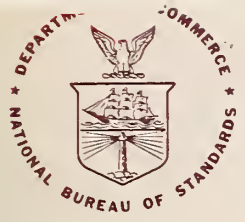

NBS TECHNICAL NOTE 1087

U.S. DEPARTMENT OF COMMERCE / National Bureau of Standards

Survey of Measurement Needs in the Chemical and Related Industries

J. Hord

The National Bureau of Standards[1] was established by an act of Congress on March 3, 1901. The Bureau's overall goal is to strengthen and advance the nation's science and technology and facilitate their effective application for public benefit. To this end, the Bureau conducts research and provides: (1) a basis for the nation's physical measurement system, (2) scientific and technological services for industry and government, (3) a technical basis for equity in trade, and (4) technical services to promote public safety. The Bureau's technical work is performed by the National Measurement Laboratory, the National Engineering Laboratory, the Institute for Computer Sciences and Technology, and the Center for Materials Science.

The National Measurement Laboratory

Provides the national system of physical and chemical measurement; coordinates the system with measurement systems of other nations and furnishes essential services leading to accurate and uniform physical and chemical measurement throughout the Nation's scientific community, industry, and commerce; provides advisory and research services to other Government agencies; conducts physical and chemical research; develops, produces, and distributes Standard Reference Materials; and provides calibration services. The Laboratory consists of the following centers:

- Basic Standards[2]
- Radiation Research
- Chemical Physics
- Analytical Chemistry

The National Engineering Laboratory

Provides technology and technical services to the public and private sectors to address national needs and to solve national problems; conducts research in engineering and applied science in support of these efforts; builds and maintains competence in the necessary disciplines required to carry out this research and technical service; develops engineering data and measurement capabilities; provides engineering measurement traceability services; develops test methods and proposes engineering standards and code changes; develops and proposes new engineering practices; and develops and improves mechanisms to transfer results of its research to the ultimate user. The Laboratory consists of the following centers:

- Applied Mathematics
- Electronics and Electrical Engineering[2]
- Manufacturing Engineering
- Building Technology
- Fire Research
- Chemical Engineering[2]

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Conducts research and provides scientific and technical services to aid Federal agencies in the selection, acquisition, application, and use of computer technology to improve effectiveness and economy in Government operations in accordance with Public Law 89-306 (40 U.S.C. 759), relevant Executive Orders, and other directives; carries out this mission by managing the Federal Information Processing Standards Program, developing Federal ADP standards guidelines, and managing Federal participation in ADP voluntary standardization activities; provides scientific and technological advisory services and assistance to Federal agencies; and provides the technical foundation for computer-related policies of the Federal Government. The Institute consists of the following centers:

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- Computer Systems Engineering

The Center for Materials Science

Conducts research and provides measurements, data, standards, reference materials, quantitative understanding and other technical information fundamental to the processing, structure, properties and performance of materials; addresses the scientific basis for new advanced materials technologies; plans research around cross-country scientific themes such as nondestructive evaluation and phase diagram development; oversees Bureau-wide technical programs in nuclear reactor radiation research and nondestructive evaluation; and broadly disseminates generic technical information resulting from its programs. The Center consists of the following Divisions:

- Inorganic Materials
- Fracture and Deformation[3]
- Polymers
- Metallurgy
- Reactor Radiation

[1] Headquarters and Laboratories at Gaithersburg, MD, unless otherwise noted; mailing address Gaithersburg, MD 20899.
[2] Some divisions within the center are located at Boulder, CO 80303.
[3] Located at Boulder, CO, with some elements at Gaithersburg, MD.

Survey of Measurement Needs in the Chemical and Related Industries

J. Hord

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U.S. DEPARTMENT OF COMMERCE, Malcolm Baldrige, Secretary

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SURVEY OF MEASUREMENT NEEDS IN THE CHEMICAL AND RELATED INDUSTRIES

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A survey of measurement needs in the chemical and related process industries has been completed, a data base established and reported herein. Sixty-five people responded to the survey, representing the chemical, oil and gas, pharmaceutical, electronic chemicals, energy, instrument manufacturer, food, plastics, and other segments of American industry. The respondents identified: 133 measurement problems of which 106 are defined in detail; 27 measurement needs where no current measurement capability exists (or is known); and three generic measurement areas (flow, composition/concentration, and temperature) in need of improvement. The survey revealed strong demands for improved in-line and in-reactor measurements, in a processing plant environment, to improve process/product quality and to reduce costs. The data base includes instrument (sensor) technical specifications, service conditions, calibration and maintenance requirements, and marketing information.

Key words: composition/concentration, data base, flow, humidity/moisture, pH, quantity, survey, temperature

To meet reader and user needs, this report departs from the usual NBS practice of using SI units. A full mix of units is used in the data base because the measurement requirements on each data sheet are reported as received from the survey respondent.

1.0 INTRODUCTION

This survey was undertaken to establish a data base on measurement needs in the chemical and related processing industries (CPI). The survey was conducted as part of a continuing effort of the Center for Chemical Engineering (CCE) to take an active role in focusing available resources (government and private sector) on the most pressing and pervasive measurement deficiencies within the CPI.

As a first step to identify these needs, the NBS/CCE sponsored an open forum on "process measurement capabilities and needs" at the national AIChE meeting in Denver, August 31, 1983. Then, on April 10, 1984, a small planning workshop was held at NBS (in Gaithersburg, Maryland) to define the survey procedures to be used, and the people to be contacted to acquire the necessary data on measurement needs. In late April, CCE requested permission from the Office of Management and Budget (OMB) to survey the private sector to obtain the desired information. In late July, OMB approval was granted and the survey forms were promptly mailed to individuals targeted as experts in specific fields of process instrumentation. Most survey responses were returned by September 1984 and all were received by late December 1984. The raw data were then compiled and analyzed, and the results are reported herein.

This survey was made possible through the expertise and cooperation of many people. The Steering Committee members that drafted the survey form and provided the initial list of candidate respondents are listed in Table 1. Table 2 acknowledges the 65 respondents who generously donated their time to complete the survey forms. Table 3 shows the form (and attachment) used in the survey.

2.0 RESULTS OF SURVEY

The tabulated survey data are presented in detail in Appendix 1. The format used for these data is derived directly from the survey form (Table 3) and the acronyms used in the data base format (Appendix 1) are identified on the first page of Appendix 1. Table 4 shows the correlation between the survey form and the data base format. The 65 contributors to the survey identified 106 primary measurement problems and an additional 27 secondary measurement problems.

As in any survey, the results are highly dependent upon representative sampling of knowledgeable respondents. From the outset, this survey was focused on the chemical and closely related processing industries. Representation of various sectors of American industry in this survey is indicated in Appendix 2. The reader should note that this listing is approximate in nature, i.e., many respondents represent diversified firms and more than one (as listed) industrial sector. Because of the pervasive diversity of these industries, it was expected that a wide variety of specialty measurement problems would be identified. This full range of measurement needs is listed in alphabetical order in Appendix 3. Additional measurement needs (of secondary importance) are alphabetically listed in Appendix 4. Measurement requirements tend to be very process specific; consequently, some very specific needs are identified in Appendices 3 and 4.

Nevertheless, a few generic measurement categories recurred frequently as major measurement problem areas as will be discussed in detail in that which follows. These major measurement problem areas are listed in Appendix 5.

Before delving into the detailed results of this survey, it should be pointed out that other related process measurement needs were identified in the 1983 Denver AIChE meeting. Specific measurement problems were identified for chemical substances that are difficult (e.g. corrosive, toxic, etc.) to handle [1], for processing of synthetic films and fibers [2], for petroleum refineries [3], and for on-line compositional analysis in various CPI applications [4]. In addition, Frost [5] has clearly defined (and discussed) the most pressing needs of the food industry. See also Wagner et al. [6] for a comprehensive review of process instrumentation for oilseeds, oil products, and combustible solvents.

The survey form used in this study produced data of varying degrees of interest to different readers. For example, nearly all of the survey parameters are of interest to sensor manufacturers and users, while researchers will be most attentive to technical requirements such as accuracy, precision, range, and response. Incentive for manufacturers to perform research to solve specific measurement problems is driven by sensor/instrument sales potential as related to item (2i) of the survey form. Recognizing this variation of interest for each reader, several parameters were selected for detailed discussion on the assumption that they were of common interest to all readers. The data sheets given in Appendix 1 permit individual readers to analyze the survey results and draw their own conclusions. The subsequent Appendices (2-17) highlight specific characteristics of those survey parameters selected for examination in this survey report.

2.1 DISCUSSION OF SPECIFIC SURVEY PARAMETERS

The survey parameters selected for individual discussion herein are: NEED, XTRANEED, DRIVER, ENVIRON, SENSITE, AVAILABLE, AND SECTOR.

NEED: The most important measurement problem(s) identified by each contributor. Each measurement problem, described by a completed survey form, is treated as a primary NEED. Each measurement problem, listed on line (1b) of the survey form and not described by a completed survey form, is treated as a secondary or XTRANEED. A perusal of the NEEDs listed in Appendix 3 reveals that the most common measurement problems involve sensing of flow rate, composition/concentration, or temperature. To facilitate study of NEEDs in each of these measurement areas, a separate listing is given in Appendix 5. Flow is cited as a major problem area 32 times, composition/concentration 27 times, and temperature 16 times. Looking back at Appendix 3, we see that quantity-gauging (level, volume, weight) is cited 9 times, humidity/moisture 6 times, pH 4 times, particle size/distribution 3 times, and oxygen content 3 times. Numerous other specific measurement problems are cited only once or twice.

Appendix 5 exhibits a wide variation of measurement problems within each of the three most cited categories--flow, composition/concentration, and temperature. In the flow category the need for improved liquid flowmetering appears dominant, followed by demands for improved gas, steam, and slurry flow measurement, respectively. There is no clear consensus of opinion on the most prevalent composition/concentration measurement need or temperature measurement need. However, a weak repetition pattern occurs for better temperature measurement in polymer processing and in combustion/gasifier applications.

XTRANEED: The next most important measurement problem(s) identified by contributors and not described in detail by a completed survey form. Twenty-seven secondary needs were identified and are listed in Appendix 4. Again, the measurement areas most cited were flow (11), composition/concentration (6), and temperature (3). Combining NEEDs and XTRANEEDs the total numbers for most cited measurement problem areas were: flow (43), composition/concentration (33)--excluding humidity and oxygen content, and temperature (19).

DRIVER: The primary driving force or incentive to improve measurement capability for the defined NEED. As indicated in the listing of Appendix 6, the dominant DRIVERs are improved process/product quality (66) and cost (34).

ENVIRON: The environment in which the sensor must function. A glance at Appendix 7 shows that an overwhelming number of the measurement problems occur in the plant (82) and nearly all of the rest occur in the lab (21).

SENSITE: The location (or "site") of the sensor within or relative to the process equipment. The listing of this parameter in Appendix 8 shows a strong preference for sensing in-line (79), in the reactor (38), or on-line (18). "In-line" has its usual meaning of making measurements with the sensor "in the flowing process stream." In this survey "on-line" is defined as making measurements with the sensor in "a stream withdrawn from the process."

AVAILABLE: The availability of the desired sensor or instrument in the commercial marketplace or via in-house research, design, and development. Referring to Appendix 9, it is apparent that commercial devices are available in most cases where measurement problems prevail ("yes/com'l" is cited 62 times) but fail to meet user requirements. Counting both commercial and in-house devices, 71 of the 106 measurement needs are partially (but inadequately) satisfied. No sensors or measurement methods are currently available (or else they are unknown) for 27 of the 106 cited measurement needs. These "shortfalls" in measurement capability are alphabetically listed in Appendix 10. A wide variety of special measurement problems are exhibited with flow, composition/concentration, and temperature in greatest demand of development of new measurement techniques. Again, liquid flowmetering seems to be the most common problem, followed closely by one-of-a-kind composition/concentration measurement problems. The unresolved temperature measurement problems are also one-of-a-kind.

SECTOR: The segment of the chemical and related processing industries most readily associated with the firm (organization) represented by the survey respondent. In many cases the respondent represents more sectors than the one listed in Appendix 2. Thus, the results are to be considered indicative of the respondent's culture but may be somewhat misleading from the standpoint of numerical representation of each sector. Performing the itemized SECTOR count in Appendix 2, we obtain: Chemical (25), oil and gas (15), pharmaceutical (11), electronic chemicals (10), energy (9), instrument manufacturer (8), food (5), and plastics (5).

In this survey no attempt was made to maintain a minimal statistical control volume of respondents from each industrial sector. It was felt that it was more important to uncover measurement needs than to determine statistically the most prevalent ones in any particular segment of American industry. The response of one contributor, knowledgeable in an entire field of measurement, can define the most pressing measurement problems in that particular sector of industry. However, in most cases it is natural to expect a respondent to address a narrower set of measurement problems, i.e., specific to a particular class of processes. Consequently, those segments of industry (e.g. chemical) represented by numerous survey responses should reveal their most pervasive measurement problems as well as a wide-ranging list of specific measurement needs. In most cases it would be presumptuous to assume that only one or two respondents have defined the most dominant measurement needs for an entire industrial sector.

The logic used in assessing the importance of measurement needs in the various segments of industry is as follows: recurrence of similar measurement problems is the primary rating factor for all SECTORS, is the only factor used for the highly diversified chemical industry, and is tempered by the author's judgment in those industries that produce a readily quantifiable class or range of products (i.e. oil and gas, pharmaceutical, electronic chemicals, energy, and food). Of course the reader can also exercise the option of studying the listings in Appendices 11 and 12 and drawing his/her own conclusions.

All measurement needs are listed by SECTOR in Appendix 11. All unavailable measurement methods (to meet specific measurement needs) are listed by SECTOR in Appendix 12. The data in Appendix 11 indicate that the dominant measurement needs, by sector, and in descending priority are:

Chemical--flow (emphasis on liquids), composition/concentration (mostly one-of-a-kind applications), low level moisture in process fluids, and special quantity-gauging applications;

Oil and Gas--flow, strongly biased to liquids with secondary emphasis on gas flows;

Pharmaceutical--fluid flow, quantity-gauging in reactors, pH, and chromatographic analyses;

Electronic Chemicals--composition in process plasmas, melt compositions, and to a lesser extent low-level moisture and trace impurities in process gases, atomic impurities in bulk materials, submicron particle counting and characterization in process fluids, crystalline defects in semiconductors, and accurate high temperatures in hostile environments;

Energy--wide-ranging temperatures (to 3000°C) in hostile environments, flow (emphasis on steam), and concentration of heavy metals (U, Pu) in process streams;

Instrument Manufacturer--flow (liquids, gases, and steam), and specialty temperature sensing applications;

Food--protein, fat, and moisture content in food products;

Plastics--no evidence of a prevalent need;

Other Sectors--measurement needs identified by other sectors responding to this survey (academe, consultant, consumer products, glass, government, metals, paper, petrochemical, steel, and textiles) are also listed in Appendix 11 without prejudice or detailed comment herein. Some of these results are considered very important, e.g. the need for real-time in-situ measurement of lignin content in the paper industry.

The listing in Appendix 12 of unavailable sensors, by sector, and in descending priority shows:

Chemical--flow (liquid, steam, slurry), composition of process streams, and level in glass-lined, agitated, jacketed reactors;

Electronic Chemicals--melt composition, submicron particle counting and characterization in process fluids, crystalline defects in semiconductors, and accurate high temperatures in hostile environments;

Other Sectors--all other unavailable measurement methods are listed, by sector, in Appendix 12 without prejudice or further comment herein.

2.2 BRIEF SYNOPSIS OF ADDITIONAL SURVEY PARAMETERS

Although not discussed separately herein, several of the other survey parameters that show interesting trends and will stand alone when separated from the body of each data sheet, are listed in Appendices 13 to 17 and briefly summarized below.

Appendix 13 lists the wide variety of MEDIA (process fluids or materials) cited in this survey. The results are indicative of the diversity of industrial sectors polled in this survey. Required SERVICE conditions for the desired measurements are shown in Appendix 14. A majority of the contributors seek corrosive SERVICE compatibility. A strong demand also exists for sensors that are serviceable under vibration, erosion, and sterile operating conditions. It is apparent from the data in Appendix 15 that most of the respondents specified electrical service

requirements for measurement equipment to meet National Electrical Code (NEC) designations of Class 1, Divisions 1 or 2, and Groups B, C, or D. Inspection of Appendix 16 reveals that the survey responses were dominated by the desire for "in-place" calibrations (CALSITE) for measurement devices. The balance of the responses, with one exception, indicated a willingness to remove the sensors for calibration. Finally, Appendix 17 indicates that the calibration requirements for physical vs. electrical sensor STIMULUS are evenly divided.

Referring to the survey data base in Appendix 1 a few additional observations are worth noting. A perusal of the acceptable LIFE expectancy parameter indicates a wide variation in contributor response--4 hours to 20 years for different sensors. As expected the acceptable sensor COST varied according to the complexity of the measurement, from $25 to $50K. The estimated quantity of sensors needed per year (NOPERYR) varied from 1 to 10,000, again depending upon the nature of the measurement and the required sensor.

3.0 SUMMARY

A data base of measurement needs in the chemical and related process industries has been constructed and is documented herein. One hundred and thirty-three measurement problems are identified and 106 of these are described in detail via data sheets. The most frequently cited measurement areas in need of improvement were flow (43 times), composition/concentration (33 times), and temperature (19 times).

The primary incentive to improve measurement capability was attributed largely to improvement of process/product quality and cost reduction. Most of the measurement problems were related to measurements in the plant with a strong desire for in-line and in-reactor sensing. About 1/4 of the measurement needs are totally unsatisfied, i.e., the respondents know of no sensor, instrument, or measurement method to satisfy their requirements. Roughly 2/3 of the measurement needs are partially (though inadequately) met via commercially available and in-house instruments. Those measurement problems where the desired measurement capability is unavailable are compiled and listed collectively, and by industrial sector, herein. Similarly, all measurement needs (i.e., where sensors are available and unavailable) are compiled and listed collectively, and by industrial sector. The most urgent measurement needs of several sectors of American industry are identified and highlighted in this survey report.

A broad cross-section of industrial experts contributed to this measurement data base with significant representation of the chemical, oil and gas, pharmaceutical, electronic chemicals, and energy sectors. It is anticipated that this data base will assist instrument manufacturers and users, and government bodies, to focus available resources on the most pressing industrial measurement problems to improve future measurement capabilities.

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5.0 TABLES AND APPENDICES

Table 1. Survey Steering Committee

Industry/Government	NBS
H.C. (Jack) Frost Jack Frost & Associates	M.M. Hessel Deputy Director, NBS/CCE
P.E. Larsen Division Engineer Dow Chemical Co.	J. Hord Director, NBS/CCE
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Other Industry Advisors

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BARRETTE , WALLACE J.
PRODUCT ENGINEER
BARBER COLMAN

BAUM , G.A.
DIRECTOR, PAPER MILLS DIV.
INSTITUTE OF PAPER CHEMISTRY

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MASS. INST. TECH.

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BRADSHAW , RAY L.
INSTRUMENT SUPERVISOR
GULF CHEMICALS

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ANHEUSER-BUSCH CO.

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PHILLIPS PETROLEUM CO.

FROST , H.C. (JACK)
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FORD MOTOR CO. (NASHVILLE GLASS PLANT)

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KANTHAL CORP.

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GEORGE KULLBERG
SR. ENGR. SPECIALIST

E.I. DUPONT DE NEMOURS
EUGENE S. TAYLOR
SR. CONSULTANT

E.I. DUPONT DE NEMOURS
J.B. ARANT
SR. CONSULTANT

FORD MOTOR CO. (NASHVILLE GLASS PLANT)
GEORGE R. GILBERT, P.E.
MFG. PROCESS ENGR.

GULF CHEMICALS
RAY L. BRADSHAW
INSTRUMENT SUPERVISOR

GULF RESEARCH & DEVELOPMENT CO.
THOMAS J. PUZNIAK
MGR., SYSTEMS & CONTROLS

HERCULES INC.
JOHN R. HILEMAN
MGR., PROCESS CONTROL SYSTEMS

Table 2. Survey Respondents (by Company)--Continued

HEWLETT PACKARD OED
A. GRANT ELLIOT
PROJECT MANAGER

HOECHST ROUSSEL PHARMACEUTICALS
MICHAEL BLOOMSTEIN
ASSOCIATE DIRECTOR, QA

INSTITUTE OF PAPER CHEMISTRY
G.A. BAUM
DIRECTOR, PAPER MILLS DIV.

JACK FROST & ASSOCIATES
H.C. (JACK) FROST
PRESIDENT

JMS SOUTHEAST INC.
FRANK L. JOHNSON
PRESIDENT

KANTHAL CORP.
ERIK HAGGLUND
DIRECTOR, CORPORATE DEVELOP.

LAND INSTRUMENTS INC.
RAYMOND G. PEACOCK
VICE PRESIDENT

LEEDS & NORTHRUP CO.
ALBERT S. TENNEY
INDUSTRY MANAGER

MARTIN MARIETTA ENERGY SYSTEMS
DONALD R. MILLER
GROUP LEADER

MARTIN MARIETTA ENERGY SYSTEMS
JAMES O. HYLTON
ENGR. (INSTRUM. & CONTROLS)

MARTIN MARIETTA ENERGY SYSTEMS
RICHARD L. ANDERSON
GROUP LEADER

MARTIN MARIETTA ENERGY SYSTEMS
D.D. McCUE
STAFF ENGINEER

MASS. INST. TECH.
J.M. BEER
PROFESSOR OF CH.E. 66-548

MERCK & CO. INC.
L. PROCYK
INSTRUMENT ENGINEER

MERCK & CO. INC.
JOSEPH WIDMER
SECTION HEAD - INSTRUMENTATION

MERCK & CO. INC.
CLEM J.C. HAGENDOORN
SECTION HEAD-INSTRUMENTATION

MERCK & CO. INC.
S.M. KLEINHANS
MANAGER, INSTR. & CONTROL ENGRG.

MERCK & CO., INC.
PAUL BERNDT
INSTRUMENT ENGR.

METROLOGY ENGRG. CENTER
REY CHEESMAN
MECH. ENGINEER

MOBIL R&D CENTER
BRIAN RATIGAN
RESEARCH ENGINEER

MOBIL R&D CORP.
RALPH W. MOORE
ENGR. CONSULTANT

MONSANTO CO.
J.G. CONVERSE
PROCESS ANALYZER SPECIALIST

NATIONAL BUREAU OF STANDARDS
CHARLES F. SINDT
ENGINEER

NATIONAL BUREAU OF STANDARDS
JAMES A. BRENNAN
ENGINEER

PHILLIPS PETROLEUM CO.
JACK J. FOX
FLUID MSMT. SUPV'R., CORP. ENGRG.

ROCKWELL INTERNAT'L SCI. CENTER
W.E. TENNANT
MANAGER, INFRARED DEVICES

Table 2. Survey Respondents (by Company)--Continued

ROHM & HAAS CO.
EUGENE P. DOUGHERTY, JR.
SR. PROCESS ENGINEER

STANDARD OIL CO. (INDIANA)
JOHN B. CLARK
RESEARCH CONSULTANT

STAUFFER CHEMICAL CO.
TIMOTHY E. LEGHORN
PRINCIPAL INSTRUM. ENGR.

TEXACO INC.
W.L. HOPKINS
CHIEF E&CS ENGINEER

TEXAS INSTRUMENTS
ANDREW J. PURDES
MGR. III-V MATERIALS BRANCH

TEXAS INSTRUMENTS INC.
CARLOS A. CASTRO
MANAGER, II-VI COMPOUNDS BRANCH

TEXAS INSTRUMENTS INC.
PEI WANG
SR. STAFF MEMBER

THE STANDARD OIL CO. (OHIO)
KENNETH L. HOPKINS
MANAGER, CONTROL SYSTEMS

UNION CARBIDE CORP.
WILLIAM H. WAGNER
STAFF ENGINEER

UPJOHN CO.
R.B. JONES
PROJECT ENGR.

WESTINGHOUSE HANFORD CO.
COLLINS P. CANNON
FELLOW SCIENTIST

WIDENER UNIVERSITY
Y.P. GUPTA
ASSOC. PROFESSOR OF ENGRG.

YELLOW SPRINGS INSTRUMENT
MICHAEL FLORA
TECHNOLOGY MGR.

Table 3. Survey Form and Attachment

NBS-1213
(07-84)

U.S. DEPARTMENT OF COMMERCE
National Bureau of Standards

OMB Approval
No. 0652-0021
Expiration Date
09/30/84

SURVEY OF MEASUREMENT NEEDS IN THE CHEMICAL AND RELATED PROCESS INDUSTRIES*

1. Measurement Needs:

(a) What is your most important measurement problem? _____

_____

(b) List other major measurement problems where current state-of-the-art capability does not meet your current or projected needs _____

_____

_____

(c) What is the process fluid (media) in the measurement need identified in 1(a)? _____

(d) What is the primary driving force for the need identified in 1(a)?

