

SECURITIES AND EXCHANGE COMMISSION
WASHINGTON, DC 20549

FORM 10-Q

(MARK ONE)

QUARTERLY REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES
EXCHANGE ACT OF 1934

For the quarterly period ended September 30, 2001

or

TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES
EXCHANGE ACT OF 1934

For the transition period from _____ to _____

Commission file number 0-23621

MKS INSTRUMENTS, INC.

(Exact name of registrant as specified in its charter)

Massachusetts (State or other jurisdiction of incorporation or organization)	04-2277512 (I.R.S. Employer Identification No.)
Six Shattuck Road, Andover, Massachusetts (Address of principal executive offices)	01810 (Zip Code)
Registrant's telephone number, including area code	(978) 975-2350

Indicate by check mark whether the registrant: (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. Yes X No .

Number of shares outstanding of the issuer's common stock as of October 31, 2001: 37,881,027

MKS INSTRUMENTS, INC.
FORM 10-Q
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PART I. FINANCIAL INFORMATION

ITEM 1. FINANCIAL STATEMENTS

MKS INSTRUMENTS, INC.
CONSOLIDATED BALANCE SHEETS
(in thousands, except share data)

	September 30, 2001	December 31, 2000
	(Unaudited)	(Note 1)
ASSETS		
Current assets:		
Cash and cash equivalents	\$ 118,434	\$ 123,082
Short-term investments	12,678	17,904
Trade accounts receivable, net	42,691	95,076
Inventories	70,548	69,165
Deferred tax asset	7,933	9,976
Other current assets	13,259	4,433
	-----	-----
Total current assets	265,543	319,636
Property, plant and equipment, net	71,363	64,133
Goodwill and acquired intangible assets, net	55,266	45,325
Long-term investments	16,100	17,100
Other assets	23,316	8,209
	-----	-----
Total assets	\$ 431,588	\$ 454,403
	=====	=====
LIABILITIES AND STOCKHOLDERS' EQUITY		
Current liabilities:		
Short-term borrowings	\$ 14,745	\$ 15,741
Current portion of long-term debt	1,392	2,783
Current portion of capital lease obligations	528	610
Accounts payable	10,822	23,653
Accrued compensation	7,985	17,003
Other accrued expenses	14,654	14,588
Income taxes payable	--	7,937
	-----	-----
Total current liabilities	50,126	82,315
Long-term debt	11,906	11,439
Long-term portion of capital lease obligations	269	947
Deferred tax liability	3,745	1,663
Other liabilities	1,498	517
Commitments and contingencies		
Stockholders' equity:		
Preferred Stock, \$0.01 par value, 2,000,000 shares authorized; none issued and outstanding	--	--
Common Stock, no par value, 75,000,000 shares authorized; 37,808,673 and 36,645,665 issued and outstanding at September 30, 2001 and December 31, 2000, respectively ...	113	113
Additional paid-in capital	280,114	263,723
Retained earnings	83,845	93,235
Accumulated other comprehensive income (loss)	(28)	451
	-----	-----
Total stockholders' equity	364,044	357,522
	-----	-----
Total liabilities and stockholders' equity	\$ 431,588	\$ 454,403
	=====	=====

The accompanying notes are an integral part of the consolidated financial statements.

MKS INSTRUMENTS, INC.
CONSOLIDATED STATEMENTS OF INCOME (LOSS)
(in thousands, except per share data)
(Unaudited)

	Three Months Ended September 30		Nine Months Ended September 30	
	2001	2000	2001	2000
	-----	-----	-----	-----
		(Note 1)		(Note 1)
Net sales	\$ 53,201	\$ 121,769	\$ 236,745	\$ 326,694
Cost of sales	37,105	67,350	151,636	182,069
Gross profit	16,096	54,419	85,109	144,625
Research and development	9,303	9,736	29,907	25,977
Selling, general and administrative	17,474	18,274	54,107	50,331
Amortization of goodwill and acquired intangible assets	3,020	1,682	8,005	2,809
Goodwill impairment charge	--	--	3,720	--
Merger expenses	--	--	7,708	--
Purchase of in-process research and development	--	310	2,340	310
Income (loss) from operations	(13,701)	24,417	(20,678)	65,198
Interest expense	424	289	1,197	1,139
Interest income	1,208	1,256	4,382	3,796
Other income (expense), net	(1,246)	60	(1,246)	(257)
Income (loss) before income taxes	(14,163)	25,444	(18,739)	67,598
Provision for income taxes (benefit)	(5,092)	9,489	(3,381)	25,235
Net income (loss)	\$ (9,071)	\$ 15,955	\$ (15,358)	\$ 42,363
	=====	=====	=====	=====
Historical net income (loss) per share:				
Basic	\$ (0.24)	\$ 0.47	\$ (0.41)	\$ 1.25
Diluted	\$ (0.24)	\$ 0.44	\$ (0.41)	\$ 1.19
	=====	=====	=====	=====
Historical weighted average common shares outstanding:				
Basic	37,801	34,290	37,364	33,969
Diluted	37,801	35,988	37,364	35,642
	=====	=====	=====	=====

The accompanying notes are an integral part of the consolidated financial statements.

MKS INSTRUMENTS, INC.
CONSOLIDATED STATEMENTS OF CASH FLOWS
(in thousands)
(Unaudited)

	Nine Months Ended September 30,	
	2001	2000
	-----	-----
		(Note 1)
Cash flows from operating activities:		
Net income (loss)	\$ (15,358)	\$ 42,363
Adjustments to reconcile net income (loss) to net cash provided by operating activities:		
Depreciation and amortization	16,681	10,210
Goodwill impairment charge	3,720	--
Purchase of in-process research and development	2,340	310
Loss (gain) on disposal of assets	1,246	471
Other	21	(392)
Changes in operating assets and liabilities net of effects of businesses acquired:		
Trade accounts receivable	52,921	(32,637)
Inventories	3,261	(19,362)
Other current assets	(9,359)	(1,523)
Accrued expenses and other current liabilities	(18,673)	12,719
Accounts payable	(13,644)	7,591
Net cash provided by operating activities	23,156	19,750
Cash flows from investing activities:		
Purchases of investments, net	(3,063)	(3,419)
Purchases of property, plant and equipment	(12,564)	(20,795)
Increase in other assets	(3,754)	(735)
Proceeds from disposal of assets	4,514	15
Purchases of companies, net of cash acquired	(7,842)	(23,784)
Net cash used in investing activities	(22,709)	(48,718)
Cash flows from financing activities:		
Proceeds from short-term borrowings	23,262	17,151
Payments on short-term borrowings	(27,346)	(1,611)
Proceeds from long-term debt	833	--
Principal payments on long-term debt	(2,073)	(4,777)
Proceeds from exercise of stock options	3,595	5,309
Cash distributions to stockholders	--	(1,417)
Principal payments under capital lease obligations	(599)	(839)
Net cash provided by (used in) financing activities	(2,328)	13,816
Effect of exchange rate changes on cash and cash equivalents	375	(579)
Decrease in cash and cash equivalents	(1,506)	(15,731)
Cash and cash equivalents at beginning of period	123,082	67,489
Effect of excluded results of ASTeX (Note 1)	(3,142)	--
Cash and cash equivalents at end of period	\$ 118,434	\$ 51,758
Supplemental disclosure of cash flow information:		
Cash paid during the period for:		
Interest	\$ 855	\$ 1,044
Income taxes	\$ 13,004	\$ 17,076
Noncash transactions during the period:		
Stock and options issued for acquisitions	\$ 12,110	\$ 8,433
Note receivable from disposal of assets	\$ 3,900	\$ --

The accompanying notes are an integral part of the consolidated financial statements.

MKS INSTRUMENTS, INC.
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS
(Tables in thousands, except per share data)

1) Basis of Presentation

The interim financial data as of September 30, 2001 and for the three and nine months ended September 30, 2001 and 2000 is unaudited; however, in the opinion of MKS Instruments, Inc., the interim data includes all adjustments, consisting only of normal recurring adjustments, necessary for a fair presentation of the results for the interim periods. The terms "MKS" and the "Company" refer to MKS Instruments, Inc. and subsidiaries, including Applied Science and Technology, Inc. ("ASTeX"). The unaudited financial statements presented herein have been prepared in accordance with the instructions to Form 10-Q and do not include all the information and note disclosures required by generally accepted accounting principles. The financial statements should be read in conjunction with the December 31, 2000 audited financial statements and notes thereto included in the MKS Annual Report on Form 10-K filed with the Securities and Exchange Commission on April 2, 2001 and the MKS Current Reports on Form 8-K filed with the Securities and Exchange Commission on April 20, 2001.

On January 26, 2001, MKS completed its acquisition of ASTeX in a transaction accounted for under the pooling of interests method of accounting. Under the terms of the agreement, each outstanding share of ASTeX common stock was exchanged for 0.7669 newly issued shares of common stock of MKS Instruments, Inc., resulting in the issuance of approximately 11.2 million shares of common stock of MKS Instruments, Inc., representing approximately 30% of its then outstanding shares. There were no material adjustments required to conform the accounting policies of the two companies. The unaudited financial statements for the three months and nine months ended September 30, 2000 combine the historical financial statements of MKS Instruments, Inc. for the three months and nine months ended September 30, 2000 with the historical financial statements of ASTeX for the three months and nine months ended March 25, 2000. The following table presents details of the results of operations for the separate companies.

	MKS Instruments, Inc. Three months ended September 30, 2000 -----	ASTeX Three months ended March 25, 2000 -----	Combined -----
Net sales	\$ 87,636	\$ 34,133	\$121,769
Net income	\$ 12,436	\$ 3,519	\$ 15,955

	MKS Instruments, Inc. Nine months ended September 30, 2000 -----	ASTeX Nine months ended March 25, 2000 -----	Combined -----
Net sales	\$230,893	\$ 95,801	\$326,694
Net income	\$ 33,053	\$ 9,310	\$ 42,363

The December 31, 2000 Balance Sheet combines the balance sheet of MKS Instruments, Inc. as of December 31, 2000 with the balance sheet of ASTeX as of July 1, 2000.

As a result of conforming dissimilar fiscal year-ends, the ASTeX results of operations for the six-month period ended December 31, 2000 are excluded from the consolidated financial statements of MKS for the year ended December 31, 2000. The following is information related to the ASTeX financial results for the six-month period ended December 31, 2000:

Net sales.....	\$89,193
Net income.....	5,968
Net cash used by operating activities.....	(3,500)
Net cash provided by investing activities.....	245
Net cash provided by financing activities.....	43

MKS INSTRUMENTS, INC.
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS - (Continued)
(Tables in thousands, except per share data)

Included in stockholders' equity at September 30, 2001 is a \$5,968,000 adjustment resulting from conforming the two companies' dissimilar year ends, which represents the ASTeX results of operations for the six-month period ended December 31, 2000.

2) Use of Estimates

The preparation of financial statements in conformity with generally accepted accounting principles requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities and disclosure of contingent assets and liabilities at the dates of the financial statements and the reported amounts of revenues and expenses during the reporting periods. Actual results could differ from those estimates.

3) Recent Accounting Pronouncements

In July 2001, the Financial Accounting Standards Board ("FASB") issued Statement of Financial Accounting Standards No. 141 ("SFAS 141"), "Business Combinations." SFAS 141 requires the purchase method of accounting for business combinations initiated after June 30, 2001 and eliminates the pooling of interests method.

In July 2001, the FASB issued Statement of Financial Accounting Standards No. 142 ("SFAS 142"), "Goodwill and Other Intangible Assets", which is effective for MKS on January 1, 2002. SFAS 142 requires, among other things, the discontinuance of goodwill amortization and includes provisions for the reclassification of certain existing recognized intangibles as goodwill, reassessment of the useful lives of existing recognized intangibles, and reclassification of certain intangibles out of previously reported goodwill. SFAS 142 also requires the Company to complete a transitional goodwill impairment test six months from the date of adoption. As a result of implementing SFAS 142, the Company expects to stop amortizing goodwill effective January 1, 2002 but will continue to amortize other intangible assets. The Company is currently reviewing the potential additional impact of SFAS 142 on its financial position and results of operations.

In August 2001, the FASB issued SFAS No. 143 ("SFAS 143"), "Accounting for Asset Retirement Obligations." SFAS 143 addresses financial accounting and reporting for obligations associated with the retirement of tangible long-lived assets and the associated asset retirement costs. SFAS 143 is effective for financial statements issued for fiscal years beginning after June 15, 2002. Management is currently determining what effect, if any, SFAS 143 will have on its financial position and results of operations.

In October 2001, the FASB issued SFAS No. 144, ("SFAS 144"), "Accounting for the Impairment or Disposal of Long-Lived Assets." SFAS 144 supersedes FASB Statement No. 121, "Accounting for the Impairment of Long-Lived Assets and for Long Lived Assets to Be Disposed of." SFAS 144 applies to all long-lived assets (including discontinued operations) and consequently amends Accounting Principles Board Opinion No. 30, "Reporting Results of Operations - Reporting the Effects of Disposal of a Segment of a Business." SFAS 144 is effective for financial statements issued for fiscal years beginning after December 15, 2001, and will thus be adopted by the Company, as required, on January 1, 2002. Management is currently determining what effect, if any, SFAS 144 will have on its financial position and results of operations.

4) Cash and Cash Equivalents and Investments

Cash equivalents consist of the following:

	September 30, 2001 ----	December 31, 2000 ----
Cash and Money Market Instruments	\$ 86,003	\$ 36,687
Commercial Paper	14,931	74,895
Federal Government and Government Agency Obligations	3,000	1,000
State and Municipal Government Obligations	8,500	2,000
Corporate Obligations	6,000	8,500
	-----	-----
	\$118,434	\$123,082
	=====	=====

Short-term available-for-sale investments maturing within one year consist of the following:

	September 30, 2001 ----	December 31, 2000 ----
Federal Government and Government Agency Obligations	\$ 2,000	\$10,101
State and Municipal Government Obligations	10,665	--
Corporate Obligations	--	1,000
Commercial Paper	13	6,803
	-----	-----
	\$12,678	\$17,904
	=====	=====

Long-term available-for-sale investments maturing within two years consist of the following:

	September 30, 2001 ----	December 31, 2000 ----
Federal Government and Government Agency Obligations	\$ 2,000	\$ 4,000
State and Municipal Government Obligations	14,100	13,100
	-----	-----
	\$16,100	\$17,100
	=====	=====

5) Net Income (Loss) Per Share

The following is a reconciliation of basic to diluted net income (loss) per share:

	Three Months Ended September 30, 2001 ----	September 30, 2000 ----
Net income (loss)	\$ (9,071)	\$ 15,955
Shares used in net income per common share - basic .	37,801	34,290
Effect of dilutive securities:		
Employee and director stock options	--	1,698
	-----	-----
Shares used in net income per common share - diluted	37,801	35,988
	=====	=====
Net income (loss) per common share - basic	\$ (0.24)	\$ 0.47
	=====	=====
Net income (loss) per common share - diluted	\$ (0.24)	\$ 0.44
	=====	=====

	Nine Months Ended September 30, 2001 ----	September 30, 2000 ----
Net income (loss)	\$(15,358)	\$ 42,363
Shares used in net income per common share - basic .	37,364	33,969
Effect of dilutive securities:		
Employee and director stock options	--	1,673
	-----	-----
Shares used in net income per common share - diluted	37,364	35,642
	=====	=====
Net income (loss) per common share - basic	\$ (0.41)	\$ 1.25
	=====	=====
Net income (loss) per common share - diluted	\$ (0.41)	\$ 1.19
	=====	=====

For purposes of computing diluted earnings per share, weighted average common share equivalents do not include stock options with an exercise price greater than the average market price of the common shares during the period. Options to purchase 464,117 and 173,571 shares of common stock which were outstanding during the three and nine months ended September 30, 2000, respectively, were not included in the calculation of diluted net income per common share because the option price was greater than the average market price of the common shares during the period. All options outstanding during the three and nine months ended September 30, 2001 are excluded from the calculation of diluted net income per common share because their inclusion would be anti-dilutive. There were options to purchase approximately 5,069,335 shares of the Company's common stock outstanding as of September 30, 2001.

MKS INSTRUMENTS, INC.
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS - (Continued)
(Tables in thousands, except per share data)

6) Inventories

Inventories consist of the following:

	September 30, 2001 ----	December 31, 2000 ----
Raw material	\$ 26,399	\$ 23,765
Work in process	18,638	20,856
Finished goods	25,511	24,544
	-----	-----
	\$ 70,548	\$ 69,165
	=====	=====

7) Stockholders' Equity

Total comprehensive income (loss) was as follows:

	Three Months Ended September 30, 2001 ----	2000 ----
Net income (loss)	\$ (9,071)	\$ 15,955
Other comprehensive loss, net of taxes:		
Changes in value of financial instruments designated as hedges of currency and interest rate exposures	(799)	95
Foreign currency translation adjustment	987	(405)
Unrealized loss on investments	(1)	(384)
	-----	-----
Other comprehensive income (loss), net of taxes	187	(694)
	-----	-----
Total comprehensive income (loss)	\$ (8,884)	\$ 15,261
	=====	=====

	Nine Months Ended September 30, 2001 ----	2000 ----
Net income (loss)	\$(15,358)	\$ 42,363
Other comprehensive loss, net of taxes:		
Changes in value of financial instruments designated as hedges of currency and interest rate exposures	(186)	408
Foreign currency translation adjustment	22	(779)
Unrealized loss on investments	(315)	(594)
	-----	-----
Other comprehensive loss, net of taxes	(479)	(965)
	-----	-----
Total comprehensive income (loss)	\$(15,837)	\$ 41,398
	=====	=====

8) Segment Information and Significant Customer

Segment information for the three months ended September 30, 2001 and 2000 was as follows:

	North America -----	Far East	Europe -----	Total -----
Net sales to unaffiliated customers 2001	\$ 33,537	\$11,082	\$ 8,582	\$ 53,201
2000	93,340	17,719	10,710	121,769
Intersegment net sales 2001	10,858	169	326	11,353
2000	18,759	805	391	19,955
Income (loss) from operations 2001	(15,011)	865	445	(13,701)
2000	20,036	1,691	2,690	24,417

MKS INSTRUMENTS, INC.
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS - (Continued)
(Tables in thousands, except per share data)

Segment information for the nine months ended September 30, 2001 and 2000 was as follows:

		North America -----	Far East -----	Europe -----	Total -----
Net sales to unaffiliated customers	2001	\$163,733	\$40,885	\$32,127	\$236,745
	2000	250,772	47,839	28,083	326,694
Intersegment net sales	2001	39,265	857	1,041	41,163
	2000	48,295	1,454	1,010	50,759
Income (loss) from operations	2001	(29,793)	4,212	4,903	(20,678)
	2000	55,929	4,061	5,208	65,198

The Company had one customer comprising 14% and 31% of net sales for the three months ended September 30, 2001 and 2000, respectively, and 19% and 31% for the nine months ended September 30, 2001 and 2000, respectively.

9) Acquisitions and Disposal of Assets

On April 27, 2001 (the date of purchase), MKS completed its acquisition of On-Line Technologies, Inc. ("On-Line"), a supplier of measurement and control products used for gas analysis, wafer metrology and process control. The acquisition has been accounted for under the purchase method of accounting. The purchase price was approximately \$23,829,000 and consisted of approximately 660,000 shares of MKS common stock valued at approximately \$12,110,000, cash payments of \$6,295,000, assumption of On-Line debt of approximately \$4,728,000 and transaction expenses of approximately \$696,000. The purchase price was allocated to the assets acquired based upon their estimated fair values and resulted in an allocation of approximately \$16,050,000 to goodwill. The results of operations are included in the Company's consolidated statement of income (loss) as of and since the date of the purchase. The allocation of the purchase price was as follows:

Fair value of tangible assets and liabilities assumed	\$ (971)
In-process research and development	2,340
Current technology	4,710
Other intangibles	1,700
Goodwill	16,050

	\$ 23,829
	=====

The amounts allocated to current technology, other intangibles, and goodwill are being amortized using the straight-line method over their respective estimated useful lives, which range from 5 to 7 years.

In connection with the acquisition of On-Line, the Company obtained an appraisal from an independent appraiser of the fair value of its intangible assets. This appraisal valued purchased in-process research and development ("IPR&D") of various projects for the development of new products and technologies at approximately \$2,340,000. Because the technological feasibility of products under development had not been established and no future alternative uses existed, the purchased IPR&D was written off during the quarter ended June 30, 2001. The value of the purchased IPR&D was determined using the income approach, which discounts expected future cash flows from projects under development to their net present value. Each project was analyzed to determine the technological innovations included; the utilization of core technology; the complexity, cost and time to complete development; any alternative future use or current technological feasibility; and the stage of completion. The cash flows derived from the in-process technology projects were discounted at a rate of 25%. The Company believes

MKS INSTRUMENTS, INC.
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS - (Continued)
(Tables in thousands, except per share data)

this rate was appropriate given the risks associated with the technologies for which commercial feasibility had not been established. The percentage of completion for each in-process project was determined by identifying the elapsed time invested in the project as a ratio of the total time required to bring the project to technical and commercial feasibility. The percentage of completion for in-process projects acquired ranged from 55% to 65%, based on management's estimates of tasks completed and the tasks to be completed to bring the projects to technological and commercial feasibility. As of September 30, 2001, the actual development timelines and costs were in line with management's estimates.

Development of in-process technology remains a substantial risk to the Company due to a variety of factors including the remaining effort to achieve technological feasibility, rapidly changing customer requirements and competitive threats from other companies and technologies.

The following unaudited pro forma information presents a summary of the historical results of operations of the Company as if the On-Line acquisition had occurred at the beginning of each period.

	Three months ended September 30,		Nine months ended September 30,	
	2001	2000	2001	2000
	-----	-----	-----	-----
Net sales	\$ 53,201	\$ 123,080	\$ 237,965	\$ 332,036
Net income (loss)	\$ (9,071)	\$ 15,898	\$ (14,969)	\$ 41,706
Net income (loss) per share:				
Basic	\$ (0.24)	\$ 0.45	\$ (0.39)	\$ 1.20
Diluted	\$ (0.24)	\$ 0.43	\$ (0.39)	\$ 1.15

The unaudited pro forma results for the nine months ended September 30, 2001 excludes approximately \$6.4 million of non-recurring charges directly related to the transaction that were incurred by On-Line prior to the date of the acquisition. Additionally, the charge for purchased IPR&D was not included in the unaudited pro forma results, because it was non-recurring and directly related to the transaction.

These unaudited pro forma results have been prepared for comparative purposes only and do not purport to be indicative of the results of operations which actually would have resulted had the acquisition occurred at the beginning of the period, or which may result in the future.

In August 2001, the Company sold its Nimbus System product group and granted a non-exclusive license of the technology of its PlasmaQuest System product group, for approximately \$9.0 million, consisting primarily of approximately \$4.7 million in cash and \$3.9 million in a note receivable. The note receivable matures August 7, 2004, bears an annual interest rate of 9.0% and is included in other assets. The loss on the transaction was \$1,246,000 before taxes, \$998,000 net of the related tax benefit, and is included in other income (expense).

10) Goodwill Impairment Charge

In August 1999, ASTeX purchased Shamrock product group for approximately \$6.4 million in cash. The costs of the acquisition were allocated on the basis of the estimated fair market value of the assets acquired at that time, and resulted in an allocation of \$4,463,000 to goodwill.

When the Company acquired the Shamrock product line, it was expected that sales of the existing system design and development of new system designs would generate future revenues. Since the acquisition, the Company has provided potential customers with purchase quotations for Shamrock systems, including a significant quotation to a potential customer in January 2001 for the sale of several systems. The customer did not purchase the systems, and the quotation expired in March 2001. The Company has been unsuccessful in selling any systems of the product line since the acquisition and, with the expiration of the significant quote in March 2001, believes that future Shamrock system sales will not be sufficient to recover the carrying value of the goodwill.

MKS INSTRUMENTS, INC.
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS - (Continued)
(Tables in thousands, except per share data)

Additionally, the Company has no current plans for future development of new system designs. Consequently, the Company believed that the carrying amount of the Shamrock related goodwill was impaired. To measure the impairment, the Company performed a cash flow analysis for the product group and determined that the estimated future cash flows of the group would be insignificant. As a result, the Company wrote-off the carrying value of the related goodwill of approximately \$3,720,000 in the quarter ended March 31, 2001.

11) Merger Costs

On January 26, 2001 MKS completed its acquisition of ASTeX in a transaction accounted for under the pooling of interests method of accounting. Under the pooling of interests method of accounting, fees and expenses related to the merger are expensed in the period of the merger. During the three months ended March 31, 2001, MKS expensed approximately \$7.7 million of merger related expenses, consisting of \$6.9 million of investment banking, legal, accounting, printing and other professional fees, and \$0.8 million of regulatory and other costs.

12) Subsequent Event

On October 30, 2001 the Company entered into a definitive merger agreement to acquire the ENI division ("ENI") of Emerson Electric Co. based in Rochester, New York. ENI designs, develops and manufactures solid-state radio frequency (RF) and direct current (DC) plasma power supplies, matching networks and instrumentation for the semiconductor and thin-film processing industries.

Under the terms of the agreement, the Company will issue 12 million shares of common stock to Emerson Electric Co. in exchange for the businesses and assets of ENI. The merger is subject to the approval of MKS stockholders, regulatory approval and other customary closing conditions.

MKS INSTRUMENTS, INC.
MANAGEMENT'S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION
AND RESULTS OF OPERATIONS

ITEM 2.

This Quarterly Report on Form 10-Q contains a number of statements, including, without limitation, statements relating to MKS' beliefs, expectations and plans which are forward-looking statements, as are statements that certain actions, conditions or circumstances will continue. Such statements are based upon management's current expectations and are subject to a number of factors and uncertainties. Information contained in these forward-looking statements is inherently uncertain and actual performance and results may differ materially due to many important factors. See "Factors That May Affect Future Results" for some, but not all, factors that could cause actual results to differ materially from any forward-looking statements made by MKS. The terms "MKS", the "Company", "we", "us" and "our" refer to MKS Instruments, Inc. and its subsidiaries, including Applied Science and Technology, Inc.

On January 26, 2001 MKS completed its acquisition of ASTeX in a transaction accounted for under the pooling of interests method of accounting. Because the fiscal years for MKS and ASTeX differ, the periods combined for the purposes of the consolidated financial statements for the three and nine months ended September 30, 2000 were as follows:

MKS ---	ASTeX -----
Three and nine months ended September 30, 2000	Three and nine months ended March 25, 2000

On April 27, 2001 (the effective date of purchase) MKS completed its acquisition of On-Line Technologies, Inc., a supplier of measurement and control products used for gas analysis, wafer metrology and process control. The acquisition has been accounted for under the purchase method of accounting. The purchase price was approximately \$23,829,000 and consisted of approximately 660,000 shares of MKS common stock valued at approximately \$12,110,000, cash payments of \$6,295,000, assumption of On-Line debt of approximately \$4,728,000 and transaction expenses of approximately \$696,000. Accordingly, the estimated fair value of assets acquired and liabilities assumed were included in the Company's consolidated balance sheet as of the effective date of the purchase. The results of operations are included in the Company's consolidated statement of income (loss) as of and since the effective date of the purchase.

MKS develops, manufactures and supplies gas measurement, control and analysis products, reactive gas generator and power delivery products used in semiconductor manufacturing and other advanced thin-film manufacturing processes. We estimate that during 2000 approximately 76% of our net sales were to semiconductor capital equipment manufacturers and semiconductor device manufacturers. The following table sets forth for the periods indicated the percentage of total net sales of certain line items included in MKS consolidated statement of income data.

	Three months ended September 30,		Nine months ended September 30,	
	2001 ----	2000 ----	2001 ----	2000 ----
Net sales	100.0%	100.0%	100.0%	100.0%
Cost of sales	69.7	55.3	64.1	55.7

Gross profit	30.3	44.7	35.9	44.3
Research and development	17.5	8.0	12.6	8.0
Selling, general and administrative	32.8	15.0	22.9	15.4
Amortization of goodwill and acquired intangible assets	5.7	1.4	3.4	0.9
Goodwill impairment charge	--	--	1.6	--
Merger expenses	--	--	3.2	--
In-process research and development	--	0.3	1.0	0.1

Income (loss) from operations	(25.7)	20.0	(8.8)	19.9
Interest income, net	1.4	0.8	1.4	0.8
Other expense, net	2.3	--	0.5	0.1

Income (loss) before income taxes	(26.6)	20.8	(7.9)	20.6
Provision (benefit) for income taxes	(9.6)	7.8	(1.4)	7.7

Net income (loss)	(17.0)%	13.0%	(6.5)%	12.9%
	=====	=====	=====	=====

Results of Operations

Net Sales. Net sales decreased 56.3% to \$53.2 million for the three months ended September 30, 2001 from \$121.8 million for the three months ended September 30, 2000. International net sales were approximately \$19.7 million for the three months ended September 30, 2001 or 37.0% of net sales and \$28.4 million for the same period of 2000 or 23.3% of net sales. Net sales decreased 27.5% to \$236.7 million for the nine months ended September 30, 2001 from \$326.7 million for the same period of 2000. International net sales were approximately \$73.0 million for the nine months ended September 30, 2001 or 30.8% of net sales and \$75.9 million for the same period of 2000 or 23.2% of net sales. The decrease in net sales is due to a worldwide slowdown in demand for semiconductors during 2001 which resulted in a decline in demand for the Company's products from the Company's semiconductor capital equipment manufacturers and semiconductor device manufacturer customers.

Gross Profit. Gross profit as a percentage of net sales decreased to 30.3% for the three months ended September 30, 2001 from 44.7% for the three months ended September 30, 2000. Gross profit as a percentage of net sales decreased to 35.9% for the nine months ended September 30, 2001 from 44.3% for the same period of 2000. The decrease was primarily due to lower absorption of manufacturing overhead costs. Additionally, gross margin for the nine months ended September 30, 2001 was negatively effected by a \$2.6 million write-off of obsolete and excess inventory in the second quarter of 2001. This write-off was significantly higher than normal and was primarily caused by a significant reduction in demand, including reduced demand for older technology products.

