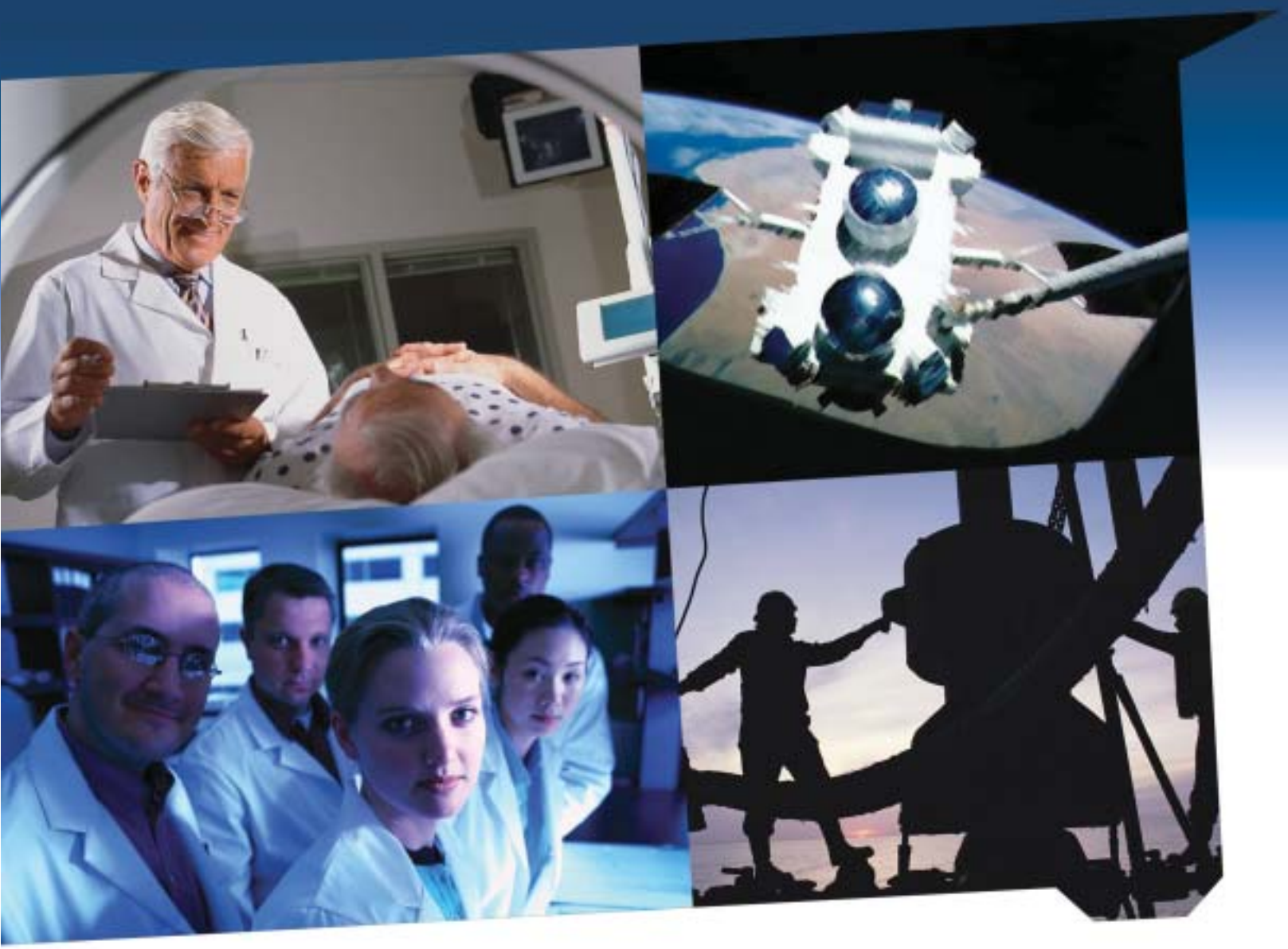
Photomultipliers for Scintillation and High Energy Physics



BURLE Discovering the Future.

www.burle.com

BURLE Photomultiplier Tubes

BURLE manufactures photomultiplier tubes offering today's best performance and quality. We are known for providing industry leading technical and logistical support as well as having highly competitive pricing. Our PMTs are used daily to improve people's quality of life in such applications as Single Emission Photon Computed Tomography, Positron Emission Tomography, cargo inspection, nuclear material monitoring and oil exploration. In addition, our PMTs are used by researchers in High Energy and Nuclear Physics programs to make fundamental discoveries about the universe. In this brochure we provide you with a summary of products made by BURLE for use in scintillation and other visible pulsed light applications.