☐ Cost Reduction ☐ Quality Improvement

☐ Other (Specify) _____

_____

2. Desired Instrument (Sensor) Characteristics:

(a) Service Conditions

☐ Corrosive ☐ Erosive ☐ Vibration ☐ Sterility

☐ Lab ☐ Plant ☐ Other (Specify) _____

_____

_____

_____

Electrical Classification (e.g. NEC, Art. 500, Class 1, Division 2, Group B, etc.) _____

(b) Accuracy _____

(c) Precision (Repeatability) _____

(d) Range _____

(e) Response Time _____

(f) Minimal Acceptable Calibration Frequency _____

☐ In-Place ☐ Remove and Calibrate ☐ Physical Stimulus Required

☐ Electrical/Simulated Stimulus Acceptable

(g) Minimal Acceptable Maintenance Frequency _____

Minimal Acceptable Down-time for Maintenance _____

(h) Minimal Acceptable Life Expectancy _____

(i) Cost Per Sensor _____ No. of sensors Needed Per Year _____

*Please complete this 2-sided form for the measurement problem you identify on line 1(a). Answer only those questions that pertain to your measurement problem. If you wish to describe another measurement problem that you list on line 1(b), use a separate form.

Table 3. Survey Form and Attachment (Continued)

3. Measurement Needs Compared to Current State-of-the Art Capabilities:

(a) Do you want measurements with the sensor in

☐ the flowing process stream? ☐ a reactor or vessel?

☐ a stream withdrawn from the process?

☐ a sample of the process stream withdrawn for lab measurement?

(b) Are there currently available devices for this measurement?_____

Commercial_____or In-House Design?_____

(c) If yes, identify devices (mfg'r, type, etc.) _____

_____

_____

_____

(d) If yes, what are the shortcomings of the present devices?

☐ Need in-line/on-line measurement ☐ Reliability ☐ Accuracy

☐ Maintenance/Upkeep ☐ Other (Specify) _____

_____

_____

4. Other explanatory remarks or comments:_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

5. Your Name_____

Title_____

Company _____

Address_____

Telephone ( )_____ Date:_____

Table 3. Survey Form and Attachment (Continued)

Process Measurement Parameters

Several generic areas of online process control and custody transfer measurements are listed below to stimulate your thoughts. This list is by no means complete.

Fluid Flow-Related Measurements

- Single component fluid flow (gaseous or liquid)
- Viscoelastic fluid flow (polymers, etc.)
- Solid-liquid flow (slurries)
- Solid-gas flow
- Liquid-gas (or vapor) flow
- Multiphase flow
- Multiphase multicomponent flow
- Quality
- Density
- Viscosity
- Solid content in solid-fluid flow

Temperature Measurements

- High temperatures
- Small temperature differences at high temperatures
- Rapidly fluctuating temperatures
- High temperature in hostile environments

Pressure Measurements

- High pressures
- Small differential pressures at high pressures
- Rapidly fluctuating pressures

Chemical Composition and Concentration Measurements

- Chemical analysis
- Impurities and trace analysis
- Elemental analysis
- Humidity (very low levels)
- Degree of mixing

Particle Characterization

- Size, shape, population, distribution, velocity

Surface Effects

- Adsorption, desorption
- Corrosion, erosion, bonding

Mechanical/Geometric Properties

- Tensile strength, compressive strength, shear stress, Poisson's ratio, moduli, expansion coefficient, Porosity, shape, thickness, diameter, proximity

Other

- pH
- Level
- Energy content (coal, oil, gas, etc.)
- Dissolved oxygen content
- Electrical conductivity
- Moisture content in solids and slurries
- Radioactivity
- Biocell age, distribution, activity level
- Turbulence/agitation intensity
- Surface tension
- Refractive index
- Off-gas analysis
- Specific ions
- Glucose
- Enzyme sensors for
  - Carbohydrates
  - Proteins
  - Energy content (State)

Table 4. Correlation Between Survey Form and Survey Data Base Format

Data Sheets (Appendix 1)	Survey Form (Table 3)	
NEED	Line 1a	Most important measurement problem
XTRANEED	Line 1b	Other important measurement problem(s)
MEDIA	Line 1c	Process fluid in which measurement is made
DRIVER	Line 1d	Driving force for improved measurement
SERVICE	Line 2a (top row)	Sensor service conditions
ENVIRON	Line 2a (2nd row)	Sensor application environment
NEC	Line 2a (6th row)	National Electrical Code designation
ACCURACY	Line 2b	Accuracy required in measurement
PRECISION	Line 2c	Precision required in measurement
RANGE	Line 2d	Range required in measurement
RESPONSE	Line 2e	Response time of sensor/instrument
CALFREQ	Line 2f	Minimal acceptable calibration frequency
CALSITE	Line 2f (top row)	Calibration "site" or location
STIMULUS	Line 2f (both rows)	Physical/electrical calibration stimulus required
MAMF	Line 2g	Minimal acceptable maintenance frequency
MADTM	Line 2g (next row)	Minimal acceptable down-time for maintenance
LIFE	Line 2h	Minimal acceptable life expectancy
COST	Line 2i (left)	Cost of each sensor
NOPERYR	Line 2i (right)	Number of sensors needed each year
SENSITE	Line 3a	Location or "site" of sensor
AVAILABLE	Line 3b	Are sensors currently available?
MFGR	Line 3c	How many manufacturers exist?
FAULTS	Line 3d	Shortcomings of existing sensors
OTHER	Line 4	Explanatory remarks/comments
SECTOR	*	Industrial sector represented by respondent

*Deduced from company affiliation and measurement problem identified.

Appendix 1. Measurement Survey Data Base

The data sheets listed herein use a consolidated data base format as defined below and are direct conversions of the survey forms completed by the respondents.

NEED	The contributor's most important measurement problem
XTRANEED	The contributor's next most important measurement problem
MEDIA	The process fluid in which the measurement is to be made
DRIVER	The driving force (incentive) to improve measurement capability
SERVICE	The service conditions to which the sensor is exposed
ENVIRON	The plant, lab, or field application environment
NEC	The National Electrical Code classification for service compatibility
ACCURACY	The accuracy required in the measurement
PRECISION	The precision (repeatability) required in the measurement
RANGE	The range (span or rangeability) required for measurement
RESPONSE	The acceptable time required for the sensor to respond to change in measured parameter
CALFREQ	The minimal acceptable calibration frequency
CALSITE	The location (or "site") where calibrations are performed
STIMULUS	The physical/electrical stimulus desired for calibration
MAMF	The minimal acceptable maintenance frequency
MADTM	The minimal acceptable down-time for maintenance
LIFE	The minimal acceptable life expectancy of sensor
COST	The desired/acceptable cost of each sensor
NOPERYR	The estimated number of sensors to be purchased each year
SENSITE	The desired location (or "site") of sensor relative to the process
AVAILABLE	The commercial or in-house availability of a suitable sensor
MFGR	The number of manufacturers of existing sensors
FAULTS	The deficiencies of existing sensors
OTHER	The additional explanatory comments/remarks
SECTOR	The sector of industry represented by the contributor

Nomenclature

Normal abbreviations are used throughout the data sheets. For example, % = percent, SEC = seconds, HR = hour(s), LB = pound(s), PPM = parts per million, MO = month(s), YR = year(s), C = Celsius Temperature, GPM = gallons per minute, SCFD = standard cubic feet per day, F = Fahrenheit temperature, DEG. = degrees, $K = kilo or thousands of dollars, BPD = barrels per day, etc. Where XTRANEED is recorded as "CITED," another data sheet has been completed by the respondent detailing the identified XTRANEED. NA means "not answered" on the original survey form. The NEC parameter is recorded in National Electrical Code style, i.e., C1/D2/GC&D means NEC Class 1, Division 2, Groups C and D electrical service compatibility is specified. Scientific computer notation is used for some numeric ranges, e.g. "10e5-2x10e5" means a range of 10^5 to 2×10^5.

Appendix 1. Measurement Survey Data Base

RECORD NO.	1
NEED	FLAMMABLE GAS DETECTORS (HYDROCARBONS IN AIR)
XTRANEED	CITED
MEDIA	HYDROCARBONS IN AIR
DRIVER	SAFETY
SERVICE	CORROSIVE
ENVIRON	PLANT
NEC	C1/D2/GC&D
ACCURACY	3% OF FULL SCALE
PRECISION	1%
RANGE	0-100% LFL
RESPONSE	<5 SEC
CALFREQ	3 MO
CALSITE	NA
STIMULUS	PHYSICAL
MAMF	3 MO
MADTM	1 DAY/6 MO
LIFE	2-3 YR
COST	$0.5-1.0K
NOPERYR	NA
SENSITE	IN-LINE/ON-LINE SAMPLING, ESPECIALLY IN VENT LINES
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	MOISTURE AFFECTS RELIABILITY
OTHER	NEED SENSORS WITH MOISTURE TOLERANCE
SECTOR	CHEMICAL

RECORD NO.	2
NEED	DEW POINT IN PRESSURE SYSTEMS
XTRANEED	CITED
MEDIA	AIR
DRIVER	COST, QUALITY
SERVICE	NA
ENVIRON	PLANT
NEC	C1/D2/GC&D
ACCURACY	1 DEG.C OF DEW POINT
PRECISION	0.5 C
RANGE	-40 TO -20 C
RESPONSE	<5 SEC
CALFREQ	6 MO
CALSITE	IN-PLACE
STIMULUS	PHYSICAL
MAMF	3 MO
MADTM	1 DAY/MO
LIFE	2-3 YR
COST	$0.5-1.0K
NOPERYR	NA
SENSITE	IN-LINE
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	ACCURACY
OTHER	NEED IMPROVED IN-LINE SENSOR
SECTOR	CHEMICAL

Appendix 1. Measurement Survey Data Base--Continued

RECORD NO.	3
NEED	NONINTRUSIVE FLOW RATE (PROCESS LIQUIDS)
XTRANEED	CITED
MEDIA	PROCESS LIQUIDS
DRIVER	COST, QUALITY
SERVICE	NA
ENVIRON	PLANT
NEC	C1/D2/GC&D
ACCURACY	0.5%
PRECISION	0.1%
RANGE	2-40 FT/SEC
RESPONSE	NA
CALFREQ	6 MO
CALSITE	IN-PLACE
STIMULUS	NA
MAMF	6 MO
MADTM	1 DAY/6 MO
LIFE	5 YR
COST	$2-2.5K (1 IN. PIPE)
NOPERYR	NA
SENSITE	IN-LINE
AVAILABLE	YES/COM'L (ULTRASONIC)
MFGR	VARIOUS
FAULTS	SCALE BUILD-UP ON PIPE I.D. AFFECTS RELIAB.
OTHER	NEED SCALE-COMPENSATING CLAMP-ON METERS
SECTOR	CHEMICAL

RECORD NO.	4
NEED	HgCdTe MELT COMPOSITION IN LIQUID PHASE EPITAXY (LPE)
XTRANEED	NA: SPECIAL EMPHASIS ON Cd ATOMIC FRACTION MEAS.
MEDIA	HgCdTe MELT UNDER 1 ATM. HYDROGEN
DRIVER	REPRODUCIBLE LPE FILMS FROM MELT
SERVICE	NONINTRUSIVE OR NONCONTAMINATING
ENVIRON	IN REACTOR @ 500 C
NEC	NA
ACCURACY	5% OF AT. FRACTION
PRECISION	2%
RANGE	SEE "OTHER"
RESPONSE	NONCRITICAL
CALFREQ	NONCRITICAL
CALSITE	NA
STIMULUS	NA
MAMF	NONCRITICAL
MADTM	NONCRITICAL
LIFE	2 YR
COST	UP TO $10K
NOPERYR	4
SENSITE	REACTOR
AVAILABLE	NO
MFGR	NA
FAULTS	NA
OTHER	AT. FR.: Hg(0.200-0.300), Te (0.650-0.850), Cd (0.003-0.010)
SECTOR	ELECTRONIC CHEMICALS

Appendix 1. Measurement Survey Data Base--Continued

RECORD NO.	5
NEED	RAPID COPPER CORROSION RATE DETECTOR
XTRANEED	ON-LINE CONTROL OF AMINE/GLYCOL REBOILER @ FUEL EFFIC. LEVEL
MEDIA	LIGHT PARAFFIN HYDROCARBONS
DRIVER	COST, QUALITY
SERVICE	CORROSIVE
ENVIRON	PLANT
NEC	C1/D2/GD
ACCURACY	ANSI/ASTM D130-75
PRECISION	ANSI/ASTM D130-75
RANGE	ANSI/ASTM D130-75
RESPONSE	3 MIN
CALFREQ	WEEKLY
CALSITE	IN-PLACE
STIMULUS	NA
MAMF	WEEKLY
MADTM	NA
LIFE	1 YR
COST	$500
NOPERYR	40
SENSITE	IN-LINE, ON-LINE
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	TOO SLOW, MANUAL OPERATION
OTHER	NEED FAST (<3 MIN) IN-LINE SENSOR
SECTOR	OIL & GAS

RECORD NO.	6
NEED	QUANTUM IR DETECTOR
XTRANEED	NA
MEDIA	MULTICOMPONENT POLYMER SOLUTIONS
DRIVER	COST, QUALITY
SERVICE	NA
ENVIRON	PLANT
NEC	C1/D2/GD
ACCURACY	NA
PRECISION	NA
RANGE	NA
RESPONSE	NA
CALFREQ	NA
CALSITE	NA
STIMULUS	NA
MAMF	NA
MADTM	NA
LIFE	NA
COST	NA
NOPERYR	50
SENSITE	IN-LINE
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	NEED IN-LINE DETECTOR
OTHER	NEED SENSOR TOLERANT OF SUDDEN CHANGES IN LIGHT LEVEL
SECTOR	CHEMICAL

Appendix 1. Measurement Survey Data Base--Continued

RECORD NO.	7
NEED	HIGH TEMPERATURE IN HOSTILE ENVIRONMENT (SYNGAS)
XTRANEED	CITED
MEDIA	REACTOR SYNGAS
DRIVER	QUALITY, RELIABILITY
SERVICE	CORROSIVE, EROSIVE (PRESSURE =1000 PSIG)
ENVIRON	PLANT
NEC	C1/D2/GB,C&D
ACCURACY	5 F
PRECISION	1 F
RANGE	TO 2000 F
RESPONSE	FAST
CALFREQ	1 YR
CALSITE	IN-PLACE/REMOV.&CAL.
STIMULUS	NA
MAMF	12-18 MO
MADTM	NONE
LIFE	NA
COST	NA
NOPERYR	NA
SENSITE	REACTOR
AVAILABLE	YES/COM'L/IN-HOUSE
MFGR	NA
FAULTS	RELIAB., ACCURACY, MAINTENANCE
OTHER	NEED ROBUST SENSOR TO RESIST MOLTEN SLAG, CARBON, ASH, ETC.
SECTOR	CHEMICAL

RECORD NO.	8
NEED	HIGH VISCOSITY (ASPHALT) @ 500 F & 1000 PSIG
XTRANEED	CITED
MEDIA	RESIDUAL OIL (HEAVY ASPHALT)
DRIVER	COST, QUALITY
SERVICE	NA
ENVIRON	PLANT
NEC	C1/D2/GD
ACCURACY	1% OF F.S.
PRECISION	0.2%
RANGE	VARIOUS
RESPONSE	MODERATE
CALFREQ	12-18 MO
CALSITE	REMOV. & CAL.
STIMULUS	NA
MAMF	12-18 MO
MADTM	NONE
LIFE	5-10 YR
COST	NA
NOPERYR	NA
SENSITE	IN-LINE
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	ACCUR., VISCOS. & TEMP. SENSITIVITY, MAINTEN.
OTHER	SEVERAL SIMILAR APPLICATIONS
SECTOR	CHEMICAL

RECORD NO.	9
NEED	LIQUID-VAPOR STEAM FLOW
XTRANEED	CITED
MEDIA	STEAM
DRIVER	ENERGY ACCOUNTING
SERVICE	NA
ENVIRON	PLANT
NEC	C1/D2/GB,C&D
ACCURACY	1%
PRECISION	0.1%
RANGE	VARIOUS
RESPONSE	NON-CRITICAL
CALFREQ	1 YR
CALSITE	IN-PLACE/REMOV.&CAL.
STIMULUS	NA
MAMF	1 YR
MADTM	MINIMAL
LIFE	5-10 YR
COST	NA
NOPERYR	MANY
SENSITE	IN-LINE
AVAILABLE	NO
MFGR	NA
FAULTS	NA
OTHER	NEED WET STEAM SENSORS TO METER ENERGY DISTRIBUTION IN PLANT
SECTOR	CHEMICAL

RECORD NO.	10
NEED	FLUID FLOW RATE (PETROLEUM PRODUCTS)
XTRANEED	NA
MEDIA	PETROLEUM PRODUCTS
DRIVER	QUALITY
SERVICE	CORROSIVE, EROSIVE
ENVIRON	PLANT
NEC	C1/D2/GB
ACCURACY	0.01%
PRECISION	0.005%
RANGE	VARIOUS
RESPONSE	3 SEC
CALFREQ	3 MO
CALSITE	IN-PLACE
STIMULUS	ELECTRICAL
MAMF	3 MO
MADTM	1 HR
LIFE	5 YR
COST	$2.5K
NOPERYR	1000
SENSITE	IN-LINE
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	ACCURACY, MAINTEN.
OTHER	RANGES: 0-100 GPM, 100-1000 GPM, 1000-2000 GPM
SECTOR	OIL & GAS

Appendix 1. Measurement Survey Data Base--Continued

RECORD NO.	11
NEED	GAS FLOW RATE
XTRANEED	CITED
MEDIA	NATURAL GAS
DRIVER	EQUITY IN COMMERCIAL EXCHANGE
SERVICE	NA
ENVIRON	PLANT & REMOTE STATIONS
NEC	NA
ACCURACY	0.1%
PRECISION	0.1%
RANGE	10-100 MILLION SCFD
RESPONSE	SEVERAL SEC.
CALFREQ	2 MO
CALSITE	IN-PLACE
STIMULUS	NA
MAMF	1 YR
MADTM	2 HR
LIFE	5 YR
COST	NA
NOPERYR	NA
SENSITE	IN-LINE
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	ACCURACY, MAINTEN.
OTHER	MAINTENANCE PROBLEM WITH TURBINE METERS
SECTOR	OIL & GAS

RECORD NO.	12
NEED	SLURRY FLOW RATE AT HIGH TEMPERATURES (HEAVY HYDROCARBONS)
XTRANEED	LIQUID FLOW RATE NEAR BOILING POINT
MEDIA	HEAVY HYDROCARBONS (TARS, STILL BOTTOMS)
DRIVER	QUALITY
SERVICE	EROSIVE, VIBRATION
ENVIRON	PLANT & TEMP. OF 500-900 F
NEC	C1/D1/GC
ACCURACY	0.25% (1.0% OK)
PRECISION	0.1%
RANGE	0-25 FT/SEC
RESPONSE	<1 SEC (3-5 SEC OK)
CALFREQ	1 MO
CALSITE	IN-PLACE
STIMULUS	ELECTRICAL
MAMF	6 MO
MADTM	2 HR
LIFE	4 YR
COST	$2K
NOPERYR	5
SENSITE	IN-LINE
AVAILABLE	YES/COM'L
MFGR	ONE
FAULTS	ACCURACY, MAINTEN.
OTHER	NEED EXISTS IN 4-12 IN. PIPES
SECTOR	OIL & GAS

RECORD NO.	13
NEED	AREA & PEAK HEIGHT OF CHROMATOGRAPHIC DATA
XTRANEED	PARTICLE SIZE & SURFACE AREA
MEDIA	NA (VOLTAGE VS. TIME MEASUREMENT)
DRIVER	QUALITY
SERVICE	NA
ENVIRON	LAB
NEC	NA
ACCURACY	1%
PRECISION	0.5%
RANGE	NA
RESPONSE	NA
CALFREQ	1 YR
CALSITE	NA
STIMULUS	ELECTRICAL
MAMF	NA
MADTM	1-2 HR
LIFE	NA
COST	NA
NOPERYR	NA
SENSITE	NA
AVAILABLE	YES/IN-HOUSE
MFGR	NA
FAULTS	NEED IN-LINE/ON-LINE MEAS., MAINTEN.
OTHER	NA
SECTOR	PHARMACEUTICAL

RECORD NO.	14
NEED	GAS OR LIQUID FLOW RATE
XTRANEED	NA
MEDIA	ETHYLENE GAS, PROPYLENE GAS
DRIVER	COST
SERVICE	NA
ENVIRON	PLANT
NEC	C1,2/D2/GB&C
ACCURACY	<0.25%
PRECISION	NA
RANGE	100 IN. WATER DP
RESPONSE	NA
CALFREQ	1 MO
CALSITE	REMOV. & CAL.
STIMULUS	ELECTRICAL
MAMF	1 MO.
MADTM	1 MO
LIFE	1 YR
COST	$3K
NOPERYR	3
SENSITE	IN-LINE
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	ACCURACY
OTHER	NEED ACCURATE FIELD METER FOR GASES & LIQUIDS
SECTOR	PETROCHEMICAL

Appendix 1. Measurement Survey Data Base--Continued

RECORD NO.	15
NEED	LOW LIQUID FLOW RATE (NATURAL GAS LIQUIDS)
XTRANEED	CITED
MEDIA	NATURAL GAS LIQUIDS
DRIVER	QUALITY
SERVICE	NA
ENVIRON	PLANT
NEC	C1/D1/GD
ACCURACY	0.25%
PRECISION	NA
RANGE	10:1 RANGEABILITY
RESPONSE	NA
CALFREQ	1 MO
CALSITE	IN-PLACE
STIMULUS	NA
MAMF	1 YR
MADTM	2 HR
LIFE	5 YR
COST	NA
NOPERYR	NA
SENSITE	IN-LINE
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	ACCURACY
OTHER	ACCURACY QUESTIONABLE WITH LOW FLOW TURBINE METERS
SECTOR	OIL & GAS

RECORD NO.	16
NEED	MASS FLOWMETER FOR NATURAL GAS LIQUIDS
XTRANEED	CITED
MEDIA	NATURAL GAS LIQUIDS
DRIVER	COST, QUALITY
SERVICE	NA
ENVIRON	PLANT
NEC	C1/D1/GD
ACCURACY	0.25%
PRECISION	NA
RANGE	10:1 RANGEABILITY
RESPONSE	NA
CALFREQ	1 MO
CALSITE	IN-PLACE
STIMULUS	NA
MAMF	1 YR
MADTM	2 YR
LIFE	5 YR
COST	NA
NOPERYR	NA
SENSITE	IN-LINE
AVAILABLE	YES/COM'L
MFGR	ONE
FAULTS	NOT PROVEN ON NAT. GAS LIQUIDS
OTHER	NA
SECTOR	OIL & GAS

Appendix 1. Measurement Survey Data Base--Continued

RECORD NO.	17
NEED	PROTEIN CONTENT IN STARCH SLURRY
XTRANEED	CITED
MEDIA	CORN STARCH
DRIVER	COST, QUALITY
SERVICE	VIBRATION & AIR BUBBLES IN SAMPLE
ENVIRON	PLANT
NEC	NEMA 4
ACCURACY	1% PROTEIN
PRECISION	0.5% PROTEIN
RANGE	50-70% PROTEIN
RESPONSE	<1 MIN
CALFREQ	1 MO
CALSITE	IN-PLACE/REMOV.&CAL.
STIMULUS	NA
MAMF	1 MO
MADTM	2 HR
LIFE	5 YR
COST	$5K UP TO $25K
NOPERYR	1
SENSITE	IN-LINE
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	ACCUR.:DENSITY-PROTEIN CORRELATION UNRELIAB.
OTHER	DENSITY CORRELATION VARIES WITH FLOW RATES & % SOLIDS
SECTOR	FOOD

RECORD NO.	18
NEED	SOLID FAT INDEX (SFI) OF HYDROGENATED VEGETABLE OILS
XTRANEED	CITED
MEDIA	HYDROGENATED VEGETABLE OILS
DRIVER	COST, QUALITY
SERVICE	PROCESS TEMPERATURES TO 420 F
ENVIRON	PLANT
NEC	C1/D1,2/GB
ACCURACY	1%
PRECISION	0.5%
RANGE	0-50% SFI
RESPONSE	1 MIN
CALFREQ	1 MO
CALSITE	IN-PLACE/REMOV./CAL.
STIMULUS	NA
MAMF	1 MO
MADTM	2 HR
LIFE	2 YR
COST	$5K UP TO $50K
NOPERYR	1
SENSITE	REACTOR/ON-LINE SAMPLING
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	NEED IN-LINE/ON-LINE SENSOR, TOO SLOW
OTHER	LAB TESTS TAKE 2 HRS
SECTOR	FOOD