Research and Development. Research and development expense decreased 4.4% to \$9.3 million or 17.5% of net sales for the three months ended September 30, 2001 from \$9.7 million or 8.0% of net sales for the three months ended September 30, 2000. The decrease was primarily due to decreased purchased services. Research and development expense increased 15.0% to \$29.9 million or 12.6% of net sales for the nine months ended September 30, 2001 from \$26.0 million or 8.0% of net sales for the same period of 2000. The increase was primarily due to increased compensation expense.

Selling, General and Administrative. Selling, general and administrative expenses decreased 4.4% to \$17.5 million or 32.8% of net sales for the three months ended September 30, 2001 from \$18.3 million or 15.0% of net sales for the three months ended September 30, 2000. The decrease was due primarily to decreased purchased services and compensation expense. Selling, general and administrative expenses increased 7.5% to \$54.1 million or 22.9% of net sales for the nine months ended September 30, 2001 from \$50.3 million or 15.4% of net sales for the same period of 2000. The increase was due primarily to increased professional fees of \$2.4 million, compensation expense of \$0.3 million related to the earnout from the Spectra acquisition, and other selling, general, and administrative expenses.

Amortization of Goodwill and Acquired Intangible Assets. Amortization of goodwill and acquired intangible assets of \$3.0 million and \$8.0 million for the three and nine months ended September 30, 2001, respectively, represents the amortization of goodwill and other intangibles resulting from the acquisitions completed by MKS.

Goodwill Impairment Charge. In August 1999, ASTeX purchased the Shamrock product group for approximately \$6.4 million in cash. The costs of the acquisition were allocated on the basis of the estimated fair market value of the assets acquired at that time, and resulted in an allocation of \$4,463,000 to goodwill.

When the Company acquired the Shamrock product line, it was expected that sales of the existing system design and development of new system designs would generate future revenues. Since the acquisition, the Company has provided potential customers with purchase quotations for Shamrock systems, including a significant quotation to a potential customer in January 2001 for the sale of several systems. The customer did not purchase the systems, and the quotation expired in March 2001. The Company has been unsuccessful in selling any systems of the product line since the acquisition and, with the expiration of the significant quote in March 2001, believes that future Shamrock system sales will not be sufficient to recover the carrying value of the goodwill. Additionally, the Company has no current plans for future development of new system designs. Consequently, the Company believed that the carrying amount of the Shamrock related goodwill was impaired. To measure the impairment, the Company performed a cash flow analysis for the product group and determined that the estimated future cash flows of the group would be insignificant. As a result, the Company wrote-off the carrying value of the related goodwill of approximately \$3,720,000 in the quarter ended March 31, 2001.

Merger Costs. On January 26, 2001 MKS completed its acquisition of ASTeX in a transaction accounted for under the pooling of interests method of accounting. Under the pooling of interests method of accounting, fees and expenses related to the merger are expensed in the period of the merger. During the nine months ended September 30, 2001, MKS expensed approximately \$7.7 million of merger related expenses, consisting of \$6.9 million of investment banking, legal, accounting, printing and other professional fees, \$0.8 million of regulatory and other costs.

Purchase of In-process Technology. In April 2001, the Company acquired On-Line in a transaction accounted for as a purchase. The purchase price was allocated to the assets acquired, including intangible assets, based on their estimated fair values. The intangible assets include approximately \$2.3 million for acquired in-process technology for projects that did not have future alternative uses. The value of the purchased in-process technology was determined using the income approach, which discounts expected future cash flows from projects under development to their net present value. Each project was analyzed to determine the technological innovations included; the utilization of core technology; the complexity, cost and time to complete development; any alternative future use or current technological feasibility; and the stage of completion. At the date of the acquisition, the development of these projects had not yet reached technological feasibility, and the technology in progress had no alternative future uses. Accordingly, these costs were expensed in the second quarter of 2001.

Interest Income (Expense), Net. During the three and nine months ended September 30, 2001, the Company generated net interest income of \$0.8 million and \$3.2 million, respectively, primarily from the invested net proceeds of its common stock offerings, offset by interest expense on outstanding debt.

Other Income (Expense), Net. In August 2001, the Company sold its Nimbus System product group and granted a non-exclusive license of the technology of its PlasmaQuest System product group, for approximately \$9,000,000. The loss on the transaction was \$1,246,000.

Provision (Benefit) for Income Taxes. The effective tax rates for the three and nine months ended September 30, 2001 were 35.9% and 18.0%, respectively, resulting in an income tax benefit of \$5.1 million and \$3.4 million, respectively. The changes in effective tax rates for the three and nine months ended September 30, 2001 as compared to the effective tax rates for the three and nine months ended September 30, 2000 were primarily due to non-deductible charges associated with acquisitions made in 2001.

LIQUIDITY AND CAPITAL RESOURCES

The Company has financed its operations and capital requirements through a combination of cash provided by operations, long-term real estate financing, capital lease financing and short-term lines of credit. On April 5, 1999, MKS completed the initial public offering of its Common Stock. In connection with this offering and the exercise of an over-allotment option by the underwriters, MKS sold 6,375,000 shares of Common Stock at a price of \$14.00 per share. The net proceeds to MKS were approximately \$82,000,000 and were received in the second quarter of 1999. Underwriting discounts and commissions were approximately \$6,200,000, and other offering costs were approximately \$1,000,000. On April 5, 1999, MKS distributed \$40,000,000, which was the estimated amount of its undistributed S Corporation earnings as of the day prior to the closing of the offering.

On March 30, 2000, ASTeX completed the registration and sale of 1,917,250 shares of common stock at \$40.42 per share. The net proceeds from the offering were approximately \$73.2 million.

On March 5, 1999, ASTeX completed the registration and sale of 1,533,800 shares of common stock at \$14.34 per share. On April 6, 1999, the underwriters exercised their over-allotment option to purchase an additional 230,070 shares of common stock. The net proceeds from the offering were approximately \$23.8 million.

In 1998, ASTeX announced that it had met the requirements for the redemption of redeemable warrants issued in connection with the ASTeX initial public offering and called the warrants for redemption. 2,082,451 redeemable warrants and 133,088 underwriter warrants were converted into 1,297,147 shares of common stock. The net proceeds were \$15,234,000.

Operations provided cash of \$23.2 million for the nine months ended September 30, 2001. This cash flow was impacted by the net loss, depreciation and amortization, the goodwill impairment charge and changes in the levels of accounts payable, accrued expenses, and accounts receivable. Investing activities utilized cash of \$22.7 million for the nine months ended September 30, 2001 primarily from the purchases of On-Line and property, plant, and equipment. Financing activities utilized cash of \$2.3 million, primarily from payments on short-term borrowings offset by proceeds from employees exercising stock options.

Working capital was \$215 million as of September 30, 2001, a decrease of \$21.9 million from December 31, 2000. The decrease in working capital was primarily due to decreased trade accounts receivable, net. MKS entered into a new credit agreement on July 31, 2001 whereby the Company has a combined \$40.0 million line of credit with two banks all of which is available. The credit agreement expires on July 31, 2002.

The Company believes that its working capital, together with the cash anticipated to be generated from operations and funds available from existing credit facilities, will be sufficient to satisfy its estimated working capital and planned capital expenditure requirements through at least the next 12 months.

FACTORS THAT MAY AFFECT FUTURE RESULTS

MKS believes that this document contains "forward-looking statements" within the meaning of the Private Securities Litigation Reform Act of 1995. These statements are subject to risks and uncertainties and are based on the beliefs and assumptions of management of MKS, based on information currently available to MKS' management. Use of words such as "believes," "expects," "anticipates," "intends," "plans," "estimates," "should," "likely" or similar expressions, indicate a forward-looking statement. Forward-looking statements involve risks, uncertainties and assumptions. Certain of the information contained in this Quarterly Report on Form 10-Q consists of forward-looking statements. Important factors that could cause actual results to differ materially from the forward-looking statements include the following:

MKS' BUSINESS DEPENDS SUBSTANTIALLY ON CAPITAL SPENDING IN THE SEMICONDUCTOR INDUSTRY WHICH IS CHARACTERIZED BY PERIODIC FLUCTUATIONS THAT MAY CAUSE A REDUCTION IN DEMAND FOR MKS' PRODUCTS.

MKS estimates that approximately 76% of its sales in 2000 were to semiconductor capital equipment manufacturers and semiconductor device manufacturers, and it expects that sales to such customers will continue to account for a substantial majority of its sales. MKS' business depends upon the capital expenditures of semiconductor device manufacturers, which in turn depend upon the demand for semiconductors. Periodic reductions in demand for the products manufactured by semiconductor capital equipment manufacturers and semiconductor device manufacturers may adversely affect MKS' business, financial condition and results of operations. Historically, the semiconductor market has been highly cyclical and has experienced periods of overcapacity, resulting in significantly reduced demand for capital equipment. For example, in 1996 and 1998, the semiconductor capital equipment industry experienced significant declines, which caused a number of MKS customers to reduce their orders. More recently, in 2001, MKS has experienced a significant reduction in demand from OEM customers, and lower gross margins due to reduced absorption of manufacturing overhead at the lower revenue levels. In addition, many semiconductor manufacturers have operations and customers in Asia, a region which in recent years has experienced serious economic problems including currency devaluations, debt defaults, lack of liquidity and recessions. MKS cannot be certain that semiconductor downturns will not recur. A decline in the level of orders as a result of any current and future downturn or slowdown in the semiconductor capital equipment industry could have a material adverse effect on MKS' business, financial condition and results of operations.

MKS' QUARTERLY OPERATING RESULTS HAVE VARIED, AND ARE LIKELY TO CONTINUE TO VARY SIGNIFICANTLY. THIS MAY RESULT IN VOLATILITY IN THE MARKET PRICE FOR MKS' SHARES.

A substantial portion of MKS' shipments occur shortly after an order is received and therefore MKS operates with a low level of backlog. As a result, a decrease in demand for MKS' products from one or more customers could occur with limited advance notice and could have a material adverse effect on MKS' results of operations in any particular period. A significant percentage of MKS' expenses are relatively fixed and based in part on expectations of future net sales. The inability to adjust spending quickly enough to compensate for any shortfall would magnify the adverse impact of a shortfall in net sales on MKS' results of operations. Factors that could cause fluctuations in MKS' net sales include:

- - the timing of the receipt of orders from major customers;
- - shipment delays;
- - disruption in sources of supply;
- - seasonal variations of capital spending by customers;
- - production capacity constraints; and
- - specific features requested by customers.

For example, MKS was in the process of increasing its production capacity when the semiconductor capital equipment market began to experience a significant downturn in 1996. This downturn had a material adverse effect on MKS' operating results in the second half of 1996 and the first half of 1997. After an increase in business in the latter half of 1997, the market experienced another downturn in 1998, which had a material adverse effect on MKS' 1998 and first quarter 1999 operating results. More recently, the semiconductor capital equipment market has experienced a significant downturn during 2001. As a result, MKS has experienced a reduction in demand from OEM customers in 2001, which has had a material adverse effect on MKS' operating results. As a result of the factors discussed above, it is likely that MKS will in the future experience quarterly or annual fluctuations and that, in one or more future quarters, its operating results will fall below the expectations of public market analysts or investors. In any such event, the price of MKS' common stock could decline significantly.

THE LOSS OF NET SALES TO ANY ONE OF MKS' MAJOR CUSTOMERS WOULD LIKELY HAVE A MATERIAL ADVERSE EFFECT ON MKS.

MKS' five largest customers accounted for approximately 45% of its net sales in 2000, 39% of its net sales in 1999 and 34% of its net sales in 1998. The loss of a major customer or any reduction in orders by these customers, including reductions due to market or competitive conditions, would likely have a material adverse effect on MKS' business, financial condition and results of operations. During 2000 and 1999, one customer, Applied Materials, accounted for approximately 30% and 29%, respectively, of MKS' net sales. MKS' purchase contract with Applied Materials expires in 2004. None of MKS' significant customers, including Applied Materials, has entered into an agreement requiring it to purchase any minimum quantity of MKS' products. The demand for MKS' products from its semiconductor capital equipment customers depends in part on orders received by them from their semiconductor device manufacturer customers.

Attempts to lessen the adverse effect of any loss or reduction through the rapid addition of new customers could be difficult because prospective customers typically require lengthy qualification periods prior to placing volume orders with a new supplier. MKS' future success will continue to depend upon:

- - its ability to maintain relationships with existing key customers;
- - its ability to attract new customers; and
- - the success of its customers in creating demand for their capital equipment products which incorporate MKS's products.

AS PART OF MKS' BUSINESS STRATEGY, MKS HAS ENTERED INTO AND MAY ENTER INTO OR SEEK TO ENTER INTO BUSINESS COMBINATIONS AND ACQUISITIONS THAT MAY BE DIFFICULT TO INTEGRATE, DISRUPT ITS BUSINESS, DILUTE STOCKHOLDER VALUE OR DIVERT MANAGEMENT ATTENTION.

MKS acquired Compact Instrument Technology ("Compact Instrument") in March 2000, Telvac Engineering, Ltd. ("Telvac") in May 2000, Spectra Instruments, Inc. ("Spectra") in July 2000, D.I.P., Inc. ("D.I.P.") in September 2000, ASTeX in January 2001, On-Line in April 2001, and entered into a definitive merger agreement to acquire the ENI division ("ENI") of Emerson Electric Co. in October 2001. As a part of its business strategy, MKS may enter into additional business combinations and acquisitions. Acquisitions are typically accompanied by a number of risks, including the difficulty of integrating the operations and personnel of the acquired companies, the potential disruption of MKS' ongoing business and distraction of management, expenses related to the acquisition and potential unknown liabilities associated with acquired businesses.

If MKS is not successful in completing acquisitions that it may pursue in the future, it may be required to reevaluate its growth strategy, and MKS may have incurred substantial expenses and devoted significant management time and resources in seeking to complete proposed acquisitions that will not generate benefits for it.

In addition, with future acquisitions, MKS could use substantial portions of its available cash as all or a portion of the purchase price. MKS could also issue additional securities as consideration for these acquisitions, which could cause significant stockholder dilution. MKS' acquisitions of Compact Instrument, Telvac, Spectra, D.I.P., ASTeX, On-Line, and ENI and any future acquisitions may not ultimately help MKS achieve its strategic goals and may pose other risks to MKS.

AN INABILITY TO CONVINCE SEMICONDUCTOR DEVICE MANUFACTURERS TO SPECIFY THE USE OF MKS' PRODUCTS TO MKS' CUSTOMERS, WHO ARE SEMICONDUCTOR CAPITAL EQUIPMENT MANUFACTURERS, WOULD WEAKEN MKS' COMPETITIVE POSITION.

The markets for MKS' products are highly competitive. Its competitive success often depends upon factors outside of its control. For example, in some cases, particularly with respect to mass flow controllers, semiconductor device manufacturers may direct semiconductor capital equipment manufacturers to use a specified supplier's product in their equipment. Accordingly, for such products, MKS' success will depend in part on its ability to have semiconductor device manufacturers specify that MKS' products be used at their semiconductor fabrication facilities. In addition, MKS may encounter difficulties in changing established relationships of competitors that already have a large installed base of products within such semiconductor fabrication facilities.

IF MKS' PRODUCTS ARE NOT DESIGNED INTO SUCCESSIVE NEW GENERATIONS OF ITS CUSTOMERS' PRODUCTS, MKS WILL LOSE SIGNIFICANT NET SALES DURING THE LIFESPAN OF THOSE PRODUCTS.

New products designed by semiconductor capital equipment manufacturers typically have a lifespan of five to ten years. MKS' success depends on its products being designed into new generations of equipment for the semiconductor industry. MKS must develop products that are technologically current so that they are positioned to be chosen for use in each successive new generation of semiconductor capital equipment. If MKS products are not chosen by its customers, MKS' net sales may be reduced during the lifespan of its customers' products. In addition, MKS must make a significant capital investment to develop products for its customers well before its products are introduced and before it can be sure that it will recover its capital investment through sales to the customers in significant volume. MKS is thus also at risk during the development phase that its products may fail to meet its customers' technical or cost requirements and may be replaced by a competitive product or alternative technology solution. If that happens, MKS may be unable to recover MKS' development costs.

THE SEMICONDUCTOR INDUSTRY IS SUBJECT TO RAPID DEMAND SHIFTS WHICH ARE DIFFICULT TO PREDICT. AS A RESULT, MKS' INABILITY TO EXPAND ITS MANUFACTURING CAPACITY IN RESPONSE TO THESE RAPID SHIFTS MAY CAUSE A REDUCTION IN ITS MARKET SHARE.

MKS' ability to increase sales of certain products depends in part upon its ability to expand its manufacturing capacity for such products in a timely manner. If MKS is unable to expand its manufacturing capacity on a timely basis or to manage such expansion effectively, its customers could implement its competitors' products and, as a result, its market share could be reduced. Because the semiconductor industry is subject to rapid demand shifts which are difficult to foresee, MKS may not be able to increase capacity quickly enough to respond to a rapid increase in demand in the semiconductor industry. Additionally, capacity expansion could increase MKS' fixed operating expenses and if sales levels do not increase to offset the additional expense levels associated with any such expansion, its business, financial condition and results of operations could be materially adversely affected.

SALES TO FOREIGN MARKETS CONSTITUTE A SUBSTANTIAL PORTION OF MKS' NET SALES; THEREFORE, MKS NET SALES AND RESULTS OF OPERATIONS COULD BE ADVERSELY AFFECTED BY DOWNTURNS IN ECONOMIC CONDITIONS IN COUNTRIES OUTSIDE OF THE UNITED STATES.

International sales, which include sales by MKS' foreign subsidiaries, but exclude direct export sales (which were less than 10% of MKS' total net sales), accounted for approximately 23% of net sales in 2000, 25% of net sales in 1999 and 21% of net sales in 1998.

MKS anticipates that international sales will continue to account for a significant portion of MKS' net sales. In addition, certain of MKS' key domestic customers derive a significant portion of their revenues from sales in international markets. Therefore, MKS' sales and results of operations could be adversely affected by economic slowdowns and other risks associated with international sales.

UNFAVORABLE CURRENCY EXCHANGE RATE FLUCTUATIONS MAY LEAD TO LOWER GROSS MARGINS, OR MAY CAUSE MKS TO RAISE PRICES WHICH COULD RESULT IN REDUCED SALES.

Currency exchange rate fluctuations could have an adverse effect on MKS' net sales and results of operations and MKS could experience losses with respect to its hedging activities. Unfavorable currency fluctuations could require MKS to increase prices to foreign customers which could result in lower net sales by MKS to such customers. Alternatively, if MKS does not adjust the prices for its products in response to unfavorable currency fluctuations, its results of operations could be adversely affected. In addition, sales made by MKS' foreign subsidiaries are denominated in the currency of the country in which these products are sold and the currency it receives in payment for such sales could be less valuable at the time of receipt as a result of exchange rate fluctuations. MKS enters into forward exchange contracts and local currency purchased options to reduce currency exposure arising from intercompany sales of inventory. However, MKS cannot be certain that its efforts will be adequate to protect it against significant currency fluctuations or that such efforts will not expose it to additional exchange rate risks.

COMPETITION FOR PERSONNEL IN THE SEMICONDUCTOR AND INDUSTRIAL MANUFACTURING INDUSTRIES IS INTENSE.

MKS' success depends to a large extent upon the efforts and abilities of a number of key employees and officers, particularly those with expertise in the semiconductor manufacturing and similar industrial manufacturing industries. The loss of key employees or officers could have a material adverse effect on MKS' business, financial condition and results of operations. MKS believes that its future success will depend in part on its ability to attract and retain highly skilled technical, financial, managerial and marketing personnel. Competition for such personnel is intense, and MKS cannot be certain that it will be successful in attracting and retaining such personnel.

MKS' PROPRIETARY TECHNOLOGY IS IMPORTANT TO THE CONTINUED SUCCESS OF ITS BUSINESS. MKS' FAILURE TO PROTECT THIS PROPRIETARY TECHNOLOGY MAY SIGNIFICANTLY IMPAIR MKS' COMPETITIVE POSITION.

As of September 30, 2001, MKS owned 125 U.S. patents and 62 foreign patents and had 52 pending U.S. patent applications and 136 pending foreign patent applications. Although MKS seeks to protect its intellectual property rights through patents, copyrights, trade secrets and other measures, it cannot be certain that:

- - MKS will be able to protect its technology adequately;
- - competitors will not be able to develop similar technology independently;
- - any of MKS' pending patent applications will be issued;
- - intellectual property laws will protect MKS' intellectual property rights; or
- - third parties will not assert that MKS' products infringe patent, copyright or trade secrets of such parties.

PROTECTION OF MKS' INTELLECTUAL PROPERTY RIGHTS MAY RESULT IN COSTLY LITIGATION.

Litigation may be necessary in order to enforce MKS' patents, copyrights or other intellectual property rights, to protect its trade secrets, to determine the validity and scope of the proprietary rights of others or to defend against claims of infringement. For example, on November 30, 2000, ASTeX brought suit in federal district court in Delaware against Advanced Energy Industries, Inc. for infringement of ASTeX's patent related to its Astron product. Such litigation could result in substantial costs and diversion of resources and could have a material adverse effect on MKS' business, financial condition and results of operations.

THE MARKET PRICE OF MKS' COMMON STOCK HAS FLUCTUATED AND MAY CONTINUE TO FLUCTUATE FOR REASONS OVER WHICH MKS HAS NO CONTROL.

The stock market has from time to time experienced, and is likely to continue to experience, extreme price and volume fluctuations. Recently, prices of securities of technology companies have been especially volatile and have often fluctuated for reasons that are unrelated to the operating performance of the companies. The market price of shares of MKS' common stock has fluctuated greatly since its initial public offering and could continue to fluctuate due to a variety of factors. In the past, companies that have experienced volatility in the market price of their stock have been the objects of securities class action litigation. If MKS were the object of securities class action litigation, it could result in substantial costs and a diversion of MKS' management's attention and resources.

MKS'S DEPENDENCE ON SOLE AND LIMITED SOURCE SUPPLIERS COULD AFFECT ITS ABILITY TO MANUFACTURE PRODUCTS AND SYSTEMS.

MKS relies on sole and limited source suppliers for a few of its components and subassemblies that are critical to the manufacturing of MKS's products. This reliance involves several risks, including the following:

- - the potential inability to obtain an adequate supply of required components;
- - reduced control over pricing and timing of delivery of components; and
- - the potential inability of its suppliers to develop technologically advanced products to support MKS's growth and development of new systems.

MKS believes that in time MKS could obtain and qualify alternative sources for most sole and limited source parts. Seeking alternative sources of the parts could require MKS to redesign its systems, resulting in increased costs and likely shipping delays. MKS may be unable to redesign its systems, which could result in further costs and shipping delays. These increased costs would decrease MKS' profit margins if it could not pass the costs to its customers. Further, shipping delays could damage MKS' relationships with current and potential customers and have a material adverse effect on MKS' business and results of operations.

MKS IS SUBJECT TO GOVERNMENTAL REGULATIONS.

MKS is subject to federal, state, local and foreign regulations, including environmental regulations and regulations relating to the design and operation of MKS' power supply products. MKS must ensure that these systems meet certain safety standards, many of which vary across the countries in which MKS' systems are used.

For example, the European Union has published directives specifically relating to power supplies. MKS must comply with these directives in order to ship MKS' systems into countries that are members of the European Union. MKS believes it is in compliance with current applicable regulations, directives and standards and has obtained all necessary permits, approvals, and authorizations to conduct MKS' business. However, compliance with future regulations, directives and standards could require it to modify or redesign certain systems, make capital expenditures or incur substantial costs. If MKS does not comply with current or future regulations, directives and standards:

- - MKS could be subject to fines;
- - MKS' production could be suspended; or
- - MKS could be prohibited from offering particular systems in specified markets.

ONE STOCKHOLDER, ALONG WITH MEMBERS OF HIS FAMILY, CONTINUES TO HAVE A SUBSTANTIAL INTEREST IN MKS.

As of January 31, 2001, John R. Bertucci, chairman and chief executive officer of MKS, and members of his family, in the aggregate, beneficially owned approximately 41.4% of MKS' outstanding common stock. As a result, these stockholders, acting together, are able to exert substantial influence over actions of MKS.

SOME PROVISIONS OF MKS' AMENDED AND RESTATED ARTICLES OF ORGANIZATION, MKS' BY-LAWS AND MASSACHUSETTS LAW COULD DISCOURAGE POTENTIAL ACQUISITION PROPOSALS AND COULD DELAY OR PREVENT A CHANGE IN CONTROL OF MKS.

Anti-takeover provisions could diminish the opportunities for stockholders to participate in tender offers, including tender offers at a price above the then current market value of the common stock. Such provisions may also inhibit increases in the market price of the common stock that could result from takeover attempts. For example, while MKS has no present plans to issue any preferred stock, MKS' board of directors, without further stockholder approval, may issue preferred stock that could have the effect of delaying, deterring or preventing a change in control of MKS. The issuance of preferred stock could adversely affect the voting power of the holders of MKS' common stock, including the loss of voting control to others. In addition, MKS' By-Laws provide for a classified board of directors consisting of three classes. The classified board could also have the effect of delaying, deterring or preventing a change in control of MKS.

ITEM 3. QUANTITATIVE AND QUALITATIVE DISCLOSURES ABOUT MARKET RISK

Information concerning market risk is contained in the Management's Discussion and Analysis of Financial Condition and Results of Operations contained in the Consolidated Supplemental Financial Statements for year ended December 31, 2000, reflecting the merger of MKS Instruments, Inc. and ASTeX, which was filed with the Securities and Exchange Commission in MKS' Current Reports on Form 8-K on April 20, 2001. MKS enters into local currency purchased options to reduce currency exposure arising from intercompany sales of inventory. The potential fair value loss for a hypothetical 10% adverse change in currency exchange rates on MKS' local currency purchased options at September 30, 2001 would be approximately \$0.5 million. The potential loss was estimated by calculating the fair value of the local currency purchased options at September 30, 2001 and comparing that with those calculated using the hypothetical currency exchange rates. There were no other material changes in MKS' exposure to market risk from December 31, 2000.

PART II OTHER INFORMATION

ITEM 1. LEGAL PROCEEDINGS

MKS is not aware of any material legal proceedings to which it or any of its subsidiaries is a party.

ITEM 2. CHANGES IN SECURITIES AND USE OF PROCEEDS

(d) Use of Proceeds from Sales of Registered Securities. The Company has previously provided information on Form 10-Q for the quarter ended September 30, 2000 relating to the use of proceeds from the sale of securities by the Company pursuant to the Registration Statement on Form S-1 (Reg. No. 333-71363) that was declared effective by the Securities and Exchange Commission on March 29, 1999. Cumulative use of net proceeds from the securities sold was \$15.8 million as of September 30, 2001. There has been no other change to the information previously provided.

ITEM 3. DEFAULTS UPON SENIOR SECURITIES

None.

ITEM 4. SUBMISSION OF MATTERS TO A VOTE OF SECURITY HOLDERS

None.

ITEM 5. OTHER INFORMATION

None.

ITEM 6. EXHIBITS AND REPORTS ON FORM 8-K

(a) Exhibits

Exhibit No. -----	Exhibit Description -----
10.37	Credit Agreement dated July 31, 2001 between Fleet National Bank as Agent and Lender, The Chase Manhattan Bank as Lender, and the Registrant as Borrower
10.38	Ninth Amendment dated July 31, 2001 to the Loan Agreement dated October 31, 1995 between Fleet National Bank as Lender and the Registrant as Borrower

(b) Reports on Form 8-K

None.

SIGNATURE

Pursuant to the requirements of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned thereunto duly authorized.

MKS INSTRUMENTS, INC.

November 14, 2001

By: /s/ Ronald C. Weigner

Ronald C. Weigner
Vice President and Chief
Financial Officer
(Principal Financial Officer)

EXHIBIT INDEX

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CREDIT AGREEMENT

by and among

MKS INSTRUMENTS, INC.,
as Borrower,

FLEET NATIONAL BANK
as Agent and as Lender,

and

THE CHASE MANHATTAN BANK,
as Lender

Dated as of July 31, 2001

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CREDIT AGREEMENT

This Credit Agreement (the "Agreement") is entered into as of the 31st day of July, 2001, by and among Fleet National Bank ("Fleet"), The Chase Manhattan Bank ("Chase"; hereinafter Fleet and Chase may be referred to individually as a "Lender" or collectively as the "Lenders"), Fleet in its capacity as agent for the Lenders (in such capacity, together with any successor agent appointed in accordance with the terms of Section 10.8, the "Agent"), and MKS Instruments, Inc., a Massachusetts corporation ("Borrower").

In consideration of the premises and for other good and valuable consideration, the adequacy and receipt of which are hereby acknowledged, the parties hereto hereby agree as follows:

ARTICLE I.
DEFINITIONS

1.1 Definitions. In addition to terms defined elsewhere in this Agreement, the following terms shall have the meanings indicated, which meanings shall be equally applicable to both the singular and plural forms of such terms:

"Accounts" shall mean, at any time, all accounts receivable of Borrower and its subsidiaries on a consolidated basis determined in accordance with GAAP appearing on the Borrower's consolidated balance sheet.

"Adjustment Date" shall mean the first day of the month immediately following the month in which a Compliance Certificate is to be delivered by the Borrower pursuant to Section 7.1(c).

"Advance" shall mean the drawing down by the Borrower of a Base Rate Loan or a LIBOR Loan on any given Advance Date.

"Advance Date" shall mean the date as of which an Advance is consummated.

