

HC135 Series

Module with Micro-controller and RS-232-C Interface



FEATURES:

- FULLY SELF-CONTAINED OPERATION
- PRE-SET ADJUSTMENTS
- PHOTON COUNTING FOR EXCELLENT SENSITIVITY AND ACCURACY
- LIGHT MEASUREMENT SENT TO PERSONAL COMPUTER THROUGH SERIAL PORT

HC135-11 includes 1" R1924A bialkali PMT with embedded micro-controller and RS-232-C interface.

HC135-12 includes 1" R1925-20 multi-alkali PMT with embedded micro-controller and RS-232-C interface.

The HC135 series of low light level detectors combines the sensitivity of a photomultiplier tube with the intelligence of a micro-controller to provide a detector module of exceptional sensitivity, accuracy and flexibility. And since the detector interfaces directly to a personal computer, operating the detector is very simple.

The detector module acquires the signal by counting the photons as they enter the input window. This method is the most sensitive technique for light measurement. And since the HC135 integrates all of the necessary components for photon counting, the details of the technique do not have to be mastered by the user to enjoy the benefits. In fact, the detector is shipped with all adjustments pre-set by a rigorous calibration procedure.

Two versions are available which differ in spectral response. The HC135-11 covers UV to 650 nm with very low background noise. The HC135-12 is suited for applications requiring measurement beyond 650 nm and into the near infrared (850 nm). Both versions provide a large, 21 mm diameter active area for good light gathering ability.

The light signal from a photomultiplier tube takes the form of very high-speed current pulses. In the HC135, these pulses are amplified and converted to digital pulses with a high-speed amplifier and discriminator. Then, counting these pulses results in a very accurate A to D conversion. The pulses are pre-scaled by a factor of four before counting. This aids in extending the dynamic range without using excessive power.

Precise counting intervals of ten milliseconds are provided by the crystal-controlled counter/timer circuitry in the micro-controller. A Cockcroft-Walton high voltage supply is used to limit current consumption and prevent unwanted temperature rise of the assembly. The supply is set by a D/A converter, allowing computer control of the setting. The HC135 has its dead time measured during production and this dead time is programmed into the micro-controller. The measured count for each ten-millisecond interval is then corrected for dead time before reporting the count rate to the host computer.

MAXIMUM RATINGS^{1,2}

HV output voltage	+1200	volts
Supply voltage	+6	volts
Maximum count rate		
Short duration	30	Mcps
Continuous	20	Mcps
Operating temperature	+5 to +50	°C
Storage temperature	-20 to +50	°C

GENERAL SPECIFICATIONS

Wavelength range	300 to 650	nm
HV output voltage range	+300 to +1200	volts
Supply voltage range	+4.75 to +5.25	volts
Voltage divider ratio	3:1:1:1:1:1:1:1:1:1	volts/volts
Warm-up time	180	seconds
Output voltage decay time constant ³	20	seconds
Active area	21 diameter	mm, min.
Overall dimensions (less projections)	1.375 diameter x 4.752	inch
Weight (head only)	180	grams, typ.

NOTES

1. This is packaged as part of an evaluation kit which includes the EVAL40 software and instructional manual. Specifications are based upon the 1 inch head-on PMT, R1924-20, embedded micro-controller and RS-232-C interface.
2. Stresses above the Maximum Ratings may cause permanent damage to the device. Exposure to maximum conditions for extended periods may reduce device reliability.
3. The gain of the PMT decays ten times faster than the output voltage.

PHOTOMULTIPLIER SPECIFICATIONS¹

Cathode luminous sensitivity, S_k	60 90	ìA/lm, min. ìA/lm, typ.
Gain	2E6	A/lm, min.
Dark counts @ default high voltage	100	cps, typ.

PERFORMANCE SPECIFICATIONS (25°C, 400 nm, default high voltage)

Supply current ² @ +5 volts input	50.0	mA, max.
Responsivity	440,000	cps/pW, typ.
Counting efficiency ³	22	%, typ.
Noise equivalent power ⁴	3x10E-17	watts, typ.
Stability		
Baseline	11	%/°C
Responsivity	± 0.1	%/°C
Prescale factor	4	-----
Dynamic range	2E6	-----
Linearity		
DC to 20 Mcps	± 1	%, max.

