



# Reacti-Therm Sample Derivatization System

Heating, stirring and evaporation

Sample  
Preparation

Derivatisation

Evaporation

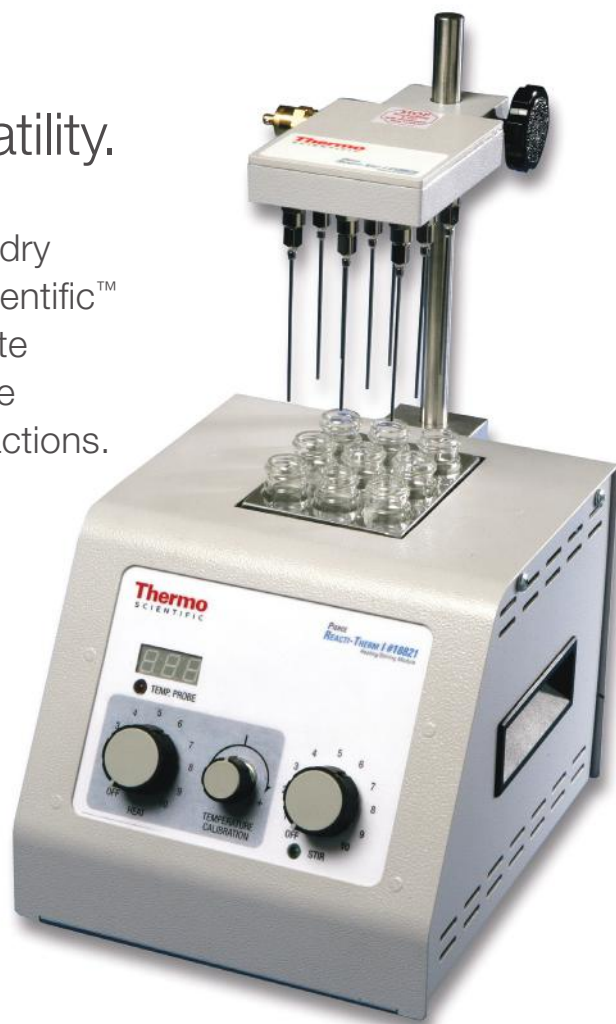
Injection

## Reacti-Therm

Combines heating, stirring, and evaporation for unmatched versatility.

Thermo Scientific offers the Thermo Scientific™ Reacti-Therm™ Heating/Stirring Module (uniform dry heat to the sample) coupled with the Thermo Scientific™ Reacti-Vap™ Evaporator (simultaneous or separate delivery of pressurized gas) to provide a complete solution for derivatization or other small scale reactions.

- Derivatization reactions for HPLC and GC
- Protein hydrolysis
- Small-scale reactions
- Sample incubation
- Vacuum hydrolysis for amino acid analysis
- Sample evaporation



Visit [thermofisher.com/chromatography](http://thermofisher.com/chromatography) for the latest news, applications and downloads for the product range.

## Select your flexible system

### Available options

Step 1 page 4

Heating only

or

Heating & stirring

Step 2 page 4

Single block (9 positions)

or

Triple block (27 positions)

Step 3 page 5

Heating block selection (make sure you order at least the number of blocks in base unit)

Step 4 page 6

Option - thermometer or remote temperature probe

Step 5 page 7

Option - Reacti-Vap module (as appropriate to your base module)

Step 6 pages 6, 8 and 9

Option - Magnetic stirrers and vials

Step 7 pages 10-11

Option - Derivatization reagents

## Specifications

| Closure type               | Single block            | Triple block            |
|----------------------------|-------------------------|-------------------------|
| Electrical Input           |                         |                         |
| Voltage                    | 120V or 240V            | 120V or 240V            |
| AC Input Voltage Tolerance | +/- 10%                 | +/- 10%                 |
| Wattage (Maximum)          | 130W                    | 260W                    |
| Frequency                  | 50/60Hz                 | 50/60Hz                 |
| Performance                |                         |                         |
| Temperature Range*         | ambient + 10°C to 200°C | ambient + 10°C to 200°C |
| Temperature Uniformity*    | ± 0.5°C                 | ± 0.5°C                 |
| Temperature Stability*     | ± 0.5°C at 37°C         | ± 0.5°C at 37°C         |
| Stirrer Operating Range    | 150-700 ± 100RPM        | 150-700 ± 100RPM        |
| Maximum Inlet              |                         |                         |
| Gas pressure               | 2psi                    | 2psi                    |