Appendix 1. Measurement Survey Data Base--Continued

RECORD NO.	19
NEED	FLOW RATE (STEAM, AIR, WATER, OTHER LIQUIDS & GASES)
XTRANEED	NA
MEDIA	STEAM, AIR, WATER, OTHER LIQUIDS & GASES
DRIVER	PROCESS MATERIAL BALANCE
SERVICE	CORROSIVE & NUCLEAR RADIATION
ENVIRON	PLANT
NEC	NA
ACCURACY	2%
PRECISION	1%
RANGE	NA
RESPONSE	NONCRITICAL
CALFREQ	1 YR
CALSITE	IN-PLACE
STIMULUS	NA
MAMF	1 YR
MADTM	NA
LIFE	20 YR
COST	NA
NOPERYR	NA
SENSITE	IN-LINE
AVAILABLE	NO
MFGR	NONE
FAULTS	NA
OTHER	NEED RADIATION RESISTANT FLOWMETER
SECTOR	UNKNOWN

RECORD NO.	20
NEED	STEAM FLOW RATE
XTRANEED	NONINTRUSIVE CLEAN LIQUID FLOW RATE
MEDIA	SATURATED & UNSATURATED STEAM
DRIVER	QUALITY, ACCURACY WITH RANGEABILITY
SERVICE	EROSIVE
ENVIRON	PLANT
NEC	NA
ACCURACY	1%
PRECISION	0.5%
RANGE	20:1 RANGEABILITY
RESPONSE	<1 SEC.
CALFREQ	12 MO
CALSITE	IN-PLACE
STIMULUS	NA
MAMF	24 MO
MADTM	24 HR
LIFE	5 YR
COST	$3K
NOPERYR	10
SENSITE	IN-LINE
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	RELIABILITY, ACCURACY, MAINTEN.
OTHER	NEED IMPROVED SENSOR TO METER ENERGY DISTRIBUTION IN PLANT
SECTOR	ENERGY

Appendix 1. Measurement Survey Data Base--Continued

RECORD NO.	21
NEED	STEAM FLOW RATE
XTRANEED	CITED
MEDIA	STEAM @ 3200 PSIG & 100-1000 C
DRIVER	COST, QUALITY
SERVICE	CORROSIVE
ENVIRON	LAB, PLANT
NEC	NA
ACCURACY	<1%
PRECISION	<0.5%
RANGE	10-1000 LB/HR
RESPONSE	<1 SEC
CALFREQ	1 YR
CALSITE	IN-PLACE/REMOV.&CAL.
STIMULUS	NA
MAMF	NA
MADTM	NA
LIFE	2 YR
COST	NA
NOPERYR	NA
SENSITE	IN-LINE
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	RELIAB., ACCURACY, RANGEABILITY
OTHER	NEED IMPROVED METER WITH 100:1 RANGEABILITY
SECTOR	ENERGY

RECORD NO.	22
NEED	CONCENTRATION OF HEAVY METALS (U,Pu) IN LIQUID SOLUTION
XTRANEED	IN-LINE FLUID DENSITY & FLOW RATE IN NUCLEAR ENVIRON.
MEDIA	NITRIC ACID
DRIVER	QUALITY
SERVICE	CORROSIVE
ENVIRON	PLANT, NUCLEAR RADIATION (>10e6 RAD/HR)
NEC	NA
ACCURACY	<1%
PRECISION	<0.5%
RANGE	ABOUT 200 g/LITER
RESPONSE	1 SEC
CALFREQ	NA
CALSITE	IN-PLACE (REMOTE)
STIMULUS	NA
MAMF	NA:REMOTE
MADTM	NA:REMOTE
LIFE	NA
COST	NA
NOPERYR	NA
SENSITE	IN-LINE
AVAILABLE	YES/IN-HOUSE
MFGR	NONE
FAULTS	ACCURACY, COST
OTHER	NEED SENSOR FOR U, Pu REPROCESS. (FROM LWPR'S & BREEDERS)
SECTOR	ENERGY

Appendix 1. Measurement Survey Data Base--Continued

RECORD NO.	23
NEED	WIDE-RANGING TEMPERATURE SENSOR (TEMP. TO 3000 C)
XTRANEED	WIDE-RANGING FLOW (VERY LOW FLOWS, SLURRIES, ETC.)
MEDIA	VARIOUS GASES, LIQUIDS, SLURRIES
DRIVER	COST, QUALITY: (CLOSER PROCESS CONTROL)
SERVICE	CORROSIVE, EROSIVE: PRESS. TO 3000 PSIG
ENVIRON	LAB, PLANT, NUCLEAR RADIATION
NEC	NA
ACCURACY	1%
PRECISION	0.5%
RANGE	273-3000 C
RESPONSE	MILLISEC. TO SEC.
CALFREQ	6 MO.
CALSITE	IN-PLACE/REMOV.&CAL.
STIMULUS	PHYS./ELECTR.
MAMF	3 MO
MADTM	24 HR
LIFE	1 YR
COST	$2K
NOPERYR	20-30
SENSITE	IN-LINE, REACTOR, ON-LINE, LAB TEST
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	RELIABILITY
OTHER	NEED IMPROVED TEMP SENSORS & RANGEABILITY FOR FLOWMETERS
SECTOR	ENERGY

RECORD NO.	24
NEED	TRACE QUANTITY U & Pu IN PROCESS WASTE STREAMS
XTRANEED	NA
MEDIA	NITRIC ACID SOLUTION
DRIVER	PUBLIC SAFETY, PRODUCT RECOVERY
SERVICE	CORROSIVE
ENVIRON	PLANT, NUCLEAR RADIATION (10e5 RAD/HR)
NEC	NA
ACCURACY	10%
PRECISION	3%
RANGE	SEE "OTHER"
RESPONSE	1 MIN
CALFREQ	1 MO
CALSITE	IN-PLACE/REMOV.&CAL.
STIMULUS	NA
MAMF	3 MO
MADTM	48 HR
LIFE	10 YR
COST	$25K
NOPERYR	10
SENSITE	IN-LINE
AVAILABLE	NO
MFGR	NONE
FAULTS	NA
OTHER	NEED RAD. & ACID RESIST. SENSOR, Pu:0-100 PPM, U:0-500 PPM
SECTOR	ENERGY

RECORD NO.	25
NEED	WEIGHT OF CONTENTS IN JACKETED, AGITATED PROCESS VESSELS
XTRANEED	NA
MEDIA	PROCESS MIXTURES
DRIVER	COST, RELIABILITY
SERVICE	CORROSIVE, VIBRATION
ENVIRON	PLANT
NEC	C1/D1,2/GB,C&D
ACCURACY	1% OF FULL SCALE
PRECISION	0.25%
RANGE	100 LB TO 5 TONS
RESPONSE	NA
CALFREQ	4 MO
CALSITE	IN-PLACE
STIMULUS	PHYSICAL
MAMF	4 MO
MADTM	24 HR
LIFE	5 YR
COST	$5K
NOPERYR	5
SENSITE	REACTOR
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	IN-LINE/ON-LINE, RELIAB., ACCURACY, MAINTEN.
OTHER	NEED LOW-MAINTEN, VIBRATION-RESIST., IN-SITU WEIGHING DEVICE
SECTOR	PHARMACEUTICAL

RECORD NO.	26
NEED	LEVEL IN GLASS-LINED REACTORS
XTRANEED	NA
MEDIA	SOLVENTS & VARIOUS PRODUCT SOLUTIONS
DRIVER	QUALITY, RELIABILITY
SERVICE	CORROSIVE
ENVIRON	PLANT
NEC	C1/D1/GB,C&D
ACCURACY	1%
PRECISION	0.25%
RANGE	0-5 IN. TO 0-200 IN.
RESPONSE	NO LAG
CALFREQ	2 MO
CALSITE	IN-PLACE
STIMULUS	NA
MAMF	6 MO
MADTM	1-2 HR
LIFE	2 YR
COST	$2-3K
NOPERYR	NA
SENSITE	REACTOR
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	RELIAB., MAINTEN., MATERIAL COMPATIBILITY
OTHER	NEED LOW-MAINTEN., VERSATILE LEVEL DETECTOR
SECTOR	PHARMACEUTICAL

Appendix 1. Measurement Survey Data Base--Continued

RECORD NO.	27
NEED	LEVEL IN GLASS-LINED, JACKETED, AGITATED VESSELS
XTRANEED	CITED
MEDIA	SOLVENTS OR SLURRIES
DRIVER	RELIABILITY
SERVICE	CORROSIVE
ENVIRON	PLANT
NEC	UL/FM APPROVED
ACCURACY	0.2% OF SPAN
PRECISION	0.05% OF CAL. SPAN
RANGE	0-25 & 0-150 IN.W.C.
RESPONSE	NA
CALFREQ	1 YR
CALSITE	REMOV. & CAL.
STIMULUS	NA
MAMF	1 YR
MADTM	3 HR
LIFE	8 YR
COST	$1.8K
NOPERYR	100
SENSITE	REACTOR
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	RELIABILITY, MAINTENANCE
OTHER	NEED RELIAB. IN-SITU DETECTOR FOR AGITATED, JACKETED REACTOR
SECTOR	PHARMACEUTICAL

RECORD NO.	28
NEED	PH IN REACTOR
XTRANEED	CITED
MEDIA	NA
DRIVER	COST, REDUCED MAINTENANCE
SERVICE	CORROSIVE
ENVIRON	PLANT
NEC	FM APPROVED
ACCURACY	0.2 PH
PRECISION	0.02 PH
RANGE	0-14 PH
RESPONSE	NA
CALFREQ	1 WK
CALSITE	CHECK BY GRAB SAMPLE
STIMULUS	ELECTRICAL
MAMF	NA
MADTM	NA
LIFE	NA
COST	$1.2K
NOPERYR	50
SENSITE	REACTOR
AVAILABLE	YES/COM'L
MFGR	ONE
FAULTS	MAINTEN. & REPLACEMENT COSTS
OTHER	SELF-CONTAINED ELECTRODE PROBE WOULD REDUCE REPLACEMENT COST
SECTOR	PHARMACEUTICAL

Appendix 1. Measurement Survey Data Base--Continued

RECORD NO.	29
NEED	VERY LOW FLOW RATE (0.025-0.25 & 0.05-0.50 GPM) OF SOLVENTS
XTRANEED	CITED
MEDIA	CLEAN PROCESS SOLVENTS
DRIVER	NEED UL/FM APPROVED METER
SERVICE	CORROSIVE
ENVIRON	PLANT
NEC	C1/D1/GD
ACCURACY	0.75%
PRECISION	0.10%
RANGE	SEE "NEED"
RESPONSE	NA
CALFREQ	3 MO
CALSITE	IN-PLACE
STIMULUS	NA
MAMF	3 MO
MADTM	NA
LIFE	10 YR
COST	$2.5K
NOPERYR	10-20
SENSITE	IN-LINE
AVAILABLE	YES/COM'L
MFGR	ONE
FAULTS	NOT UL OR FM APPROVED
OTHER	NEED PKG: METER, RATE INDIC., TOTALIZ., START & STOP CONTROL
SECTOR	PHARMACEUTICAL

RECORD NO.	30
NEED	FLOW RATE WITH WIDE RANGEABILITY (SOLVENTS & AQUEOUS SOL'NS)
XTRANEED	ACCURATE MASS FLOW RATE
MEDIA	SOLVENTS & WATER-BASED SOLUTIONS
DRIVER	QUALITY
SERVICE	CORROSIVE
ENVIRON	PLANT
NEC	C1/D2/GB,C&D
ACCURACY	<1%
PRECISION	NA
RANGE	0-50 GPM
RESPONSE	NA
CALFREQ	2 MO
CALSITE	IN-PLACE
STIMULUS	NA
MAMF	6 MO
MADTM	1 HR
LIFE	2 YR
COST	UP TO $3K
NOPERYR	NA
SENSITE	IN-LINE
AVAILABLE	NO
MFGR	NONE
FAULTS	CANDIDATES LACK ACCURACY/RANGEABILITY
OTHER	NEED PASSIVE, VERSATILE, ACCUR. METER WITH WIDE RANGEABILITY
SECTOR	PHARMACEUTICAL

Appendix 1. Measurement Survey Data Base--Continued

RECORD NO.	31
NEED	PH IN REACTOR
XTRANEED	CITED
MEDIA	VARIOUS
DRIVER	QUALITY, EASE OF MAINTENANCE
SERVICE	CORROSIVE, VIBRATION, STERILITY
ENVIRON	PLANT
NEC	C1/D1/GD
ACCURACY	0.1 PH
PRECISION	0.1%
RANGE	0-14PH:2PH MIN SPAN
RESPONSE	NA
CALFREQ	1 MO
CALSITE	IN-PLACE
STIMULUS	PHYSICAL
MAMF	1 MO
MADTM	4 HR
LIFE	NA
COST	NA
NOPERYR	NA
SENSITE	REACTOR
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	MAINTEN., FRAGILE, HEAVY, BULKY
OTHER	REFERENCE FLUID DEPLETED BY REACTOR PRESS/VAC CHANGES
SECTOR	PHARMACEUTICAL

RECORD NO.	32
NEED	STEAM FLOW RATE
XTRANEED	CITED
MEDIA	150 PSIG PLANT STEAM & CONDEN. SLUG FLOW
DRIVER	COST
SERVICE	EROSIVE, VIBRATION
ENVIRON	PLANT
NEC	NA
ACCURACY	<1%
PRECISION	<0.1%
RANGE	10:1 RANGEABILITY
RESPONSE	NA
CALFREQ	3 MO
CALSITE	IN-PLACE
STIMULUS	PHYSICAL
MAMF	3 MO
MADTM	24 HR
LIFE	3 MO
COST	NA
NOPERYR	NA
SENSITE	IN-LINE (CRITICAL PLACEMENT)
AVAILABLE	YES/COM'L
MFGR	ONE
FAULTS	RELIAB., ACCUR., MAINTEN., OPER. TEMP. LIMITS
OTHER	DAMAGED BY CONDENS., TURB. BLADE COATING, LOCATION REQMNTS
SECTOR	PHARMACEUTICAL

Appendix 1. Measurement Survey Data Base--Continued

RECORD NO.	33
NEED	GASEOUS & SOLID SPECIES CONCENTRATIONS IN FLAMES
XTRANEED	CITED
MEDIA	COMBUSTION PRODUCTS
DRIVER	RESEARCH INTEREST
SERVICE	NA
ENVIRON	NA
NEC	NA
ACCURACY	NA
PRECISION	NA
RANGE	NA
RESPONSE	NA
CALFREQ	NA
CALSITE	NA
STIMULUS	NA
MAMF	NA
MADTM	NA
LIFE	NA
COST	NA
NOPERYR	NA
SENSITE	IN-LINE/REACTOR/LAB SAMPLE & ANALYSIS
AVAILABLE	NO. LAB TECHNIQUES ONLY
MFGR	NA
FAULTS	NEED PILOT SCALE PROOF OF OPTICAL LAB METHODS
OTHER	LASER (RAMAN SPECTRA, FLUORESC., SCATTERING) TECHNIQUES
SECTOR	ACADEME

RECORD NO.	34
NEED	GAS TEMPERATURE (NONINTRUSIVELY)
XTRANEED	CITED
MEDIA	COMBUSTION PRODUCTS
DRIVER	RESEARCH INTEREST
SERVICE	NA
ENVIRON	NA
NEC	NA
ACCURACY	NA
PRECISION	NA
RANGE	NA
RESPONSE	NA
CALFREQ	NA
CALSITE	NA
STIMULUS	NA
MAMF	NA
MADTM	NA
LIFE	NA
COST	NA
NOPERYR	NA
SENSITE	IN-LINE/REACTOR
AVAILABLE	NA
MFGR	NA
FAULTS	POINT MEASUREMENTS DIFFICULT
OTHER	TWO-COLOR PYROMETRY OF INTEREST
SECTOR	ACADEME

Appendix 1. Measurement Survey Data Base--Continued

RECORD NO.	35
NEED	GAS VELOCITY IN FLAMES
XTRANEED	CITED
MEDIA	COMBUSTION PRODUCTS
DRIVER	RESEARCH INTEREST
SERVICE	NA
ENVIRON	NA
NEC	NA
ACCURACY	NA
PRECISION	NA
RANGE	NA
RESPONSE	NA
CALFREQ	NA
CALSITE	NA
STIMULUS	NA
MAMF	NA
MADTM	NA
LIFE	NA
COST	NA
NOPERYR	NA
SENSITE	IN-LINE/REACTOR
AVAILABLE	NA
MFGR	NA
FAULTS	NA
OTHER	LDV TECHNIQ. NOT YET DEVELOPED FOR USE IN LARGE TURB. FLAMES
SECTOR	ACADEME

RECORD NO.	36
NEED	TEMPERATURE (POLYMERS @ 290 C)
XTRANEED	NA
MEDIA	POLYMERS @ 290 C
DRIVER	QUALITY
SERVICE	VIBRATION
ENVIRON	PLANT
NEC	NA
ACCURACY	0.1 C
PRECISION	0.1 C
RANGE	275-300 C
RESPONSE	NA
CALFREQ	1 WK
CALSITE	IN-PLACE
STIMULUS	NA
MAMF	6 MO
MADTM	24 HR
LIFE	6 MO
COST	$50-75
NOPERYR	6000
SENSITE	IN-LINE
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	RELIAB., ACCUR., MAINTEN., INTERCHANG.
OTHER	REPEATABLE, REMOTE MEASUREMENTS REQ'D
SECTOR	TEXTILES

RECORD NO.	37
NEED	TEMPERATURE TO 2500 C IN SODIUM
XTRANEED	TEMPERATURE TO 2200 C IN STEAM
MEDIA	LIQUID SODIUM
DRIVER	QUALITY, RELIABILITY
SERVICE	CORROSIVE
ENVIRON	NA
NEC	NA
ACCURACY	1%
PRECISION	1%
RANGE	20-2500 C
RESPONSE	1 MILLISEC
CALFREQ	NA
CALSITE	NA
STIMULUS	ELECTRICAL
MAMF	NA
MADTM	NA
LIFE	4 HR
COST	$3K
NOPERYR	50
SENSITE	REACTOR
AVAILABLE	YES/IN-HOUSE DEVELOPMENT
MFGR	NA
FAULTS	RELIABILITY
OTHER	EXTENDED LIFE OF 4-10 HR @ 2500 C DESIRED
SECTOR	ENERGY

RECORD NO.	38
NEED	TEMPERATURE IN GLASS MFG.
XTRANEED	DETECT DEFECTS IN GLASS DURING MFG & FABRICATION
MEDIA	AIR IN GLASS OVENS
DRIVER	COST, QUALITY
SERVICE	NA
ENVIRON	PLANT
NEC	NA
ACCURACY	NA
PRECISION	NA
RANGE	NA
RESPONSE	NA
CALFREQ	INFREQUENT
CALSITE	IN-PLACE
STIMULUS	ELECTRICAL
MAMF	NA
MADTM	NA
LIFE	NA
COST	NA
NOPERYR	NA
SENSITE	IN-LINE
AVAILABLE	NA
MFGR	NA
FAULTS	NA
OTHER	NA
SECTOR	GLASS

Appendix 1. Measurement Survey Data Base--Continued

RECORD NO.	39
NEED	TEMPERATURE (WATER & AIR)
XTRANEED	RESPONSE TIMES OF TEMPERATURE & PRESSURE SENSORS
MEDIA	WATER & AIR
DRIVER	QUAL., PLANT SAFETY, TECH. SPECS.
SERVICE	VIBRATION
ENVIRON	PLANT
NEC	NA
ACCURACY	0.001 C
PRECISION	NA
RANGE	0-700 C
RESPONSE	MILLISEC TO FEW SEC
CALFREQ	3 YR
CALSITE	IN-PLACE/REMOV.&CAL.
STIMULUS	NA
MAMF	3 YR
MADTM	MINIMUM
LIFE	5 YR
COST	$5-10K
NOPERYR	30
SENSITE	REACTOR
AVAILABLE	YES/COM'L
MFGR	NA
FAULTS	RELIABILITY/ACCURACY
OTHER	NUCLEAR REGULATORY REQUIREMENTS
SECTOR	ENERGY

RECORD NO.	40
NEED	MOISTURE LEVEL IN POWDERS & SOLIDS
XTRANEED	CITED
MEDIA	SOLIDS & POWDERS
DRIVER	COST, QUALITY
SERVICE	EROS., VIBRA., STERILITY (OCCASIONALLY)
ENVIRON	PLANT
NEC	C1/D2/GB
ACCURACY	0.1% BY WEIGHT
PRECISION	0.1% BY WEIGHT
RANGE	0-20% WATER BY WT.
RESPONSE	<5 SEC.
CALFREQ	1 MO
CALSITE	IN-PLACE
STIMULUS	PHYSICAL
MAMF	1 MO
MADTM	3 HR
LIFE	5 YR
COST	$100
NOPERYR	THOUSANDS
SENSITE	IN-LINE/REACTOR/ON-LINE
AVAILABLE	NO
MFGR	NA
FAULTS	RELIAB., ACCUR., MAINTEN., INFERENTIAL
OTHER	DESIRED QUALITY DEVICE NOT AVAILABLE
SECTOR	INSTRUM. MFGR.

RECORD NO.	41
NEED	NONCONTACT TEMPERATURE MEASUREMENT (POLYMERS IN AIR)
XTRANEED	EMISSIVITY OF POLYMERS IN CONTACT WITH AIR
MEDIA	POLYMERS UNDER AIR
DRIVER	TEMP. MEAS. ERROR DUE TO EMISSIVITY
SERVICE	NA
ENVIRON	PLANT
NEC	NA
ACCURACY	0.25 C
PRECISION	0.05 C
RANGE	20-1800 C
RESPONSE	1-2 SEC
CALFREQ	6 MO
CALSITE	NA
STIMULUS	PHYSICAL
MAMF	3 MO
MADTM	6 HR
LIFE	5 YR
COST	$250
NOPERYR	NA
SENSITE	IN-LINE/REACTOR
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	ACCUR., MAINTEN., CALIBR. FREQUENCY
OTHER	NA
SECTOR	INSTRUM. MFGR.

RECORD NO.	42
NEED	LOW LEVELS OF WATER & OXYGEN
XTRANEED	CITED
MEDIA	ETHYLENE, HYDROGEN, NITROGEN, HEXENE
DRIVER	QUALITY
SERVICE	NA
ENVIRON	PLANT
NEC	C1/D2/GB
ACCURACY	0.1 PPM
PRECISION	0.05 PPM
RANGE	1-10 PPM
RESPONSE	1 MIN
CALFREQ	1 WK
CALSITE	IN-PLACE
STIMULUS	NA
MAMF	3 MO
MADTM	4 HR
LIFE	1 YR
COST	$500
NOPERYR	1
SENSITE	IN-LINE
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	ACCURACY, NEED IN-LINE/ON-LINE MEAS.
OTHER	NA
SECTOR	CHEMICAL

Appendix 1. Measurement Survey Data Base--Continued

RECORD NO.	43
NEED	LOW CONCENTRATIONS OF ETHYLENE OXIDE
XTRANEED	LOW PPM OF WATER, OXYGEN, FORMALDEHYDE, ETHYLENE GLYCOL
MEDIA	ETHYLENE, NITROGEN, ETHANE
DRIVER	COST
SERVICE	NA
ENVIRON	PLANT
NEC	C1/D2/GC
ACCURACY	0.005% ETHYL. OXIDE
PRECISION	0.001% ETHYL. OXIDE
RANGE	5%
RESPONSE	30 SEC
CALFREQ	8 HR
CALSITE	IN-PLACE
STIMULUS	NA
MAMF	2 WK
MADTM	4 HR
LIFE	7 YR
COST	NA
NOPERYR	NA
SENSITE	IN-LINE/ON-LINE
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	ACCURACY, PRECISION, RESPONSE TIME
OTHER	TENFOLD IMPROVEMENT NEEDED IN GAS CHROMAT. & MASS SPECS.
SECTOR	CHEMICAL

RECORD NO.	44
NEED	SKIN TEMP. OF TUBES IN PYROLYSIS FURNACES & PROCESS HEATERS
XTRANEED	NA
MEDIA	NA
DRIVER	OPTIMIZE THROUGHPUT VS. MAINTEN. COSTS
SERVICE	NA
ENVIRON	PLANT, HOT ENVIRONMENT
NEC	NA
ACCURACY	<20 F
PRECISION	5 F
RANGE	SEE "OTHER"
RESPONSE	NA
CALFREQ	1 WK
CALSITE	REMOV. & CAL.
STIMULUS	NA
MAMF	NA
MADTM	NA
LIFE	5 YR
COST	NA
NOPERYR	NA
SENSITE	NA
AVAILABLE	NA
MFGR	NA
FAULTS	NA
OTHER	PROCESS HEATERS: 800-1200 F, PYROLYSIS: 1300-1700 F
SECTOR	INSTRUM. MFGR.

