Paroscientific,Inc

4500 148th Avenue N. E.
Redmond, WA 98052-5194
Telephone: (425) 883-8700

Facsimile: (425) 867-5407
Email: salessupport@paroscientific.com
Internet: http://www.paroscientific.com

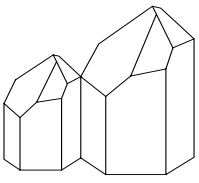
Model 785

Multi-Range Pressure Standard

Operation and Maintenance Manual

Document No. G8109-001

Revision B



Digiquartz® Pressure Instrumentation

HIGH PRESSURE
High pressure liquids and gases are potentially hazardous. Energy stored in these liquids and gases can be released unexpectedly and with extreme force. High pressure systems should be assembled and operated only by personnel who have been instructed in proper safety practices.

Paroscientific, Inc.
4500 148th Ave. NE, Redmond WA 98052 http://www.paroscientific.com
Printed in the USA.

Table of Contents

1. INTRODUCTION 1—1

1.1 ABOUT THIS MANUAL 1—1

1.1.1 Manual Conventions 1—1

1.2 PRODUCT OVERVIEW 1—1

1.3 SPECIFICATIONS 1—2

1.3.1 General Specifications 1—2

1.3.2 Pressure Measurement Specifications 1—2

1.3.2.1 Standard Reference Pressure Transducer (RPT) 1—3

1.3.2.1.1 Standard RPT Designations and Ranges 1—3

1.3.2.2 On-Board Barometer 1—4

1.3.3 Configurations 1—4

1.3.3.1 One or Two RPTs: Group 1 (≤A1000) 1—5

1.3.3.2 Two RPTs: One Group 1 (≤A1000) and One Group 2 (>A1500 and ≤A10000) 1—6

1.3.3.3 Two RPTs: Both Group 2 (>A1500 and ≤A10000) 1—7

1.3.3.4 One RPT: Group 2 (>A1500 and ≤A10000) or Group 3 (>A10000) 1—8

2. INSTALLATION 2—1

2.1 UNPACKING AND INSPECTION 2—1

2.1.1 Removing from Packaging 2—1

2.1.2 Inspecting Contents 2—1

2.2 SITE REQUIREMENTS 2—1

2.3 INITIAL SETUP 2—2

2.3.1 Preparing for Operation 2—2

2.3.2 Front and Rear Panels 2—2

2.3.2.1 Front Panel 2—2

2.3.2.2 Rear Panel 2—3

2.3.3 Power Connection 2—3

2.3.4 TEST Port Connecting 2—3

2.3.4.1 The ATM and VENT Ports 2—4

2.4 POWER UP AND VERIFICATION 2—5

2.4.1 Apply Power 2—5

2.4.2 Check Proper Pressure Measurement Operation 2—5

2.4.2.1 Checking Absolute Mode Pressure Measurement 2—5

2.4.2.2 Checking Gauge Mode Pressure Measurement 2—6

2.5 SHORT TERM STORAGE 2—6

3. OPERATION 3—1

3.1 GENERAL/MANUAL OPERATION 3—1

3.1.1 The Main Run Screen 3—1

3.1.2 General Operating Principles 3—2

3.1.2.1 Keypad Layout and Protocol 3—2
3.1.2.2 Sounds 3—3
3.1.2.3 “Soft” **[On/Off]** Key 3—3
3.1.2.4 Pressure Ready/Not Ready Indication 3—3
3.1.2.5 Multiple Pressure Ranges 3—4
3.1.2.6 SDS Self Defense System 3—5
3.1.2.7 Direct Function Keys Summary 3—5

3.2 DIRECT FUNCTION KEYS 3—7

3.2.1 [RANGE] 3—7

3.2.2 [UNIT] 3—8

3.2.3 [MODE] 3—10

3.2.4 [UL] (UPPER LIMIT) 3—11

3.2.4.1 Over-pressure Function (Pmax!) 3—12

3.2.5 [RES] (RESOLUTION) 3—13

3.2.6 [DISPLAY] 3—13

3.2.6.1 Avg (Average) 3—15
3.2.6.2 Rate 3—16
3.2.6.3 Dev (Deviation) 3—16
3.2.6.4 RPT 3—17
3.2.6.5 Hi/Lo 3—18
3.2.6.6 Freeze 3—19
3.2.6.7 Clean 3—20

3.2.7 [HEAD] 3—20

3.2.8 [SDS] (SELF DEFENSE SYSTEM) 3—21

3.2.9 [AutoZ] 3—24

3.2.9.1 Running AutoZ in Gauge Measurement Mode 3—24
3.2.9.2 Running AutoZ in Absolute Measurement Mode 3—25
3.2.9.2.1 Run AutoZ by Entry 3—26
3.2.9.2.2 Run AutoZ by COM2 3—27
3.2.9.2.3 Run AutoZ by RngL3 3—27

3.3 [SETUP] MENU KEY 3—28

3.3.1 Head 3—28

3.3.2 PresU 3—30

3.3.3 ReadRt (Read Rate) 3—31

3.3.4 Stab (Stability) 3—32

3.3.5 Leak (Leak Check) 3—33

3.4 [SPECIAL] MENU KEY 3—35

3.4.1 AutoZ 3—35

3.4.1.1 AutoZ On/Off 3—38
3.4.1.2 View AutoZ 3—38
3.4.1.3 Edit AutoZ 3—39

3.4.2 SDS 3—39

3.4.3 ATM 3—40
3.4.4 Remote 3—41
3.4.5 Reset 3—42
3.4.5.1 Reset - sets 3—43
3.4.5.2 Reset - units 3—43
3.4.5.3 Reset - com 3—43
3.4.5.4 Reset - cal 3—44
3.4.5.5 Reset - all 3—44
3.4.6 Cal 3—44
3.4.7 Intern 3—44
3.4.7.1 ScrSav 3—45
3.4.7.2 Sound 3—45
3.4.7.3 Time 3—46
3.4.7.4 ID 3—46
3.4.8 Level 3—47
3.4.9 Log 3—50

4. REMOTE OPERATION 4—1

4.1 OVERVIEW 4—1

4.2 INTERFACING 4—1
4.2.1 RS232 INTERFACE 4—1
4.2.1.1 COM1 4—1
4.2.1.2 COM2 4—2
4.2.2 IEEE-488 (GPIB) 4—2

4.3 REMOTE COMMAND SYNTAX AND STYLE 4—2
4.3.1 Local and Remote Setting 4—2
4.3.2 Command Syntax 4—2
4.3.3 Queries and Replies 4—3
4.3.4 Multiple Commands 4—3
4.3.5 Command Parameters 4—3
4.3.6 Suffixes 4—4
4.3.7 Programming Tips 4—4

4.4 COMMANDS 4—8
4.4.1 Command Summary 4—8
4.4.2 Error Messages 4—11
4.4.3 Command Descriptions 4—12
4.4.3.1 IEEE Std. 488.2 Common and Status Commands 4—12
4.4.3.2 Measurement Subsystem 4—15
4.4.3.3 Calculate Subsystem 4—20
4.4.3.4 Calibration Subsystem 4—22
4.4.3.5 Display Subsystem 4—25
4.4.3.6 Sense Subsystem 4—26
4.4.3.7 Status Subsystem 4—28
4.4.3.8 System Subsystem 4—35
4.4.3.9 Unit Subsystem 4—41

4.5 STATUS SYSTEM **4—43**
4.5.1 Status Reporting System 4—43
4.5.1.1 SCPI Status Subsystem 4—43
4.5.1.2 Error Queue 4—43
4.5.1.3 Status Byte Register 4—44
4.5.1.4 Standard Event Register 4—45
4.5.1.5 RPT Ready Status Register 4—46
4.5.2 Status Subsystem 4—46
4.5.2.1 Operation Register Structure 4—47
4.5.2.2 Questionable Register Structure 4—49

5. MAINTENANCE, ADJUSTMENTS AND CALIBRATION **5—1**

5.1 INTRODUCTION **5—1**

5.2 CALIBRATION OF REFERENCE PRESSURE TRANSDUCERS **5—1**
5.2.1 Principle 5—1
5.2.2 Equipment Required 5—3
5.2.3 Set-Up and Preparation 5—4
5.2.4 RPT Calibration Using MODEL 785 CalTool Software 5—4
5.2.5 Editing and Viewing RPT Calibration Information 5—4
5.2.6 Setting ZNATERR 5—5
5.2.7 RPT Calibration/Adjustment Without MODEL 785 CalTool Software 5—6

5.3 ADJUSTMENT OF ON-BOARD BAROMETER **5—7**

5.4 OVERHAUL **5—8**

5.5 RELOADING EMBEDDED SOFTWARE INTO FLASH MEMORY **5—8**

5.6 SUBASSEMBLY DESCRIPTION AND LOCATION **5—9**
5.6.1 Internal View 5—9
5.6.1.1 SDS Module 5—9
5.6.1.2 RPTs 5—10
5.6.1.3 Power Supply 5—10
5.6.1.4 Cooling Fan 5—10
5.6.1.5 Micro Board 5—10
5.6.1.6 Main Board 5—10
5.6.1.7 On-board Barometer 5—10
5.6.1.8 Display 5—10

6. TROUBLESHOOTING **6—1**

7. APPENDIX **7—1**

7.1 PRESSURE UNIT CONVERSIONS **7—1**

7.2 WARRANTY STATEMENT **7—2**

7.3 GLOSSARY **7—3**

7.4 NON STANDARD CONFIGURATION **7---4**

1. INTRODUCTION

1.1 ABOUT THIS MANUAL

This manual provides the user with the basic information necessary to operate an MODEL 785, Multi-Range Pressure Standard. It also includes a great deal of additional information provided to help you optimize MODEL 785 use and take full advantage of its many features and functions.

Before using the manual, take a moment to familiarize yourself with the Table of Contents structure: All first time MODEL 785 users should read Chapters 1, 2 and 3. Chapter 3 provides a comprehensive description of general MODEL 785 operating principles. Chapter 4 is for remote operation from an external computer. Chapter 5 provides maintenance and calibration information. Chapter 6 is a quick trouble shooting guide. Use it to trouble shoot unexpected MODEL 785 behavior based on the symptoms of that behavior.

Certain words and expressions have specific meaning as they pertain to MODEL 785. The Glossary Section (Section 7.3) is useful as a quick reference for exact definition of specific words and expressions as they are used in this manual.

➢ FOR THOSE OF YOU WHO "DON'T READ MANUALS", GO DIRECTLY TO SECTION 2.3 TO SET UP YOUR MODEL 785 AND THEN SECTION 2.4 FOR POWER UP AND VERIFICATION. THIS WILL GET YOU RUNNING QUICKLY WITH MINIMAL RISK OF CAUSING DAMAGE TO YOURSELF OR YOUR NEW MODEL 785. THEN... WHEN YOU HAVE QUESTIONS OR START TO WONDER ABOUT ALL THE GREAT FEATURES YOU MIGHT BE MISSING, GET INTO THE MANUAL!

1.1.1 Manual Conventions

(CAUTION) is used throughout the manual to identify user warnings and cautions.

➢ **(NOTE) is used throughout the manual to identify operating and applications advice and additional explanations.**

[ ] indicates direct function keys (for example **[RANGE])**.

< > indicates MODEL 785 screen displays (for example **<1yes>**).

1.2 PRODUCT OVERVIEW

MODEL 785 is a stand-alone, microprocessor driven, Multi-Range Pressure Standard intended to accurately measure gas or liquid pressure in a wide variety of pressure calibration, measurement and testing applications. It has been designed to provide very high performance and extensive features combined with maximum versatility and ease of use.

MODEL 785 uses one or two high accuracy reference pressure transducers (RPTs) and an on-board barometer to measure pressure. Various internal configurations exist depending on the RPT ranges.

MODEL 785 can be controlled locally by the operator using its front panel display and keypad or remotely by a computer using ASCII character command strings over its RS232 and IEEE-488 interfaces.

MODEL 785 models are available to measure pressure in ranges from 5.0 psi (34.47 kPa) to 40 000 psi (275 MPa) in gauge, compound and absolute measurement modes.

Model 785 is compliant to the Year 2000 compatibility. Entering the year requires a four digit date entry.

1.3 SPECIFICATIONS

1.3.1 General Specifications

See the Specification Control Drawing for complete Model 785 specifications.

1.3.2 Pressure Measurement Specifications

MODEL 785 can be configured with one or two reference pressure transducers (RPT). Each transducer has three ranges (see 3.1.2.5 Multiple Pressure Ranges). The type and designation of the MODEL 785's RPTs determine its measurement specifications and configuration (see 1.3.2 Pressure Measurement Specifications, 1.3.3 Configurations).

All reference pressure transducers (RPTs) with designation greater than G200 (1030 kPa) are of the absolute pressure type with an evacuated, permanently sealed reference. Absolute RPTs can measure both absolute and gauge pressure. Gauge pressures with an absolute RPT are defined by offsetting atmospheric pressure dynamically with compensation for atmospheric changes by the on-board barometer. Gauge RPTs cannot measure absolute pressure.

1.3.2.1 Standard Reference Pressure Transducer (RPT)

1.3.2.1.1 *Standard RPT Designations and Ranges* (A=Absolute, G=Gauge RPTs)

	US VERSION UNITS (PSI)			SI UNITS VERSION (> A1500, MPa; ≤ A1500, kPa)				
Transducer Designation	Range 1 (Lo) Absolute / Gauge	Range 2 (Mid) Absolute / Gauge	Range 3 (High) Absolute / Gauge	Range 1 (Lo) Absolute / Gauge	Range 2 (Mid) Absolute / Gauge	Range 3 (High) Absolute / Gauge	Test Connection	SDS System
G0015	NA / 5	NA / 10	NA / 15	NA / 30	NA / 60	NA / 100	1/8” NPT F	Yes
G0022	NA / 7	NA / 15	NA / 22	NA / 50	NA / 100	NA / 150	1/8” NPT F	Yes
G0030	NA / 10	NA / 20	NA / 30	NA / 60	NA / 120	NA / 200	1/8” NPT F	Yes
G0100	NA / 30	NA / 50	NA / 100	NA / 230	NA / 460	NA / 700	1/8” NPT F	Yes
G0150	NA / 50	NA / 75	NA / 150	NA / 350	NA / 700	NA / 1000	1/8” NPT F	Yes
G0200	NA / 70	NA / 140	NA / 200	NA / 450	NA / 950	NA / 1400	1/8” NPT F	Yes
A0015	5 / -10	10 / -5	15 / 0	30 / -70	60 / -40	100 / 0	1/8” NPT F	Yes
A0023	7 / -8	15 / 0	23 / 8	50 / -50	100 / 0	160 / 60	1/8” NPT F	Yes
A0030	10 / -5	20 / 5	30 / 15	60 / -40	120 / 20	200 / 100	1/8” NPT F	Yes
A0050	15 / 0	30 / 15	50 / 35	100 / 0	200 / 100	350 / 250	1/8” NPT F	Yes
A0100	30 / 15	60 / 50	100 / 100	200 / 100	400 / 300	700 / 700	1/8” NPT F	Yes
A0200	50 / 50	100 / 100	200 / 200	400 / 400	800 / 800	1400 / 1400	1/8” NPT F	Yes
A0300	100 / 100	200 / 200	300 / 300	600 / 600	1200 / 1200	2000 / 2000	1/8” NPT F	Yes
A0400	130 / 130	260 / 260	400 / 400	800 / 800	1600 / 1600	2800 / 2800	1/8” NPT F	Yes
A0500	150 / 150	300 / 300	500 / 500	1000 / 1000	2000 / 2000	3500 / 3500	1/8” NPT F	Yes
A1000	300 / 300	600 / 600	1000 / 1000	2000 / 2000	4000 / 4000	7000 / 7000	1/8” NPT F	Yes
A1500	500 / 500	1000 / 1000	1500 / 1500	3000 / 3000	6000 / 6000	10000 / 10000	1/8” NPT F	No
A2000	600 / 600	1200 / 1200	2000 / 2000	5 / 5	9 / 9	14 / 14	1/8” NPT F	No
A3000	1000 / 1000	2000 / 2000	3000 / 3000	6 / 6	12 / 12	20 / 20	1/8” NPT F	No
A6000	2000 / 2000	4000 / 4000	6000 / 6000	13 / 13	25 / 25	40 / 40	1/8” NPT F	No
A10000	3000 / 3000	6000 / 6000	10000 / 10000	20 / 20	40 / 40	70 / 70	1/8” NPT F	No
A15000	5000 / 5000	10000 / 10000	15000 / 15000	30 / 30	60 / 60	100 / 100	1/4” HIP F	No
A20000	6000 / 6000	12000 / 12000	20000 / 20000	40 / 40	80 / 80	140 / 140	1/4” HIP F	No
A30000	10000 / 10000	20000 / 20000	30000 / 30000	60 / 60	120 / 120	200 / 200	1/4” HIP F	No
A40000	12000 / 12000	25000 / 25000	40000 / 40000	100 / 100	150 / 150	275 / 275	1/4” HIP F	No

1.3.2.2 On-Board Barometer

Sensor Technology Micro-machined silicon
Warm Up Time: None required
Resolution: 1.25 Pa (0.00018 psi)

➢ **The on-board barometer is not used as a source of absolute accuracy. It is used only to measure changes in atmospheric pressure for dynamic compensation of the atmospheric pressure offset when using an absolute reference pressure transducer to make gauge pressure measurements (see 3.4.1 AutoZ, PRINCIPLE).**

1.3.3 Configurations

MODEL 785 rear panel and internal schematic configurations vary depending on the number (1 or 2) and pressure ranges of the MODEL 785's RPT(s). For configuration purposes, RPTs are divided into three groups by range designation as follows:

RPT Group	RPT Designations	Test connection	SDS
1	A1000 or lower	1/8" NPT F	Yes
2	A1500 to A10000	1/8" NPT F	No
3	Greater than A10000	HIF HF4	No

In a single RPT MODEL 785, the RPT is referred to as the "Hi" RPT.

In a dual RPT MODEL 785, the higher designation RPT is referred to as the "Hi" RPT and the lower designation RPT is referred to as the "Lo" RPT.

Identify which RPT or RPTs your MODEL 785 is equipped with and refer to the corresponding sections:

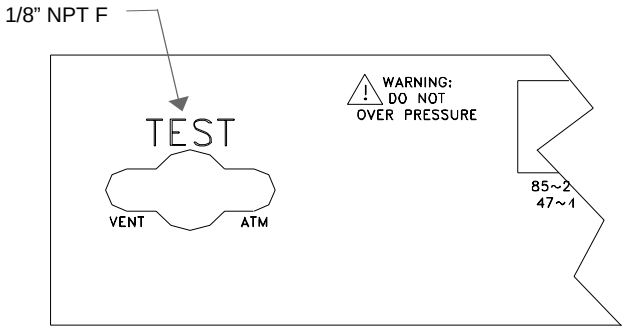
Part Number	Model 785 Configuration
• 1340-001	1 ea. 1000 psi or less RPT
• 1340-002	2 ea. 1000 psi or less RPTs
• 1340-003	1 ea. 1000 psi or less and 1 ea. 1500 psi to 10,000 psi RPTs
• 1340-004	1 or 2 ea. 1500 psi to 10,000 psi RPTs
• 1340-005	1 ea. 15,000 psi to 40,000 psi RPT

Part Numbers shown above are "Standard configurations. Other "Non-Standard configurations may be available, and (if applicable) are identified in appendix (see 7.4).

➢ **The designation of the RPT(s) with which an MODEL 785 is equipped is given on the Model 785 label and on the power up introduction screen.**

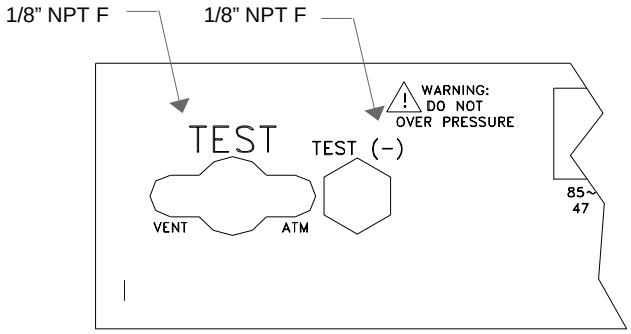
1.3.3.1 One or Two RPTs: Group 1 (≤A1000)

NUMBER OF TEST PORTS	HI RPT TEST PORT FITTING	LO RPT TEST PORT FITTING (IF 2 RPTs)	TEST (-) PORT FITTING (IF GXXXX RPT PRESENT)	SDS PROTECTION
1	1/8" NPT F	Uses same Test Port as HI RPT	1/8" NPT F	YES (On all RPTs)



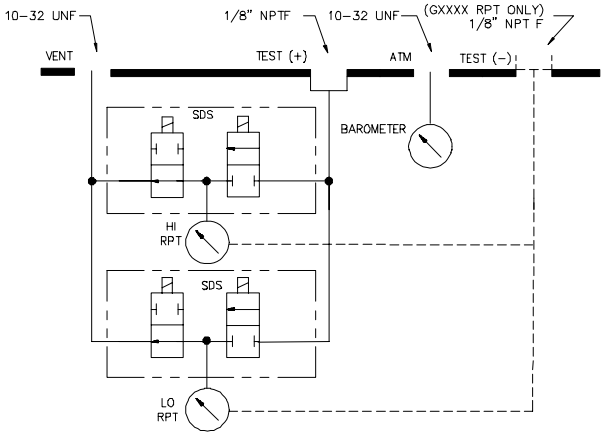
REAR PANEL:

P/N 1340-001 OR 1340-002



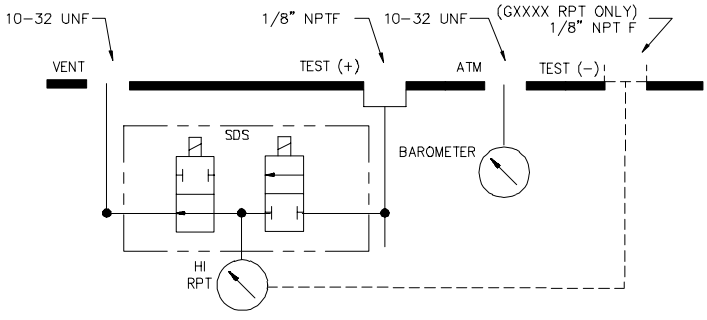
REAR PANEL:

P/N 1340-003 & 1340-006



SCHEMATIC:

P/N 1340-002

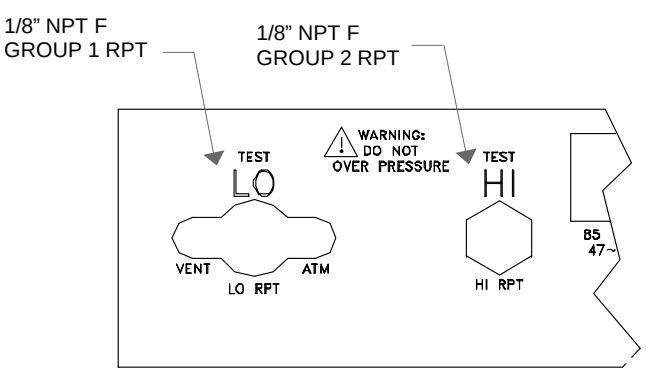


SCHEMATIC:

P/N 1340-001

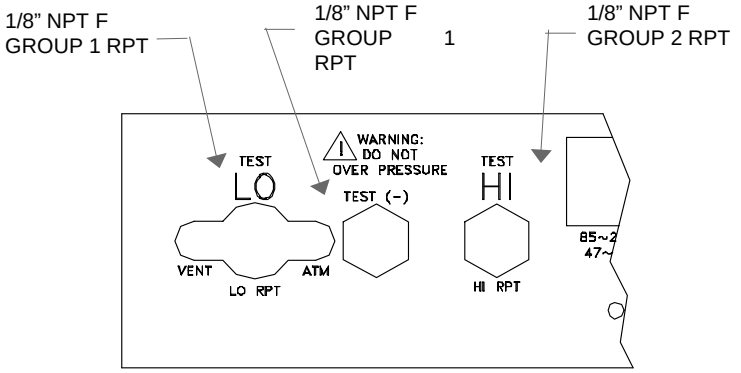
1.3.3.2 Two RPTs: One Group 1 (≤A1000) and One Group 2 (>A1000 and ≤A10000)

NUMBER OF TEST PORTS	HI RPT TEST PORT FITTING	LO RPT TEST PORT FITTING (IF 2 RPTs)	TEST (-) PORT FITTING (IF GXXXX RPT PRESENT)	SDS PROTECTION
2	1/8" NPT F	1/8" NPT F	1/8" NPT F	YES (On LO, Group 1 RPTs only)



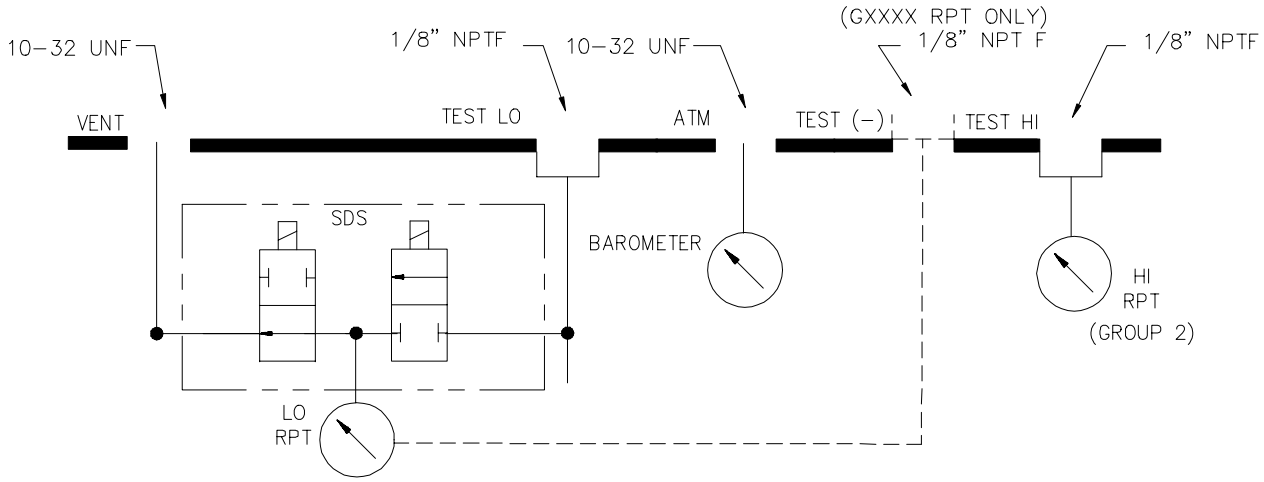
REAR PANEL:

P/N 1340-003 (ABSOLUTE) & 1340-006



REAR PANEL:

P/N 1340-003 (GAUGE)

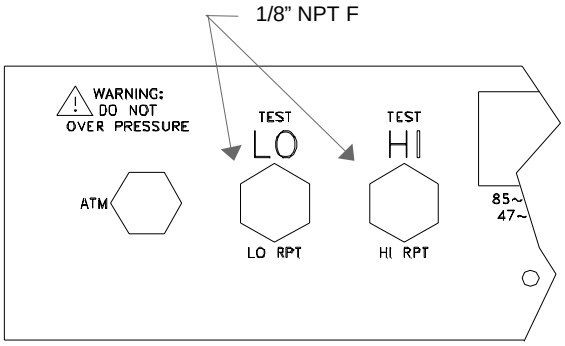


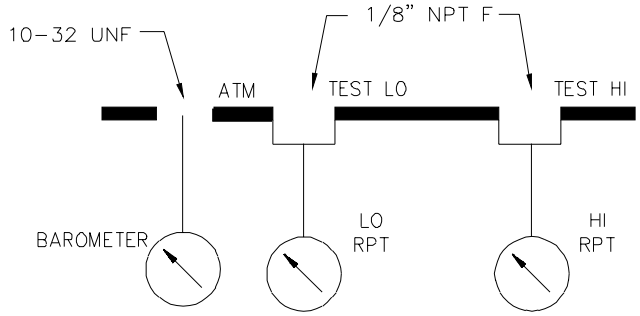
SCHEMATIC:

P/N 1340-003 & 1340-006

1.3.3.3 Two RPTs: Both Group 2 (>A1000 and ≤A10000)

NUMBER OF TEST PORTS	HI RPT TEST PORT FITTING	LO RPT TEST PORT FITTING (IF 2 RPTs)	SDS PROTECTION
2	1/8" NPT F	1/8" NPT F	NO





REAR PANEL:

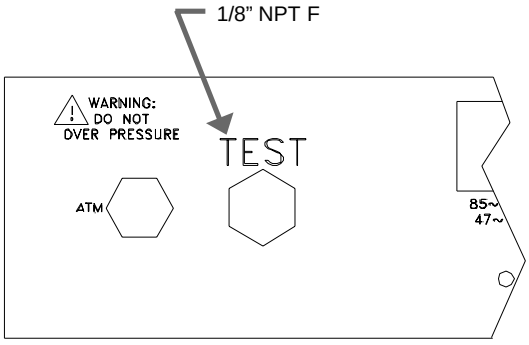
P/N 1340-004

SCHEMATIC:

P/N 1340-004

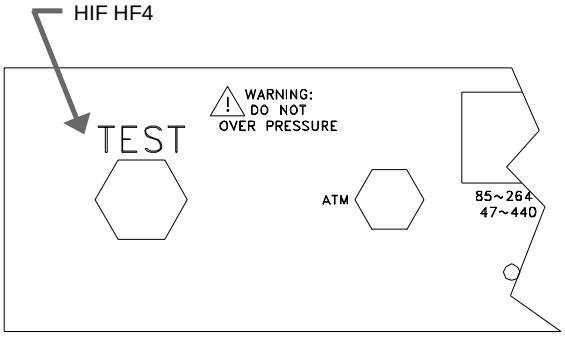
1.3.3.4 One RPT: Group 2 (>A1000 and ≤A10000) or Group 3 (>A10000)

NUMBER OF TEST PORTS	HI RPT TEST PORT FITTING	SDS PROTECTION
1	1/8" NPT F (If Group 2) HIF HF4 (If Group 3)	NO



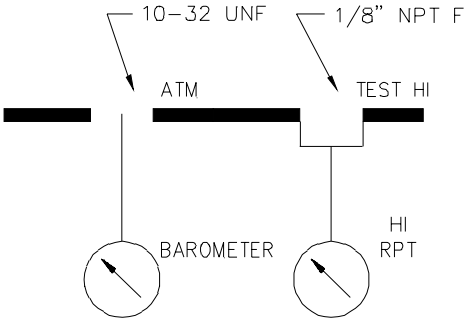
REAR PANEL:

P/N 1340-004



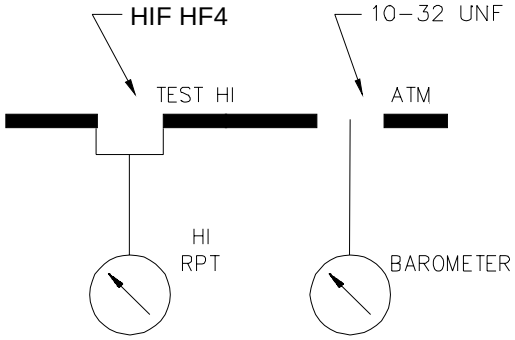
REAR PANEL:

P/N 1340-005



SCHEMATIC:

P/N 1340-004



SCHEMATIC:

P/N 1340-005

User Notes

2. INSTALLATION

2.1 UNPACKING AND INSPECTION

2.1.1 Removing from Packaging

Remove the MODEL 785 and its accessories from the shipping container and remove each element from its protective plastic wraping.