"Affiliate" of any Person shall mean any other Person which, directly or indirectly, controls, or is controlled by, or is under common control with, such Person. For purposes of this definition, "control" of any Person shall mean the power, directly or indirectly, either to (i) vote 10% or more of the securities having ordinary voting power for the election of directors of such Person or (ii) direct the management and policies of such Person, whether by contract or otherwise. As to the Borrower, the term "Affiliate" shall include, without limitation, any partnership or joint venture of which the Borrower or any Affiliate of the Borrower is a general partner or is a limited partner with more than a ten percent (10%) interest, and any director or executive officer of the Borrower.

"Applicable Commitment Percentage" shall mean, with respect to each Lender at any time, a fraction, the numerator of which shall be such Lender's Commitment and the denominator of which shall be the Total Commitment, which Applicable Commitment

Percentage for each Lender as of the Closing Date is as set forth in Exhibit A; provided, however, that the Applicable Commitment Percentage of each Lender shall be increased or decreased to reflect any assignments to or by such Lender effected in accordance with Section 11.1.

"Applicable Margin" shall mean for each period commencing on an Adjustment Date through the date immediately preceding the next Adjustment Date, the applicable margin set forth below with respect to the Total Liabilities-To-Tangible Net Worth Ratio, as determined for the most recent fiscal quarter for which the Borrower has delivered its financial statements pursuant to Section 7.1(a) or (b) and Compliance Certificate pursuant to Section 7.1(c):

TOTAL LIABILITIES-TO-TANGIBLE NET WORTH RATIO	APPLICABLE MARGIN FOR LIBOR LOANS AND LETTER OF CREDIT FEE	APPLICABLE MARGIN FOR UNUSED COMMITMENT FEE
Greater than or equal to 0.50:1.00	2.00%	0.40%
Less than 0.50:1.00 but greater than or equal to 0.25:1.00	1.50%	0.40%
Less than 0.25:1.00	1.25%	0.35%

If for any reason the Borrower shall fail to deliver the financial statements or Compliance Certificate as required, the Applicable Margin shall in each case be the highest percentage set forth above.

"Assignment and Acceptance" shall mean an Assignment and Acceptance in the form of Exhibit B (with blanks appropriately filled in) delivered to the Agent in connection with an assignment of a Lender's interest under this Agreement pursuant to Section 11.1.

"Base Rate" shall mean the higher of (a) the annual rate of interest announced from time to time by Fleet at Fleet's office at 100 Federal Street, Boston, Massachusetts, as its "base rate" or (b) one-half of one percent (1/2%) above the Federal Funds Effective Rate. For the purposes of this definition, "Federal Funds Effective Rate" shall mean, for any day, the rate per annum equal to the weighted average of the rates on overnight federal funds transactions with members of the Federal Reserve System arranged by federal funds brokers, as published for such day (or, if such day is not a Business Day, for the next preceding Business Day) by the Federal Reserve Bank of New York, or if such rate is not so published for any day that is a Business Day, the average of the quotations for such day on such transactions received by Fleet from three funds brokers of recognized standing selected by Fleet.

"Base Rate Loan" shall mean an Advance that is specified as such in the Notice of Borrowing with respect to such Advance and that bears interest at the Base Rate.

"Borrowing" shall mean the incurrence of one or more Advances on a given date.

"Business Day" shall mean a day on which commercial banks are required to be open for business in Boston, Massachusetts.

"Change in Control" shall be deemed to have occurred at such time after the date hereof that any person (other than, in the case of clause (ii) below, John R. Bertucci, together with its affiliates and associates (as defined in Rule 12b-2 under the Securities Exchange Act of 1934 (the "Exchange Act") or any successor rule thereto):

(i) shall file with the Securities and Exchange Commission and deliver to the Borrower a report under or in response to Schedule 13D or 14D-1 (or any successor schedule, form or report) pursuant to the Exchange Act disclosing that such person has become the beneficial owner (as defined in Rule 13D-3 under the Exchange Act, or any successor provisions) of more than 25% of the total voting power of all classes of voting stock of the Borrower or

(ii) shall succeed in having a sufficient number of its nominees elected to the board of directors of the Borrower such that such nominees so elected (whether new or continuing as directors) shall constitute a majority of the board of directors of the Borrower.

"Closing Date" shall mean the date of this Agreement.

"Commitment" means, with respect to each Lender, the obligation of such Lender to make Advances to the Borrower up to an aggregate principal amount at any one time outstanding equal to such Lender's Applicable Commitment Percentage of the Total Commitment.

"Compliance Certificate" shall have the meaning set forth in Section 7.1(c).

"Consolidated Current Liabilities" shall mean, at any time, all current liabilities of Borrower and its subsidiaries on a consolidated basis that in accordance with GAAP are properly classified as current liabilities plus all other indebtedness for borrowed money except such indebtedness that is subordinated to the payment of the Obligations pursuant to an agreement in form and substance acceptable to the Required Lenders ("Subordinated Debt").

"Consolidated Indebtedness" shall mean the Indebtedness of the Borrower and its Subsidiaries, determined on a consolidated basis.

"Consolidated Net Income" shall mean for any period the net income (or loss) for such period (before extraordinary items and excluding the net income of any business entity that is not a Subsidiary in which the Borrower or one of its Subsidiaries has an ownership interest unless such net income shall have actually been received by such company in the form of cash distributions) of the Borrower and its Subsidiaries after deducting all operating expenses, depreciation and amortization, Interest Expense, the interest portion of Financing Lease

Obligations, all taxes in respect of income and profits paid or payable and all other proper deductions, all determined on a consolidated basis.

"Consolidated Quick Assets" shall mean, at any time, the sum of the cash, Accounts, Short Term Investments and Long Term Fixed Income Investments of the Borrower and its Subsidiaries, provided the sum of Long Term Fixed Income Investments shall not exceed 25% of the amount of the Borrower's cash.

"Consolidated Tangible Net Worth" shall mean, at any time, the stockholders' equity of the Borrower and its Subsidiaries determined in accordance with GAAP excluding the book amount of all minority interests in Affiliates and any foreign exchange translation adjustment, with no upward adjustments due to a reevaluation of assets (other than any such upward adjustment as may be required under generally accepted accounting principles in connection with the acquisition by the Borrower or any Subsidiary of another company or entity) minus the following items (without duplication of deductions) appearing on the balance sheet of the Borrower and its Subsidiaries:

(a) the book amount of all assets (including, without limitation, goodwill, patents, trademarks, copyrights, organizational expense and unamortized debt discount) that would be treated as intangibles under generally accepted accounting principles;

(b) treasury stock; and

(c) any write-up in the book amount of any asset or Investment subsequent to the Closing Date, resulting from a reevaluation or reappraisal thereof from the amount entered in accordance with generally accepted accounting principles by the Borrower or any Subsidiary on its books with respect to its acquisition of the asset or Investment.

"Consolidated Total Liabilities" shall mean, at any time, all liabilities of the Borrower and its Subsidiaries on a consolidated basis that in accordance with GAAP are properly classified as liabilities on the Borrowers' consolidated balance sheet plus the sum of (i) the face amount of outstanding Letters of Credit, (ii) sales of receivables described in clause (f) of the definition of "Indebtedness" below and (iii) Synthetic Leases. In computing such aggregate liabilities, the "amount" of the liability with respect to any such sale of receivables shall be the amount of unrecovered capital or principal investment of the purchaser (other than the Borrower or any of its wholly-owned Subsidiaries) thereof, excluding amounts representative of yield or interest earned on such investment, and the "amount" of any Synthetic Lease shall be the stipulated loss value, termination value or other equivalent amount.

"Costs" shall have the meaning set forth in Section 11.4.

"Default" shall mean any event that, with the lapse of time, the giving of notice, or both, would become an Event of Default hereunder.

"ERISA" shall have the meaning set forth in Section 5.12.

"Event of Default" shall have the meaning set forth in Section 9.1.

"Existing Loan Agreement" shall mean the Loan Agreement between the Borrower and Fleet dated October 31, 1995 as amended.

"Financing Lease" shall mean any lease of the Borrower or a Subsidiary, as lessee, that is shown or is required to be shown in accordance with generally accepted accounting principles as a liability on the balance sheet of the lessee thereunder.

"Financing Lease Obligation" shall mean for any period the monetary obligation of the lessee under a Financing Lease. The amount of a Financing Lease Obligation at any date is the amount at which the lessee's liability under the Financing Lease would be required to be shown on its balance sheet at such date.

"GAAP" shall mean generally accepted accounting principles.

"Hazardous Substances" shall mean any hazardous waste, as defined by 42 U.S.C. Section 6903(5), any hazardous substances, as defined by 42 U.S.C. Section 9601(14), any pollutant or contaminant, as defined by 42 U.S.C. Section 9601(33), or any toxic substance, oil or hazardous materials or other chemicals or substances regulated by any laws or regulations relating to the discharge of air pollutants, water pollutants, or processed wastewater.

"Indebtedness" shall mean, for any Person,

(a) all obligations of any other Person the payment or collection of which such Person has guaranteed (except by reason of endorsement for collection in the ordinary course of business) or in respect of which such Person is liable, contingently or otherwise, including, without limitation, liable by way of agreement to purchase, to provide funds for payment, to supply funds to or otherwise to invest in such other Person, or otherwise to assure a creditor against loss,

(b) all obligations of any other Person for borrowed money or for the deferred purchase price of property or services secured by (or for which the holder of such indebtedness has an existing right, contingent or otherwise, to be secured by) any mortgage, or other encumbrance upon or in property (including, without limitation, accounts and contract rights) owned by such Person, whether or not such Person has assumed or become liable for the payment of such indebtedness or obligations,

(c) Financing Lease Obligations of such Person,

(d) every reimbursement obligation of such Person with respect to letters of credit, bankers' acceptances or similar facilities issued for the account of such Person,

(e) every obligation of such Person under any Synthetic Lease,

(f) all sales by such Person of (i) accounts or general intangibles for money due or to become due, (ii) chattel paper, instruments or documents creating or evidencing a right to payment of money or (iii) other receivables (collectively "receivables"), whether pursuant to a purchase facility or otherwise, other than in connection with the disposition of the business

operations of such Person relating thereto or a disposition of defaulted receivables for collection and not as a financing arrangement, and together with any obligation of such Person to pay any discount, interest, fees, indemnities, penalties, recourse, expenses or other amounts in connection therewith,

(g) every obligation of such Person (an "equity related purchase obligation") to purchase, redeem, retire or otherwise acquire for value any shares of capital stock of any class issued by such Person, any warrants, options or other rights to acquire any such shares, or any rights measured by the value of such shares, warrants, options or other rights, and

(h) every obligation of such Person under any forward contract, futures contract, swap, option or other financing agreement or arrangement (including, without limitation, caps, floors, collars and similar agreements), the value of which is dependent upon interest rates, currency exchange rates, commodities or other indices (a "derivative contract").

"Interest Expense" shall mean for any period the aggregate amount of interest recorded, in accordance with generally accepted accounting principles, on the financial statements for that period by the Borrower and its Subsidiaries in respect of Consolidated Indebtedness incurred for borrowed money.

"Interest Period" shall mean the period designated by the Borrower as such in the Notice of Borrowing with respect to any LIBOR Loan pursuant to and subject to the limitations set forth in Section 2.5.

"Interest Rate Determination Date" shall mean the third Business Day prior to the first day of the related Interest Period for a LIBOR Loan.

"Interim Maturity Date" shall mean the last day of any Interest Period.

"International Standby Practices" shall mean International Standby Practices (ISP98), International Chamber of Commerce Publication No. 590, or any successor code of standby letter of credit practices among banks adopted by the Issuing Bank in the ordinary course of its business as a standby letter of credit issuer and in effect at the time of issuance of such Letter of Credit.

"Investments" shall have the meaning set forth in Section 8.6.

"IPO" shall mean the initial underwritten public offering pursuant to an effective registration statement under the Securities Act of 1933, as amended, covering the offer and sale of the Borrower's Common Stock for the account of the Borrower.

"Lenders" shall mean the Lenders as of the date hereof so long as they maintain Commitments hereunder and any other institutions to which all or part of the Total Commitment is assigned hereafter.

"Letter of Credit" shall have the meaning set forth in Section 3.1.

"Letter of Credit Application" shall have the meaning set forth in Section 3.1.

"LIBOR Loan" shall mean an Advance that is specified as such in the Notice of Borrowing with respect to such Advance and that bears interest at the adjusted LIBOR Rate.

"LIBOR Rate" shall mean for any Interest Rate Determination Date, the rate obtained by dividing (i) the quotation offered by the Agent in the interbank Eurodollar market for U.S. dollar deposits of amounts in immediately available funds comparable to the principal amount of the LIBOR Loan for which the LIBOR Rate is being determined with a maturity comparable to the Interest Period for which such LIBOR Rate will apply as of approximately noon (Boston time) three Business Days prior to the commencement of such Interest Period by (ii) a percentage equal to 100% minus the stated maximum rate of all reserves required to be maintained against "Eurocurrency liabilities" as specified in Regulation D (or against any other category of liabilities that includes deposits by reference to which the interest rate on LIBOR Loans is determined) as applicable on such date to any member bank of the Federal Reserve System.

"Licenses" shall have the meaning set forth in Section 5.8.

"Lien" shall mean any interest in property securing an obligation owed to, or a claim by, a Person other than the owner of the property, whether the interest is based on common law, statute or contract (including the security interest lien arising from a mortgage, encumbrance, pledge, conditional sale or trust receipt or a lease, consignment or bailment for security purposes). For the purposes of this Agreement, the Borrower or a Subsidiary shall be deemed to be the owner of any property that it has acquired or holds subject to a Financing Lease or a conditional sale agreement or other arrangement pursuant to which title to the property has been retained by or vested in some other Person for security purposes, and such retention or vesting shall be deemed to be a Lien.

"Loan Documents" shall mean each of this Agreement, the Notes and any other document or instrument executed by the Borrower or any of its Affiliates in favor of the Lenders in connection with the transactions contemplated hereby.

"Long Term Fixed Income Investments" shall mean investment grade bonds with long-term debt ratings of A- or A3 or higher by at least one nationally recognized rating agency and maturities of three years or less.

"Maximum Draw" shall mean the maximum aggregate amount from time to time that beneficiaries may draw under outstanding Letters of Credit, as such aggregate amount may be reduced from time to time pursuant to the terms of the Letters of Credit.

"Material Subsidiary" shall mean each domestic Subsidiary of the Borrower (other than Massachusetts securities corporations) with gross revenues in excess of 5% of the total gross revenues of the Borrower and its Subsidiaries, determined on a consolidated basis, or assets in excess of 5% of the total assets of Borrower and its Subsidiaries, determined on a consolidated basis, in each case as of the end of Borrower's last fiscal quarter.

"Note" shall mean a Revolving Credit Note.

"Notice of Borrowing" shall have the meaning set forth in Section 2.2.1.

"Obligations" shall mean, without limitation, any and all liabilities, debts, and obligations of the Borrower to each of the Lenders, of each and every kind, nature and description, arising under this Agreement or any other Loan Document, whether now existing or hereafter incurred. "Obligations" also means, without limitation, any and all obligations of the Borrower to act or to refrain from acting in accordance with the terms, provisions and covenants of this Agreement or of any other Loan Document.

"Permitted Liens" shall have the meaning set forth in Section 8.2.

"Person" shall mean any natural person, corporation, unincorporated organization, trust, joint-stock company, joint venture, association, company, partnership or government, or any agency or political subdivision of any government.

"Quick Ratio" shall have the meaning set forth in Section 8.11.

"Reimbursement Obligation" shall mean the Borrower's obligation to reimburse the Lender on account of any drawing under any Letter of Credit as provided in Section 3.2.

"Required Lenders" shall mean, as of any date, Lenders on such date having Credit Exposures (as defined below) aggregating at least 66-2/3% of the aggregate Credit Exposures of all the Lenders on such date, provided that a minimum of two Lenders shall be required at any time. For purposes of the preceding sentence, the "Credit Exposure" of each Lender shall mean the aggregate principal amount of the Advances owing to such Lender plus the aggregate unutilized amounts of such Lender's Commitment.

"Revolver Termination Date" shall mean July 30, 2002 or any subsequent anniversary thereof if the Total Commitment shall have been renewed by the Lenders.

"Revolving Credit Facility" shall mean the loan arrangement described in Article II of this Agreement, subject to all other applicable terms of this Agreement.

"Revolving Credit Note" shall have the meaning set forth in Section 2.3.

"Revolving Credit Outstandings" means, as of any date of determination, the aggregate principal amount of all Advances then outstanding and all interest accrued thereon.

"Revolving Loan Account" shall mean the account on the books of the Agent in the name of the Borrower in which the following shall be recorded: Advances made by the Lenders to and for the account of the Borrower pursuant to Section 2 of this Agreement; all other charges, expenses and other items properly chargeable to the Borrower with respect to such Advances; all Costs with respect to such Advances; all payments made by the Borrower on account of Indebtedness evidenced by the Revolving Credit Notes; and other appropriate debits and credits.

"Short Term Investments" shall mean short term investments as determined in accordance with GAAP.

"Subordinated Debt" shall have the meaning set forth in the definition of Consolidated Current Liabilities set forth above.

"Subsidiary" shall mean any Person of which the Borrower at the time owns, directly or indirectly, through another Subsidiary or otherwise, 50% or more of the equity interests.

"Synthetic Lease" shall mean any lease that is treated as an operating lease under GAAP and as a loan or financing for U.S. income tax purposes.

"Total Commitment" shall mean, subject to Section 2.1.3, a principal amount equal to \$40,000,000.

"Total Liabilities-to-Tangible Net Worth Ratio" shall have the meaning set forth in Section 8.10.

"Total Outstandings" shall mean at any time the sum of Revolving Credit Outstandings, the Maximum Draw and Unpaid Reimbursement Obligations.

"Uniform Customs" shall mean the Uniform Customs and Practice for Documentary Credits (1993 Revision), International Chamber of Commerce Publication No. 500 or any successor version thereto adopted by the Issuing Bank in the ordinary course of its business as a letter of credit issuer and in effect at the time of issuance of such Letter of Credit.

"Unpaid Reimbursement Obligation" shall mean any Reimbursement Obligation for which the Borrower does not reimburse the Lenders on the date specified in, and in accordance with, Section 3.2.

1.2 Accounting Terms. Accounting terms not specifically defined in this Agreement shall have the meanings given to them under GAAP.

1.3 Other Definitional Provisions. The words "hereof," "herein" and "hereunder," and words of similar import when used in this Agreement shall refer to this Agreement as a whole and not any particular provision of this Agreement. Any Article, Section, Exhibit or Schedule references are to this Agreement unless otherwise specified.

ARTICLE II. REVOLVING CREDIT FACILITY

2.1 Revolving Credit.

2.1.1 Except as provided in Section 2.1.2 hereof and subject to the terms and conditions of this Agreement, each Lender severally agrees to make Advances from time to time to the Borrower during the period from the date hereof to the Revolver Termination Date on a pro rata basis as to the total Borrowing requested by the Borrower on any day determined by such Lender's Applicable Commitment Percentage up to but not exceeding the Commitment of such Lender, provided, however, that the Lenders will not be required and shall have no obligation to make any such Advance (i) so long as a Default or an Event of Default has occurred

and is continuing or (ii) if the Agent has accelerated the maturity of any of the Notes as a result of an Event of Default; provided further, however, that immediately after giving effect to each such Advance, the aggregate principal amount of Total Outstandings shall not exceed the Total Commitment. Within such limits and subject to the terms and conditions hereof, the Borrower may borrow, repay and reborrow under the Revolving Credit Facility on any Business Day from the Closing Date until, but (as to borrowings and reborrowings) not including, the Revolver Termination Date. All Advances shall be due and payable no later than the Revolver Termination Date. Each Advance shall, at the option of the Borrower, be a Base Rate Loan or a LIBOR Loan provided, however, that no LIBOR Loan having an Interest Period of 2, 3 or 6 months shall be made at any time in a principal amount of less than \$1,250,000 and no LIBOR Loan having an Interest Period of one month shall be made at any time in a principal amount of less than \$1,000,000.

2.1.2 Until such time as the Borrower and its Material Subsidiaries shall grant to the Lenders a first priority security interest in their domestic accounts receivable and domestic inventory and all documentation necessary to grant and perfect such security interest shall have been completed to the Agent's reasonable satisfaction, the principal amount of Total Outstandings shall not exceed \$5,000,000.

2.1.3 At any time on or prior to the date 90 days after the Closing, the Borrower may (so long as no Event of Default has occurred and is continuing) request that either Lender increase its Commitment up to an amount that would increase the Total Commitment to no more than \$50,000,000. If neither Lender is willing to increase its Commitment, the Borrower may during such period (so long as no Event of Default has occurred and is continuing) by irrevocable written notice to the Agent, request on one occasion that the Total Commitment be increased to an amount not greater than \$50,000,000 by engaging Fleet Securities, Inc. (the "Arranger") to locate one or more additional Lenders to hold Commitments for the requested increase (the "Syndication"). Fleet shall cause the Arranger to use commercially reasonable efforts to locate such additional Lenders including any potential lenders proposed by the Borrower. The Borrower shall provide all information requested by the Arranger and reasonably necessary for the successful completion of the Syndication, which information will be distributed on a confidential basis to selected financial institutions. In addition, the management of the Borrower, will, at the request of the Agent or the Arranger, make themselves and their advisors available at reasonable times to meet with and answer questions of potential lenders. In the event that the Borrower engages the Arranger, the Borrower shall not offer, or permit any of its Subsidiaries to offer, any debt or equity securities (other than Common Stock of the Borrower) prior to the completion of the Syndication except with the prior written consent of the Agent and the Arranger. The Borrower shall pay the Arranger an engagement fee as provided in a separate writing between the Borrower and the Arranger, of which one-half shall be payable on the date the Arranger is engaged and the balance shall be payable on the date on which a closing on the Syndication shall occur.

2.2 Advances.

2.2.1 Whenever the Borrower desires to obtain a LIBOR Loan hereunder, it may request that the Agent provide quotes as of any specified Interest Rate Determination Date as to the LIBOR Rate for any or all Interest Periods, and the Agent shall promptly provide such

quotes. The Borrower shall give the Agent prior telecopied or telephone notice (given not later than 11:00 a.m. (Boston time)) on the day of any Borrowing with respect to a Base Rate Loan and at least three Business Days prior to the day of any Borrowing with respect to a LIBOR Loan. Each such notice (each a "Notice of Borrowing") shall specify the principal amount of each Advance to be made, the date of the Borrowing (which shall be a Business Day), whether each Advance being made is to be initially maintained as a Base Rate Loan or a LIBOR Loan and, in the case of a LIBOR Loan, the initial Interest Period applicable thereto. If such notice is given by telephone, it shall be immediately confirmed in writing. Notice of receipt of a Notice of Borrowing, together with the amount of each Lender's portion of an Advance requested thereunder, shall be provided by the Agent to each Lender by facsimile transmission with reasonable promptness on the day the Agent receives the Notice of Borrowing. No more than one Base Rate Loan shall be outstanding at any time, but the Borrower may increase the principal amount of any Base Rate Loan at any time by giving a Notice of Borrowing as set forth above.

2.2.2 No later than 3:00 p.m. on the Advance Date, each Lender shall, pursuant to the terms and subject to the conditions of this Agreement, make the amount of the Advance or Advances to be made by it on such day available by wire transfer to the Agent in the amount of its pro rata share, determined according to such Lender's Applicable Commitment Percentage of the Advance or Advances to be made on such day. Such wire transfer shall be directed to the Agent and shall be in the form of Dollars constituting immediately available funds. The amount so received by the Agent shall, subject to the terms and conditions of this Agreement, promptly be made available to the Borrower on the date so specified by delivery of the proceeds thereof to the Revolving Loan Account or otherwise as shall be directed in the applicable Notice of Borrowing and reasonably acceptable to the Agent.

2.2.3 Upon the Interim Maturity Date of any LIBOR Loan, unless the Borrower (i) shall have given the Agent a Notice of Borrowing in accordance with Section 2.2.1 requesting that a new LIBOR Loan be made on such Interim Maturity Date or (ii) shall have repaid such LIBOR Loan on such Interim Maturity Date, the Borrower shall be deemed to have requested that the Lenders make a Base Rate Loan to the Borrower on such Interim Maturity Date in an aggregate principal amount equal to the aggregate principal amount of the LIBOR Loan maturing on such Interim Maturity Date.

2.2.4 Notwithstanding the notice requirement set forth above in this Section 2.2, the Lenders agree to make Advances to the Borrower sufficient to pay to the Issuing Bank any Unpaid Reimbursement Obligations on the date on which such Reimbursement Obligations become Unpaid Reimbursement Obligations. The Borrower hereby requests and authorizes the Lenders to make from time to time such Advances, which shall be Base Rate Loans, by means of paying Unpaid Reimbursement Obligations. The Borrower acknowledges and agrees that the making of such Advances shall, in each case, be subject in all respects to the provisions of this Agreement, including, without limitation, the limitations set forth in Section 2.1 and the requirements of the applicable conditions in Article VI. All actions taken by the Lenders pursuant to the provisions of this Section 2.2.4 shall be conclusive and binding on the Borrower.

2.3 Revolving Loan Account. The Advances made by each Lender from time to time to the Borrower under this Agreement shall be evidenced by a Revolving Credit Note in the form

of Exhibit C hereto (each, a "Revolving Credit Note") in the amount of such Lender's Commitment. The Advances and the amounts of all payments on the Revolving Credit Notes shall be recorded by the Agent in the Revolving Loan Account of the Borrower. The debit balance of the Revolving Loan Account shall represent the amount of the Borrower's indebtedness to the Lenders from time to time by reason of Advances and other appropriate charges hereunder. All statements regarding the Revolving Loan Account shall be deemed to be accurate absent manifest error or unless objected to by the Borrower within 30 days after receipt. The Borrower agrees to review each such statement promptly after receipt and to bring any errors or discrepancies to the Agent's attention promptly.

2.4 Interest.

2.4.1 The Borrower agrees to pay interest in respect of the unpaid principal amount of each Advance from the date the proceeds thereof are made available to the Borrower until maturity (whether by acceleration, voluntary prepayment or otherwise) as follows. Each Advance shall bear interest at the Base Rate in effect from time to time unless the Borrower elects and qualifies to pay interest on such Advance at the LIBOR Rate plus the Applicable Margin; provided, however, that the Applicable Margin shall not be less than 1.50% prior to the first day of the month following the month in which the Borrower shall deliver to the Lenders the financial statements required by Section 7.1(b) for the year ended December 31, 2001 and related Compliance Certificate.

2.4.2 Overdue principal and (to the extent permitted by law) overdue interest in respect of each Base Rate Loan and each LIBOR Loan (to the extent not converted into a Base Rate Loan) shall bear interest, payable on demand, after as well as before judgment, at a rate per annum equal to the Base Rate in effect from time to time plus 2% per annum.

2.4.3 Interest shall accrue from and including the date of any Advance and shall be payable by the Borrower on each Advance in arrears on the last day of each of the Borrower's fiscal quarters, on any prepayment (on the amount prepaid), on any maturity date (whether by acceleration or otherwise), and after such maturity, on demand. Interest shall be calculated on the basis of actual days elapsed and a 360- day year.

2.5 Interest Periods. At the time it gives any Notice of Borrowing with respect to a LIBOR Loan, the Borrower shall elect the Interest Period applicable to the related Advance, which Interest Period shall, at the option of the Borrower, be a period of 1, 2, 3 or 6 months. Notwithstanding anything to the contrary contained herein:

(i) if any Interest Period begins on a day for which there is no numerically corresponding day in the calendar month at the end of such Interest Period, such Interest Period shall end on the last Business Day of such calendar month;

(ii) if any Interest Period would otherwise expire on a day that is not a Business Day, such Interest Period shall expire on the next succeeding Business Day; provided that if any Interest Period would otherwise expire on the day that is not a Business Day but is a day of the month after which no further Business Day

occurs in such month, such Interest Period shall expire on the next preceding Business Day;

(iii) no Interest Period shall extend beyond the Revolver Termination Date.

2.6 Unused Commitment Fee. For the period beginning on the Closing Date and ending on the Revolver Termination Date, the Borrower agrees to pay to the Agent, for the pro rata benefit of the Lenders based on their Applicable Commitment Percentages, an unused commitment fee equal to the Applicable Margin multiplied by the average daily amount by which (a) the Total Commitment exceeds (b) the Total Outstandings less all accrued and unpaid interest. Such fees shall be due in arrears on the last Business Day of each March, June, September and December commencing September 30, 2001 to and on the Revolver Termination Date. Notwithstanding the foregoing, so long as any Lender fails to make available any portion of its Commitment when requested, such Lender shall not be entitled to receive payment of its pro rata share of such fee for so long as such Lender shall not have made available such portion. Such fee shall be calculated on the basis of a year of 360 days for the actual number of days elapsed.

2.7 Deficiency Advances. No Lender shall be responsible for any default of any other Lender in respect to such other Lender's obligation to make any Advance nor shall the Commitment of any Lender hereunder be increased as a result of such default of any other Lender. Without limiting the generality of the foregoing, in the event any Lender shall fail to advance funds to the Borrower as herein provided, the Agent may in its discretion, but shall not be obligated to, advance under the Revolving Credit Note in its favor as a Lender all or any portion of such amount or amounts (each, a "deficiency advance") and shall thereafter be entitled to payments of principal of and interest on such deficiency advance in the same manner and at the same interest rate or rates to which such other Lender would have been entitled had it made such advance under its Revolving Credit Note; provided that, upon payment to the Agent from such other Lender of the entire outstanding amount of each such deficiency advance, together with accrued and unpaid interest thereon, from the most recent date or dates interest was paid to the Agent by the Borrower on each Advance comprising the deficiency advance at the rate of interest payable by the Borrower and payment by such other Lender to Agent of customary late fees, then such payment shall be credited against the applicable Revolving Credit Note of the Agent in full payment of such deficiency advance and the Borrower shall be deemed to have borrowed the amount of such deficiency advance from such other Lender as of the most recent date or dates, as the case may be, upon which any payments of interest were made by the Borrower thereon.

