RC2
DETECTOR/MICROCOOLER ASSEMBLY

TELEDYNE
JUDSON TECHNOLOGIES
A Teledyne Technologies Company

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Description

The RC2 microcooler is an integral Stirling engine with the detector directly mounted to the cold finger. Its 3.5 watt power requirement makes it ideal for use with a battery.

Teledyne Judson recommends rotary coolers when low power dissipation and portability are important. The RC2 microcooler fits easily into the palm of the hand and cools down to77° Kelvin ± 0.5°K.

The RC2 detector cooler assembly can be used with the J10D and J15D Series detectors. To determine performance of a detector with the cooler, typical specifications from the relevant detector series should be used.

This cooler assembly is available with a plug-in temperature control module which provides an adjustable temperature set point and requires 12VDC input.

Applications include:

- Portable Infrared Radiometers
- Environmental Monitoring
- Thermal Imaging
- Range Finding
- Spectroscopy
- Infrared Instrumentation

Design Features:

- MTTF 2000 hours
- Dissipates 150mW heat load
- Operates at 12VDC at 0.25A
- Power requirement 3.5 watts
- Hand held

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Microcooler Motor
The motor must be in a room ambient environment to allow heat to dissipate. If it is operated in an enclosure, it may require an air circulating fan. Power consumption is very low, consequently it will require a relatively small amount of heat sinking. The motor is designed for operation with an Inframetrics motor control circuit. Do not connect the motor directly to a power source.

Temperature Control/Motor Control Module
The control module consists of the following major sub components:
1. Circuit board (1.69" x 3.00") containing electronic components (temperature control circuit and motor control circuit). Reference figure below.
2. Temperature sensor wires (black/white pair attached at one end to the circuit board). Note: Black wire is the common (-) electrode.
3. 9 to 12 volt DC source wires (black/red pair of wires attached at one end to the circuit board). Note: apply power only after procedures in this document are read.
4. A circular fiberglass board attached via a cable to the circuit board. The board is connected to the pins exiting the motor housing. If the fiberglass board is not attached to the motor assembly, follow the instructions titled "Control Circuit Attachment" on page 3 but read "Controlled Temperature Operation" first.

Controlled Temperature Operation
This cooler has been specifically designed to maintain an infrared sensor at 77 Kelvin. In normal operation, a 2N2222 silicon diode chip is attached adjacent to the infrared sensor and serves as the cold finger temperature sensor. At 77 Kelvin, with a forward bias current of 1 milliampere, the voltage across the base (+) to emitter (-) junction of the diode is typically 1.060 volts. (At 295K, it is 0.7 volts.)

During the initial cooling, the cooler motor operates at peak RPM. Once the set point is reached, the motor throttles back to maintain temperature established by the set point. If the temperature sensor is left in an open circuit condition, it will appear as a max. voltage to the controller circuit and cause the cooler to throttle back immediately. Conversely, if the sensor leads are shorted together, the motor will operate at full RPM and the cold finger will stabilize at a temperature at which cooler power equals the sum of radiative and conductive thermal loads. The set point is placed at 1.060 volts at the factory. This can be adjusted for some other voltage via a temperature adjust pot on the control circuit board. (See figure below.) The adjustment range is 1.0 to 1.1 volts.

		Power Supply Requirements	
Wires	Power	Voltage	Current
Red	+V	11-35V	2.0A
Purple/Black	Gnd	Supply Gnd	2.0A

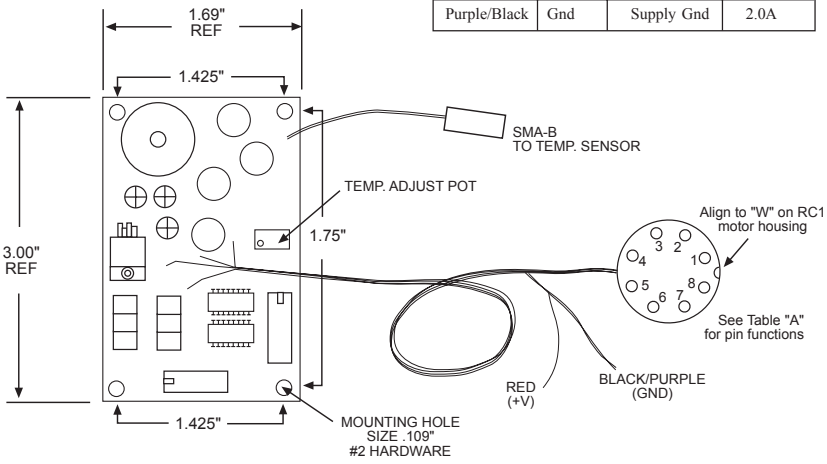


TABLE A

Pin No.	Function
1.	Motor Drive 0A
2.	+5 Volt Hall Sensor
3.	Hall Sensor 0A
4.	Hall Sensor 0B
5.	Hall Sensor 0C
6.	+5 Volt Return
7.	Motor Drive 0C
8.	Motor Drive 0B

Control Circuit Attachment

1. The fiberglass board has a notch located in line with a white insulated wire. The notch must be aligned with the conductor pin marked "W" on the motor housing. Slip pins into insertion socket on fiberglass board. The control board is now attached to the motor.

2. Attach temperature sensor SMB connector to the temperature sensor board. Temperature sensor should read approximately 1.060 volts at 77° Kelvin. This is set at the factory.

3. To operate the cooler, connect the power leads to a 11-35 volt DC supply (red (+) and black/purple (Gnd) lead wires). Use care in attaching the positive and negative terminals. If wired incorrectly, it can damage the electronic motor controller and/or the cooler. Motor voltage (Vm) and current (Im) can be verified by connecting at points shown in figure on page 2. Raising detector operating temperature can elongate cooler lifetime but will degrade detector performance. Detector temperature is set at 77° Kelvin at the factory.