2.1.2 Inspecting Contents

Check that all items are present and have no visible damage.

A standard MODEL 785 includes:

Description
MODEL 785 Multi-Range Pressure Standard
Calibration Certificate
Accessories:
Operation and Maintenance Manual
Power Cord (7.5 ft.) 110v or 220v.
MODEL 785 CalTool Software
MODEL 785 CalTool Manual
MODEL 785 LabView Driver Software

2.2 SITE REQUIREMENTS

Install MODEL 785 on any stable surface at a convenient height. The front feet are extendible so that the unit can be inclined for easier viewing.

The MODEL 785 can also be mounted in a standard 19" rack mount using the optional rack mount kit.

Consider **appropriate access to the MODEL 785 rear panel** if TEST port connections may be changed frequently.

Support facilities required include:

- **An electrical power source** of 85 to 264 VAC, 47 to 440 Hz.

2.3 INITIAL SETUP

2.3.1 Preparing for Operation

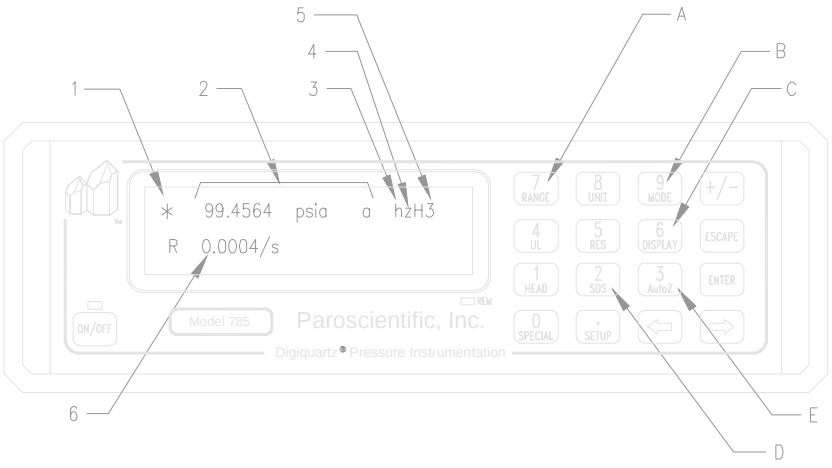
To prepare MODEL 785 for check out and operation:

- Remove the plastic caps from the MODEL 785 rear panel pressure connections.
- Remove the protective plastic sheet from the front panel display.
- Familiarize yourself briefly with the front and rear panels (see 2.3.2 Front and Rear Panels, 1.3.3 Configurations).

2.3.2 Front and Rear Panels

2.3.2.1 Front Panel

The front panel assembly provides a 2 X 20 vacuum fluorescent display of MODEL 785 operating status, a membrane keypad for local user interface and a “soft” on/off key.

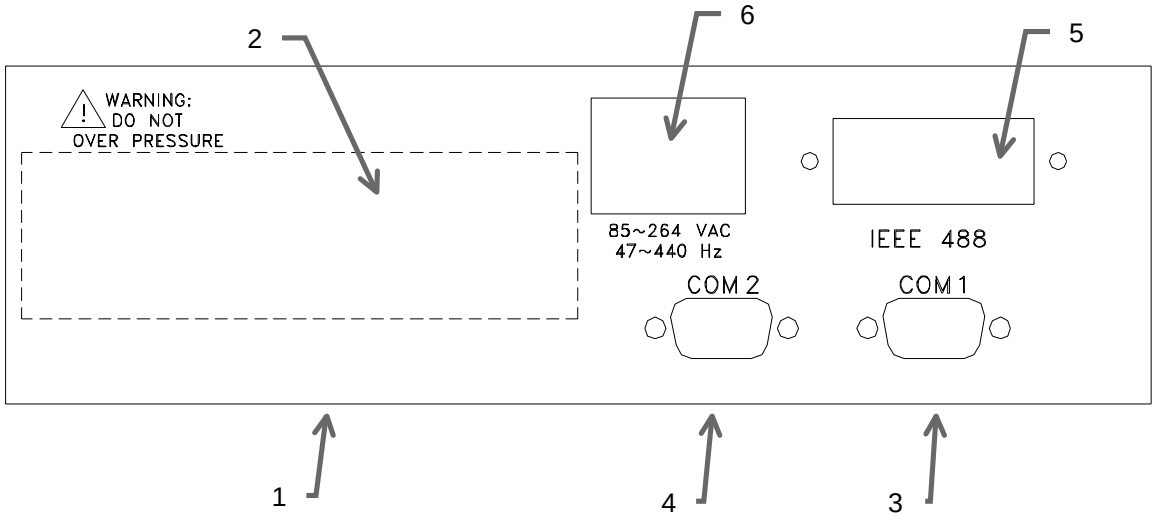


1. Ready/not ready indication based on user setable stability test.
2. Current pressure, pressure units and measurement mode.
3. Head correction on/off.
4. AutoZ on/off.
5. Current measurement range.
6. Special function display (average, rate, deviation, hi/low, freeze, leak test).

A. RANGE FUNCTION: Select between up to six ranges at the push of a button.
B. MODE Function: Change between gauge and absolute measurement modes at will without special equipment or procedures.
C. DISPLAY Function: Select special display functions including rate, deviation, average, hi/lo, freeze and clean.
D. SDS Function: Self Defense System to isolate and protect internal transducers from test system.
E. AutoZ Function: One step, intelligent rezeroing relative to a reference for improved stability over time.

2.3.2.2 Rear Panel

The rear panel assembly provides pressure connections, communications interfaces and the power connection module. Pressure fittings are internally secured to prevent loosening when making and breaking connections.



TEST PORT(S)

1. Label, Product (on bottom of case)
2. Pressure Port(s), layout depending on RPT configuration (see 1.3.3 Configurations)
3. COM1 Connector
4. COM2 Connector
5. IEEE-488 (GPIB) Connector
6. Electrical Power Connector (IEC320-C13)

2.3.3 Power Connection

- Connect the power cable to the rear panel power module.
- Do not connect the other end of the power cable to a power source yet.

➢ **MODEL 785 is always powered and active when power is supplied through the rear panel power connector. The front panel on/off key controls a "soft" on/off (see 3.1.2.3 "Soft" [On/Off] Key)**

2.3.4 TEST Port Connecting

Depending on the reference pressure transducer (RPT) configuration of the specific MODEL 785, the TEST port layout, Test port fittings and acceptable test medium differ (see 1.3.3 Configurations, 1.3.1 General Specifications).

Using a pressure hose or tube of appropriate pressure rating, connect the appropriate TEST port to the test system or supply from which pressure is to be measured. The MODEL 785 TEST port is either a 1/8" NPT F or a HIP HF4, high pressure fitting. Always use compatible male hardware of the same type. Use Teflon tape or another sealer to make 1/8" NPT connections.

If MODEL 785 is equipped with a gauge RPT (GXXXX), it has a TEST(-) port. The TEST(-) port is connected to the "low" side of the gauge RPT. This connection is normally left open to atmosphere. It can also be connected to the low side of a differential device that is being calibrated or tested. When measuring very low pressures, this may enhance the results by

helping assure that the MODEL 785 and the device under test reference ports are at the same pressure (see 1.3.3 Configurations).

USE THE CORRECT TEST PORT: Some MODEL 785s have more than one TEST port corresponding to more than one internal RPT. Before connecting an MODEL 785 TEST port to a pressure source, familiarize yourself with the RPTs, their pressure limits and their TEST port fittings (see 1.3.3 Configurations). In most cases, over-pressuring an RPT by more than 25% will damage it beyond repair.

USE THE CORRECT PRESSURE CONNECTORS: MODEL 785 TEST port fittings are either 1/8" NPT F or HIP HF4 (see 1.3.1 General Specifications). Never use fittings other than the corresponding male fittings in these connectors. Damage to the connectors and dangerous failure under pressure could result from using incorrect fittings.

NEVER connect a pressure source to the TEST(-) port . The pressure applied to this port should be maintained at standard atmospheric pressure ± 3 psi (20 kPa). Exceeding these limits may damage the RPT.

SDS Self Defense System: RPTs designated A1000 or lower include the SDS Self Defense System. SDS, operated properly, allows a Group 1 RPT TEST port (see 1.3.3 Configurations) to be left connected to a pressure up to 2000 psi (13 MPa) without damage to the RPT. Do not attempt to use SDS in this manner without first becoming thoroughly familiar with its operations and limitations (see 3.1.2.6 SDS Self Defense System, 3.2.8 [SDS] (SELF DEFENSE SYSTEM), 3.4.2 SDS).

2.3.4.1 The ATM and VENT Ports

The ATM pass through is connected to the on-board barometer. This connection assures that the on-board barometer actually measures ambient atmospheric pressure rather than the pressure inside the MODEL 785 case that may vary slightly from ambient pressure. The ATM port should be left open and unobstructed.

The VENT port is only present on MODEL 785s equipped with SDS Self Defense System (Group 1 RPTs only) (see 1.3.3 Configurations, 3.1.2.6 SDS Self Defense System). The VENT port is connected to the SDS vent valve to assure that any gases vented through SDS escape outside the MODEL 785 case. A connection may be made to the VENT port to direct these gases if desired but the port must not be obstructed. Obstructing the VENT port may interfere with SDS operation.

NEVER plug or obstruct the ATM pass through as this may adversely affect gauge mode operation and autozeroing on an absolute transducer

NEVER plug or obstruct the VENT pass through as this may interfere with SDS operation and RPT autozeroing (see 3.1.2.6 SDS Self Defense System).

2.4 POWER UP AND VERIFICATION

2.4.1 Apply Power

Connect the MODEL 785 power cable to an electric supply of 85 to 264 VAC (47 to 440 Hz). Observe the front panel display as MODEL 785 initializes, error checks and goes to the main run screen (see 3.1.1 The Main Run Screen).

- **MODEL 785 is always powered and active when power is supplied through the rear panel power connector. The front panel on/off key controls a "soft" on/off (see 3.1.2.3 "Soft" [On/Off] Key**).

If the MODEL 785 fails to reach the main run screen, service is required. Record the sequence of operation and displays observed.

- **Any SDS present in MODEL 785 is active at power up. This causes SDS to flash over the measured pressure (see 3.1.2.6 SDS Self Defense System).**

- **The active range on power up is the same as the range that was active at the last power down (see 3.1.2.5 Multiple Pressure Ranges).**

2.4.2 Check Proper Pressure Measurement Operation

2.4.2.1 Checking Absolute Mode Pressure Measurement

If the MODEL 785 has an absolute RPT (designated AXXXX), check that it operates properly in absolute mode.

Make sure that the TEST port of the RPT is open to atmosphere.

Use **[RANGE]** to change ranges if necessary (see 3.2.1 [RANGE), select a range of the absolute RPT.

Press **[MODE]** and select absolute mode (available on AXXXX RPTs only). Change the pressure unit if desired (see 3.2.2 [UNIT]).

If SDS is on (SDS flashes over the pressure indication on the top display line), turn SDS off. Press **[SDS]** and select **<2 Yes>** to defeat SDS (see 3.2.8 [SDS] (SELF DEFENSE SYSTEM).

- **Do not defeat SDS with a pressure higher than the active range maximum applied to the TEST port. Damage to the RPT may result.**

Observe the current value of atmospheric pressure. Check that the value agrees with the local value of atmospheric pressure within measurement tolerances. Repeat this process for all the ranges on both RPTs if the MODEL 785 has two absolute RPTs. Check that the values of atmospheric pressure measured by the different ranges agree with each other within MODEL 785 measurement tolerances (see 1.3.2 Pressure Measurement Specifications). If they do not agree within tolerances, MODEL 785 may need calibration or repair.

2.4.2.2 Checking Gauge Mode Pressure Measurement

Make sure that the TEST port(s) of the RPT(s) is/are open to atmosphere.

Use **[RANGE]** to change ranges if necessary (see 3.2.1 [RANGE]), select a range of the RPT.

Press **[MODE]** and select gauge mode. Change the pressure unit if desired (see 3.2.2 [UNIT]).

If SDS is on (SDS flashes over the pressure indication on the top display line), turn SDS off. Press **[SDS]** and select **<2 Yes>** to defeat SDS (see 3.2.8 [SDS] (SELF DEFENSE SYSTEM)).

Do not defeat SDS with a pressure higher than the RPT maximum applied to the TEST port. Damage to the RPT may result.

The value indicated should be near zero (+/- 6 psi, 35 kPa). Press **[AutoZ].** This runs AutoZ to zero the range (see 3.2.9 [AutoZ]). Upon return to the main run screen, observe that the indication of measured pressure has zeroed.

Use **[RANGE]** to change ranges, repeat the zeroing process for each range.

If a range fails to zero properly, MODEL 785 may need repair.

- **The MODEL 785 will normally indicate a value other than zero when vented when gauge mode is first entered or ranges are changed, especially if AutoZ is off and/or MODEL 785 has been off for some time or its location has changed.**

2.5 SHORT TERM STORAGE

The following is recommended for short term storage of MODEL 785:

- Vent the MODEL 785 TEST port.
- Disconnect the power supply.

When the MODEL 785 will not be used for some time, it may be left powered, but use the “soft” on/off key to turn off the display.

3. OPERATION

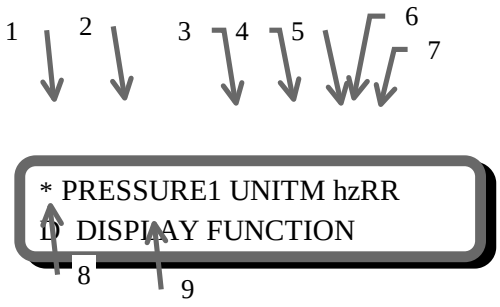
3.1 GENERAL/MANUAL OPERATION

MODEL 785 is designed to offer the optimum balance between simple, straight forward operation and the availability of a wide variety of functions with a high level of operator discretion if desired. The local operator interface is through a 2 X 20 character alpha-numeric display and a 4 X 4 multi-function keypad.

3.1.1 The Main Run Screen

The MODEL 785 main run screen is its home display that is reached on power up and from which other functions and menus are accessed. It is the top level of all menu structures.

The main run screen is where the MODEL 785 is left in normal operation. It displays the current measured pressure as well as a variety of additional information if desired.



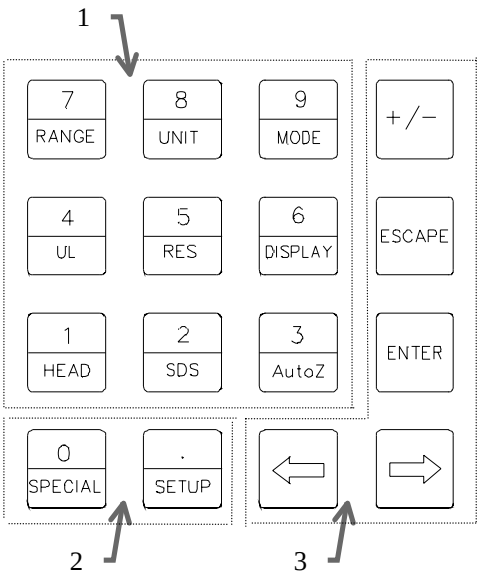
1. **<*>** Ready/not ready indication, **<*>** when ready, **<↑>** or **<↓>** indicating direction of measured pressure evolution when not ready . (see 3.1.2.4 Pressure Ready/Not Ready Indication).
2. **<PRESSURE1>:** Numerical value and sign of pressure measured by active RPT and range. Shows result of last average in "average" display mode (see 3.2.6.1 Avg (Average)).
   <SDS**>** To indicate when SDS is "on" (see 3.1.2.6 SDS Self Defense System) for the active RPT, **SDS** is displayed alternating with PRESSURE1.
3. **<UNIT>** Current unit of measure (see 3.2.2 [UNIT).
4. **<M>** Pressure measurement mode: **<g>** for gauge, **<a>** for absolute (see 3.2.3 [MODE, 3.2.2 [UNIT).
5. **<h>:** Indicates whether a head correction is applied. **h** if applied, blank if not (see 3.2.7 [HEAD).
6. **<z>:** Indicates whether the autozero function is on or off. **z** if on; blank if off (see 3.4.1 AutoZ, PRINCIPLE)
7. **<RR>:** Indicates active RPT (**H** = high, **L** = low) and range (**1** = low, **2** = mid, **3** = hi) (see 3.2.1 [RANGE]).
8. **<D>:** Indication of what is being displayed on the bottom line of the display as set by the DISPLAY function (see 3.2.6 [DISPLAY]). Choices include:
   - **<σ>:** Current DISPLAY mode is "average" (see 3.2.6.1 Avg (Average)).
   - **<R>:** Current DISPLAY mode is "rate" (see 3.2.6.2 Rate); or if **<n avg>** is in the bottom right hand corner of the display, current DISPLAY mode is "average" and this is the instantaneous reading average screen (see 3.2.6.1 Avg (Average)).
   - **<H>:** Current DISPLAY mode is "hi/lo" (see 3.2.6.5 Hi/Lo).
   - **<D>:** Current DISPLAY mode is "deviation" (see 3.2.6.3 Dev (Deviation))
   - **<∗>**, **<↑> or <↓>:** Current DISPLAY mode is "RPT" (see 3.2.6.4 RPT).
   - **<F>:** Current DISPLAY mode is "freeze" (see 3.2.6.6 Freeze).
   - **Blank, no character:** Current DISPLAY mode is "clean" (see 3.2.6.7 Clean).
9. **<DISPLAY FUNCTION>**: Information displayed depends on current display function.

➢ **MODEL 785 has a screen saver function that causes the display to dim if no key is pressed for 10 minutes. Pressing a key restores full power to the display. The screen saver activation time can be changed or screen saving can be completely suppressed *(see 3.4.7.1* ScrSav*).***

3.1.2 General Operating Principles

3.1.2.1 Keypad Layout and Protocol

The MODEL 785 has a 4 X 4 keypad for local operator access to direct functions, function menus and for data entry.



KEYPAD

1. **The Function/Data keys** allow very commonly used functions to be accessed directly from the main run screen by a single keystroke. The name of the function is on the bottom half of the key (see 3.1.2.7 Direct Function Keys Summary). These keys enter numerical values when editing.
2. **The Menu/Data keys** provide access to function menus from the main run screen. The menu name is on the bottom half of the key. The SETUP menu is for more frequently used functions (see 3.3 [SETUP] MENU KEY). The SPECIAL menu is for functions that are not generally used as a part of day to day operation (see 3.4 [SPECIAL] MENU KEY). These keys enter numerical values when editing.
3. **The Editing and Execution keys** are for execution, suspending execution, backing up in menus and editing entries.

Key press confirmation is provided by both tactile and audible feedback. A single tone confirms a valid entry, a descending two note tone signals an invalid entry. The audible valid entry feedback can be suppressed or modified using **[SPECIAL]**, **<7Intern>, <2sound>** (see 3.4.7.2 Sound).

The **[ENTER]** key generally causes execution or forward movement in the menu tree.

The **[ESCAPE]** key moves back in the menu tree and/or causes execution to cease or suspend without changes being implemented. Pressing **[ESCAPE]** repeatedly eventually returns to the main run screen. From the main run screen, pressing **[ESCAPE]** allows momentary viewing of the MODEL 785 introduction screen.

The **[+/-]** key changes a numerical sign when editing. It also toggles through multiple screens when available.

The **[←]** and **[→]** keys allow reverse and forward cursor movement when editing data entry. They are also used to scroll through choices.

- **Some screens go beyond the two lines provided by the display. This is indicated by a flashing arrow in the second line of the display. Use [←] and [→] to move the cursor to access the lines that are not visible or directly enter the number of the hidden menu choice if you know it.**

3.1.2.2 Sounds

MODEL 785 is equipped with a variable frequency tone device to provide audible feedback and alarms. The beeper is used for the following indications.

1. Valid key press - Brief beep. Choice between three frequencies or no sound is available (see 3.4.7.2 Sound).
2. Invalid key press - Descending two tone “blurp”.
3. Leak check routine completed - Three two second beeps (see 3.3.5 Leak (Leak Check)).
4. UL (upper limit) exceeded - Intermittent one second beeps (see 3.2.4 [UL] (UPPER LIMIT)).
5. Pmax! (overpressure limit) exceeded - Eight second high frequency beep (see 3.2.4.1 Over-pressure Function (Pmax!)).

3.1.2.3 “Soft” **[On/Off]** Key

MODEL 785 is equipped with a “soft” **[on/off]** key and indicator LED on the bottom left hand corner of the front panel. The purpose of the soft on/off key is to put MODEL 785 into a dormant mode in which the display is turned off but power is still supplied and SDS and overpressure functions are still active. When MODEL 785 is on, the on/off indicator is on continuously. When MODEL 785 is soft off, the on/off indicator blinks every five seconds.

The soft **[on/off]** key can also be used to reset from an overpressure condition (see 3.2.4.1 Over-pressure Function (Pmax!)).

When MODEL 785 is soft off, receiving a remote command turns it on.

Turning MODEL 785 soft “off” does NOT turn SDS “on”. Do not assume that SDS is on when an MODEL 785 is soft “off”. Disconnecting power completely turns SDS on (see 3.1.2.6 SDS Self Defense System).

3.1.2.4 Pressure Ready/Not Ready Indication

The character to the left of the measured pressure on the main run screen provides a pressure "Ready/Not Ready" indication. This indication is intended to provide the user with a clear and objective indication of when a stable pressure has been achieved. Ready is indicated when the current stability (rate of change) of pressure is less than the stability limit. The user can set the stability limit (see 3.3.4 Stab (Stability)) The ready indication is often used when comparing the MODEL 785 and a test device to indicate when a valid reading can be made.

Ready/Not Ready character indications are:

- **<*> :** Pressure "ready" (stable).
- **<↓>:** Pressure "not ready" (unstable) and decreasing.
- **<↑>**: Pressure "not ready" (unstable) and increasing.

3.1.2.5 Multiple Pressure Ranges

MODEL 785 has one or two reference pressure transducers (RPT) each of which has three ranges for a total of three or six pressure ranges. This multi-ranging feature allows accuracy to be optimized for the range of pressure in which you are working. Generally, the best range to select (see 3.2.1 [RANGE) is that whose full scale is closest to, but greater than, the maximum pressure of the device or system under test.

MODEL 785 handles all of the data operations needed to make range changes occur transparently to the user when the RANGE function is used for range selection. For a range change to be executed, the current pressure applied to the RPT on which the range is being selected must be lower than the current upper limit (UL) of that range (see 3.2.4[UL] (UPPER LIMIT)).

When ranges are changed, the upper limit is automatically changed to the default for that range or to the last upper limit set for that range. In addition, most other functions and settings are range specific (see 3.2.1 [RANGE, RANGE SPECIFIC FUNCTIONS AND SETTINGS).

- **Each MODEL 785 has three or six ranges. In general, settings and operational adjustments are specific to the range currently in use, as if you had six instruments rather than one. The DISPLAY function, HEAD functions and AUTO READRT function are NOT range specific. In remote mode, most settings are RPT specific rather than range specific (see4.3 REMOTE COMMAND SYNTAX AND STYLE).**

- **MODEL 785 internal pressure schematics and rear panel TEST port configurations change depending on the number of RPTs and their ranges (See 1.3.3 Configurations for details on possible MODEL 785 configurations).**

RANGES AND IDENTIFICATION

The currently active RPT and range is continuously indicated in the upper right hand corner of the main run screen and most other screens (see 1.3.2 Pressure Measurement Specifications for complete listing of the RPTs available and their ranges)

Hi RPT: The RPT in a single RPT MODEL 785 or the RPT with the highest maximum range in a dual RPT MODEL 785 is referred to as the Hi RPT.

Lo RPT: The RPT with the lower maximum range in a dual RPT MODEL 785 is referred to as the Lo RPT.

Range 1, 2 or 3: The three ranges of an RPT are referred to as 1 = lo range, 2 = mid range, 3 = hi range.

MODEL 785 RANGE IDENTIFICATION SUMMARY		
Reference Pressure Transducer and Range	**Designation**	**Display Symbol ***
Lo RPT, Lo range	Lo, 1	L1
Lo RPT, Mid range	Lo, 2	L2
Lo RPT, Hi range	Lo, 3	L3
Hi RPT, Lo range	Hi, 1	H1
Hi RPT, Mid range	Hi, 2	H2
Hi RPT, Hi range)	Hi, 3	H3

* The display symbol is included in the upper, right hand corner of most MODEL 785 menu displays as a convenient indicator of active range.

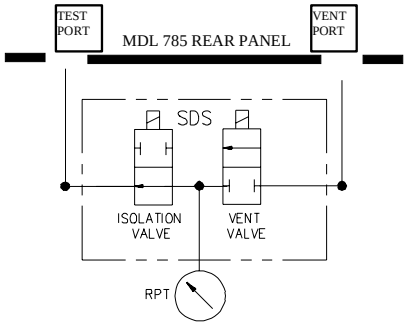
3.1.2.6 SDS Self Defense System

RPTs designated A1000 or lower are equipped with the SDS self defense system. The SDS system includes hardware and embedded software logic to protect RPTs from overpressure. When SDS is "on" for an RPT, that RPT is isolated from the MODEL 785 TEST port and opened to the VENT port (See SDS Schematic below and 1.3.3 Configurations and 5.6.1.1 SDS).

In dual RPTs with a single TEST port, SDS is used to protect the Lo RPT from overpressure when the high RPT is in use.

MODEL 785 internal logic uses SDS to protect against accidental overpressure. Whenever MODEL 785 is on (or in soft "off" mode) it monitors the pressure read by its RPTs. If the pressure reaches the maximum pressure limit for a range, SDS will activate automatically to isolate the RPT from the TEST port and vent it to atmosphere.

SDS can also be used to isolate an MODEL 785 from a test system which may sometimes be subjected to pressures higher than the MODEL 785s maximum pressure. When configuring a multi-range system, this can eliminate the need for external valving or connecting and disconnecting MODEL 785s. When used in this manner, SDS should be activated prior to applying pressure. Automatic SDS activation should only be used in an emergency overpressure situation.



SDS "ON": ISOLATION Closed
VENT Open

SDS "OFF" (DEFEATED): ISOLATION Open
VENT Closed

The maximum pressure that should be applied to an MODEL 785 TEST port when SDS is "on" is 1000 psi (6.9 MPa).

Though the SDS self defense system includes features to automatically protect RPTs against accidental overpressure, SDS should not be considered a fail-safe overpressure protection system. SDS cannot guarantee that overpressure damage will not occur. SDS automatic activation may protect an RPT in case of accidental overpressure but conventional measures for protecting against overpressure should also always be followed. Damage to RPTs due to overpressure is not covered by the MODEL 785 product warranty even when SDS is present.

3.1.2.7 Direct Function Keys Summary

Local operation of MODEL 785 is through the 4 X 4 pressure sensitive keypad. To minimize the use of multi-layered menu structure, the 4 X 4 keypad numerical keys also provide direct access to the most commonly used functions. The function accessed is labeled on the bottom half of the keys. Direct function keys are active whenever MODEL 785 is in its main run screen. The table on the following page summarizes the operation of the direct function keys.

➢ **The table on the following page provides a brief summary of direct function key operation. It may be useful to keep a copy of this summary near the MODEL 785, especially when first becoming acquainted with its operation.**

SUMMARY OF MODEL 785

DIRECT FUNCTION KEY OPERATION

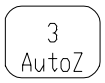
Direct function keys are active from the main run screen.
See corresponding manual sections for full detail.

Menu of commonly used setup features including run LEAK CHECK.

Menu of less frequently used internal functions and settings.

Adjust height of fluid head correction. Set to zero to defeat head correction.

Turn SDS (Self Defense System) on/off (if present). SDS on is indicated by flashing **<***SDS***>**. SDS must be turned off to measure pressures applied to TEST port. Use with caution as turning SDS off with overpressure on test port could damage RPT.



Runs AutoZ to “rezero” active range. Should be used in gauge mode whenever vented.

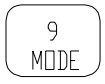
View/adjust upper limit.

Adjust display resolution of measured pressure and other indications and settings.