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# The flexible system for your laboratory

## Modular base systems

### Modules

| Product No. | Description  | Pkg. Size |
|-------------|--|-----------|
| TS-18820    | ThermoFisher™ Reacti-Probe™ Remote Temperature Probe | 1 unit    |
| TS-18821    | Reacti-Therm Heating/Stirring Module (Single Block)  | 1 unit    |
| TS-18822    | Reacti-Therm Heating Module (Single Block)           | 1 unit    |
| TS-18823    | Reacti-Therm Heating/Stirring Module (Triple Block)  | 1 unit    |
| TS-18824    | Reacti-Therm III Heating Module (Triple Block)       | 1 unit    |
| TS-18825    | Reacti-Vap Evaporator                                | 1 unit    |
| TS-18826    | Reacti-Vap Evaporator                                | 1 unit    |

Underwriters Laboratories, Inc. Listed

Note: Our Reacti-Therm Modules bear a CE marking for meeting the requirements of the European Union's Low-Voltage and EMC Directives.


















## The flexible system for your laboratory

### Choice of heating blocks

Thermo Scientific™ Reacti-Block™ Aluminium Blocks are available with many hole configurations, machine-drilled to accommodate almost any size Thermo Scientific™ Reacti-Vial™ Small Reaction Vial (page 8), test tube or microcentrifuge tube. These highly efficient units are constructed of an aluminium alloy for optimal thermal conductivity. To ensure proper heat transference, be sure to have a close block-to-sample container fit.

### Ordering information

| Product No.   |   | Description  |
|---|---|--|
| TS-18801  |    | <b>Reacti-Block A-1</b><br>Holds 13 × 0.3ml or 1ml Reacti-Vials; 13 holes/14mm dia. × 23mm deep    |
| TS-18802  |    | <b>Reacti-Block B-1</b><br>Holds 9 × 3ml or 5ml Reacti-Vials; 9 holes/21mm dia. × 32mm deep        |
| TS-18803  |    | <b>Reacti-Block C-1</b><br>Holds 13 × 3.5ml Screw Cap Septum Vials; 13 holes/15mm dia. × 34mm deep |
| TS-18804  |    | <b>Reacti-Block Z-1</b><br>Holds 9 × 0.1mm Reacti-Vials; 9 holes/12mm dia. × 21mm deep             |
| TS-18811  |    | <b>Reacti-Block M-1</b><br>Holds 6 × 27.5ml Reacti-Vials; 6 holes/28.5mm dia. × 70mm deep          |
| TS-18814  |  | <b>Reacti-Block Q-1</b><br>Holds 10 Reacti-Vials; Small Reaction Vials 8 holes 25mm × 46mm deep    |
| TS-18816  |  | <b>Reacti-Block S-1</b><br>Holds 13 × 13mm dia. Test Tubes; 13 holes/14mm dia. × 45mm deep         |
| TS-18817  |  | <b>Reacti-Block T-1</b><br>Holds 9 × 16mm dia. Test Tubes; 9 holes/17mm dia. × 45mm deep           |
| TS-18818  |  | <b>Reacti-Block U-1</b><br>Holds 8 × 20mm dia. Test Tubes; 8 holes/21mm dia. × 45mm deep           |
| TS-18819  |  | <b>Reacti-Block V-1</b><br>Holds 17 Microcentrifuge Test Tubes; 17 holes/11mm dia. × 45mm deep     |
| The Reacti-Block Aluminum Blocks featured below are designed to be used exclusively with the Reacti-Therm Modules. The hole patterns do not match the needle configuration of Reacti-Vap Evaporators. |   |  |
| TS-18806  |  | <b>Reacti-Block F</b><br>Holds 8 × 6ml Vacuum Hydrolysis Tubes; 8 holes/10mm dia. × 64mm deep      |
| TS-18807  |  | <b>Reacti-Block G</b><br>Holds 4 × 18ml Vacuum Hydrolysis Tubes; 4 holes/19mm dia. × 64mm deep     |
| TS-18809  |  | <b>Reacti-Block J</b><br>Blank/no holes (for custom drilling) 7.6cm tall                           |
| TS-18810  |  | <b>Reacti-Block K</b><br>Blank/no holes (for custom drilling) 5.1cm tall                           |
| TS-18812  |  | <b>Reacti-Block L</b><br>Holds 16 × 0.1ml Reacti-Vials; 16 holes/12mm dia. × 21mm deep             |