ARTICLE III.
LETTER OF CREDIT FACILITY

3.1 Letter of Credit Commitment.

3.1.1 Subject to the terms and conditions hereof, Fleet (the "Issuing Bank") at the risk of the Lenders to the extent of their Applicable Commitment Percentages, in reliance upon the representations and warranties of the Borrower contained herein, shall issue, extend and

renew from time to time from the date hereof until but not including the date which is fourteen (14) days prior to the then scheduled Revolver Termination Date, for the account of the Borrower, standby and documentary letters of credit (each a "Letter of Credit"), in such form as may be requested by the Borrower and agreed to by the Issuing Bank so long as (i) the Borrower shall have executed and delivered a letter of credit application on the Issuing Bank's customary form (a "Letter of Credit Application"), (ii) after giving effect to such request, the sum of the aggregate Maximum Draw and all Unpaid Reimbursement Obligations shall not exceed \$10,000,000 at any one time, (iii) the sum of the principal amount of Total Outstandings shall not exceed the Total Commitment and (iv) until the condition set forth in Section 2.1.2 is met, the principal amount of Total Outstandings shall not exceed \$5,000,000.

3.1.2 Each Letter of Credit Application shall be completed to the satisfaction of the Issuing Bank at least two Business Days prior to the desired date of issuance. In the event that any provision of any Letter of Credit Application shall be inconsistent with any provision of this Agreement, then the provisions of this Agreement shall, to the extent of any such inconsistency, govern.

3.1.3 Each Letter of Credit issued, extended or renewed hereunder shall, among other things, (a) provide for the payment of sight drafts for honor thereunder when presented in accordance with the terms thereof and when accompanied by the documents described therein, and (b) have an expiry date no later than the date which is fourteen (14) days (or, if the Letter of Credit is confirmed by a confirmer or otherwise provides for one or more nominated persons, forty-five (45) days) prior to the Revolver Termination Date. Each Letter of Credit so issued, extended or renewed shall be subject to the Uniform Customs or, in the case of a standby Letter of Credit, either the Uniform Customs or the International Standby Practices. The Issuing Bank shall give the other Lenders reasonably prompt notice of the issuance and amount of each Letter of Credit and the expiration of each Letter of Credit.

3.2 Reimbursement Obligation of the Borrower. In order to induce the Lenders to issue, extend and renew each Letter of Credit, the Borrower hereby agrees to reimburse the Lenders for or to pay to the Lenders with respect to each Letter of Credit issued, extended or renewed by the Lenders hereunder,

3.2.1 except as otherwise expressly provided in Section 3.2.2, on each date that any draft presented under such Letter of Credit is honored by the Issuing Bank, or the Issuing Bank otherwise makes a payment with respect thereto, (i) the amount paid by the Issuing Bank under or with respect to such Letter of Credit, and (ii) the amount of any taxes, fees, charges or other costs and expenses whatsoever incurred by the Issuing Bank in connection with any payment made by the Issuing Bank under, or with respect to, such Letter of Credit;

3.2.2 upon the termination of the Commitment, or the acceleration of the Reimbursement Obligations with respect to all Letters of Credit in accordance with Article IX an amount equal to the Maximum Draw, which amount shall be held by the Issuing Bank as cash collateral for all Reimbursement Obligations.

Unless funded by an Advance, each such payment shall be made to the Issuing Bank at its office at 100 Federal Street, Boston, Massachusetts 02110 in immediately available funds.

Interest on any and all amounts remaining unpaid by the Borrower under this Section 3.2 and not required to be funded by an Advance pursuant to Section 2.2.4 at any time from the date such amounts become due and payable (whether as stated in this Section 3.2, by acceleration or otherwise) until payment in full (whether before or after judgment) shall be payable to the Issuing Bank on demand at the rate specified in Section 2.4.2 following an Event of Default.

3.3 Letter of Credit Payments. If any draft shall be presented or other demand for payment shall be made under any Letter of Credit, the Issuing Bank shall notify the Borrower of the date and amount of the draft presented or demand for payment and of the date and time when it expects to pay such draft or honor such demand for payment. The responsibility of the Issuing Bank to the Borrower shall be only to determine that the documents (including each draft) delivered under each Letter of Credit in connection with such presentment shall be in conformity in all material respects with such Letter of Credit.

3.4 Obligations Absolute. The Borrower's obligations under this Article III shall be absolute and unconditional under any and all circumstances and irrespective of the occurrence of any Default or Event of Default or any condition precedent whatsoever or any setoff, counterclaim or defense to payment which the Borrower may have or have had against the Lenders or any beneficiary of a Letter of Credit. The Borrower further agrees with the Lenders that the Lenders shall not be responsible for, and the Reimbursement Obligations shall not be affected by, among other things, the validity or genuineness of documents or of any endorsements thereon, even if such documents should in fact prove to be in any or all respects invalid, fraudulent or forged, or any dispute between or among the Borrower, the beneficiary of any Letter of Credit or any financing institution or other party to which any Letter of Credit may be transferred or any claims or defenses whatsoever of the Borrower against the beneficiary of any Letter of Credit or any such transferee. The Lenders shall not be liable for any error, omission, interruption or delay in transmission, dispatch or delivery of any message or advice, however transmitted, in connection with any Letter of Credit. The Borrower agrees that any action taken or omitted by the Lenders under or in connection with each Letter of Credit and the related drafts and documents, if done in good faith, shall be binding upon the Borrower and shall not result in any liability on the part of the Lenders to the Borrower.

3.5 Reliance by Issuer. To the extent not inconsistent with Section 3.4, the Lenders shall be entitled to rely, and shall be fully protected in relying upon, any Letter of Credit, draft, writing, resolution, notice, consent, certificate, affidavit, letter, cablegram, telegram, teletype, telex or teletype message, statement, order or other document believed by them to be genuine and correct and to have been signed, sent or made by the proper person or entity and upon advice and statements of legal counsel, independent accountants and other experts selected by the Lenders.

3.6 Letter of Credit Fees. The Borrower shall pay a fee to the Lenders in respect of each Letter of Credit equal to the Applicable Margin per annum multiplied by the face amount of such Letter of Credit. In addition, the Borrower shall pay to the Issuing Bank for its own account a fee of 1/8% per annum of the face amount of each Letter of Credit. Both fees shall be payable in arrears on the last day of each of the Borrower's fiscal quarters, on any prepayment (on the amount prepaid), on any maturity date (whether by acceleration or otherwise) and after such maturity, on demand.

ARTICLE IV.
ADDITIONAL TERMS

4.1 Payments.

4.1.1 The Borrower shall have the right to prepay the Notes, in whole at any time or in part from time to time, without premium or penalty, provided that, except as set forth in Section 4.3, no Advance, either in whole or in part, may be prepaid on the Advance Date of such Advance. The Borrower shall give notice (by telex or telecopier, or by telephone (confirmed in writing promptly thereafter)) to the Agent of each proposed prepayment hereunder prior to 11:00 a.m. (Boston time), (x) with respect to Base Rate Loans, upon the Business Day of the proposed prepayment and (y) with respect to LIBOR Loans, at least three Business Days prior to the Business Day of the proposed prepayment, which notice in each case shall specify the proposed prepayment date (which shall be a Business Day), the aggregate principal amount of the proposed prepayment and which Advances are to be prepaid. LIBOR Loans that are voluntarily prepaid before the last day of the applicable Interest Period shall be subject to the additional compensation requirements set forth in Section 4.3, and each prepayment of a LIBOR Loan shall be in an aggregate principal amount of not less than the total principal amount outstanding at such time under such LIBOR Loan. If at any time the Total Outstandings exceed \$40,000,000, the Borrower will immediately pay the amount of such excess to the Agent.

4.1.2 All payments of principal and interest due under the Notes (including prepayments), and any other amounts owing to the Lenders under this Agreement shall be made by the Borrower not later than 2:30 p.m., Boston time, on the day due in lawful money of the United States of America to the Agent at its Boston, Massachusetts office in immediately available funds. The Borrower hereby authorizes the Agent to charge such payments as they become due, if not otherwise paid by the Borrower, to any account of the Borrower with the Agent as the Agent may elect.

4.1.3 Whenever any payment to be made hereunder or under any other Loan Document shall be stated to be due on a day that is not a Business Day, such payment may be made on the next succeeding Business Day, and such extension of time shall in such case be included in computing interest or other fees or charges provided for under this Agreement or any other Loan Document; provided, however, that with respect to LIBOR Loans, if the next succeeding Business Day falls in another calendar month, such payment shall be made on the next preceding Business Day.

4.1.4 All payments made by the Borrower on the Notes shall be applied by the Agent (a) first, to the payment of Costs with respect to the Notes, (b) second, to the payment of accrued and unpaid interest on the Notes, until all such accrued interest has been paid, and (c) third, to the payment of the unpaid principal amount of the Notes. Except as otherwise provided herein, (a) each payment on account of the principal of and interest on the Notes and the fees described in Sections 2.6 and 3.6 shall be made to the Agent for the account of the Lenders pro rata based on their Applicable Commitment Percentages, (b) all payments to be made by the Borrower for the account of each of the Lenders on account of principal, interest and fees, shall be made without diminution, setoff, recoupment or counterclaim, and (c) the Agent will

promptly distribute to the Lenders in immediately available funds payments received in fully collected, immediately available funds from the Borrower.

4.1.5 The Borrower may elect to reduce or terminate the Commitment by a minimum principal amount of \$5,000,000 and integral multiples of \$1,000,000 but not by an amount greater than the Maximum Draw at such time, upon written notice to the Agent given by 10:00 a.m. Boston time at least five days prior to the date of such reduction or termination. The Borrower shall not be entitled to reinstate the Commitment following such reduction or termination.

4.1.6 If the Borrower sells any of its capital stock or other equity interests or any warrants, rights or options to acquire its capital stock or other equity interests other than sales of common stock upon the exercise of stock options held by employees, the Borrower shall prepay Advances by the amount of the excess of the gross cash proceeds received from such sale after deduction of reasonable and customary transaction expenses (including without limitation, underwriting discounts and commissions) incurred in connection with such sale.

4.2 Capital Adequacy.

4.2.1 If, after the date of this Agreement, a Lender shall have reasonably determined in good faith that the adoption or effectiveness after the date hereof of any applicable law, rule or regulation regarding capital adequacy, or any change therein, or any change in the interpretation or administration thereof by any governmental authority, central bank or comparable agency charged with the interpretation or administration thereof, or compliance by such Lender with any request or directive regarding capital adequacy (whether or not having the force of law) of any such authority, central bank or comparable agency, has or would have the effect of materially reducing the rate of return on such Lender's capital or assets as a consequence of its commitments or obligations hereunder to a level below that which such Lender could have achieved but for such adoption, effectiveness, change or compliance (taking into consideration such Lender's then current policies with respect to capital adequacy), then from time to time, subject to Section 4.2.2, within 15 days after demand, the Borrower shall pay to the Agent for the account of such Lender such additional amount or amounts as will compensate such Lender for such reduction (after such Lender shall have allocated the same fairly and equitably among all of its customers or any class generally affected thereby).

4.2.2 The Agent will notify the Borrower of any event occurring after the date of this Agreement that will entitle a Lender to any additional payment under this Section 4.2 as promptly as practicable. The Agent will furnish to the Borrower with such notice a certificate signed by an officer of the Lender requesting payment certifying that such Lender is entitled to payment under this Section 4.2 and setting forth the basis (in reasonable detail) and the amount of each request by such Lender for any additional payment pursuant to this Section 4.2. Such certificate shall be conclusive in the absence of manifest error. The Borrower shall not be obligated to compensate such Lender pursuant to this Section for amounts accruing prior to the date that is 180 days before such Agent notifies the Borrower of its obligations to compensate such Lender for such amounts.

4.3 Special Provisions Governing LIBOR Loans. Notwithstanding any other provisions of this Agreement, the following provisions shall govern with respect to LIBOR Loans as to the matters covered:

4.3.1 Increased Costs, Illegality, etc. (a) In the event that the Agent shall have determined (which determination shall, if made in good faith and absent manifest error, be final, conclusive and binding upon all parties):

(i) on any Interest Rate Determination Date, that by reason of any changes arising after the date of this Agreement affecting the interbank Eurodollar market, adequate and fair means do not exist for ascertaining the applicable interest rate on the basis provided for in the definition of LIBOR Rate; or

(ii) at any time during any Interest Period, that the Lenders shall incur increased costs (including taxes) or reductions in the amounts received or receivable hereunder with respect to a LIBOR Loan by reason of (x) any change since the Interest Rate Determination Date for the Interest Period in question in any applicable law or governmental rule, regulation, guideline or order (or any interpretation thereof and including the introduction of any new law or governmental rule, regulation, guideline or order) (such as, for example but not limited to, a change in official reserve requirements, but excluding reserve requirements that have been included in calculating the LIBOR Rate for such Interest Period) and/or (y) other circumstances affecting any Lender, the interbank Eurodollar market or the position of any Lender in the relevant market; or

(iii) at any time, that the making or continuance of any LIBOR Loan has become unlawful by compliance by the Lenders in good faith with any law, governmental rule, regulation, guideline or order, or has become impracticable as a result of a contingency occurring after the date of this Agreement;

then and in any such event, the Agent shall promptly after making such determination give notice (by telephone confirmed in writing) to the Borrower of such determination. Thereafter (x) in the case of clause (i) above, any Notice of Borrowing given by the Borrower with respect to a LIBOR Loan that has not yet been incurred shall be deemed rescinded by the Borrower and LIBOR Loans shall no longer be available until such time as the Agent notifies the Borrower that the circumstances giving rise to such notice no longer exist or that, notwithstanding such circumstances, LIBOR Loans will again be made available hereunder, (y) in the case of clause (ii), the Borrower shall pay to the Agent, upon written demand therefor (but only with respect to any LIBOR Loan made pursuant to a Notice of Borrowing issued after the giving of the written notice that LIBOR Loans will again be made available hereunder referred to in clause (x) above), such additional amounts (in the form of an increased rate of, or a different method of calculating, interest or otherwise as the Agent in its sole discretion shall determine) as shall be required to compensate the Lenders for such increased cost or reduction in amount received (a written notice as to additional amounts owed the Lenders, showing the basis for such calculation thereof, shall be given to the Borrower by the Agent and shall, absent manifest error, be final, conclusive and binding upon the parties hereto), and (z) in the case of clause (iii), the Borrower shall take one of

the actions specified in Section 4.3.1(b) as promptly as possible and, in any event, within the time period required by law.

(b) At any time that any LIBOR Loan is affected by the circumstances described in Section 4.3.1(a)(ii) or (iii), the Borrower may (and in the case of a LIBOR Loan affected pursuant to Section 4.3.1(a)(iii) shall) either (x) if the affected LIBOR Loan is then being made, withdraw the related Notice of Borrowing by giving the Agent telephonic (confirmed in writing) notice thereof on the same date that the Borrower was notified by the Agent pursuant to Section 4.3.1(a), or (y) if the affected LIBOR Loans are then outstanding, upon at least three Business Days' written notice to the Agent, require the Agent to convert each LIBOR Loan so affected into a Base Rate Loan.

4.3.2 Compensation. The Borrower shall compensate the Lenders, upon the Agent's written request (which request shall set forth the basis for requesting such amounts), for all reasonable losses, expenses and liabilities (including, without limitation, any interest paid by the Lender to lenders of funds borrowed by it to make or carry its LIBOR Loans to the extent not recovered by the Lenders in connection with the re-employment of such funds) and any loss sustained by any Lender in connection with the re-employment of the funds (including, without limitation, a return on such re-employment that would result in such Lender's receiving less than it would have received had such LIBOR Loan remained outstanding until the last day of the Interest Period applicable to such LIBOR Loan) that such Lender may sustain: (i) if for any reason (other than a default by or negligence of any Lender) a LIBOR Loan is not advanced on a date specified therefor in a Notice of Borrowing (unless timely withdrawn pursuant to Section 4.3.1(b)(x) above), (ii) if any payment or prepayment of any LIBOR Loans occurs for any reason whatsoever (including, without limitation, by reason of Section 4.3.1(b)) on a date that is prior to the last day of an Interest Period applicable thereto, (iii) if any prepayment of any of its LIBOR Loans is not made on the date specified in a notice of payment given by the Borrower pursuant to Section 4.1 or (iv) as a consequence of an election made by the Borrower pursuant to Section 4.3.1(b)(y).

4.4 Taxes. All payments made by the Borrower under this Agreement and any Notes shall be made free and clear of, and without deduction or withholding for or on account of, any present or future income, stamp or other taxes, levies, imposts, duties, charges, fees, deductions or withholdings, now or hereafter imposed, levied, collected, withheld or assessed by any governmental authority, excluding net income taxes and franchise taxes (imposed in lieu of net income taxes) imposed on any Lender as a result of a present or former connection between such Lender and the jurisdiction of the governmental authority imposing such tax or any political subdivision or taxing authority thereof or therein (other than any such connection arising solely from such Lender's having executed, delivered or performed its obligations or received a payment under, or enforced, this Agreement or any Note). If any such non-excluded taxes, levies, imposts, duties, charges, fees deductions or withholdings ("Non-Excluded Taxes") are required to be withheld from any amounts payable to the Lenders hereunder or under any Note, the amounts so payable to the Lenders shall be increased to the extent necessary to yield to the Lenders (after payment of all Non-Excluded Taxes) interest or any such other amounts payable hereunder at the rates or in the amounts specified in this Agreement. Whenever any Non-Excluded Taxes are payable by the Borrower, as promptly as possible thereafter the Borrower shall send to the Agent a certified copy of an original official receipt received by the Borrower

showing payment thereof. If the Borrower fails to pay any Non-Excluded Taxes when due to the appropriate taxing authority or fails to remit to the Agent the required receipts or other required documentary evidence, the Borrower shall indemnify the Lenders for any incremental taxes, interest or penalties that may become payable to any Lenders as a result of any such failure. The agreements in this subsection shall survive the termination of this Agreement and the payment of the Advances and all other amounts payable hereunder.

ARTICLE V.
REPRESENTATIONS AND WARRANTIES OF THE BORROWER

In order to induce the Lenders to enter into this Agreement and to make the loans provided for herein, the Borrower makes the following representations and warranties to the Lenders, all of which shall survive the execution and delivery of this Agreement and the Notes.

5.1 Organization, Existence and Power. Each of the Borrower and each Material Subsidiary is duly incorporated, validly existing and in good standing under the laws of the jurisdiction of its incorporation. Each of the Borrower and each Material Subsidiary has the corporate power necessary to conduct the business in which it is engaged, to own the properties owned by it and to consummate the transactions contemplated by the Loan Documents. Each of the Borrower and each Material Subsidiary is duly qualified or licensed to transact business in all places where the nature of the properties owned by it or the business conducted by it makes such qualification necessary and where the failure to be so qualified or licensed would have a material adverse effect upon the consolidated financial condition, assets or results of operations of the Borrower and its Subsidiaries taken as a whole.

5.2 Authorization of Loan Documents; Binding Effect. The execution and delivery of this Agreement and the other Loan Documents and the performance of the transactions contemplated hereby and thereby have been duly authorized by all necessary corporate actions of the Borrower and each Material Subsidiary. Each of the Loan Documents constitutes the legal, valid and binding obligation of the Borrower, enforceable against the Borrower in accordance with its terms. Each Guaranty constitutes the legal, valid and binding obligation of the Material Subsidiary executing it, enforceable against such Material Subsidiary in accordance with its terms.

5.3 Authority. The Borrower has all requisite corporate power and authority to execute, deliver and perform its obligations under the Loan Documents. Each Material Subsidiary has all requisite corporate power and authority to execute, deliver and perform its obligations under its Guaranty. Neither the authorization, execution, delivery, or performance by the Borrower of this Agreement or of any other Loan Document nor the authorization, execution, delivery, or performance by each Material Subsidiary of its Guaranty nor the performance of the transactions contemplated hereby or thereby violates or will violate any provision of the corporate charter or by-laws of the Borrower or any Material Subsidiary, or does or will, with the passage of time or the giving of notice or both, result in a breach of or a default under, or require any consent under or result in the creation of any lien, charge or encumbrance upon any property or assets of the Borrower or any Material Subsidiary pursuant to, any material instrument, agreement or other document to which the Borrower or any Material Subsidiary is a

party or by which the Borrower, any Material Subsidiary or any of their properties may be bound or affected.

5.4 Capital Structure. The number of shares of stock of which the Borrower's authorized capital stock consists, the par value per share of such stock, the number of shares of such stock that have been issued and are outstanding and the number of shares that have been issued and are held by the Borrower as treasury shares are all disclosed on the Disclosure Schedule. Set forth on the Disclosure Schedule is a complete and accurate list of all Subsidiaries of the Borrower. The Disclosure Schedule indicates the jurisdiction of incorporation or organization of each of the Subsidiaries, the number of shares or units of each class of capital stock or other equity of the Subsidiaries authorized, and the number of such shares or units outstanding and the percentage of each class of such equity owned (directly or indirectly) by the Borrower. No shares of stock or units of equity interests of the Borrower or any of its Subsidiaries are covered by outstanding options, warrants, rights of conversion or purchase or similar rights granted or created by the Borrower except as set forth on the Disclosure Schedule. All the outstanding capital stock of the Borrower has been validly issued and is fully paid and nonassessable. All the stock or units of equity interests of the Borrower's Subsidiaries that are owned by the Borrower or any Subsidiary of the Borrower are owned free and clear of all mortgages, deeds of trust, pledges, liens, security interests and other charges or encumbrances. The Disclosure Schedule sets forth the name of each Material Subsidiary.

5.5 Financial Condition. The audited consolidated balance sheet of the Borrower and its Subsidiaries dated as of December 31, 2000 and the unaudited consolidated balance sheet of the Borrower and its Subsidiaries dated as of June 30, 2001 (the "Balance Sheet Date") and the related audited and unaudited, respectively, statements of operations, cash flows and stockholders' equity of the Borrower and its Subsidiaries for the periods ending on such dates, including any related notes (the "Financial Statements"), all of which were heretofore furnished to the Lenders, are true, correct and complete in all material respects and fairly present in all material respects the financial condition of the Borrower and its Subsidiaries as of the date of each such statement and have been prepared in accordance with generally accepted accounting principles consistently applied throughout the periods involved except, in the case of unaudited statements, for the absence of footnotes and subject to normal year-end adjustments that shall not be materially adverse in the aggregate. Other than as reflected in such Financial Statements and except for liabilities incurred in the ordinary course of business since the date thereof, the Borrower and its Material Subsidiaries have no Indebtedness that is or would be material to the financial condition of the Borrower, nor any material unrealized or unanticipated losses from any commitments. Since the Balance Sheet Date there has been no material adverse change in the consolidated financial condition (as set forth in the Financial Statements) or results of operations of the Borrower and its Subsidiaries taken as a whole.

5.6 Pending Litigation. Except as set forth in the Disclosure Schedule, there are no suits or proceedings pending or, to the knowledge of the Borrower, threatened before any court or arbitration tribunal or by or before any governmental or regulatory authority, commission, bureau or agency or public regulatory body against the Borrower or any Material Subsidiary that if adversely determined would have a material adverse effect on the consolidated financial condition, assets or results of operations of the Borrower and its Subsidiaries taken as a whole.

5.7 Certain Agreements; Material Contracts. Neither the Borrower nor any Material Subsidiary is a party to any agreement or instrument or subject to any court order or governmental decree adversely affecting in any material respect the business, properties, assets or financial condition of the Borrower and its Subsidiaries taken as a whole.

5.8 Authorization, Etc. All authorizations, consents, approvals, accreditations, certifications and licenses required under the corporate charters or by- laws of the Borrower and its Material Subsidiaries or under applicable law or regulation for the ownership or operation of the property owned or operated by the Borrower or any Material Subsidiary or the conduct of any business or activity conducted by the Borrower or any Material Subsidiary, including provision of services for which reimbursement is made by third party payors, other than authorizations, consents, approvals, accreditations, certifications or licenses the failure to obtain and/or maintain which would not have a material adverse effect on the consolidated financial condition, assets or results of operations of the Borrower and its Subsidiaries taken as a whole (collectively, "Licenses") have been duly issued and are in full force and effect . The Borrower and its Material Subsidiaries have fulfilled and performed all of their material obligations with respect to such Licenses (to the extent now required to be fulfilled or performed) and no event has occurred that would allow, with or without the passage of time or the giving of notice or both, revocation or termination thereof or would result in any other material impairment of the rights of the holder of any such License. All filings or registrations with any governmental or regulatory authority required for the conduct of the business or activity conducted by the Borrower or any Material Subsidiary have been made, other than any such filings or registrations as to which the failure to make same would not have a material adverse effect on the consolidated financial condition, assets or results of operations of the Borrower and its Subsidiaries, taken as a whole. Except as expressly contemplated hereby, no approval, consent or authorization of or filing or registration with any governmental commission, bureau or other regulatory authority or agency is required with respect to the execution, delivery or performance of any of the Loan Documents.

5.9 No Violation. The execution, delivery and performance by the Borrower of the Loan Documents and by each Material Subsidiary of its Guaranty do not and will not violate any provision of law or regulation applicable to the Borrower or any Material Subsidiary, or any writ, order or decree of any court or governmental or regulatory authority or agency applicable to the Borrower or any Material Subsidiary. Neither the Borrower nor any Material Subsidiary is in default, nor has any event occurred that with the passage of time or the giving of notice, or both, would constitute a default, in the performance, observance or fulfillment of any of the obligations, covenants or conditions contained in any agreement, instrument or other document to which the Borrower or any Material Subsidiary is a party, which default would have a material adverse effect on the consolidated assets, financial condition or results of operations of the Borrower and its Subsidiaries, taken as a whole. Neither the Borrower nor any Material Subsidiary is in violation of any applicable federal, state or local law, rule or regulation or any writ, order or decree, which violation would have a material adverse effect on the consolidated assets, financial condition or results of operations of the Borrower and its Subsidiaries, taken as a whole. Except as otherwise set forth in the Disclosure Schedule under the caption "Litigation," neither the Borrower nor any Material Subsidiary has received notice of any violation of any federal, state or local environmental law, rule or regulation or assertion that the Borrower or any

Material Subsidiary has any obligation to clean up or contribute to the cost of cleaning up any waste or pollutants.

5.10 Payment of Taxes. The Borrower and its Subsidiaries have properly prepared and filed or caused to be properly prepared and filed all federal tax returns and all material state and local tax returns that are required to be filed and have paid all taxes shown thereon to be due and all other taxes, assessments and governmental charges or levies imposed upon the Borrower and its Subsidiaries, their income or profits or any properties belonging to the Borrower. No extensions of any statute of limitations are in effect with respect to any tax liability of the Borrower or any Subsidiary of the Borrower. No deficiency assessment or proposed adjustment of the federal income taxes of the Borrower or any Subsidiary of the Borrower is pending and the Borrower has no knowledge of any proposed liability of a substantial nature for any tax to be imposed upon any of its properties or assets.

5.11 Transactions With Affiliates, Officers, Directors and 1% Shareholders. Except as set forth on the Disclosure Schedule, neither the Borrower nor any Material Subsidiary has any Indebtedness to or material contractual arrangement or understanding with any Affiliate, officer or director of the Borrower or any Material Subsidiary, nor any shareholder holding of record at least 1% of the equity of the Borrower or any Material Subsidiary nor, to the best of the Borrower's knowledge (without independent inquiry), any of their respective relatives.

5.12 ERISA. Neither the Borrower nor any Material Subsidiary has ever established or maintained any funded employee pension benefit plan as defined under Section 3(2)(A) of the Employee Retirement Income Security Act of 1974, as amended and in effect on the date hereof ("ERISA"), other than the plans described on the Disclosure Schedule. No employee benefit plan established or maintained, or to which contributions have been made, by the Borrower or any Subsidiary of the Borrower that is subject to Part 3 of Title I-B of ERISA, had an accumulated funding deficiency (as such term is defined in Section 302 of ERISA) as of the last day of the fiscal year of such plan ended most recently prior to the date hereof, or would have had an accumulated funding deficiency (as so defined) on such day if such year were the first year of the plan to which Part 3 of Title I-B of ERISA applied. No material liability to the Pension Benefit Guaranty Corporation has been incurred or is expected by the Borrower or any Material Subsidiary to be incurred by it or any Subsidiary of the Borrower with respect to any such plan or otherwise. The execution, delivery and performance of this Agreement and the other Loan Documents will not involve on the part of the Borrower or any Material Subsidiary any prohibited transaction within the meaning of ERISA or Section 4975 of the Internal Revenue Code. Neither the Borrower nor any Material Subsidiary has ever maintained, contributed to or been obligated to contribute to any "multiemployer plan," as defined in Section 3(37) of ERISA. Neither the Borrower nor any Material Subsidiary has ever incurred any "withdrawal liability" calculated under Section 4211 of ERISA, and there has been no event or circumstance that would cause the Borrower or any Material Subsidiary to incur any such liability.

5.13 Ownership of Properties; Liens. The Borrower and its Subsidiaries have good and marketable title to all their material properties and assets, real and personal, that are now carried on their books, including, without limitation, those reflected in the Financial Statements (except those disposed of in the ordinary course since the date thereof), and have valid leasehold interests in their properties and assets, real and personal, which they purport to lease, subject in

either case to no mortgage, security interest, pledge, lien, charge, encumbrance or title retention or other security agreement or arrangement of any nature whatsoever other than Permitted Liens and those specified in the Disclosure Schedule. All of the material leasehold interests and material obligations with respect to real property of the Borrower and its Subsidiaries are described on the Disclosure Schedule.

5.14 Employment Matters. Except as set forth on the Disclosure Schedule, there are no material grievances, disputes or controversies pending or, to the knowledge of the Borrower, threatened between the Borrower and its employees or any Material Subsidiary and its employees, nor is any strike, work stoppage or slowdown pending or threatened against the Borrower or any Material Subsidiary.