Appendix 1. Measurement Survey Data Base--Continued

RECORD NO.	45
NEED	MULTIPHASE MULTICOMPONENT MASS FLOW RATE (GASIFIC./COMBUST.)
XTRANEED	TEMPERATURE (GASIFIERS & COMBUSTION PROCESSES)
MEDIA	FEEDS/PRODUCTS OF GAS./COMBUST.PROCESS.
DRIVER	UNDERSTAND PHENOM., PROCESS CONTROL
SERVICE	CORROSIVE, EROSIVE, VIBRATION
ENVIRON	LAB, PLANT
NEC	C1,2/D2/GB&D
ACCURACY	1% OF FULL SCALE
PRECISION	0.25% OF FULL SCALE
RANGE	10-2000 LB/HR
RESPONSE	1 SEC
CALFREQ	3 MO
CALSITE	REMOV. & CAL.
STIMULUS	NA
MAMF	3 MO
MADTM	USE SPARE
LIFE	1 YR
COST	$2K
NOPERYR	10
SENSITE	IN-LINE
AVAILABLE	NO
MFGR	NONE
FAULTS	NA
OTHER	NA
SECTOR	ENERGY (GOVT.)

RECORD NO.	46
NEED	TEMPERATURE (POLYMER EMULSIONS)
XTRANEED	PRESS., FLOW, PH, MONOMER COMPOSITION DURING POLYMERIZATION
MEDIA	POLYMER EMULSIONS
DRIVER	QUALITY, PROCESS CONTROL, SAFETY
SERVICE	CORROSIVE, HIGH SHEAR
ENVIRON	PLANT
NEC	NA
ACCURACY	0.2 C
PRECISION	0.05 C
RANGE	0-150 C
RESPONSE	<10 SEC
CALFREQ	1 YR
CALSITE	IN-PLACE
STIMULUS	NA
MAMF	NA
MADTM	2 WK/YR
LIFE	10 YR
COST	$25
NOPERYR	50
SENSITE	IN-LINE/REACTOR/ON-LINE/LAB TEST
AVAILABLE	YES/COM'L/IN-HOUSE
MFGR	VARIOUS
FAULTS	NEED IN-LINE MEAS., ACCUR., MAINTEN.
OTHER	NEED IMPROVED IN-LINE SENSOR
SECTOR	PLASTICS

Appendix 1. Measurement Survey Data Base--Continued

RECORD NO.	47
NEED	CALIBRATING JET ENGINE THERMOCOUPLE
XTRANEED	RELATED HEATER PROBE CALIBRATION
MEDIA	NA
DRIVER	NA
SERVICE	NA
ENVIRON	FIELD CAL. OF JET ENGINE THERMOCOUPLE
NEC	NA
ACCURACY	1 C
PRECISION	NA
RANGE	100-1000 C
RESPONSE	30-60 SEC
CALFREQ	NA
CALSITE	NA
STIMULUS	NA
MAMF	NA
MADTM	NA
LIFE	NA
COST	NA
NOPERYR	NA
SENSITE	NA
AVAILABLE	YES
MFGR	ONE
FAULTS	ACCURACY
OTHER	DOD STUDYING PROBLEM
SECTOR	UNKNOWN

RECORD NO.	48
NEED	CONSTANT TEMPERATURE BATH (100-1200 F.)
XTRANEED	CITED
MEDIA	FLUIDIZED ALUMINUM OXIDE
DRIVER	QUALITY
SERVICE	NA
ENVIRON	LAB, ON-BOARD SHIP LAB
NEC	NA
ACCURACY	<0.5 F
PRECISION	0.2% OF INDIC. VAL.
RANGE	100-1200 F
RESPONSE	2-5 MIN
CALFREQ	NA
CALSITE	NA
STIMULUS	NA
MAMF	NA
MADTM	NA
LIFE	NA
COST	NA
NOPERYR	NA
SENSITE	NA
AVAILABLE	NO
MFGR	NONE
FAULTS	SAFETY HAZARD (DUST PERCOLATION)
OTHER	TEMP. STABILITY (5-50 F GRADIENTS @ 1200 F)
SECTOR	UNKNOWN

Appendix 1. Measurement Survey Data Base--Continued

RECORD NO.	49
NEED	PLASMA PARAMETERS, COMPOSITION IN PLASMAS
XTRANEED	NA
MEDIA	NA
DRIVER	QUALITY
SERVICE	CORROSIVE, EROSIVE
ENVIRON	LAB, PLANT
NEC	NA
ACCURACY	<50%
PRECISION	NA
RANGE	NA
RESPONSE	NA
CALFREQ	NA
CALSITE	REMOV. & CAL.
STIMULUS	NA
MAMF	1 MO
MADTM	HOURS
LIFE	NA
COST	$1-50K
NOPERYR	NA
SENSITE	IN-LINE/REACTOR/ON-LINE/LAB TEST
AVAILABLE	YES/COM'L/IN-HOUSE
MFGR	VARIOUS
FAULTS	RELIAB., ACCURAC., NONEXISTENCE OF SENSOR
OTHER	NA
SECTOR	ELECTRONIC CHEMICALS

RECORD NO.	50
NEED	SURFACE TEMPERATURE OF HOT SOLID STEEL BODIES
XTRANEED	NA
MEDIA	STEEL IN AIR
DRIVER	COST
SERVICE	NA
ENVIRON	PLANT
NEC	NA
ACCURACY	2 C
PRECISION	NA
RANGE	20-1000 C
RESPONSE	FEW SEC
CALFREQ	NA
CALSITE	REMOV. & CAL.
STIMULUS	NA
MAMF	NA
MADTM	NA
LIFE	NA
COST	NA
NOPERYR	NA
SENSITE	IN-LINE
AVAILABLE	NO
MFGR	NONE
FAULTS	NA
OTHER	NA
SECTOR	STEEL (ACADEME)

Appendix 1. Measurement Survey Data Base--Continued

RECORD NO.	51
NEED	DISSOLVED OXYGEN IN BIOLOG. WASTEWATER WITH BIOFOULING
XTRANEED	NA
MEDIA	BIOLOGICALLY-TREATED WASTEWATER
DRIVER	COST
SERVICE	NA
ENVIRON	WASTEWATER TREATMENT PLANT
NEC	NEMA 4X
ACCURACY	0.5 PPM
PRECISION	0.025 PPM
RANGE	0-10 PPM
RESPONSE	SEVERAL MIN
CALFREQ	1 MO
CALSITE	REMOV. & CAL.
STIMULUS	NA
MAMF	1 MO
MADTM	0.5 HR
LIFE	2 YR
COST	$1K
NOPERYR	>10,000 IN U.S.
SENSITE	IN-LINE/REACTOR, USUALLY OPEN BASINS
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	MAINTEN., SLIME GROWTH CONTROL METHOD NEEDED
OTHER	BIOSLIME REDUCES INDICATED OXYGEN CONCENTRATION
SECTOR	INSTRUM. MFGR.

RECORD NO.	52
NEED	TEMPERATURE MEAS. IN THERMOWELLS
XTRANEED	NA
MEDIA	VARIOUS
DRIVER	QUALITY
SERVICE	CORROSIVE
ENVIRON	PLANT
NEC	NA
ACCURACY	NA
PRECISION	NA
RANGE	NA
RESPONSE	NA
CALFREQ	NA
CALSITE	NA
STIMULUS	NA
MAMF	NA
MADTM	NA
LIFE	1 YR
COST	$50-300
NOPERYR	SEVERAL HUNDRED
SENSITE	IN-LINE/REACTOR/ON-LINE
AVAILABLE	YES/IN-HOUSE
MFGR	NA
FAULTS	MAINTENANCE
OTHER	IMPROVED RESPONSE & REPEATABILITY DESIRED
SECTOR	INSTRUM. MFGR.

Appendix 1. Measurement Survey Data Base--Continued

RECORD NO.	53
NEED	FLOW OF MILDLY-ABRASIVE FILLED POLYMER
XTRANEED	CITED
MEDIA	NONCONDUCTIVE OPAQUE COMPOUND
DRIVER	QUALITY, PROCESS CONTROL
SERVICE	EROSIVE
ENVIRON	PLANT
NEC	C1/D2/GD
ACCURACY	<1%
PRECISION	0.25%
RANGE	0-5 & 0-20 GPM
RESPONSE	NA
CALFREQ	1 MO
CALSITE	IN-PLACE
STIMULUS	ELECTRICAL
MAMF	6 MO
MADTM	USE SPARE
LIFE	3-5 YR
COST	NA
NOPERYR	NA
SENSITE	IN-LINE
AVAILABLE	YES/COM'L
MFGR	ONE
FAULTS	EXCESS. PRESS. DROP, NEED 4-20 ma DC SIGNAL
OTHER	VISCOS:500-1,000,000 cP, TEMP:60-300 F, PRESS: 50-750 PSIG
SECTOR	CHEMICAL

RECORD NO.	54
NEED	FLOW RATE OR VOLUMETRIC METHOD FOR LIQUID COMMODITY TRANSFER
XTRANEED	CITED
MEDIA	LIQUIDS (INERTS, FLAMMABLES, CORROSIVES)
DRIVER	COST
SERVICE	CORROSIVE
ENVIRON	PLANT
NEC	C1/D2/GD
ACCURACY	<1%
PRECISION	0.25%
RANGE	0-20 & 0-80 GPM
RESPONSE	NA
CALFREQ	1 MO
CALSITE	IN-PLACE
STIMULUS	ELECTRICAL
MAMF	6 MO
MADTM	8 HR
LIFE	3-5 YR
COST	NA
NOPERYR	NA
SENSITE	IN-LINE/REACTOR
AVAILABLE	NO
MFGR	NONE
FAULTS	NEED LOCAL READOUT & 4-20 ma DC/PULSE SIGNAL
OTHER	PRESSURE (20-100 PSIG), TEMPERATURE (-20 F TO +95 F)
SECTOR	CHEMICAL

Appendix 1. Measurement Survey Data Base--Continued

RECORD NO.	55
NEED	LEVEL IN GLASS-LINED, AGITATED, JACKETED VESSEL
XTRANEED	CITED
MEDIA	MINERAL ACID, ORGANIC & ALICYCLIC HC MIX
DRIVER	PROCESS CONTROL
SERVICE	CORROSIVE
ENVIRON	PLANT
NEC	C1/D1/GC
ACCURACY	1%
PRECISION	0.25%
RANGE	0-20 FT
RESPONSE	1 SEC
CALFREQ	6 MO
CALSITE	IN-PLACE
STIMULUS	ELECTRICAL
MAMF	6 MO
MADTM	USE SPARE
LIFE	3-5 YR
COST	NA
NOPERYR	NA
SENSITE	REACTOR
AVAILABLE	NO
MFGR	NONE
FAULTS	NEED ACCUR. 4-20 ma DC SIGNAL DURING AGITAT.
OTHER	VAC:<100 mm Hg, PRESS:<200 PSIG, TEMP:<500 F
SECTOR	CHEMICAL

RECORD NO.	56
NEED	NONINTRUSIVE GAS TEMPERATURE IN COAL GASIFIER
XTRANEED	PROCESS FLOW RATES
MEDIA	SYNGAS (FLYING PARTICLES & MOLTEN SLAG)
DRIVER	QUALITY, RELIABILITY, SENSOR LIFE
SERVICE	CORROSIVE, OXIDIZING, REDUCING
ENVIRON	PLANT
NEC	C1/D2/GB,C&D
ACCURACY	<1%
PRECISION	<0.5%
RANGE	500-2800 F
RESPONSE	THERMOCOUPLE EQUIV.
CALFREQ	6 MO
CALSITE	NA
STIMULUS	NA
MAMF	6 MO
MADTM	12 HR
LIFE	>10 YR
COST	NA
NOPERYR	NA
SENSITE.	REACTOR
AVAILABLE	NO
MFGR	NONE
FAULTS	NA
OTHER	NA
SECTOR	ENERGY

Appendix 1. Measurement Survey Data Base--Continued

RECORD NO.	57
NEED	ULTRA-TRACE MOISTURE IN PROCESS GASES
XTRANEED	TRACE ANALYSIS OF CORROSIVE GAS ENVIRONMENTS
MEDIA	HIGH PURITY GASES
DRIVER	QUALITY
SERVICE	CORROSIVE
ENVIRON	LAB, PLANT
NEC	NA
ACCURACY	0.01 PPM
PRECISION	0.01 PPM
RANGE	0-100 PPM
RESPONSE	10 SEC
CALFREQ	1 MO
CALSITE	IN-PLACE
STIMULUS	NA
MAMF	6 MO
MADTM	2-4 DAY
LIFE	5 YR
COST	<$5K
NOPERYR	10
SENSITE	IN-LINE
AVAILABLE	YES/COM'L
MFGR	TWO
FAULTS	ACCURACY, RELIABILITY
OTHER	NEED IN-LINE, INEXPENSIVE INSTRUMENT
SECTOR	ELECTRONIC CHEMICALS

RECORD NO.	58
NEED	PARTICLE SIZE & DISTRIBUTION (IN ORGANIC SOLVENTS, GASES)
XTRANEED	CITED
MEDIA	ORGANIC SOLVENTS, GASES
DRIVER	QUALITY
SERVICE	CORROSIVE, EROSIVE, VIBRATION
ENVIRON	NA
NEC	NA
ACCURACY	10%
PRECISION	10%
RANGE	10-10,000 ANGSTROM
RESPONSE	10 MIN
CALFREQ	DAILY
CALSITE	IN-PLACE
STIMULUS	ELECTRICAL
MAMF	DAILY
MADTM	NA
LIFE	1 YR
COST	NA
NOPERYR	NA
SENSITE	ON-LINE/LAB TEST
AVAILABLE	NA
MFGR	NA
FAULTS	NA
OTHER	NA
SECTOR	CONSULTANT

Appendix 1. Measurement Survey Data Base--Continued

RECORD NO.	59
NEED	ELECTRICAL CONDUCTIVITY
XTRANEED	SURFACE CONDUCTIVITY ON DIELECTRIC SUBSTRATE
MEDIA	HUMID AIR, SALT FOG
DRIVER	QUALITY
SERVICE	CORROSIVE
ENVIRON	NA
NEC	NA
ACCURACY	NA
PRECISION	NA
RANGE	NA
RESPONSE	NA
CALFREQ	NA
CALSITE	NA
STIMULUS	NA
MAMF	NA
MADTM	NA
LIFE	NA
COST	NA
NOPERYR	MANY
SENSITE	NA
AVAILABLE	NA
MFGR	NA
FAULTS	NA
OTHER	COATINGS ON GLASS PANELS USED IN MARINE/AUTO EQUIPMENT
SECTOR	CONSULTANT

RECORD NO.	60
NEED	FLOW RATE OF CORROSIVE FLUID (Br) WITH LOW PRESSURE DROP
XTRANEED	NA
MEDIA	LIQUID BROMINE
DRIVER	QUALITY
SERVICE	CORROSIVE, TEMP:60C, PRESS:14.4-50 PSIA
ENVIRON	PLANT
NEC	GEN. PURPOSE
ACCURACY	1.0%
PRECISION	0.1%
RANGE	0-6 GPM
RESPONSE	NA
CALFREQ	6 MO
CALSITE	IN-PLACE
STIMULUS	ELECTRICAL
MAMF	6 MO
MADTM	3 DAY
LIFE	10 YR
COST	$4-8K
NOPERYR	6
SENSITE	IN-LINE
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	NEED IN-LINE METER, ACCUR., MAINTEN.
OTHER	LOW HEAD-LOSS IN-LINE METER NEEDED
SECTOR	CHEMICAL

Appendix 1. Measurement Survey Data Base--Continued

RECORD NO.	61
NEED	CAUSTIC CONCENTRATION IN CAUSTIC SCRUBBER (CHLORINE)
XTRANEED	CITED
MEDIA	50% NaOH (START) & 0% (END)
DRIVER	COST, SAFETY
SERVICE	CORROSIVE
ENVIRON	NA
NEC	GEN. PURPOSE
ACCURACY	2%
PRECISION	0.5%
RANGE	NA
RESPONSE	FAST AS POSSIBLE
CALFREQ	1 WK
CALSITE	IN-PLACE
STIMULUS	NA
MAMF	NA
MADTM	NA
LIFE	NA
COST	NA
NOPERYR	NA
SENSITE	IN-LINE
AVAILABLE	NO
MFGR	NONE
FAULTS	NEED IN-LINE CONTINUOUS SENSOR
OTHER	CURRENT PRACTICE:SAMPLE & TITRATION
SECTOR	CHEMICAL

RECORD NO.	62
NEED	LIQUID LEVEL OF MOLTEN SULFUR
XTRANEED	CITED
MEDIA	LIQUID SULFUR
DRIVER	QUALITY
SERVICE	CORROSIVE
ENVIRON	NA
NEC	C1/D1/GD
ACCURACY	2%
PRECISION	0.5%
RANGE	NA
RESPONSE	2 SEC
CALFREQ	1 MO
CALSITE	IN-PLACE
STIMULUS	NA
MAMF	NA
MADTM	NA
LIFE	NA
COST	NA
NOPERYR	NA
SENSITE	REACTOR
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	RELIABILITY
OTHER	MOLTEN SULFUR INTERFACED WITH AIR & WITH HOT WATER SLURRY
SECTOR	CHEMICAL

Appendix 1. Measurement Survey Data Base--Continued

RECORD NO.	63
NEED	VISCOUS, NONAQUEOUS, CORROS. LIQ. & SLURRY FLOW (ORGANICS)
XTRANEED	CITED
MEDIA	WASTE ORGANIC STREAM TO INCINERATOR
DRIVER	QUALITY
SERVICE	CORROSIVE
ENVIRON	NA
NEC	C1/D1/GD
ACCURACY	2%
PRECISION	0.5%
RANGE	VARIABLE
RESPONSE	INSTANTANEOUS
CALFREQ	NA
CALSITE	NA
STIMULUS	NA
MAMF	NA
MADTM	NA
LIFE	NA
COST	NA
NOPERYR	NA
SENSITE	IN-LINE
AVAILABLE	NO
MFGR	NONE
FAULTS	NO RELIABLE METERS AVAILABLE
OTHER	NA
SECTOR	CHEMICAL

RECORD NO.	64
NEED	LOW FLOW RATES OF HIGH VISCOSITY LIQUIDS
XTRANEED	NA
MEDIA	ORGANIC LIQUID (SP.GR. 0.86, 800cP@160F)
DRIVER	QUALITY
SERVICE	VIBRATION
ENVIRON	PLANT
NEC	C1/D2/GC&D
ACCURACY	1%
PRECISION	1%
RANGE	0-23 g/MIN
RESPONSE	10 SEC
CALFREQ	1 MO
CALSITE	IN-PLACE
STIMULUS	NA
MAMF	6 MO
MADTM	2 HR
LIFE	5 YR
COST	$2-2.5K
NOPERYR	2
SENSITE	IN-SITE
AVAILABLE	YES/COM'L
MFGR	ONE
FAULTS	PRESSURE DROP TOO HIGH
OTHER	NA
SECTOR	CHEMICAL

Appendix 1. Measurement Survey Data Base--Continued

RECORD NO.	65
NEED	IMPURITY ANALYSIS IN BULK MATERIALS:10e13-10e14 ATOMS/cc
XTRANEED	CITED
MEDIA	GaAs, GaP, InP, GaAlAs, GaAsP, ETC.
DRIVER	QUALITY
SERVICE	NA
ENVIRON	LAB
NEC	NA
ACCURACY	50%
PRECISION	10%
RANGE	10e13-10e18 ATOMS/cc
RESPONSE	MINUTES
CALFREQ	6 MO
CALSITE	IN-PLACE
STIMULUS	PHYSICAL
MAMF	1 MO
MADTM	2-3 DAY
LIFE	5 YR
COST	NA
NOPERYR	NA
SENSITE	LAB TEST
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	ELEMENT SPECIFIC, RELIAB., ACCURACY
OTHER	SOME NEW LAB TECHNIQUES LOOK PROMISING, NEED COMMERCIALIZING
SECTOR	ELECTRONIC CHEMICALS

RECORD NO.	66
NEED	SMALL TEMPERATURE DIFFER. @ HIGH TEMPS IN HOSTILE ENVIRON.
XTRANEED	CITED
MEDIA	LIQUID GaAs, GaP, B(2)O(3)
DRIVER	DEVELOPMENT OF HIGH QUALITY MATERIALS
SERVICE	MEDIA INCL. As(4) OR P(4) LADEN N(2) GAS
ENVIRON	LAB
NEC	NA
ACCURACY	1%
PRECISION	0.05%
RANGE	1000-1500 C
RESPONSE	MIN
CALFREQ	6 MO
CALSITE	REMOV. & CAL.
STIMULUS	PHYSICAL
MAMF	1 MO
MADTM	24 HR
LIFE	3 YR
COST	$100
NOPERYR	10
SENSITE	REACTOR
AVAILABLE	NO
MFGR	NONE
FAULTS	NA
OTHER	OPTICAL TECHNIQUE WOULD BE ACCEPTABLE
SECTOR	ELECTRONIC CHEMICALS

Appendix 1. Measurement Survey Data Base--Continued

RECORD NO.	67
NEED	THE As:Ga RATIO IN A GaAs CRYSTAL MELT
XTRANEED	NA
MEDIA	GaAs MELT (1250C & 2 ATM. N(2) GAS)
DRIVER	QUALITY
SERVICE	CORROSIVE
ENVIRON	LAB
NEC	NA
ACCURACY	0.003 OF RATIO
PRECISION	0.003 OF RATIO
RANGE	As:Ga = 0.98 TO 1.04
RESPONSE	2 MIN
CALFREQ	48 HR
CALSITE	IN PLACE/REMOV.&CAL.
STIMULUS	PHYSICAL
MAMF	48 HR
MADTM	24 HR
LIFE	48 HR
COST	$100
NOPERYR	50
SENSITE	REACTOR
AVAILABLE	NO
MFGR	NONE
FAULTS	NA
OTHER	MEAS. NEEDED FOR PRODUCT QUALITY CONTROL
SECTOR	ELECTRONIC CHEMICALS

RECORD NO.	68
NEED	LEVEL IN VESSEL UNDER PRESSURE OR VACUUM
XTRANEED	VERIFICATION OF ACCURACY OF RTD'S
MEDIA	LIQUID BROMINE
DRIVER	QUALITY, SAFETY
SERVICE	CORROSIVE, EROSIVE, VIBRATION
ENVIRON	PLANT
NEC	NA
ACCURACY	0.2% OF SPAN
PRECISION	0.05% OF SPAN
RANGE	0-800 IN. WATER
RESPONSE	0.15 SEC (SPAN STEP)
CALFREQ	6 MO
CALSITE	IN-PLACE
STIMULUS	PHYSICAL
MAMF	NA
MADTM	NA
LIFE	NA
COST	$800
NOPERYR	NA
SENSITE	IN-LINE/REACTOR
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	MAINTENANCE
OTHER	PRESSURE-COMPENSATING LEVEL DEVICE DESIRED
SECTOR	CHEMICAL

Appendix 1. Measurement Survey Data Base--Continued

RECORD NO.	69
NEED	ON-MACHINE MEASUREMENTS OF PAPER MECHANICAL PROPERTIES
XTRANEED	CITED
MEDIA	PAPER
DRIVER	QUALITY, PROCESS CONTROL
SERVICE	NA
ENVIRON	PLANT
NEC	NA
ACCURACY	1-3%
PRECISION	<1%
RANGE	VARIABLE
RESPONSE	<30 SEC
CALFREQ	NA
CALSITE	IN-PLACE
STIMULUS	NA
MAMF	NA
MADTM	NA
LIFE	NA
COST	NA
NOPERYR	NA
SENSITE	IN-LINE
AVAILABLE	YES/IN-HOUSE
MFGR	UNDER DEVELOPMENT
FAULTS	MAINTENANCE
OTHER	MILLWORTHINESS, CALIBRATION, ELECTRONICS/CORROSION
SECTOR	PAPER

RECORD NO.	70
NEED	ON-MACHINE LIGNIN CONTENT (PULP DIGESTER)
XTRANEED	CITED
MEDIA	WOOD PULP, COOKING LIQUORS
DRIVER	QUALITY, UNIFORMITY
SERVICE	CORROSIVE, HIGH TEMPERATURE
ENVIRON	PLANT
NEC	NA
ACCURACY	1-3%
PRECISION	1%
RANGE	NA
RESPONSE	NA
CALFREQ	NA
CALSITE	NA
STIMULUS	NA
MAMF	NA
MADTM	NA
LIFE	NA
COST	NA
NOPERYR	NA
SENSITE	IN-LINE/REACTOR
AVAILABLE	NO
MFGR	NONE
FAULTS	RELIABILITY, MAINTENANCE
OTHER	NEED IN-LINE/ON-LINE SENSOR
SECTOR	PAPER

Appendix 1. Measurement Survey Data Base--Continued

RECORD NO.	71
NEED	REMOTE HYDROCARBON SENSING
XTRANEED	CITED
MEDIA	HYDROCARBON LEAKS IN AIR
DRIVER	ENVIRON. CONTROL, STOCK LOSS MONITORING
SERVICE	NA
ENVIRON	PLANT, LOADING DOCK, PIPELINE MONITORING
NEC	NA
ACCURACY	2%
PRECISION	2% OF RANGE
RANGE	1-5000 PPM
RESPONSE	2 SEC
CALFREQ	1 MO
CALSITE	IN-PLACE
STIMULUS	PHYSICAL
MAMF	1 MO
MADTM	2-4 HR
LIFE	5 YR
COST	$20K
NOPERYR	10
SENSITE	REMOTE SENSING
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	RELIAB., ACCUR., MAINTEN., COST
OTHER	OPTICAL TECHNIQUES HAVE POTENTIAL TO SOLVE THIS PROBLEM
SECTOR	OIL & GAS