Select DISPLAY function for second line of MODEL 785 display. Choices include average, rate, other RPT, Hi/Lo, Deviation, Freeze, Clean.

View/Select ranges. Shows active range and then toggles through available ranges. **[ENTER]** on a range activates it.

Change pressure measurement unit. Choice of units can be customized



Change pressure measurement mode (gauge, absolute).

3.2 DIRECT FUNCTION KEYS

3.2.1 [RANGE]

PURPOSE

To view and/or change the active pressure measurement range.

PRINCIPLE

Each MODEL 785 has three or six ranges (see 3.1.2.5 Multiple Pressure Ranges).

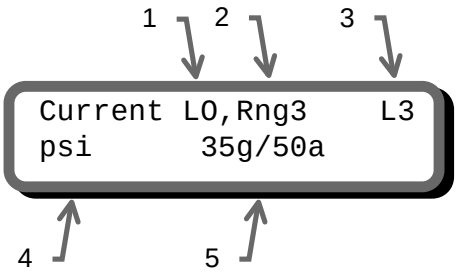
The **[RANGE]** key allows the range values to be viewed and a range selection to be made.

Most MODEL 785 settings such as pressure unit of measure (UNIT) and measurement mode (MODE), are range specific. Changes made while in one range apply to that range only and do not affect the other ranges (see Range Specific Functions and Settings below).

OPERATION

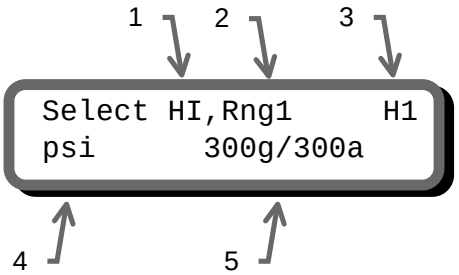
Pressing **[RANGE]** activates the range viewing and selecting function. Pressing **[RANGE]** key again or **[+/-]** while in the RANGE function steps through displays of available ranges, Lo to Hi.

When **[RANGE]** is first pressed, the active reference pressure transducer (RPT) and range are displayed, for example:



1. Identifies active RPT(Lo or Hi).
2. Identifies active range (1, 2 or 3) of the active RPT.
3. Range designator.
4. Unit of measure (the unit of measure currently active for this range).
5. Full scale pressure value in the current units for the RPT and range when used in gauge (g) or absolute(a) mode. If the RPT is a gauge only RPT there is no absolute (a) range indicated.

Pressing **[RANGE]** again or **[+/-]** causes the screen to step through the other available ranges in sequence Lo to Hi, for example:



1. Identifies RPT (Lo or Hi).
2. Identifies range of the RPT (1, 2 or 3).
3. Range designator.
4. Units of measure (the unit of measure currently active for the range).
5. Full scale pressure value in the active units of measure for the RPT and range number when used in gauge (g) or absolute (a) mode. If the RPT is a gauge only RPT there is no absolute (a) range indicated.

- **Range full scale limits are given in the pressure unit that is currently active for that range.**

Pressing **[ENTER]** while in the RANGE function causes the MODEL 785 to attempt to change the active range to the range currently displayed. If the pressure currently applied to the RPT with the new range is less then the current upper limit of that range (see 3.2.4[UL] (UPPER LIMIT)), the range change will be completed.

Pressing **[ESCAPE]** while in the range function returns to the main run screen without changing ranges.

For a range change to occur, the pressure currently measured by the new range RPT must be less than the current upper limit (see 3.2.4 [UL] (UPPER LIMIT)) of the new range. If this condition is not met when a range change is attempted, a warning message is displayed and the range change is not completed. Reduce the pressure applied to the TEST port and reattempt the range change. It is, however, possible to make a range change from RPT to another with pressure applied to the current RPT. If both RPTs are on a common TEST port, be sure to reduce pressure on the TEST port before making the range change.

SDS AND RANGE CHANGES

Changing ranges causes the active RPT to change from the Lo RPT to the Hi RPT or vice-versa, SDS will be turned “on” for the RPT that is being changed from. This leaves the inactive RPT with SDS “on” so that it is protected

When changing ranges causes the active RPT to be changed, if the new active RPT is equipped with SDS, SDS will almost certainly be “on” when the new range is activated (as indicated by the flashing SDS alternating with the pressure display). To open the RPT to the TEST port SDS must be turned “off” using the SDS function key (see 3.2.8 SDS Self Defense System).

RANGE SPECIFIC FUNCTIONS AND SETTINGS

In general, MODEL 785 functions and settings are range specific. They are set and stored for each range so that changing settings when in one range does not change settings in the other ranges. When returning to a range, settings are be the same as they were when the range was left.

Functions and settings that are NOT range specific are:

- **Functions:** HEAD (See 3.2.7 [HEAD), DISPLAY (See 3.2.6 [DISPLAY]).
- **Setup Menu:** 3ReadRt (see 3.3.3 ReadRt (Read Rate))

➢ **In remote mode, most settings are RPT specific rather than range specific (see4.3 REMOTE COMMAND SYNTAX AND STYLE).**

3.2.2 [UNIT]

PURPOSE

To specify the pressure unit of measure for the active range.

➢ **See also 3.2.3 [MODE].**

PRINCIPLE

MODEL 785 allows the pressure measurement unit for a range to be changed. Internally, MODEL 785 always operates in Pascal (Pa), the SI unit of pressure. Values of pressure are represented in other units by the application of conversion factors to convert from Pa (see 7.1 PRESSURE UNIT CONVERSION).

The pressure measurement unit selection (e.g. psi, kPa, etc.) is separate from the pressure measurement mode selection (gauge or absolute). See 3.2.3 [MODE for information on changing the measurement mode.

OPERATION

To change the pressure measurement unit for the active range, press the **[UNIT]** function key. The display is:

```
1psi  2inWa  3inHg H3
4kPa  5mmHg  6kcm2
```

The cursor is on the number corresponding to the active unit for the active range. To change the pressure unit for the active range, select the desired unit. The display returns to the main run screen with the selected unit active.

If the pressure unit selected is inWa the reference temperature for water density must be specified. When inWa is selected as the unit, the next display is:

```
Select inWa ref temp
 4°C    20°C    60°F
```

Select the desired reference temperature for water density using **[←]** or **[→]** key to move the cursor. **[ENTER]** returns to the main run screen with inWa based on water density at the selected reference temperature as the pressure unit. The current inWa reference temperature can be viewed by observing the position of the cursor in the reference temperature screen. Reference temperature for inch of water units is NOT range specific.

- **No reference temperature selection is necessary for the unit mmWa as the only reference temperature commonly used for mmWa is 4° C.**

- **The pressure measurement unit selected is range specific. When in a given range, all functions and settings are represented in the current measurement unit for that range. However, certain internal and/or metrological functions (e.g. RPT calibration coefficients) are always represented in Pa regardless of the active range unit. In addition, when the current unit is an altitude unit, the range and upper limit indications are in kPa if the unit is meters (m) and in psi if the unit is feet (ft).**

- **See 7.1 PRESSURE UNIT CONVERSION for tables of the conversion factors used by MODEL 785.**

- **The UNIT function provides rapid access to a choice of six units. The choice of units can be customized from a wider selection by the user (see 3.3.2 PresU). The default six units of the UNIT function depend on whether the MODEL 785 is set up as a US or SI version (indicated by "us" or "si" in the bottom right hand of the MODEL 785 introduction screen). To return the six units of the UNIT function key to default see 3.4.5.2 Reset - units.**

3.2.3 [MODE]

PURPOSE

To set the measurement mode (gauge or absolute) for the active range..

- **See also 3.2.2 [UNIT].**

OPERATION

RPTs designated AXXXX can be used by MODEL 785 to measure absolute or positive and negative gauge pressure. AXXXX RPTs have an evacuated and sealed reference so that they always measure absolute pressure. MODEL 785 supports extensive on-board measurements and logic to precisely subtract atmospheric pressure from absolute pressure when gauge pressure measurements are desired. A separate on-board barometer and unique atmospheric compensation system are used to assure highly accurate gauge pressure values even if atmospheric pressure changes between zeroing opportunities (see 3.4.1 AutoZ, PRINCIPLE, Gauge Mode with an Absolute RPT, Dynamic Compensation for Atmospheric Pressure). This allows simple, one step switching between gauge and absolute measurement modes without special procedures or hardware.

RPTs designated GXXXX are referenced to atmospheric pressure. GXXXX RPTs are only used to measure gauge pressures. They do not support absolute measurement mode.

OPERATION

To change the pressure measurement mode for the active range, press **[MODE]**. The display is:

```
Measurement mode:  H1
1absolute 2gauge
```

The cursor is on the number corresponding to the current measurement mode. Making a measurement mode selection returns to the main run screen with the selected mode active.

- **If a measurement mode change is not currently possible (if the active RPT is gauge only or if the current pressure unit is an altitude unit which can only be absolute), an error message displays when [MODE] is pressed.**

- **When going from absolute to gauge measurement mode, the AutoZ function should be used to update the atmospheric pressure offset (see 3.2.9 [AutoZ, 3.2.9.2 Running AutoZ in Absolute Measurement Mode, 3.4.1 AutoZ, PRINCIPLE, Gauge Mode with an Absolute RPT, Dynamic Compensation for Atmospheric Pressure).**

3.2.4 [UL] (UPPER LIMIT)

PURPOSE

To set the upper limit value for the active range and measurement mode.

PRINCIPLE

The UPPER LIMIT function provides the user with a setable pressure limit at which an alarm will sound.

When the upper limit is reached the MODEL 785's beeper sounds intermittently.

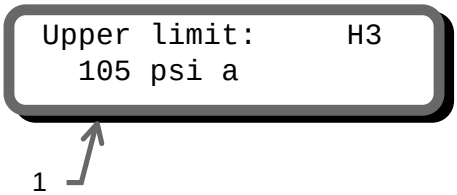
The UPPER LIMIT function has two purposes. First, when UL is set to its default value, it serves as a warning that the maximum pressure of the active range is about to be exceeded. Second, UL can be set by the user to a lower value than the default value to provide an alarm that a specific pressure limit has been exceeded. This feature is often used to help protect an external device or system on which MODEL 785 is being used to measure pressure. For example, it might be set just over the full scale of a device under test (DUT) that is being calibrated.

Upper limit settings are specific to each range ***and measurement mode (gauge or absolute)***.

- **The UL function is separate and different from the over-pressure (Pmax!) function. The Pmax! function is not adjustable and activates regardless of UL setting when the maximum acceptable pressure for the active RPT range has been exceeded (see 3.2.4.1 Over-pressure Function).**

OPERATION

When **[UL]** is pressed from the main run screen the display is:



1. Edit field to view current upper limit value and modify if desired.

Enter the desired upper limit value and MODEL 785 returns to the main run screen with the new upper limit value active.

When the upper limit has been exceeded, the display of current pressure flashes and the beeper sounds three times for two seconds. Reduce the pressure applied to the RPT to less than the upper limit to return to normal operation. For RPTs equipped with SDS, the SDS function can be used to isolate the RPT from the TEST port and rapidly vent it to atmosphere (see 3.1.2.6 SDS Self Defense System, 3.2.8 [SDS] (SELF DEFENSE SYSTEM)).

- **Default upper limit values are 105% of the range full scale for ranges 1 and 2 and 102% FS for range 3. If the range full scale is less than or equal to atmospheric pressure the default UL is just over atmospheric pressure to avoid exceeding UL when open to atmosphere. Upper limit values may be adjusted by the user. The adjusted value must be lower than or equal to the default value and lower then the current measured pressure.**

Upper limit values are specific to each range *and measurement mode*. Do not assume that the upper limit set in one measurement mode will apply to the other. For example, if you set 17 psi as the upper limit in gauge mode, the upper limit will not be 17 psi or the equivalent absolute pressure in absolute mode. The upper limit setting in one mode has no affect on the upper limit setting in another mode.

- **Upper limit values are always specified and displayed in the current pressure unit except for altitude units. When in altitude units, upper limits are expressed in kPa if the altitude unit is meters (m) and psi if the altitude unit is feet (ft).**

- **[RANGE] is disabled so range changes cannot be made when the upper limit is exceeded.**

3.2.4.1 Over-pressure Function (Pmax!)

In addition to the UL (Upper Limit) function, MODEL 785 has an over-pressure function (Pmax!). Whereas the UL function is a setable alarm to assist the operator in monitoring a pressure limit, Pmax! is a fixed limit intended as a warning that the maximum pressure acceptable for a range has been exceeded and damage to the MODEL 785 may be imminent. The Pmax! function activates when the maximum acceptable pressure for the current range on the active or inactive RPT has been exceeded. When the overpressure function activates because Pmax! has been exceeded:

- The beeper sounds continuously at high frequency for 8 seconds. **<Rng "RR" RPT EXCEEDED PMAX>** and overpressure value display toggles with normal run screen ("RR" identifies the range that has exceeded Pmax!, e.g. L1, H3, etc.; the overpressure value is always in absolute pressure for an AXXXX RPT and gauge for a GXXXX RPT).
- **<!!!Pmax!!!>** displays in the main run screen instead of the measured pressure so long as the pressure read by the active RPT exceeds Pmax!
- The **[SDS]** and **[RANGE]** keys are disabled and display error messages when pressed
- SDS activates if present.
- The overpressure condition is logged.

To recover from an overpressure condition, remove the overpressure source and then clear the overpressure condition by cycling MODEL 785 power using the soft **[on/off]** key (See 3.1.2.3 "Soft" [On/Off] Key) or by disconnecting and reconnecting the power cable. The overpressure message will continue to display until the overpressure condition has been cleared by cycling power.

- **The overpressure function monitors both the active and inactive RPT. When an overpressure occurs, check the <Rng "RR" RPT exceeded> message to determine which RPT and range has been overpressured.**

- **Pmax! values are 110% of the range full scale for ranges 1 and 2 and 104% of the range full scale for range 3. On absolute RPTs (AXXXX), Pmax! Is always in absolute and relative to the absolute range. In some cases, atmospheric pressure is added to Pmax! to accommodate the gauge mode equivalent of the absolute range.**

When Pmax! is exceeded, <!!!Pmax!!!> displays on the MODEL 785 display top line where the current pressure is normally displayed because the actual pressure applied can no longer be indicated reliably.

3.2.5 [RES] (RESOLUTION)

PURPOSE

To set the resolution with which measured pressures and other indications and settings are displayed.

PRINCIPLE

The resolution with which the pressure measured by MODEL 785 is displayed can be adjusted. This feature can be used to reduce the resolution when lower precision measurements are being made and additional digits might confuse or distract the operator.

The resolution setting determines the number of digits with which pressure is displayed. The desired resolution is calculated based on the full scale of the range and then rounded to the furthest digit to the right. For example, resolution of 0.001% on a range of 150 psi is 150 X 0.001% = 0.0015 which is rounded down to 0.001psi.

- **Default resolution settings are 0.001% for standard RPTs and 0.01% for b Type RPTs. Maximum resolution setting is 0.0001% for standard RPTs and 0.001% for b Type RPTs.**

OPERATION

To access the resolution function, press **[RES].** The display is:

```
Measure resltn:  H3
0.0010% FS   < and >
```

Use the **[←]** and **[→]** keys to select the desired level of resolution. Press **[ENTER]** to set the resolution and return to the main run screen.

- **The resolution setting affects the display of the measured pressure as well as other indications and settings, such as quantities shown by DISPLAY functions (see 3.2.6 [DISPLAY), the reading of the on-board barometer, etc.**

- **The resolution setting is range specific. A resolution setting made in one range does not affect other ranges.**

- **The measured pressure resolution is fixed for altitudes units at 1 m in meters and 1 ft in feet.**

3.2.6 [DISPLAY]

PURPOSE

To select, from a variety of choices, the information that is displayed on the second line of the MODEL 785 display.

PRINCIPLE

MODEL 785 supports a variety of advanced pressure measurement functions that are displayed on the second (bottom) line of the MODEL 785 display. In summary, the available display functions included are:

- AVERAGE: Calculates the average pressure measurement over a user specified period of time and displays the average, the standard deviation about the mean and a countdown in seconds to the next average(see 3.2.6.1 Avg (Average). This function is often used to filter out pressure noise in an unstable system. The magnitude of the noise is quantified by the standard deviation about the mean. A second Avg screen allows the instantaneous pressure values to be viewed during an averaging cycle.
- RATE: Calculates and displays the current rate of change of pressure in current pressure units/second (see 3.2.6.2 Rate). This function is a useful indication of the stability of the pressure being measured. It is often used as an indication of positive or negative leak rate and as a go/no go criterion of when to take data when comparing MODEL 785 and a device under test, for example in a calibration. Rate is used by the Ready/Not Ready function to determine when a Ready condition exists (see 3.1.2.4 Pressure Ready/Not Ready Indication).
- DEVIATION: Calculates and displays the difference between the pressure measured by MODEL 785 and a target pressure defined by the user (see 3.2.6.3 Dev (Deviation)). This function is useful in monitoring the evolution of pressure around and/or away from a desired set point.
- RPT: If the MODEL 785 has two PRTs, allows pressure measurement from the two RPTs to be displayed simultaneously (see 3.2.6.4 RPT). This function is particularly useful in dual RPT MODEL 785s with independent TEST ports to monitor two separate pressures simultaneously.
- HI/LO: Records and displays maximum and minimum pressures measured (see 3.2.6.5 Hi/Lo). This function is used to keep track of the minimum and maximum pressure observed in a system over a period of time or to monitor if a pressure min/max limit has been exceeded..
- FREEZE: Captures and displays the pressure measured by the active range of MODEL 785 when the **[ENTER]** key is pressed (see 3.2.6.6 Freeze). This function is useful to record the pressure present at the time of an operator observed trigger event, for example when the needle of an analog gauge was on the nominal point or when a switch activates.
- CLEAN: Blanks out the second line of the display (see 3.2.6.7 Clean). This function is used when a simple display of pressure measured by the MODEL 785 active range without additional information is desired.

➢ **MODEL 785 also includes a leak check function (see 3.3.5 Leak (Leak Check)).**

OPERATION

To set the DISPLAY function press **[DISPLAY]** from the main run screen.

The display is:

```
1Avg 2Rate 3Dev 4RPT
5Hi/Lo 6Freez 7Clean
```

The cursor is on the active DISPLAY function. Selecting a display function returns to the main run screen with the selected function active.

See 3.2.6.1 to 3.2.6.7 for details on each DISPLAY function.

➢ **The DISPLAY selection is NOT range specific. A DISPLAY selection made in one range applies to all ranges.**

➢ **The default DISPLAY function is Rate which causes the second line of the display to show "R" followed by the current rate of change of pressure in current pressure units per second.**

3.2.6.1 Avg (Average)

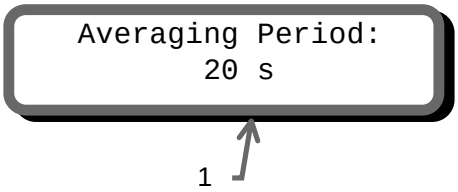
PURPOSE

To activate the Average DISPLAY and/or adjust the period of time over which averaging occurs

➢ **See 3.2.6 [DISPLAY], PRINCIPLE.**

OPERATION

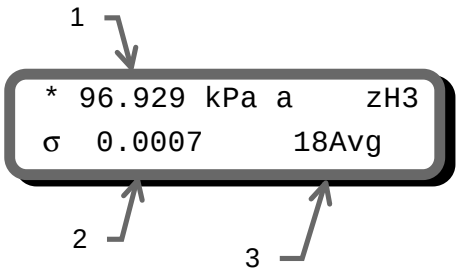
To access the Average DISPLAY, press **[DISPLAY], <1Avg>.** The display is:



1. Edit field for averaging period in seconds. Default is 20. Minimum 1, maximum 999.

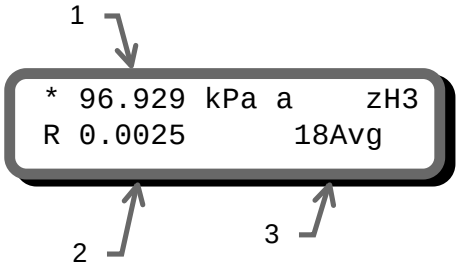
Edit the averaging time period if desired. Pressing **[ENTER]** returns to the main run screen with the Average DISPLAY active.

With the Average DISPLAY active the main run screen is:



1. Average measured over last completed averaging period.
2. Standard deviation of last completed averaging period.
3. Countdown in seconds until completion of on-going averaging period.

The Average DISPLAY has a second screen that allows the instantaneous pressure readings to be viewed while an averaging cycle is running. The instantaneous Average screen is:



1. Instantaneous pressure values at MODEL 785s normal integration rate.
2. Current rate of change of pressure in pressure units/second.
3. Countdown in seconds until completion of on-going averaging period.

The **[+/-]** key toggles between the main run Average screen and the instantaneous values Average screen.

➢ **In the Average DISPLAY the Ready/Not Ready indication applies to the result of the previous averaging period. "Ready" indicates that all readings during the previous averaging period met the stability criterion (see 3.3.4 Stab (Stability)). "Not Ready" indicates that one or more readings were outside of the stability criterion (See 3.1.2.4 Pressure Ready/Not Ready Indication).**

- **Changing the pressure unit of measure, measurement mode (gauge or absolute) or range while the averaging screen is active, starts a new averaging period.**

- **Pressing [ENTER] while in the Average DISPLAY aborts the current averaging period and causes a new one to begin. [ENTER] can thus be used to trigger a new averaging period on demand.**

- **To go to a DISPLAY other than Average, press [DISPLAY] and make a new DISPLAY choice (see 3.2.6 [DISPLAY]).**

3.2.6.2 Rate

PURPOSE

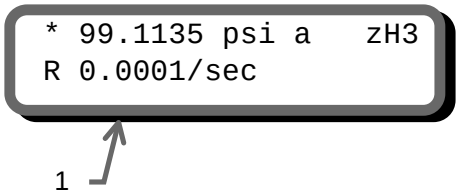
To activate the Rate DISPLAY.

- **See 3.2.6 [DISPLAY], PRINCIPLE.**

OPERATION

To activate the Rate DISPLAY press **[DISPLAY]**, **<2Rate>.** Pressing **<2Rate>** returns to the main run screen with the Rate DISPLAY active.

With the Rate DISPLAY active the main run screen is :



1. Current rate of change of pressure in current pressure units per second.

- **The Rate DISPLAY is different and separate from the stability setting which is used to set the stability criterion on which the Ready/Not Ready indication is based (see 3.3.4 Stab (Stability), 3.1.2.4 Pressure Ready/Not Ready Indication). The Rate DISPLAY only causes the current rate of change to be displayed and has no affect on the stability setting or the Ready/Not Ready condition.**

- **To go to a DISPLAY other than Rate, press [DISPLAY] and make a new DISPLAY choice (see 3.2.6 [DISPLAY]).**

3.2.6.3 Dev (Deviation)

PURPOSE

To activate the Deviation DISPLAY and/or set the deviation target value.

- **See 3.2.6 [DISPLAY], PRINCIPLE.**

OPERATION

To activate the Deviation DISPLAY press **[DISPLAY]**, **<3Dev>**. The display is:

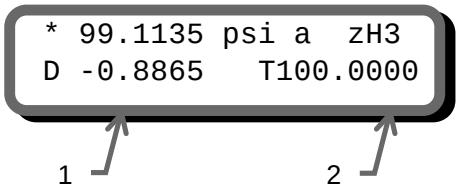
```
Target:
100.0000 psi a
```

Edit the desired target value. Pressing **[ENTER]** returns to the main run screen with the Deviation DISPLAY active using the entered target value.

- **The target value is the value from which deviations (D) are measured by the Deviation DISPLAY following:**

D = current pressure - target pressure

With the Deviation DISPLAY active the main run screen is:



1. Deviation of current pressure from the target value.
2. Target value.

- **Pressing [ENTER] from the main run screen when the Deviation DISPLAY is active goes directly to the Target editing screen. This allows the target value to be changed without going through the DISPLAY menu.**

- **If the pressure measurement unit or mode (gauge or absolute) is changed while the Deviation DISPLAY is active the target value remains at the same numerical value. It is not converted.**

- **To go to a DISPLAY other than Deviation, press [DISPLAY] and make a new DISPLAY choice (see 3.2.6 [DISPLAY]).**

3.2.6.4 RPT

PURPOSE

To activate the RPT DISPLAY.

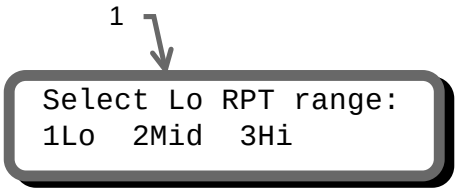
- **See 3.2.6 [DISPLAY], PRINCIPLE.**

- **The RPT DISPLAY is only available in dual RPT MODEL 785s.**

OPERATION

- **For the sake of clarity, when describing the RPT DISPLAY, the active MODEL 785 range when the RPT function is selected is referred to as the "active" range. This is the range that is displayed on the first line of the display. The other RPT and the range to be displayed on the second (bottom) line of the MODEL 785 display are referred to as the "inactive" RPT and range. They are "inactive" in the sense that all MODEL 785 functions and settings such as UNIT and RES still apply to the "active" RPT. To make changes to the "inactive" RPT, for example to change its measurement units, it must be made the active RPT by a conventional range change (see 3.2.1 [RANGE]).**

To activate the RPT DISPLAY, press **[DISPLAY]**, **<4RPT>**. The display is

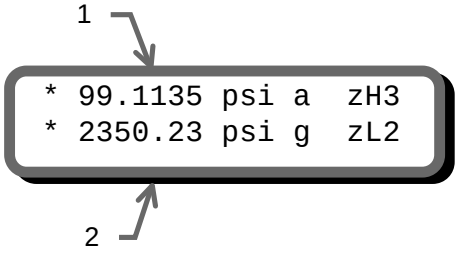


1. Lo or Hi, whichever RPT is currently **inactive** .

Select the desired range of the inactive RPT. Making the range selection returns to the main run screen with the RPT DISPLAY active.

➢ **If the MODEL 785 is a single RPT MODEL 785, "Not available with single RPT!" displays for five seconds when DISPLAY, 4RPT is pressed and operation returns to the main run screen.**

With the RPT DISPLAY active the main run screen is:



1. Active RPT display.
2. Inactive RPT display.

If the inactive RPT is equipped with SDS Self Defense System (see 3.1.2.6 SDS Self Defense System), SDS will almost certainly be on when the RPT DISPLAY is activated. SDS can be defeated on the inactive RPT using SPECIAL, 2 SDS (see 3.4.2 SDS).

➢ **With the RPT display active, executing a range change to a range on the inactive RPT causes the range change to occur making the inactive RPT the active RPT. The DISPLAY defaults back to Rate.**

➢ **To go to a DISPLAY other than RPT, press [DISPLAY] and make a new DISPLAY choice (see 3.2.6 [DISPLAY]).**

3.2.6.5 Hi/Lo

PURPOSE

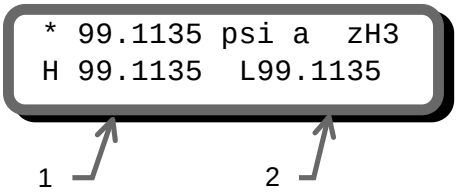
To activate the Hi/Lo DISPLAY.

➢ **See 3.2.6 [DISPLAY], PRINCIPLE.**

OPERATION

To activate the Hi/Lo DISPLAY press **[DISPLAY]**, **<5Hi/Lo>**. Pressing **<5Hi/Lo>** resets the Hi/Lo values and returns to the main run screen with the Hi/Lo DISPLAY active.

With the Hi/Lo DISPLAY active the main run screen is:



1. Highest pressure observed since Hi/Lo reset.
2. Lowest pressure observed since Hi/Lo reset.

The Hi/Lo values change each time a new Hi or Lo pressure is observed.

- **The Hi/Lo record can be reset at any time by pressing [ENTER]. This allows a Hi/Lo reset without going back through the DISPLAY menu.**

- **If the pressure measurement unit, mode (gauge or absolute) or range is changed while the Hi/Lo DISPLAY is active, Hi/Lo resets.**

- **To go to a DISPLAY other than Hi/Lo, press [DISPLAY] and make a new DISPLAY choice (see 3.2.6 [DISPLAY]).**

3.2.6.6 Freeze

PURPOSE

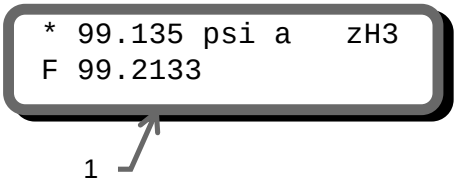
To activate the Freeze DISPLAY.

- **See 3.2.6 [DISPLAY],PRINCIPLE.**

OPERATION

To activate the Freeze DISPLAY press **[DISPLAY]**, **<6Free>**. Pressing 6Free returns to the main run screen with the Freeze DISPLAY active.

With the Freeze DISPLAY active the main run screen is:



1. Pressure measured by active range of MODEL 785 when ENTER was pressed in the current pressure units (displays 0.00 by default when Freeze DISPLAY is first activated).

Pressing **[ENTER]** causes the current pressure measured by the active MODEL 785 range to be captured and displayed.

- **If the pressure measurement unit, mode (gauge or absolute) or range is changed while the Freeze DISPLAY is active, the Freeze value defaults back to zero.**

- **To go to a DISPLAY other than Freeze, press [DISPLAY] and make a new DISPLAY choice (see 3.2.6 [DISPLAY]).**

3.2.6.7 Clean

PURPOSE

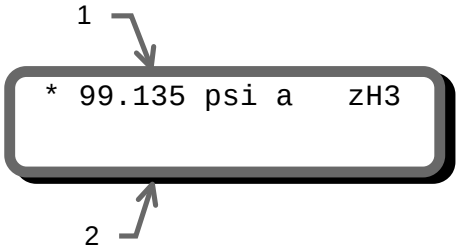
To activate the Clean DISPLAY.