5.15 Insurance. Each of The Borrower and each Material Subsidiary maintains in force fire, casualty, comprehensive liability and other insurance covering its properties and business that is adequate and customary for the type and scope of its properties and business.

5.16 Indebtedness. Except as reflected in the Financial Statements or set forth in the Disclosure Schedule, and other than Indebtedness incurred in the ordinary course of business since the Balance Sheet Date, the Borrower and its Material Subsidiaries have no outstanding Indebtedness.

5.17 Securities Law Compliance. Neither the Borrower nor any Material Subsidiary is an "investment company" as defined in the Investment Company Act of 1940, as amended. All of the Borrower's and each Material Subsidiary's outstanding stock was offered, issued and sold in compliance with all applicable state and federal securities laws.

5.18 Accuracy of Information. None of the information furnished to the Lenders by or on behalf of the Borrower or any Material Subsidiary for purposes of this Agreement or any Loan Document or any transaction contemplated hereby or thereby contains, and none of such information hereinafter furnished will contain any material misstatement of fact, nor does or will any such information omit any material fact necessary to make such information not misleading at such time.

ARTICLE VI.
CONDITIONS TO ADVANCES

The Lenders shall not be obligated to make any Advances unless the following conditions have been satisfied:

6.1 Each Advance. The obligations of the Lenders to make each Advance are subject to the following conditions precedent, each of which shall have been met or performed on or before the Advance Date or the Closing Date, as the case may be:

(a) No Default. No Default or Event of Default shall have occurred and be continuing or will occur upon the making of the Advance.

(b) Correctness of Representations. The representations and warranties made by the Borrower in this Agreement shall be true and correct with the same force and effect as

though such representations and warranties had been made on and as of the Advance Date (i) except to the extent that the representations and warranties set forth in Article V of this Agreement are untrue as a result of circumstances that have changed subsequent to the date hereof, which change has caused non-compliance by the Borrower with the covenants, conditions and agreements in this Agreement and (ii) except that the references in Section 5.5 of this Agreement to the financial statements and the term "Balance Sheet Date" are deemed to refer to the most recent financial statements (inclusive of consolidated balance sheets and statements of operations, cash flows and stockholders' equity of the Borrower and its Subsidiaries) furnished to the Lenders pursuant to Section 7.1(a) and (b) of this Agreement and the date of such financial statements, respectively.

(c) No Litigation; Certain Other Conditions. There shall be no suit or proceeding (other than suits or proceedings disclosed on the Disclosure Schedule on the date of this Agreement) pending or threatened before any court or arbitration tribunal or by or before any governmental or regulatory authority, commission, bureau or agency or public regulatory body that, if determined adversely to the Borrower or any Subsidiary of the Borrower, is reasonably likely to have a material adverse effect on the consolidated financial condition or results of operations of the Borrower and its Subsidiaries taken as a whole.

(d) No Material Adverse Change. There shall have been no material adverse change in the consolidated financial condition or results of operations of the Borrower and its Subsidiaries taken as a whole since the Balance Sheet Date.

(e) Loan Documents. All Loan Documents shall be in full force and effect.

6.2 First Advance. The obligations of the Lenders to make the first Advance after the Closing Date are subject to the following additional conditions precedent, each of which shall have been met or performed on or before the Closing Date:

(a) Deliveries. The Agent shall have received, in form and substance satisfactory to the Agent and Lenders, the following:

(i) an opinion or opinions of independent counsel to the Borrower with respect to the Loan Documents and the transactions contemplated thereby;

(ii) certificates as to the Borrower's legal existence and good standing under the laws of The Commonwealth of Massachusetts, and certificates as to the Borrower's authority to do business as a foreign corporation in all states in which it is qualified to do business, each dated as of a recent date;

(iii) a certificate of the Borrower's Clerk or Assistant Clerk as to (i) its charter documents and by-laws, as amended, (ii) corporate votes authorizing the execution and delivery of the Loan Documents, and (iii) incumbency of the officers authorized to execute the Loan Documents on behalf of the Borrower;

(iv) a Revolving Credit Note to the order of each Lender, each duly executed by the Borrower and otherwise appropriately completed;

(v) a certificate duly executed by the Borrower's chief financial officer or treasurer dated the Advance Date or Closing Date, as the case may be, to the effect that each of the conditions set forth in the foregoing Section 6.1 has been met as of such date; and

(vi) an executed guaranty of the Obligations in form and substance acceptable to the Lenders (a "Guaranty") from each Material Subsidiary.

(b) All Proceedings Satisfactory. All corporate and other proceedings taken prior to or on the Closing Date in connection with the transactions contemplated by this Agreement, and all documents and exhibits related thereto, shall be reasonably satisfactory in form and substance to the Agent and the Lenders.

(c) Additional Documents. The Borrower shall have delivered to the Agent all additional opinions, documents and certificates that the Agent or any Lender may reasonably require.

ARTICLE VII.
AFFIRMATIVE COVENANTS OF THE BORROWER

The Borrower covenants and agrees that from the date of execution of this Agreement and until the payment in full of the principal of and interest upon the Notes and payment and performance of all other Obligations, unless the Required Lenders shall otherwise consent in writing:

7.1 Reporting Requirements. The Borrower shall furnish to the Lenders:

(a) As soon as available and in any event within forty-five days after the end of each of the first three quarters of each fiscal year of the Borrower and its Subsidiaries, (i) an unaudited consolidated and consolidating balance sheet of the Borrower and its Subsidiaries as of the end of such quarter and (ii) unaudited consolidated and consolidating statements of operations, cash flows and stockholders' equity of the Borrower and its Subsidiaries for the period commencing at the end of the previous fiscal year and ending with the end of such quarter, all in reasonable detail and duly certified by the chief financial officer or treasurer of the Borrower as having been prepared in accordance with generally accepted accounting principles consistently applied (subject to addition of notes and ordinary year-end audit adjustments), together with a certificate of the chief financial officer or treasurer of the Borrower stating that no Default or Event of Default has occurred and is continuing or, if a Default or an Event of Default has occurred and is continuing, a statement as to the nature thereof and the action that the Borrower proposes to take with respect thereto;

(b) As soon as available and in any event within ninety days after the end of each fiscal year of the Borrower, the audited consolidated balance sheet of the Borrower and its Subsidiaries as of the end of such fiscal year and the audited consolidated statements of operations, cash flows and stockholders' equity of the Borrower and its Subsidiaries for such fiscal year, in each case accompanied by the unqualified opinion with respect thereto of the Borrower's independent public accountants and a certification by such accountants stating that they have reviewed this Agreement and whether, in making their audit, they have become aware

of any Default or Event of Default and if so, describing its nature, along with the related unaudited consolidating balance sheet of the Borrower and its Subsidiaries as of the end of such fiscal year and the unaudited consolidating statements of operations, cash flows and stockholders' equity of the Borrower and its Subsidiaries for such fiscal year;

(c) Concurrent with, and no later than the required date for delivery of the financial information outlined in Sections 7.1(a) and (b), a certificate signed by the chief financial officer or treasurer of the Borrower substantially in the form of Exhibit D hereto (the "Compliance Certificate");

(d) Not later than forty-five days after the end of each fiscal year of the Borrower, the Borrower's representative forecast for the next fiscal year on a consolidated basis, including, at a minimum, projected statements of profit and loss and projected cash flow, prepared in accordance with generally accepted accounting principles consistently applied;

(e) Promptly upon receipt thereof, one copy of each other report submitted to the Borrower or any Subsidiary by independent accountants in connection with any annual, interim or special audit made by them of the books of the Borrower or any Material Subsidiary;

(f) Promptly after the commencement thereof, notice of all actions, suits and proceedings before any court, arbitration tribunal or governmental regulatory authority, commission, bureau, agency or public regulatory body that, if determined adversely to the Borrower or any Subsidiary of the Borrower, would be reasonably likely to have a material adverse effect on the consolidated financial condition or results of operations of the Borrower and its Subsidiaries taken as a whole;

(g) As soon as possible, and in any event within five days after the Borrower shall know of the occurrence of any Default or Event of Default, the written statement of the chief financial officer or treasurer of the Borrower setting forth details of such Default or Event of Default and action that the Borrower proposes to take with respect thereto;

(h) As soon as possible, and in any event within five days after the occurrence thereof, written notice as to any other event of which the Borrower becomes aware that with the passage of time, the giving of notice or otherwise, is reasonably likely to result in a material adverse change in the consolidated financial condition or results of operations of the Borrower and its Subsidiaries taken as a whole;

(i) Promptly after Borrower becomes aware thereof, written notice of any noncompliance with ERISA that with the passage of time, the giving of notice or otherwise, is reasonably likely to result in a liability to the Borrower in excess of \$1,000,000; and

(j) Such other information respecting the business or properties or the condition or operations, financial or otherwise, of the Borrower as any Lender may from time to time reasonably request.

7.2 Loan Proceeds. The Borrower shall use the proceeds of the Advances only for the purpose of general working capital, acquisitions not prohibited hereby and capital expenditures; provided, however, that the Borrower may use proceeds of the Advances to repurchase its

outstanding capital stock so long as it does not make aggregate purchases with such proceeds exceeding \$6,000,000.

7.3 Maintenance of Business and Properties; Insurance.

(a) The Borrower will continue to engage in business of the same general nature as the business currently engaged in by the Borrower. The Borrower will at all times maintain, preserve and protect all material franchises and trade names and preserve all the Borrower's material tangible property used or useful in the conduct of its business and keep the same in good repair, working order and condition, ordinary wear and tear excepted, and from time to time make all needful and proper repairs, renewals, replacements, betterments, and improvements thereto so that the business carried on in connection therewith may be conducted properly and advantageously at all times; provided that nothing in this Section 7.3 shall prevent the Borrower from discontinuing the operation and maintenance of any of its properties or any of those of its Subsidiaries (including the voluntary liquidation and dissolution of a Subsidiary other than a Material Subsidiary) if such discontinuance is, in the judgment of the Borrower, desirable in the conduct of its or their business and does not materially adversely affect the business of the Borrower and its Subsidiaries on a combined basis.

(b) The Borrower will keep all of its insurable properties now or hereafter owned adequately insured at all times against loss or damage by fire or other casualty to the extent customary with respect to like properties of companies conducting similar businesses and to the extent available at commercially reasonable rates; and will maintain public liability and workmen's compensation insurance insuring the Borrower to the extent customary with respect to companies conducting similar businesses and to the extent available at commercially reasonable rates, all by financially sound and reputable insurers. The Borrower shall furnish to the Agent from time to time at the Agent's request copies of all such insurance policies and certificates evidencing such insurance coverage. Notwithstanding the foregoing, the Borrower may self-insure workmen's compensation to the extent permitted by law and may also self-insure other risks to the extent reasonably deemed prudent by the Borrower.

7.4 Payment of Taxes. The Borrower shall pay and discharge, or cause to be paid and discharged, all material taxes, assessments, and governmental charges or levies imposed upon the Borrower and its Subsidiaries or their income or profits, or upon any other properties belonging to the Borrower prior to the date on which penalties attach thereto, and all lawful claims that, if unpaid, might become a lien or charge upon any material properties of the Borrower, except for such taxes, assessments, charges, levies or claims as are being contested by the Borrower in good faith by appropriate proceedings promptly initiated and diligently prosecuted, for which adequate book reserves have been established in accordance with generally accepted accounting principles, as to which no foreclosure, distraint, sale or other similar proceedings shall have been commenced, or, if commenced, have been effectively stayed.

7.5 Compliance with Laws, etc. The Borrower shall comply with the requirements of all applicable laws, rules, regulations and orders of any governmental authority, and obtain or maintain all Licenses required under applicable law or regulation for the operation of the Borrower's business, where noncompliance or failure to obtain or maintain would have a material adverse effect on the consolidated financial condition, assets, or results of operations of

the Borrower and its Subsidiaries taken as a whole; provided, however, that such compliance or the obtaining of such Licenses may be delayed while the applicability or validity of any such law, rule, regulation or order or the necessity for obtaining any such License is being contested by the Borrower in good faith by appropriate proceedings promptly initiated and diligently prosecuted.

7.6 Books, Records and Accounts. The Borrower shall keep true and correct books, records and accounts, in which entries will be made in accordance with generally accepted accounting principles consistently applied, and that shall comply with the requirements of the Foreign Corrupt Practices Act of 1977 to the extent applicable to the Borrower. Each Lender or its representatives shall upon reasonable notice to the Borrower be afforded, during normal business hours, access to and the right to examine and copy any such books, records and accounts and the right to inspect the Borrower's premises and business operations. All financial and other information with respect to the Borrower and/or any of its Subsidiaries now or hereafter obtained by any Lender under this Agreement or otherwise in connection with any of the transactions contemplated hereunder shall be held in confidence and shall not be released or made available to any other Person, except (i) to governmental agencies (and examiners employed by same) having oversight over the affairs of such Lender, (ii) pursuant to subpoena or similar process issued by a court or governmental agency of competent jurisdiction, or (iii) as otherwise directed by order of any court or governmental agency of competent jurisdiction.

7.7 Further Assurances. The Borrower shall execute and deliver, at the Borrower's expense, all notices and other instruments and documents and take all actions, including, but not limited to, making all filings and recordings, that any Lender shall reasonably request in order to assure to the Lenders all rights given to the Lenders hereby or under any other Loan Document.

7.8 Bank Accounts. The Borrower shall maintain its principal operating accounts with the Agent.

7.9 Guaranties. The Borrower shall cause any Subsidiary that becomes a Material Subsidiary promptly thereafter to execute and deliver a Guaranty to the Agent.

ARTICLE VIII.
NEGATIVE COVENANTS OF THE BORROWER

The Borrower covenants and agrees that from the date of execution of this Agreement and until the payment in full of the principal of and interest upon the Notes and payment and performance of all other Obligations, unless the Required Lenders shall otherwise consent in writing, the Borrower will not, and will not cause or permit any of its Subsidiaries to:

8.1 Sale of Assets; Mergers, Etc.

(a) Sale of Assets. Except for sales in the ordinary course of business, sell, transfer, or otherwise dispose of, to any Person any assets (including the securities of any Subsidiary) other than assets having an aggregate fair market value less than five percent (5%) of Borrower's Consolidated Tangible Net Worth.

(b) Mergers, Etc. Consolidate with or merge into any other Person or permit any other Person to consolidate with or merge into it, or acquire all or substantially all of the capital stock or assets of any Person, or sell, assign, lease or otherwise dispose of (whether in one transaction or in a series of transactions) all or substantially all of its assets to any Person, except that

(1) a Subsidiary may consolidate with or merge into, or sell, assign, lease or otherwise dispose of any or all of its assets to, the Borrower or another Subsidiary; and

(2) the Borrower or any of its Subsidiaries may acquire all or substantially all of the capital stock or assets of any Person or consolidate or merge with any Person provided (i) such Person is engaged in a line of business substantially similar to one or more of Borrower's existing lines of business, (ii) the aggregate purchase price liability incurred between the date hereof and the Revolver Termination Date, including all contingent liabilities, when aggregated with all such acquisitions and any Investments permitted under Section 8.6(3) during such period shall not exceed \$20,000,000, and if 80% or more of the purchase price is paid in capital stock of the Borrower, 20% of Consolidated Tangible Net Worth as of the end of the most recent fiscal quarter, (iii) based on a pro forma calculation of the ratios set forth in Sections 8.9 - 8.11 as of the date such acquisition is closed, assuming consolidation of the acquired business with the Borrower for the four full fiscal quarters ended immediately preceding such closing and pro forma debt and debt service payments based on scheduled principal payments, including acquisition borrowings, if any, and pro forma interest on total debt at then prevailing borrowing rates, Borrower is in compliance with the financial covenants set forth in Sections 8.9 - 8.11, and (iv) all contingent liability and contingent payment obligations incurred by Borrower or any of its Subsidiaries in connection with such transaction shall be reasonably acceptable to the Agent.

8.2 Liens and Encumbrances.

(a) Create incur, assume or permit to exist any of its real or personal property, whether now owned or subsequently acquired, to be subject to any Lien other than Liens described below (which may herein be referred to as "Permitted Liens"):

(1) Liens securing the payment of taxes, assessments or governmental charges or levies or the demands of suppliers, mechanics, carriers, warehousemen, landlords and other like Persons, which payments are not yet due and payable or (as to taxes) may be paid without interest or penalty; provided, that, if such payments are due and payable, such Liens shall be permitted hereunder only to the extent that (A) all claims that the Liens secure are being actively contested in good faith and by appropriate proceedings, (B) adequate book reserves have been established with respect thereto to the extent required by generally accepted accounting principles, and (C) such Liens do not in the aggregate materially

interfere with the owning company's use of property necessary or material to the conduct of the business of the Borrower and its Subsidiaries taken as a whole;

(2) Liens incurred or deposits made in the ordinary course of business (A) in connection with worker's compensation, unemployment insurance, social security and other like laws, or (B) to secure the performance of letters of credit, bids, tenders, sales contracts, leases, statutory obligations, surety, appeal and performance bonds and other similar obligations, in each case not incurred in connection with the borrowing of money, the obtaining of advances or the payment of the deferred purchase price of property;

(3) Liens not otherwise described in Section 8.2(a)(1) or (2) that are incurred in the ordinary course of business and are incidental to the conduct of its business or ownership of its property, were not incurred in connection with the borrowing of money, the obtaining of advances or the payment of the deferred purchase price of property and do not in the aggregate materially detract from the value of, or materially interfere with the owning company's use of, property necessary or material to the conduct of the business of the Borrower and its Subsidiaries taken as a whole;

(4) Liens in favor of the Agent for the benefit of the Lenders;

(5) Judgment liens or attachments that shall not have been in existence for a period longer than 30 days after the creation thereof, or if a stay of execution shall have been obtained, for a period longer than 30 days after the expiration of such stay or if such an attachment is being actively contested in good faith and by appropriate proceedings, for a period longer than 30 days after the creation thereof;

(6) Liens existing as of the Closing Date and disclosed on the Disclosure Schedule hereto;

(7) Liens provided for in equipment or Financing Leases (including financing statements and undertakings to file financing statements) provided that they are limited to the equipment subject to such leases and the proceeds thereof;

(8) Leases or subleases with third parties or licenses and sublicenses granted to third parties not interfering in any material respect with the business of the Borrower or any Subsidiary of the Borrower;

(9) Any Lien on any asset of any corporation existing at the time such corporation is merged into or consolidated with (or acquired in accordance with Section 8.1(b) by) the Borrower or a Subsidiary of the Borrower and not created in contemplation of such event;

(10) Any Lien existing on any asset prior to the acquisition thereof by the Borrower or any Subsidiary of the Borrower and not created in contemplation of such event;

(11) Liens in respect of any purchase money obligations for tangible property used in its business, which obligations shall not at any time exceed 5% of Consolidated Tangible Net Worth, provided that any such encumbrances shall not extend to property and assets of the Borrower or any Subsidiary not financed by such a purchase money obligation;

(12) Easements, rights of way, restrictions and other similar charges or Liens relating to real property and not interfering in a material way with the ordinary conduct of its business;

(13) Liens on its property or assets created in connection with the refinancing of Indebtedness secured by Permitted Liens on such property, provided that the amount of Indebtedness secured by any such Lien shall not be increased as a result of such refinancing and no such Lien shall extend to property and assets of the Borrower or any Subsidiary not encumbered prior to any such refinancing; and

(14) Cash collateral not to exceed 497,463 Pounds Sterling delivered to Chase with respect to Borrower's Letters of Credit issued by Chase for account party MKS Instruments UK Limited in an aggregate amount not exceeding 497,463 Pounds Sterling, provided the outstanding debt under the Existing Loan Agreement is paid in full prior to the provision of such collateral.

(b) In case any property is subjected to a Lien in violation of Section 8.2(a), the Borrower will make or cause to be made provision whereby the Notes will be secured equally and ratably with all other obligations secured by such property, and in any case the Notes shall have the benefit, to the full extent that the holders may be entitled thereto under applicable law, of an equitable Lien equally and ratably securing the Notes. Such violation of Section 8.2(a) shall constitute an Event of Default hereunder, whether or not any such provision is made pursuant to this Section 8.2(b).

(c) Neither the Borrower nor any Subsidiary will agree with any third party not to cause or permit any of its real or personal property, whether now owned or subsequently acquired, to be subject to Liens (with or without exceptions).

(d) (i) Cause or permit or (ii) agree or consent to cause or permit in the future (upon the happening of a contingency or otherwise), any of its equity interests in any Subsidiary to be subject to any Lien (including any Permitted Lien).

8.3 Sales and Leasebacks. Sell or transfer any of their property and become, directly or indirectly, liable as the lessee under a lease of such property (other than such transactions between the Subsidiaries and transfers of capital equipment that will be leased pursuant to Financing Leases).

8.4 Indebtedness. Create, incur or assume any Indebtedness other than:

(1) Indebtedness to the Lenders pursuant to this Agreement and the Existing Loan Agreement;

(2) Financing Lease Obligations, not to exceed \$10,000,000 in the aggregate at any one time outstanding;

(3) Endorsements for collection, deposit or negotiation and warranties of products or services, in each case incurred in the ordinary course of business;

(4) Subordinated Debt;

(5) Indebtedness of the Borrower owing to Subsidiaries not otherwise permitted by this Section 8.4 in an aggregate principal amount at any time outstanding not to exceed \$5,000,000;

(6) Indebtedness of Subsidiaries owing to the Borrower not otherwise permitted by this Section 8.4 in an aggregate principal amount at any time outstanding not to exceed \$5,000,000;

(7) Indebtedness of any wholly-owned Subsidiary owing to any other wholly-owned Subsidiary;

(8) Guarantees by Material Subsidiaries of the Obligations;

(9) Indebtedness with respect to Investments permitted by Section 8.6(3) so long as such entities remain Subsidiaries or Affiliates of the Borrower; and

(10) Indebtedness not included above and listed on the Disclosure Schedule.

8.5 Dividends and Distributions. Declare or pay, directly or indirectly, any dividend (other than a dividend payable solely in the Common Stock of the Borrower) or make any other distribution (by reduction of capital or otherwise), whether in cash, property, securities or a combination thereof, with respect to any shares of its capital stock or, directly or indirectly, except to the extent permitted by Section 7.2 hereof, redeem, purchase, retire or otherwise acquire for value any shares of any class of its capital stock or set aside any amount for any such purpose; provided, however, that any Subsidiary of the Borrower may declare and pay dividends or make other distributions to the Borrower.

8.6 Investments. Except as permitted by Section 8.1, make or maintain any investments, made in cash or by delivery of property or assets, (a) in any Person, whether by acquisition of capital stock, Indebtedness, or other obligations or securities, or by loan or capital contribution, or otherwise, or (b) in any property, whether real or personal, (items (a) and (b) being herein called "Investments") except the following (but only with funds other than proceeds of Advances):

(1) Investments in direct obligations of, or guaranteed by, the United States government, its agencies or any public instrumentality thereof and backed by the full faith and credit of the United States government with maturities not to

exceed (or an unconditional right to compel purchase within) three years from the date of acquisition;

(2) Repurchase agreements collateralized by securities of the U.S. Government and U.S. Government-sponsored securities;

(3) Investments in or to any Subsidiary or other Affiliate, provided Borrower remains in compliance with Section 8.1(b);

(4) Investments and obligations issued by the United States government, any agency thereof, any state of the United States or any political subdivision of any such state or any public instrumentality thereof with maturities not to exceed (or an unconditional right to compel purchase within) three years from the date of acquisition that are rated AA- or higher by at least one nationally recognized rating agency;

(5) Investments and obligations issued by any company (other than a bank) with maturities not to exceed three years from the date of acquisition with a long-term debt rating of A or higher or a short-term debt rating of A1 or P1 by at least one nationally recognized rating agency;

(6) Investments in demand and time deposits with, Eurodollar deposits with, certificates of deposit issued by, or obligations or securities fully backed by letters of credit issued by (x) any bank organized under the laws of the United States, any state thereof, the District of Columbia or Canada having combined capital and surplus aggregating at least \$500,000,000, or (y) any other bank organized under the laws of a state that is a member of the European Economic Community (or any political subdivision thereof), Japan, the Cayman Islands, or British West Indies having as of any date of determination combined capital and surplus of not less than \$500,000,000 or the equivalent thereof (determined in accordance with generally accepted accounting principles);

(7) Shares of money market mutual funds registered under the Investment Company Act of 1940, as amended;

(8) Foreign currency swaps and hedging arrangements entered into in the ordinary course of business to protect against currency losses, and interest rate swaps and caps entered into in the ordinary course of business to protect against interest rate exposure on Indebtedness bearing interest at a variable rate;

(9) Investments in mutual funds (other than money market mutual funds and short term bond funds with individual maturities under three years and aggregate ratings of A- or A3 or higher by at least one nationally recognized rating agency) that in the aggregate shall not exceed \$5,000,000;

(10) Investments in the form of advances to employees in the ordinary course of business for moving, entertainment, travel and other similar expenses, but not more than \$1,000,000 in the aggregate outstanding at any time; and

(11) Other Investments existing on the Closing Date and listed on the Disclosure Schedule.

8.7 Transactions with Affiliates. Enter into any transaction (including the purchase, sale or exchange of property or the rendering of any service) with any Affiliate except upon fair and reasonable terms that are at least as favorable to the Borrower or the Subsidiary as would be obtained in a comparable arm's-length transaction with a non-Affiliate.

8.8 ERISA Compliance. Permit any employee pension benefit plan (as such term is defined in Section 3 of ERISA) maintained by the Borrower or any of its Subsidiaries or in which employees of the Borrower or any of its Subsidiaries is entitled to participate to:

- (a) engage in any "prohibited transaction" as such term is defined in Section 4975 of the Internal Revenue Code of 1986, as amended, or described in Section 406 of ERISA;
- (b) incur any "accumulated funding deficiency" as such term is defined in Section 302 of ERISA, whether or not waived; or
- (c) terminate under circumstances that could result in the imposition of a Lien on the property of the Borrower or any Subsidiary of the Borrower pursuant to Section 4068 of ERISA.

8.9 Tangible Net Worth Test. Permit the Consolidated Tangible Net Worth as of the end of each fiscal quarter of the Borrower to be less than the sum of (i) \$292,000,000, plus (ii) 80% of Consolidated Net Income (excluding losses), plus (iii) the net proceeds of any equity securities sold by the Borrower after June 30, 2001, for each consecutive fiscal quarter of the Borrower beginning with the quarter ending September 30, 2001, on a cumulative basis.

8.10 Total Liabilities-to-Tangible Net Worth Ratio. Permit the ratio ("Total Liabilities-to-Tangible Net Worth Ratio") of the Consolidated Total Liabilities as of the end of each fiscal quarter of the Borrower beginning with the fiscal quarter ending September 30, 2001 to its Consolidated Tangible Net Worth as of the end of each fiscal quarter of the Borrower beginning with the fiscal quarter ending September 30, 2001 to exceed 1 to 1.

8.11 Quick Ratio. Permit the ratio (the "Quick Ratio") of (i) Consolidated Quick Assets to (ii) Consolidated Current Liabilities to be less than 2.25 to 1.00.

8.12 Capital Expenditures. Make capital expenditures that in the aggregate and on a consolidated basis exceed during each fiscal quarter of the Borrower the sum of \$7,000,000 plus the amount by which such expenditures during the immediately preceding quarter, beginning with the quarter ended September 30, 2001, were less than \$7,000,000.

8.13 Contracts Prohibiting Compliance with Agreement. Enter into any contract or other agreement that would prohibit or in any way restrict the ability of the Borrower to comply with any provision of this Agreement.

ARTICLE IX.
EVENTS OF DEFAULT

9.1 Default. If any one of the following events ("Events of Default") shall occur:

(a) Any representation or warranty made by the Borrower herein or in any other Loan Document, or in any certificate or report furnished by the Borrower hereunder or thereunder, shall prove to have been incorrect in any material respect when made;

(b) Payment of any principal or interest due under any Note shall not be made on or before the date due;

(c) A final judgment or settlement for in excess of \$3,000,000 shall be rendered against or agreed to by the Borrower or any of its Subsidiaries for the payment of money that, after deducting the amount of any insurance proceeds paid or payable to or on behalf of the Borrower or its Subsidiary in connection with such judgment or settlement, as the case may be, is in excess of \$3,000,000, and such judgment shall remain undischarged for a period of thirty (30) days, during which period execution shall not effectively be stayed, or such settlement shall remain unpaid for a period of thirty days after the agreed payment date unless such delay has been agreed to by the other party. If a dispute exists with respect to the liability of any insurance underwriter under any insurance policy of the Borrower or its Subsidiary, no deduction under this subsection shall be made for the insurance proceeds that are the subject of such dispute;

(d) The Borrower or any Subsidiary (except to the extent explicitly permitted by this Agreement), shall (1) voluntarily terminate operations or apply for or consent to the appointment of, or the taking of possession by, a receiver, custodian, trustee or liquidator of such Person or of all or a substantial part of the assets of such Person, (2) admit in writing its inability, or be generally unable, to pay its debts as the debts become due, (3) make a general assignment for the benefit of its creditors, (4) commence a voluntary case under the Federal Bankruptcy Code (as now or hereafter in effect), (5) file a petition seeking to take advantage of any other law relating to bankruptcy, insolvency, reorganization, winding-up, or composition or adjustment of debts, (6) fail to controvert in a timely and appropriate manner, or acquiesce in writing to, any petition filed against it in an involuntary case under the Federal Bankruptcy Code or applicable state bankruptcy laws or (7) take any corporate action for the purpose of effecting any of the foregoing;

(e) Without its application, approval or consent, a proceeding shall be commenced, in any court of competent jurisdiction, seeking in respect of the Borrower or any domestic Subsidiary: the liquidation, reorganization, dissolution, winding-up, or composition or readjustment of debt, the appointment of a trustee, receiver, liquidator or the like of such Person or of all or any substantial part of the assets of such Person, or other like relief in respect of such Person under any law relating to bankruptcy, insolvency, reorganization, winding-up, or composition or adjustment of debts; and, if the proceeding is being contested in good faith by such Person, the same shall continue undismissed, or unstayed and in effect for any period of 45 consecutive days, or an order for relief against such Person shall be entered in any case under the Bankruptcy Code or applicable state bankruptcy laws;

(f) Any foreclosure or other proceedings shall be commenced to enforce, execute or realize upon any lien, encumbrance, attachment, trustee process, mortgage or security interest for payment of an amount in excess of \$500,000 against the Borrower or any Subsidiary;

(g) Default shall be made in the due observance or performance of any covenant or agreement under Article VIII;

(h) Default shall be made in the due observance or performance of any covenant or agreement contained herein (and not constituting an Event of Default under any other clause in this Article IX) or in any other Loan Document or in any other agreement between any Lender and the Borrower evidencing or securing borrowed monies and such default shall continue and shall not have been remedied within thirty days after the date on which such default occurred;

(i) There shall occur any default under any instrument or agreement evidencing any indebtedness for money borrowed in excess of \$100,000 by the Borrower or any of its Subsidiaries;

(j) There shall occur a Change in Control;

(k) There shall occur any material adverse change in the financial condition of the Borrower;

(l) There shall occur any Event of Default under the Existing Loan Agreement;

then, and in any such event and at any time thereafter, if such Event of Default or any other Event of Default shall have not been waived, any or all of the following actions may be taken: (i) the Agent (A) with the consent of the Required Lenders, may, and at the direction of the Required Lenders shall, declare any obligation of the Lenders to make further Advances terminated, whereupon the obligation of each Lender to make further Advances hereunder shall terminate immediately, and (B) the Agent shall at the direction of the Required Lenders, at their option, declare by notice to the Borrower any or all of the Obligations to be immediately due and payable, and the same, including all interest accrued thereon and all other obligations of the Borrower to the Agent and the Lenders, shall forthwith become immediately due and payable without presentment, demand, protest, notice or other formality of any kind, all of which are hereby expressly waived, anything contained herein or in any instrument evidencing the Obligations to the contrary notwithstanding; provided, however, that notwithstanding the above, if there shall occur an Event of Default under clause (d) or (e) above, then the obligation of the Lenders to make Advances shall automatically terminate and any and all of the Obligations shall be immediately due and payable without the necessity of any action by the Agent or the Required Lenders or notice to the Agent or the Lenders; and (ii) the Agent and each of the Lenders shall have all of the rights and remedies available under each of the Loan Documents or under any applicable law.