RECORD NO.	72
NEED	FLARE GAS FLOW RATE (HYDROCARBONS)
XTRANEED	CITED
MEDIA	HYDROCARBON GASES
DRIVER	COST, ENVIRONMENTAL CONTROL
SERVICE	CORROSIVE
ENVIRON	PLANT
NEC	NA
ACCURACY	1-2%
PRECISION	1%
RANGE	50:1 RANGEABILITY
RESPONSE	0.5 SEC
CALFREQ	1 MO
CALSITE	REMOV. & CAL.
STIMULUS	NA
MAMF	1 MO
MADTM	2-6 HR
LIFE	5-10 YR
COST	$2K
NOPERYR	30
SENSITE	IN-LINE
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	ACCUR., MAINTEN., RANGE, SPECIES COMPENSATION
OTHER	NEED ACCUR. METER FOR ENVIRON.-EMISS.& STOCK-LOSS CONTROLS
SECTOR	OIL & GAS

Appendix 1. Measurement Survey Data Base--Continued

RECORD NO.	73
NEED	HIGH ACCURACY LIQUID FLOW RATE (OIL, HYDROCARBON PRODUCTS)
XTRANEED	CITED
MEDIA	CRUDE OIL, LIQUID HYDROCARBON PRODUCTS
DRIVER	COST, CUSTODY TRANSFER
SERVICE	NA
ENVIRON	PLANT, SHIP, PIPE & COM'L XCHANGE STA.
NEC	NA
ACCURACY	0.1%
PRECISION	0.05%
RANGE	10e5-2X10e5 BPD
RESPONSE	1 SEC
CALFREQ	3 MO
CALSITE	IN-PLACE
STIMULUS	NA
MAMF	1 MO
MADTM	2 HR
LIFE	8-10 YR
COST	$20K
NOPERYR	20
SENSITE	IN-LINE
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	ACCUR., COST, PORTABILITY, EASE OF CAL.
OTHER	HIGH CRUDE COST, STOCK-CONTROL, PROCESS MAT'L. BALANCE
SECTOR	OIL & GAS

RECORD NO.	74
NEED	NONCONTACT TEMPERATURE OF WIRE DURING DRAWING PROCESS
XTRANEED	NA
MEDIA	METAL WIRE EXITING A WIRE-DRAWING DIE
DRIVER	COST
SERVICE	VIBRATION, OIL MIST & DUST IN AIR
ENVIRON	PLANT
NEC	NA
ACCURACY	5 C
PRECISION	2.5 C
RANGE	50-500 C
RESPONSE	MILLISECONDS
CALFREQ	1 MO
CALSITE	IN-PLACE/REMOV.&CAL.
STIMULUS	PHYSICAL
MAMF	1 WK
MADTM	0.5 HR
LIFE	10 YR
COST	$500
NOPERYR	LARGE POTENTIAL
SENSITE	NA
AVAILABLE	YES/COM'L
MFGR	ONE
FAULTS	DOESN'T WORK ON WIRE DIA'S. <0.015 IN.
OTHER	Cu,Ni,Fe BASE ALLOYS OF 0.004-0.020 IN. DIA MAIN PROBLEM
SECTOR	METALS

RECORD NO.	75
NEED	% SOLIDS (0 TO 50%) IN NEUTRAL DENSITY FLUID
XTRANEED	CITED
MEDIA	SEE "OTHER"
DRIVER	COST
SERVICE	CORROSIVE, INTERNALLY COATS WALLS
ENVIRON	NA
NEC	C1/D2/GB
ACCURACY	0.5%
PRECISION	0.2%
RANGE	0-50% SOLIDS
RESPONSE	15 SEC FULL SCALE
CALFREQ	6 MO
CALSITE	IN-PLACE
STIMULUS	ELECTRICAL
MAMF	6 MO
MADTM	1-2 HR
LIFE	5 YR
COST	$1.5K & UPWARD
NOPERYR	4
SENSITE	IN-LINE
AVAILABLE	NO
MFGR	NONE
FAULTS	NUCLEAR DENSITY METERS NOT SATISFACTORY
OTHER	POLYETHANE IN HEXANE, CHLORINATED POLYETHYLENE IN WATER
SECTOR	PLASTICS

RECORD NO.	76
NEED	VERY LOW FLOW RATE OF HIGH PRESSURE (1000 PSIG) HYDROGEN
XTRANEED	CITED
MEDIA	HYDROGEN GAS @ 1000 PSIG
DRIVER	QUALITY
SERVICE	VIBRATION
ENVIRON	NA
NEC	C1/D2/GB
ACCURACY	0.2%
PRECISION	0.1%
RANGE	0-1.0 LB/HR
RESPONSE	0.5 SEC
CALFREQ	6 MO
CALSITE	IN-PLACE/REMOV.&CAL.
STIMULUS	ELECTRICAL
MAMF	6 MO
MADTM	1 HR
LIFE	5 YR
COST	$1.5K
NOPERYR	2
SENSITE	IN-LINE
AVAILABLE	NA
MFGR	NA
FAULTS	COST
OTHER	DESIRE LINEAR FLOW RESPONSE WITH >10:1 RANGEABILITY
SECTOR	CHEMICAL/PLASTICS

RECORD NO.	77
NEED	SOLIDS FRACTION IN SOLID-GAS FLOWS
XTRANEED	CITED
MEDIA	POLYETHYLENE PELLETS/POWDER IN AIR
DRIVER	COST, QUALITY, PRODUCTION EFFICIENCY
SERVICE	VIBRATION
ENVIRON	PLANT
NEC	C1/D2/GB
ACCURACY	<0.5%
PRECISION	0.2%
RANGE	2,000-10,000 LB/HR
RESPONSE	2 SEC FULL SCALE
CALFREQ	6 MO
CALSITE	IN-PLACE
STIMULUS	ELECTRICAL
MAMF	6 MO
MADTM	8 HR
LIFE	1 YR
COST	$1K
NOPERYR	50
SENSITE	IN-LINE
AVAILABLE	YES/COM'L
MFGR	ONE
FAULTS	WORKS WITH PELLETS ONLY (NOT POWDERS)
OTHER	ACCURACY AFFECTED BY VIBRATION, FLOW PATTERN, MOISTURE, ETC.
SECTOR	PLASTICS

RECORD NO.	78
NEED	LEVEL IN POLYETHYLENE REACTOR
XTRANEED	CITED
MEDIA	MOLTEN POLYETHYLENE @ 300 C
DRIVER	QUALITY
SERVICE	NA
ENVIRON	NA
NEC	C1/D2/GB
ACCURACY	1%
PRECISION	1%
RANGE	NA
RESPONSE	2 MIN
CALFREQ	6 MO
CALSITE	IN-PLACE
STIMULUS	ELECTRICAL
MAMF	6 MO
MADTM	4 HR
LIFE	1 YR
COST	$1K
NOPERYR	4
SENSITE	REACTOR
AVAILABLE	NO
MFGR	NONE
FAULTS	NUCLEAR MEAS. TECHNIQUES NOT SATISFACTORY
OTHER	HIGH VESSEL:PRODUCT WEIGHT RATIO, THICK PRODUCT COATS WALLS
SECTOR	PLASTICS

RECORD NO.	79
NEED	CHEMICAL COMPOSITION OF FILTHY LIQUID PROCESS STREAMS
XTRANEED	CITED
MEDIA	NA
DRIVER	QUALITY, ISOLATION OF DESIRED COMPONENT
SERVICE	CORROSIVE, EROSIVE
ENVIRON	PLANT
NEC	C1/D2/GA,B,C&D
ACCURACY	1%
PRECISION	0.1%
RANGE	LOW PPM TO %
RESPONSE	MINUTES
CALFREQ	1 WK
CALSITE	IN-PLACE
STIMULUS	PHYSICAL
MAMF	CHECK DAILY
MADTM	8 HR/WK
LIFE	5 YR
COST	$10-15K
NOPERYR	1-2
SENSITE	IN-LINE/REACTOR/ON-LINE
AVAILABLE	NO/IN-HOUSE DEVELOPMENT
MFGR	NONE
FAULTS	RELIABILITY, MAINTENANCE
OTHER	IN-HOUSE VAPOR-LIQUID EQUILIBRIUM SPARGER USED
SECTOR	CHEMICAL

RECORD NO.	80
NEED	CHEMICAL COMPOSITION OF HOT (100-300C) VAPOR PROCESS STREAMS
XTRANEED	CITED
MEDIA	VARIOUS VAPORS IN AIR
DRIVER	QUALITY
SERVICE	CORROSIVE
ENVIRON	PLANT
NEC	C1/D2/GA,B,C&D
ACCURACY	1%
PRECISION	0.1%
RANGE	LOW PPM TO 100%
RESPONSE	30 SEC TO 10 MIN
CALFREQ	1 WK
CALSITE	IN-PLACE
STIMULUS	PHYSICAL
MAMF	CHECK DAILY
MADTM	4 HR/WK
LIFE	5 YR
COST	$5-10K
NOPERYR	6-12
SENSITE	IN-LINE/REACTOR/ON-LINE
AVAILABLE	YES/COM'L/IN-HOUSE
MFGR	VARIOUS
FAULTS	RELIAB., MAINTEN., EASE OF REPAIR & CAL.
OTHER	NEED RUGGED, RELIAB., MODULAR, SIMPLE ANALYZER
SECTOR	CHEMICAL

RECORD NO.	81
NEED	ON-LINE PH
XTRANEED	ON-LINE CHEMICAL ANALYSIS
MEDIA	WATER & TOLUENE
DRIVER	QUALITY
SERVICE	CORROSIVE, EROSIVE, HIGH TEMPERATURE
ENVIRON	PLANT
NEC	C1/D1/GD
ACCURACY	INDUSTRY STD.
PRECISION	INDUSTRY STD.
RANGE	6-14 PH
RESPONSE	INDUSTRY STD.
CALFREQ	1 WK
CALSITE	IN-PLACE
STIMULUS	NA
MAMF	1 WK
MADTM	0.5 HR
LIFE	6 MO
COST	$200
NOPERYR	4
SENSITE	IN-LINE/REACTOR
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	RELIABILITY, MAINTENANCE
OTHER	NEED IN-LINE/ON-LINE MEASUREMENT
SECTOR	CHEMICAL

RECORD NO.	82
NEED	PARTICLE SIZE DISTRIBUTION (IN FLUIDS)
XTRANEED	CITED
MEDIA	SEE "OTHER"
DRIVER	QUALITY CONTROL
SERVICE	CORROSIVE, EROSIVE
ENVIRON	PLANT
NEC	NA
ACCURACY	NA
PRECISION	2%
RANGE	0.3-100 MICRONS
RESPONSE	10-60 MIN
CALFREQ	NA
CALSITE	IN-PLACE
STIMULUS	NA
MAMF	1 MO
MADTM	1%
LIFE	5 YR
COST	$5-50K
NOPERYR	2
SENSITE	IN-LINE
AVAILABLE	YES/COM'L
MFGR	ONE
FAULTS	ACCURACY, NEED IN-LINE/ON-LINE MEAS.
OTHER	SOLIDS IN GAS, SOLIDS IN LIQ., LIQ.IN LIQ., LIQ. IN GAS
SECTOR	CHEMICAL

Appendix 1. Measurement Survey Data Base--Continued

RECORD NO.	83
NEED	LOW LEVEL MOISTURE (<100 PPM) IN HYDROCARBON STREAMS
XTRANEED	CITED
MEDIA	HYDROCARBON STREAMS
DRIVER	QUALITY CONTROL
SERVICE	CORROSIVE
ENVIRON	PLANT
NEC	NA
ACCURACY	1% RELATIVE
PRECISION	1% RELATIVE
RANGE	0-1 PPM TO 0-100 PPM
RESPONSE	<5 MIN
CALFREQ	1 MO
CALSITE	IN-PLACE
STIMULUS	PHYSICAL
MAMF	3 MO
MADTM	1%
LIFE	5 YR
COST	$20K
NOPERYR	20
SENSITE	IN-LINE
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	MAINTENANCE, NON-SPECIES SPECIFIC
OTHER	NA
SECTOR	CHEMICAL

RECORD NO.	84
NEED	TRACE ANALYSIS OF ORGANICS (SPECIFIC) IN WATER
XTRANEED	CITED
MEDIA	NA
DRIVER	PROCESS CONTROL
SERVICE	CORROSIVE
ENVIRON	PLANT
NEC	NA
ACCURACY	20% RELATIVE
PRECISION	4% RELATIVE
RANGE	0-100 PPM
RESPONSE	<5 MIN
CALFREQ	1 MO
CALSITE	IN-PLACE
STIMULUS	NA
MAMF	3 MO
MADTM	1%
LIFE	NA
COST	$20K
NOPERYR	3
SENSITE	IN-LINE
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	RELIAB., ACCUR., REPRODUCIBILITY
OTHER	NA
SECTOR	CHEMICAL

RECORD NO.	85
NEED	% ETHANOL IN BEER
XTRANEED	YEAST GROWTH (FERMENTATION), SELECTED FLAVOR COMPONENTS
MEDIA	WATER
DRIVER	QUALITY
SERVICE	STERILITY
ENVIRON	PLANT
NEC	NA
ACCURACY	0.02%
PRECISION	0.02%
RANGE	2-6% ETHANOL
RESPONSE	<1 MIN
CALFREQ	1 WK
CALSITE	IN-PLACE
STIMULUS	ELECTRICAL
MAMF	3 MO
MADTM	1-3 DAY
LIFE	NA
COST	$20K
NOPERYR	22 NEEDED
SENSITE	IN-LINE
AVAILABLE	YES/UNDER COM'L DEVELOPMENT
MFGR	ONE
FAULTS	NEED IN-LINE ETHANOL MONITOR
OTHER	RELIABLE ENOUGH TO CONTROL BLENDING OPERATIONS
SECTOR	CONSUMER PRODUCTS

RECORD NO.	86
NEED	MASS FLOW OF MIXTURES OF LIGHT HYDROCARBONS
XTRANEED	ORIFICES: VISCOUS FLOW, PIPES<2 IN. DIA. & >18 IN. DIA.
MEDIA	GAS, LPG, LPG MIX, CO(2)
DRIVER	COM'L XCHANGE, COST, 0-40,000 BPD LIQ'S
SERVICE	CORROSIVE, VIBRATION, STERILITY, EROSIVE
ENVIRON	PLANT, FIELD & LEASE STA., LAB
NEC	C1/D1,2/GD
ACCURACY	<0.5%
PRECISION	0.25%
RANGE	0-50/0-100 IN. WATER
RESPONSE	NA
CALFREQ	1 DAY TO 3 MO
CALSITE	IN-PLACE/REMOV.&CAL.
STIMULUS	PHYS./ELECTR.
MAMF	1 YR
MADTM	1 HR TO 1 DAY
LIFE	10 YR
COST	$50 TO $5K
NOPERYR	3,000-6,000
SENSITE	IN-LINE/ON-LINE/REACTOR/LAB TEST
AVAILABLE	YES/COM'L/IN-HOUSE
MFGR	VARIOUS
FAULTS	RELIAB., ACCUR., MAINTEN., REPEAT., RANGEAB.
OTHER	NEED TO ACC'T. FOR PULSATION, COMPOSITION, COMPRESS., ETC.
SECTOR	OIL & GAS

Appendix 1. Measurement Survey Data Base--Continued

RECORD NO.	87
NEED	PH OF OILY WATER
XTRANEED	CITED
MEDIA	WATER WITH SOME ENTRAINED OIL
DRIVER	PROCESS CONTROL, POLLUTION CONTROL
SERVICE	NA
ENVIRON	NA
NEC	C1/D2/GD
ACCURACY	0.1 PH
PRECISION	0.1 PH
RANGE	1-14 PH
RESPONSE	<5 SEC
CALFREQ	1 DAY
CALSITE	REMOV. & CAL.
STIMULUS	NA
MAMF	1 DAY
MADTM	15 MIN
LIFE	1 YR
COST	$100
NOPERYR	FEW
SENSITE	IN-LINE/ON LINE
AVAILABLE	YES/COM'L
MFGR	ONE
FAULTS	RELIABILITY, MAINTENANCE
OTHER	CURRENT DEVICES ONLY LAST FOR A FEW MINUTES OR HOURS
SECTOR	OIL & GAS

RECORD NO.	88
NEED	TWO-PHASE FLOW OF OIL & GAS MIXTURES (AT WELLHEAD)
XTRANEED	CITED
MEDIA	FLUID EXITING WELLHEAD IN OIL PRODUCTION
DRIVER	PROCESS CONTROL
SERVICE	NA
ENVIRON	NA
NEC	C1/D2/GD
ACCURACY	2-5% (OR LESS)
PRECISION	1%
RANGE	0-SEVERAL THOUS. BPD
RESPONSE	<1 SEC
CALFREQ	1 MO
CALSITE	IN-PLACE/REMOV.&CAL.
STIMULUS	NA
MAMF	1 MO
MADTM	15 MIN
LIFE	FEW YR
COST	$1.5K
NOPERYR	SEVERAL
SENSITE	IN-LINE
AVAILABLE	NO
MFGR	NA
FAULTS	NA
OTHER	NA
SECTOR	OIL & GAS

RECORD NO.	89
NEED	LOW DIFFERENTIAL PRESSURE @ HIGH LINE PRESSURES
XTRANEED	DYNAMIC PRESS. RESPONSE & CAL. CAPABILITIES FOR X-DUCERS
MEDIA	HIGH PRESSURE GASES TO 1000 PSIG
DRIVER	QUALITY
SERVICE	VIBRATION
ENVIRON	LAB, PLANT
NEC	NA
ACCURACY	0.1%
PRECISION	0.05%
RANGE	0-200 IN. WATER
RESPONSE	5-10 MILLISEC
CALFREQ	1 WK
CALSITE	IN-PLACE
STIMULUS	PHYSICAL
MAMF	USE SPARE
MADTM	USE SPARE
LIFE	5 YR
COST	$600
NOPERYR	10
SENSITE	IN-LINE
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	ACCURACY, DYNAMIC RESPONSE CHARACTERISTICS
OTHER	NA
SECTOR	GOVERNMENT

RECORD NO.	90
NEED	SMALL DIFFERENTIAL PRESSURE @ HIGH BASE PRESSURES
XTRANEED	MASS FLOW OF GAS, GAS MIXTURES, & LIQ.-GAS MIXTURES
MEDIA	NATURAL GAS @ 600-1000 PSIG
DRIVER	ACCUR. IN GAS FLOW USING HEAD METERS
SERVICE	NA
ENVIRON	LAB, FIELD SITES, PIPELINES
NEC	NA
ACCURACY	0.1%
PRECISION	0.05%
RANGE	0-100 kPa
RESPONSE	FAST
CALFREQ	1 WK
CALSITE	IN-PLACE
STIMULUS	PHYSICAL
MAMF	6 MO
MADTM	USE SPARE
LIFE	10 YR
COST	$2-3K
NOPERYR	10
SENSITE	IN-LINE
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	RELIAB., ACCUR., CAL. HARDWARE
OTHER	NO RELIABLE CAL. PROCEDURE/SYSTEM EXISTS
SECTOR	GOVERNMENT

RECORD NO.	91
NEED	OXYGEN CONTENT OF BEER OR CARBONATED WATER IN PIPELINES
XTRANEED	CO(2) CONTENT OF BEER OR CARBONATED WATER IN PIPELINES
MEDIA	BEER, CARBONATED WATER
DRIVER	QUALITY
SERVICE	STERILITY
ENVIRON	LAB, PLANT
NEC	NEMA 4
ACCURACY	1% OF SCALE
PRECISION	0.5% OF SCALE
RANGE	0-0.10 PPM OXYGEN
RESPONSE	90% IN 2 MIN
CALFREQ	2 MO
CALSITE	IN-PLACE
STIMULUS	NA
MAMF	6 MO
MADTM	1 HR
LIFE	10 YR
COST	NA
NOPERYR	6-30
SENSITE	IN-LINE
AVAILABLE	NO
MFGR	NONE
FAULTS	NA. SIMILAR NEEDS EXIST FOR CO(2) ANALYZERS
OTHER	NEEDED IN THE BREWING, BEVERAGE, UTILITY INDUSTRIES
SECTOR	CONSUMER PRODUCTS

RECORD NO.	92
NEED	STEAM FLOW RATE
XTRANEED	CITED
MEDIA	STEAM
DRIVER	COST, ALLOCATION OF COSTS TO USE AREAS
SERVICE	CORROSIVE, VIBRATION
ENVIRON	PLANT, HOSTILE (HOT)
NEC	C1/D2/GB
ACCURACY	0.5%
PRECISION	0.1%
RANGE	1-16 IN. DIA. PIPES
RESPONSE	NONCRITICAL
CALFREQ	1 MO
CALSITE	IN-PLACE
STIMULUS	NA
MAMF	1 YR
MADTM	8 HR
LIFE	20 YR
COST	NA
NOPERYR	NA
SENSITE	IN-LINE
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	ACCURACY
OTHER	NA
SECTOR	INSTRUM. MFGR.

RECORD NO.	93
NEED	LOW FLOW RATES OF VISCOUS (LOW Re NO.) FLUIDS
XTRANEED	CITED
MEDIA	INDUSTRIAL VISCOUS FLUIDS
DRIVER	QUALITY, METERS
SERVICE	CORROSIVE, VIBRATION
ENVIRON	PLANT
NEC	C1/D2/GB
ACCURACY	1%
PRECISION	0.25%
RANGE	0.25-6 IN.DIA. PIPES
RESPONSE	MINUTES
CALFREQ	NA
CALSITE	IN-PLACE/REMOV.&CAL.
STIMULUS	NA
MAMF	3 MO
MADTM	24 HR
LIFE	20 YR
COST	NA
NOPERYR	NA
SENSITE	IN-LINE/ON-LINE
AVAILABLE	NO & STD. METERS DO NOT WORK
MFGR	NONE
FAULTS	NO METERS DESIGNED TO MEET THIS NEED
OTHER	MARKET TOO SMALL TO ATTRACT METER MFGR.
SECTOR	INSTRUM. MFGR.

RECORD NO.	94
NEED	ACCURATE FLOW RATES OF PROCESS FLUIDS
XTRANEED	MULTIPHASE FLOW RATES
MEDIA	VARIOUS PROCESS FLUIDS
DRIVER	COST, QUALITY, MATERIAL ACCOUNTABILITY
SERVICE	CORROSIVE, EROSIVE, VIBRATION, STERILITY
ENVIRON	LAB, PLANT
NEC	ALL
ACCURACY	<1%
PRECISION	0.1%
RANGE	VARIABLE
RESPONSE	NA
CALFREQ	6 MO
CALSITE	IN-PLACE/REMOV.&CAL.
STIMULUS	NA
MAMF	3 MO
MADTM	8 HR
LIFE	20 YR
COST	NA
NOPERYR	NA
SENSITE	IN-LINE/ON-LINE
AVAILABLE	YES. SOME APPLICATIONS
MFGR	VARIOUS COM'L & IN-HOUSE
FAULTS	RELIAB., ACCUR., PROCESS FRIENDLY
OTHER	IMPROVE PROCESS CONTROL, MAT'L ACCOUNTABILITY
SECTOR	INSTRUM. MFGR.