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## The flexible system for your laboratory

### Reacti-Vial magnetic stirrers

Faster reaction times with smooth, efficient mixing of small reaction samples

- PTFE-coated stirring bars fit the cone portion of the Reacti-Vial
- Solubilization of sticky concentrated residues such as those found on evaporation of sugar solutions
- Increased speed-of-surface reactions by keeping insoluble reactants in suspension
- More information about appropriate vials on page 8
- More information about derivatisation reagents on pages 10 and 11



### Ordering information

| Product No. | Description  | Pkg. Size |
|-------------|--|-----------|
| TS-16000    | <b>Reacti-Vial Magnetic Stirrers</b><br>For use with 3.0, 5.0. and 10ml Reacti-Vial Small Reaction Vials | Pkg. of 6 |
| TS-16010    | <b>Reacti-Vial Magnetic Stirrers</b><br>For use with 0.3 and 1.0ml Reacti-Vial Small Reaction Vials      | Pkg. of 6 |

## Flexible system for your requirements

### Reacti-Therm Remote Temperature Probe and Thermometers

**PTFE-coated, designed specifically for dry incubations.**

Remote Temperature Probe (RTP) provides more accurate and responsive control of the heating function, is not a substitute for temperature calibration to an independent thermometer.

For best results, perform temperature calibration with the RTP placed in the aluminum block thermometer well and a standard thermometer placed in a reaction vial in one of the aluminum block wells.

### Ordering information

| Product No. | Description  | Pkg. Size |
|-------------|--|-----------|
| TS-18914    | <b>Reacti-Therm Thermometer</b> , Mercury-free (0-100°C) | Pkg. of 1 |
| TS-18915    | <b>Reacti-Therm Thermometer</b> , Mercury-free (0-200°C) | Pkg. of 1 |
| TS-18820    | <b>Reacti-Probe</b> Remote Temperature Probe             | Pkg. of 1 |

## The flexible system for your laboratory

### Reacti-Vap Evaporator

Thermo Scientific Reacti-Vap Evaporators are precision-machined gas manifolds. They provide simple, efficient evaporation by allowing the simultaneous or separate delivery of nonreactive pressurized gas to samples.

The evaporators attach simply to the Reacti-Thermo modules and the evaporating head tilts back for easy needle attachment and removal. PTFE-coated needles are available for applications using strong acids. Each Reacti-Vap Needle has a Luer-Lok® hub for leak-proof attachment to Reacti-Vap Evaporators. Needles are available in 4- and 6-inch lengths.