9.2 Agent to Act. In case any one or more Events of Default shall occur and not have been waived, the Agent may, and at the direction of the Required Lenders shall, proceed to protect and enforce their rights or remedies either by suit in equity or by action at law, or both,

whether for the specific performance of any covenant, agreement or other provision contained herein or in any other Loan Document, or to enforce the payment of the Obligations or any other legal or equitable right or remedy.

9.3 Cumulative Rights. No right or remedy herein conferred upon the Lenders or the Agent is intended to be exclusive of any other rights or remedies contained herein or in any other Loan Document, and every such right or remedy shall be cumulative and shall be in addition to every other such right or remedy contained herein and therein or now or hereafter existing at law or in equity or by statute, or otherwise.

9.4 No Waiver. No course of dealing between the Borrower and any Lender or the Agent or any failure or delay on the part of any Lender or the Agent in exercising any rights or remedies under any Loan Document or otherwise available to it shall operate as a waiver of any rights or remedies and no single or partial exercise of any rights or remedies shall operate as a waiver or preclude the exercise of any other rights or remedies hereunder or of the same right or remedy on a future occasion.

9.5 Allocation of Proceeds. If an Event of Default has occurred and not been waived, and the maturity of the Notes has been accelerated pursuant to this Article IX, all payments received by the Agent hereunder, in respect of any principal of or interest on the Obligations or any other amounts payable by the Borrower hereunder, shall be applied by the Agent in the following order:

(a) amounts due to the Lenders pursuant to Sections 2.6 and 11.4;

(b) amounts due to the Agent pursuant to Section 10.10 and to the Arranger pursuant to Section 2.1.3;

(c) payments of interest on the Notes to be applied for the ratable benefit of the Lenders;

(d) payments of principal of the Notes to be applied for the ratable benefit of the Lenders;

(e) payments of all other amounts due under any of the Loan Documents, if any, to be applied for the ratable benefit of the Lenders; and

(f) any surplus remaining after application as provided for herein, to the Borrower or otherwise as may be required by applicable law.

ARTICLE X.
THE AGENT

10.1 Appointment. Each Lender hereby irrevocably designates and appoints Fleet as the Agent for the Lenders under this Agreement, and each of the Lenders hereby irrevocably authorizes Fleet as the Agent for such Lender, to take such action on its behalf under the provisions of this Agreement and the other Loan Documents and to exercise such powers as are expressly delegated to the Agent by the terms of this Agreement and such other Loan

Documents, together with such other powers as are reasonably incidental thereto. The Agent shall not have any duties or responsibilities, except those expressly set forth herein, or any fiduciary relationship with any of the Lenders, and no implied covenants, functions, responsibilities, duties, obligations or liabilities shall be read into this Agreement or any other Loan Document or otherwise exist against the Agent.

10.2 Limitation on Liability. Neither the Agent nor any of its officers, directors, employees, agents or attorneys-in-fact shall be liable to the Lenders for any action lawfully taken or omitted to be taken by it or them under or in connection with the Loan Documents except for its or their own gross negligence or willful misconduct. Neither the Agent nor any of its affiliates shall be responsible in any manner to any of the Lenders for any recitals, statements, representations or warranties made by the Borrower or any officer or representative thereof contained in any Loan Document, or in any certificate, report, statement or other document referred to or provided for in or received by the Agent under or in connection with any Loan Document, or for the value, validity, effectiveness, genuineness, enforceability or sufficiency of any Loan Document, or for any failure of the Borrower to perform its obligations under any Loan Document, or for any recitals, statements, representations or warranties made, or for the value, validity, effectiveness, genuineness, enforceability or sufficiency of any collateral. The Agent shall not be under any obligation to any of the Lenders to ascertain or to inquire as to the observance or performance of any of the terms, covenants or conditions of any Loan Document on the part of the Borrower or to inspect the properties, books or records of the Borrower or its Subsidiaries.

10.3 Reliance. The Agent shall be entitled to rely, and shall be fully protected in relying, upon any Note, writing, resolution, notice, consent certificate, affidavit, letter, cablegram, telegram, telefacsimile or telex message, statement, order or other document or conversation reasonably believed by it to be genuine and correct and to have been signed, sent or made by the proper Person or Persons and upon advice and statements of legal counsel (including, without limitation, counsel to the Borrower), independent accountants and other experts selected by the Agent. The Agent may deem and treat the payee of any Note as the owner thereof for all purposes unless an Assignment and Acceptance shall have been filed with and accepted by the Agent. The Agent shall be fully justified in failing or refusing to take any action under this Agreement unless it shall first receive advice or concurrence of the Lenders or the Required Lenders as provided in this Agreement or it shall first be indemnified to its satisfaction by the Lenders against any and all liability and expense that may be incurred by it by reason of taking or continuing to take any such action. The Agent shall in all cases be fully protected in acting, or in refraining from acting, under the Loan Documents in accordance with a request of the Required Lenders, and such request and any action taken or failure to act pursuant thereto shall be binding upon all the Lenders and all present and future holders of the Notes.

10.4 Notice of Default. The Agent shall not be deemed to have knowledge or notice of the occurrence of any Default or Event of Default hereunder unless the Agent has received notice from a Lender or the Borrower referring to this Agreement, describing such Default or Event of Default and stating that such notice is a "notice of default". In the event that the Agent receives such a notice, the Agent shall promptly give notice thereof to the Lenders. The Agent shall take such action with respect to such Default or Event of Default as shall be reasonably directed by the Required Lenders; provided that, unless and until the Agent shall have received such

directions, the Agent may (but shall not be obligated to) take such action, or refrain from taking such action, with respect to such Event of Default as it shall deem advisable in the best interests of the Lenders.

10.5 No Representations. Each Lender expressly acknowledges that neither the Agent nor any of its affiliates has made any representations or warranties to it and that no act by the Agent hereafter taken, including any review of the affairs of the Borrower or its Subsidiaries, shall be deemed to constitute any representation or warranty by the Agent to any Lender. Each Lender represents to the Agent that it has, independently and without reliance upon the Agent or any other Lender, and based on such documents and information as it has deemed appropriate, made its own appraisal of and investigation into the financial condition, creditworthiness, affairs, status and nature of the Borrower and made its own decision to enter into this Agreement. Each Lender also represents that it will, independently and without reliance upon the Agent or any other Lender, and based on such documents and information as it shall deem appropriate at the time, continue to make its own credit analysis, appraisals and decisions in taking or not taking action under the Loan Documents and to make such investigation as it deems necessary to inform itself as to the status and affairs, financial or otherwise, of the Borrower or its Subsidiaries. Except for notices, reports and other documents expressly required to be furnished to the Lenders by the Agent hereunder, the Agent shall not have any duty or responsibility to provide any Lender with any credit or other information concerning the affairs, financial condition or business of the Borrower or its Subsidiaries which may come into the possession of the Agent or any of its Affiliates.

10.6 Indemnification. Each of the Lenders agrees to indemnify the Agent in its capacity as such (to the extent not reimbursed by the Borrower and without limiting any obligations of the Borrower to do so), ratably according to the respective principal amount of the Notes held by them (or, if no Notes are outstanding, ratably in accordance with their respective Applicable Commitment Percentages as then in effect) from and against any and all liabilities, obligations, losses (excluding any losses suffered by the Agent as a result of Borrower's failure to pay any fee owing to the Agent), damages, penalties, actions, judgments, suits, costs, expenses or disbursements of any kind or nature whatsoever that may at any time (including without limitation at any time following the payment of the Notes) be imposed on, incurred by or asserted against the Agent in any way relating to or arising out of any Loan Document or any other Document contemplated by or referred to therein or the transactions contemplated thereby or any action taken or omitted by the Agent under or in connection with any of the foregoing; provided that no Lender shall be liable for the payment of any portion of such liabilities, obligations, losses, damages, penalties, actions, judgments, suits, costs, expenses or disbursements resulting from the Agent's gross negligence or willful misconduct. The agreements in this subsection shall survive the payment of the Obligations and the termination of this Agreement.

10.7 The Agent in its Individual Capacity. With respect to its Advances made or renewed by it and any Note issued to it, the Agent shall have the same rights and powers under this Agreement as any Lender and may exercise the same as though it were not the Agent, and the terms "Lender" and "Lenders" shall, unless the context otherwise indicates, include the Agent in its individual capacity. The Agent and its Affiliates may make loans to, accept deposits from and generally engage in any kind of business with the Borrower as though the Agent were

not the Agent hereunder. The Agent may apply any amount obtained by it through exercise of a right of banker's lien, set-off, counterclaim or otherwise to satisfaction of any obligations owed it by the Borrower whether under this Agreement or the Existing Loan Agreement and shall have the right to determine the order in which amounts are applied to such obligations.

10.8 Resignation. If the Agent shall resign as Agent under this Agreement, then the Required Lenders may appoint, with the consent, so long as there shall not have occurred and be continuing a Default or Event of Default, of the Borrower, which consent shall not be unreasonably withheld, a successor Agent for the Lenders, which successor Agent shall be a commercial bank organized under the laws of the United States or any state thereof, having a combined surplus and capital of not less than \$500,000,000, whereupon such successor Agent shall succeed to the rights, powers and duties of the former Agent and the obligations of the former Agent shall be terminated and canceled, without any other or further act or deed on the part of such former Agent or any of the parties to this Agreement; provided, however, that the former Agent's resignation shall not become effective until such successor Agent has been appointed and has succeeded of record to all right, title and interest in any collateral held by the Agent; provided, further, that if the Required Lenders and, if applicable, the Borrower cannot agree as to a successor Agent within ninety (90) days after such resignation, the Agent shall appoint a successor Agent that satisfies the criteria set forth above in this Section 10.8 for a successor Agent and the parties hereto agree to execute whatever documents are necessary to effect such action under this Agreement or any other Document executed pursuant to this Agreement; provided, however, that in such event all provisions of the Loan Documents, shall remain in full force and effect. After any retiring Agent's resignation hereunder as Agent, the provisions of this Article X shall inure to its benefit as to any actions taken or omitted to be taken by it while it was Agent under this Agreement.

10.9 Sharing of Payments, Etc. Each Lender agrees that if it shall, through the exercise of a right of banker's lien, set-off, counterclaim or otherwise, obtain payment with respect to its Obligations (other than pursuant to Article VI) that results in its receiving more than its pro rata share of the aggregate payments with respect to all of the Obligations (other than any payment pursuant to Section 4.2 or 4.3), then (a) such Lender shall be deemed to have simultaneously purchased from the other Lenders a share in their Obligations so that the amount of the Obligations held by each of the Lenders shall be pro rata and (b) such other adjustments shall be made from time to time as shall be equitable to insure that the Lenders share such payments ratably; provided, however, that for purposes of this Section 10.9, the term "pro rata" shall be determined with respect to the Commitment after subtraction of amounts, if any, by which any such Lender has not funded its share of the outstanding Advances and Obligations. If all or any portion of any such excess payment is thereafter recovered from the Lender that received the same, the purchase provided in this Section 10.9 shall be rescinded to the extent of such recovery, without interest. The Borrower expressly consents to the foregoing arrangements and agrees that each Lender so purchasing a portion of the other Lenders' Obligations may exercise all rights of payment (including, without limitation, all rights of set-off, banker's lien or counterclaim) with respect to such portion as fully as if such Lender were the direct holder of such portion.

10.10 Fees. The Borrower agrees to pay to the Agent, for its individual account, an annual Agent's fee as from time to time agreed to by the Borrower and Agent in writing.

ARTICLE XI.
MISCELLANEOUS

11.1 Assignments and Participations. (a) At any time after the Closing Date each Lender may, with the prior consent of the Borrower (so long as no Event of Default has occurred and is continuing) and the Agent, which consents shall not be unreasonably withheld, assign to one or more banks or financial institutions all or a portion of its rights and obligations under the Loan Documents (including, without limitation, all or a portion of any Note payable to its order); provided, that (i) each such assignment shall be of a constant and not a varying percentage of all of the assigning Lender's rights and obligations hereunder, (ii) for each assignment involving the issuance and transfer of a Note, the assigning Lender shall execute an Assignment and Acceptance and the Borrower hereby agrees to execute a replacement Note to give effect to the assignment, (iii) the minimum aggregate amount of a Commitment that shall be assigned is \$1,000,000, (iv) such assignee shall have an office located in the United States, (v) the assigning Lender shall pay the Agent a transaction fee of \$2500, and (vi) no consent of the Borrower or the Agent shall be required in connection with any assignment by a Lender to another Lender or to an Affiliate of any Lender. Upon such execution, delivery, approval and acceptance, from and after the effective date specified in each Assignment and Acceptance, (x) the assignee thereunder shall be a party hereto and, to the extent that rights and obligations hereunder or under any such Note have been assigned or negotiated to it pursuant to such Assignment and Acceptance, have the rights and obligations of a Lender hereunder and a holder of such Note and (y) the assignor thereunder shall, to the extent that rights and obligations hereunder or under such Note have been assigned or negotiated by it pursuant to such Assignment and Acceptance, relinquish its rights and be released from its obligations under this Agreement.

(b) By executing and delivering an Assignment and Acceptance, the Lender assignor thereunder and the assignee thereunder confirm to and agree with each other and the other parties hereto as follows: (i) the assignment made under such Assignment and Acceptance is made under such Assignment and Acceptance without recourse; (ii) such assigning Lender makes no representation or warranty and assumes no responsibility with respect to the financial condition of the Borrower or its Subsidiaries or the performance or observance by the Borrower of any of its obligations under any Loan Document or any other instrument or Document furnished pursuant hereto; (iii) such assignee confirms that it has received a copy of this Agreement, together with copies of the financial statements delivered pursuant to Section 5.5 or Section 7.1, as the case may be, and such other Loan Documents and other documents and information as it has deemed appropriate to make its own credit analysis and decision to enter into such Assignment and Acceptance; (iv) such assignee will, independently and without reliance upon the Agent, such assigning Lender or any other Lender and based on such documents and information as it shall deem appropriate at the time, continue to make its own credit decisions in taking or not taking action under any Loan Document; (v) such assignee appoints and authorizes the Agent to take such action as agent on its behalf and to exercise such powers under the Loan Documents as are delegated to the Agent by the terms hereof and thereof, together with such powers as are reasonably incidental thereto; and (vi) such assignee agrees that it will perform in accordance with their terms all of the obligations that by the terms of the Loan Documents are required to be performed by it as a Lender and a holder of a Note.

(c) The Agent shall maintain at its address referred to herein a copy of each Assignment and Acceptance delivered to and accepted by it.

(d) Upon its receipt of an Assignment and Acceptance executed by an assigning Lender, the Agent shall give prompt notice thereof to Borrower.

(e) Nothing herein shall prohibit any Lender from pledging or assigning, without notice to or consent of the Borrower, any Note to any Federal Reserve Bank in accordance with applicable law.

(f) Each Lender may sell participations at its expense to one or more banks or other entities as to all or a portion of its rights and obligations under this Agreement; provided, that (i) such Lender's obligations under this Agreement shall remain unchanged, (ii) such Lender shall remain solely responsible to the other parties hereto for the performance of such obligations, (iii) such Lender shall remain the holder of any Note issued to it for the purpose of this Agreement, (iv) the Borrower, the Agent and the other Lenders shall continue to deal solely and directly with such Lender in connection with such Lender's rights and obligations under this Agreement and with regard to any and all payments to be made under this Agreement and (v) the sale of any such participations that require Borrower to file a registration statement with the Securities and Exchange Commission or under the securities regulations or laws of any state shall not be permitted.

(g) The Borrower may not assign any rights, powers, duties or obligations under this Agreement or the other Loan Documents without the prior written consent of all the Lenders.

11.2 Survival of Representations, Etc. All representations, warranties and covenants made herein or in any Loan Document shall survive the making of any Advance hereunder and the delivery of the Notes and the consummation of all other transactions contemplated hereby or thereby.

11.3 Right of Setoff. In addition to any rights now or hereafter granted under applicable law or otherwise and not by way of limitation of any such rights, upon the occurrence and during the unremedied continuation of an Event of Default, the Agent and each Lender is hereby authorized at any time or from time to time, without presentment, demand, protest or other notice of any kind to the Borrower or to any other Person, any such notice being hereby expressly waived, to set off and to appropriate and apply any and all deposits (general or special) and any other indebtedness at any time held or owing by the Agent or any Lender to or for the credit or the account of the Borrower against and on account of the Obligations, and all other claims of any nature or description arising out of or connected with this Agreement or any other Loan Document, irrespective of whether or not such Agent or Lender shall have made any demand hereunder and although said Obligations, liabilities or claims, or any of them, shall be contingent or unmatured.

11.4 Indemnity; Costs, Expenses and Taxes. The Borrower hereby agrees to indemnify the Lenders and their legal representatives, successors, assigns and agents against, and agrees to protect, save and keep harmless each of them from and to pay upon demand, any and all liabilities, obligations, taxes (including any and all stamp and other taxes payable or

determined to be payable in connection with the execution and delivery of any Loan Documents), liens, charges, losses, damages, penalties, claims, actions, suits, costs, indemnities, expenses and disbursements (including, without limitation, reasonable legal fees, costs and expenses, including without limitation reasonable costs of attending and preparing for depositions and other court proceedings), of whatsoever kind and nature, imposed upon, incurred by or asserted against such indemnified party in any way relating to or arising out of the execution, delivery, enforcement, performance and administration of this Agreement or any other Loan Documents (all of the foregoing, collectively, "Costs") except to the extent arising by reason of any Lender's gross negligence, misconduct or breach hereof. Without limiting the foregoing, the Borrower agrees to pay on demand (a) all out- of- pocket costs and expenses of the Agent in connection with the preparation, execution and delivery of this Agreement and any other Loan Documents, including without limitation the reasonable fees and out-of-pocket expenses of Foley, Hoag & Eliot, LLP, special counsel for the Agent, with respect thereto, as well as (b) the reasonable fees and all out- of- pocket expenses of legal counsel, independent public accountants and other outside experts retained by the Lenders in connection with any request by the Borrower for consents, waivers or other action or forbearance by the Lenders hereunder, for the modification or amendment hereof, or other like matters relating to the administration of this Agreement; and (c) all reasonable costs and expenses, if any, of the Lenders incurred after the occurrence of any Event of Default hereunder in connection with the enforcement of any of the Loan Documents or the protection of any of the Lenders' rights thereunder, including, without limitation, any internal costs, including personnel costs of the Lenders incurred in connection with such administration and enforcement or protection.

11.5 Notices.

(a) Unless telephonic notice is specifically permitted pursuant to the terms of this Agreement, any notice or other communication hereunder to any party hereto shall be by telegram, telecopier, telex, delivery in hand or by courier, or registered or certified mail (return receipt requested) and shall be deemed to have been given or made when telegraphed, telexed, telecopied (and confirmed received), delivered in hand or by courier, or three days after being deposited in the mails, postage prepaid, registered or certified, addressed to the party as follows (or at any other address that such party may hereafter specify to the other parties in writing):

(a) If to the Agent:

Fleet National Bank
100 Federal Street
Boston, Massachusetts 02110
Attn: Mr. Daniel G. Head, Jr., Director
Telecopier No. (617) 434-0819

with a copy to:

Arlene L. Bender, Esq.
Foley, Hoag & Eliot LLP
One Post Office Square
Boston, Massachusetts 02109
Telecopier No. (617) 832-7000

(b) If to the Borrower:

MKS Instruments, Inc.
Six Shattuck Road
Andover, Massachusetts 01810
Attn: Mr. Ronald C. Weigner, CFO
Telecopier No. (978) 975-7663
with a copy to:

Richard S. Chute, Esq.
Hill & Barlow
One International Place
Boston, Massachusetts 02110
Telecopier No. (617) 428-3500

(c) if to the Lenders:

At the addresses set forth on
the signature pages hereof and
on the signature page of each
Assignment and Acceptance.

11.6 MASSACHUSETTS LAW. THIS AGREEMENT AND EACH OF THE LOAN DOCUMENTS SHALL BE DEEMED A CONTRACT MADE UNDER THE LAW OF THE COMMONWEALTH OF MASSACHUSETTS AND SHALL BE GOVERNED BY, AND CONSTRUED AND ENFORCED IN ACCORDANCE WITH, THE INTERNAL LAWS OF SAID STATE (WITHOUT REGARD TO ITS PRINCIPLES OF CONFLICT OF LAWS).

11.7 Counterparts. This Agreement may be executed in any number of counterparts and by different parties hereto in separate counterparts, each of which when so executed and delivered shall be deemed an original and all of which when taken together shall constitute one and the same instrument.

11.8 JURISDICTION, SERVICE OF PROCESS.

(a) ANY SUIT, ACTION OR PROCEEDING AGAINST THE BORROWER WITH RESPECT TO ANY OF THE LOAN DOCUMENTS OR ANY JUDGMENT ENTERED BY ANY COURT IN RESPECT OF ANY THEREOF SHALL BE BROUGHT IN THE COURTS OF THE COMMONWEALTH OF MASSACHUSETTS LOCATED IN SUFFOLK COUNTY OR IN THE UNITED STATES DISTRICT COURT FOR THE EASTERN DISTRICT OF MASSACHUSETTS, AS THE LENDERS (IN THEIR SOLE DISCRETION) MAY ELECT, AND THE BORROWER HEREBY ACCEPTS THE EXCLUSIVE JURISDICTION OF SUCH COURTS FOR THE PURPOSE OF ANY SUIT, ACTION OR PROCEEDING AND AGREES NOT TO

ASSERT ANY CLAIM THAT IT IS NOT PERSONALLY SUBJECT TO THE JURISDICTION OF SUCH COURTS.

(b) IN ADDITION, THE BORROWER HEREBY IRREVOCABLY WAIVES, TO THE FULLEST EXTENT PERMITTED BY LAW, ANY OBJECTION IT MAY NOW OR HEREAFTER HAVE TO THE LAYING OF VENUE OF ANY SUIT, ACTION OR PROCEEDING ARISING OUT OF OR RELATING TO ANY OF THE LOAN DOCUMENTS OR ANY JUDGMENT ENTERED BY ANY COURT IN RESPECT THEREOF BROUGHT IN SUFFOLK COUNTY IN THE COMMONWEALTH OF MASSACHUSETTS, AND HEREBY FURTHER IRREVOCABLY WAIVES ANY CLAIM THAT ANY SUIT, ACTION OR PROCEEDING BROUGHT IN SUFFOLK COUNTY IN THE COMMONWEALTH OF MASSACHUSETTS HAS BEEN BROUGHT IN AN INCONVENIENT FORUM.

11.9 Limit on Interest. It is the intention of the Lenders and the Borrower to comply strictly with all applicable usury laws; and, accordingly, in no event and upon no contingency shall the Lenders ever be entitled to receive, collect, or apply as interest under any Note any interest, fees, charges or other payments equivalent to interest, in excess of the maximum rate that the Lenders may lawfully charge under applicable statutes and laws from time to time in effect; and, in the event that the Lenders ever receive, collect or apply as interest on the Notes, any such excess, such amount that, but for this provision, would be excessive interest shall be applied to the reduction of the principal amount of the indebtedness evidenced by the Notes; and, if the principal amount of indebtedness evidenced by the Notes, and all lawful interest thereon, is paid in full, any remaining excess shall forthwith be paid to the Borrower, or other party lawfully entitled thereto. In determining whether or not the interest paid or payable, under any specific contingency exceeds the highest contract rate permitted by applicable law from time to time in effect, the Borrower and the Lenders shall, to the maximum extent permitted under applicable law, characterize any non- principal payment as a reasonable loan charge, rather than as interest. Any provision of any Note, or of any other agreement between the Lenders and the Borrower, that operates to bind, obligate, or compel the Borrower to pay interest in excess of such maximum lawful contract rate shall be construed to require the payment of the maximum rate only. The provisions of this Section 11.9 shall be given precedence over any other provisions contained in the Notes or in any other agreement between the Lenders and the Borrower that is in conflict with the provisions of this Section 11.9.

11.10 Amendments. No amendment, modification or waiver of any provision of any Loan Document and no consent by the Lenders to any departure therefrom by the Borrower shall be effective unless such amendment, modification or waiver shall be in writing and signed by the Agent, shall have been approved by the Required Lenders through their written consent, and the same shall then be effective only for the period and on the conditions and for the specific instances and purposes specified in such writing; provided, however, that, no such amendment, modification or waiver

(i) that changes, extends or waives any provision of Section 4.1.4, Section 10.9 or this Section 11.10, the amount of or the due date of any scheduled principal installment of or the rate of interest payable on or fees payable with respect to any Obligation, that changes the definition of Required Lenders, that permits an assignment by the Borrower

of its Obligations under any Loan Document, that reduces the required consent of the Lenders provided hereunder, that increases, decreases (other than pursuant to the express terms hereof) or extends (other than pursuant to the express terms hereof) the Commitment of any Lender or the Total Commitment or that waives any condition to the making of any Advance, shall be effective unless in writing and signed by each of the Lenders; or

(ii) that affects the rights, privileges, immunities or indemnities of the Agent shall be effective unless in writing and signed by the Agent.

Notwithstanding any provision of the other Loan Documents to the contrary, as between the Agent and the Lenders, execution by the Agent shall not be deemed conclusive evidence that the Agent has obtained the written consent of the Required Lenders. No notice to or demand on the Borrower in any case shall entitle the Borrower to any other or further notice or demand in similar or other circumstances, except as otherwise expressly provided herein. No delay or omission on any Lender's or the Agent's part in exercising any right, remedy or option shall operate as a waiver of such or any other right, remedy or option or of any Default or Event of Default.

11.11 Headings. The headings of this Agreement are for convenience only and are not to affect the construction of or to be taken into account in interpreting the substance of this Agreement.

11.12 WAIVER OF NOTICE, ETC. THE BORROWER WAIVES DEMAND, NOTICE, PROTEST, NOTICE OF ACCEPTANCE OF THIS AGREEMENT, NOTICE OF LOANS MADE, CREDIT EXTENDED, COLLATERAL RECEIVED OR DELIVERED OR OTHER ACTION TAKEN IN RELIANCE HEREON AND ALL OTHER DEMANDS AND NOTICE OF ANY DESCRIPTION, EXCEPT AS REQUIRED HEREBY. WITH RESPECT BOTH TO THE OBLIGATIONS AND COLLATERAL, THE BORROWER ASSENTS TO ANY EXTENSION OR POSTPONEMENT OF THE TIME OF PAYMENT OR ANY OTHER INDULGENCE, TO ANY SUBSTITUTION, EXCHANGE OR RELEASE OF COLLATERAL, TO THE ADDITION OR RELEASE OF ANY PARTY OR PERSONS PRIMARILY OR SECONDARILY LIABLE, TO THE ACCEPTANCE OF PRETRIAL PAYMENT THEREON AND THE SETTLEMENT, COMPROMISING OR ADJUSTING OF ANY THEREOF, ALL IN SUCH MANNER AND AT SUCH TIME OR TIMES AS THE LENDERS MAY DEEM ADVISABLE. THE BORROWER AGREES THAT NO ACTIONS TAKEN BY ANY PERSON EXCEPT THE LENDERS SHALL IMPAIR OR OTHERWISE AFFECT ITS OBLIGATIONS HEREUNDER UNTIL ALL OBLIGATIONS OF THE BORROWER HEREUNDER ARE SATISFIED IN FULL.

11.13 Severability. In the event that any one or more of the provisions contained in this Agreement shall for any reason be held to be invalid, illegal or unenforceable in any respect, such invalidity, illegality or unenforceability shall not affect any other provision of this Agreement, but this Agreement shall be construed as if such invalid, illegal or unenforceable provision had never been contained herein.