RECORD NO.	95
NEED	VISCOELASTIC FLUID FLOW RATE OF POLYMER MELT
XTRANEED	CITED
MEDIA	HIGH VISCOSITY POLYMER MELT
DRIVER	QUALITY, PROCESS CONTROL
SERVICE	NA
ENVIRON	PLANT
NEC	C1/D2/GB
ACCURACY	0.5% OF CALIBRATION
PRECISION	0.25% OF READING
RANGE	VARIABLE
RESPONSE	0.25 SEC
CALFREQ	VARIABLE
CALSITE	IN-PLACE
STIMULUS	NA
MAMF	1 YR
MADTM	4 HR
LIFE	5 YR
COST	$3-4K
NOPERYR	2-4
SENSITE	IN-LINE
AVAILABLE	YES/COM'L
MFGR	TWO
FAULTS	RELIABILITY
OTHER	FLOW RESTRICTIONS IN LAMINAR FLOW
SECTOR	PHARMACEUTICAL

RECORD NO.	96
NEED	LIQUID CHROMATOGRAPHY & ANALYSES (COMPOSITION)
XTRANEED	CITED
MEDIA	CHLORINATED AROMATIC HYDROCARBONS
DRIVER	QUALITY, PROCESS CONTROL
SERVICE	NA
ENVIRON	PLANT
NEC	C1/D2/GB
ACCURACY	1% OF READING
PRECISION	0.25%
RANGE	VARIABLE
RESPONSE	VARIABLE
CALFREQ	1 MO
CALSITE	IN-PLACE
STIMULUS	NA
MAMF	6 MO
MADTM	4 HR
LIFE	5 YR
COST	$25K
NOPERYR	5
SENSITE	IN-LINE/ON-LINE
AVAILABLE	NO
MFGR	NONE
FAULTS	NEED IN-LINE ANALYZER FOR PLANT (CPI)
OTHER	LAB ANALYT. INSTR. & LIQ. CHROMAT. NOT DEVELOPED FOR CPI
SECTOR	PHARMACEUTICAL

RECORD NO.	97
NEED	VOLUME, FLOW & WATER CONTENT OF CRUDE OIL
XTRANEED	OIL-IN-WATER CONTENT & OIL-GAS-WATER FLOW RATE
MEDIA	CRUDE OIL
DRIVER	COST
SERVICE	NA
ENVIRON	PLANT
NEC	C1/D2
ACCURACY	0.1%
PRECISION	0.05%
RANGE	FLOW:10-10,000 BPH
RESPONSE	NONCRITICAL
CALFREQ	NA
CALSITE	IN-PLACE
STIMULUS	NA
MAMF	6 MO TO 1 YR
MADTM	1 DAY
LIFE	10 YR
COST	$10K
NOPERYR	5
SENSITE	IN-LINE
AVAILABLE	YES/COM'L
MFGR	VARIOUS FOR EACH PARAMETER
FAULTS	NEED IN-LINE MEAS., RELIAB., ACCURACY
OTHER	NEED AUTOMATIC TANK GAGES, IN-LINE OIL/WATER ANALYZERS
SECTOR	OIL & GAS

RECORD NO.	98
NEED	LOW FLOW RATES OF LIQUIDS (0.1 TO 2 CC/MIN.)--HYDROCARBONS
XTRANEED	CITED
MEDIA	HYDROCARBONS
DRIVER	COMPUTER CONTROL OF LIQUID FEED RATES
SERVICE	PULSATING OUTPUT FROM PUMPS
ENVIRON	LAB
NEC	NA
ACCURACY	1%
PRECISION	0.5%
RANGE	20:1 RANGEABILITY
RESPONSE	NA
CALFREQ	1 WK
CALSITE	IN-PLACE
STIMULUS	NA
MAMF	1 YR
MADTM	NA
LIFE	3 YR
COST	$2K
NOPERYR	20
SENSITE	IN-LINE
AVAILABLE	YES/IN-HOUSE
MFGR	NONE SATISFACTORY
FAULTS	NOT AVAILABLE IN DESIRED FLOW RANGE
OTHER	CURRENTLY USING COMPUTED-CONTROLLED DIGITAL BALANCE
SECTOR	OIL & GAS

Appendix 1. Measurement Survey Data Base--Continued

RECORD NO.	99
NEED	SMALL TEMPERATURE DIFFERENCES @ HIGH BASE TEMPERATURES
XTRANEED	CITED
MEDIA	AIR INSIDE OF FURNACE
DRIVER	HEATER CONTROL: ADIABATIC REACTOR TESTS
SERVICE	NA
ENVIRON	LAB
NEC	NA
ACCURACY	0.1 F
PRECISION	0.05 F
RANGE	0-50 F @ 1000 F
RESPONSE	0.1 SEC
CALFREQ	1 YR
CALSITE	REMOV. & CAL.
STIMULUS	NA
MAMF	1 YR
MADTM	NA
LIFE	1 YR
COST	NA
NOPERYR	50
SENSITE	NA
AVAILABLE	YES/COM'L, THERMOCOUPLES
MFGR	VARIOUS
FAULTS	ACCURACY
OTHER	NEED ACCUR. TEMP. DIFF. (FURNACE TO OUTER WALL OF REACTOR)
SECTOR	OIL & GAS

RECORD NO.	100
NEED	IN-PROCESS MOISTURE CONTENT IN FOODS
XTRANEED	CITED
MEDIA	A VARIETY OF SOLID FOODSTUFFS
DRIVER	COST, QUALITY
SERVICE	STERILITY
ENVIRON	PLANT
NEC	NO EXPLOS. HAZ.
ACCURACY	VARIABLE: 0.1-0.5%
PRECISION	0.1-0.5%
RANGE	VARIABLE:SEE "OTHER"
RESPONSE	INSTANTANEOUS
CALFREQ	1 MO
CALSITE	IN-PLACE
STIMULUS	NA
MAMF	1 MO
MADTM	4 HR
LIFE	10 YR
COST	NA
NOPERYR	NA
SENSITE	IN-LINE/REACTOR
AVAILABLE	NA
MFGR	NA
FAULTS	NEED IN-LINE, RELIABILITY
OTHER	5-15%, 10-15%, 8-26%, 18-35%, 35-40%, 35-50%, 40-60%, ETC.
SECTOR	FOOD

RECORD NO.	101
NEED	IN-PROCESS FAT CONTENT IN FOODS
XTRANEED	CITED
MEDIA	A VARIETY OF SOLID FOODSTUFFS
DRIVER	COST, QUALITY
SERVICE	STERILITY
ENVIRON	PLANT
NEC	NO. EXPLOS. HAZ
ACCURACY	VARIABLE:0.05-0.5%
PRECISION	0.05-0.5%
RANGE	VARIABLE:SEE "OTHER"
RESPONSE	INSTANTANEOUS
CALFREQ	1 MO
CALSITE	IN-PLACE
STIMULUS	NA
MAMF	1 MO
MADTM	4 HR
LIFE	10 YR
COST	NA
NOPERYR	NA
SENSITE	IN-LINE/REACTOR
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	RELIABILITY
OTHER	0.3-1.0%, 0.5-2.0%, 2-8%, 10-20%, 25-35%, 40-60%, 77-83%
SECTOR	FOOD

RECORD NO.	102
NEED	IN-PROCESS PROTEIN CONTENT IN FOODS
XTRANEED	CITED
MEDIA	A VARIETY OF SOLID FOODSTUFFS
DRIVER	COST, QUALITY
SERVICE	STERILITY
ENVIRON	PLANT
NEC	NO EXPLOS. HAZ.
ACCURACY	VARIABLE:0.05-5.0%
PRECISION	0.05 TO 5.0%
RANGE	VARIABLE:SEE "OTHER"
RESPONSE	INSTANTANEOUS
CALFREQ	1 MO
CALSITE	IN-PLACE
STIMULUS	NA
MAMF	1 MO
MADTM	4 HR
LIFE	10 YR
COST	NA
NOPERYR	NA
SENSITE	IN-LINE/REACTOR
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	RELIABILITY
OTHER	0.2-0.5%, 2-4%, 5-15%, 12-18%, 19-23%, 30-40%, 91-96%
SECTOR	FOOD

RECORD NO.	103
NEED	QUAL. & QUANT. ID OF CRYSTAL. DEFECTS IN COMPOUND SEMICOND.
XTRANEED	NA
MEDIA	Hg(1-x)Cd(x)Te EPITAXIAL OR BULK MAT'L
DRIVER	QUALITY OF HgCdTe & OTHER IR SEMICOND.
SERVICE	NONDESTRUCTIVE, SPATIALLY LOCALIZED
ENVIRON	LAB
NEC	NA
ACCURACY	SEE "OTHER"
PRECISION	WITHIN 25%
RANGE	(10e14-10e18)/CC
RESPONSE	NA
CALFREQ	NONCRITICAL
CALSITE	NA
STIMULUS	NA
MAMF	NONCRITICAL
MADTM	NONCRITICAL
LIFE	5 YR
COST	NONCRITICAL
NOPERYR	NA
SENSITE	IN-LINE/LAB TEST
AVAILABLE	NO MEAS. TECHNIQUE EXISTS
MFGR	LUMINESC. MAY ID IMPURITIES
FAULTS	STOICH. DEFECTS & COMPLEXES HARD TO IDENTIFY
OTHER	IDENTIFY DEFECT TYPE, QUANTITY WITHIN 50%
SECTOR	ELECTRONIC CHEMICALS

RECORD NO.	104
NEED	SUBMICRON PARTICLE COUNTING & CHARACTERIZ. IN PROCESS FLUIDS
XTRANEED	CITED
MEDIA	SEE "OTHER"
DRIVER	QUALITY CONTROL IN VLSI DEVICE FABRIC.
SERVICE	CORROSIVE
ENVIRON	LAB, PLANT
NEC	NA
ACCURACY	ACCEPT CAL. STD.
PRECISION	MOST IMPORTANT
RANGE	LOW RANGES
RESPONSE	<1 MIN
CALFREQ	1 MO
CALSITE	IN-PLACE
STIMULUS	ELECTRICAL
MAMF	6 MO
MADTM	8 HR
LIFE	5 YR
COST	REASONABLE
NOPERYR	MORE THAN 1
SENSITE	IN-LINE (PARTICLE CONTAMINATION SENSING)
AVAILABLE	NO/COM'L UNITS UNDER DEVELOP.
MFGR	NONE
FAULTS	0.3-0.5 MICRON DETECTION LIMIT NOT LOW ENOUGH
OTHER	HIGH PURITY WATER, ACIDS, SOLVENTS & CHEMICAL SOLUTIONS
SECTOR	ELECTRONIC CHEMICALS

Appendix 1. Measurement Survey Data Base--Continued

RECORD NO.	105
NEED	TRACE IMPURITIES IN PROCESS GASES & CARRIER GASES
XTRANEED	CITED
MEDIA	INDUSTRIAL PIPELINE & CYLINDER GASES
DRIVER	QUALITY, HIGH PURITY GASES FOR VLSI FAB
SERVICE	CORROSIVE
ENVIRON	LAB, PLANT, PIPELINES
NEC	NA
ACCURACY	NA
PRECISION	IMPORTANT
RANGE	BELOW PPM LEVEL
RESPONSE	10-15 MIN. MAX
CALFREQ	8 HR
CALSITE	IN-PLACE
STIMULUS	ELECTRICAL
MAMF	6 MO
MADTM	24 HR
LIFE	5 YR
COST	NONCRITICAL
NOPERYR	MORE THAN 1
SENSITE	IN-LINE (DELIVERY PIPELINE)/REACTOR
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	NEED IN-LINE, RELIAB., ACCUR., CORROS. SERV.
OTHER	DETECTION LIMITS, RESOLUTION, SPECIES IDENT. INADEQUATE
SECTOR	ELECTRONIC CHEMICALS

RECORD NO.	106
NEED	CHEMICAL/IONIC SPECIES IN A PROCESS PLASMA
XTRANEED	CITED
MEDIA	VARIOUS GAS MIXTURES
DRIVER	UNDERSTAND, MODEL & CONTROL PROCESS
SERVICE	CORROSIVE
ENVIRON	LAB, PLANT
NEC	NA
ACCURACY	NA
PRECISION	NA
RANGE	WIDE
RESPONSE	FAST
CALFREQ	NA
CALSITE	IN-PLACE
STIMULUS	ELECTRICAL
MAMF	NONCRITICAL
MADTM	NONCRITICAL
LIFE	NA
COST	NA
NOPERYR	NA
SENSITE	REACTOR/ON-LINE ACCEPTABLE
AVAILABLE	YES/COM'L
MFGR	VARIOUS
FAULTS	NEED IN-SITU MEAS. OF ACTIVE IONIC SPECIES
OTHER	CHARACTERIZE SPECIES IN REACT. ION ETCH/PLASMA-ENHANCED CVD
SECTOR	ELECTRONIC CHEMICALS

Appendix 2. Industrial SECTORs Responding to Survey

00033	ACADEME	00100	FOOD
00034	ACADEME	00101	FOOD
00035	ACADEME	00102	FOOD
00001	CHEMICAL	00038	GLASS
00002	CHEMICAL	00089	GOVERNMENT
00003	CHEMICAL	00090	GOVERNMENT
00006	CHEMICAL	00040	INSTRUM. MFGR.
00007	CHEMICAL	00041	INSTRUM. MFGR.
00008	CHEMICAL	00044	INSTRUM. MFGR.
00009	CHEMICAL	00051	INSTRUM. MFGR.
00042	CHEMICAL	00052	INSTRUM. MFGR.
00043	CHEMICAL	00092	INSTRUM. MFGR.
00053	CHEMICAL	00093	INSTRUM. MFGR.
00054	CHEMICAL	00094	INSTRUM. MFGR.
00055	CHEMICAL	00074	METALS
00060	CHEMICAL	00005	OIL & GAS
00061	CHEMICAL	00010	OIL & GAS
00062	CHEMICAL	00012	OIL & GAS
00063	CHEMICAL	00015	OIL & GAS
00064	CHEMICAL	00016	OIL & GAS
00068	CHEMICAL	00071	OIL & GAS
00079	CHEMICAL	00072	OIL & GAS
00080	CHEMICAL	00073	OIL & GAS
00081	CHEMICAL	00086	OIL & GAS
00082	CHEMICAL	00087	OIL & GAS
00083	CHEMICAL	00088	OIL & GAS
00084	CHEMICAL	00097	OIL & GAS
00076	CHEMICAL/PLASTICS	00098	OIL & GAS
00058	CONSULTANT	00099	OIL & GAS
00059	CONSULTANT	00011	OIL & GAS
00085	CONSUMER PRODUCTS	00069	PAPER
00091	CONSUMER PRODUCTS	00070	PAPER
00004	ELECTRONIC CHEMICALS	00014	PETROCHEMICAL
00049	ELECTRONIC CHEMICALS	00013	PHARMACEUTICAL
00057	ELECTRONIC CHEMICALS	00025	PHARMACEUTICAL
00065	ELECTRONIC CHEMICALS	00026	PHARMACEUTICAL
00066	ELECTRONIC CHEMICALS	00027	PHARMACEUTICAL
00067	ELECTRONIC CHEMICALS	00028	PHARMACEUTICAL
00103	ELECTRONIC CHEMICALS	00029	PHARMACEUTICAL
00104	ELECTRONIC CHEMICALS	00030	PHARMACEUTICAL
00105	ELECTRONIC CHEMICALS	00031	PHARMACEUTICAL
00106	ELECTRONIC CHEMICALS	00032	PHARMACEUTICAL
00020	ENERGY	00095	PHARMACEUTICAL
00021	ENERGY	00096	PHARMACEUTICAL
00022	ENERGY	00046	PLASTICS
00023	ENERGY	00075	PLASTICS
00024	ENERGY	00077	PLASTICS
00037	ENERGY	00078	PLASTICS
00039	ENERGY	00050	STEEL (ACADEME)
00056	ENERGY	00036	TEXTILES
00045	ENERGY (GOVT.)	00019	UNKNOWN
00017	FOOD	00047	UNKNOWN
00018	FOOD	00048	UNKNOWN

00085 % ETHANOL IN BEER
00075 % SOLIDS (0 TO 50%) IN NEUTRAL DENSITY FLUID
00094 ACCURATE FLOW RATES OF PROCESS FLUIDS
00013 AREA & PEAK HEIGHT OF CHROMATOGRAPHIC DATA
00047 CALIBRATING JET ENGINE THERMOCOUPLE
00061 CAUSTIC CONCENTRATION IN CAUSTIC SCRUBBER (CHLORINE)
00079 CHEMICAL COMPOSITION OF FILTHY LIQUID PROCESS STREAMS
00080 CHEMICAL COMPOSITION OF HOT (100-300C) VAPOR PROCESS STREAMS
00106 CHEMICAL/IONIC SPECIES IN A PROCESS PLASMA
00022 CONCENTRATION OF HEAVY METALS (U,Pu) IN LIQUID SOLUTION
00048 CONSTANT TEMPERATURE BATH (100-1200 F.)
00002 DEW POINT IN PRESSURE SYSTEMS
00051 DISSOLVED OXYGEN IN BIOLOG. WASTEWATER WITH BIOFOULING
00059 ELECTRICAL CONDUCTIVITY
00001 FLAMMABLE GAS DETECTORS (HYDROCARBONS IN AIR)
00072 FLARE GAS FLOW RATE (HYDROCARBONS)
00053 FLOW OF MILDLY-ABRASIVE FILLED POLYMER
00019 FLOW RATE (STEAM, AIR, WATER, OTHER LIQUIDS & GASES)
00060 FLOW RATE OF CORROSIVE FLUID (Br) WITH LOW PRESSURE DROP
00054 FLOW RATE OR VOLUMETRIC METHOD FOR LIQUID COMMODITY TRANSFER
00030 FLOW RATE WITH WIDE RANGEABILITY (SOLVENTS & AQUEOUS SOL'NS)
00010 FLUID FLOW RATE (PETROLEUM PRODUCTS)
00011 GAS FLOW RATE
00014 GAS OR LIQUID FLOW RATE
00034 GAS TEMPERATURE (NONINTRUSIVELY)
00035 GAS VELOCITY IN FLAMES
00033 GASEOUS & SOLID SPECIES CONCENTRATIONS IN FLAMES
00073 HIGH ACCURACY LIQUID FLOW RATE (OIL, HYDROCARBON PRODUCTS)
00007 HIGH TEMPERATURE IN HOSTILE ENVIRONMENT (SYNGAS)
00008 HIGH VISCOSITY (ASPHALT) @ 500 F & 1000 PSIG
00004 HgCdTe MELT COMPOSITION IN LIQUID PHASE EPITAXY (LPE)
00065 IMPURITY ANALYSIS IN BULK MATERIALS:10e13-10e14 ATOMS/cc
00101 IN-PROCESS FAT CONTENT IN FOODS
00100 IN-PROCESS MOISTURE CONTENT IN FOODS
00102 IN-PROCESS PROTEIN CONTENT IN FOODS
00026 LEVEL IN GLASS-LINED REACTORS
00055 LEVEL IN GLASS-LINED, AGITATED, JACKETED VESSEL
00027 LEVEL IN GLASS-LINED, JACKETED, AGITATED VESSELS
00078 LEVEL IN POLYETHYLENE REACTOR
00068 LEVEL IN VESSEL UNDER PRESSURE OR VACUUM
00096 LIQUID CHROMATOGRAPHY & ANALYSES (COMPOSITION)
00062 LIQUID LEVEL OF MOLTEN SULFUR
00009 LIQUID-VAPOR STEAM FLOW
00043 LOW CONCENTRATIONS OF ETHYLENE OXIDE
00089 LOW DIFFERENTIAL PRESSURE @ HIGH LINE PRESSURES
00064 LOW FLOW RATES OF HIGH VISCOSITY LIQUIDS
00098 LOW FLOW RATES OF LIQUIDS (0.1 TO 2 CC/MIN.)--HYDROCARBONS
00093 LOW FLOW RATES OF VISCOUS (LOW Re NO.) FLUIDS
00083 LOW LEVEL MOISTURE (<100 PPM) IN HYDROCARBON STREAMS
00042 LOW LEVELS OF WATER & OXYGEN
00015 LOW LIQUID FLOW RATE (NATURAL GAS LIQUIDS)
00086 MASS FLOW OF MIXTURES OF LIGHT HYDROCARBONS
00016 MASS FLOWMETER FOR NATURAL GAS LIQUIDS

Appendix 3. Measurement NEEDs Identified by Survey--Continued

00040 MOISTURE LEVEL IN POWDERS & SOLIDS
00045 MULTIPHASE MULTICOMPONENT MASS FLOW RATE (GASIFIC./COMBUST.)
00041 NONCONTACT TEMPERATURE MEASUREMENT (POLYMERS IN AIR)
00074 NONCONTACT TEMPERATURE OF WIRE DURING DRAWING PROCESS
00003 NONINTRUSIVE FLOW RATE (PROCESS LIQUIDS)
00056 NONINTRUSIVE GAS TEMPERATURE IN COAL GASIFIER
00081 ON-LINE PH
00070 ON-MACHINE LIGNIN CONTENT (PULP DIGESTER)
00069 ON-MACHINE MEASUREMENTS OF PAPER MECHANICAL PROPERTIES
00091 OXYGEN CONTENT OF BEER OR CARBONATED WATER IN PIPELINES
00058 PARTICLE SIZE & DISTRIBUTION (IN ORGANIC SOLVENTS, GASES)
00082 PARTICLE SIZE DISTRIBUTION (IN FLUIDS)
00028 PH IN REACTOR
00031 PH IN REACTOR
00087 PH OF OILY WATER
00049 PLASMA PARAMETERS, COMPOSITION IN PLASMAS
00017 PROTEIN CONTENT IN STARCH SLURRY
00103 QUAL. & QUANT. ID OF CRYSTAL. DEFECTS IN COMPOUND SEMICOND.
00006 QUANTUM IR DETECTOR
00005 RAPID COPPER CORROSION RATE DETECTOR
00071 REMOTE HYDROCARBON SENSING
00044 SKIN TEMP. OF TUBES IN PYROLYSIS FURNACES & PROCESS HEATERS
00012 SLURRY FLOW RATE AT HIGH TEMPERATURES (HEAVY HYDROCARBONS)
00090 SMALL DIFFERENTIAL PRESSURE @ HIGH BASE PRESSURES
00066 SMALL TEMPERATURE DIFFER. @ HIGH TEMPS IN HOSTILE ENVIRON.
00099 SMALL TEMPERATURE DIFFERENCES @ HIGH BASE TEMPERATURES
00018 SOLID FAT INDEX (SFI) OF HYDROGENATED VEGETABLE OILS
00077 SOLIDS FRACTION IN SOLID-GAS FLOWS
00020 STEAM FLOW RATE
00021 STEAM FLOW RATE
00032 STEAM FLOW RATE
00092 STEAM FLOW RATE
00104 SUBMICRON PARTICLE COUNTING & CHARACTERIZ. IN PROCESS FLUIDS
00050 SURFACE TEMPERATURE OF HOT SOLID STEEL BODIES
00046 TEMPERATURE (POLYMER EMULSIONS)
00036 TEMPERATURE (POLYMERS @ 290 C)
00039 TEMPERATURE (WATER & AIR)
00038 TEMPERATURE IN GLASS MFG.
00052 TEMPERATURE MEAS. IN THERMOWELLS
00037 TEMPERATURE TO 2500 C IN SODIUM
00067 THE As:Ga RATIO IN A GaAs CRYSTAL MELT
00084 TRACE ANALYSIS OF ORGANICS (SPECIFIC) IN WATER
00105 TRACE IMPURITIES IN PROCESS GASES & CARRIER GASES
00024 TRACE QUANTITY U & Pu IN PROCESS WASTE STREAMS
00088 TWO-PHASE FLOW OF OIL & GAS MIXTURES (AT WELLHEAD)
00057 ULTRA-TRACE MOISTURE IN PROCESS GASES
00029 VERY LOW FLOW RATE (0.025-0.25 & 0.05-0.50 GPM) OF SOLVENTS
00076 VERY LOW FLOW RATE OF HIGH PRESSURE (1000 PSIG) HYDROGEN
00095 VISCOELASTIC FLUID FLOW RATE OF POLYMER MELT
00063 VISCOUS, NONAQUEOUS, CORROS. LIQ. & SLURRY FLOW (ORGANICS)
00097 VOLUME, FLOW & WATER CONTENT OF CRUDE OIL
00025 WEIGHT OF CONTENTS IN JACKETED, AGITATED PROCESS VESSELS
00023 WIDE-RANGING TEMPERATURE SENSOR (TEMP. TO 3000 C)

Appendix 4. Measurement XTRANEEDs Identified by Survey

00030 ACCURATE MASS FLOW RATE
00091 CO(2) CONTENT OF BEER OR CARBONATED WATER IN PIPELINES
00038 DETECT DEFECTS IN GLASS DURING MFG & FABRICATION
00089 DYNAMIC PRESS. RESPONSE & CAL. CAPABILITIES FOR X-DUCERS
00041 EMISSIVITY OF POLYMERS IN CONTACT WITH AIR
00022 IN-LINE FLUID DENSITY & FLOW RATE IN NUCLEAR ENVIRON.
00012 LIQUID FLOW RATE NEAR BOILING POINT
00043 LOW PPM OF WATER, OXYGEN, FORMALDEHYDE, ETHYLENE GLYCOL
00090 MASS FLOW OF GAS, GAS MIXTURES, & LIQ.-GAS MIXTURES
00094 MULTIPHASE FLOW RATES
00020 NONINTRUSIVE CLEAN LIQUID FLOW RATE
00097 OIL-IN-WATER CONTENT & OIL-GAS-WATER FLOW RATE
00081 ON-LINE CHEMICAL ANALYSIS
00005 ON-LINE CONTROL OF AMINE/GLYCOL REBOILER @ FUEL EFFIC. LEVEL
00086 ORIFICES: VISCOUS FLOW, PIPES<2 IN. DIA. & >18 IN. DIA.
00013 PARTICLE SIZE & SURFACE AREA
00046 PRESS., FLOW, PH, MONOMER COMPOSITION DURING POLYMERIZATION
00056 PROCESS FLOW RATES
00047 RELATED HEATER PROBE CALIBRATION
00039 RESPONSE TIMES OF TEMPERATURE & PRESSURE SENSORS
00059 SURFACE CONDUCTIVITY ON DIELECTRIC SUBSTRATE
00045 TEMPERATURE (GASIFIERS & COMBUSTION PROCESSES)
00037 TEMPERATURE TO 2200 C IN STEAM
00057 TRACE ANALYSIS OF CORROSIVE GAS ENVIRONMENTS
00068 VERIFICATION OF ACCURACY OF RTD'S
00023 WIDE-RANGING FLOW (VERY LOW FLOWS, SLURRIES, ETC.)
00085 YEAST GROWTH (FERMENTATION), SELECTED FLAVOR COMPONENTS