### Ordering information

| Product No. | Description  | Pkg. Size           |
|-------------|--|---------------------|
| TS-18825    | <b>Reacti-Vap Evaporator (9-port)</b><br>For use with Reacti-Therm Single Block Modules; TS-18822 and TS-18821, Includes 9 needles and plugs | –                   |
| TS-18826    | <b>Reacti-Vap III Evaporator (27-port)</b><br>For use with Reacti-Therm III Modules; TS-18823 and TS-18824, Includes 27 needles and plugs    | –                   |
| TS-18782    | <b>Reacti-Vap Replacement Tube Kit</b><br>2.5 inch (64mm)  | Pkg. of 9 and plugs |
| TS-18784    | <b>Reacti-Vap PTFE Coated Needles</b><br>4-inch (102mm) × 19 gauge   | Pkg. of 9           |
| TS-18786    | <b>Reacti-Vap PTFE Coated Needles</b><br>6-inch (152mm) × 19 gauge   | Pkg. of 9           |
| TS-18827    | <b>Replacement Luer-Lok Fitting</b>  | Pkg. of 1           |
| TS-18828    | <b>Replacement Screws for Mounting Bracket</b>   | Pkg. of 4           |
| TS-18829    | <b>Replacement Height Adjustment Knob</b>  | Pkg. of 1           |
| TS-18830    | <b>Replacement Mounting Bracket</b>  | Pkg. of 1           |
| TS-18831    | <b>Replacement Metal Rod</b>   | Pkg. of 1           |
| TS-18832    | <b>Replacement Dial for Flow Control</b>   | Pkg. of 1           |
| TS-18833    | <b>Replacement Long Screws for Mounting Bracket</b>  | Pkg. of 4           |

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## The flexible system for your laboratory

### Reacti-Vials

Thermo Scientific Reacti-Vial Small Reaction Vials have an internal cone designed to make small-sample collection and handling easy and convenient. The cone feature is particularly useful for removing small quantities of sample with a syringe, even into the microliter range. The extra thick glass wall magnifies the sample, making these units ideal for observing chemical reactions.

Ideal for:

- Derivative preparation
- Residue isolation
- Digestion or hydrolysis
- Sample storage



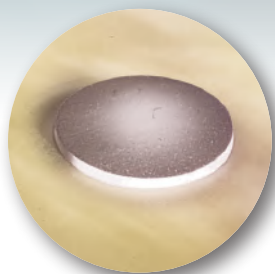
### Reacti-Vial Small Reaction Vials

| Size    | Dimensions<br>(Diam. x Height)<br>(mm ± 1mm) | Inside<br>Diameter (mm) | Thread<br>Style | Clear<br>Pkg. of 12 | Amber<br>Pkg. of 12 |
|---------|--|-------------------------|-----------------|---------------------|---------------------|
|         |  |                         |                 | Product #           | Product #           |
| 100 µl  | 12 x 32                                      | 8                       | 425-8           | TS-13100            | –                   |
| 0.3 ml  | 13 x 32                                      | 11                      | 425-13          | TS-13220            | –                   |
| 1.0 ml  | 13 x 45                                      | 11                      | 425-13          | TS-13221            | TS-13097            |
| 3.0 ml  | 20 x 47                                      | 18                      | 425-20          | TS-13222            | –                   |
| 5.0 ml  | 20 x 60                                      | 18                      | 425-20          | TS-13223            | TS-13099            |
| 10.0 ml | 25 x 69                                      | 22                      | 425-24          | TS-13225            | –                   |

All Reacti-Vial Small Reaction Vials are supplied complete with Open-Top Screw Caps and PTFE/Rubber Septa (other septa can be ordered separately, see optional accessories overleaf).



## Accessories



### PTFE/Rubber Septa

For a highly inert and nonreactive seal.



### PTFE/Silicone Septa

Unique septa that combine the inertness of a PTFE coating with the resealability of silicone.



### Mininert Valves

Ideal for chemicals that deteriorate or evaporate in conventionally sealed containers.