One of BURLE's emerging strengths is our ability to customize PMTs by adding packaging and electronics designed to meet your particular application. Below is a partial list of features that can be incorporated into most of our PMTs in an amazingly short period of time:

- Conductive coating at cathode potential with insulating wrap
- Magnetic shield, foil under insulating wrap or rigid housing
- Protective housings
- Voltage divider circuits, both passive and active, with analog and digital gain adjustment options
- Amplifiers covering a wide range of bandwidths
- High voltage power supplies with either analog or digital voltage control, some having ultra-low power requirements
- Potting for severe environmental conditions including moisture, vibration, shock and high-altitude

Timing PMTs

8575B

- BURLE's high performance timing PMTs have Plano-Concave windows and front-end electron-optics designed to minimize the variation in transit time over the full entrance window, resulting in excellent timing resolution
- The electron multipliers used in these PMTs are either linear focused or circular, providing fast transit time and minimizing the temporal spread of multiplied electrons
- These PMTs have anodes designed to perform well in high-speed pulsed applications and together with the front-end and multiplier design result in fast rise-times
- BURLE's line of Timing PMTs cover a wide range of input sizes, from ¾" to 5" including the NEW Low Profile 83114.

Ruggedized

83092-103

- BURLE's line of ruggedized PMTs are designed for demanding well logging applications which require operation at temperatures of up to 175°C and survival in harsh shock and vibration environments
- Variants of these PMTs with lower temperature ratings are ideal for use in portable and mobile scintillation devices that must endure rough handling and temperature extremes
- Assemblies are available which match the temperature ratings of the PMTs and additional circuitry can be designed for custom applications

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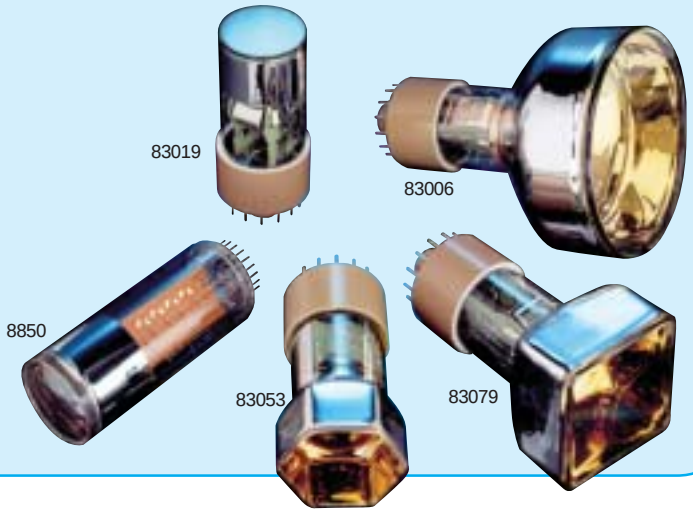
General Scintillation Counting

- BURLE's full line of general scintillation counting photomultipliers provide the user with the best possible pulse height resolution due to:
  - Excellent quantum efficiency of converting blue-green light into photoelectrons
  - A Plano-plano entrance window that provides a large, uniform sensitive area to maximize light collection
  - The large first dynodes are designed to provide excellent photoelectron collection efficiency, resulting in the efficient transfer of electrons to the second dynode and yielding high gain
- BURLE has standard scintillation counting PMTs designed to maintain excellent stability over a large range of count rates
- Standard geometries available include round, square and hexagonal. We also have low profile PMTs for use in space constrained applications. If you don't see the geometry required for your application in the adjoining table, contact our technical representative for an individualized assessment of your needs
- All of BURLE's Timing PMTs are designed to perform well in general scintillation counting and should be considered for these applications, especially if small size or timing information is needed



PLANACON™ Family of PMTs

- BURLE's Innovative Planacon™ family of PMTs uses a continuous electron multiplier rather than a discrete set of dynodes to provide:
  - A very low-profile package
  - 2" square geometry, ideal for close packing into arrays
  - Intrinsic spatial resolution down to tens of microns, limited only by the anode configuration
  - Outputs currently available with 4, 64 or the NEW 85021 with 1024 individual anodes, each 25mm, 6mm, and 1.5mm respectively
  - The best timing properties available in a PMT today
  - Excellent pulse linearity
  - Excellent immunity to magnetic fields
- BURLE is expanding this product line to include variants with high open-area format, custom anode configurations and modules with position readout
- Watch the website for exciting developments