OUTPUT DATA FORMAT

Serial interface	RS-232-C 9600 baud, no parity, 8 data bits, 1 stop bit No handshaking lines are monitored; CTS,DSR,DCD and DTR are not used Alternate specs are not supported
Data string	4 bytes of data; i.e. a 32-bit value An overflow of the internal counter will set the most significant bit to 1

NOTES

1. The Photomultiplier tube used in this assembly meets all specifications and should be used with the limitations listed in the Hamamatsu Photonics, Japan general data sheet. The R1924-20 refers to a special selection for the characteristics listed in this section
2. Current consumption increases if high light levels are applied to the Photomultiplier tube.
3. This is the ratio of measured counts to actual photon flux. The effects of photocathode quantum efficiency, electron-optic collection efficiency, dynode gain and loss in the discrimination process are all included.
4. Measured with 1 second integration time.

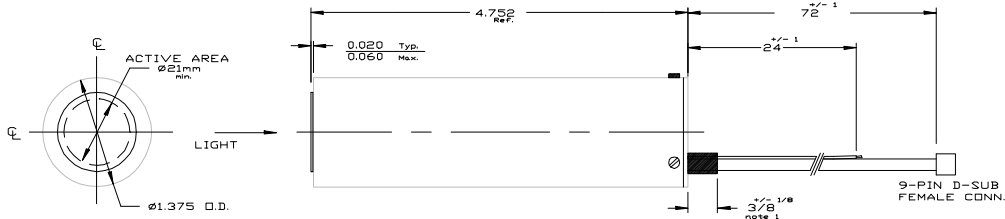
COMMAND SET

ACTION	COMMAND	ARGUMENT	RESPONSE ¹
Set the number of 10 msec intervals to sum. Same as integration time for 1 reading	P # C _R	# is between 1 and 100	VA,BC,BA
Set a sequence of readings, where each reading uses the integration time set with the P command	R # C _R	# is between 1 and 255	VA,BC,BA
Change the high voltage applied to the tube	V # C _R	# is between 0 and 1200. Two bytes are to be sent	VA,BC,BA
Set the output of the user digital output line	O # C _R	# is 0 or 1	VA,BC,BA
Start the reading sequence	S C _R	none	4 bytes of data per reading
Start a continuous reading process. Will continue indefinitely until a STOP character (C _R) is sent	C C _R	none	4 bytes of data per reading
Start a reading sequence for each positive-edge TTL transition applied to the purple stripe user line	E C _R	none	4 bytes of data per reading
Start a reading sequence for each positive-level TTL transition applied to the purple stripe user line	L C _R	none	4 bytes of data per reading
Re-set the default high voltage to the tube	D C _R	none	VA,BC

NOTES

1. The RESPONSE acknowledgment is returned having two bytes:
VA = valid command, BC = bad command, BA = bad argument

PROPRIETARY TO:
GENERAL



MATERIALS

Housing material- 321W stainless steel tubing
(end cap- T6061 aluminum round stock)
Housing finish- Brushed
Potting material- RTV-11
Photocathode- Bi-alkali
Window- Borosilicate
Wires- All lead wires are color-coded
 stranded conductor, #24 AWG, XLPVC
 except signal output cable which is
 PVC shielded, 3 conductor RS-232-C
 (Refer to wiring code)
Connectors- One, as noted
 9-pin D-sub
 female connector

WIRING CODE


YELLOW	+5 volts input
BLACK	Power ground
ORANGE STRIPE	User line, TTL output
PURPLE STRIPE	External trigger

NOTES

1. Strain relief and shrink sleeve starts inside housing

ALL DIMENSIONS IN INCHES
UNLESS OTHERWISE NOTED

ALL TOLERANCES ARE TO BE
+/- 0.005 UNLESS OTHERWISE NOTED

DESCRIPTION	1' H-O ASSEMBLY - PHOTON COUNTER W/ uC	
HC PART NO.	HC135-01 Rev 0	
HC DRAWING NO.	PS13501-0.dwg	
CUST DWG NO.		
DRAWN BY:	H. YOUNG	
DATE	05/15/95	
SCALE/SIZE	1/1"B	

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