## Vacuum Hydrolysis Tubes

For fast, effective protein and peptide hydrolysis

- The upper temperature limit of the Vacuum Hydrolysis Tubes is 260°C; however, do not heat the tubes greater than 100°C in an oven
- Vacuum Hydrolysis Tubes fit conveniently into Reacti-Block Aluminium Heating Blocks

## Optional accessories

|           | PTFE/<br>silicone septa<br>pkg. of 72 | Rubber<br>laminated septa<br>pkg. of 72 | Open-Top<br>screw caps<br>pkg. of 72 | Miniert<br>valves<br>pkg. of 72 | Reacti-Vial<br>Magnetic<br>Stirrers<br>pkg. of 6 |
|-----------|---------------------------------------|---|--------------------------------------|---------------------------------|--|
| Vial Size | Product #                             | Product #                               | Product #                            | Product #                       | Product #  |
| 100 µl    | TS-12708                              | –                                       | TS-13208                             | –                               | –  |
| 0.3 ml    | TS-12712                              | TS-12412                                | TS-13215                             | –                               | TS-16010   |
| 1.0 ml    | TS-12712                              | TS-12412                                | TS-13215                             | –                               | TS-16010   |
| 3.0 ml    | TS-12718                              | TS-12418                                | TS-13218                             | TS-10135                        | TS-16000   |
| 5.0 ml    | TS-12718                              | TS-12418                                | TS-13218                             | TS-10135                        | TS-16000   |
| 10.0 ml   | TS-12722                              | TS-12422                                | TS-13219                             | TS-10130                        | TS-16000   |

## Septa compatibility guide optional accessories

| Closure type                | Resealability | Recommended for use with  | Not recommended for use with             |
|-----------------------------|---------------|---|--|
| PTFE/Silicone Septa         | Excellent     | DMF, DMSO, organic solvents, pyridine, THF and silylation reactions             | Strong corrosives, such as chlorosilanes |
| PTFE/Rubber Laminated Septa | Poor          | Corrosives such as chlorosilanes, DMF, DMSO, organic solvents, pyridine and THF | Trifluoroacetic anhydride                |

# The flexible system for your laboratory

## GC Derivatization reagents

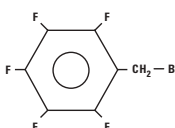
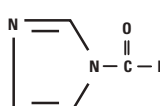
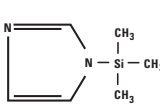
Why do we derivatize?

- To make a compound that otherwise could not be analysed by a particular method suitable for analysis
- To improve the analytical efficiency of the compound
- To improve the detectability of the compound

Often compounds cannot be analysed because they are not in a form that is suitable for the particular analytical technique. Examples include non-volatile compounds for GC analysis, insoluble compounds for HPLC analysis and materials that are not stable using the conditions of the technique. The derivatization procedure modifies the chemical structure of the compounds, allowing analysis by a desired technique.