11.14 Entire Agreement. This Agreement and the other Loan Documents constitute the full and entire understanding and agreement between the parties with regard to the subject matter hereof and thereof and shall supersede all prior agreements and understandings, whether written or oral, between the parties with respect to the subject matter hereof and thereof.

11.15 Compliance with Covenants. All computations determining compliance with Article VIII shall utilize accounting principles in conformity with those used in the preparation of the financial statements referred to in Section 5.5. If any subsequent financial reports of the Borrower shall be prepared in accordance with accounting principles different from those used in the preparation of the financial statements referred to in Section 5.5, the Borrower shall inform the Agent of the changes in accounting principles and shall provide the Agent with such reports, such supplemental reconciling financial information as may be required to ascertain compliance by the Borrower with the covenants contained in this Agreement.

11.16 Termination. This Agreement may be terminated by the Borrower at any time upon written notice of such termination to the Agent; provided, however, that, unless and until all loans made by the Lenders hereunder and all other Obligations hereunder of the Borrower to any Lender existing (whether or not due) as of the time of the receipt of such notice by the Agent shall have been paid in full, such termination shall in no way affect the rights and powers granted to the Lenders in connection with this Agreement, and until such payment in full all rights and powers hereby granted to the Lenders hereunder shall be and remain in full force and effect.

11.17 WAIVER OF TRIAL BY JURY. THE BORROWER WAIVES ANY AND ALL RIGHTS THAT IT MAY HAVE TO A TRIAL BY JURY ON ANY CLAIM OR ACTION, OF ANY NATURE WHATSOEVER, RELATING TO OR ARISING OUT OF THIS AGREEMENT OR ANY OF THE OTHER LOAN DOCUMENTS.

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed as an agreement under seal as of the date first above written.

Witness: MKS INSTRUMENTS, INC.

/s/ JM Tocci

By: /s/ William P Donlan

Title: Treasurer

FLEET NATIONAL BANK

By: /s/ Daniel G. Head Jr.

Title: Director
Address: 100 Federal Street
Boston, MA 02110

THE CHASE MANHATTAN BANK

By: /s/ Neil Sweeny

Title: Vice President
Address: 999 Broad Street
Bridgeport, CT 06604

EXHIBIT A

LENDER	COMMITMENT	APPLICABLE COMMITMENT PERCENTAGE
Fleet National Bank	\$24,000,000	60%
The Chase Manhattan Bank	\$16,000,000	40%
	-----	---
	\$40,000,000	100%

REVOLVING CREDIT NOTE

\$24,000,000

Boston, Massachusetts

July 31, 2001

FOR VALUE RECEIVED, MKS INSTRUMENTS, INC., a Massachusetts corporation having its principal place of business located in Andover, Massachusetts (the "Borrower"), hereby promises to pay to the order of FLEET NATIONAL BANK (the "Lender"), in its individual capacity, at the office of FLEET NATIONAL BANK, as agent for the Lender (the "Agent"), located at 100 Federal Street, Boston, Massachusetts (or at such other place or places as the Agent may designate in writing) at the times set forth in the Credit Agreement dated as of July 31, 2001, as it may be amended, among the Borrower, the financial institutions party thereto (collectively, the "Lenders") and the Agent (the "Agreement" -- all capitalized terms not otherwise defined herein shall have the respective meanings set forth in the Agreement), in lawful money of the United States of America, in immediately available funds, the principal amount of TWENTY-FOUR MILLION DOLLARS (\$24,000,000) or, if less than such principal amount, the aggregate unpaid principal amount of all Advances made by the Lender to the Borrower pursuant to the Agreement, on the Revolver Termination Date or such earlier date as may be required pursuant to the terms of the Agreement, and to pay interest from the date hereof on the unpaid principal amount hereof, in like money, at said office, on the dates and at the rates provided in the Agreement. All or any portion of the principal amount of Advances may be prepaid as provided in the Agreement.

If payment of all sums due hereunder is accelerated under the terms of the Agreement or under the terms of the other Loan Documents executed in connection with the Agreement, the then remaining principal amount and accrued but unpaid interest shall bear interest, which shall be payable on demand, at the rate per annum set forth in Section 2.4.2 of the Agreement. Further, in the event of such acceleration, this Revolving Credit Note shall become immediately due and payable, without presentation, demand, protest or notice of any kind, all of which are hereby waived by the Borrower.

In the event this Revolving Credit Note is not paid when due at any stated or accelerated maturity, the Borrower agrees to pay, in addition to the principal and interest, all costs of collection, including reasonable attorneys' fees, and interest thereon at the rates set forth above.

Interest hereunder shall be computed as provided in the Agreement.

This Revolving Credit Note is one of the Revolving Credit Notes referred to in the Agreement and is issued pursuant to and entitled to the benefits of the Agreement to which reference is hereby made for a more complete statement of the terms and conditions upon which the Advances evidenced hereby were or are made and are to be repaid. This Revolving Credit Note is subject to certain restrictions on transfer or assignment as provided in the Agreement.

No delay or omission on the part of the Lender in exercising any right hereunder shall operate as a waiver of such right or of any other right of the Lender, nor shall any delay, omission or waiver on any one occasion be deemed a bar to or waiver of the same or any other right on any future occasion. Every maker, endorser and guarantor of this Revolving Credit Note

or the obligations represented hereby waives presentment, demand, notice, protest and all other demands and notices in connection with the delivery, acceptance, performance, default or enforcement of this Revolving Credit Note, assents to any extension or postponement of the time of payment or any other indulgence, to any substitution, exchange or release of collateral and to the addition or release of any other party or person primarily or secondarily liable.

[Remainder of page intentionally left blank.]

IN WITNESS WHEREOF, the Borrower has caused this Revolving Credit Note to be made, executed and delivered by its duly authorized representative under seal as of the date and year first above written.

MKS INSTRUMENTS, INC.

WITNESS:

/s/ JM Tocci

By: /s/ William P Donlan

Name: William P Donlan
Title: Treasurer

REVOLVING CREDIT NOTE

\$16,000,000

Boston, Massachusetts

July 31, 2001

FOR VALUE RECEIVED, MKS INSTRUMENTS, INC., a Massachusetts corporation having its principal place of business located in Andover, Massachusetts (the "Borrower"), hereby promises to pay to the order of THE CHASE MANHATTAN BANK (the "Lender"), in its individual capacity, at the office of FLEET NATIONAL BANK, as agent for the Lender (the "Agent"), located at 100 Federal Street, Boston, Massachusetts (or at such other place or places as the Agent may designate in writing) at the times set forth in the Credit Agreement dated as of July 31, 2001, as it may be amended, among the Borrower, the financial institutions party thereto (collectively, the "Lenders") and the Agent (the "Agreement" -- all capitalized terms not otherwise defined herein shall have the respective meanings set forth in the Agreement), in lawful money of the United States of America, in immediately available funds, the principal amount of SIXTEEN MILLION DOLLARS (\$16,000,000) or, if less than such principal amount, the aggregate unpaid principal amount of all Advances made by the Lender to the Borrower pursuant to the Agreement, on the Revolver Termination Date or such earlier date as may be required pursuant to the terms of the Agreement, and to pay interest from the date hereof on the unpaid principal amount hereof, in like money, at said office, on the dates and at the rates provided in the Agreement. All or any portion of the principal amount of Advances may be prepaid as provided in the Agreement.

If payment of all sums due hereunder is accelerated under the terms of the Agreement or under the terms of the other Loan Documents executed in connection with the Agreement, the then remaining principal amount and accrued but unpaid interest shall bear interest, which shall be payable on demand, at the rate per annum set forth in Section 2.4.2 of the Agreement. Further, in the event of such acceleration, this Revolving Credit Note shall become immediately due and payable, without presentation, demand, protest or notice of any kind, all of which are hereby waived by the Borrower.

In the event this Revolving Credit Note is not paid when due at any stated or accelerated maturity, the Borrower agrees to pay, in addition to the principal and interest, all costs of collection, including reasonable attorneys' fees, and interest thereon at the rates set forth above.

Interest hereunder shall be computed as provided in the Agreement.

This Revolving Credit Note is one of the Revolving Credit Notes referred to in the Agreement and is issued pursuant to and entitled to the benefits of the Agreement to which reference is hereby made for a more complete statement of the terms and conditions upon which the Advances evidenced hereby were or are made and are to be repaid. This Revolving Credit Note is subject to certain restrictions on transfer or assignment as provided in the Agreement.

No delay or omission on the part of the Lender in exercising any right hereunder shall operate as a waiver of such right or of any other right of the Lender, nor shall any delay, omission or waiver on any one occasion be deemed a bar to or waiver of the same or any other right on any future occasion. Every maker, endorser and guarantor of this Revolving Credit Note

or the obligations represented hereby waives presentment, demand, notice, protest and all other demands and notices in connection with the delivery, acceptance, performance, default or enforcement of this Revolving Credit Note, assents to any extension or postponement of the time of payment or any other indulgence, to any substitution, exchange or release of collateral and to the addition or release of any other party or person primarily or secondarily liable.

[Remainder of page intentionally left blank.]

IN WITNESS WHEREOF, the Borrower has caused this
Revolving Credit Note to be made, executed and delivered by its duly authorized
representative under seal as of the date and year first above written.

MKS INSTRUMENTS, INC.

WITNESS:

/s/ JM Tocci

By: /s/ William P Donlan

Name: William P Donlan
Title: Treasurer

SUBSIDIARY GUARANTY

This Subsidiary Guaranty (the "Guaranty") is made as of the 31st day of July, 2001, by Applied Science and Technology, Inc., a Delaware corporation (the "Guarantor"), to Fleet National Bank ("Fleet") and The Chase Manhattan Bank (each, a "Lender" and collectively, the "Lenders") with respect to obligations of MKS Instruments, Inc., a Massachusetts corporation and the parent of the Guarantor (the "Borrower").

Whereas, the Lenders have extended credit to the Borrower under the terms of the Credit Agreement dated as of the date hereof between the Borrower, the Lenders and Fleet as agent (as amended, the "Credit Agreement");

Whereas, the Borrower and the Guarantor are members of a group of related corporations, the success of any one of which is dependent in part on the success of the other members of such group;

Whereas, the Guarantor expects to receive substantial direct benefits from the extensions of credit to the Borrower by the Lenders pursuant to the Credit Agreement;

Whereas, it is a condition precedent to the Lenders' execution and delivery of the Credit Agreement that the Guarantor execute and deliver to the Lenders a guaranty substantially in the form hereof; and

Whereas, the Guarantor wishes to guaranty the Borrower's obligations to the Lenders under the Credit Agreement as provided herein;

Now therefore, for good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the Guarantor covenants and agrees as follows:

1. GUARANTY OF PAYMENT AND PERFORMANCE. The Guarantor hereby guarantees to the Lenders the full and punctual payment when due (whether at maturity, by acceleration or otherwise), as well as the performance, of all of the Obligations (as defined in the Credit Agreement), including all such that would become due but for the operation of the automatic stay pursuant to Section 362(a) of the Federal Bankruptcy Code and the operation of Sections 502(b) and 506(b) of the Federal Bankruptcy Code, together with all costs of collection, compromise or enforcement, including without limitation reasonable attorneys' fees, incurred with respect to the Obligations or this Guaranty, or with respect to a proceeding under the federal bankruptcy laws or any insolvency, receivership, arrangement or reorganization law or an assignment for the benefit of creditors concerning Borrower or Guarantor, together with interest on all such costs of collection, compromise or enforcement from the date arising at the rate of interest for overdue principal set forth in the Credit Agreement (all the foregoing, collectively, the "Guaranty Obligations"). This Guaranty is an absolute, unconditional and continuing guaranty of the full and punctual payment and performance of the Guaranty Obligations and not of their collectibility only and is in no way conditioned upon any requirement that the Lenders first attempt to collect any of the Guaranty Obligations from the Borrower or resort to any security or other means of obtaining their payment. Should the Borrower default in the payment or performance of any of the Obligations, the obligations of the Guarantor hereunder shall become immediately due and

payable to the Lenders, without demand or notice of any nature, all of which are expressly waived by the Guarantor. Payments by the Guarantor hereunder may be required by the Lenders on any number of occasions. All payments by the Guarantor hereunder shall be made to Fleet as agent for the Lenders, in the manner and at the place of payment specified therefor in the Credit Agreement.

2. GUARANTOR'S AGREEMENT TO PAY ENFORCEMENT COSTS. The Guarantor further agrees, as the principal obligor and not as a guarantor only, to pay to the Lenders, on demand, all reasonable costs and expenses (including court costs and legal expenses) incurred or expended by the Lenders in connection with the Guaranty Obligations, this Guaranty and the enforcement thereof, together with interest on amounts recoverable under this Section 2 from the time when such amounts become due until payment, whether before or after judgment, at the rate of interest for overdue principal set forth in the Credit Agreement.

3. WAIVERS BY GUARANTOR; LENDERS' FREEDOM TO ACT. The Guarantor agrees that the Guaranty Obligations will be paid and performed strictly in accordance with their respective terms regardless of any law, regulation or order now or hereafter in effect in any jurisdiction affecting any of such terms or the rights of the Lenders with respect thereto. Except as specifically provided herein, the Guarantor waives promptness, diligence, presentment, demand, protest, notice of acceptance, notice of any Guaranty Obligations incurred and all other notices of any kind, all defenses that may be available by virtue of any valuation, stay, moratorium law or other similar law now or hereafter in effect, any right to require the marshalling of assets of the Borrower or any other entity or other person primarily or secondarily liable with respect to any of the Guaranty Obligations, and all suretyship defenses generally. Without limiting the generality of the foregoing, the Guarantor agrees to the provisions of any instrument evidencing, securing or otherwise executed in connection with any Guaranty Obligation and agrees that the obligations of the Guarantor hereunder shall not be released or discharged, in whole or in part, or otherwise affected by (i) the failure of the Lenders to assert any claim or demand or to enforce any right or remedy against the Borrower or any other entity or other person primarily or secondarily liable with respect to any of the Guaranty Obligations; (ii) any extensions, compromises, refinancings, consolidations or renewals of, or alteration of the terms of, any Guaranty Obligation; (iii) any change in the time, place or manner of payment of any of the Guaranty Obligations or any rescissions, waivers, compromises, refinancings, consolidations or other amendments or modifications of any of the terms or provisions of the Credit Agreement or the other Loan Documents (as defined in the Credit Agreement) or any other agreement evidencing, securing or otherwise executed in connection with any of the Guaranty Obligations; (iv) the addition, substitution or release of any entity primarily or secondarily liable for any Guaranty Obligation; (v) the adequacy of any rights the Lenders may have against any collateral or other means of obtaining repayment of the Guaranty Obligations; (vi) the impairment of any collateral securing the Guaranty Obligations, including without limitation the failure to perfect or preserve any rights the Lenders might have in such collateral or the substitution, exchange, surrender, release, loss or destruction of any such collateral; (vii) the failure to obtain or maintain a right of contribution for the benefit of the Guarantor; (viii) errors or omissions in connection with the Lenders' administration of the Guaranty Obligations (except behavior constituting gross negligence or bad faith); or (ix) any other act or omission that might in any manner or to any extent vary the risk of the Guarantor or otherwise operate as a release or discharge of the Guarantor, all of which may be done without notice to the Guarantor. To the fullest extent

permitted by law, the Guarantor hereby expressly waives any and all rights or defenses arising by reason of (i) any "one action" or "anti-deficiency" law which would otherwise prevent the Lenders from bringing any action, including any claim for a deficiency, or exercising any other right or remedy (including any right of set-off), against the Guarantor before or after the Lenders' commencement or completion of any foreclosure action, whether judicially, by exercise of power of sale or otherwise, or (ii) any other law which in any other way would otherwise require any election of remedies by the Lenders.

4. UNENFORCEABILITY OF OBLIGATIONS AGAINST BORROWER. If for any reason the Borrower has no legal existence or is under no legal obligation to discharge any of the Guaranty Obligations, or if any of the Guaranty Obligations have become irrecoverable from the Borrower by reason of the Borrower's insolvency, bankruptcy or reorganization or by other operation of law or for any other reason, this Guaranty shall nevertheless be binding on the Guarantor to the same extent as if the Guarantor at all times had been the principal obligor on all such Guaranty Obligations. In the event that acceleration of the time for payment of any of the Guaranty Obligations is stayed upon the insolvency, bankruptcy or reorganization of the Borrower, or for any other reason, all such amounts otherwise subject to acceleration under the terms of the Credit Agreement or any other agreement evidencing, securing or otherwise executed in connection with any Guaranty Obligation shall be immediately due and payable by the Guarantor.

5. SUBROGATION; SUBORDINATION. Until the payment and performance in full of all of the Guaranty Obligations, the Guarantor shall not exercise and hereby waives any rights against the Borrower arising as a result of payment by the Guarantor hereunder, by way of subrogation, reimbursement, restitution or otherwise, and will not prove any claim in competition with the Lenders in respect of any payment hereunder in bankruptcy or insolvency proceedings of any nature; the Guarantor will not claim any set-off or counterclaim against the Borrower in respect of any liability of the Guarantor to the Borrower; and the Guarantor waives any benefit of and any right to participate in any collateral that may be held by the Lenders. The payment of any amounts due with respect to any indebtedness of the Borrower now or hereafter held by the Guarantor is hereby subordinated to the prior payment in full of the Guaranty Obligations; provided, however, that, until the occurrence of any default in the payment or performance of the Guaranty Obligations, the Borrower may pay any such indebtedness of the Borrower to the Guarantor. The Guarantor agrees that after the occurrence of any default in the payment or performance of the Guaranty Obligations, the Guarantor will not demand, sue for or otherwise attempt to collect any such indebtedness of the Borrower to the Guarantor until the Guaranty Obligations shall have been paid in full. If, notwithstanding the foregoing sentence, the Guarantor shall collect, enforce or receive any amounts in respect of such indebtedness while any Guaranty Obligations are still outstanding, such amounts shall be collected, enforced and received by the Guarantor as trustee for the Lenders and be paid over to the Lenders on account of the Guaranty Obligations without affecting in any manner the liability of the Guarantor under the other provisions of this Guaranty.

6. GUARANTOR'S NON-RELIANCE. The Guarantor warrants to and agrees with the Lenders that the Guarantor has adequate means to obtain from the Borrower or others on a continuing basis information concerning the Borrower's financial condition and affairs, and that the Guarantor is not relying on the Lenders to provide such information at the date of executing this Guaranty or at any time thereafter.

7. SECURITY; SETOFF. The Guarantor grants to each Lender, as security for the full and punctual payment and performance of all the Guarantor's obligations hereunder, a continuing lien on and security interest in all securities or other or other property belonging to the Guarantor now or hereafter held by such Lender and in all deposits (general or special, time or demand, provisional or final) and other sums credited by or due from such Lender to the Guarantor or subject to withdrawal by the Guarantor. Regardless of the adequacy of any collateral security or other means of obtaining payment of any of the Guaranty Obligations, each Lender is hereby authorized after an Event of Default (as defined in the Credit Agreement) and while it is continuing without notice to the Guarantor (any such notice being expressly waived by the Guarantor) and to the fullest extent permitted by law, to set off and apply any deposits and other sums due from the Lender against the obligations of the Guarantor under this Guaranty, whether or not the Lender shall have made any demand under this Guaranty and although such obligations may be contingent or unmaturred.

8. FURTHER ASSURANCES. The Guarantor agrees that it will from time to time, at the request of either Lender, do all such things and execute all such documents as such Lender may reasonably consider necessary or desirable to give full effect to this Guaranty and to perfect and preserve the rights and powers of the Lenders hereunder.

9. TERMINATION; REINSTATEMENT. This Guaranty shall remain in full force and effect until Fleet as agent for the Lenders is given written notice of the Guarantor's intention to discontinue this Guaranty, notwithstanding any intermediate or temporary payment or settlement of the whole or any part of the Guaranty Obligations. No such notice shall be effective unless received and acknowledged by an officer of Fleet at the address for notices set forth in Section 12 below. No such notice shall affect any rights of the Lenders hereunder, including without limitation the rights set forth in Sections 3 and 5, with respect to any Guaranty Obligations incurred or accrued prior to the receipt of such notice or any Guaranty Obligations incurred or accrued pursuant to any contract or commitment in existence prior to such receipt. This Guaranty shall continue to be effective or be reinstated if at any time any payment made or value received with respect to any Guaranty Obligation is rescinded or must otherwise be returned by either Lender upon the insolvency, bankruptcy or reorganization of the Borrower, or otherwise, all as though such payment had not been made or value received.

10. SUCCESSORS AND ASSIGNS. This Guaranty shall be binding upon the Guarantor, its successors and assigns, and shall inure to the benefit of and be enforceable by the Lenders and their successors, transferees and assigns. Without limiting the generality of the foregoing sentence, to the extent permitted by the Credit Agreement, each Lender may assign or otherwise transfer the Credit Agreement, the other Loan Documents or any other agreement or note held by it evidencing, securing or otherwise executed in connection with the Guaranty Obligations, or sell participations in any interest therein, to any other entity or other person, and such other entity or other person shall thereupon become vested, to the extent set forth in the agreement evidencing such assignment, transfer or participation, with all the rights in respect thereof granted to such Lender herein. The Guarantor may not assign any of its obligations hereunder.

11. AMENDMENTS AND WAIVERS. No amendment or waiver of any provision of this Guaranty nor consent to any departure by the Guarantor therefrom shall be effective unless the same shall be in writing and signed by the Lenders. No failure on the part of the Lenders to

exercise, and no delay in exercising, any right hereunder shall operate as a waiver thereof; nor shall any single or partial exercise of any right hereunder preclude any other or further exercise thereof or the exercise of any other right.

12. NOTICES. All notices and other communications called for hereunder shall be made in writing and, unless otherwise specifically provided herein, shall be deemed to have been duly made or given when delivered by hand or mailed first class mail postage prepaid or, in the case of telecopied notice, when transmitted, receipt confirmed, addressed as follows: if to the Guarantor, at the address or telecopier number set forth below, and if to the Lenders, to their agent, Fleet National Bank, at 100 Federal Street, Boston, Massachusetts 02110, Attention: Daniel G. Head, or at such address as any party may designate in writing.

13. GOVERNING LAW; CONSENT TO JURISDICTION. This Guaranty is intended to take effect as a sealed instrument and shall be governed by, and construed in accordance with, the laws of The Commonwealth of Massachusetts (excluding the laws applicable to conflicts or choice of law). The Guarantor agrees that any suit for the enforcement of this Guaranty may be brought in the courts of The Commonwealth of Massachusetts or any Federal Court sitting therein and consents to the non-exclusive jurisdiction of such court and to service of process in any such suit's being made upon the Guarantor by mail at the addresses set forth below. The Guarantor hereby waives any objection that it may now or hereafter have to the venue of any such suit or any such court or that such suit was brought in an inconvenient court.

14. WAIVER OF JURY TRIAL. EACH OF THE GUARANTOR AND EACH OF THE LENDERS HEREBY WAIVES ITS RIGHT TO A JURY TRIAL WITH RESPECT TO ANY ACTION OR CLAIM ARISING OUT OF ANY DISPUTE IN CONNECTION WITH THIS GUARANTY, ANY RIGHTS OR OBLIGATIONS HEREUNDER OR THE PERFORMANCE OF ANY OF SUCH RIGHTS OR OBLIGATIONS. Except as prohibited by law, each of the Guarantor and each of the Lenders hereby waives any right that it may have to claim or recover in any litigation referred to in the preceding sentence any special, exemplary, punitive or consequential damages or any damages other than or in addition to, actual damages. The Guarantor (a) certifies that neither the Lenders nor any representative, agent or attorney of the Lenders has represented, expressly or otherwise, that the Lenders would not, in the event of litigation, seek to enforce the foregoing waivers and (b) acknowledges that, in entering into the Credit Agreement and the other Loan Documents to which the Lenders are parties, the Lenders are relying upon, among other things, the waivers and certifications contained in this Section 14.

15. MISCELLANEOUS. This Guaranty constitutes the entire agreement of the Guarantor with respect to the matters set forth herein. This writing is intended by the parties as a final, complete and exclusive expression of their guaranty agreement. No course of dealing, course of performance or trade usage, and no parol evidence of any nature, shall be used to supplement or modify any terms. There are no conditions to the full effectiveness of this Guaranty. The rights and remedies herein provided are cumulative and not exclusive of any remedies provided by law or any other agreement, and this Guaranty shall be in addition to any other guaranty of the Guaranty Obligations. The invalidity or unenforceability of any one or more sections of this Guaranty shall not affect the validity or enforceability of its remaining provisions. Captions are for the ease of reference only and shall not affect the meaning of the relevant provisions. The

meanings of all defined terms used in this Guaranty shall be equally applicable to the singular and plural forms of the terms defined.

[Remainder of page intentionally left blank.]

IN WITNESS WHEREOF, the Guarantor has caused this Guaranty to be executed and delivered as a sealed instrument as of the date appearing on page one.

APPLIED SCIENCE AND TECHNOLOGY, INC.

By: /s/ Ron Weiger

Title: Treasurer
Address: 6 Shattuck Rd
Andover, MA

MKS INSTRUMENTS, INC.

NINTH AMENDMENT

TO LOAN AGREEMENT

This Ninth Amendment (the "Amendment") dated as of July 31, 2001 concerns the Loan Agreement dated as of October 31, 1995 (the "Loan Agreement"), between MKS Instruments, Inc. (the "Borrower") and Fleet National Bank (f/k/a BankBoston, N.A. and The First National Bank of Boston, the "Lender"), as amended on February 23, 1996, February 4, 1997, February 3, 1998, January 28, 1999, January 1, 2000, September 1, 2000, January 1, 2001 and April 30, 2001. Capitalized terms used herein but not otherwise defined shall have the meanings assigned to them in the Loan Agreement.

WHEREAS, the Loan Agreement was previously amended to provide for terms consistent with those set forth in the First Amended and Restated Loan Agreement among the Borrower, the Lender and The Chase Manhattan Bank, which is now being replaced by a new Credit Agreement (the "Credit Agreement"); and

WHEREAS, the Lender and the Borrower are willing to amend the Loan Agreement to make its terms consistent with the terms in the Credit Agreement;

NOW, THEREFORE, the Lender and the Borrower agree as follows:

Section 1. Amendment of the Loan Agreement.

(A) Article I of the Loan Agreement is hereby amended by the deletion of all subsection numbers at the beginnings of the definitions, the deletion of the definitions of "Base Rate", "Cash Flow Ratio", "Consolidated Debt Service", "Debt-to-New Worth Ratio", "Indebtedness", and "Sub S Dividends", and the addition of the following definitions in alphabetical order:

"Accounts" shall mean, at any time, all accounts receivable of Borrower and its subsidiaries on a consolidated basis determined in accordance with GAAP appearing on the Borrower's consolidated balance sheet.

"Adjustment Date" shall mean the first day of the month immediately following the month in which a Compliance Certificate is to be delivered by the Borrower pursuant to Section 6.1(c).

"Applicable Margin" shall mean for each period commencing on an Adjustment Date through the date immediately preceding the next Adjustment Date, the applicable margin set forth below with respect to the Debt-To-Tangible Net Worth Ratio, as determined for the most recent fiscal quarter for which the Borrower has delivered its financial statements pursuant to Section 6.1(a) or (b) and Compliance Certificate pursuant to Section 6.1(c):

DEBT-TO-TANGIBLE NET WORTH RATIO	APPLICABLE MARGIN FOR LIBOR LOANS
Greater than or equal to 0.50:1.00	2.00%
Less than 0.50:1.00 but greater than or equal to 0.25:1.00	1.50%
Less than 0.25:1.00	1.25%

"Base Rate" shall mean the higher of (a) the annual rate of interest announced from time to time by Lender at Lender's office at 100 Federal Street, Boston, Massachusetts, as its "base rate" or (b) one-half of one percent (1/2%) above the Federal Funds Effective Rate. For the purposes of this definition, "Federal Funds Effective Rate" shall mean, for any day, the rate per annum equal to the weighted average of the rates on overnight federal funds transactions with members of the Federal Reserve System arranged by federal funds brokers, as published for such day (or, if such day is not a Business Day, for the next preceding Business Day) by the Federal Reserve Bank of New York, or if such rate is not so published for any day that is a Business Day, the average of the quotations for such day on such transactions received by the Lender from three funds brokers of recognized standing selected by the Lender.

"Change in Control" shall be deemed to have occurred at such time after the date hereof that any person (other than, in the case of clause (ii) below, John R. Bertucci, together with its affiliates and associates (as defined in Rule 12b-2 under the Securities Exchange Act of 1934 (the "Exchange Act") or any successor rule thereto):

(i) shall file with the Securities and Exchange Commission and deliver to the Borrower a report under or in response to Schedule 13D or 14D-1 (or any successor schedule, form or report) pursuant to the Exchange Act disclosing that such person has become the beneficial owner (as defined in Rule 13D-3 under the Exchange Act, or any successor provisions) of more than 25% of the total voting power of all classes of voting stock of the Borrower or

(ii) shall succeed in having a sufficient number of its nominees elected to the board of directors of the Borrower such that such nominees so elected (whether new or continuing as directors) shall constitute a majority of the board of directors of the Borrower.

"Consolidated Current Liabilities" shall mean, at any time, all current liabilities of Borrower and its subsidiaries on a consolidated basis that in accordance with GAAP are properly classified as current liabilities plus all other indebtedness for borrowed money except such indebtedness that is subordinated to the payment of the Obligations pursuant to an agreement in form and substance acceptable to the Lender ("Subordinated Debt").

"Consolidated Quick Assets" shall mean, at any time, the sum of the cash, Accounts, Short Term Investments and Long Term Fixed Income Investments of the Borrower and its Subsidiaries, provided the sum of Long Term Fixed Income Investments shall not exceed 25% of the amount of the Borrower's cash..