4. To adjust temperature set point, turn cooler power off. Connect DVM on DC volts to temperature sensor leads on circuit board E10 and E11. Turn temperature sensor potentiometer to raise detector temperature approximately 2.3mV/°K.

Microcooler Compressor

The cooler compressor is charged with high pressure helium gas and, as such, the mechanical seals of the components to the compressor body must not be altered or tampered with in any way. The cooler compressor contains four (4) threaded #2-56UNC holes for installation/mounting of the assembly. The screw holes are located at the compressor face below the cold finger interface flange. The holes are set on a nominal 1.322 DBC pattern and are .22 inches minimum deep.

Detector/Dewar Instructions, Pin Nomenclature

The assembly includes an integrated detector/dewar. The following information applies.

CAUTION!

Electrical static discharge can damage the electronic components. Take corrective measures to eliminate the risk of ESD.

Check to make certain that the meter about to be used puts out a maximum of one milliampere at all ranges.

Wires can be soldered to dewar pins. However, some soldering irons exhibit an electrical potential which could damage sensitive components. Test the soldering iron to be used to insure this condition does not exist or preheat the iron tip and then disconnect from the power source before making each of the soldered connections. Use a soldering iron of 20 watts or less. Control iron tip temperature at 550°F to 600°F. Keep soldering time to a minimum (seconds).

Use extreme care when handling and connecting to detector and temperature sensor pins. Electrical power sources such as bias supplies, ohm meters, soldering irons and electro-static discharge can cause permanent damage to the component.

The bias supply/preamplifier is the most common source of problems. The detector must never be connected to a bias supply which is already on. Always check out the bias supply independently from the detector with an appropriate value resistor to simulate the detector. Make sure the power dissipation is close to the value provided in the test report for that unit. When the bias supply is ready to be connected to the detector, always start with power source disconnected and input leads shorted together to eliminate any residual charges or electrical potential before making connection.

The dewar section contains electrical conductors (pins exiting around the glass section) with corresponding reference decal labels.

A. Temperature Sensor Diode
The 2N2222 diode is indicated by a (+) and (-).

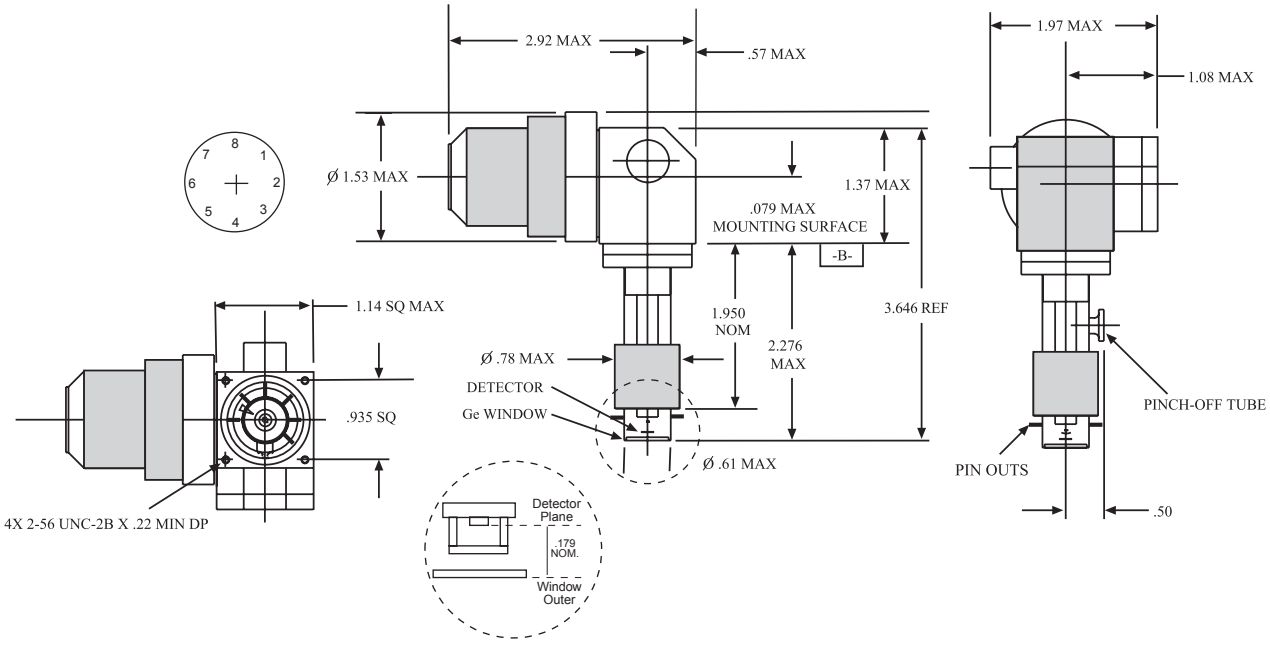
B. Detector Element(s)
Detectors are identified by number for the sensor number and (G) indicating the common. The unit is designed for housing several elements and the extra pins are left unidentified.

C. General Handling
• To reduce the possibility of damage, unnecessary handling of the unit should be avoided.
• Avoid touching the coated surface of the dewar window. Keep the dewar window protective cap in place until ready to install the unit.
• Refrain from handling the dewar pin area to minimize any ESD damage potential.

D. General Cleaning
In the event that the dewar window becomes contaminated and requires cleaning, the window may be cleaned with isoproponal. Using a clean soft cloth or lens tissue saturated with solvent, lightly rub the contaminated surface and then immediately wipe dry with a second clean soft cloth.

CAUTION!

Do not scratch window.
Avoid exposing dewar to temperatures above 60°C.



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