➢ **See 3.2.6 [DISPLAY], PRINCIPLE.**

OPERATION

To activate the Clean DISPLAY press **[DISPLAY]**, **<7Clean>**. Pressing **<7Clean>** returns to the main run screen with the Clean DISPLAY active.

With the Clean DISPLAY active the main run screen is:



1. Conventional main run screen first line.
2. "Clean" second line.

➢ **To go to a DISPLAY other than Clean, press [DISPLAY] and make a new DISPLAY choice (see 3.2.6 [DISPLAY]).**

3.2.7 [HEAD]

PURPOSE

To cause a pressure value representing a difference in height to be added to the pressure measured by the MODEL 785 reference pressure transducer (RPT).

PRINCIPLE

MODEL 785's RPTs measure gauge or absolute pressure at the height of the rear panel TEST port. Frequently, when performing a calibration or test, the device or system under test is at a different height than the MODEL 785's TEST port. This difference in height, frequently called "head", can cause a significant difference between the pressure measured by the MODEL 785 at its TEST port height and the pressure actually applied to the device under test located at a different height. In this case, it is useful to make a head correction to the pressure measured by the MODEL 785 RPT at its TEST port in order to accurately predict the pressure actually applied at a different height. The HEAD function allows head corrections to be applied automatically for a variety of fluids based on operator entry of the nature of the pressurized fluid and the height difference.

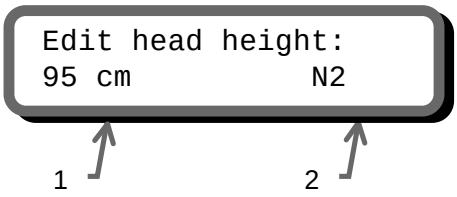
MODEL 785 can accurately determine "head" pressures for gas (nitrogen, helium and air) and liquids (oil, water) as the pressurized medium. In calculating the head value, standard gravity (9.80665 m/s^2) is used. Gas densities are calculated from standard density correcting for temperature of 20°C and the measured pressure using the gas's compressibility factor to 1500 psi (10 MPa) and extrapolated above 1500 psi. Above 1500 psi, gas heads should be minimized to minimize uncertainties due to head corrections. Oil density is taken at 850 kg/m^3, the density of typical calibration oils at 20°C. Water density is taken at 998.2321kg/m^3 (20°C). A custom liquid density may also be specified.

The HEAD function key is used to specify the difference between the MODEL 785 TEST port and the test height. The height units and the head fluid are specified under **[SETTINGS]**, **<1Head>** (see 3.3.1 Head).

- **Use of the HEAD function to assure in tolerance measurements when gas is the test fluid is most important at low absolute pressures. In this case, specifying the head height within ± 4 in. (10 cm) is adequate to assure that, even in the worst case, the uncertainty on the head correction will be insignificant relative to the tolerance on the MODEL 785 measurement. Use of the HEAD function to assure in tolerance measurements is particularly critical when a liquid is the test fluid due to the high density of liquids. To determine when and how precisely a head correction for liquids must be made, 0.03 psi/inch (90 Pa/cm) may be used as an estimation of the liquid head value.**

OPERATION

To access the HEAD function, press **[HEAD]**. The display is:



1. Entry field for head height (1 to 999 cm or in).
2. Test fluid currently specified for the head correction.

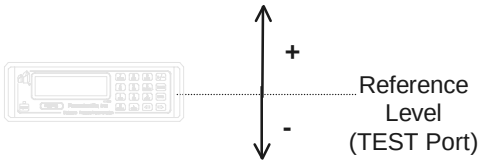
Entering a value of zero turns the HEAD function off. Entering a value other than zero turns the HEAD function on using the height entered. Pressing **[ESCAPE]** returns to the main run screen with no change to the current head setting.

- **The reference height of the MODEL 785 pressure measurement is the middle of the MODEL 785 TEST port. The head height should be entered as a positive value if the device or system under test is higher than the MODEL 785 and negative if it is lower.**

- **The HEAD function is *NOT* range specific. The HEAD "on" or "off" status remains the same as ranges are changed; edits made to the head specifications are independent of range.**

- **When the HEAD function is "on" (default head value =0), this is indicated by <h> in the right side of the top line of the main run screen (see 3.1.1 The Main Run Screen). When the HEAD function is "off", the <h> is not shown.**

- **To change units of head height between inches and centimeters and to change the test gas species, use [SETTING], <1Head> (see 3.3.1 Head).**



3.2.8 [SDS] (SELF DEFENSE SYSTEM)

PURPOSE

To activate SDS on all reference pressure transducers (RPTs). To defeat SDS on the active RPT.

- **SDS is present only on RPTs designated A1000 or lower.**

The [SDS] key should be used with care to avoid accidentally overpressuring an RPT. Always double check to ensure that the pressure applied to the RPT test port is lower than the maximum pressure acceptable to the RPT before defeating SDS.

PRINCIPLE

SDS is a self defense system to protect MODEL 785 RPTs from overpressure.

When SDS is "on" for an RPT, that RPT is isolated from the TEST port and opened to the VENT port. When SDS is on, the RPT cannot measure the pressure connected to the TEST port so SDS must be defeated TEST port pressure can be measured by the RPT. The SDS function key allows SDS on the active RPT to be defeated.

The SDS function can also be used to turn SDS "on" as might be desired when leaving MODEL 785 at rest or when a possible overpressure situation is anticipated. Pressing **[SDS]** always turns on any SDS systems that are off.

- **See 3.1.2.6 SDS Self Defense System for additional information on the SDS system and 1.3.3 Configurations for schematics of SDS configuration.**

- **SDS on is indicated by <***SDS***> flashing in the current measured pressure display field. When SDS is on, the RPT is isolated from the TEST port and the displayed pressure is the pressure at the VENT port.**

OPERATION

Though the SDS self defense system includes features to protect RPTs against overpressure, SDS should not be considered a fail-safe overpressure protection system. SDS cannot guarantee that overpressure damage will not occur. SDS automatic activation may protect an RPT in case of accidental overpressure but conventional measures for protecting against overpressure should always be followed. Damage to RPTs due to overpressure is not covered by the MODEL 785 product warranty even when SDS is present.

The maximum pressure that should be applied to an MODEL 785 test port when SDS is "on" is 1000 psi (6.9 MPa).

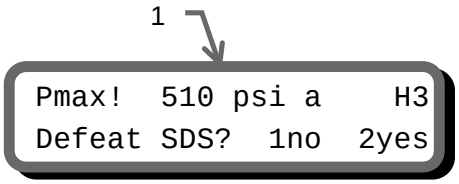
When SDS is turned on with a pressure applied, a valve shuts isolating the RPT from the TEST port. A second valve vents the RPT to atmosphere through the VENT port. If the pressure applied at the time SDS is turned on is less than 250 psi (1 700 kPa), the VENT valve will open causing sudden release of pressure through the VENT port and returning the RPT to atmospheric pressure. If the pressure applied at the time SDS is turned on is greater than 250 psi, the VENT valve may not open. In this case, to vent the RPT, remove the pressure from the test port. This will cause the SDS TEST port isolation valve to open partially, reducing pressure under 250 psi at which time the SDS VENT valve will open.

- **Pressing [SDS] always turns on any SDS system that is off. In a dual RPT MODEL 785, even if the active RPT has no SDS, pressing SDS will turn SDS on for the inactive RPT if SDS is present.**

Use **[SDS]** to defeat SDS if it is on for the active RPT and/or to turn SDS on for the active and inactive RPT if present.

When **[SDS]** is pressed, there are three possible results depending whether the active RPT is SDS equipped and, if so, whether SDS is off or on.

1. If the active **RPT IS NOT SDS** equipped: **<No SDS on RPT>** is displayed for 5 seconds and operation returns to the main run screen.
2. If the active **RPT IS SDS EQUIPPED and SDS on the active RPT is OFF**: SDS is turned on and operation returns to the main run screen.
3. If the active **RPT IS SDS EQUIPPED and SDS on the active RPT is ON**. The opportunity to defeat SDS is presented. The display is :



1. Maximum acceptable pressure (Pmax!) for active range (always absolute on an absolute RPT and gauge on a gauge RPT).

Check that the pressure applied to the TEST port does not exceed the Pmax! value for the active range. Select **<1no>** to return to the main run screen without defeating SDS, select **<2yes>** to defeat SDS and return to the main run screen with SDS defeated (the active RPT open to the TEST port).

Defeating SDS with a pressure greater than Pmax! applied to the test port may cause overpressure damage to the RPT.

- **The SDS key is also the 2 key which is pressed to select <2Yes> to defeat SDS. Thus, SDS can be defeated by two rapid presses of the SDS function. Use this feature to conveniently defeat SDS but always check that the pressure connected the TEST port does not exceed Pmax! before doing so.**

- **When changing ranges changes the active RPT, SDS is automatically turned on for the RPT that is being changed from, leaving the inactive RPT with SDS on.**

- **Direct control over SDS for both the Lo and Hi RPTs if present, regardless of which RPT is currently active, is provided under SPECIAL, 2 SDS (see 3.4.2 SDS). Direct SDS control should only be used with caution and by qualified operators, as the chances of accidental overpressure to an RPT are increased.**

3.2.9 [AutoZ]

PURPOSE

To run the AutoZ function that "rezeros" the active range.

- **See 3.4.1 AutoZ, PRINCIPLE for an explanation of AutoZ principles.**

⚠ **To assure operation within "with autozero" measurement accuracy specifications (see 1.3.2 Pressure Measurement Specifications), AutoZ should be run regularly to update the value of ZOFFSET. For absolute measurement mode, it is recommended that AutoZ be run at least every 30 days or when MODEL 785 has been exposed to temperature changes exceeding ± 20ºC (36ºF). For gauge measurement mode, it is recommended that AutoZ be run each time the range or measurement mode is changed and each time the RPT is known to be in a vented condition.**

PRINCIPLE

Run AutoZ is the function by which the current RPT reading is compared to ZSTD and a new value of ZOFFSET representing RPT zero drift is determined and applied (see 3.4.1 AutoZ, PRINCIPLE).

OPERATION

To run AutoZ, press **[AutoZ]** from the main run screen. If the measurement mode of the active range is gauge, ZSTD is atmospheric pressure (zero gauge) and AutoZ runs automatically (see 3.2.9.1 Running AutoZ in Gauge Measurement Mode). If the measurement mode of the active range is absolute, the source of ZSTD must be specified when AutoZ is run (See 3.2.9.2 Running AutoZ in Absolute Measurement Mode).

- **Run AutoZ and the value of ZOFFSET that it updates are specific to each range and operating mode (gauge or absolute).**

3.2.9.1 Running AutoZ in Gauge Measurement Mode

PURPOSE

To "rezero", redetermine ZOFFSET, for the active RPT and range in gauge measurement mode.

- **See 3.4.1 AutoZ, PRINCIPLE for an explanation of AutoZ principles.**

OPERATION

- **For the AutoZ function key to run AutoZ, AutoZ must be turned on for the active range and measurement mode. AutoZ "on" is indicated by <z> to the left of the range designator on the first line of the main run screen. AutoZ on and off is set using [SPECIAL], <1AutoZ> (see 3.4.1 AutoZ, PRINCIPLE, AutoZ On/Off, 3.4.1.1 AutoZ On/Off). If AutoZ is off for the active range, and measurement mode, <AutoZ disabled> is displayed when [AutoZ] is pressed.**

To run AutoZ in gauge measurement mode, press the AutoZ function key from the main run screen. **<Running gauge AutoZ>** is displayed briefly before returning to the main run screen.

Before running AutoZ in gauge mode, ensure that the pressure applied to the RPT is truly zero gauge (atmospheric pressure). For very low gauge pressure ranges, better results may be obtained by connecting the TEST port to the TEST (-) port to be sure that the differential is truly zero. If running AutoZ in gauge mode results in a zero offset that MODEL 785 considers unusually large, <Confirm 0 gauge P!> is displayed when AutoZ is pressed. Check that the TEST port (and TEST(-) port if the RPT is a gauge RPT) are fully open to atmosphere and press ENTER to continue or ESCAPE to abort. Running AutoZ without zero applied to the RPT may result in out of tolerance measurements.

- **If a HEAD correction is active as indicated by <h> in the first line of the display, MODEL 785 may not indicate zero even right after running AutoZ in gauge mode. The head correction is momentarily disabled when AutoZ is run. The value displayed just after MODEL 785 is zeroed is the value of the current head correction which is the pressure applied at the head height when the pressure at the MODEL 785 reference level is zero gauge (see 3.2.7 [HEAD).**

3.2.9.2 Running AutoZ in Absolute Measurement Mode

PURPOSE

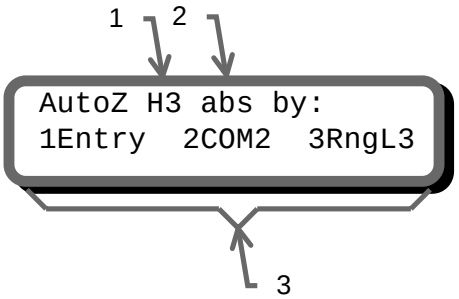
To "rezero" (redetermine ZOFFSET) for the active RPT and range in absolute measurement mode .

- **See 3.4.1 AutoZ, PRINCIPLE for an explanation of AutoZ principles.**

OPERATION

- **For the AutoZ function key to run AutoZ, AutoZ must be turned "on" for the active range and measurement mode. AutoZ "on" is indicated by <z> to the left of the range designator on the first line of the main run screen. AutoZ "on" and "off" is set using [SPECIAL], <1AutoZ> (see 3.4.1.1 AutoZ On/Off). If AutoZ is "off" for the active range, and measurement mode, <AutoZ disabled> is displayed when [AutoZ] is pressed.**

To run AutoZ in absolute measurement mode, press [AutoZ] from the main run screen. The display is:



1. Active range.
2. Current measurement mode (gauge or abs for absolute).
3. Selection of source of ZSTD for ZOFFSET determination.

1Entry allows the value of ZSTD to be entered from the front panel keypad (see 3.2.9.2.1 Run AutoZ by Entry).

2COM2 allows the value of ZSTD to be read automatically from an RPM1, RPM2 or MODEL 785 connected to MODEL 785's COM2 serial port (see 0

Run AutoZ by COM2).

3RngL3 Allows the value of ZSTD to be read automatically from the Lo RPT Range 3 (available only if the active RPT is a Hi absolute RPT and there is a Lo absolute RPT)(see 3.2.9.2.3 Run AutoZ by RngL3).

Allow the MODEL 785 to stabilize at atmospheric pressure and ambient temperature for 5 to 10 minutes before running AutoZ in absolute mode.

If running AutoZ results in values of ZOFFSET that are greater than ± 0.01% FS (± 0.05% FS for b Type RPTs) of the active MODEL 785 measurement range, the MODEL 785 and/or the source of ZSTD may be out of tolerance or the AutoZ process may have been faulty. Before activating a new ZOFFSET greater than ± 0.01% FS (± 0.05% FS for b Type RPTs) of the active MODEL 785 range, check to be sure that both the MODEL 785 and the source of ZSTD were in good working order, properly vented to stable atmospheric pressure, at the same height, and reading in the same pressure units when AutoZ was run.

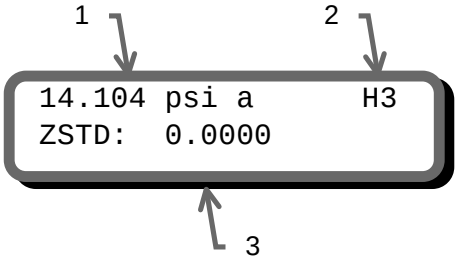
- **When the run AutoZ selection is made, if a HEAD correction is currently active (see 3.2.7 [HEAD), the head correction is temporarily disabled to avoid "zeroing out" the head correction.**

- **The value of ZOFFSET in absolute mode is not necessarily be exactly equal to the difference between the current reading and ZSTD if ZNATERR is not zero (see 3.4.1 AutoZ, PRINCIPLE). For the same reason, MODEL 785 may not read exactly the same value as ZSTD even right after AutoZ has been run.**

3.2.9.2.1 *Run AutoZ by Entry*

AutoZ by entry allows the value of ZSTD (see 3.4.1 AutoZ, PRINCIPLE) to be entered manually. This provides a simple way of autozeroing relative to an independent reference device such as a house barometer that does not interface directly with MODEL 785.

To access run AutoZ by entry press **[AutoZ]** from the main run screen while in absolute measurement mode. Then select **<1Entry>**. The display is:



1. Pressure reading, units and mode of the active RPT range.
2. Active range indicator.
3. Entry field for the value of ZSTD.

Enter the value of ZSTD in the current units. The next display is:

```
Old ZOFFSET:  0.0 Pa
New ZOFFSET:  6.5 Pa
```

The old ZOFFSET is the ZOFFSET currently used.

The new ZOFFSET is the ZOFFSET resulting from this execution of run AutoZ.

Press [ENTER] to activate the new ZOFFSET and return to the main run screen.

Press [ESCAPE] to maintain the old ZOFFSET and return to the main run screen.

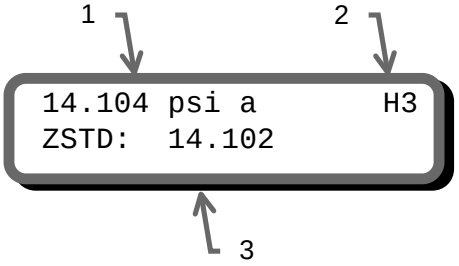
- **The value of ZOFFSET is always displayed and entered in Pascal (Pa).**

The value of ZSTD must be entered in the current pressure units or the calculation of ZOFFSET will be incorrect.

3.2.9.2.2 *Run AutoZ by COM2*

AutoZ by COM2 allows the value of ZSTD (see 3.4.1 AutoZ, PRINCIPLE) to be read automatically from a MODEL 785 connected by RS-232 interface to the MODEL 785 COM2 port.

To access "run AutoZ by COM2", press **[AutoZ]** from the main run screen while in absolute measurement mode. Then select **<2COM2>**. The display is:



1. Pressure reading, units and mode of the active RPT range.
2. Active range indicator.
3. Pressure reading of the RPM connected to MODEL 785's COM2 port.

When ready, press **[ENTER]**. The next display is:

```
Old ZOFFSET:  0.0 Pa
New ZOFFSET: 13.8 Pa
```

The old ZOFFSET is the ZOFFSET currently used.

The new ZOFFSET is the ZOFFSET resulting from this execution of run AutoZ.

Press **[ENTER]** to activate the new ZOFFSET and return to the main run screen.

Press **[ESCAPE]** to maintain the old ZOFFSET and return to the main run screen.

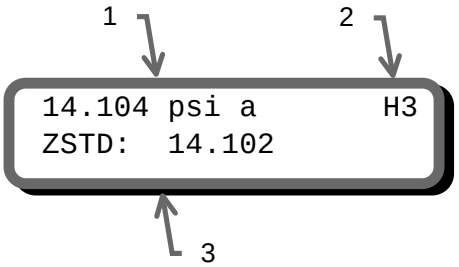
- **For MODEL 785 to communicate with another Model 785 connected to its COM2 port, the MODEL 785 and the RS-232 interfaces must be set up properly (see 3.4.4 Remote). If, the MODEL 785 is unable to locate another Model 785 on COM2 when running AutoZ by COM2, it times out after 6 seconds and displays "Model 785 not detected".**

- **The value of ZOFFSET is always displayed and entered in Pascal (Pa).**

3.2.9.2.3 *Run AutoZ by RngL3*

The AutoZ by RngL3 choice is only available if the active RPT is an absolute, Hi RPT and there is also an absolute Lo RPT in the MODEL 785. Run AutoZ by RngL3 allows AutoZ to be run on a Hi RPT range using Lo RPT range 3 (L3) as the source of ZSTD (see 3.4.1 AutoZ, PRINCIPLE).

To access "run AutoZ by RngL3", press **[AutoZ]** from the main run screen while in absolute measurement mode. Then select **[3RngL3]**. The display is:



1. Pressure reading, units and mode of the active Hi RPT range.
2. Active range indicator.
3. Pressure reading of Lo RPT range 3 (L3).

When ready, press **[ENTER]**. The next display is:

```
Old ZOFFSET:  0.0 Pa
New ZOFFSET: 13.8 Pa
```

The old ZOFFSET is the ZOFFSET currently used.

The new ZOFFSET is the ZOFFSET resulting from this execution of run AutoZ.

Press **[ENTER]** to activate the new ZOFFSET and return to the main run screen.

Press **[ESCAPE]** to maintain the old ZOFFSET and return to the main run screen.

Before running AutoZ by Lo RPT, be sure that range L3 of the Lo RPT is correctly calibrated and autozeroed.

If you are running AutoZ on the Hi and Lo RPTs of an MODEL 785 and using run AutoZ by RngL3 to autozero the Hi RPT, be sure to run AutoZ on the Lo RPT first.

➢ **The value of ZOFFSET is always displayed and entered in Pa.**

3.3 [SETUP] MENU KEY

PURPOSE

The **[SETUP]** key accesses a menu of commonly used MODEL 785 functions and features that do not have direct function keys. These include:

1. **<Head>** - To change the height units and fluid (see 3.3.1 Head).
2. **<PresU>** - To customize the choices available under **[UNIT]** and to set up User Defined Units (see 3.3.2 PresU).
3. **<ReadRt>** - To turn on and off MODEL 785's automated, rate of change dependent, reading integration time feature (see 3.3.3 ReadRt (Read Rate)).
4. **<Stab>** - To view and adjust the stability limit that is the criterion for the Ready/Not Ready condition (see 3.3.4 Stab (Stability), 3.1.2.4 Pressure Ready/Not Ready Indication).
5. **<Leak>** - To run an automated leak checking function (see 3.3.5 Leak (Leak Check)).

OPERATION

To access the SETUP menu, press **[SETUP]** from the main run screen. The display is:

```
1Head  2PresU
3ReadRt
3Stab  5Leak
```

3.3.1 Head

PURPOSE

To specify the configuration of the HEAD function (see 3.2.7 [HEAD) including the length unit of measure for head height entry and the test fluid for head pressure calculations.

OPERATION

From the main run screen, press **[SETUP]**, **<1Head>**. The display is:

```
Head height unit:
1in  2cm
```

Select the desired head height unit. The next display is:

```
Head medium:
1Gas  2Liquid
```

If **<1Gas>** is selected the display offers the choice of three gasses. Making a gas selection returns to the main run screen with that gas active for the HEAD function.

If **<2Liquid>** is selected the display offers the choice of oil, water or a user defined liquid. If the user defined liquid is selected, its density must be specified. Making a liquid selection returns to the main run screen with that liquid active for the HEAD function.

```
Liquid type:
1Oil 2H2O 3User
```

3.3.2 PresU

PURPOSE

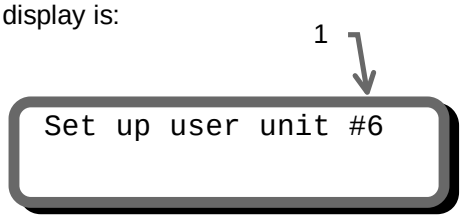
To customize the selection of pressure units that are available for selection from the UNIT function key.

PRINCIPLE

The UNIT function key makes available a choice of six default pressure units (US or SI depending on whether the MODEL 785 has been factory set as US or SI) (see 3.2.2 [UNIT). MODEL 785 also supports many commonly used units in addition to those included in the default set up. These units can be made available for active selection by customizing the UNIT function using **[SETUP]**, **<2PresU>**. This allows MODEL 785 to offer a very wide selection of units while simplifying day to day operation. The typical user will customize the UNIT function key to support his/her six most commonly used units.

OPERATION

To customize the UNIT function key, from the main run screen press **[SETUP]**, **<2PresU>**. The display is:



1. Entry field to select which unit position (1 - 6) of the UNIT function key menu is to be changed.

Enter the number of the unit position that you would like to change. The display becomes:

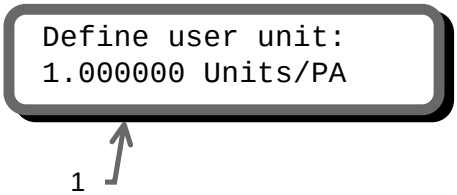
```
Unit#6    1SI  2other
3altitude 4user
```

Select the desired pressure unit category (SI units include units *based* on SI such as mmHg), then select the desired unit from the unit menu.

The units available are:

1SI	2other	3altitude	4user
1Pa	1psi	1feet	1user
2kPa	2psf	2meters	
3mPa	3inHg		
4mbar	4inWa		
5bar	5kcm2		
6mmHg			
7mmWa			

If 4user was selected, the user unit must be defined. The display is:



1. Entry field.

Enter the number of user units per Pascal (Pa) in the entry field. Pressing **[ENTER]** defines the user unit and returns to the **<Set up unit #>** screen.

- **The user defined unit can be assigned a user defined label using the UNIT: USER remote command (see 4.4.3.9 Unit Subsystem).**

- **See 7.1 PRESSURE UNIT CONVERSION for the pressure unit conversion factors used by MODEL 785.**

3.3.3 ReadRt (Read Rate)

PURPOSE

To turn on and off MODEL 785's automated, rate of change dependent, reading integration rate feature.

PRINCIPLE

To obtain maximum resolution from MODEL 785 RPT pressure measurements, an integration time of about 1 second per reading is used. In most situations, maximum accuracy is needed when pressures are stable so a relatively slow reading rate presents no disadvantage. However, when pressure is changing quickly, more rapid pressure updates are usually more important than obtaining maximum accuracy on individual readings. The Model 785 read rate function automatically adjusts pressure measurement integration time depending on the rate of change of pressure. When pressure is changing rapidly, reading rate is increased. When pressure is evolving slowly, reading rate is decreased and maximum accuracy is obtained.

When the automated read rate function is on, three pressure rate of change dependent read rates are used. The result is three display update rates:

Pressure Rate of Change	Display Update
>3% FS/s	≈0.2 s
>0.5 and <3% FS/s	≈0.5 s
<0.5% FS/s	≈1 s

For situations in which an evolving reading rate is not desired, the MODEL 785 automated read rate function can be turned off. In this case, the reading rate is always the high resolution rate of about 1 reading per second.

OPERATION

To turn the automated read rate function on or off press **[SETUP]**, **<3ReadRt>**.

The display is:

```
Auto read rate:    H3
1no 2yes
```

The cursor is on the current selection.

Selecting **<1on>** activates the automated reading rate and returns to the main run screen. Selecting **<2off>** turns off the automated reading rate and returns to the main run screen.

The default MODEL 785 condition is auto read rate "on".

- **Auto read rate on/off is NOT range specific. Turning auto read rate on or off in one range turns it on or off for all MODEL 785 ranges.**

3.3.4 Stab (Stability)

PURPOSE

To view and/or adjust the stability test that is the Ready/Not Ready criterion for the active RPT and range.

- **See 3.1.2.4 Pressure Ready/Not Ready Indication.**

PRINCIPLE

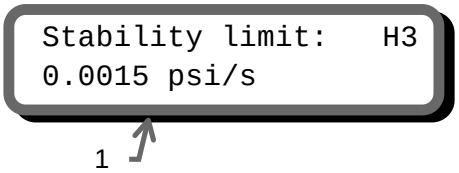
MODEL 785 continuously monitors the rate of change of pressure measured by the active RPT and range and compares this rate to the stability limit to make a Ready/Not Ready determination (see 3.1.2.4 Pressure Ready/Not Ready Indication). The stability function allows the stability limit to be adjusted by the user to increase or decrease the stability required for a Ready condition to occur.

- **The default stability limit is ± 0.005% FS of the active range.**

- **The stability limit is separate and different from the Rate DISPLAY function (see 3.2.6.2 Rate) which allows the current rate of change of pressure to be displayed.**

OPERATION

To adjust the stability limit press **[SETUP]**, **<4Stab>**. The display is:



1. Entry field for setting the desired stability limit. Recalls the default stability limit or the last custom stability limit for the active range in the current pressure units for that range.

Edit the desired stability limit setting if desired. ENTER activates the stability limit for the range and returns to the main run screen.

- **The stability setting is range specific. Changes made in one range do not affect any other range.**

3.3.5 Leak (Leak Check)

PURPOSE

To run an automated leak check routine using MODEL 785 to measure the total pressure change and average rate of change over a period of time; to edit the leak check time.

PRINCIPLE

The Leak Check function is provide to assist in using MODEL 785 to measure leaks by measuring pressure changes.

The principle of the leak check function is the measurement of pressure increase or decrease. The Leak Check function allows a leak check time to be set. The total pressure change and the average rate of change over the leak check time are calculated and displayed.

- **Changing the pressure in a test system causes adiabatic temperature changes in the gas that need to have dissipated before a valid leak measurement can be made. In general, a 0.5 to 1 minute wait before running a leak check is adequate to allow the adiabatic temperature change to dissipate and valid leak measurements to be made. However, stabilization time may be much longer with liquid test media, as volumes increase and as pressures increase.**

OPERATION

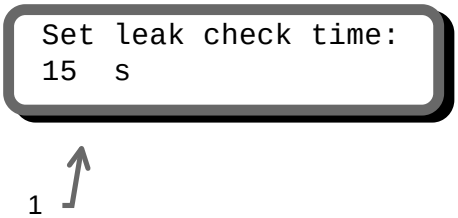
To access the LEAK function press [**SETUP**], **<5Leak>**.

The display is :

Press **<2view>** to view the results of the last leak check executed (see below for description of results screen). Results screen displays **<Data not available>** briefly and returns to main run screen if no leak check data is stored, for example if the MODEL 785 has never run a leak test or a reset has cleared previous leak test results. Pressing **[ENTER]** or **[ESCAPE]** returns to the main run screen.