Main types of derivatization

- Silylation
- Acylation
- Alkylation

| Silylation  |   | Acylation  |  | Alkylation |  |
|---|---|--|--|------------|--|
| $\begin{array}{c} \text{CH}_3 \quad \text{CH}_3 \\   \quad   \\ \text{CH}_3 - \text{Si} - \text{NH} - \text{Si} - \text{CH}_3 \\   \quad   \\ \text{CH}_3 \quad \text{CH}_3 \end{array}$ <p><b>HMDS</b><br/>MW 161.4<br/>bp 125°C<br/>n<sub>D</sub><sup>20</sup> 1.4071</p>   | $\begin{array}{c} \text{CH}_3 \\   \\ \text{CH}_3 - \text{Si} - \text{CH}_3 \\   \\ \text{O} \\   \\ \text{CF}_3 - \text{C} = \text{N} - \text{Si} - \text{CH}_3 \\   \\ \text{CH}_3 \end{array}$ <p><b>BSTFA</b><br/>MW 257.4<br/>bp 40°C/12 mm<br/>d<sub>4</sub><sup>20</sup> 0.961</p>   | $\begin{array}{c} \text{F} \quad \text{F} \quad \text{H} \\   \quad   \quad   \\ \text{F} - \text{C} - \text{C} - \text{C} - \text{OH} \\   \quad   \quad   \\ \text{F} \quad \text{F} \quad \text{H} \end{array}$ <p><b>Pentafluoropropanol</b><br/>MW 150.05<br/>bp 80.6°C<br/>d<sub>4</sub><sup>20</sup> 1.2880</p> | $\begin{array}{c} \text{F} \quad \text{H} \\   \quad   \\ \text{F} - \text{B} : \text{O} - \text{CH}_3 \\   \\ \text{F} \end{array}$ <p><b>BF<sub>3</sub>-Methanol</b><br/>14% BF<sub>3</sub> MW 67.82<br/>86% CH<sub>3</sub>OH MW 32.04</p> |            |  |
| $\begin{array}{c} \text{CH}_3 \\   \\ \text{CH}_3 - \text{Si} - \text{Cl} \\   \\ \text{CH}_3 \end{array}$ <p><b>TMCS</b><br/>MW 108.7<br/>bp 57.6°C<br/>d<sub>4</sub><sup>20</sup> 0.858</p>   | $\begin{array}{c} \text{CH}_3 \\   \\ \text{CH}_3 - \text{Si} - \text{CH}_3 \\   \\ \text{O} \\   \\ \text{CF}_3 - \text{C} = \text{N} - \text{Si} - \text{CH}_3 \\   \quad   \\ \text{CH}_3 \quad \text{CH}_3 \end{array}$ <p><b>BSTFA</b><br/>MW 257.4<br/>bp 40°C/12 mm<br/>d<sub>4</sub><sup>20</sup> 0.961</p> $\begin{array}{c} \text{CH}_3 \\   \\ \text{CH}_3 - \text{Si} - \text{Cl} \\   \\ \text{CH}_3 \end{array}$ <p><b>TMCS</b><br/>MW 108.7<br/>bp 57.6°C<br/>d<sub>4</sub><sup>20</sup> 0.858</p> | $\begin{array}{c} \text{O} \quad \quad \text{O} \\    \quad \quad    \\ \text{CF}_3 - \text{C} - \text{N} - \text{C} - \text{CF}_3 \\   \\ \text{CH}_3 \end{array}$ <p><b>MBTFA</b><br/>MW 223.08<br/>bp 123-124°C<br/>d<sub>4</sub><sup>20</sup> 1.55</p>   |  <p><b>PFBBr</b><br/>MW 260.9<br/>bp 174-175°C<br/>d<sub>4</sub><sup>20</sup> 1.86</p>  |            |  |
| $\begin{array}{c} \text{O} \quad \text{CH}_3 \quad \text{CH}_3 \\    \quad   \quad   \\ \text{CF}_3 - \text{C} - \text{N} - \text{Si} - \text{CH}_3 \\   \\ \text{CH}_3 \end{array}$ <p><b>MSTFA</b><br/>MW 199.1<br/>bp 70°C/75 mm<br/>d<sub>4</sub><sup>20</sup> 1.11</p> $\begin{array}{c} \text{CH}_3 \quad \text{CH}_3 \\   \quad   \\ \text{CH}_3 - \text{C} - \text{Si} - \text{Cl} \\   \quad   \\ \text{CH}_3 \quad \text{CH}_3 \end{array}$ <p><b>TBDMCS</b><br/>MW 150.73<br/>bp 125°C</p> | $\begin{array}{c} \text{O} \quad \text{CH}_3 \quad \text{CH}_3 \\    \quad   \quad   \\ \text{CF}_3 - \text{C} - \text{N} - \text{Si} - \text{CH}_3 \\   \\ \text{CH}_3 \end{array}$ <p><b>MSTFA</b><br/>MW 199.1<br/>bp 70°C/75 mm<br/>d<sub>4</sub><sup>20</sup> 1.11</p>   |  <p><b>Methylate Reagent</b><br/>MW 119.17<br/>bp 102-104°C<br/>d<sub>4</sub><sup>20</sup> 0.897</p>   |  |            |  |
|  <p><b>TMSI</b><br/>MW 140.26<br/>bp 99°C/14 mm Hg<br/>d<sub>4</sub><sup>20</sup> 0.957</p>  | $\begin{array}{c} \text{CH}_3 \\   \\ \text{CH}_3 - \text{Si} - \text{CH}_3 \\   \\ \text{O} \\   \\ \text{CH}_3 - \text{C} = \text{N} - \text{Si} - \text{CH}_3 \\   \\ \text{CH}_3 \end{array}$ <p><b>BSA</b><br/>MW 203.4<br/>bp 71-73°C/35 mm<br/>d<sub>4</sub><sup>20</sup> 0.832</p>  | $\begin{array}{c} \text{O} \quad \quad \text{O} \\    \quad \quad    \\ \text{R} - \text{C} - \text{O} - \text{C} - \text{R} \end{array}$  | $\begin{array}{c} \text{CH}_3 \\   \\ [\text{CH}_3 - \text{N} - \text{CH}_3]^+ \\   \\ \text{C}_6\text{H}_5 \end{array}$ <p><b>TMPAH</b></p>   |            |  |