"Consolidated Total Liabilities" shall mean, at any time, all liabilities of the Borrower and its Subsidiaries on a consolidated basis that in accordance with GAAP are properly classified as liabilities on the Borrowers' consolidated balance sheet plus the sum of (i) the face amount of outstanding Letters of Credit, (ii) sales of receivables described in clause (f) of the definition of "Indebtedness" below and (iii) Synthetic Leases. In computing such aggregate liabilities, the "amount" of the liability with respect to any such sale of receivables shall be the amount of unrecovered capital or principal investment of the purchaser (other than the Borrower or any of its wholly-owned Subsidiaries) thereof, excluding amounts representative of yield or interest earned on such investment, and the "amount" of any Synthetic Lease shall be the stipulated loss value, termination value or other equivalent amount.

"ERISA" shall have the meaning set forth in Section 4.12.

"GAAP" shall mean generally accepted accounting principles.

"Indebtedness" shall mean, for any Person,

(a) all obligations of any other Person the payment or collection of which such Person has guaranteed (except by reason of endorsement for collection in the ordinary course of business) or in respect of which such Person is liable, contingently or otherwise, including, without limitation, liable by way of agreement to purchase, to provide funds for payment, to supply funds to or otherwise to invest in such other Person, or otherwise to assure a creditor against loss,

(b) all obligations of any other Person for borrowed money or for the deferred purchase price of property or services secured by (or for which the holder of such indebtedness has an existing right, contingent or otherwise, to be secured by) any mortgage, or other encumbrance upon or in property (including, without limitation, accounts and contract rights) owned by such Person, whether or not such Person has assumed or become liable for the payment of such indebtedness or obligations,

(c) Financing Lease Obligations of such Person,

(d) every reimbursement obligation of such Person with respect to letters of credit, bankers' acceptances or similar facilities issued for the account of such Person,

(e) every obligation of such Person under any Synthetic Lease,

(f) all sales by such Person of (i) accounts or general intangibles for money due or to become due, (ii) chattel paper, instruments or documents creating or evidencing a right to payment of money or (iii) other receivables (collectively "receivables"), whether pursuant to a purchase facility or otherwise, other than in connection with the disposition of the business operations of such Person relating thereto or a disposition of defaulted receivables for collection and not as a financing arrangement, and together with any obligation of such Person to pay any discount, interest, fees, indemnities, penalties, recourse, expenses or other amounts in connection therewith,

(g) every obligation of such Person to purchase, redeem, retire or otherwise acquire for value any shares of capital stock of any class issued by such Person, any warrants, options or other rights to acquire any such shares, or any rights measured by the value of such shares, warrants, options or other rights, and

(h) every obligation of such Person under any forward contract, futures contract, swap, option or other financing agreement or arrangement (including, without limitation, caps, floors, collars and similar agreements), the value of which is dependent upon interest rates, currency exchange rates, commodities or other indices.

"Loan Documents" shall mean each of this Agreement, the Note and any other document or instrument executed by the Borrower or any of its Affiliates in favor of the Lender in connection with the transactions contemplated hereby.

"Long Term Fixed Income Investments" shall mean investment grade bonds with long-term debt ratings of A- or A3 or higher by at least one nationally recognized rating agency and maturities of three years or less.

"Material Subsidiary" shall mean each domestic Subsidiary of the Borrower (other than Massachusetts securities corporations) with gross revenues in excess of 5% of the total gross revenues of the Borrower and its Subsidiaries, determined on a consolidated basis, or assets in excess of 5% of the total assets of Borrower and its Subsidiaries, determined on a consolidated basis, in each case as of the end of Borrower's last fiscal quarter.

"Quick Ratio" shall have the meaning set forth in Section 7.11.

"Short Term Investments" shall mean short term investments as determined in accordance with GAAP.

"Subordinated Debt" shall have the meaning set forth in the definition of Consolidated Current Liabilities set forth above

"Synthetic Lease" shall mean any lease that is treated as an operating lease under GAAP and as a loan or financing for U.S. income tax purposes.

"Total Liabilities-to-Tangible Net Worth Ratio" shall have the meaning set forth in Section 7.10.

(B) Section 2.2.1 of the Loan Agreement is hereby deleted in its entirety and replaced by the following:

2.2.1. Borrower agrees to pay interest in respect of the unpaid principal amount of the Term Loan from the date of this Agreement until paid in full as follows. The Term Loan shall bear interest at the Base Rate unless the Borrower desires to pay interest on all or a portion of the Term Loan at the LIBOR Rate plus the Applicable Margin; provided, however, that the Applicable Margin shall not be less than 1.5% prior to the first day of the month following the month in which the Borrower shall deliver to the Lender the financial statements required by Section 6.1(b) for the year ended December 31, 2001 and related Compliance Certificate.

(C) Section 6.1 of the Loan Agreement is hereby deleted in its entirety and replaced by the following:

6.1 Reporting Requirements. The Borrower shall furnish to the Lender:

(a) As soon as available and in any event within forty-five days after the end of each of the first three quarters of each fiscal year of the Borrower and its Subsidiaries, (i) an unaudited consolidated and consolidating balance sheet of the

Borrower and its Subsidiaries as of the end of such quarter and (ii) unaudited consolidated and consolidating statements of operations, cash flows and stockholders' equity of the Borrower and its Subsidiaries for the period commencing at the end of the previous fiscal year and ending with the end of such quarter, all in reasonable detail and duly certified by the chief financial officer or treasurer of the Borrower as having been prepared in accordance with generally accepted accounting principles consistently applied (subject to addition of notes and ordinary year-end audit adjustments), together with a certificate of the chief financial officer or treasurer of the Borrower stating that no Default or Event of Default has occurred and is continuing or, if a Default or an Event of Default has occurred and is continuing, a statement as to the nature thereof and the action that the Borrower proposes to take with respect thereto;

(b) As soon as available and in any event within ninety days after the end of each fiscal year of the Borrower, the audited consolidated balance sheet of the Borrower and its Subsidiaries as of the end of such fiscal year and the audited consolidated statements of operations, cash flows and stockholders' equity of the Borrower and its Subsidiaries for such fiscal year, in each case accompanied by the unqualified opinion with respect thereto of the Borrower's independent public accountants and a certification by such accountants stating that they have reviewed this Agreement and whether, in making their audit, they have become aware of any Default or Event of Default and if so, describing its nature, along with the related unaudited consolidating balance sheet of the Borrower and its Subsidiaries as of the end of such fiscal year and the unaudited consolidating statements of operations, cash flows and stockholders' equity of the Borrower and its Subsidiaries for such fiscal year;

(c) Concurrent with, and no later than the required date for delivery of the financial information outlined in Sections 6.1(a) and (b), a certificate signed by the chief financial officer or treasurer of the Borrower substantially in the form of Exhibit D hereto (the "Compliance Certificate");

(d) Not later than forty-five days after the end of each fiscal year of the Borrower, the Borrower's representative forecast for the next fiscal year on a consolidated basis, including, at a minimum, projected statements of profit and loss and projected cash flow, prepared in accordance with generally accepted accounting principles consistently applied;

(e) Promptly upon receipt thereof, one copy of each other report submitted to the Borrower or any Subsidiary by independent accountants in connection with any annual, interim or special audit made by them of the books of the Borrower or any Material Subsidiary;

(f) Promptly after the commencement thereof, notice of all actions, suits and proceedings before any court, arbitration tribunal or governmental regulatory authority, commission, bureau, agency or public regulatory body that, if determined adversely to the Borrower or any Subsidiary of the Borrower, would be reasonably likely

to have a material adverse effect on the consolidated financial condition or results of operations of the Borrower and its Subsidiaries taken as a whole;

(g) As soon as possible, and in any event within five days after the Borrower shall know of the occurrence of any Default or Event of Default, the written statement of the chief financial officer or treasurer of the Borrower setting forth details of such Default or Event of Default and action that the Borrower proposes to take with respect thereto;

(h) As soon as possible, and in any event within five days after the occurrence thereof, written notice as to any other event of which the Borrower becomes aware that with the passage of time, the giving of notice or otherwise, is reasonably likely to result in a material adverse change in the consolidated financial condition or results of operations of the Borrower and its Subsidiaries taken as a whole;

(i) Promptly after Borrower becomes aware thereof, written notice of any noncompliance with ERISA that with the passage of time, the giving of notice or otherwise, is reasonably likely to result in a liability to the Borrower in excess of \$1,000,000; and

(j) Such other information respecting the business or properties or the condition or operations, financial or otherwise, of the Borrower as the Lender may from time to time reasonably request.

(D) Section 6.3(a) of the Loan Agreement is hereby deleted in its entirety and replaced by the following:

(a) The Borrower will continue to engage in business of the same general nature as the business currently engaged in by the Borrower. The Borrower will at all times maintain, preserve and protect all material franchises and trade names and preserve all the Borrower's material tangible property used or useful in the conduct of its business and keep the same in good repair, working order and condition, ordinary wear and tear excepted, and from time to time make all needful and proper repairs, renewals, replacements, betterments, and improvements thereto so that the business carried on in connection therewith may be conducted properly and advantageously at all times; provided that nothing in this Section 6.3 shall prevent the Borrower from discontinuing the operation and maintenance of any of its properties or any of those of its Subsidiaries (including the voluntary liquidation and dissolution of a Subsidiary other than a Material Subsidiary) if such discontinuance is, in the judgment of the borrower, desirable in the conduct of its or their business and does not materially adversely affect the business of the Borrower and its Subsidiaries on a combined basis.

(E) Article VI of the Loan Agreement is hereby further amended by the addition of the following new Section 6.9:

Guaranties. The Borrower shall cause any Subsidiary that becomes a Material Subsidiary promptly thereafter to execute and deliver a Guaranty to the Lender.

(F) Article VII of the Loan Agreement is hereby deleted in its entirety and replaced by the following:

ARTICLE VII.

NEGATIVE COVENANTS OF THE BORROWER

The Borrower covenants and agrees that from the date of execution of this Agreement and until the payment in full of the principal of and interest upon the Notes and payment and performance of all other Obligations, unless the Lender shall otherwise consent in writing, the Borrower will not, and will not cause or permit any of its Subsidiaries to:

7.1 Sale of Assets; Mergers, Etc.

(a) Sale of Assets. Except for sales in the ordinary course of business, sell, transfer, or otherwise dispose of, to any Person any assets (including the securities of any Subsidiary) other than assets having an aggregate fair market value less than five percent (5%) of Borrower's Consolidated Tangible Net Worth.

(b) Mergers, Etc. Consolidate with or merge into any other Person or permit any other Person to consolidate with or merge into it, or acquire all or substantially all of the capital stock or assets of any Person, or sell, assign, lease or otherwise dispose of (whether in one transaction or in a series of transactions) all or substantially all of its assets to any Person, except that

(1) a Subsidiary may consolidate with or merge into, or sell, assign, lease or otherwise dispose of any or all of its assets to, the Borrower or another Subsidiary; and

(2) the Borrower or any of its Subsidiaries may acquire all or substantially all of the capital stock or assets of any Person or consolidate or merge with any Person provided (i) such Person is engaged in a line of business substantially similar to one or more of Borrower's existing lines of business, (ii) the aggregate purchase price liability incurred between the date hereof and the Revolver Termination Date, including all contingent liabilities, when aggregated with all such acquisitions and any Investments permitted under Section 7.6(3) during such period shall not exceed \$20,000,000, and if 80% or more of the purchase price is paid in

capital stock of the Borrower, 20% of Consolidated Tangible Net Worth as of the end of the most recent fiscal quarter, (iii) based on a pro forma calculation of the ratios set forth in Sections 7.9 - 7.11 as of the date such acquisition is closed, assuming consolidation of the acquired business with the Borrower for the four full fiscal quarters ended immediately preceding such closing and pro forma debt and debt service payments based on scheduled principal payments, including acquisition borrowings, if any, and pro forma interest on total debt at then prevailing borrowing rates, Borrower is in compliance with the financial covenants set forth in Sections 7.9 - 7.11, and (iv) all contingent liability and contingent payment obligations incurred by Borrower or any of its Subsidiaries in connection with such transaction shall be reasonably acceptable to the Lender.

7.2. Liens and Encumbrances.

(a) Create incur, assume or permit to exist any of its real or personal property, whether now owned or subsequently acquired, to be subject to any Lien other than Liens described below (which may herein be referred to as "Permitted Liens"):

(1) Liens securing the payment of taxes, assessments or governmental charges or levies or the demands of suppliers, mechanics, carriers, warehousemen, landlords and other like Persons, which payments are not yet due and payable or (as to taxes) may be paid without interest or penalty; provided, that, if such payments are due and payable, such Liens shall be permitted hereunder only to the extent that (A) all claims that the Liens secure are being actively contested in good faith and by appropriate proceedings, (B) adequate book reserves have been established with respect thereto to the extent required by generally accepted accounting principles, and (C) such Liens do not in the aggregate materially interfere with the owning company's use of property necessary or material to the conduct of the business of the Borrower and its Subsidiaries taken as a whole;

(2) Liens incurred or deposits made in the ordinary course of business (A) in connection with worker's compensation, unemployment insurance, social security and other like laws, or (B) to secure the performance of letters of credit, bids, tenders, sales contracts, leases, statutory obligations, surety, appeal and performance bonds and other similar obligations, in each

case not incurred in connection with the borrowing of money, the obtaining of advances or the payment of the deferred purchase price of property;

(3) Liens not otherwise described in Section 7.2(a)(1) or (2) that are incurred in the ordinary course of business and are incidental to the conduct of its business or ownership of its property, were not incurred in connection with the borrowing of money, the obtaining of advances or the payment of the deferred purchase price of property and do not in the aggregate materially detract from the value of, or materially interfere with the owning company's use of, property necessary or material to the conduct of the business of the Borrower and its Subsidiaries taken as a whole;

(4) Liens in favor of the Lender;

(5) Judgment liens or attachments that shall not have been in existence for a period longer than 30 days after the creation thereof, or if a stay of execution shall have been obtained, for a period longer than 30 days after the expiration of such stay or if such an attachment is being actively contested in good faith and by appropriate proceedings, for a period longer than 30 days after the creation thereof;

(6) Liens existing as of the Closing Date and disclosed on the Disclosure Schedule hereto;

(7) Liens provided for in equipment or Financing Leases (including financing statements and undertakings to file financing statements) provided that they are limited to the equipment subject to such leases and the proceeds thereof;

(8) Leases or subleases with third parties or licenses and sublicenses granted to third parties not interfering in any material respect with the business of the Borrower or any Subsidiary of the Borrower;

(9) Any Lien on any asset of any corporation existing at the time such corporation is merged into or consolidated with (or acquired in accordance with Section 7.1(b) by) the Borrower or a Subsidiary of the Borrower and not created in contemplation of such event;

(10) Any Lien existing on any asset prior to the acquisition thereof by the Borrower or any Subsidiary of the Borrower and not created in contemplation of such event;

(11) Liens in respect of any purchase money obligations for tangible property used in its business, which obligations shall not at any time exceed 5% of Consolidated Tangible Net Worth, provided that any such encumbrances shall not extend to property and assets of the Borrower or any Subsidiary not financed by such a purchase money obligation;

(12) Easements, rights of way, restrictions and other similar charges or Liens relating to real property and not interfering in a material way with the ordinary conduct of its business; and

(13) Liens on its property or assets created in connection with the refinancing of Indebtedness secured by Permitted Liens on such property, provided that the amount of Indebtedness secured by any such Lien shall not be increased as a result of such refinancing and no such Lien shall extend to property and assets of the Borrower or any Subsidiary not encumbered prior to any such refinancing.

(b) In case any property is subjected to a Lien in violation of Section 7.2(a), the Borrower will make or cause to be made provision whereby the Note will be secured equally and ratably with all other obligations secured by such property, and in any case the Note shall have the benefit, to the full extent that the holder may be entitled thereto under applicable law, of an equitable Lien equally and ratably securing the Note. Such violation of Section 7.2(a) shall constitute an Event of Default hereunder, whether or not any such provision is made pursuant to this Section 7.2(b).

(c) None of the equity interests of the Borrower or any Subsidiary in any Subsidiary is subject to any Lien (including any Permitted Lien), and neither the Borrower nor any Subsidiary will agree with any third party not to cause or permit any of its real or personal property, whether now owned or subsequently acquired, to be subject to Liens (with or without exceptions).

(d) Cause or permit or (ii) agree or consent to cause or permit in the future (upon the happening of a contingency or otherwise), any of its equity interests in any Subsidiary to be subject to any Lien (including any Permitted Lien).

7.3 Sales and Leasebacks. Sell or transfer any of their property and become, directly or indirectly, liable as the lessee under a lease of such property (other than such transactions between the Subsidiaries and transfers of capital equipment that will be leased pursuant to Financing Leases).

7.4 Indebtedness. Create, incur or assume any Indebtedness other than:

(1) Indebtedness to the Lender pursuant to this Agreement and Indebtedness pursuant to the Credit Agreement;

(2) Financing Lease Obligations, not to exceed \$10,000,000 in the aggregate at any one time outstanding;

(3) Endorsements for collection, deposit or negotiation and warranties of products or services, in each case incurred in the ordinary course of business;

(4) Subordinated Debt:

(5) Indebtedness of the Borrower owing to Subsidiaries not otherwise permitted by this Section 7.4 in an aggregate principal amount at any time outstanding not to exceed \$5,000,000;

(6) Indebtedness of Subsidiaries owing to the Borrower not otherwise permitted by this Section 7.4 in an aggregate principal amount at any time outstanding not to exceed \$5,000,000;

(7) Indebtedness of any wholly-owned Subsidiary owing to any other wholly-owned Subsidiary;

(8) Guarantees by Material Subsidiaries of the Obligations;

(9) Indebtedness with respect to Investments permitted by Section 7.6(3) so long as such entities remain Subsidiaries or Affiliates of the Borrower; and

(10) Indebtedness not included above and listed on the Disclosure Schedule.

7.5 Dividends and Distributions. Declare or pay, directly or indirectly, any dividend (other than a dividend payable solely in the Common Stock of the Borrower) or make any other distribution (by reduction of capital or otherwise), whether in cash, property, securities or a combination thereof, with respect to any shares of its capital stock or, directly or indirectly, except to the extent permitted by Section 6.2 hereof, redeem, purchase, retire or otherwise acquire for value any shares of any class of its capital stock or set aside any amount for any such

purpose; provided, however, that any Subsidiary of the Borrower may declare and pay dividends or make other distributions to the Borrower.

7.6 Investments. Except as permitted by Section 7.1, make or maintain any investments, made in cash or by delivery of property or assets, (a) in any Person, whether by acquisition of capital stock, Indebtedness, or other obligations or securities, or by loan or capital contribution, or otherwise, or (b) in any property, whether real or personal, (items (a) and (b) being herein called "Investments") except the following (but only with funds other than proceeds of Advances):

(1) Investments in direct obligations of, or guaranteed by, the United States government, its agencies or any public instrumentality thereof and backed by the full faith and credit of the United States government with maturities not to exceed (or an unconditional right to compel purchase within) three years from the date of acquisition;

(2) Repurchase agreements collateralized by securities of the U.S. Government and U.S. Government-sponsored securities;

(3) Investments in or to any Subsidiary or other Affiliate, provided Borrower remains in compliance with Section 7.1(b);

(4) Investments and obligations issued by the United States government, any agency thereof, any state of the United States or any political subdivision of any such state or any public instrumentality thereof with maturities not to exceed (or an unconditional right to compel purchase within) three years from the date of acquisition that are rated AA- or higher by at least one nationally recognized rating agency;

(5) Investments and obligations issued by any company (other than a bank) with maturities not to exceed three years from the date of acquisition with a long-term debt rating of A or higher or a short-term debt rating of A1 or P1 by at least one nationally recognized rating agency;

(6) Investments in demand and time deposits with, Eurodollar deposits with, certificates of deposit issued by, or obligations or securities fully backed by letters of credit issued by (x) any bank organized under the laws of the United States, any state thereof, the District of Columbia or Canada having combined capital and surplus aggregating at least \$500,000,000, or (y) any

other bank organized under the laws of a state that is a member of the European Economic Community (or any political subdivision thereof), Japan, the Cayman Islands, or British West Indies having as of any date of determination combined capital and surplus of not less than \$500,000,000 or the equivalent thereof (determined in accordance with generally accepted accounting principles);

(7) Shares of money market mutual funds registered under the Investment Company Act of 1940, as amended;

(8) Foreign currency swaps and hedging arrangements entered into in the ordinary course of business to protect against currency losses, and interest rate swaps and caps entered into in the ordinary course of business to protect against interest rate exposure on indebtedness bearing interest at a variable rate;

(9) Investments in mutual funds (other than money market mutual funds and short term bond funds with individual maturities under three years and aggregate ratings of A- or A3 or higher by at least one nationally recognized rating agency) that in the aggregate shall not exceed \$5,000,000;

(10) Investments in the form of advances to employees in the ordinary course of business for moving, entertainment, travel and other similar expenses, but not more than \$1,000,000 in the aggregate outstanding at any time; and

(11) Other Investments existing on the Closing Date and listed on the Disclosure Schedule.

7.7 Transactions with Affiliates. Enter into any transaction (including the purchase, sale or exchange of property or the rendering of any service) with any Affiliate except upon fair and reasonable terms that are at least as favorable to the Borrower or the Subsidiary as would be obtained in a comparable arm's-length transaction with a non-Affiliate.

7.8 ERISA Compliance. Permit any employee pension benefit plan (as such term is defined in Section 3 of ERISA) maintained by the Borrower or any of its Subsidiaries or in which employees of the Borrower or any of its Subsidiaries is entitled to participate to:

- (a) engage in any "prohibited transaction" as such term is defined in Section 4975 of the Internal Revenue Code of 1986, as amended, or described in Section 406 of ERISA;

- (b) incur any "accumulated funding deficiency" as such term is defined in Section 302 of ERISA, whether or not waived; or
- (c) terminate under circumstances that could result in the imposition of a Lien on the property of the Borrower or any Subsidiary of the Borrower pursuant to Section 4068 of ERISA.

7.9 Tangible Net Worth Test. Permit the Consolidated Tangible Net Worth as of the end of each fiscal quarter of the Borrower to be less than the sum of (i) \$292,000,000, plus (ii) 80% of Consolidated Net Income (excluding losses), plus (iii) the net proceeds of any equity securities sold by the Borrower after June 30, 2001, for each consecutive fiscal quarter of the Borrower beginning with the quarter ending September 30, 2001, on a cumulative basis.

7.10 Total Liabilities-to-Tangible Net Worth Ratio. Permit the ratio ("Total Liabilities-to-Tangible Net Worth Ratio") of the Consolidated Total Liabilities as of the end of each fiscal quarter of the Borrower beginning with the fiscal quarter ending September 30, 2001 to its Consolidated Tangible Net Worth as of the end of each fiscal quarter of the Borrower beginning with the fiscal quarter ending September 30, 2001 to exceed 1 to 1.

7.11 Quick Ratio. Permit the ratio (the "Quick Ratio") of (i) Consolidated Quick Assets to (ii) Consolidated Current Liabilities to be less than 2.25 to 1.00.

7.12 Capital Expenditures. Make capital expenditures that in the aggregate and on a consolidated basis exceed during each fiscal quarter of the Borrower the sum of \$7,000,000 plus the amount by which such expenditures during the immediately preceding quarter, beginning with the quarter ended September 30, 2001, were less than \$7,000,000.

7.13 Contracts Prohibiting Compliance with Agreement. Enter into any contract or other agreement that would prohibit or in any way restrict the ability of the Borrower to comply with any provision of this Agreement.

(G) Article VIII of the Loan Agreement is hereby amended by the replacement of existing subsections 8.1(c), (d) (e), (f) and (m) with the following:

(c) A final judgment or settlement for in excess of \$3,000,000 shall be rendered against or agreed to by the

Borrower or any of its Subsidiaries for the payment of money that, after deducting the amount of any insurance proceeds paid or payable to or on behalf of the Borrower or its Subsidiary in connection with such judgment or settlement, as the case may be, is in excess of \$3,000,000, and such judgment shall remain undischarged for a period of thirty (30) days, during which period execution shall not effectively be stayed, or such settlement shall remain unpaid for a period of thirty days after the agreed payment date unless such delay has been agreed to by the other party. If a dispute exists with respect to the liability of any insurance underwriter under any insurance policy of the Borrower or its Subsidiary, no deduction under this subsection shall be made for the insurance proceeds that are the subject of such dispute;

(d) The Borrower or any Subsidiary (except to the extent explicitly permitted by this Agreement), shall (1) voluntarily terminate operations or apply for or consent to the appointment of, or the taking of possession by, a receiver, custodian, trustee or liquidator of such Person or of all or a substantial part of the assets of such Person, (2) admit in writing its inability, or be generally unable, to pay its debts as the debts become due, (3) make a general assignment for the benefit of its creditors, (4) commence a voluntary case under the Federal Bankruptcy Code (as now or hereafter in effect), (5) file a petition seeking to take advantage of any other law relating to bankruptcy, insolvency, reorganization, winding-up, or composition or adjustment of debts, (6) fail to controvert in a timely and appropriate manner, or acquiesce in writing to, any petition filed against it in an involuntary case under the Federal Bankruptcy Code or applicable state bankruptcy laws or (7) take any corporate action for the purpose of effecting any of the foregoing;

(e) Without its application, approval or consent, a proceeding shall be commenced, in any court of competent jurisdiction, seeking in respect of the Borrower or any domestic Subsidiary: the liquidation, reorganization, dissolution, winding-up, or composition or readjustment of debt, the appointment of a trustee, receiver, liquidator or the like of such Person or of all or any substantial part of the assets of such Person, or other like relief in respect of such Person under any law relating to bankruptcy, insolvency, reorganization, winding-up, or composition or adjustment of debts; and, if the proceeding is being contested in good faith by such Person, the same shall continue undismissed, or unstayed and in effect for any period of 45 consecutive days, or an order for relief against such Person shall be

entered in any case under the Bankruptcy Code or applicable state bankruptcy laws;

(f) Any foreclosure or other proceedings shall be commenced to enforce, execute or realize upon any lien, encumbrance, attachment, trustee process, mortgage or security interest for payment of an amount in excess of \$500,000 against the Borrower or any Subsidiary;

(m) There shall occur a Change in Control;

Section 2. Representations and Warranties. The Borrower hereby represents and warrants as follows:

(a) The execution and delivery of this Amendment and the performance of this Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents, and the transactions contemplated hereby and thereby, have been authorized by all necessary corporate actions of the Borrower. This Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents constitute the legal, valid and binding obligations of the Borrower, enforceable against the Borrower in accordance with their respective terms.

(b) The Borrower has all requisite corporate power and authority to execute, deliver and perform its obligations under this Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents. Neither the authorization, execution, delivery or performance by the Borrower of this Amendment nor the performance of the Loan Agreement as amended hereby or any other Loan Document nor the performance of the transactions contemplated hereby or thereby violates or will violate any provision of the corporate charter or by-laws of the Borrower, or does or will, with the passage of time or the giving of notice or both, result in a breach of or a default under, or require any consent under or result in the creation of any lien, charge or encumbrance upon any property or assets of the Borrower pursuant to, any material instrument, agreement or other document to which the Borrower is a party or by which the Borrower or any of its properties may be bound or affected.

(c) The execution and delivery by the Borrower of this Amendment and the performance by the Borrower of the Loan Agreement as amended hereby and the Loan Documents do not and will not violate any provision of law or regulation applicable to the Borrower, or any writ, order or decree of any court or governmental or regulatory authority or agency applicable to the Borrower.

(d) The representations and warranties contained in Article IV of the Loan Agreement are true and correct, and the Borrower and its Subsidiaries are in compliance with all covenants set forth in Article VII of the Loan Agreement, provided that for this purpose that all references to the "Disclosure Schedule" in such Articles IV and VII shall be deemed to mean the Disclosure Schedule attached hereto, which is true and complete.

Section 3. Loan Documents. This Amendment shall be a Loan Document for all purposes.

Section 4. Conditions to Effectiveness. The effectiveness of this Amendment is conditioned on the following:

(a) The Borrower and the Lender shall each have executed and delivered a counterpart of this Amendment;

(b) The representations and warranties contained in Article IV of the Loan Agreement shall be true and correct in all material respects as of the date hereof as though made on and as of the date hereof;

(c) No Default or Event of Default under the Loan Agreement shall have occurred and be continuing;

(d) The conditions set forth in Sections 5.2-5.5 of the Loan Agreement shall have been met as of the date hereof, provided that for purposes thereof and Section 4.5 of the Loan Agreement, the "Balance Sheet Date" shall mean June 30, 2001 and the financial statements referred to therein shall mean the unaudited statements for the period ended June 30, 2001, that have been furnished to the Lender.

(e) The Lender shall have received a certificate of the clerk of the Borrower as to the votes of Borrower's directors authorizing the execution and delivery of this Amendment and the incumbency of the officers authorized to execute this Amendment on behalf of the Borrower and a certificate of the secretary of each of the Guarantors as to the votes of such Guarantor's directors authorizing the execution and delivery of the Guaranty and the incumbency of the officers authorized to execute the Guaranty on behalf of such Guarantor.

Section 5. Miscellaneous.

(a) On and after the date hereof, each reference in the Loan Agreement to "this Agreement" or words of like import shall mean and be deemed to be a reference to the Loan Agreement as amended hereby.

(b) Except as amended and modified hereby, the Loan Agreement is in all respects ratified and confirmed as of the date hereof, and the terms, covenants and agreements therein shall remain in full force and effect.

(c) This Amendment and the modifications to the Loan Agreement set forth herein shall be deemed to be a document executed under seal and shall be governed by and construed in accordance with the laws of The Commonwealth of Massachusetts.

(d) This Amendment may be executed in counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same document.

[Remainder of page intentionally left blank.]

IN WITNESS WHEREOF, the parties have caused this Amendment to be duly executed as of the date and the year first above written.

MKS INSTRUMENTS, INC.

By: /s/ William P Donlan

Title: Treasurer

FLEET NATIONAL BANK

By: /s/ Daniel G. Head Jr.

Title: Director