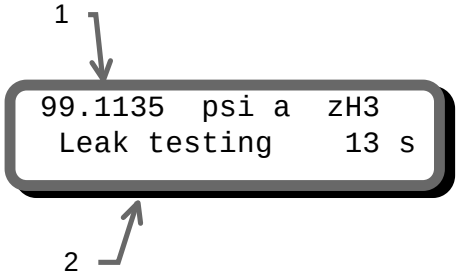
- **Leak check is range specific in the sense that leak check is run using the active range. However, only one set of leak check results is maintained in memory and each leak test completed overwrites the memory. View leak check always shows the results of the last leak check run regardless of the range that is now active. The results screen includes the range indicator to indicate the range in which the leak check was run.**

Press **<1run>** to run a leak check and/or to edit the leak check time. The display is:



1. Edit field for leak check time in seconds (1 min, 999 max)

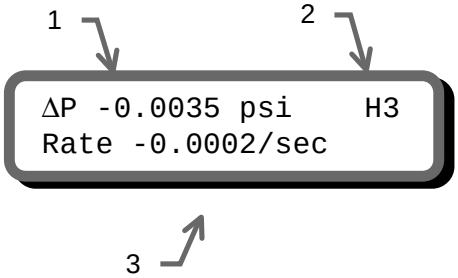
Edit the leak check time if desired. Press **[ENTER]** to run leak test. The display is:



1. Standard main run screen first line.
2. Indication that leak test is running and countdown of time remaining (s).

Pressing [**ESCAPE]** during the countdown offers a leak check abort option to return to the main run screen or continue leak test. Pressing **[ENTER]** during the leak check countdown causes the countdown to reset to start.

Once the leak check countdown has completed, the results screen is displayed:



1. Net change in pressure over the leak check time period.
2. Indicator of range in which leak check was run.
3. Average rate of change of pressure over the leak check time period.

Pressing **[ENTER]** from the leak check results screen following execution of a leak check starts a new leak check routine directly without having to go through the leak check menu. Pressing **[ESCAPE]** returns to the main run screen.

- **Pressing [ENTER] while counting down a leak check or when in leak check results screen starts a new leak check sequence.**

3.4 [SPECIAL] MENU KEY

PURPOSE

The **[SPECIAL]** key accesses a menu of MODEL 785 functions and settings that are less commonly or not normally used in regular operation. These include:

1. **<AutoZ>** - Turn AutoZ on/off, view and edit ZOFFSET values (see 3.4.1 AutoZ).
2. **<SDS>** - Turn SDS on/off independently of the **[SDS]** key (see 3.1.2.6 SDS Self Defense System, 3.4.2 SDS).
3. **<ATM>** - View the current reading of the on-board barometer (see 3.4.3 ATM).
4. **<Remote>** - Set up MODEL 785 serial and GPIB (IEEE-488) interfaces (see 3.4.4 Remote).
5. **<Reset>** - Access and execute a number if reset options (see 3.4.5 Reset).
6. **<Cal>** - View and adjust MODEL 785 RPT and barometer calibration coefficients (see 3.4.6 Cal, 5.2 CALIBRATION OF REFERENCE PRESSURE TRANSDUCERS).
7. **<Intern>** - View and set screen saver, keypad sounds, time and ID features (see **Error! Reference source not found.** Intern).
8. **<Level>** - View and change User Level protection of MODEL 785 functions (see 3.4.8 Level).
9. **<Log>** - View the MODEL 785 incident log (see 3.4.9 Log).

OPERATION

To access the SPECIAL menu, press **[SPECIAL]** from the main run screen.

This display is:

```
1AutoZ  2SDS   3Atm
4Remote 5Reset 6Cal ↓
7Intern  8Level 9Log
```

- **Some screens, such as the SPECIAL menu go beyond the two lines provided by the display. This is indicated by a flashing arrow in the second line of the display. Use the [←] and [→] keys to move the cursor to access the lines that are not visible or directly enter the number of the hidden menu choice if you know it.**

3.4.1 AutoZ

PURPOSE

To manage the AutoZ function for the active RPT and range including turning AutoZ on/off, viewing and editing AutoZ values.

- **To run AutoZ (rezero), use the [AutoZ] direct function key (see 3.2.9 [AutoZ).**

PRINCIPLE

How AutoZ Works

The main component of the change over time of the MODEL 785 RPTs is zero drift or offset, independent of span. Rezeroing MODEL 785 RPTs relative to a stable reference between recalibrations allows higher measurement accuracy specifications to be maintained with a longer interval between full recalibrations. The MODEL 785 autozero function (AutoZ) provides full on-board support for the rezeroing process to simplify its application by the user.

The autozeroing function uses four parameters:

1. **ZSTD:** The value of the autozero pressure as indicated by the reference autozero device.

For *absolute RPTs in absolute measurement mode*, the autozero pressure is always atmospheric pressure and the ZSTD value can be supplied either a) by manual entry; b) from a ***PAROSCIENTIFIC↖CalTechnix*** RPM connected to the MODEL 785 COM2 port or; c) from a Lo absolute RPT if one is available.

For *gauge RPTs or absolute RPTs in gauge measurement mode*, the autozero pressure is always zero (atmospheric pressure) which is available by definition any time the RPT is vented to atmosphere.

2. **ZCURERR:** The difference between ZSTD and the RPT indication at the autozero pressure ***at some time after the RPT has been calibrated*** (ZCURERR = RPT reading w/out ZOFFSET- ZSTD).

3. **ZNATERR**: The difference between ZSTD and the RPT indication at the autozero pressure ***just after the RPT has been calibrated*** (ZNATERR = RPT reading w/out ZOFFSET - ZSTD). This value, when measured just after RPT calibration, is referred to as the “natural error” at the autozero pressure. Because no RPT is perfectly linear and ZSTD is not perfectly accurate, the disagreement between the RPT reading and ZSTD at the autozero pressure is unlikely to ever be zero (except for gauge RPTs for which the zero point is “forced” at calibration).

4. **ZOFFSET**: ZCURERR corrected for ZNATERR, represents the drift of the RPT relative to the reference (ZOFFSET = ZCURERR - ZNATERR). The active RPT reading, adjusted by ZOFFSET, is the “autozeroed” RPT reading, i.e. the RPT reading corrected for zero drift since it was calibrated. For an absolute RPT used in gauge mode, ZOFFSET also includes the value of atmospheric pressure that is being subtracted to arrive at gauge pressure.

The AutoZ function manages the determination, storage and application of ZNATERR and ZOFFSET individually for each MODEL 785 range and measurement mode. ZNATERR error is determined at the time of calibration (see 5.2 CALIBRATION OF REFERENCE PRESSURE TRANSDUCERS). ZCURRERR and ZOFFSEST between calibrations are determined by “running AutoZ” using the **[AutoZ]** direct function key (see 3.2.9 [AutoZ function).

AutoZ On/Off

The AutoZ function can be turned on and off. When AutoZ is on, ZOFFSET is always applied to the pressure measured by MODEL 785 and new values of ZOFFSET can be determined by “running AutoZ” using the **[AutoZ]** key. When AutoZ is off, ZOFFSET is not applied (except for an absolute RPT in gauge mode for which ZOFFSET is the current value of atmospheric pressure which is always subtracted to achieve gauge pressure) and AutoZ cannot be run (see 3.4.1.1 AutoZ On/Off). In gauge mode turning AutoZ off turns off the dynamic for compensation atmospheric pressure (see below).

Gauge Mode with an Absolute RPT, Dynamic Compensation for Atmospheric Pressure

MODEL 785 supports gauge pressure measurements with an absolute RPT by subtracting the value of atmosphere (tare) from the RPT's absolute measurement to arrive at a gauge value. The appropriate tare value changes with the natural evolution of atmospheric pressure at a given location. For this reason, the value of the tare should be redetermined by running AutoZ (see 3.2.9 [AutoZ) each time the RPT is vented to atmospheric pressure. However, if atmospheric pressure changes significantly between vented conditions, these changes in atmospheric pressure are not eliminated by retaring. To compensate for changes in atmospheric pressure between autozeroing (taring) opportunities, "dynamic atmospheric pressure compensation" is used.

To minimize zero errors due to the evolution of atmospheric pressure between taring opportunities when using an absolute RPT in gauge measurement mode, MODEL 785 dynamically compensates the atmospheric tare value. MODEL 785's on-board barometer measures atmospheric pressure independently from the RPT. Between opportunities to update the tare value (vented conditions), the difference between the on-board barometer reading at the time of the last tare value and the current on-board barometer reading is used to compensate the tare value. This difference is called ATMOFFSET. This dynamic atmospheric compensation technique, which relies only on the resolution and short term stability of the on-board barometer (not its absolute accuracy or long term stability), allows gauge measurements with an absolute RPT with an additional uncertainty due to possible changes in atmospheric pressure of only ± 0.00035 psi (2.5 Pa).

- **When using an absolute RPT to make low gauge mode measurements, the limit in resolution of the on-board barometer used for dynamic compensation for atmospheric pressure may cause distortion of the results. For best results when using an absolute RPT in gauge mode under 7 psi (50 kPa) consider turning the AutoZ function OFF (see 3.4.1.1 AutoZ On/Off) to eliminate the effect of the dynamic compensation system and rezero (run AutoZ) MODEL 785 often to keep the atmospheric tare value current (see 3.2.9 [AutoZ).**

Recommendations for the Use of the AutoZ Function

The AutoZ function provides a powerful and easy to use tool for improving the measurement accuracy specifications of an MODEL 785 and reducing the calibration recall interval by compensating for zero drift between full recalibrations. The following simple recommendations will help assure that you use this feature to best advantage.

- Always leave AutoZ "on" when operating in the gauge measurement mode. The only possible exception is when using an absolute RPT in gauge mode at pressures under 7 psi (50 kPa) (see note just above).
- Always leave AutoZ "on" when operating in the absolute measurement mode if ZNATERR was set properly at calibration and the AutoZ routine using a valid atmospheric reference has been run regularly.
- Execute the run AutoZ routine in absolute mode only when a reference whose accuracy is known to be significantly better than that of the MODEL 785 RPT is available. Keep range ratios in mind when comparing accuracy. A ± 0.01% FS barometer is roughly 10 times more accurate than a ± 0.01 % FS 150 psi (1 MPa) RPT range because the RPT/barometer range ratio is 10:1.
- If possible, allow the MODEL 785 to stabilize at atmospheric pressure and ambient temperature for 5 to 10 minutes before running AutoZ in absolute mode.
- In gauge mode, run AutoZ every time MODEL 785 is vented.

OPERATION

- **The AutoZ function and values are range AND mode (gauge or absolute) specific.**

To access the MODEL 785 AutoZ function press **[SPECIAL]**, **<1AutoZ>**. The display is :

```
1off  2view        H3
3edit
```

<1off> (or <1on>) is for changing the AutoZ status for the active range and measurement mode from on to off or vice versa, (see AutoZ On/Off above).

<2view> allows the current value of ZOFFSET for the active range and measurement mode to be viewed.

<3edit> allows the current value of ZOFFSET for the active range and measurement mode to be edited.

3.4.1.1 AutoZ On/Off

To turn AutoZ on/off for the current range and measurement mode, press **[SPECIAL]**, **<1AutoZ>**.

If AutoZ is off for the current range and measurement mode, **<1On>** is displayed in the **[SPECIAL]**, **<1AutoZ>** menu. Press **<1On>** to turn AutoZ on and return to the main run screen.

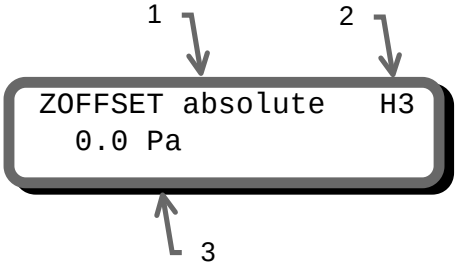
If AutoZ is on for the current range and measurement mode, **<1Off>** is displayed in the **[SPECIAL]**, **<1AutoZ>** menu. Press **<1Off>** to turn AutoZ off and return to the main run screen.

- **AutoZ on is indicated by a <z> in the main run screen, top line, third character from the right. When AutoZ is off, the character is blank.**

- **In absolute mode (AXXXX RPT), or gauge mode with a gauge RPT (GXXXX RPT), when AutoZ is off the [AutoZ] key is disabled and ZOFFSET is not applied.**
- **In gauge mode with an absolute RPT (AXXXX RPT), when AutoZ is off the [AutoZ] key is disabled and "dynamic compensation for atmospheric pressure" is off. ZOFFSET is still applied to tare out atmospheric pressure.**

3.4.1.2 View AutoZ

To view the current ZOFFSET for the active range and measurement mode press **[SPECIAL]**, **<1AutoZ>**, **<2view>**. The display is:



1. Current measurement mode.
2. Active range.
3. Display field of current value of ZOFFSET

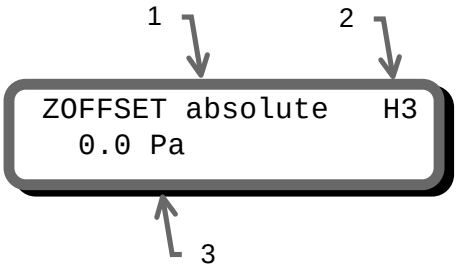
- **ZOFFSET should be zero in absolute mode when the MODEL 785 is new or has just been calibrated. ZOFFSET should be roughly equal to atmospheric pressure for an absolute RPT operating in gauge mode.**

- **The value of ZOFFSET is always displayed and entered in Pascal (Pa) regardless of the current MODEL 785 measurement unit as MODEL 785's internal operations are in Pa.**

3.4.1.3 Edit AutoZ

The edit AutoZ function should be used with caution as entering inappropriate values and turning on AutoZ may result in incorrect autozeroing and out of tolerance measurements. In normal operation, the value of ZOFFSET should be changed using the run AutoZ function (see 3.2.9 [AutoZ). The only expected use of edit AutoZ is to set ZOFFSET to zero after a calibration of MODEL 785 RPTs. Before editing ZOFFSET, see, 3.4.1 AutoZ, PRINCIPLE and 5.2.6 Setting ZNATERR.

To edit ZOFFSET for the active range and measurement mode press **[SPECIAL]**, **<1AutoZ>**, **<3edit>**. The display is:



1. Current measurement mode.
2. Active range.
3. Edit field for value of ZOFFSET

- **The value of ZOFFSET is always displayed and entered in Pascal (Pa) regardless of the current MODEL 785 measurement unit.**

3.4.2 SDS

PURPOSE

To view and/or change the status of SDS (on/off) for any SDS equipped RPT independently of the **[SDS]** direct function key or the active RPT and range.

- **See also 3.1.2.6 SDS Self Defense System, 3.2.8 [SDS] (SELF DEFENSE SYSTEM), 1.3.3 Configurations for additional information on the SDS Self Defense System,**

- **SDS is present only on RPTs designated A1500 or lower.**

SDS on/off should be operated with great care to avoid accidentally overpressuring an RPT. Always double check to ensure that the pressure applied to the RPT test port is lower than maximum pressure acceptable to the RPT before defeating SDS.

OPERATION

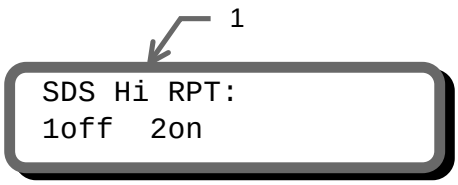
To access the special SDS control function press **[SPECIAL]**, **<2SDS>**.

The display is:

```
SDS control:
1Hi RPT  2Lo RPT
```

If this is a single RPT MODEL 785, this menu is skipped.

Press **<1Hi PRT>** to control SDS on the Hi RPT or **<2Lo RPT>** to control SDS on the Lo RPT. If the selected RPT is not SDS equipped, a message indicating so displays briefly. If the selected RPT is SDS equipped the display is :



1. Hi or Lo depending on the RPT selected.

The cursor is on the number corresponding to the current status of SDS for the selected RPT. Press **[ESCAPE]** to return to the main run screen without affecting SDS status.

Select **<2on>** to turn on SDS on. SDS turns on for the selected RPT and operation returns to the main run screen.

Select **<1off>** to turn SDS off. Operation is identical to using the SDS direct function key to defeat SDS (see 3.2.8 [SDS] (SELF DEFENSE SYSTEM)). MODEL 785 displays the maximum acceptable pressure for the active RPT and range and ask for confirmation that SDS should be defeated. Press ESCAPE to return to the main run screen without affecting SDS status.

Defeating SDS with a pressure greater than Pmax! applied to the test port may cause overpressure damage to the RPT.

3.4.3 ATM

PURPOSE

To view the value of atmospheric pressure as measured by the on-board barometer.

PRINCIPLE

MODEL 785 has an independent on-board barometer connected to the ATM port on the rear panel. The atmospheric pressure measurements made by the on-board barometer are used only for dynamic compensation of atmospheric pressure when using an absolute reference pressure transducer to make gauge pressure measurements. (see 3.4.1 AutoZ, PRINCIPLE).

- **See 1.3.2.2 On-Board Barometer, 5.6.1.7 On-board Barometer.**

- **The on-board barometer is used only for measuring <u>changes</u> in atmospheric pressure over short periods of time. MODEL 785 measurement accuracy does not depend on the absolute accuracy of the on-board barometer.**

OPERATION

To view the current reading of the on-board barometer press **[SPECIAL]**, **<7Atm>**. The display is in the current pressure units and current resolution setting of the active MODEL 785 range.

3.4.4 Remote

PURPOSE

To configure the MODEL 785 COM1, COM2 and IEEE-488 (GPIB) communication ports. To test COM1 and COM2 communications.

PRINCIPLE

The MODEL 785 has two RS-232 communications ports referred to as COM1 and COM2 and a single IEEE-488 (GPIB) port. COM1 or the IEEE-488 port is for communicating with a host computer (see 4. REMOTE OPERATION), and COM2 is reserved for communicating with an external device, e.g. a multimeter, MODEL 785, etc.. These ports can be set up from the MODEL 785 front panel.

A self test is supplied for RS-232 communications. The self test allows verification that the MODEL 785 RS-232 ports (COM1 and COM2) are operating properly and that a valid interface cable is being used. The test has two steps. In the first, COM1 sends a message to COM2 and in the second COM2 sends a message to COM1. In each step, MODEL 785 checks the message received at the receiving COM port. If the receiving COM port times out or receives an incorrect message, that step of the test fails.

OPERATION

To access the port configurations press **[SPECIAL]**. Select **<1COM1>**, **<2COM2>**, or **<3IEEE-488>** to view and edit that port's settings. Press **[SPECIAL]**, **<4RS232test t**o access the RS-232 self test.

1COM1 and 2COM2

The COMx ports can be set for the specific settings required by the user. These settings are baud, parity, length and stop bit. The available options are:

Baud: 300, 600, 1200, 2400, 4800, 9600, 19200
Parity: NONE, ODD or EVEN
Length: 7 or 8
Stop Bit: 1 or 2

The default is "2400, E, 7,1" for COM1 and COM2.

The MODEL 785 appends a carriage return and a line feed to all messages that are sent out of the COM1 port to the host. It looks for a carriage return to terminate incoming messages and ignores line feeds. The user MUST wait for a reply to each message sent to the MODEL 785 before sending another message to it.

3IEEE-488

The IEEE-488 port address can be specified from 1 to 31.

The MODEL 785 sends a line feed and asserts the EOI line at the end of all transmitted messages. It looks for a line feed and/or assertion of the EOI line to terminate incoming messages.

4RS-232 self test

The RS-232 self test is provided to check the MODEL 785 COM ports and the interface cable independently of an external device or computer. If you are having difficulty communicating with MODEL 785 by RS-232 from a computer, the RS-232 self test can help establish that the MODEL 785 COM1 port you are trying to communicate with and the interface cable you are using are good.

To run a self test of the RS-232 ports (COM1 and COM2) press **[SPECIAL]**, **<4RS232test>**.

The display prompts you to connect COM1 to COM2 using the appropriate cable (see 4.2.1 RS232 INTERFACE).

Once the connection has been made, press **[ENTER]** to run the self test. The test is first executed in the COM1 → COM2 direction and then in the COM2 → COM1 direction. If the COM1 → COM2 test passes, **<PASSED>** displays briefly and the test proceeds to COM2 → COM1. If COM2 → COM1 passes **<PASSED>** is displayed briefly followed by the conclusion, **<MODEL 785 RS232 test has PASSED>**. If a test fails, execution is suspended until **[ENTER]** is pressed.

- **The MODEL 785 RS-232 test can fail for three reasons: 1) the RS-232 cable being used is incorrect (see 4.2.1 RS232 INTERFACE for information on the correct cable); 2) COM1 and COM2 do not have the same serial communications settings and therefore cannot communicate together (see 3.4.4 Remote to set the COM ports); 3) COM1or COM2 is defective. The reason for failed communications is almost always a cable or RS-232 interface settings problem. Be sure that these are correct before concluding that a COM port is defective.**

3.4.5 Reset

PURPOSE

To reset various MODEL 785 settings to default or factory values.

MODEL 785 stores its user definable settings in non-volatile memory. The reset menu allows the user to selectively or completely reset these settings to factory defaults. This clears out any settings that the user has set up, and should be used only to restore the MODEL 785 to a known state. MODEL 785 will go through its reboot routine after any type of reset is selected.

OPERATION

To access the reset choices press **<5Reset>** under the **[SPECIAL]** menu. The display is:

```
1sets  2units  3com
4cal     5all
```

3.4.5.1 Reset - sets

PURPOSE

Clears all of the normal user settings for pressure measurements. This includes:

- Head settings set to disabled with “cm” as the height unit and “N2” as the medium (see 3.2.7 [HEAD, 3.3.1 Head)
- Sets the upper limits to factory defaults (see 3.2.4[UL] (UPPER LIMIT)).
- Set the stability limits to ±0.005% FS (see 3.3.4 Stab (Stability)).
- Sets the auto zero ATMSTART measurement to 101.325 kPa (see 3.4.1 AutoZ).
- Enables the auto read rate feature (see 3.3.3 ReadRt (Read Rate)).
- Sets the resolution to factory defaults (see 3.2.5 [RES] (RESOLUTION)).
- Sets the pressure units to “psi” if the MODEL 785 is a “US” version or “kPa/MPa” if “SI” (see 3.3.2 PresU).
- Sets the measurement mode to “absolute” for ranges on absolute RPTs and “gauge” for ranges on gauge RPTs (see 3.2.3 [MODE]).
- Enables auto zero for all ranges and measurement modes (see 3.2.9 [AutoZ]).
- Sets the range to “H3” (see 3.2.1 [RANGE]).
- Sets the beeper on valid key entry to “MID” (see 3.4.7.2 Sound).
- Sets the Screen saver period to 10 minutes (see 3.4.7.1 ScrSav)
- Clears the previous leak check results (see 3.3.5 Leak (Leak Check)).

3.4.5.2 Reset - units

PURPOSE

Resets unit and mode settings to defaults.

- Sets the six pressure unit selectable from **[UNIT]** to defaults (see 3.2.2 [UNIT]).
- Sets the reference temperature for inches of water to 4 °C.
- Sets the user unit coefficient to 1.00/Pa (see 3.3.2 PresU).
- Sets the active pressure unit to default for all ranges (psi for “US” MODEL 785, kPa or MPa for “SI” MODEL 785) (see 3.2.2 [UNIT]).
- Sets the active measurement mode to default (see 3.2.3 [MODE]).

3.4.5.3 Reset - com

PURPOSE

Resets communications port settings: COM1 and COM2 set to 2400,E,7,1 using <CR> and <LF> as the terminating characters. The IEEE-488 interface address is set to 10.

➢ **See 3.4.4 Remote.**

3.4.5.4 Reset - cal

PURPOSE

Use caution with this reset as critical calibration data may be deleted.

This clears the user calibrations information, which affects the calibration of the unit.

- Clears the user defined RPT calibration coefficients. PA/PM, to 0 and 1 (See 5.2 CALIBRATION OF REFERENCE PRESSURE TRANSDUCERS, PRINCIPLE).
- Clears the user defined barometer calibration. Sets PA/PM to 0 and 1 (See 5.3 ADJUSTMENT OF ON-BOARD BAROMETER, PRINCIPLE).
- Clears the ZNATERR and ZOFFSET values to 0 (See 3.2.9 [AutoZ).

3.4.5.5 Reset - all

PURPOSE

To return MODEL 785 to the as delivered original factory condition. Performs the functions of the Sets, Units, Cal and Com resets. Also resets the user security level to low (see 3.4.8 Level).

3.4.6 Cal

To calibrate the MODEL 785 Hi and Lo RPTs and adjust the on-board barometer. These functions are considered part of MODEL 785 maintenance and are therefore covered in the maintenance section of this manual (see 5.2 CALIBRATION OF REFERENCE PRESSURE TRANSDUCERS, 5.3 ADJUSTMENT OF ON-BOARD BAROMETER).

3.4.7 Intern

PURPOSE

To access a menu of MODEL 785 internal operating preferences and functions. These include:

1. **<ScrSvr>** - View and change the screen saver function (see 3.4.7.1 ScrSav).
2. **<sounds>** - View and change valid entry keypad sound settings (see 3.4.7.2 Sound).
3. **<time>** - View and edit the internal time and date settings (see 3.4.7.3 Time)
4. **<ID>** - View the MODEL 785 serial number, view and edit the ID number (see 3.4.7.4 ID).

OPERATION

To access the Intern menu press **[SPECIAL]**, **<7Intern>**. The display is:

```
1ScrSav 2sound 3time
4ID
```

Select **<1ScrSvr>** to access the screen saver activation time menu (see 3.4.7.1 ScrSav).

Select **<2sound>** to access the keypad sounds choices (see 3.4.7.2 Sound).

Select **<3time>** to access the time and date view/edit (see 3.4.7.3 Time).

Select **<4ID>** to access the S/N view and the ID view/edit (see 3.4.7.4 ID).

3.4.7.1 ScrSav

PURPOSE

To adjust the MODEL 785 screen saver function.

PRINCIPLE

MODEL 785 has a screen saver function which causes the display to dim after a front panel key is not pressed for a certain amount of time. This function is factory set to activate after 10 minutes of inactivity but can be adjusted by the user.

OPERATION

To access the screen saver function press **[SPECIAL]**, **<7Intern>**, **<1ScrSav>**. Edit the time in minutes, after which screen saver will turn on.

- **Setting screen saver time to zero eliminates the screen saver function so that the display remains permanently at full brightness. The display may also be completed suppressed using the "soft" [on/off] key (see 3.1.2.3 "Soft" [On/Off] Key).**

3.4.7.2 Sound

PURPOSE

To adjust or suppress the MODEL 785 keypad valid key press sounds.

PRINCIPLE

MODEL 785 provides audible feedback by a brief "beep" when a valid key press is executed. The frequency of this beep may be selected from three choices or it may be completely suppressed. Invalid key presses are indicated by a descending two tone "blurp" which cannot be suppressed. (See 3.1.2.2 Sounds)

OPERATION

To access the keypad sound adjustment function press **[SPECIAL]**, **<7Intern>**, **<2sound>**.

Select between **<2lo>**, **<3mid>** or **<4hi>** to adjust the valid key press tone frequency.

Select **<1none>** to suppress the valid key press sound.

- **The sound function only affects the valid key press tone.**

3.4.7.3 Time

PURPOSE

To view and edit the MODEL 785 internal time and date settings.

OPERATION

To access the time function press **[SPECIAL]**, **<7Intern>**, **<3time>**. The display is:

```
Edit: 1time 2date
08:32:11 am  19980101
```

Select 1time to edit the time. Edit hours, then minutes, then am/pm by pressing ENTER at each entry. Seconds go to zero when minutes are entered.

Select 2date to edit the date. The date must be specified in YYYYMMDD format.

- **The MODEL 785 date and time are set to United States Mountain Standard Time in the final test and inspection process at the factory. If desired, used the date function to set your local time and date.**

3.4.7.4 ID

PURPOSE

To view the MODEL 785 serial number (SN) and to view or edit the ID number.

PRINCIPLE

MODEL 785 has a factory programmed serial number that is included on the product label on the bottom of the case and can be viewed in the ID menu.

MODEL 785 also allows the user to store a unique alpha numeric ID number. This feature is frequently used to assign and organizational control ID such as an asset number. Tool number, standard number, etc. The ID function allows the ID number to be viewed and edited.

OPERATION

To access the ID function press **[SPECIAL]**, **<7Intern>**, **<4Keypad>**. Select **<1view>** view the current ID and serial number (SN).

Select **<2edit>** to edit the ID.

The ID has twelve characters. When the edit screen is entered, the cursor is on the first character. Numerical values can be entered directly from the keypad. In addition, the **[←]** and **[→]** keys can be used to toggle through a list of available alpha numeric characters. Holding the key slews through the characters. Character order going up (**[→]**) is: blank space, symbols, lower case letters, upper case letters, numbers. . Press **[ENTER]** to select a character and move to the next character.

When a character is selected the cursor moves to the next character. To leave a blank character, **[ENTER]** with the field for that character blank. Use this for the trailing characters if the ID being entered is less than 12 characters.

After the last of the twelve characters has been entered, the Save ID? Option is offered. Select **<1no>** to return to the ID edit screen. Select **<2yes>** to save the edited ID.

➢ **The ID can also be set remotely from a computer which is quite a bit more convenient than writing it from the keyboard! (see 4.4.3.8 System Subsystem). ID cannot be cleared or reset by user commands.**

3.4.8 Level

PURPOSE

To set user protection levels to restrict access to certain functions and to edit the password required for changing user levels.

PRINCIPLE

MODEL 785's front panel user interface provides the means to access all MODEL 785 user defined data, settings and functions including calibration data. Inadvertent, uninformed or unauthorized altering or deleting of data, settings and functions could require extensive reconfiguration by the user and might cause invalid readings or damage to the system. For these reasons, depending upon the application in which MODEL 785 is being used, it may be desirable to restrict access to certain functions for certain users. The user level function provides a means of restricting access to certain functions. Four different levels of security are available.