Appendix 5. Major Measurement Problem Areas Identified by Survey

Flow Measurement Needs

00094 ACCURATE FLOW RATES OF PROCESS FLUIDS
00072 FLARE GAS FLOW RATE (HYDROCARBONS)
00053 FLOW OF MILDLY-ABRASIVE FILLED POLYMER
00019 FLOW RATE (STEAM, AIR, WATER, OTHER LIQUIDS & GASES)
00060 FLOW RATE OF CORROSIVE FLUID (Br) WITH LOW PRESSURE DROP
00054 FLOW RATE OR VOLUMETRIC METHOD FOR LIQUID COMMODITY TRANSFER
00030 FLOW RATE WITH WIDE RANGEABILITY (SOLVENTS & AQUEOUS SOL'NS)
00010 FLUID FLOW RATE (PETROLEUM PRODUCTS)
00011 GAS FLOW RATE
00014 GAS OR LIQUID FLOW RATE
00073 HIGH ACCURACY LIQUID FLOW RATE (OIL, HYDROCARBON PRODUCTS)
00009 LIQUID-VAPOR STEAM FLOW
00064 LOW FLOW RATES OF HIGH VISCOSITY LIQUIDS
00098 LOW FLOW RATES OF LIQUIDS (0.1 TO 2 CC/MIN.)--HYDROCARBONS
00093 LOW FLOW RATES OF VISCOUS (LOW Re NO.) FLUIDS
00015 LOW LIQUID FLOW RATE (NATURAL GAS LIQUIDS)
00086 MASS FLOW OF MIXTURES OF LIGHT HYDROCARBONS
00016 MASS FLOWMETER FOR NATURAL GAS LIQUIDS
00045 MULTIPHASE MULTICOMPONENT MASS FLOW RATE (GASIFIC./COMBUST.)
00003 NONINTRUSIVE FLOW RATE (PROCESS LIQUIDS)
00012 SLURRY FLOW RATE AT HIGH TEMPERATURES (HEAVY HYDROCARBONS)
00077 SOLIDS FRACTION IN SOLID-GAS FLOWS
00020 STEAM FLOW RATE
00021 STEAM FLOW RATE
00032 STEAM FLOW RATE
00092 STEAM FLOW RATE
00088 TWO-PHASE FLOW OF OIL & GAS MIXTURES (AT WELLHEAD)
00029 VERY LOW FLOW RATE (0.025-0.25 & 0.05-0.50 GPM) OF SOLVENTS
00076 VERY LOW FLOW RATE OF HIGH PRESSURE (1000 PSIG) HYDROGEN
00095 VISCOELASTIC FLUID FLOW RATE OF POLYMER MELT
00063 VISCOUS, NONAQUEOUS, CORROS. LIQ. & SLURRY FLOW (ORGANICS)
00097 VOLUME, FLOW & WATER CONTENT OF CRUDE OIL

Appendix 5. Major Measurement Problem Areas Identified by Survey --Continued

Composition/Concentration Measurement Needs

00085 % ETHANOL IN BEER
00013 AREA & PEAK HEIGHT OF CHROMATOGRAPHIC DATA
00061 CAUSTIC CONCENTRATION IN CAUSTIC SCRUBBER (CHLORINE)
00079 CHEMICAL COMPOSITION OF FILTHY LIQUID PROCESS STREAMS
00080 CHEMICAL COMPOSITION OF HOT (100-300C) VAPOR PROCESS STREAMS
00106 CHEMICAL/IONIC SPECIES IN A PROCESS PLASMA
00022 CONCENTRATION OF HEAVY METALS (U,Pu) IN LIQUID SOLUTION
00001 FLAMMABLE GAS DETECTORS (HYDROCARBONS IN AIR)
00033 GASEOUS & SOLID SPECIES CONCENTRATIONS IN FLAMES
00004 HgCdTe MELT COMPOSITION IN LIQUID PHASE EPITAXY (LPE)
00065 IMPURITY ANALYSIS IN BULK MATERIALS:10e13-10e14 ATOMS/cc
00101 IN-PROCESS FAT CONTENT IN FOODS
00100 IN-PROCESS MOISTURE CONTENT IN FOODS
00102 IN-PROCESS PROTEIN CONTENT IN FOODS
00096 LIQUID CHROMATOGRAPHY & ANALYSES (COMPOSITION)
00043 LOW CONCENTRATIONS OF ETHYLENE OXIDE
00040 MOISTURE LEVEL IN POWDERS & SOLIDS
00070 ON-MACHINE LIGNIN CONTENT (PULP DIGESTER)
00049 PLASMA PARAMETERS, COMPOSITION IN PLASMAS
00017 PROTEIN CONTENT IN STARCH SLURRY
00071 REMOTE HYDROCARBON SENSING
00018 SOLID FAT INDEX (SFI) OF HYDROGENATED VEGETABLE OILS
00067 THE As:Ga RATIO IN A GaAs CRYSTAL MELT
00084 TRACE ANALYSIS OF ORGANICS (SPECIFIC) IN WATER
00105 TRACE IMPURITIES IN PROCESS GASES & CARRIER GASES
00024 TRACE QUANTITY U & Pu IN PROCESS WASTE STREAMS
00097 VOLUME, FLOW & WATER CONTENT OF CRUDE OIL

Temperature Measurement Needs

00048 CONSTANT TEMPERATURE BATH (100-1200 F.)
00034 GAS TEMPERATURE (NONINTRUSIVELY)
00007 HIGH TEMPERATURE IN HOSTILE ENVIRONMENT (SYNGAS)
00041 NONCONTACT TEMPERATURE MEASUREMENT (POLYMERS IN AIR)
00074 NONCONTACT TEMPERATURE OF WIRE DURING DRAWING PROCESS
00056 NONINTRUSIVE GAS TEMPERATURE IN COAL GASIFIER
00066 SMALL TEMPERATURE DIFFER. @ HIGH TEMPS IN HOSTILE ENVIRON.
00099 SMALL TEMPERATURE DIFFERENCES @ HIGH BASE TEMPERATURES
00050 SURFACE TEMPERATURE OF HOT SOLID STEEL BODIES
00046 TEMPERATURE (POLYMER EMULSIONS)
00036 TEMPERATURE (POLYMERS @ 290 C)
00039 TEMPERATURE (WATER & AIR)
00038 TEMPERATURE IN GLASS MFG.
00052 TEMPERATURE MEAS. IN THERMOWELLS
00037 TEMPERATURE TO 2500 C IN SODIUM
00023 WIDE-RANGING TEMPERATURE SENSOR (TEMP. TO 3000 C)

Appendix 6. The DRIVER (Incentive) for Improvement of Measurement Capability

00090	ACCUR. IN GAS FLOW USING HEAD METERS
00086	COM'L XCHANGE, COST, 0-40,000 BPD LIQ'S
00098	COMPUTER CONTROL OF LIQUID FEED RATES
00014	COST
00032	COST
00043	COST
00050	COST
00051	COST
00054	COST
00074	COST
00075	COST
00097	COST
00092	COST, ALLOCATION OF COSTS TO USE AREAS
00073	COST, CUSTODY TRANSFER
00072	COST, ENVIRONMENTAL CONTROL
00002	COST, QUALITY
00003	COST, QUALITY
00005	COST, QUALITY
00006	COST, QUALITY
00008	COST, QUALITY
00016	COST, QUALITY
00017	COST, QUALITY
00018	COST, QUALITY
00021	COST, QUALITY
00038	COST, QUALITY
00040	COST, QUALITY
00101	COST, QUALITY
00102	COST, QUALITY
00094	COST, QUALITY, MATERIAL ACCOUNTABILITY
00077	COST, QUALITY, PRODUCTION EFFICIENCY
00023	COST, QUALITY: (CLOSER PROCESS CONTROL)
00100	COST, QUALITY
00028	COST, REDUCED MAINTENANCE
00025	COST, RELIABILITY
00061	COST, SAFETY
00066	DEVELOPMENT OF HIGH QUALITY MATERIALS
00009	ENERGY ACCOUNTING
00071	ENVIRON. CONTROL, STOCK LOSS MONITORING
00011	EQUITY IN COMMERCIAL EXCHANGE
00099	HEATER CONTROL: ADIABATIC REACTOR TESTS
00029	NEED UL/FM APPROVED METER
00044	OPTIMIZE THROUGHPUT VS. MAINTEN. COSTS
00055	PROCESS CONTROL
00084	PROCESS CONTROL
00088	PROCESS CONTROL
00087	PROCESS CONTROL, POLLUTION CONTROL
00019	PROCESS MATERIAL BALANCE
00024	PUBLIC SAFETY, PRODUCT RECOVERY
00039	QUAL., PLANT SAFETY, TECH. SPECS.
00010	QUALITY
00012	QUALITY
00013	QUALITY
00015	QUALITY
00022	QUALITY
00030	QUALITY
00036	QUALITY
00042	QUALITY
00048	QUALITY
00049	QUALITY
00052	QUALITY
00057	QUALITY
00058	QUALITY
00059	QUALITY
00060	QUALITY
00062	QUALITY
00063	QUALITY
00064	QUALITY
00065	QUALITY
00067	QUALITY
00076	QUALITY
00078	QUALITY
00080	QUALITY
00081	QUALITY
00085	QUALITY
00089	QUALITY
00091	QUALITY

Appendix 6. The DRIVER (Incentive) for Improvement of Measurement Capability--Continued

00082 QUALITY CONTROL
00083 QUALITY CONTROL
00104 QUALITY CONTROL IN VLSI DEVICE FABRIC.
00103 QUALITY OF HgCdTe & OTHER IR SEMICOND.
00020 QUALITY, ACCURACY WITH RANGEABILITY
00031 QUALITY, EASE OF MAINTENANCE
00105 QUALITY, HIGH PURITY GASES FOR VLSI FAB
00079 QUALITY, ISOLATION OF DESIRED COMPONENT
00093 QUALITY, METERS
00053 QUALITY, PROCESS CONTROL
00069 QUALITY, PROCESS CONTROL
00095 QUALITY, PROCESS CONTROL
00096 QUALITY, PROCESS CONTROL
00046 QUALITY, PROCESS CONTROL, SAFETY
00007 QUALITY, RELIABILITY
00026 QUALITY, RELIABILITY
00037 QUALITY, RELIABILITY
00056 QUALITY, RELIABILITY, SENSOR LIFE
00068 QUALITY, SAFETY
00070 QUALITY, UNIFORMITY
00027 RELIABILITY
00004 REPRODUCIBLE LPE FILMS FROM MELT
00033 RESEARCH INTEREST
00034 RESEARCH INTEREST
00035 RESEARCH INTEREST
00001 SAFETY
00041 TEMP. MEAS. ERROR DUE TO EMISSIVITY
00045 UNDERSTAND PHENOM., PROCESS CONTROL
00106 UNDERSTAND, MODEL & CONTROL PROCESS

Appendix 7. The ENVIRONment in which the Measurement is Made

00047	FIELD CAL. OF JET ENGINE THERMOCOUPLE
00004	IN REACTOR @ 500 C
00013	LAB
00065	LAB
00066	LAB
00067	LAB
00098	LAB
00099	LAB
00103	LAB
00090	LAB, FIELD SITES, PIPELINES
00048	LAB, ON-BOARD SHIP LAB
00021	LAB, PLANT
00045	LAB, PLANT
00049	LAB, PLANT
00057	LAB, PLANT
00089	LAB, PLANT
00091	LAB, PLANT
00094	LAB, PLANT
00104	LAB, PLANT
00106	LAB, PLANT
00023	LAB, PLANT, NUCLEAR RADIATION
00105	LAB, PLANT, PIPELINES
00001	PLANT
00002	PLANT
00003	PLANT
00005	PLANT
00006	PLANT
00007	PLANT
00008	PLANT
00009	PLANT
00010	PLANT
00014	PLANT
00015	PLANT
00016	PLANT
00017	PLANT
00018	PLANT
00019	PLANT
00020	PLANT
00025	PLANT
00026	PLANT
00027	PLANT
00028	PLANT
00029	PLANT
00030	PLANT
00031	PLANT
00032	PLANT
00036	PLANT
00038	PLANT
00039	PLANT
00040	PLANT
00041	PLANT
00042	PLANT

Appendix 7. The ENVIRONment in which the Measurement is Made --Continued

00043	PLANT
00046	PLANT
00050	PLANT
00052	PLANT
00053	PLANT
00054	PLANT
00055	PLANT
00056	PLANT
00060	PLANT
00064	PLANT
00068	PLANT
00069	PLANT
00070	PLANT
00072	PLANT
00074	PLANT
00077	PLANT
00079	PLANT
00080	PLANT
00081	PLANT
00082	PLANT
00083	PLANT
00084	PLANT
00085	PLANT
00093	PLANT
00095	PLANT
00096	PLANT
00097	PLANT
00100	PLANT
00101	PLANT
00102	PLANT
00011	PLANT & REMOTE STATIONS
00012	PLANT & TEMP. OF 500-900 F
00086	PLANT, FIELD & LEASE STA., LAB
00092	PLANT, HOSTILE (HOT)
00044	PLANT, HOT ENVIRONMENT
00071	PLANT, LOADING DOCK, PIPELINE MONITORING
00024	PLANT, NUCLEAR RADIATION (10e5 RAD/HR)
00022	PLANT, NUCLEAR RADIATION (>10e6 RAD/HR)
00073	PLANT, SHIP, PIPE & COM'L XCHANGE STA.
00051	WASTEWATER TREATMENT PLANT

Appendix 8. The Desired Sensor Location--SENSITE

00002 IN-LINE
00003 IN-LINE
00006 IN-LINE
00008 IN-LINE
00009 IN-LINE
00010 IN-LINE
00011 IN-LINE
00012 IN-LINE
00014 IN-LINE
00015 IN-LINE
00016 IN-LINE
00017 IN-LINE
00019 IN-LINE
00020 IN-LINE
00021 IN-LINE
00022 IN-LINE
00024 IN-LINE
00029 IN-LINE
00030 IN-LINE
00036 IN-LINE
00038 IN-LINE
00042 IN-LINE
00045 IN-LINE
00050 IN-LINE
00053 IN-LINE
00057 IN-LINE
00060 IN-LINE
00061 IN-LINE
00063 IN-LINE
00069 IN-LINE
00072 IN-LINE
00073 IN-LINE
00075 IN-LINE
00076 IN-LINE
00077 IN-LINE
00082 IN-LINE
00083 IN-LINE
00084 IN-LINE
00085 IN-LINE
00088 IN-LINE
00089 IN-LINE
00090 IN-LINE
00091 IN-LINE
00092 IN-LINE
00095 IN-LINE
00097 IN-LINE
00098 IN-LINE
00032 IN-LINE (CRITICAL PLACEMENT)
00105 IN-LINE (DELIVERY PIPELINE)/REACTOR
00104 IN-LINE (PARTICLE CONTAMINATION SENSING)
00005 IN-LINE, ON-LINE
00023 IN-LINE, REACTOR, ON-LINE, LAB TEST
00103 IN-LINE/LAB TEST

Appendix 8. The Desired Sensor Location--SENSITE
--Continued

00087	IN-LINE/ON-LINE
00043	IN-LINE/ON-LINE
00093	IN-LINE/ON-LINE
00094	IN-LINE/ON-LINE
00096	IN-LINE/ON-LINE
00001	IN-LINE/ON-LINE SAMPLING, ESPECIALLY IN VENT LINES
00086	IN-LINE/ON-LINE/REACTOR/LAB TEST
00034	IN-LINE/REACTOR
00035	IN-LINE/REACTOR
00041	IN-LINE/REACTOR
00054	IN-LINE/REACTOR
00068	IN-LINE/REACTOR
00070	IN-LINE/REACTOR
00081	IN-LINE/REACTOR
00100	IN-LINE/REACTOR
00101	IN-LINE/REACTOR
00102	IN-LINE/REACTOR
00051	IN-LINE/REACTOR, USUALLY OPEN BASINS
00033	IN-LINE/REACTOR/LAB SAMPLE & ANALYSIS
00040	IN-LINE/REACTOR/ON-LINE
00052	IN-LINE/REACTOR/ON-LINE
00079	IN-LINE/REACTOR/ON-LINE
00080	IN-LINE/REACTOR/ON-LINE
00046	IN-LINE/REACTOR/ON-LINE/LAB TEST
00049	IN-LINE/REACTOR/ON-LINE/LAB TEST
00064	IN-SITE
00065	LAB TEST
00058	ON-LINE/LAB TEST
00004	REACTOR
00007	REACTOR
00025	REACTOR
00026	REACTOR
00027	REACTOR
00028	REACTOR
00031	REACTOR
00037	REACTOR
00039	REACTOR
00055	REACTOR
00056	REACTOR
00062	REACTOR
00066	REACTOR
00067	REACTOR
00078	REACTOR
00106	REACTOR/ON-LINE ACCEPTABLE
00018	REACTOR/ON-LINE SAMPLING
00071	REMOTE SENSING

Appendix 9. Is the Desired Instrument (Sensor) AVAILABLE?

00004	NO
00009	NO
00019	NO
00024	NO
00030	NO
00040	NO
00045	NO
00048	NO
00050	NO
00054	NO
00055	NO
00056	NO
00061	NO
00063	NO
00066	NO
00067	NO
00070	NO
00075	NO
00078	NO
00088	NO
00091	NO
00096	NO
00093	NO & STD. METERS DO NOT WORK
00103	NO MEAS. TECHNIQUE EXISTS
00033	NO. LAB TECHNIQUES ONLY
00104	NO/COM'L UNITS UNDER DEVELOP.
00079	NO/IN-HOUSE DEVELOPMENT
00047	YES
00094	YES. SOME APPLICATIONS
00001	YES/COM'L
00002	YES/COM'L
00005	YES/COM'L
00006	YES/COM'L
00008	YES/COM'L
00010	YES/COM'L
00011	YES/COM'L
00012	YES/COM'L
00014	YES/COM'L
00015	YES/COM'L
00016	YES/COM'L
00017	YES/COM'L
00018	YES/COM'L
00020	YES/COM'L
00021	YES/COM'L
00023	YES/COM'L
00025	YES/COM'L
00026	YES/COM'L
00027	YES/COM'L
00028	YES/COM'L
00029	YES/COM'L
00031	YES/COM'L
00032	YES/COM'L
00036	YES/COM'L
00039	YES/COM'L
00041	YES/COM'L
00042	YES/COM'L
00043	YES/COM'L
00051	YES/COM'L
00053	YES/COM'L
00057	YES/COM'L
00060	YES/COM'L
00062	YES/COM'L
00064	YES/COM'L
00065	YES/COM'L
00068	YES/COM'L
00071	YES/COM'L
00072	YES/COM'L
00073	YES/COM'L
00074	YES/COM'L
00077	YES/COM'L
00081	YES/COM'L
00082	YES/COM'L
00083	YES/COM'L
00084	YES/COM'L
00087	YES/COM'L
00089	YES/COM'L
00090	YES/COM'L
00092	YES/COM'L
00095	YES/COM'L
00097	YES/COM'L
00101	YES/COM'L
00102	YES/COM'L
00105	YES/COM'L
00106	YES/COM'L
00003	YES/COM'L (ULTRASONIC)
00099	YES/COM'L, THERMOCOUPLES
00007	YES/COM'L/IN-HOUSE
00046	YES/COM'L/IN-HOUSE
00049	YES/COM'L/IN-HOUSE
00080	YES/COM'L/IN-HOUSE
00086	YES/COM'L/IN-HOUSE
00013	YES/IN-HOUSE
00022	YES/IN-HOUSE
00052	YES/IN-HOUSE
00069	YES/IN-HOUSE
00098	YES/IN-HOUSE
00037	YES/IN-HOUSE DEVELOPMENT
00085	YES/UNDER COM'L DEVELOPMENT

Appendix 10. Measurement NEEDs Where the Desired Sensor or Measurement Method is not Currently AVAILABLE

00075 % SOLIDS (0 TO 50%) IN NEUTRAL DENSITY FLUID
00061 CAUSTIC CONCENTRATION IN CAUSTIC SCRUBBER (CHLORINE)
00079 CHEMICAL COMPOSITION OF FILTHY LIQUID PROCESS STREAMS
00048 CONSTANT TEMPERATURE BATH (100-1200 F.)
00019 FLOW RATE (STEAM, AIR, WATER, OTHER LIQUIDS & GASES)
00054 FLOW RATE OR VOLUMETRIC METHOD FOR LIQUID COMMODITY TRANSFER
00030 FLOW RATE WITH WIDE RANGEABILITY (SOLVENTS & AQUEOUS SOL'NS)
00033 GASEOUS & SOLID SPECIES CONCENTRATIONS IN FLAMES
00004 HgCdTe MELT COMPOSITION IN LIQUID PHASE EPITAXY (LPE)
00055 LEVEL IN GLASS-LINED, AGITATED, JACKETED VESSEL
00078 LEVEL IN POLYETHYLENE REACTOR
00096 LIQUID CHROMATOGRAPHY & ANALYSES (COMPOSITION)
00009 LIQUID-VAPOR STEAM FLOW
00093 LOW FLOW RATES OF VISCOUS (LOW Re NO.) FLUIDS
00040 MOISTURE LEVEL IN POWDERS & SOLIDS
00045 MULTIPHASE MULTICOMPONENT MASS FLOW RATE (GASIFIC./COMBUST.)
00056 NONINTRUSIVE GAS TEMPERATURE IN COAL GASIFIER
00070 ON-MACHINE LIGNIN CONTENT (PULP DIGESTER)
00091 OXYGEN CONTENT OF BEER OR CARBONATED WATER IN PIPELINES
00103 QUAL. & QUANT. ID OF CRYSTAL. DEFECTS IN COMPOUND SEMICOND.
00066 SMALL TEMPERATURE DIFFER. @ HIGH TEMPS IN HOSTILE ENVIRON.
00104 SUBMICRON PARTICLE COUNTING & CHARACTERIZ. IN PROCESS FLUIDS
00050 SURFACE TEMPERATURE OF HOT SOLID STEEL BODIES
00067 THE As:Ga RATIO IN A GaAs CRYSTAL MELT
00024 TRACE QUANTITY U & Pu IN PROCESS WASTE STREAMS
00088 TWO-PHASE FLOW OF OIL & GAS MIXTURES (AT WELLHEAD)
00063 VISCOUS, NONAQUEOUS, CORROS. LIQ. & SLURRY FLOW (ORGANICS)

Appendix 11. Measurement NEEDs by SECTOR

Chemical

00061 CAUSTIC CONCENTRATION IN CAUSTIC SCRUBBER (CHLORINE)
00079 CHEMICAL COMPOSITION OF FILTHY LIQUID PROCESS STREAMS
00080 CHEMICAL COMPOSITION OF HOT (100-300C) VAPOR PROCESS STREAMS
00002 DEW POINT IN PRESSURE SYSTEMS
00001 FLAMMABLE GAS DETECTORS (HYDROCARBONS IN AIR)
00053 FLOW OF MILDLY-ABRASIVE FILLED POLYMER
00060 FLOW RATE OF CORROSIVE FLUID (Br) WITH LOW PRESSURE DROP
00054 FLOW RATE OR VOLUMETRIC METHOD FOR LIQUID COMMODITY TRANSFER
00014 GAS OR LIQUID FLOW RATE
00007 HIGH TEMPERATURE IN HOSTILE ENVIRONMENT (SYNGAS)
00008 HIGH VISCOSITY (ASPHALT) @ 500 F & 1000 PSIG
00055 LEVEL IN GLASS-LINED, AGITATED, JACKETED VESSEL
00068 LEVEL IN VESSEL UNDER PRESSURE OR VACUUM
00062 LIQUID LEVEL OF MOLTEN SULFUR
00009 LIQUID-VAPOR STEAM FLOW
00043 LOW CONCENTRATIONS OF ETHYLENE OXIDE
00064 LOW FLOW RATES OF HIGH VISCOSITY LIQUIDS
00083 LOW LEVEL MOISTURE (<100 PPM) IN HYDROCARBON STREAMS
00042 LOW LEVELS OF WATER & OXYGEN
00003 NONINTRUSIVE FLOW RATE (PROCESS LIQUIDS)
00081 ON-LINE PH
00082 PARTICLE SIZE DISTRIBUTION (IN FLUIDS)
00006 QUANTUM IR DETECTOR
00084 TRACE ANALYSIS OF ORGANICS (SPECIFIC) IN WATER
00076 VERY LOW FLOW RATE OF HIGH PRESSURE (1000 PSIG) HYDROGEN
00063 VISCOUS, NONAQUEOUS, CORROS. LIQ. & SLURRY FLOW (ORGANICS)