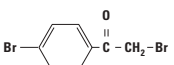
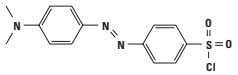
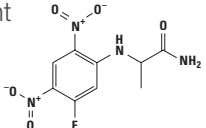
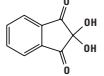
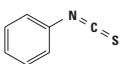
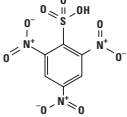
## The flexible system for your laboratory

### Detection and Hydrolysis Reagents

Pre- and post-chromatographic techniques are both used in HPLC derivatization. Pre-chromatographic (or pre-column techniques) offer more than greater selectivity and sensitivity in detection and can be used to enhance stability, improve resolution, improve peak symmetry and increase or decrease retention of solutes.

Most protein samples require some form of chemical treatment before their component amino acids are suitable for analysis. Protein and peptide samples must be hydrolyzed to free amino acids from peptide linkages. Acids (usually HCl) are the most widely used agents for hydrolyzing proteins.

Thermo Scientific Detection Reagents for HPLC

| Functional Group  | Description   | Detection* |
|---|---|------------|
| Carboxylic Acid<br>$\text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{OH}$ | <i>p</i> -Bromophenacylate<br>   | UV         |
| Primary Amine<br>$\text{R}-\overset{\text{H}}{\underset{\text{H}}{\text{N}}}$   | Dabsyl Chloride<br>              | Vis        |
|   | FDAA, Marfey's Reagent<br>       | UV         |
|   | Ninhydrin<br>                    | Vis        |
|   | PITC<br>                         | UV         |
|   | TNBSA<br><br>TNBSA<br>MW 293.17 | EC, UV     |
| Secondary Amine<br>$\text{R}-\text{NH}-\text{R}'$                               | Ninhydrin (see structure above)   | Vis        |
|   | PITC (see structure above)  | UV         |

\*EC = electrochemical; F = fluorescence; UV = ultraviolet; Vis = visible.

## Handbook of Analytical Derivatization Reaction

A self-contained methodology reference manual and efficient entry point to the original literature resource book.

The *Handbook of Analytical Derivatization Reactions* by Daniel R. Knapp is a general collection of analytical derivatization methods for chromatography and mass spectroscopy involving the formation of covalent derivatives before analysis. Methods contained in this volume are organized according to the type of sample being derivatized.

Methods include structural formulas, experimental directions and useful comments.

A thorough system of indexing takes you quickly to the "lab ready" methods of interest.



### Ordering information

| Product No. | Description   | Pkg. Size         |
|-------------|---|-------------------|
| TS-24308    | <b>Hydrochloric Acid</b><br>(Constant boiling, Hydrochloric Acid 6N Sequencing Grade)   | 10 × 1 ml ampules |
| TS-15012    | <b>Handbook of Analytical Derivatization Reactions</b><br>Knapp, D.R. Ed (1979) Published by John Wiley and Sons, Inc. Hardcover, 741 pages |                   |

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