Access to changing security levels can be left open, or be protected by a password..

SECURITY LEVELS

The security levels are structured to support typical operating environments as follows:

None This level is intended for use only by the system manager and/or calibration facility. It allows access and editing in all areas including critical metrological information.

Low This level of security is designed to protect the specific metrological information and system diagnostic and maintenance functions of the system. It is intended for an advanced operator performing many different tasks.

Medium This level of security is designed to protect specific metrological information in the system and to assure that the MODEL 785 is operated using consistent operational parameters.

High This level of security is designed to protect all operating parameters. It is intended to minimize operator choices, for example to perform repeated identical tests under consistent conditions.

MODEL 785 is delivered with the security level set at low to avoid inadvertent altering of critical internal settings but with access to changing security levels unrestricted. It is recommended that the low security level be maintained at all times. If there is a risk of unauthorized changing of the security level, changing authority should be password protected (see OPERATION below).

➢ **The High security level disables remote communications and returns an error message to all remote commands. All other security levels have no effect on remote communications.**

SECURITY LEVELS

The security levels are structured to support typical levels of operation as follows:

Specifically, the security levels prevent execution of the X'd functions:

Function	Low	Medium	High
[RANGE]			X
[UNIT]			X
[MODE]			X
[UPPER LIMIT] (change setting)			X
[RES]			X
[RES] (change setting)		X	X
[DISPLAY]			X
[HEAD]			X
[SDS]			X
[AutoZ] (in absolute mode)		X	X
[SETUP], **<1Head>**		X	X
[SETUP], **<2PresU>**		X	X
[SETUP], **<3ReadRt>** (change status)		X	X
[SETUP], **<4Stab>** (change setting)		X	X
[SPECIAL], **<1AutoZ>**			X
[SPECIAL], **<1AutoZ>**, **<1on/off>**		X	X
SPECIAL], **<1AutoZ>**, **<3edit>**		X	X
[SPECIAL], **<2SDS>**		X	X
[SPECIAL], **<3Atm>**			X
[SPECIAL], **<4Remote>** (access)			X
[SPECIAL], **<4Remote>** (make changes)		X	X
[SPECIAL], **<5Reset>**		X	X
[SPECIAL], **<5Reset>**, **<3com>**	X	X	X
[SPECIAL], **<5Reset>**, **<4cal>**	X	X	X
[SPECIAL], **<5Reset>**, **<5all>**	X	X	X
[SPECIAL], **<6Cal>**		X	X
[SPECIAL], **<6Cal>**, **<1RPT>**, **<2edit>**	X	X	X
[SPECIAL], **<6Cal>**, **<1RPT>**, **<3run ZNATERR>**	X	X	X
[SPECIAL], **<6Cal>**, **<2barometer>**, **<2edit>**	X	X	X
[SPECIAL], **<7Intern>**			X
[SPECIAL], **<7Intern>**, **<3Time>** (make changes)	X	X	X
[SPECIAL], **<7Intern>**, **<4ID>**, **<2edit>**	X	X	X
[SPECIAL], **<9Log>** (view)			X
[SPECIAL], **<9Log>** (clear log)	X	X	X
Remote communications disabled			X

OPERATION

MODEL 785 is delivered with no active password so access to the User Level menu is open. The user level is set to **<1Low>**. User levels can be changed freely until a password has been created.

To access the User Level function, press **[SPECIAL]**, **<8Level>**. **If no password yet exists or if the correct password has been entered**. The display is:

```
1change user level
2edit password
```

<1change> user level brings up the restriction menu:

```
Restriction: 1none
2low 3medium 4high
```

You can then select the current restriction level, or **[ESCAPE]** back to the main run screen

<2edit password> displays the user password and allows it to be edited. Passwords can be up to six numbers in length and cannot start with a zero.

```
Password:  pppppp
0 disables password
```

Once a password has been entered, the user level cannot be changed without reentering the password.

If '0' is entered, then the password is made inactive and a password will not be required to access the user level menu. This is the factory default with a security level of 2low.

If there is an active password, the MODEL 785 password entry screen appears. The user must enter the user defined password or the factory **secondary** password to proceed any further:

```
MODEL 785 SNnnnn-xx
Password:  pppppp
```

The first field ***<nnnn>*** is the serial number of the MODEL 785, followed by a second field ***<xx>*** that represents the number of times that a **secondary** password has been used. This second field increments each time a **secondary** password is used. The third field, ***<pppppp>***, is for normal password entry.

- **The factory secondary password is available in case the user's password has been misplaced or forgotten. It can be obtained by contacting *PAROSCIENTIFIC*. The factory secondary password is different for all MODEL 785's and changes each time it is used.**

3.4.9 Log

PURPOSE

To view and/or clear the MODEL 785 event log.

PRINCIPLE

MODEL 785 records to a log each time one of the following events occurs:

- Pmax! is exceeded (see 3.2.4.1 Over-pressure Function (Pmax!)).
- A memory fault occurs.

OPERATION

To view the event log press **[SPECIAL]**, **<9Log>**. The oldest logged event appears. Pressing **[ENTER]** steps through the logged events from the oldest to the most recent and ending with the option to clear the log, yes or no..

If no events have been logged, **<End of log>** displays.

User Notes

4. REMOTE OPERATION

4.1 OVERVIEW

Most of the MODEL 785 front panel functions can also be executed by commands from a remote computer. The host computer can communicate to the MODEL 785 using the MODEL 785 COM1 RS232 port or the IEEE-488 port.

4.2 INTERFACING

Sending a message to the MODEL 785 places it in remote mode. The remote indicator to the bottom right of the display lights when the MODEL 785 is in remote mode. It will also flicker when a message is received. The menus usually accessed from the front panel are locked out while in remote. **[ESCAPE]** returns the MODEL 785 to local operation unless the "SYSTEM:KLOC ON" command was used to lock out keypad operation.

4.2.1 RS232 INTERFACE

4.2.1.1 COM1

The MODEL 785 COM1 RS232 interface is located on the rear panel. It is a 9 pin female DB-9F connector configured as a DCE device. Data is transmitted out of MODEL 785 using pin 2, and is received on pin 3. This allows a normal "pin to pin" DB-9M to DB-9F RS232 cable to be used to connect to a DTE host. Handshaking is not required or supported.

MODEL 785 COM1 DB-9F Pin Designations		
Pin#	**Function**	**Description**
2	TxD	This pin transmits serial data from the MODEL 785 to the host.
3	RxD	This pin accepts serial data from the host computer.
5	Grn	This pin is the common return for the TxD and RxD signals.

IBM PC/XT DB-9F Connections		IBM PC/XT DB-9M to MODEL 785 DB9F Connection	
DB-25M	**DB-9F**	**DB-9M**	**DB-9F**
2	3	3	3
3	2	2	2
7	5	5	5

4.2.1.2 COM2

The MODEL 785 COM2 RS232 interface is located on the rear panel. It is a 9 pin male DB-9M connector configured as a DTE device. Data is transmitted out of the MODEL 785 using pin 3 and is received on pin 2. This allows a normal "pin to pin" DB-9F to DB-9M RS232 cable to be used to connect to a DCE slave. Handshaking is not required or supported. COM2 can be used to allow communication to other MODEL 785s by connecting the Host port to the first MODEL 785's COM1 port, and then connecting COM1 of the second MODEL 785 to the COM2 port of the first MODEL 785. This method can be used to chain multiple MODEL 785s together using the "SYST:COMM:THRU" command.

MODEL 785 COM2 DB-9M Pin Designations		
Pin#	**Function**	**Description**
2	RxD	This pin accepts serial data from another MODEL 785 or another device.
3	TxD	This pin transmits serial data from the MODEL 785 to another MODEL 785 or another device
5	Grn	This pin is the common return for the TxD and RxD signals.

IBM PC/XT DB-25F to DB-9M Connections		IBM PC/XT DB-9F to MODEL 785 DB9M Connection	
DB-25F	**DB-9M**	**DB-9F**	**DB-9M**
2	3	3	3
3	2	2	2
7	5	5	5

4.2.2 IEEE-488 (GPIB)

The MODEL 785 IEEE-488 interface is located on the rear panel. The physical and electrical interface conforms to IEEE Std 488.1-1987 Subset E2 and IEEE Std. 488.2-1992 You should not attempt to communicate with the IEEE-488 interface while using the COM1 interface. The IEEE-488 receive buffer is 250 bytes deep. The MODEL 785 will hold off release of the NRFD handshake line until it can service and empty the receive buffer. This keeps the buffer from overflowing.

4.3 REMOTE COMMAND SYNTAX AND STYLE

4.3.1 Local and Remote Setting

When in local mode, each of the three ranges of each of the (up to) two RPTs has its own settings (unit, mode, resolution, stability)(see 3.1.2.5 Multiple Pressure Ranges) that are set range specifically and remain with the range. When ranges are changed, the settings change to those that were last set in that range; settings change as ranges are changed. In remote, each RPT is treated as a channel and the settings are common to all the ranges of one RPT. The only range specific settings are calibration and AutoZ settings. When you change ranges on one RPT the settings remain the same. Changes made to the settings while in remote mode will remain when operation is switched back to local mode.

4.3.2 Command Syntax

The remote command set for the MODEL 785 uses SCPI, 1992.0 (Standard Communications Protocol for Instruments) syntax and format. Commands are grouped into subsystems that contain related keywords in a hierarchical structure in a command "tree". These keywords are strung together to create a command. A colon (':') is a header separator that separates each keyword as you move down each level or "node" of the command "tree". The beginning of a command message does not require a colon, but one is allowed.

Each keyword has a long form and a short form. The short form is always shown in uppercase, while the remaining lower case letters indicate the long form. Either long or short form use is allowed and the MODEL 785 is case insensitive to these commands. Brackets ("[]") are used to identify optional keywords that are the default keyword for a particular node.

4.3.3 Queries and Replies

Many commands require additional parameters, some require no additional parameters, and many also have a query form. Some commands are only queries. A question mark ('?') immediately following a command specifies a query. Commands for the COM1 port and the IEEE-488 port use the same style and syntax, but differ slightly in their responses from MODEL 785. When using the IEEE-488 port, only queries generate a reply from the MODEL 785. When using the COM1 port, every command generates a reply, and the user must wait for the reply before sending another command. For COM1 non query commands, the MODEL 785 replies with an "OK" or "ERROR". This maintains sync between the host and the MODEL 785.

4.3.4 Multiple Commands

Multiple commands may be sent within a single message to the MODEL 785 if desired. These commands must be separated by a semicolon (';') and the total message length cannot exceed 80 characters. Each command must be preceded by a colon unless you wish to reference the previous command node (discussed later). Query replies to such messages are returned in a single reply message with each reply separated by a semicolon. If you send multiple commands in a single message to the COM1 port, each query generates a reply and each non query command generates an "OK" response, with a semicolon separating each reply within the reply message. Examples:

PC $\rightarrow$ MODEL 785 (GPIB): "SYST:VERS?;:DISP:BLAN;:ABOR"

MODEL 785 $\rightarrow$ PC (GPIB): "1992.2"

PC $\rightarrow$ MODEL 785 (COM1): "SYST:VERS?;:DISP:BLAN;:ABOR"

MODEL 785 $\rightarrow$ PC (COM1): "1992.2;OK;OK"

When using multiple commands, you may reference the previous command level by not preceding the command with a colon. MODEL 785 interprets the command starting at the command level defined by the preceding command in the message. This level must be established by the first command of a message. Example:

To set the MODEL 785 COM1 port to 2400 baud, even parity, 7 bit word length and one stop bit, you could send:

"COMM:SERIAL:TRAN:BAUD 2400;PAR EVEN;BITS 7;STOP 1"

Because this message actually contains 4 commands, the reply from the MODEL 785 if using the MODEL 785 COM1 port would be:

"OK;OK;OK;OK"

4.3.5 Command Parameters

Command parameters can be required or optional. There must be at least one space preceding the first parameter. Additional parameters are preceded by a comma (','). Parameters which depend on a unit (e.g. pressure or height) are interpreted in the current default unit unless a unit suffix follows the parameter separated by at least a space. Where indicated, specific keywords can be used in place of parameters for MIN, MAX and DEFAULT parameter values that are determined by the MODEL 785. Brackets ("[]") are used to identify optional parameters. In some cases, queries may allow parameters.

4.3.6 Suffixes

In some cases, a numeric suffix can follow a keyword to differentiate between the Hi RPT and the Lo RPT. '1' accesses the Hi RPT, and is the assumed RPT if a suffix is not given. '2' accesses the Lo RPT (if present) The command descriptions indicate an optional suffix by the use of "[*n*]" where *n* can be '1' or '2'

4.3.7 Programming Tips

SCPI AND IEEE-488.2

The MODEL 785 uses a remote command syntax and format based on the SCPI (Standard Commands for Programmable Instruments) language (see 4.3 REMOTE COMMAND SYNTAX AND STYLE). SCPI has been adopted because it provides the benefits of a standardized logical structure and common command syntax for users of programmable test instruments. Those that have developed programs for other SCPI compliant instruments will find the MODEL 785 command set familiar and easy to understand. First time SCPI users need to take some time to become familiar with the hierarchical SCPI commands. At first, these will seem complex, especially when compared with the simple linear command set used with older ***PAROSCIENTIFIC*** products. In fact, they offer greater versatility and commonality with other programmable test instruments.

MODEL 785 also supports IEEE-488.2 common and status commands.

- **LabVIEW® drivers are available for the MODEL 785. These drivers allow users of the National Instruments' LabVIEW environment to create systems that include one or more MODEL 785s using LabVIEW virtual instruments instead of using the remote commands directly. The MODEL 785 LabVIEW drivers are an abstraction of the remote commands into a consistent set of common and specific instrument functions. The drivers can be obtained at no charge from the *PAROSCIENTIFIC* web site http://www.paroscientific.com.**

PROGRAM TECHNIQUE

The following seven step procedure can be used to create a program which acquires pressure data over the MODEL 785's remote interface.

1. Establish communications with the MODEL 785 via RS232 or IEEE488

RS-232 (COM1): To establish serial communications the PC and MODEL 785 must be configured to have matching baud rates, parity, data bits, and stop bits. The PC's COM port must be connected to the MODEL 785's COM1 port using a straight-thru DB9M to DB9F cable (4.2.1 RS232 INTERFACE). The MODEL 785 COM1 port can be configured locally from the front panel using **[SPECIAL], <4Remote>** (see 3.4.4 Remote).

- **MODEL 785 supports an independent RS-232 self test to verify that the MODEL 785 RS-232 ports are operating correctly and the interface cable being used is valid. Use this self test to trouble sheet if you are having difficulty establishing communications over MODEL 785 COM1 (see 3.4.4 Remote, RS-232 Self Test).**

IEEE-488: To establish IEEE-488 communications the PC must have an IEEE-488 card and the MODEL 785 must be correctly addressed (4.2.2 IEEE-488 (GPIB)). The MODEL 785's IEEE-488 address can be set locally from the front panel using **[SPECIAL],<4Remote>** (see 3.4.4 Remote). An IEEE-488 interface cable must be used.

Send the command "*IDN?" and read the response (see 4.4.3.1 IEEE Std. 488.2 Common and Status Commands, "*IDN" Command Description). Scan the response for the string "MODEL 785". This verifies that communications have been successfully established and that the instrument connected is actually an MODEL 785.

- **When in high security user level (3.4.8 Level), remote commands are locked out. This mode is set from the front panel. Any attempt to communicate remotely when locked out by the user level results in an error. The error query remote command (see 4.4.3.8 System Subsystem, "SYSTem:ERRor?" Command Description) is the only remote command that will function when remote commands are locked out by the user level.**

2. Set the pressure units for the desired RPT:

Send the command "UNIT[n] *PRESUNIT*" (where n equals 1 to select the Hi RPT and 2 to select the Lo RPT) . For example, to set the measurement units on the lo RPT to "psi" send the command "UNIT:PRESsure2 PSI". Note that the keyword "PRESsure" is optional for this command, so the command "UNIT2 PSI" would have the same effect (see 4.4.3.9 Unit Subsystem, "UNIT[:PRESsure][n]" Command Description).

3. Set the pressure measurement mode for the desired RPT:

Send the command "UNIT[n]:*PRESMODE*" (where n equals 1 to select the Hi RPT and 2 to select the Lo RPT. Where *PRESMODE* equals "A" to select absolute and "G" to select gauge. For example, to set the measurement mode on the Lo RPT to "gauge", send the command "UNIT:PRESsure:MODE G" (see 4.4.3.9 Unit Subsystem, "UNIT[:PRESsure][n]: *PRESMODE*" Command Description).

4. Turn SDS off (disable SDS) on the RPT that is going to be used to make measurements:

Send the command "SDS[n] OFF" (where n equals 1 to select the Hi RPT and 2 to select the Lo RPT). For example, to turn SDS "off" (disable SDS) on the Lo RPT, send the command "SDS2 OFF". It is generally recommended to turn SDS "on" for the RPT channel that is not being used to isolate it from the TEST port. For this example, use the command "SDS1 ON". The SDS command is not necessary if SDS is not present on the RPT (see 1.3.3 Configurations to determine if SDS is present).

Incorrect use of SDS may result in RPT overpressure and severe damage to MODEL 785.

Before using the SDS command, determine your MODEL 785's configuration (see 1.3.3 Configurations) and become thoroughly familiar with SDS principles and operation (see 3.1.2.6 SDS Self Defense System, 3.2.8 [SDS] (SELF DEFENSE SYSTEM), 3.4.2 SDS).

When SDS is "on" for an RPT, that RPT is isolated from the TEST port. Turning SDS "off" for an RPT (disabling SDS), connects that RPT to the TEST port. Before turning SDS "off", be sure that the pressure applied to the RPT's TEST port is less than the maximum acceptable pressure for that RPT. Always turn SDS "on" to protect an RPT when it is not in use.

Some RPTs are not equipped with SDS. An SDS command directed to an RPT channel that is not equipped with SDS results in an error message (see 4.4.2 Error Messages, "160 - SDS not available").

5. Start and get a new pressure measurement:

Send the command "MEASure[n]? Lo|Mid|Hi" (where n equals 1 to select the Hi RPT and 2 to select the Lo RPT). This command allows the RPT range and resolution for a pressure measurement to be defined.. For example, to read the pressure using Range 2 (the Mid range) of the Lo RPT send the command "MEASure2:PRESsure? MID". Note that the resolution is an optional parameter and was not sent in this example (see 4.4.3.2 Measurement Subsystem, "MEASure[n]:[[PRESsure]?" Command Description").

6. Obtain information related to the last measurement cycle:

Use the “FETCh[n]?” command. The “FETCh[n]?” command does not initiate a new pressure reading cycle and therefore can be used to quickly obtain previously initiated pressure readings. For example, to read the pressure rate of change that was associated with the measurement cycle of (5.) above, send the command “FETCh2:Rate?” (see 4.4.3.2 Measurement Subsystem, “FETCh[n]:RATE?” Command Description).

7. Read the pressure ready status associated with the last measurement cycle:

Use the “CALCulate:STABility[n]:LIMIT:FAIL?. This command allows the “ready/not ready” status of the previous pressure measurement to be determined (3.1.2.4 Pressure Ready/Not Ready Indication). For example, send the command “CALCulate:STABility2:LIMIT:FAIL?” to read the stability dependent ready/not ready value associated with the reading made in (5.) above (0 if ready, 1 if not ready) (see 4.4.3.3 Calculate Subsystem).

The preceding procedure utilizing the “MEASure” command is recommended for single pressure readings. This command is simple to use since it allows the selection of RPT, range and resolution, initiates a pressure measurement cycle and reads the result all in a single command. The drawback of combining all these functions in a single command is that it takes several seconds to execute and includes functions that are not necessary when repeating measurements.. The preferred method when taking repeated readings from a specific RPT and range is to first use the “CONFigure” command to set the range and resolution and then to repeatedly use the “READ” command to start and get the pressure measurements on the current range. The following commands could be used to perform the same test as described above instead of using the measure command: “CONFigure2 Mid” followed by “READ2?” (4.4.3.2 Measurement Subsystem).

In fact, if MODEL 785 is already set up as needed for the measurements to be made, the only command that is needed to collect data is the READ[n]? command. For the test above the command to send to read pressure from the current range is “READ2?”.

QUICK TIPS

In order too]	Use Command	Notes
Set the pressure units	UNIT[n] *PRESUNIT*	Use UNIT:MODE to set gauge or absolute measurement mode.
Read the pressure using the current range of the specified RPT, in current measurement units and resolution	READ[n]?]	Remember to turn SDS off, if present, prior to taking a reading.
Turn SDS off or on for the specified RPT	SDS[n] OFF|ON	Use with caution (see 3.1.2.6 SDS Self Defense System).
Set the RPT and range and read the pressure.	CONF[n] Lo|Mid|Hi followed by READ1[n]?	As an alternate, Meas[n]? Lo|Mid|Hi also works but contains redundant functions when used repeatedly on the same range.
Determine the pressure stability rate dependent ready/not ready condition for a pressure reading.	CALC:STAB[n]:LIMIT:FAIL?	Returns 0 when previous reading was ready (within stability criterion).
Read the pressure rate of change associated with a prior pressure reading.	FETC[n]:RATE?	Fetch can also be used to reread the last pressure.
Set the head height	CALC:HEAD:HEIGht *HEIGHT*	Send UNIT:HEIGht IN|CM prior to setting the head height.
Turn on AutoZ for the specified RPT	CAL[n]:ZERO:STATe ON	This enables AutoZ on the current range. The setting applies to other ranges on the same RPT when the range is changed.
Run AutoZ on a specified RPT and range to specify the value of ZSTD and determine a new ZOFFSET for a given range and measurement mode.	CAL[n]:ZERO:AUTO [*ONCE,ZSTD*]	Prior to executing this command the range must be selected using the CONF command and the measurement mode must be selected using the UNIT:MODE command.
Check if the upper limit was exceeded.	SENS[n]:PROT:TRIP?	SENS[n]:PROT:CLE is used to clear this flag.
See if any errors have occurred	SYST:ERR?	
Have the MODEL 785 screen correspond to a specific RPT and range.	CONF[n]:*RANGE*	This command affects the display. READ and MEAS commands do not.

4.4 COMMANDS

4.4.1 Command Summary

Items inside brackets"[]" are optional A '|' signifies 'or'
[*n*] specifies the RPT channel ('1' Hi, '2' Lo. Default is '1')
[*nn*] specifies the optional RPT range from 1 to 3 (default is '1')

COMMAND	PARAMETERS	NOTES
*CLS	Command only	Clears the queues and status registers
*ESE	0..255	Event status enable register
*ESR?	Query only	Event status register
*IDN?	Query only	Identify software version and hardware
*OPC	None	Operation complete
*OPT?	Query only	Operation identification
*RSE	0..255	RPT ready status enable register
*RSR?	Query only	RPT ready status event register
*RST	Command only	Reset to default settings
*SRE	0..255	Service request register
*STB?	0..255	Status byte
*TST?	Query only	System self test results
:ABORt		Halt current measurement cycle
:CALCulate		
:HEAD		
:HEIGht	Headheight	Height difference of MODEL 785 and DUT
:MEDium	N2|He|Air|Oil|H20|User	The pressure medium
:DENSity	Density	The user defined pressure medium density
:STABility[*n*]		
:LIMIT	Stability	Stability limit.
:FAIL?	Query only	Stability limit Ready status..
:CALibration[*n*]		
:AMBient		
[:PRESsure]	Adder, Multiplier	Barometer PA/PM
:DATE	YYYY,MM,DD	Barometer calibration date
:RPT[*nn*]	Adder, Multiplier	RPT range PA/PM
:DATE	YYYY,MM,DD	RPT range calibration date
:ZERO		
:STATe	0 |1 |OFF|ON	AutoZ on/off
:AUTO	ONCE	Run AutoZ
:OFFSet[*nn*]		
:ABSolute	Absolute ZOFFSET	ZOFFSET for absolute mode
:GAUGe	Gauge ZOFFSET	ZOFFSET for gauge mode
:NATerr[*nn*]	ZNATERR	ZNATERR (absolute mode only)
:CONFigure[*n*]		
[:PRESsure]	range, resolution	Configure RPT for range and resolution.
:DISPlay	…...	…...
BLANking	0..99 min	Screen saver period
PAGE	1..7	Changes the DISPLAY function
:FETCh[*n*]	…...	…...
:[PRESsure]?	Query only	Pres result from a previous measurement.
:RATE?	Query only	Rate result from a previous measurement.

COMMAND	PARAMETERS	NOTES
:INITiate[*n*]	…...	…...
[:IMMediate]	Command only	Starts a new single measurement cycle
:CONTinuous	0|1|OFF|ON	Disable / Enable continuous measurement
:MEASure[*n*]	…...	…...
[:PRESsure]?	range, resolution	Start and get new pressure measurement
:RATE?	range, resolution	Start and get new rate measurement
		…...
SENSe[*n*]	…...	
[:PRESsure]		
:PROTection		
:LEVel		
:ABSolute	Upper Limit	The absolute mode upper limit (UL) alarm
:GAUGe	Upper Limit	The gauge mode limit (UL) alarm
:TRIPped?	Query only	Check if UL has been exceeded
:CLEar	Command only	Clears the “TRIPped” flag
:AVERage		
:COUNt	0..10	The # of measurements to average
:AUTO	0 |1|OFF|ON	Disable/enable the auto read rate
:READ[*n*]	…...	…...
[:PRESsure]?	Query only	Start and get new pressure measurement
:RATE?	Query only	Start and get new rate measurement
:STATus		
:OPERation		
:CONDition?	Query Only	Read the condition register
:NTRAnsition	0..32767	Reads or sets the negative transition filter
:PTRAnsition	0..32767	Reads or sets the positive transition filter
[:EVENt]	0..32767	Reads or sets the event register
:ENABle	0..32767	Reads or sets the event enable
:INSTrument		
:CONDition?	Query Only	Read the condition register
:NTRAnsition	0..32767	Reads or sets the negative transition filter
:PTRAnsition	0..32767	Reads or sets the positive transition filter
[:EVENt]	0..32767	Reads or sets the event register
:ENABle	0..32767	Reads or sets the event enable
:ISUMmary[*n*]		
:CONDition?	Query Only	Read the condition register
:NTRAnsition	0..32767	Reads or sets the negative transition filter
:PTRAnsition	0..32767	Reads or sets the positive transition filter
[:EVENt]	0..32767	Reads or sets the event register
:ENABle	0..32767	Reads or sets the event enable
:QUEStionable		
:CONDition?	Query Only	Read the condition register
:NTRAnsition	0..32767	Reads or sets the negative transition filter
:PTRAnsition	0..32767	Reads or sets the positive transition filter
[:EVENt]	0..32767	Reads or sets the event register
:ENABle	0..32767	Reads or sets the event enable
:INSTrument		
:CONDition?	Query Only	Read the condition register
:NTRAnsition	0..32767	Reads or sets the negative transition filter
:PTRAnsition	0..32767	Reads or sets the positive transition filter
[:EVENt]	0..32767	Reads or sets the event register
:ENABle	0..32767	Reads or sets the event enable
:ISUMmary[*n*]		
	Query Only	Read the condition register

COMMAND	PARAMETERS	NOTES
:CONDition?	0..32767	Reads or sets the negative transition filter
:NTRAnsition	0..32767	Reads or sets the positive transition filter
:PTRAnsition	0..32767	Reads or sets the event register
[:EVENt]	0..32767	Reads or sets the event enable
:ENABle		
	…..	…...
:SYSTem		
:AMBient	Query only	Gets the most recent barometer meas.
[:PRESsure]?		
:BEEPer	0 |1|OFF|ON	Enable/Disable valid key press beep
:STATe	250..10000	Changes the key press beep frequency
:FREQuency	250..10000	Beeps the beeper once
:IMMediate	YYYY,MM,DD	Reads or sets MODEL 785 calendar
:COMMunicate	[*x*] defines COM1 or COM2	
:DATE		
:SERial[*x*]	1200|2400|4800|9600|19200	RS-232 baud rate
:TRANsmit	7|8	RS-232 word length
:BAUD	EVEN|ODD|ZERO|ONE|NONE	RS-232 parity type
:BITS	1|2	RS-232 number of stop bits
:PARity		
:STOP	1200|2400|4800|9600|19200	RS-232 baud rate
:[RECeive]	7|8	RS-232 word length
:BAUD	EVEN|ODD|ZERO|ONE|NONE	RS-232 parity type
:BITS	1|2	RS-232 number of stop bits
:PARity		
:STOP	1..30	The IEEE-488 address
:GPIB	message	Communicate with device on COM2
:ADDRess	Query Only	Get a message from the error queue
:THRU	ID number	Read or sets MODEL 785 ID number
:ERRor?	0..20	Same as a direct key press
:IDENtify	0|1|OFF|ON	Locks/unlocks the front panel.
:KEY	0 |1|OFF|ON	Turn the MODEL 785 power soft on or off
:KLOCk	0 |1|OFF|ON	SDS on/off system
:POWer	HH:MM “AM”|”PM”	Reads or sets the MODEL 785 clock
:SDS[*n*]	Query only	SCPI ‘version” in the form “YYYY.*n*”
:TIME	…….	……..
:VERSion?	IN|CM	Default height units
:UNIT	pressure units text	Default pressure units
:HEIGht	g|a or gauge|absolute	The pressure measurement mode
[:PRESsure][n]	Query only	Pressure unit conversion coefficient
:MODE	4|20|60	Sets the ref temperature for inWa unit
:COEFficient?	coef, label	Defines a user unit.
:TEMPerature		
:USER		

4.4.2 Error Messages

While using COM1, the MODEL 785 always replies to a non-query program message with “OK” if an error did not occur or “ERROR” if an error was reported to the MODEL 785 error queue. If you are using the IEEE-488 port, then only queries reply, so you must use the status reporting system to generate a service request when the error queue is not full, or you must check the error queue periodically using the “SYSTem:ERROr?” query.