Tube Type	Physical Characteristics							Cathode				
	Size (mm)	Stiff Pin	Fly Leads	Base	Assembly	Module	Cage	Spectral Range (nm)	Blue Sensitivity (µA/Blm)	QE at Peak (%)	λ Peak (nm)	Ty Vo
General Scintillation												
ROUND												
83010	38		X				CC/10	300 - 660	10.0	26	400	10
83019	51	X	X	X			F/10	300 - 660	10	34.5	370	11
83054	51	X	X	X	X		B/8	300 - 700	10.5	32.6	370	8
New! **83096**	51	X	X	X			B-L/8	300 - 660	11.3	32.6	370	10
83021	76	X	X	X			F/10	300 - 660	10	34.5	370	11
83049	76	X	X	X	X	X	B/8	300 - 700	10.5	32.6	380	8
New! **83095**	76	X	X	X			B-L/8	300 - 660	11.3	32.6	370	10
83013	90	X	X	X			F/10	300 - 660	10	34.5	370	11
83006	127	X	X	X			B-CC/10	300 - 660	12	32.6	380	11
SQUARE												
83079	76 SQUARE	X	X	X	X		B/8	300 - 660	11.3	32.6	370	8
HEX												
83020	60 HEX	X	X	X			F/10	300 - 660	10	34.5	370	11
83053	60 HEX	X	X	X			B/8	300 - 700	10.5	32.6	380	8
83025	76 HEX	X	X	X			F/10	300 - 660	10	34.5	370	11
83056	76 HEX	X	X	X			B/8	300 - 700	11.3	32.6	370	8
83069	35x46 HEX		X	X			B/8	300 - 700	9.6	32.6	370	8
Good Timing and Scintillation												
83090	19mm	X					LF/9	300 - 660	10			18
83112	25mm		X		X		LF/10	280 - 660	9.1		370	12
New! **83114**	25mm	X				X	CC/10	300 - 660	8.5	23	390	12
New! **83120**	28mm	X				X	LF/10	300 - 660	10.8	31	370	10
New! **83115**	51mm	X					B-L/8	300 - 660	11.3	32.6	370	10
8575B	51mm	X				X	LF/12	300 - 660	9.2	25	390	20
8850	51mm	X					LF/12	260 - 660	10	25	420	20
8854	127mm	X					LF/14	220 - 660	7.8	22.5	385	20
PLANACON™												
85001	50mm	X			X		MCP	165 - 660	7.5		410	24
85011	50mm	X			X		MCP	165 - 660	7.5		410	24
New! **85021**	50mm						MCP	165 - 660	7.5		410	24
Ruggedized												
83092	25mm	X	X		X		CC/10	250 - 660	5	17	370	15
83051	25mm	X					CC/10	220 - 640	6.5	20	380	15
C31000AP	51mm	X					LF/12	250 - 660	7	19	380	20

	Anode				Timing		PHR	Notes
	Typical Voltage (V)	Typical Gain	Typical Dark Current (nA)	Maximum Average Anode Current (mA)	Rise Time (ns)	Transit Time (ns)	Typical Pulse Height Resolution (% FWHM)	
	1000	2.4 x 10 ^ 6	3	0.5	2.8	32	7.5 (Cs-137)	
	1100	0.095 x 10 ^ 6	1	0.1			9.3 (Co-57)	
	800	0.19 x 10 ^ 6	3	0.1	11	63	9.1 (Co-57)	
	1000	0.069 x 10 ^ 6	3	0.1			8.8 (Co-57)	
	1100	0.095 x 10 ^ 6	1	0.1			9.0 (Co-57)	
	800	0.133 x 10 ^ 6	2.9	0.1	12	66	6.6 (Cs-137)	
	1000	0.0885 x 10 ^ 6	3.5	0.1			8.5 (Co-57)	
	1100	0.095 x 10 ^ 6	1	0.1			8.8 (Co-57)	
	1100	0.067 x 10 ^ 6	1	0.5	22	105	6.9 (Cs-137)	
	800	0.212 x 10 ^ 6	3	0.1			8.9 (Co-57)	
	1100	0.095 x 10 ^ 6	1	0.1			9.1 (Co-57)	
	800	0.19 x 10 ^ 6	3	0.1	13	69	8.8 (Co-57)	
	1100	0.095 x 10 ^ 6	1	0.1			9.2 (Co-57)	
	800	0.177 x 10 ^ 6	3	0.1	12	40	8.5 (Cs-137)	
	800	0.025 x 10 ^ 6	2	0.1			11.0 (Co-57)	
	1800	4.5 x 10 ^ 6	5					
	1250	34 x 10 ^ 6	0.1	0.2	1.5	22	14.6 (BGO/Na-22)	
	1250	0.6 x 10 ^ 6	3	0.1	1.5	19	7.8 (Cs-137)	
	1000	1.7 x 10 ^ 6	1.2	0.2	1.6	22	7.5 (Cs-137)	
	1000	0.27 x 10 ^ 6	8	0.1		39	7.3 (Na-22)	
	2000	27 x 10 ^ 6	1	0.2	2.8	37	7.0 (Cs-137)	
	2000	16 x 10 ^ 6	0.6	0.2	2.1	31	7.3 (Cs-137)	
	2000	51 x 10 ^ 6	60	0.2	2.9	66		
	2400	0.6 x 10 ^ 6	0.5	0.003	0.3	1.8	10.0 (Cs-137)	4 Anode, 2 x 2 configuration
	2400	0.6 x 10 ^ 6	0.5	0.003	0.3	1.8	10.0 (Cs-137)	64 Anode, 8 x 8 configuration
	2400	0.6 x 10 ^ 6	0.5	0.003	0.3	1.8	10.0 (Cs-137)	1024 Anode, 32 x 32 configuration
	1500	0.6 x 10 ^ 6	0.1	0.02	1.5			90° C, 175° C
	1500	0.2 x 10 ^ 6	0.1	0.02	2.5	20	8.3 (Cs-137)	90° C, 175° C
	2000	10 x 10 ^ 6	25	0.2	2.8	37		90° C, 175° C

