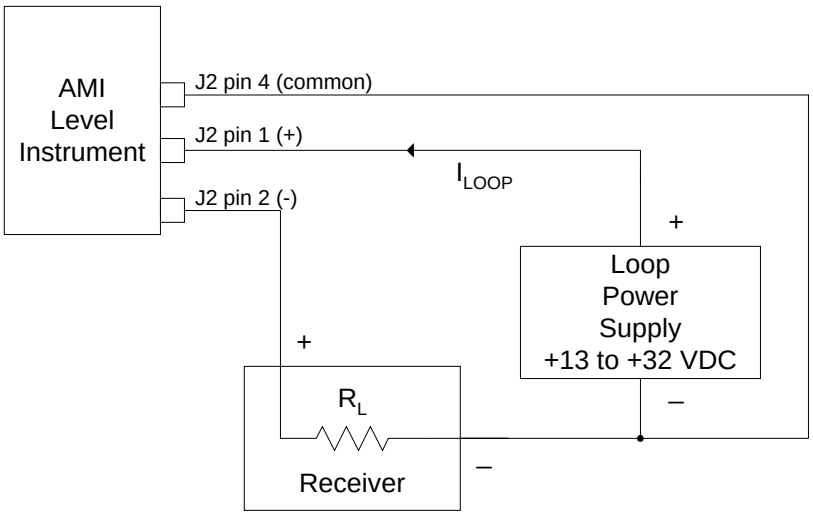
Appendix

A.1 4-20 ma Current Loop Option

The 4-20 mA output utilizes pins 1 and 2 of connector J2. When the Model 135/136 is configured for the 4-20 mA current loop option, the 0-10 VDC analog output from connector J2 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.

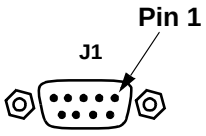


Note

For maximum immunity to external electrical and electromagnetic disturbances, all external cabling (except for the AC input and controller output) should be shielded. The cable shield should be connected to the chassis of the instrument by connecting to the D-sub connector shell.

A.2 Sensor Connector J1 Wiring

Pin	Function
1	Sensor I+ (Red)
2	Not used
3	Not used
4	Not used
5	Not used
6	Sensor V- (Yellow)
7	Sensor I- (Black)
8	Sensor V+ (Blue)
9	Not used

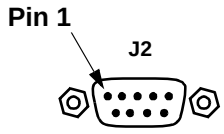


Warning

Although the sensor connector terminals are isolated from earth ground and therefore touching one terminal is not hazardous, the voltage between terminals is at a hazardous potential. The sensor connector is for use with an AMI LHe sensor and the wiring for the sensor is to have no live parts which are accessible. Conductors connected to its terminals must be insulated from user contact by basic insulation rated for 150 VAC (Category I).

A.3 Auxiliary Connector J2 Pinout

Pin	Function
1	4-20 mA current loop input (optional feature)
2	4-20 mA current loop output (optional feature)
3	0-10 VDC output (optional feature)
4	0-10 VDC output common (optional feature)
5 & 6	Lo level relay contacts (dry)
7 & 8	Hi level relay contacts (dry)
9	Not used



The HI level and LO level contacts are provided for external use by the customer. When a HI or LO level condition exists, the respective contact pairs are closed. All setpoints have 1/2 mm hysteresis, therefore the respective contact pairs may “chatter” if the liquid sloshes, bubbles, etc.

The HI level and LO level contacts also provide positive indication of a power-off condition. With a power-off condition, *both* the HI level and LO level contacts will be *closed*, which is a state unique to the power-off condition.

The following table provides the specifications for the contacts:

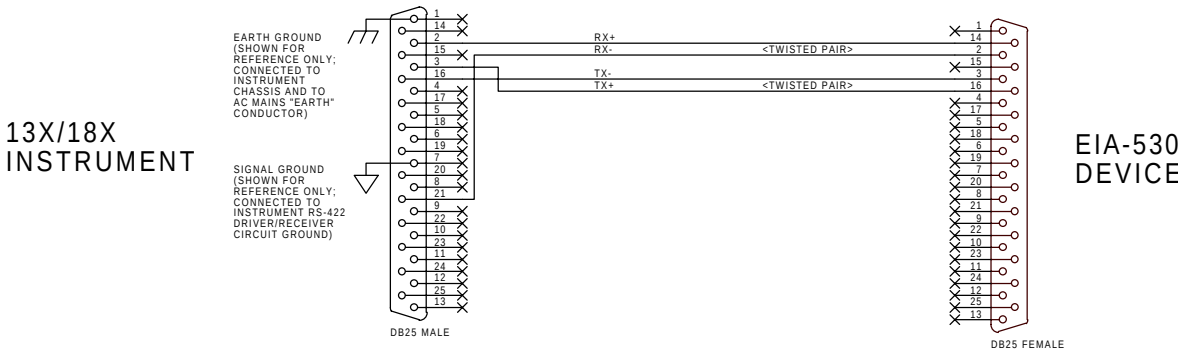
Max switching VA	10
Max switching voltage	30 VAC or 60 VDC
Max switching current	0.5 A
Max continuous current	1.5 A

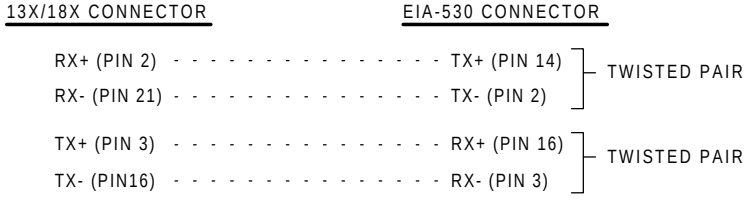
A.4 RS-232 Cable DB-25 to DB-9 Translation

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.

A.5 RS-422 Cable Wiring





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