Each error is placed into the Error Queue as it occurs. The “SYSTem:ERROr?” query can then be used to remove each error description (first in, first out) from the queue. The query reply “0, No error” signals that the error queue is empty. Here is a list of the possible errors numbers and the error description for each:

“SYSTEM:ERROR?” QUERY REPLY
“0, No error”
“-100, Command error”
“-102, Syntax error”
“-103, Invalid separator”
“-108, Parameter not allowed”
“-109, Missing parameter”
“-110, Command header error”
“-114, Header suffix out of range”
“-138, Suffix not allowed”
“-141, Invalid character data”
“-150, String data error”
“-222, Data out of range”
“-224, Illegal parameter value”
“102, User defined coefficient cannot be 0”
“103, Not available with an absolute RPT”
“104, Not available with a gauge RPT”
“105, Not available with altitude units”
“106, Not available with absolute units”
“107, Not available with gauge units”
“110, Numeric data not part of set”
“111, Numeric data length too great”
“112, Remote communications is restricted (see 3.4.8 Level)
“120, Data length too great”
“130, String data not part of set”
“131, String data length too great”
“140, Pressure exceeds range upper limit” (see 3.2.4 [UL] (UPPER LIMIT)
“150, External device not detected”
“151, External device improperly configured”
“152, External device timeout error”
“160, SDS not available”
“161, RPT timeout”
“180, Ambient temperature sensor failed
“181, Ambient pressure sensor failed

4.4.3 Command Descriptions

Each command description gives the full syntax showing the short form in uppercase, and the long form remainder in lower case. If the command has only a query form, it is followed by a question mark, and only a query syntax is given. If the command is not just a query, the command form is also given. Parameters are indicated by italics. Ranges of parameters or parameter types are indicated. The '|' character indicates multiple possible literal parameters or responses.

4.4.3.1 IEEE Std. 488.2 Common and Status Commands

The MODEL 785 supports a set of commands that are common to all instruments conforming to IEEE Std. 488.2 protocol. Though defined by the IEEE-488.2 standard, they also apply to MODEL 785 RS-232 (COM1) communications. These command make it easy to perform basic function for any device that supports these commands. These command also cover the status reporting commands. Refer to 4.5 Status System for details on the status registers mentioned in these commands. These IEEE-488.2 common commands always start with an asterisk

---

∗CLS

Purpose: Clear all of the status and event structures.
Command: "∗CLS"
Notes: This program message clears the following evens and status registers:
Standard Byte Register (STB)
Standard Event Status Register (ESR)
Error Queue
Pending OPC operations

∗ESE

Purpose: Read or set the Standard Event Status Enable Register.
Command: "∗ESE *n*"
Query: "∗ESE?"
Parameters *n:* '0 to 255' This is the decimal representation of the bit(s) to enable. To enable the PON and QYE bits, the argument would be 128+4 = 132
Query reply: *n* (0 to 255)
Notes: The Standard Event Status Enable register determines which bits in the standard Event Status Register are enabled and included in the Status Byte Register (ESB bit), and can assert the SRQ line. The reply is in decimal numeric form.

∗ESR

Purpose: Read the Standard Event Register
Query: "∗ESR?"
Query reply: *n* (0 to 255)
Notes: The Standard Event Register contents are cleared after reading. The reply is in decimal numeric form.

∗IDN

Purpose: Identify the MODEL 785 version, range, and serial number.

Query: "∗IDN?"

Notes: The identification reply is made up of the manufacturer, the model, the serial number and the software version. Each is separated by a comma.

Query reply: "PAROSCIENTIFIC, INC, MODEL 785 A0100/A0015, 1234, Ver1.00 -"

∗OPC

Purpose: Sets the operation complete bit when all operations have completed.

Command: "∗OPC"

Query: "∗OPC?"

Notes: This Command enables the MODEL 785 to set the OPC bit in the Standard Event Status Register when it has completed all pending functions. The Query replies with a "1" when all functions are complete.

Since the MODEL 785 does not support overlapping commands, this command has no practical use

Query reply: "0" or "1"

∗OPT

Purpose: Reads the list of installed MODEL 785 options.

Query: "∗OPT?"

Notes: This Query returns any registered electronic option(s) installed in the MODEL 785. Each option is separated by a comma

.

Query reply: "NONE"

∗RST

Purpose: Resets the MODEL 785 settings to factory settings

Command: "∗RST"

Notes: This Command sets the MODEL 785 settings to factory settings which is equivalent to a front panel executed **[SPECIAL], <5Reset>, 1sets**. This does not affect the communications settings.

See Also: 3.4.5.1 Reset - sets

∗SRE

Purpose: Read or set the Service Request Enable Register.

Command: "∗SRE *n*"

Query: "∗SRE?"

Parameters *n:* '0 to 255' This is the decimal representation of the bit(s) to enable. To allow the MAV and ESB bits to assert the SRQ line, the argument would be 32+16 = 48. Bit 6 (64) is reserved and cannot be set.

Notes: The Service Request Enable Register determines which bits of the Status Byte can set the MSS bit of the Status Byte and request service by asserting the SRQ line of the IEEE-488 interface.

Query reply: *n* (0 to 255)

∗STB?

Purpose: Read the Status Byte Register

Query: "∗STB?"

Notes: The Status Byte Register reflects the general status of the MODEL 785. The 'MSS' bit state is represented by bit 6

Query reply: *n* (0 to 255)

∗RSE

Purpose: Read or set the RPT ready status enable register

Command: "∗RSE *n*"

Query: "∗RSE?"

Parameters *n:* '0 to 255' This is the decimal representation of the bit(s) to enable. To enable the RDY2 bit, the argument would be 16

Query reply: *n* (0 to 255)

Notes: The RPT ready status enable register determines which bits in the RPT ready status register are enabled and included in the RPT ready status summary bit in the Status Byte Register (ESB bit), and can assert the SRQ line. The reply is in decimal numeric form.

∗RSR?

Purpose: Read the RPT ready status register.

Query: "∗RSR?"

Query reply: *n* (0 to 255)

Notes: The RPT ready status register contents are cleared after reading. The reply is in decimal numeric form.

See Also 3.1.2.4 Pressure Ready/Not Ready Indication

∗TST

Purpose: Read the power on self test status.

Query: "∗TST?""

Notes: The MODEL 785 system memory stores the user settings (units, mode, resolution) and retains them when the unit is shut.off. On power up, this memory is checked. If this memory is corrupted, all user settings are reset to default (as if the "∗RST" program message was executed), and the ∗TST query returns a '1'. If the MODEL 785 passed the test on power up OR if the ∗TST query was used at least once since the MODEL 785 was powered up the reply is '0'

Query reply: "0" or "1"

See Also: 3.4.5.1 Reset - sets

4.4.3.2 Measurement Subsystem

The measurement subsystem provides several ways of getting a measurement from the Hi or Lo (if present) RPT. The easiest is to use the MEASure commands. These commands provide a single step configuration and measurement of pressure or rate. The READ commands can also read back a new measurement, but without options to set the resolution or RPT range. For explicit control, you may use the ABORt, CONFigure, INITiate and FETCh commands (in that order) to control every aspect of the measurement process.

The pressure measurement cycle is continuous in local and remote mode. Initiating a measurement cycle with the READ, MEASure or INITiate command restarts the measurement cycle for the specified RPT channel..

The MODEL 785 can have a single RPT or two RPTs (Hi and Lo). The RPTs are considered separate channels and can be CONFigured differently. They each have their own related settings (pressure units, measurement mode, resolution, range, AutoZ) but share other common settings (head settings). You must use a suffix to access each separate RPT where '1' accesses the Hi RPT and '2' accesses the Lo RPT. Commands that do not allow a suffix affect both RPTs. If you try to access the optional Lo RPT and the MODEL 785 has only a Hi RPT, the operation will not be completed and an error will be placed in the error queue.

Measurement can occur at three levels. Level1 (the lowest level) is ideal if flexible control of the measurement process is required. Level1 also requires more commands. The highest level requires only one command:

LEVEL1:

"CONFigure" Selects the range and resolution"
"INITiate" Starts the measurement cycle
"FETCh?" Gets the results of the measurement cycle. You must wait until the cycle is complete before sending a FETCh command or you will get the results from the last measurement.

This level is useful if your program cannot wait for a new measurement to become available. Typically, you CONFigure once, INITiate and then have the program perform other functions before returning and using the FETCh command to get the result and INITiate again. You may use the status system registers ("*RSR?" or the STATus sub-system) to check or generate an IEEE-488 service request when the measurement cycle is complete

LEVEL2:

"CONFigure" Selects the range and resolution"
"READ?" Starts a new measure cycle, waits until the cycle is complete, and then gets the results of the measurement cycle.

You only need to CONFigue once, and then use the READ? query as needed to get new measurements.

LEVEL3:

"MEASure?" Configures the range and resolution, starts a new measure cycle, waits until the cycle is complete, and then gets the results of the measurement cycle.

This level very simple to use, because you can specify to configure the unit prior to the measurement in one command. However, it may take several seconds for the command to complete execution.

ABORt[*n*]

Purpose: Stops any current remote measurement cycle.

Command: "ABOR[*n*]"

Suffix: *n:* '1' to access the Hi RPT (default)
'2' to access the optional Lo RPT

Notes: Any measurements in progress are stopped. This should be done before INITiating a new measurement to ensure that you are getting a new measurement*s*, and not one from a previous cycle

CONFigure[*n*]:[PRESsure]

Purpose: Configures the specified RPT channel for a specific range and resolution All measurements made will use this configuration unless otherwise specified.

Command: "CONF[*n*] [*RANGE*, [*RESOLUTION*]"

Query: "CONF[*n*]? [*RANGE*, [*RESOLUTION*]"

Suffix *n:* '1' to access the Hi RPT (default)
'2' to access the optional Lo RPT

Parameters: *RANGE:* The expected pressure to be measured in the current default pressure units. The MODEL 785 will select one of the 3 possible ranges of the selected RPT. This range will be the lowest pressure range that is greater than the current and the anticipated pressure.. If the *RANGE* is not given, then the current default range will be used. As an alternative, you may pick the range to use by specifying "LO", "MED", or "HI"

RESOLUTION The resolution desired in the current default pressure units. This should be steps of 10^n where *n* is a whole number

Query reply: *RANGE, RESOLUTION* In the current default pressure unit

Notes: The reply can take up to 1 second due to range configuration If the current pressure is greater than the upper limit of the range specified, the operation will be completed in the current range and an error will be placed in the error queue

See Also 3.1.2.5 Multiple Pressure Ranges, 3.2.1 [RANGE], 3.2.5 [RES] (RESOLUTION)

FETCh[*n*]:[PRESsure]?

Purpose: Returns a RPT pressure measurement that was previously INITiated.

Query: "FETC[*n*]?"

Suffix: *n:* '1' to access the Hi RPT (default)
'2' to access the optional Lo RPT

Query reply: *PRESSURE* in the default pressure units and mode

Notes: The reply can take up to one measurement cycle. (1.3 sec), depending on the current integration rate and when the measurement was INITiated. This command only gets the results of a single measurement that must be INITiated using the INITiate command. You must make sure that the SDS system for the selected RPT is turned off (if installed) to allow pressure to be applied to the RPT.

FETCh[*n*]:RATE?

Purpose: Returns a RPT pressure rate (stability) measurement that was previously INITiated.

Query: "FETC[*n*]:RATE?"

Suffix: *n:* '1' to access the Hi RPT (default)
'2' to access the optional Lo RPT

Query reply: *RATE* in the default pressure units per second

Notes: The reply can take up to one measurement cycle. (1.3 sec), depending on the current integration rate. The rate is calculated using the previous measurement and the just completed measurement cycle. If the current pressure is greater than the upper limit of the range specified, the operation will be completed in the current range and an error will be placed in the error queue.

See Also 3.2.6.2 Rate, 3.3.4 Stab (Stability), 3.1.2.4 Pressure Ready/Not Ready Indication

INITiate[*n*]:CONTinuous

Purpose: Starts a new measurement cycle on the specified RPT.

Command: "INIT[*n*]:CONT *BOOLEAN*

Query: "INIT[*n*]:CONT?

Suffix: *n:* '1' to access the Hi RPT (default)
'2' to access the optional Lo RPT

Parameters: *BOOLEAN:* '0' or "OFF" to disable
'1' or "ON" to enable

Query reply: '0' if disabled
'1' if enabled

Notes: Continuous mode starts a new measurement cycle as each measurement cycle completes and allows the measurements to occur without further INITiation. This allows the user to use the FETch command to read the resulting pressure or rate measurements without manually starting each measurement cycle. This is Ideal if synchronization of the measurement is not required.

INITiate[*n*]:[IMMediate]

Purpose: Starts a new measurement cycle on the specified RPT.

Command "INIT[*n*

Suffix: *n:* '1' to access the Hi RPT (default)
'2' to access the optional Lo RPT

Notes: The measurement cycle can take up to (1.3 sec), depending on the current integration rate. This command (re)starts a single measurement cycle. The FETCh command can be used to retrieve the pressure and/or rate measurement when the cycle is finished You must make sure that the SDS system for the selected RPT is turned off (if installed) to allow pressure to be applied to the RPT.

MEASure[*n*]:[PRESsure]?

Purpose: Configures, initiates, and fetches a new RPT pressure measurement.

Query: "MEAS[*n*]? [*RANGE,* [*RESOLUTION*]]"

Suffix:
- *n:* '1' to access the Hi RPT (default)
- '2' to access the optional Lo RPT

Parameters:
- *RANGE:* The expected pressure to be measured in the current default pressure units. The MODEL 785 will select one of the 3 possible ranges of the selected RPT. This range will be the lowest pressure range that is greater than the current and the anticipated pressure.. If the *RANGE* is not given, then the current default range will be used. As an alternative, you may pick the range to use by specifying "LO", "MED", or "HI"
- *RESOLUTION* The resolution desired in the current default pressure units. This should be steps of 10^x where *x* is a whole number

Query reply: *PRESSURE* in the default pressure units and mode.

Notes: The reply can take up to 2 second due to range configuration and measurement times. You must make sure that the SDS system for the selected RPT is turned off (if installed) to allow pressure to be applied to the RPT. If the current pressure is greater than the upper limit of the range specified, the operation will be completed in the current range and an error will be placed in the error queue.

See Also: 3.1.2.5 Multiple Pressure Ranges, 3.2.1 [RANGE], 3.2.5 [RES] (RESOLUTION)

MEASure[*n*]:RATE?

Purpose: Configures, initiates, and fetches a new RPT rate measurement.

Query: "MEAS[*n*]:RATE? [*RANGE,* [*RESOLUTION*]]"

Suffix:
- *n:* '1' to access the Hi RPT (default)
- '2' to access the optional Lo RPT

Parameters:
- *RANGE:* The expected pressure point at which the rate is to be measured in the current default pressure units. The MODEL 785 will select one of the 3 possible ranges of the selected RPT. This range will be the lowest pressure range that is greater than the current and the anticipated pressure.. If the *RANGE* is not given, then the current default range will be used. As an alternative, you may pick the range to use by specifying "LO", "MED", or "HI".
- *RESOLUTION:* The resolution desired in the current default pressure units. This should be steps of 10^x where *x* is a whole number

Query reply: *RATE* in the default pressure units per second

Notes: The reply can take up to 2 second due to range configuration and measurement times. The rate is calculated using the previous measurement and the just completed measurement cycle. If the current pressure is greater than the upper limit of the range specified, the operation will be completed in the current range and an error will be placed in the error queue.

See Also: 3.1.2.5 Multiple Pressure Ranges, 3.2.1 [RANGE], 3.2.5 [RES] (RESOLUTION), 3.2.6.2 Rate, 3.3.4 Stab (Stability), 3.1.2.4 Pressure Ready/Not Ready Indication

READ[*n*]:[PRESsure]?

Purpose: Initiates, and fetches a new RPT pressure measurement.

Query: "READ[*n*]?"

Suffix *n:* '1' to access the Hi RPT (default)
'2' to access the optional Lo RPT

Query reply: *PRESSURE* in the default pressure units and mode

Notes: The reply can take up to one measurement cycle. (1.3 sec), depending on the current integration rate.. This command starts a single measurement cycle and returns the result when finished. You must make sure that the SDS system for the selected RPT is turned off (if installed) to allow pressure to be applied to the RPT.

READ[*n*]:RATE?

Purpose: Initiates, and fetches a new RPT rate measurement.

Query: "READ[*n*]:RATE?"

Suffix *n:* '1' to access the Hi RPT (default)
'2' to access the optional Lo RPT

Query reply: *RATE* in the default pressure units and mode

Notes: The reply can take up to one measurement cycle. (1.3 sec), depending on the current integration rate. The rate is calculated using the previous measurement and the just completed measurement cycle. If the current pressure is greater than the upper limit of the range specified, the operation will be completed in the current range and an error will be placed in the error queue.

See Also: 3.2.6.2 Rate, 3.3.4 Stab (Stability), 3.1.2.4 Pressure Ready/Not Ready Indication

4.4.3.3 Calculate Subsystem

The calculate subsystem accesses the stability limit and head settings.

CALCulate:STABility:LIMit [*n*]

Purpose: Reads or sets ready stability fail limit.
Command: "CALC:STAB:LIM[*n*] *STAB*"
Query: "CALC:STAB?"
Suffix: *n:* '1' to access the Hi RPT (default)
'2' to access the optional Lo RPT
Parameters: *STAB:* The stability rate of change limit in the default pressure units/sec
Query reply: *STAB* in the default pressure units/sec
See Also: 3.3.4 Stab (Stability), 3.1.2.4 Pressure Ready/Not Ready Indication

---

CALCulate:STABility:LIMit [*n*]:FAIL?

Purpose: Reads if the current RPT measurement fails the stability criteria
Query: "CALC:STAB:LIM[*n*]:FAIL?"
Suffix: *n:* '1' to access the Hi RPT (default)
'2' to access the optional Lo RPT
Query reply: *BOOLEAN* '1' if the previous measurement has failed the stability criteria.
'0' if the previous measurement has passed the stability criteria.
See Also: 3.3.4 Stab (Stability), 3.1.2.4 Pressure Ready/Not Ready Indication

---

CALCulate:HEAD:HEIGht

Purpose: Reads or sets height difference between the MODEL 785 and another reference or device under test.
Command: "CALC:HEAD:HEIG *HEIGHT"*
Query: "CALC:HEAD:HEIG?
Parameters: *HEIGHT:* The height relative to the MODEL 785 in the default height units.
Query reply: *HEIGHT*
Notes: Set the head height to '0' to disable.
See Also: 3.3.1 Head, 3.2.7 [HEAD]

CALCulate:HEAD:MEDium

Purpose: Reads or sets the type of gas or liquid that is being used with the MODEL 785.
Command: "CALC:HEAD:MED *MEDIUM*"
Query: "CALC:HEAD:MED? "
Parameters: *MEDIUM* "N2"|"He"|"Air"|"Oil"|"H20"|"User"
Query reply: *MEDIUM*
Notes: If "User" is specified, use the "CALCulate:HEAD:MEDium:DENSity" command to specify the medium density.
See Also: 3.3.1 Head, 3.2.7 [HEAD]

CALCulate:HEAD:DENSity

Purpose: Reads or sets the density of the “User” defined medium.
Command: “CALC:HEAD:DENS *DENSITY*”
Query: “CALC:HEAD:DENS?”
Parameters: *DENSITY* The density of the medium in kg/m^2
Query reply: *MEDIUM*
Notes: This setting is only used when the “CALCulate:HEAD:” has been set to “User”
See Also: 3.3.1 Head, 3.2.7 [HEAD]

4.4.3.4 Calibration Subsystem

The subsystem access the pressure and ambient sensor calibration and zero setting.

CALibration:AMBient[:PRESsure]

Purpose: Reads or sets the user adder and multiplier for the Ambient sensor.
Command: "CAL:AMB *ADDER, MULT*"
Query: "CAL:AMB?"
Parameters:
ADDER: The barometer pressure adder in the default pressure units
MULT: The barometer pressure multiplier.
Query reply: *ADDER, MULT*
See Also: 5.3 ADJUSTMENT OF ON-BOARD BAROMETER

CALibration:AMBient[:PRESsure]:DATE

Purpose: Reads or sets the barometer calibration date.
Command: "CAL:AMB:DATE *YEAR, MONTH, DAY*"
Query: "CAL:AMB:DATE? "
Parameters:
YEAR: The 4 digit year from 0 to 9999.
MONTH: The month from 1 to 12
DAY: The day from 1 to 31
Query reply: *YEAR, MONTH, DAY*
See Also: 5.3 ADJUSTMENT OF ON-BOARD BAROMETER

CALibration[*n*]:RPT[*nn*]

Purpose: Reads or sets the RPT and range calibration adder (PA) and multiplier (PM) for the RPT and RPT range.
Command: "CAL[*n*]:RPT[*nn*] *ADDER, MULT*"
Query: "CAL[*n*]:RPT[*nn*]?
Suffix
n: '1' to access the Hi RPT (default)
'2' to access the optional Lo RPT
nn: '1' to access the low range calibration data (default)
'2' to access the mid range calibration data
'3' to access the mid range calibration data
Parameters:
ADDER: The pressure adder in the default units
MULT: The pressure adder
Query reply: *ADDER, MULT*
See Also: 5.2 CALIBRATION OF REFERENCE PRESSURE TRANSDUCERS, PRINCIPLE

CALibration[*n*]:RPT[*nn*]:DATE

Purpose: Reads or sets the RPT and range calibration date.

Command: "CAL[*n*]:RPT[*nn*]:DATE *YEAR, MONTH, DAY*"

Query: "CAL[*n*]:RPT[*nn*]:DATE? "

Suffix:
- *n:* '1' to access the Hi RPT (default)
- '2' to access the optional Lo RPT
- *nn:* '1' to access the low range calibration data (default)
- '2' to access the mid range calibration data
- '3' to access the high range calibration data

Parameters:
- *YEAR:* The 4 digit year from 0 to 9999.
- *MONTH:* The month from 1 to 12
- *DAY:* The day from 1 to 31

Query reply: *YEAR, MONTH, DAY*

See Also: 5.2 CALIBRATION OF REFERENCE PRESSURE TRANSDUCERS

CALibration[*n*]:ZERO:AUTO

Purpose: Runs AutoZ to update the value of ZOFFSET for the selected RPT In the currently active range and measurement mode.

Command: "CAL[*n*]:ZERO:AUTO *ONCE [,ZSTD]* "

Suffix:
- *n:* '1' to access the Hi RPT (default)
- '2' to access the optional Lo RPT

Parameters:
- *ONCE:* "ONCE"
- *ZSTD* The reference used to calculate ZOFFSET. This should be always "0" if in gauge mode. If the Zstd is not given, "0" is assumed. To use the reading of range L3 as ZSTD, choose "lo" (valid only when running AutoZ on a Hi absolute RPT when there is also a Lo absolute RPT in the MODEL 785).

Notes: This runs AutoZ for the selected RPT in the currently active range and measurement mode ONLY!!.

See Also: 3.4.1 AutoZ, 3.2.9 [AutoZ], 3.2.9.2.1 Run AutoZ by Entry

CALibration[*n*]:ZERO:NERRor[*nn*]

Purpose: Reads or sets ZNATERR for the selected RPT currently active range (absolute only).

Command: "CAL[*n*]:ZERO:NERR[*nn*] *ZNATERR*"

Query: "CAL[*n*]:ZERO:NERR[*nn*]?"

Suffix:
- *n:* '1' to access the Hi RPT (default)
- '2' to access the optional Lo RPT
- *nn:* '1' to access the low range data (default)
- '2' to access the mid range data
- '3' to access the high range data

Parameters:
- *ZNATERR:* The natural error for the given range in the default pressure units.

Query reply: *ZNATERR*

See Also: 3.4.1 AutoZ, 5.2.6 Setting ZNATERR

CALibration[*n*]:ZERO:OFFSet[*nn*]:GAUGe

CALibration[*n*]:ZERO:OFFSet[*nn*]:ABSolute

Purpose: Reads or sets ZOFFSET.
Command: "CAL[*n*]:ZERO:OFFS[*nn*]:GAUG *GAOFFSET*"
"CAL[*n*]:ZERO:OFFS[*nn*]:ABS *ABSOFFSET*"
Query: "CAL[*n*]:ZERO:OFFS[*nn*]:GAUG? "
"CAL[*n*]:ZERO:OFFS[*nn*]:ABS?"
Suffix:
n: '1' to access the Hi RPT (default)
'2' to access the optional Lo RPT
nn: '1' to access the low range data (default)
'2' to access the mid range data
'3' to access the high range data
Parameters:
GAOFFSET: The gauge mode ZOFFSET in the default pressure units
ABSOFFSET: The absolute mode ZOFFSET in the default pressure units
Query reply: *GAOFFSET* or *ABSOFFSET*
Notes: The *ABSOFFSET* is reported but does not apply if the RPT is a gauge RPT.
See Also: 3.4.1 AutoZ, 3.2.9 [AutoZ]

CALibration[*n*]:ZERO:STATe

Purpose: Reads or sets the AutoZ on/off status.
Command: "CAL[*n*]:ZERO:STAT *BOOLEAN*"
Query: "CAL[*n*]:ZERO:STAT? "
Suffix:
n: '1' to access the Hi RPT (default)
'2' to access the optional Lo RPT
Parameters:
BOOLEAN: '0' or "OFF" to disable AutoZ.
'1' or "ON" to enable AutoZ.
Query reply:
BOOLEAN: "0" or "1"
See Also: 3.4.1 AutoZ, 3.4.1.1 AutoZ On/Off

4.4.3.5 Display Subsystem

The display subsystem controls the front panel display attributes including screen saver, time function and ID function.

DISPlay:BLANking

Purpose: Sets or reads the period of local inactivity MODEL 785 waits until it dims the screen to 33% intensity.

Command: "DISP:BLAN *PERIOD*"

Query: "DISP:BLAN? "

Parameters: *PERIOD:* The period from 1 to 99 minutes

Query reply: *PERIOD*

See Also: 3.4.7.1 ScrSav

DISPlay:PAGE

Purpose: Sets the display page shown on the main run screen of the MODEL 785. These are the same pages available from the front panel **[DISPLAY]** function.

Command: "DISP:PAGE *PAGE*"

Query: "DISP:PAGE? "

Parameters: *PAGE:* The page number to display (default is "2Rate")
- '1' Display the Average screen. (local data only)
- '2' Display the default Rate screen
- '3' Display the Deviation screen. (local data only)
- '4' Display the dual RPT screen (Must have dual RPT option)
- '5' Display the Hi/Lo screen.
- '6' Display the Freeze screen (local data only)
- '7' Display the Clean screen.

Query reply: *PAGE* from '1' to '7'

Notes: These display screens may show information that is available only through the front panel display (Average, Deviation, Freeze).

See Also: 3.2.6 [DISPLAY]

4.4.3.6 Sense Subsystem

The sense subsystem controls the upper limit (UL) settings and the pressure reading integration functions.

SENSe[n]:AVERage:AUTO

Purpose: Enables and disables the auto read rate function.
Command: "SENS[*n*]:AVER:AUTO *BOOLEAN*"
Query: "SENS[*n*]:AVER:AUTO?"
Suffix: *n:* '1' to access the Hi RPT (default)
'2' to access the optional Lo RPT
Parameters: *BOOLEAN* '1' to enable auto read rate.
'0' to disable auto read rate.
Query reply: *BOOLEAN* '1' or '0'
See Also: 3.3.3 ReadRt (Read Rate)

SENSe[*n*]:AVERage:COUNt

Purpose: Sets or reads the number of samples averaged by the RPT before completing a measurement cycle.
Command: "SENS[*n*]:AVER:COUN *SAMPLES*"
Query: "SENS[*n*]:AVER:COUN?"
Suffix: *n:* '1' to access the Hi RPT (default)
'2' to access the optional Lo RPT
Parameters: *SAMPLES:* The number of samples averaged before a measurement cycle is complete. Each sample takes 200 ms to complete.
Query reply: *SAMPLES*
Notes: This setting is automatically adjusted by the auto integration function (if enabled) to increase the integration rate when the rate of change is great. This command is only effective if auto integration is disabled using the "SENSe[n]:AVERage:AUTO" command.
See Also: 3.3.3 ReadRt (Read Rate)

SENSe[*n*][:PRESsure]:PROTection:LEVel:GAUGe
SENSe[*n*][:PRESsure]:PROTection:LEVel:ABSolute

Purpose: Sets or reads the upper limit (UL) for the specified RPT and the current RPT range.

Command: "SENS[*n*]:PROT:LEV:GAUG *GAUGEUL*"
"SENS[*n*]:PROT:LEV:ABS *ABSUL*"

Query: "SENS[*n*]:PROT:LEV:GAUG?"
"SENS[*n*]:PROT:LEV:ABS?"

Suffix: *n:* '1' to access the Hi RPT (default)
'2' to access the optional Lo RPT

Parameters: *GAUGEUL:* The Upper Limit in the current default units for gauge mode measurements. The pressure unit can optionally be specified after the *GAUGEUL* separated by a space
ABSUL: The Upper Limit in the current default units for absolute mode measurements. The pressure unit can optionally be specified after the *ABSUL* separated by a space.

Query reply: *GAUGEUL* OR *ABSUL*

Notes: Separate limits are maintained for each mode (absolute and gauge) and each range of each RPT. The UL can only be set slightly above the range (1 of 3) for each RPT. If the RPT is a gauge RPT, then the *ABSUL* setting is ignored

See Also: 3.2.4 [UL] (UPPER LIMIT)

SENSE[*N*][:PRESsure]:PROTection:TRIPped?

Purpose: Reads the upper limit (UL) exceeded flag for the specified RPT.