BURLE INDUSTRIES, INC., is a global manufacturer and supplier of specialized electron tubes and electro-optic products. BURLE is headquartered in Lancaster, Pennsylvania USA with additional locations in Sturbridge, Massachusetts USA; Germany, United Kingdom, and Mexico. BURLE manufactures Power Tubes and Cavities, Photomultiplier Tubes; Channeltron® Mass Spec Detectors, Microchannel Plates, Advanced Performance Detectors, Flexible Fiber Optics and Power Supplies.

BURLE INDUSTRIES is the successor to the RCA Corporation, New Products Division. The Lancaster facility was opened in 1942 as a US Navy plant operated by RCA for the manufacture of radio and microwave tubes. After WWII, the facility was acquired by RCA and became the base for development and production of commercial television products. In subsequent years other products were added. These included image tubes, photomultiplier tubes, motion- sensing light control switches, and closed circuit video systems. In 1983, the New Products Division was formed with the existing product lines. The 1986 acquisition of RCA by General Electric Company resulted in the divestiture of the Division. On July 14, 1987, the management team, led by Dr. Erich Burlefinger, purchased the Division and founded BURLE INDUSTRIES, INC.

On March 23, 1998, BURLE opened a facility in Matamoros, Mexico for the manufacture of photomultiplier assemblies.

On July 1, 1999, BURLE purchased the Scientific Detector Products Group consisting of the Microchannel Plate and Detector Assemblies, Single Channel Electron Multipliers, Flexible Fiber Optics and Glass-on-Wire product lines from Galileo forming BURLE Electro-Optics, Inc. a wholly owned subsidiary of BURLE INDUSTRIES, INC.

BURLE's employees are dedicated to a continuing process of technology and product advancements along with a promise of outstanding quality and service. To keep this promise, BURLE maintains the highest standard of quality as signified by BURLE's designation as ISO9001:2000 certified. BURLE has been continuously certified since 1992. This standard, compared to prior standards, puts added focus on continual improvement, increased emphasis on the role of top management and monitoring of customer satisfaction as a measure of (Quality) system performance. It reflects BURLE's ongoing commitment to delivering quality products to its customers.

BURLE INDUSTRIES, INC.
1000 New Holland Avenue
Lancaster, PA 17601-5688
USA
burlecs@burle.com

1-800-366-2875
1-717-295-6888
1-717-295-6773 (Intl. Calls)
Fax: 1-717-295-6096

BURLE Electro-Optics, Inc.
Sturbridge Bus. Park
P.O. Box 1159
Sturbridge, MA 01566
USA
sales@burle-eo.com

1-800-648-1800
1-508-347-4000 (US/Intl. Calls)
Fax: 1-508-347-3849

BURLE INDUSTRIES GmbH
Hermann-Hollerith-Str.6
D-52499 Baesweiler
Germany
Postfach 1349
D-52492 Baesweiler
Germany
burle.europe@t-online.de

+49 (0) 2401-806-0
Fax: +49 (0) 2401-806-10

BURLE Industries (UK) Ltd.
55 Wynn Close
Baldock Herts SG7 6QS
United Kingdom
burle.uk@btinternet.com

+44 (0) 1462 892088
Fax: +44 (0) 1462 892678

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