Oil & Gas

00072 FLARE GAS FLOW RATE (HYDROCARBONS)
00010 FLUID FLOW RATE (PETROLEUM PRODUCTS)
00011 GAS FLOW RATE
00073 HIGH ACCURACY LIQUID FLOW RATE (OIL, HYDROCARBON PRODUCTS)
00098 LOW FLOW RATES OF LIQUIDS (0.1 TO 2 CC/MIN.)--HYDROCARBONS
00015 LOW LIQUID FLOW RATE (NATURAL GAS LIQUIDS)
00086 MASS FLOW OF MIXTURES OF LIGHT HYDROCARBONS
00016 MASS FLOWMETER FOR NATURAL GAS LIQUIDS
00087 PH OF OILY WATER
00005 RAPID COPPER CORROSION RATE DETECTOR
00071 REMOTE HYDROCARBON SENSING
00012 SLURRY FLOW RATE AT HIGH TEMPERATURES (HEAVY HYDROCARBONS)
00099 SMALL TEMPERATURE DIFFERENCES @ HIGH BASE TEMPERATURES
00088 TWO-PHASE FLOW OF OIL & GAS MIXTURES (AT WELLHEAD)
00097 VOLUME, FLOW & WATER CONTENT OF CRUDE OIL

Appendix 11. Measurement NEEDs by SECTOR--Continued

Pharmaceutical

00013 AREA & PEAK HEIGHT OF CHROMATOGRAPHIC DATA
00030 FLOW RATE WITH WIDE RANGEABILITY (SOLVENTS & AQUEOUS SOL'NS)
00026 LEVEL IN GLASS-LINED REACTORS
00027 LEVEL IN GLASS-LINED, JACKETED, AGITATED VESSELS
00096 LIQUID CHROMATOGRAPHY & ANALYSES (COMPOSITION)
00028 PH IN REACTOR
00031 PH IN REACTOR
00032 STEAM FLOW RATE
00029 VERY LOW FLOW RATE (0.025-0.25 & 0.05-0.50 GPM) OF SOLVENTS
00095 VISCOELASTIC FLUID FLOW RATE OF POLYMER MELT
00025 WEIGHT OF CONTENTS IN JACKETED, AGITATED PROCESS VESSELS

Electronic Chemicals

00106 CHEMICAL/IONIC SPECIES IN A PROCESS PLASMA
00004 HgCdTe MELT COMPOSITION IN LIQUID PHASE EPITAXY (LPE)
00065 IMPURITY ANALYSIS IN BULK MATERIALS:10e13-10e14 ATOMS/cc
00049 PLASMA PARAMETERS, COMPOSITION IN PLASMAS
00103 QUAL. & QUANT. ID OF CRYSTAL. DEFECTS IN COMPOUND SEMICOND.
00066 SMALL TEMPERATURE DIFFER. @ HIGH TEMPS IN HOSTILE ENVIRON.
00104 SUBMICRON PARTICLE COUNTING & CHARACTERIZ. IN PROCESS FLUIDS
00067 THE As:Ga RATIO IN A GaAs CRYSTAL MELT
00105 TRACE IMPURITIES IN PROCESS GASES & CARRIER GASES
00057 ULTRA-TRACE MOISTURE IN PROCESS GASES

Energy

00022 CONCENTRATION OF HEAVY METALS (U,Pu) IN LIQUID SOLUTION
00045 MULTIPHASE MULTICOMPONENT MASS FLOW RATE (GASIFIC./COMBUST.)
00056 NONINTRUSIVE GAS TEMPERATURE IN COAL GASIFIER
00020 STEAM FLOW RATE
00021 STEAM FLOW RATE
00039 TEMPERATURE (WATER & AIR)
00037 TEMPERATURE TO 2500 C IN SODIUM
00024 TRACE QUANTITY U & Pu IN PROCESS WASTE STREAMS
00023 WIDE-RANGING TEMPERATURE SENSOR (TEMP. TO 3000 C)

Instrument Manufacturer

00094 ACCURATE FLOW RATES OF PROCESS FLUIDS
00051 DISSOLVED OXYGEN IN BIOLOG. WASTEWATER WITH BIOFOULING
00093 LOW FLOW RATES OF VISCOUS (LOW Re NO.) FLUIDS
00040 MOISTURE LEVEL IN POWDERS & SOLIDS
00041 NONCONTACT TEMPERATURE MEASUREMENT (POLYMERS IN AIR)
00044 SKIN TEMP. OF TUBES IN PYROLYSIS FURNACES & PROCESS HEATERS
00092 STEAM FLOW RATE
00052 TEMPERATURE MEAS. IN THERMOWELLS

Appendix 11. Measurement NEEDs by SECTOR--Continued

Food

00101 IN-PROCESS FAT CONTENT IN FOODS
00100 IN-PROCESS MOISTURE CONTENT IN FOODS
00102 IN-PROCESS PROTEIN CONTENT IN FOODS
00017 PROTEIN CONTENT IN STARCH SLURRY
00018 SOLID FAT INDEX (SFI) OF HYDROGENATED VEGETABLE OILS

Plastics

00075 % SOLIDS (0 TO 50%) IN NEUTRAL DENSITY FLUID
00078 LEVEL IN POLYETHYLENE REACTOR
00077 SOLIDS FRACTION IN SOLID-GAS FLOWS
00046 TEMPERATURE (POLYMER EMULSIONS)
00076 VERY LOW FLOW RATE OF HIGH PRESSURE (1000 PSIG) HYDROGEN

Academe

00034 GAS TEMPERATURE (NONINTRUSIVELY)
00035 GAS VELOCITY IN FLAMES
00033 GASEOUS & SOLID SPECIES CONCENTRATIONS IN FLAMES
00050 SURFACE TEMPERATURE OF HOT SOLID STEEL BODIES

Consultant

00059 ELECTRICAL CONDUCTIVITY
00058 PARTICLE SIZE & DISTRIBUTION (IN ORGANIC SOLVENTS, GASES)

Consumer Products

00085 % ETHANOL IN BEER
00091 OXYGEN CONTENT OF BEER OR CARBONATED WATER IN PIPELINES

Glass

00038 TEMPERATURE IN GLASS MFG.

Government

00089 LOW DIFFERENTIAL PRESSURE @ HIGH LINE PRESSURES
00090 SMALL DIFFERENTIAL PRESSURE @ HIGH BASE PRESSURES

Metals

00074 NONCONTACT TEMPERATURE OF WIRE DURING DRAWING PROCESS

Paper

00070 ON-MACHINE LIGNIN CONTENT (PULP DIGESTER)
00069 ON-MACHINE MEASUREMENTS OF PAPER MECHANICAL PROPERTIES

Appendix 11. Measurement NEEDs by SECTOR--Continued

Petrochemical

00014 GAS OR LIQUID FLOW RATE

Steel

00050 SURFACE TEMPERATURE OF HOT SOLID STEEL BODIES

Textiles

00036 TEMPERATURE (POLYMERS @ 290 C)

Appendix 12. Measurement NEEDs (by SECTOR) Where the Desired Sensor or Measurement Method is not Currently AVAILABLE

Chemical

00061 CAUSTIC CONCENTRATION IN CAUSTIC SCRUBBER (CHLORINE)
00079 CHEMICAL COMPOSITION OF FILTHY LIQUID PROCESS STREAMS
00054 FLOW RATE OR VOLUMETRIC METHOD FOR LIQUID COMMODITY TRANSFER
00055 LEVEL IN GLASS-LINED, AGITATED, JACKETED VESSEL
00009 LIQUID-VAPOR STEAM FLOW
00063 VISCOUS, NONAQUEOUS, CORROS. LIQ. & SLURRY FLOW (ORGANICS)

Oil & Gas

00088 TWO-PHASE FLOW OF OIL & GAS MIXTURES (AT WELLHEAD)

Pharmaceutical

00030 FLOW RATE WITH WIDE RANGEABILITY (SOLVENTS & AQUEOUS SOL'NS)
00096 LIQUID CHROMATOGRAPHY & ANALYSES (COMPOSITION)

Electronic Chemicals

00004 HgCdTe MELT COMPOSITION IN LIQUID PHASE EPITAXY (LPE)
00103 QUAL. & QUANT. ID OF CRYSTAL. DEFECTS IN COMPOUND SEMICOND.
00066 SMALL TEMPERATURE DIFFER. @ HIGH TEMPS IN HOSTILE ENVIRON.
00104 SUBMICRON PARTICLE COUNTING & CHARACTERIZ. IN PROCESS FLUIDS
00067 THE As:Ga RATIO IN A GaAs CRYSTAL MELT

Energy

00045 MULTIPHASE MULTICOMPONENT MASS FLOW RATE (GASIFIC./COMBUST.)
00056 NONINTRUSIVE GAS TEMPERATURE IN COAL GASIFIER
00024 TRACE QUANTITY U & Pu IN PROCESS WASTE STREAMS

Instrument Manufacturer

00093 LOW FLOW RATES OF VISCOUS (LOW Re NO.) FLUIDS
00040 MOISTURE LEVEL IN POWDERS & SOLIDS

Food

Plastic

00075 % SOLIDS (0 TO 50%) IN NEUTRAL DENSITY FLUID
00078 LEVEL IN POLYETHYLENE REACTOR

Academe

00033 GASEOUS & SOLID SPECIES CONCENTRATIONS IN FLAMES
00050 SURFACE TEMPERATURE OF HOT SOLID STEEL BODIES

Consultant

Appendix 12. Measurement NEEDs (by SECTOR) Where the Desired Sensor or Measurement Method is not Currently AVAILABLE--Continued

Consumer Products

00091 OXYGEN CONTENT OF BEER OR CARBONATED WATER IN PIPELINES

Glass

Government

Metals

Paper

00070 ON-MACHINE LIGNIN CONTENT (PULP DIGESTER)

Petrochemical

Steel

00050 SURFACE TEMPERATURE OF HOT SOLID STEEL BODIES

Textiles

Appendix 13. Process Fluid (MEDIA) Where Measurement is Made

00032	150 PSIG PLANT STEAM & CONDEN. SLUG FLOW
00061	50% NaOH (START) & 0% (END)
00100	A VARIETY OF SOLID FOODSTUFFS
00101	A VARIETY OF SOLID FOODSTUFFS
00102	A VARIETY OF SOLID FOODSTUFFS
00002	AIR
00038	AIR IN GLASS OVENS
00099	AIR INSIDE OF FURNACE
00091	BEER, CARBONATED WATER
00051	BIOLOGICALLY-TREATED WASTEWATER
00096	CHLORINATED AROMATIC HYDROCARBONS
00029	CLEAN PROCESS SOLVENTS
00033	COMBUSTION PRODUCTS
00034	COMBUSTION PRODUCTS
00035	COMBUSTION PRODUCTS
00017	CORN STARCH
00097	CRUDE OIL
00073	CRUDE OIL, LIQUID HYDROCARBON PRODUCTS
00014	ETHYLENE GAS, PROPYLENE GAS
00042	ETHYLENE, HYDROGEN, NITROGEN, HEXENE
00043	ETHYLENE, NITROGEN, ETHANE
00045	FEEDS/PRODUCTS OF GAS./COMBUST.PROCESS.
00088	FLUID EXITING WELLHEAD IN OIL PRODUCTION
00048	FLUIDIZED ALUMINUM OXIDE
00086	GAS, LPG, LPG MIX, CO(2)
00067	GaAs MELT (1250C & 2 ATM. N(2) GAS)
00065	GaAs, GaP, InP, GaAlAs, GaAsP, ETC.
00012	HEAVY HYDROCARBONS (TARS, STILL BOTTOMS)
00089	HIGH PRESSURE GASES TO 1000 PSIG
00057	HIGH PURITY GASES
00095	HIGH VISCOSITY POLYMER MELT
00059	HUMID AIR, SALT FOG
00072	HYDROCARBON GASES
00071	HYDROCARBON LEAKS IN AIR
00083	HYDROCARBON STREAMS
00098	HYDROCARBONS
00001	HYDROCARBONS IN AIR
00076	HYDROGEN GAS @ 1000 PSIG
00018	HYDROGENATED VEGETABLE OILS
00103	Hg(1-x)Cd(x)Te EPITAXIAL OR BULK MAT'L
00004	HgCdTe MELT UNDER 1 ATM. HYDROGEN
00105	INDUSTRIAL PIPELINE & CYLINDER GASES
00093	INDUSTRIAL VISCOUS FLUIDS
00005	LIGHT PARAFFIN HYDROCARBONS
00060	LIQUID BROMINE
00068	LIQUID BROMINE
00066	LIQUID GaAs, GaP, B(2)O(3)
00037	LIQUID SODIUM
00062	LIQUID SULFUR
00054	LIQUIDS (INERTS, FLAMMABLES, CORROSIVES)
00074	METAL WIRE EXITING A WIRE-DRAWING DIE
00055	MINERAL ACID, ORGANIC & ALICYCLIC HC MIX
00078	MOLTEN POLYETHYLENE @ 300 C

Appendix 13. Process Fluid (MEDIA) Where Measurement is Made --Continued

00006	MULTICOMPONENT POLYMER SOLUTIONS
00013	NA (VOLTAGE VS. TIME MEASUREMENT)
00011	NATURAL GAS
00090	NATURAL GAS @ 600-1000 PSIG
00015	NATURAL GAS LIQUIDS
00016	NATURAL GAS LIQUIDS
00022	NITRIC ACID
00024	NITRIC ACID SOLUTION
00053	NONCONDUCTIVE OPAQUE COMPOUND
00064	ORGANIC LIQUID (SP.GR. 0.86, 800cP@160F)
00058	ORGANIC SOLVENTS, GASES
00069	PAPER
00010	PETROLEUM PRODUCTS
00077	POLYETHYLENE PELLETS/POWDER IN AIR
00046	POLYMER EMULSIONS
00036	POLYMERS @ 290 C
00041	POLYMERS UNDER AIR
00003	PROCESS LIQUIDS
00025	PROCESS MIXTURES
00007	REACTOR SYNGAS
00008	RESIDUAL OIL (HEAVY ASPHALT)
00020	SATURATED & UNSATURATED STEAM
00040	SOLIDS & POWDERS
00026	SOLVENTS & VARIOUS PRODUCT SOLUTIONS
00030	SOLVENTS & WATER-BASED SOLUTIONS
00027	SOLVENTS OR SLURRIES
00009	STEAM
00092	STEAM
00021	STEAM @ 3200 PSIG & 100-1000 C
00019	STEAM, AIR, WATER, OTHER LIQUIDS & GASES
00050	STEEL IN AIR
00056	SYNGAS (FLYING PARTICLES & MOLTEN SLAG)
00031	VARIOUS
00052	VARIOUS
00106	VARIOUS GAS MIXTURES
00023	VARIOUS GASES, LIQUIDS, SLURRIES
00094	VARIOUS PROCESS FLUIDS
00080	VARIOUS VAPORS IN AIR
00063	WASTE ORGANIC STREAM TO INCINERATOR
00085	WATER
00039	WATER & AIR
00081	WATER & TOLUENE
00087	WATER WITH SOME ENTRAINED OIL
00070	WOOD PULP, COOKING LIQUORS

Appendix 14. SERVICE Conditions for Desired Measurement (Sensor)

00001	CORROSIVE	00032	EROSIVE, VIBRATION
00005	CORROSIVE	00066	MEDIA INCL. As(4) OR P(4) LADEN N(2) GAS
00021	CORROSIVE	00103	NONDESTRUCTIVE, SPATIALLY LOCALIZED
00022	CORROSIVE	00004	NONINTRUSIVE OR NONCONTAMINATING
00024	CORROSIVE	00018	PROCESS TEMPERATURES TO 420 F
00026	CORROSIVE	00098	PULSATING OUTPUT FROM PUMPS
00027	CORROSIVE	00085	STERILITY
00028	CORROSIVE	00091	STERILITY
00029	CORROSIVE	00100	STERILITY
00030	CORROSIVE	00101	STERILITY
00037	CORROSIVE	00102	STERILITY
00052	CORROSIVE	00036	VIBRATION
00054	CORROSIVE	00039	VIBRATION
00055	CORROSIVE	00064	VIBRATION
00057	CORROSIVE	00076	VIBRATION
00059	CORROSIVE	00077	VIBRATION
00061	CORROSIVE	00089	VIBRATION
00062	CORROSIVE	00017	VIBRATION & AIR BUBBLES IN SAMPLE
00063	CORROSIVE	00074	VIBRATION, OIL MIST & DUST IN AIR
00067	CORROSIVE		
00072	CORROSIVE		
00080	CORROSIVE		
00083	CORROSIVE		
00084	CORROSIVE		
00104	CORROSIVE		
00105	CORROSIVE		
00106	CORROSIVE		
00019	CORROSIVE & NUCLEAR RADIATION		
00010	CORROSIVE, EROSIVE		
00049	CORROSIVE, EROSIVE		
00079	CORROSIVE, EROSIVE		
00082	CORROSIVE, EROSIVE		
00007	CORROSIVE, EROSIVE (PRESSURE =1000 PSIG)		
00081	CORROSIVE, EROSIVE, HIGH TEMPERATURE		
00045	CORROSIVE, EROSIVE, VIBRATION		
00058	CORROSIVE, EROSIVE, VIBRATION		
00068	CORROSIVE, EROSIVE, VIBRATION		
00094	CORROSIVE, EROSIVE, VIBRATION, STERILITY		
00023	CORROSIVE, EROSIVE: PRESS. TO 3000 PSIG		
00046	CORROSIVE, HIGH SHEAR		
00070	CORROSIVE, HIGH TEMPERATURE		
00075	CORROSIVE, INTERNALLY COATS WALLS		
00056	CORROSIVE, OXIDIZING, REDUCING		
00060	CORROSIVE, TEMP:60C, PRESS:14.4-50 PSIA		
00025	CORROSIVE, VIBRATION		
00092	CORROSIVE, VIBRATION		
00093	CORROSIVE, VIBRATION		
00031	CORROSIVE, VIBRATION, STERILITY		
00086	CORROSIVE, VIBRATION, STERILITY, EROSIVE		
00040	EROS., VIBRA., STERILITY (OCCASIONALLY)		
00020	EROSIVE		
00053	EROSIVE		
00012	EROSIVE, VIBRATION		

Appendix 15. Electrical Service Classification (NEC) in Sensor Environment

00094	ALL
00014	C1,2/D2/GB&C
00045	C1,2/D2/GB&D
00018	C1/D1,2/GB
00025	C1/D1,2/GB,C&D
00086	C1/D1,2/GD
00026	C1/D1/GB,C&D
00012	C1/D1/GC
00055	C1/D1/GC
00015	C1/D1/GD
00016	C1/D1/GD
00029	C1/D1/GD
00031	C1/D1/GD
00062	C1/D1/GD
00063	C1/D1/GD
00081	C1/D1/GD
00097	C1/D2
00079	C1/D2/GA,B,C&D
00080	C1/D2/GA,B,C&D
00010	C1/D2/GB
00040	C1/D2/GB
00042	C1/D2/GB
00075	C1/D2/GB
00076	C1/D2/GB
00077	C1/D2/GB
00078	C1/D2/GB
00092	C1/D2/GB
00093	C1/D2/GB
00095	C1/D2/GB
00096	C1/D2/GB
00007	C1/D2/GB,C&D
00009	C1/D2/GB,C&D
00030	C1/D2/GB,C&D
00056	C1/D2/GB,C&D
00043	C1/D2/GC
00001	C1/D2/GC&D
00002	C1/D2/GC&D
00003	C1/D2/GC&D
00064	C1/D2/GC&D
00005	C1/D2/GD
00006	C1/D2/GD
00008	C1/D2/GD
00053	C1/D2/GD
00054	C1/D2/GD
00087	C1/D2/GD
00088	C1/D2/GD
00028	FM APPROVED
00060	GEN. PURPOSE
00061	GEN. PURPOSE
00017	NEMA 4
00091	NEMA 4
00051	NEMA 4X
00100	NO EXPLOS. HAZ.
00102	NO EXPLOS. HAZ.
00101	NO EXPLOS. HAZ
00027	UL/FM APPROVED

Appendix 16. Desired Location of Sensor (CALSITE) During Calibration

00028	CHECK BY GRAB SAMPLE
00067	IN PLACE/REMOV.&CAL.
00002	IN-PLACE
00003	IN-PLACE
00005	IN-PLACE
00010	IN-PLACE
00011	IN-PLACE
00012	IN-PLACE
00015	IN-PLACE
00016	IN-PLACE
00019	IN-PLACE
00020	IN-PLACE
00025	IN-PLACE
00026	IN-PLACE
00029	IN-PLACE
00030	IN-PLACE
00031	IN-PLACE
00032	IN-PLACE
00036	IN-PLACE
00038	IN-PLACE
00040	IN-PLACE
00042	IN-PLACE
00043	IN-PLACE
00046	IN-PLACE
00053	IN-PLACE
00054	IN-PLACE
00055	IN-PLACE
00057	IN-PLACE
00058	IN-PLACE
00060	IN-PLACE
00061	IN-PLACE
00062	IN-PLACE
00064	IN-PLACE
00065	IN-PLACE
00068	IN-PLACE
00069	IN-PLACE
00071	IN-PLACE
00073	IN-PLACE
00075	IN-PLACE
00077	IN-PLACE
00078	IN-PLACE
00079	IN-PLACE
00080	IN-PLACE
00081	IN-PLACE
00082	IN-PLACE
00083	IN-PLACE
00084	IN-PLACE
00085	IN-PLACE
00089	IN-PLACE
00090	IN-PLACE
00091	IN-PLACE
00092	IN-PLACE
00095	IN-PLACE
00096	IN-PLACE
00097	IN-PLACE
00098	IN-PLACE
00100	IN-PLACE
00101	IN-PLACE
00102	IN-PLACE
00104	IN-PLACE
00105	IN-PLACE
00106	IN-PLACE
00022	IN-PLACE (REMOTE)
00007	IN-PLACE/REMOV.&CAL.
00009	IN-PLACE/REMOV.&CAL.
00017	IN-PLACE/REMOV.&CAL.
00021	IN-PLACE/REMOV.&CAL.
00023	IN-PLACE/REMOV.&CAL.
00024	IN-PLACE/REMOV.&CAL.
00039	IN-PLACE/REMOV.&CAL.
00074	IN-PLACE/REMOV.&CAL.
00076	IN-PLACE/REMOV.&CAL.
00086	IN-PLACE/REMOV.&CAL.
00088	IN-PLACE/REMOV.&CAL.
00093	IN-PLACE/REMOV.&CAL.
00094	IN-PLACE/REMOV.&CAL.
00018	IN-PLACE/REMOV.&CAL.
00008	REMOV. & CAL.
00014	REMOV. & CAL.
00044	REMOV. & CAL.
00045	REMOV. & CAL.
00049	REMOV. & CAL.
00050	REMOV. & CAL.
00051	REMOV. & CAL.
00066	REMOV. & CAL.
00072	REMOV. & CAL.
00087	REMOV. & CAL.
00099	REMOV. & CAL.
00027	REMOV. & CAL.

Appendix 17. Desired STIMULUS for Calibration of Sensor

00010	ELECTRICAL
00012	ELECTRICAL
00013	ELECTRICAL
00014	ELECTRICAL
00028	ELECTRICAL
00037	ELECTRICAL
00038	ELECTRICAL
00053	ELECTRICAL
00054	ELECTRICAL
00055	ELECTRICAL
00058	ELECTRICAL
00060	ELECTRICAL
00075	ELECTRICAL
00076	ELECTRICAL
00077	ELECTRICAL
00078	ELECTRICAL
00085	ELECTRICAL
00104	ELECTRICAL
00105	ELECTRICAL
00106	ELECTRICAL
00023	PHYS./ELECTR.
00086	PHYS./ELECTR.
00001	PHYSICAL
00002	PHYSICAL
00025	PHYSICAL
00031	PHYSICAL
00032	PHYSICAL
00040	PHYSICAL
00041	PHYSICAL
00065	PHYSICAL
00066	PHYSICAL
00067	PHYSICAL
00068	PHYSICAL
00071	PHYSICAL
00074	PHYSICAL
00079	PHYSICAL
00080	PHYSICAL
00083	PHYSICAL
00089	PHYSICAL
00090	PHYSICAL

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11. ABSTRACT (A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here)

A survey of measurement needs in the chemical and related process industries has been completed, a data base established and reported herein. Sixty-five people responded to the survey, representing the chemical, oil and gas, pharmaceutical, electronic chemicals, energy, instrument manufacturer, food, plastics, and other segments of American industry. The respondents identified: 133 measurement problems of which 106 are defined in detail; 27 measurement needs where no current measurement capability exists (or is known); and three generic measurement areas (flow, composition/concentration, and temperature) in need of improvement. The survey revealed strong demands for improved in-line and in-reactor measurements, in a processing plant environment, to improve process/product quality and to reduce costs. The data base includes instrument (sensor) technical specifications, service conditions, calibration and maintenance requirements, and marketing information.

12. KEY WORDS (Six to twelve entries; alphabetical order; capitalize only proper names; and separate key words by semicolons)

composition/concentration, data base, flow, humidity/moisture, pH, quantity, survey, temperature

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