Query: "SENS[*n*]:PROT:TRIP?"

Suffix: *n:* '1' to access the Hi RPT (default)
'2' to access the optional Lo RPT

Query reply: *BOOLEAN:* '1' The pressure has exceeded upper limit since power up or since the flag was last cleared. You can clear this flag with the command "SENSe[*n*]PRESsure:PROTection:CLEar" command.
'0' The pressure has not been exceeded.

Notes: Separate limits are maintained for each range and measurement mode (absolute and gauge) of each RPT. The UL can only be set slightly above the range (1 of 3) for each RPT. If the RPT is a gauge RPT, then the *ABSUL* setting is accepted but ignored

See Also: 3.2.4 [UL] (UPPER LIMIT)

SENSe[*n*][:PRESsure]:PROTection:CLEar

Purpose: Clears the upper limit (UL) exceeded flag for the specified RPT.

Query: "SENS[*n*]:PROT:CLE"

Suffix: *n:* '1' to access the Hi RPT (default)
'2' to access the optional Lo RPT

Notes: Only this command or a power cycle will clear the upper limit flag.

See Also: 3.2.4 [UL] (UPPER LIMIT)

4.4.3.7 Status Subsystem

For information on the status system, status reporting system and status subsystem see 4.5 **STATUS SYSTEM**. Familiarize yourself with the status system section before attempting to use status subsystem register commands.

STATus:OPERation:CONDition?

Purpose: Reads the operation condition register.

Query: "STAT:OPER:COND?

Query reply: *REGISTER:* The 16 bit operation condition register.

Notes: This register reports the contents of the operation condition register without altering it's contents. Events represented by the bits in this register are always enabled and are a direct representation of the event status.

The instrument summary bit (bit13) of this register is the only valid bit. It can be set by either Bit0 or Bit1 of the INSTrument event register ("STAT:OPER:INST") if those bits are enabled to do so.

STATus:OPERation:NTRansition
STATus:OPERation:PTRansition

Purpose: Reads or sets the operation negative or positive transition filter

Command: "STAT:OPER:NTRansition *REGISTER*"

"STAT:OPER:PTRansition *REGISTER:*"

Query: "STAT:OPER:NTRansition?"

"STAT:OPER:PTRansition?"

Query reply: *REGISTER:* The 16 bit operation transition filter.

Notes: If a bit is set in the negative and/or positive transition filter, then a true to false and/or false to true transition of the associated bit in the operation condition register will cause the associated bit in the operation event register to be set. By default, the negative transition filter bits are all 0's, and the positive filter is set to all 1's (except bit15 which is not used) so that by default, a false to true transition will cause a bit in the operation event register to set.

STATus:OPERation[:EVENt]?

Purpose: Reads and then clears the operation event register.

Query: "STAT:OPER?

Query reply: *REGISTER:* The 16 bit operation event register.

Notes: This register represents event transitions defined by the operation condition register after the transition filter has been applied.

Enabled bits in this register ("STAT:OPER:ENAB") will set the operation summary bit (bit7) of the status byte register.

STATus:OPERation:ENABle

Purpose: Reads or sets the enable mask for the operation event enable register

Command: "STAT:OPER:ENAB *REGISTER*"

Query: "STAT:OPER:ENAB?"

Query reply: *REGISTER:* The 16 bit mask.

Notes: If a bit is set in the mask, then the associated bit in the operation event register will set the operation summary bit (bit7) of the status byte register. The default value for the mask is 0, with all bits masked out and not enabled.

STATus:OPERation:INSTrument:CONDition?

Purpose: Reads the instrument condition register.

Query: "STAT:OPER:INST:COND?

Query reply: *REGISTER:* The 16 bit instrument condition register.

Notes: This register reports the contents of the instrument condition register without altering it's contents. Events represented by the bits in this register are always enabled and are a direct representation of the event status.

Bit0 represents the summary of the ISUMmary1 register which is the operation status of the high RPT. Bit1 represents the summary of the ISUMmary2 register which is the operation status of the optional low RPT.

STATus:OPERation:INSTrument:NTRansition
STATus:OPERation:INSTrument:PTRansition

Purpose: Reads or sets the instrument negative or positive transition filter

Command: "STAT:OPER:INST:NTRansition *REGISTER*"

"STAT:OPER:INST:PTRansition *REGISTER:*"

Query: "STAT:OPER:INST:NTRansition?"

"STAT:OPER:INST:PTRansition?"

Query reply: *REGISTER:* The 16 bit instrument transition filter.

Notes: If a bit is set in the negative and/or positive transition filter, then a true to false and/or false to true transition of the associated bit in the instrument condition register will cause the associated bit in the instrument event register to be set. By default, the negative transition filter bits are all 0's, and the positive filter is set to all 1's (except bit15 which is not used) so that by default, a false to true transition will cause a bit in the instrument event register to set.

STATus:OPERation:INSTrument [:EVENt]?

Purpose: Reads and then clears the instrument event register.

Query: "STAT:OPER:INST?

Query reply: *REGISTER:* The 16 bit instrument event register.

Notes: This register represents event transitions defined by the instrument condition register after the transition filter has been applied. Enabled bits in this register ("STAT:OPER:INST:ENAB") will set the instrument summary bit (bit13) of the operation condition register

STATus:OPERation:INSTrument:ENABle

Purpose: Reads or sets the enable mask for the instrument event enable register
Command: "STAT:OPER:INST:ENAB *REGISTER*"
Query: "STAT:OPER:INST:ENAB?"
Query reply: *REGISTER:* The 16 bit mask.
Notes: If a bit is set in the mask, then the associated bit in the instrument event register will set the instrument summary bit (bit13) of the operation condition register. The default value for the mask is 0, with all bits masked out and not enabled.

STATus:OPERation:INSTrument:ISUMmary[*n*]:CONDition?

Purpose: Reads the instrument summary condition register.
Query: "STAT:OPER:INST:ISUM[*n*]:COND?
Suffix: *n:* '1' to access the high RPT summary condition register.
'2' to access the optional low RPT summary condition register.
Query reply: *REGISTER:* The 16 bit instrument summary condition register.
Notes: This register reports the contents of the instrument summary condition register without altering it's contents. Events represented by the bits in this register are always enabled and are a direct representation of the event status.
Bit2 is set when the RPT is changing a range, and is cleared when it is finished changing a range
Bit4 is set when the RPT is executing a measurement cycle, and is cleared when it is finished with the cycle.

STATus:OPERation:INSTrument:ISUMmary[*n*]:NTRansition
STATus:OPERation:INSTrument:ISUMmary[*n*]:PTRansition

Purpose: Reads or sets the instrument summary negative or positive transition filter
Command: "STAT:OPER:INST:ISUM[*n*]:NTRansition *REGISTER*"
"STAT:OPER:INST:ISUM[*n*]:PTRansition *REGISTER:*"
Suffix: *n:* '1' to access the high RPT instrument summary transition filter.
'2' to access the optional low RPT transition filter.
Query: "STAT:OPER:INST:ISUM[*n*]:NTRansition?"
"STAT:OPER:INST:ISUM[*n*]:PTRansition?"
Query reply: *REGISTER:* The 16 bit instrument summary transition filter.
Notes: If a bit is set in the negative and/or positive transition filter, then a true to false and/or false to true transition of the associated bit in the instrument summary condition register will cause the associated bit in the instrument summary event register to be set. By default, the negative transition filter bits are all 0's, and the positive filter is set to all 1's (except bit15 which is not used) so that by default, a false to true transition will cause a bit to set.

STATus:OPERation:INSTrument:ISUMmary[*n*][:EVENt]?

Purpose: Reads and then clears the instrument summary event register.
Suffix: *n:* '1' to access the high RPT instrument summary event register.
'2' to access the optional low RPT event register.
Query: "STAT:OPER:INST:ISUM[*n*]?
Query reply: *REGISTER:* The 16 bit instrument summary event register.
Notes: This register represents event transitions defined by the instrument summary condition register after the transition filter has been applied. Enabled bits in this register ("STAT:OPER:INST:ISUM:ENAB") will set Bit0 or Bit1 (depending on "*n*") of the instrument condition register ("STAT:OPER:INST:COND").

STATus:OPERation:INSTrument:ISUMmary[*n*]:ENABle

Purpose: Reads or sets the enable mask for the instrument summary event enable register

Command: "STAT:OPER:INST:ISUM[*n*]:ENAB *REGISTER*"

Suffix: *n:* '1' to access the high RPT instrument summary event register.
'2' to access the optional low RPT event register.

Query: "STAT:OPER:INST:ISUM[*n*]:ENAB?"

Query reply: *REGISTER:* The 16 bit mask.

Notes: If a bit is set in the mask, then the associated bit in the instrument summary event register will set Bit0 or Bit1 (depending on "*n*") of the instrument condition register ("STAT:OPER:INST:COND"). The default value for the mask is 0, with all bits masked out and not enabled.

STATus:QUEStionable:CONDition?

Purpose: Reads the questionable condition register.

Query: "STAT:QUES:COND?

Query reply: *REGISTER:* The 16 bit questionable condition register.

Notes: This register reports the contents of the questionable condition register without altering it's contents. Events represented by the bits in this register are always enabled and are a direct representation of the event status.

The instrument summary bit (bit13) of this register is the only valid bit. It can be set by either Bit0 or Bit1 of the INSTrument event register ("STAT:QUES:INST") if those bits are enabled to do so.

STATus:QUEStionable:NTRansition
STATus:QUEStionable:PTRansition

Purpose: Reads or sets the questionable negative or positive transition filter

Command: "STAT:QUES:NTRansition *REGISTER*"
"STAT:QUES:PTRansition *REGISTER:*"

Query: "STAT:QUES:NTRansition?"
"STAT:QUES:PTRansition?"

Query reply: *REGISTER:* The 16 bit questionable transition filter.

Notes: If a bit is set in the negative and/or positive transition filter, then a true to false and/or false to true transition of the associated bit in the questionable condition register will cause the associated bit in the questionable event register to be set. By default, the negative transition filter bits are all 0's, and the positive filter is set to all 1's (except bit15 which is not used) so that by default, a false to true transition will cause a bit in the questionable event register to set.

STATus:QUEStionable[:EVENt]?

Purpose: Reads and then clears the questionable event register.

Query: "STAT:OPER?

Query reply: *REGISTER:* The 16 bit questionable event register.

Notes: This register represents event transitions defined by the questionable condition register after the transition filter has been applied.

Enabled bits in this register ("STAT:QUES:ENAB") will set the questionable summary bit (bit3) of the status byte register.

STATus:QUEStionable:ENABle

Purpose: Reads or sets the enable mask for the questionable event enable register

Command: "STAT:QUES:ENAB *REGISTER*"

Query: "STAT:QUES:ENAB?"

Query reply: *REGISTER:* The 16 bit mask.

Notes: If a bit is set in the mask, then the associated bit in the questionable event register will set the questionable summary bit (bit3) of the status byte register. The default value for the mask is 0, with all bits masked out and not enabled.

STATus:QUEStionable:INSTrument:CONDition?

Purpose: Reads the instrument condition register.

Query: "STAT:QUES:INST:COND?

Query reply: *REGISTER:* The 16 bit instrument condition register.

Notes: This register reports the contents of the instrument condition register without altering it's contents. Events represented by the bits in this register are always enabled and are a direct representation of the event status.

Bit0 represents the summary of the ISUMmary1 register which is the questionable status of the high RPT. Bit1 represents the summary of the ISUMmary2 register which is the questionable status of the optional low RPT.

STATus:QUEStionable:INSTrument:NTRansition
STATus:QUEStionable:INSTrument:PTRansition

Purpose: Reads or sets the instrument negative or positive transition filter

Command: "STAT:QUES:INST:NTRansition *REGISTER*"

"STAT:QUES:INST:PTRansition *REGISTER:*"

Query: "STAT:QUES:INST:NTRansition?"

"STAT:QUES:INST:PTRansition?"

Query reply: *REGISTER:* The 16 bit instrument transition filter.

Notes: If a bit is set in the negative and/or positive transition filter, then a true to false and/or false to true transition of the associated bit in the instrument condition register will cause the associated bit in the instrument event register to be set. By default, the negative transition filter bits are all 0's, and the positive filter is set to all 1's (except bit15 which is not used) so that by default, a false to true transition will cause a bit in the instrument event register to set.

STATus:QUEStionable:INSTrument [:EVENT]?

Purpose: Reads and then clears the instrument event register.

Query: "STAT:QUES:INST?

Query reply: *REGISTER:* The 16 bit instrument event register.

Notes: This register represents event transitions defined by the instrument condition register after the transition filter has been applied. Enabled bits in this register ("STAT:QUES:INST:ENAB") will set the instrument summary bit (bit13) of the questionable condition register

STATus:QUEStionable:INSTrument:ENABle

Purpose: Reads or sets the enable mask for the instrument event enable register
Command: "STAT:QUES:INST:ENAB *REGISTER*"
Query: "STAT:QUES:INST:ENAB?"
Query reply: *REGISTER:* The 16 bit mask.
Notes: If a bit is set in the mask, then the associated bit in the instrument event register will set the instrument summary bit (bit13) of the questionable condition register. The default value for the mask is 0, with all bits masked out and not enabled.

STATus:QUEStionable:INSTrument:ISUMmary[*n*]:CONDition?

Purpose: Reads the instrument summary condition register.
Query: "STAT:QUES:INST:ISUM[*n*]:COND?
Suffix: *n:* '1' to access the high RPT summary condition register.
'2' to access the optional low RPT summary condition register.
Query reply: *REGISTER:* The 16 bit instrument summary condition register.
Notes: This register reports the contents of the instrument summary condition register without altering it's contents. Events represented by the bits in this register are always enabled and are a direct representation of the event status.
Bit9 is set when the MODEL 785 is not within the stability limit defined by the CALC:STAB:LIMIT setting.
Bit14 is set when the MODEL 785 has received and executed a command that contained data that could not be used and may result in unexpected behavior.

STATus:QUEStionable:INSTrument:ISUMmary[*n*]:NTRansition
STATus:QUEStionable:INSTrument:ISUMmary[*n*]:PTRansition

Purpose: Reads or sets the instrument summary negative or positive transition filter
Command: "STAT:QUES:INST:ISUM[*n*]:NTRansition *REGISTER*"
"STAT:QUES:INST:ISUM[*n*]:PTRansition *REGISTER:*"
Suffix: *n:* '1' to access the high RPT instrument summary transition filter.
'2' to access the optional low RPT transition filter.
Query: "STAT:QUES:INST:ISUM[*n*]:NTRansition?"
"STAT:QUES:INST:ISUM[*n*]:PTRansition?"
Query reply: *REGISTER:* The 16 bit instrument summary transition filter.
Notes: If a bit is set in the negative and/or positive transition filter, then a true to false and/or false to true transition of the associated bit in the instrument summary condition register will cause the associated bit in the instrument summary event register to be set. By default, the negative transition filter bits are all 0's, and the positive filter is set to all 1's (except bit15 which is not used) so that by default, a false to true transition will cause a bit to set.

STATus:QUEStionable:INSTrument:ISUMmary[*n*][:EVENT]?

Purpose: Reads and then clears the instrument summary event register.

Suffix: *n:* '1' to access the high RPT instrument summary event register.
'2' to access the optional low RPT event register.

Query: "STAT:QUES:INST:ISUM[*n*]?

Query reply: *REGISTER:* The 16 bit instrument summary event register.

Notes: This register represents event transitions defined by the instrument summary condition register after the transition filter has been applied. Enabled bits in this register ("STAT:QUES:INST:ISUM:ENAB") will set Bit0 or Bit1 (depending on "*n*") of the instrument condition register ("STAT:QUES:INST:COND").

STATus:QUEStionable:INSTrument:ISUMmary[*n*]:ENABle

Purpose: Reads or sets the enable mask for the instrument summary event enable register

Command: "STAT:QUES:INST:ISUM[*n*]:ENAB *REGISTER*"

Suffix: *n:* '1' to access the high RPT instrument summary event register.
'2' to access the optional low RPT event register.

Query: "STAT:QUES:INST:ISUM[*n*]:ENAB?"

Query reply: *REGISTER:* The 16 bit mask.

Notes: If a bit is set in the mask, then the associated bit in the instrument summary event register will set Bit0 or Bit1 (depending on "*n*") of the instrument condition register ("STAT:QUES:INST:COND"). The default value for the mask is 0, with all bits masked out and not enabled.

4.4.3.8 System Subsystem

The system subsystem controls general settings such as display, keypad, beeper, and communications.

SYSTem:AMBient[:PRES]?

Purpose: Gets the most recent internal barometer measurement
Query: "SYST:AMB?"
Query reply: *AMBPRES* in the current default pressure units.
See Also: *1.3.2.2* On-Board Barometer, *3.4.3* ATM

SYSTem:BEEPer:FREQuency

Purpose: Sets the beeper frequency for valid keypress feedback.
Command: "SYST:BEEP:FREQ *FREQ*"
Query: "SYST:BEEP:FREQ?"
Parameters: *FREQ:* The beeper frequency from 250 to 10000 Hz
Query reply: *FREQ*
See Also: 3.1.2.2 Sounds

SYSTem:BEEPer[:IMMediate]

Purpose: Beeps the beeper for one second.
Command: "SYST:BEEP"
Notes: The beeper beeps in the default frequency.

SYSTem:BEEPer:STATe

Purpose: Enables and disables the beeper for valid keypress feedback. It does not disable error feedback or alarm events.
Command: "SYST:BEEP:STAT *BOOLEAN*"
Query: "SYST:BEEP:STAT? "
Parameters: *BOOLEAN:* '0' or "OFF" to disable the beeper events
'1' or "ON" to enable the beeper events
Query reply: '0' or '1'
See Also: 3.1.2.2 Sounds

SYSTem:COMMunicate:GPIB[:ADDRess]

Purpose: Sets or gets the IEE-488 (GPIB) port address.
Command: "SYST:COMM:GPIB *ADDR*"
Query: "SYST:COMM:GPIB?"
Parameters: *ADDR:* The primary GPIB address from 1 to 30. Secondary addressing is not supported
Query reply: *ADDR*
See Also: 3.4.4 Remote, 4.2 INTERFACING

SYSTem:COMMunicate:SERial[*m*][:RECeive]:BAUD
SYSTem:COMMunicate:SERial[*m*]:TRANsmit:BAUD

Purpose: Sets or gets the baud rate for the RS-232 port.

Command: "SYST:COMM:SER[*m*]:BAUD *BAUDRATE*"
"SYST:COMM:SER[*m*]:TRAN:BAUD *BAUDRATE*"

Query: "SYST:COMM:SER[*m*]:BAUD?"
"SYST:COMM:SER[*m*]:TRAN:BAUD?"

Section Parameters:
m: '1' to set the COM1 baud rate (default)
'2' to set the COM2 baud rate

BAUDRATE: "1200"|"2400"|"4800"|"9600"|"19200"

Query reply: *BAUDRATE*

Notes: The receive and transmit baud rates are always the same, so both commands change the transmit baud rate as well as the receive baud rate.

See Also: 3.4.4 Remote, 4.2 INTERFACING

SYSTem:COMMunicate:SERial[*m*][:RECeive]:BITS
SYSTem:COMMunicate:SERial[*m*]:TRANsmit:BITS

Purpose: Sets or gets the RS-232 port data word length.

Command: "SYST:COMM:SER[*m*]:BITS *NUMBERBITS*"
"SYST:COMM:SER[*m*]:TRAN:BITS *NUMBERBITS*"

Query: "SYST:COMM:SER[*m*]:BITS?"
"SYST:COMM:SER[*m*]:TRAN:BITS?"

Section Parameters:
m: '1' to set the COM1 word length (default)
'2' to set the COM2 word length.

NUMBERBITS: "7"|"8"

Query reply: *NUMBERBITS*

Notes: The receive and transmit word lengths are always the same, so both commands change the transmit word length as well as the receive word length

See Also: 3.4.4 Remote, 4.2 INTERFACING

SYSTem:COMMunicate:SERial[*m*][:RECeive]:PARity
SYSTem:COMMunicate:SERial[*m*]:TRANsmit:PARity

Purpose: Sets or gets the parity for the RS-232 port.

Command: "SYST:COMM:SER[*m*]:PAR *PARITY*"
"SYST:COMM:SER[*m*]:TRAN:PAR *PARITY*"

Query: "SYST:COMM:SER[*m*]:PAR?"
"SYST:COMM:SER[*m*]:TRAN:PAR?"

Section Parameters:
m: '1' to set the COM1 parity (default)
'2' to set the COM2 parity

PARITY: "EVEN"|"ODD"|"NONE"|"ONE"|"ZERO"

Query reply: *PARITY*

Notes: The receive and transmit parity are always the same, so both commands change the transmit parity as well as the receive parity.

See Also: 3.4.4 Remote, 4.2 INTERFACING

SYSTem:COMMunicate:SERial[*m*][:RECeive]:STOP
SYSTem:COMMunicate:SERial[*m*]:TRANsmit:STOP

Purpose: Sets or gets the number of stop bits for the RS-232 port.

Command: "SYST:COMM:SER[m]:STOP *STOPBIT*"
"SYST:COMM:SER[m]:TRAN:STOP *STOPBITS*"

Query: "SYST:COMM:SER[m]:STOP?"
"SYST:COMM:SER[m]:TRAN:STOP?"

Section *m:* '1' to set the COM1 stop bits (default)
'2' to set the COM2 stop bits

Parameters *STOPBITS:* 1|2

Query reply: *BSTOPBITS*

Notes: The receive and transmit stop bits are always the same, so both commands change the transmit stop bits as well as the receive stop bits

See Also: 3.4.4 Remote, 4.2 INTERFACING

SYSTem:COMMunicate:THRU

Purpose: Transfers massages to and from the specified COM2 port.

Command: "SYST:COMM *MESSAGE*"

Query: "SYST:COMM? [*MESSAGE*]"

Parameters *MESSAGE:* The message to send to the port. It can be up to 60 char long.

Query reply: *REPLY:* Any message that is received by the port within 2 seconds

Notes: You can communicate with other instruments via the COM2 of the MODEL 785. Handshaking is not supported. Ensure that the COM2 is properly setup before establishing communications using the MODEL 785 COM2 port

SYSTem:DATE

Purpose: Reads or sets the MODEL 785 calendar

Command: "SYST:DATE *YEAR, MONTH, DAY*"

Query: "SYST:DATE? "

Parameters: *YEAR:* The 4 digit year from 1980 to 2079.
MONTH: The month from 1 to 12
DAY: The day from 1 to 31

Query reply: *YEAR, MONTH, DAY*

Notes: The internal calendar is active even when the unit is not connected to a power source.

See Also 3.4.7.3 Time

SYSTem:ERRor?

Purpose: Gets the next entry in the error message queue.

Query: "SYST:ERR?"

Query reply
ERROR: The error number and the error description text separated by a comma. The possible errors supported are listed in 4.4.2 Error Messages. Unlisted error messages may be added as improvements are made to the MODEL 785.

Notes: The MODEL 785 has an error queue that retains up to 20 errors. The "SYSTem:ERRor?" query is used to remove them one at a time. If an error occurs and the error queue is full, then the oldest entry will be lost to make way for the new error. You should check and empty this queue if an error is detected (by COM1 "ERROR" reply or GPIB service request). When you receive the reply "0, No error", then the error queue is empty.

SYSTem:IDENtify

Purpose: Gets or sets the MODEL 785 identification string..

Command: "SYST:IDEN *ID*"

Query: "SYST:IDEN?"

Parameters:
ID: 'An alphanumeric string of (up to) 12 characters that the user can use to identify the MODEL 785. This string is stored in permanent memory and cannot be erased by normal user operation. The ID can be entered or edited from the front panel only. The default is the text "NONE".

Query reply: *ID*

Also see: Section 3.4.7.4 ID

SYSTem:KEY

Purpose: Places a key press in the keypad queue, simulating an actual key press.

Command: "SYST:KEY *KEYCODE*"

Parameters:
KEYCODE: '0' to '9' to simulate keys '1' through '9' being pressed
'10' for the decimal point key.
'11' for the ⇐ key.
'12' for the ⇒ key.
'13' for the ESCAPE key
'14' for the ENTER key
'15' for the ± key
'16' for the POWER key.

Notes: The MODEL 785 keypad queue can hold up to 20 entries before additional entries are ignored.

SYSTem:KLOCk

Purpose: Locks and unlocks the MODEL 785 keypad.
Command: "SYST:KLOC *BOOLEAN*"
Query: "SYST:KLOC?"
Parameters: *BOOLEAN:* '0' or 'OFF' to unlock the keypad
'1' or 'ON' to lock the keypad
Query reply: *BOOLEAN:* '0' or '1'
Notes: The MODEL 785 keypad can only be unlocked using this command, or by cycling the power button.

SYSTem:POWer

Purpose: Turns the MODEL 785's power on or off
Command: "SYST:POW *BOOLEAN*"
Query: "SYST:POW?"
Parameters: *BOOLEAN:* '0' or 'OFF' to turn the MODEL 785 off
'1' or 'ON' to turn an MODEL 785 on
Query reply: *BOOLEAN:* '0' or '1'
Notes: The MODEL 785 will not respond to remote commands except the SYSTem:POWer command when it is off. You must use this command to turn it on before usage if it is off. You should also use the SYSTem:POWer? Query to check that the MODEL 785 has turned back on after requesting that the unit turn on to ensure that it has completed it's power on startup routines.
See Also: 3.1.2.3 "Soft" **[On/Off]** Key

SYSTem:SDS[*n*]

Purpose: Turns the SDS system for the specified RPT on or off.
Command: "SYST:SDS[*n*] *BOOLEAN*"
Query: "SYST:SDS[*n*]?"
Suffix: *n:* '1' to access the Hi RPT (default)
'2' to access the optional Lo RPT
Parameters: *BOOLEAN:* '0' or 'OFF' to turn the SDS off for the specified RPT
'1' or 'ON' to turn the SDS on for the specified RPT
Query reply: *BOOLEAN:* '0' or '1'
Notes: Caution must be used when turning the SDS off, as this connects the RPT to the test port. SDS should be turned on when an RPT is not being used, and must be turned off when you need to use an RPT to measure with. If an overpressure occurs, the SDS will automatically turn on.
See Also: 3.1.2.6 SDS Self Defense System, 3.4.2 SDS, 5.6.1.1SDS Module

SYSTem:TIME

Purpose: Reads or sets the MODEL 785 real time clock
Command: "SYST:TIME *TIME*"
Query: "SYST:TIME?"
Parameters: *TIME:* The time in the form HH:MM "AM"|"PM" in 12 hour format. The seconds are reset to 0 when the time is set.
Query reply: *YEAR, MONTH, DAY*
Notes: The internal clock is active even when the unit is not connected to a power source.

SYSTem:VERSion?

Purpose: Gets the SCPI date & version.

Query: "SYST:VERS?"

Query reply: *VER:* The SCPI compatibility date and revision number in the form YYYY:*n*: where YYYY is the date and n is the revision

4.4.3.9 Unit Subsystem

Each RPT channel has a separate default pressure unit. The default unit is the last unit used on the RPT channel. All pressure dependent communications sent to the MODEL 785 are interpreted in the current default pressure unit for the specified RPT channel unless a pressure unit suffix follows the setting, with at least one white space between the setting and the unit text. There is also a user defined unit available whose definition is not RPT specific.

UNIT:HEIGht

Purpose: Changes the default head height for both RPTs.
Command: "UNIT:HEIG *UNIT*"
Query: "UNIT:HEIG?"
Parameters: *UNIT:* "in" to specify the default head height in inches
"cm" to specify the default head height in centimeters
Query reply: *UNIT:* "in" or "cm".
Notes: The head units and height apply to both RPT channels
See Also: 3.2.7 [HEAD], 3.3.1 Head

UNIT[:PRESsure][*n*]

Purpose: Changes the default pressure unit for the specific RPT.
Command: "UNIT[*n*] *PRESUNIT*"
Query: "UNIT[*n*]?"
Suffix: *n:* '1' to access the Hi RPT (default)
'2' to access the optional Lo RPT
Parameters: *PRESUNIT:* "psi"
"psf"
"inHg"
"inWa"
"kcm2"
"Pa"
"kPa"
"MPa"
"mbar"
"bar"
"mmHg"
"mmWa"
"mWa"
"ft"
"m"
"user" (Text is user definable)
Query reply: *PRESUNIT*
Notes: Each RPT can be assigned a different pressure unit. The "user" unit can be configures by the user using the "UNIT[*n*]:USER" command.
See Also: 3.2.2 [UNIT], 3.3.2 PresU

UNIT[:PRESsure][*n*]:COEFFFicient?

Purpose: Converts a pressure from Paa to the default pressure unit.
Query: "UNIT[*n*]:COEF? [*PRESSURE*]"
Suffix: *n:* '1' to access the Hi RPT (default)
'2' to access the optional Lo RPT
Parameters: *PRESSUREIN:* An optional pressure value to convert from Paa to the default pressure unit (default is 1 Paa)
Query reply: *PRESSOUT:* The Pressure value converted in the default pressure units
See Also: 7.1 PRESSURE UNIT CONVERSIONS

UNIT[:PRESsure][*n*]:MODE

Purpose: Changes the default measurement mode for the specific RPT.
Command: "UNIT[*n*]:MODE *PRESMODE*"
Query: "UNIT[*n*]:MODE?"
Suffix: *n:* '1' to access the Hi RPT (default)
'2' to access the optional Lo RPT
Parameters: *PRESMODE:* "a" or "ABSOLUTE" for absolute measurement mode.
"g" or "GAUGE" for gauge measurement mode.
Query reply: *PRESMODE:* "a" or "g".
Notes: Each RPT can be assigned a different pressure mode. The pressure units "m" and "ft" are always absolute. Gauge RPTs must use gauge units.
See Also: 3.2.3 [MODE]

UNIT: PRESsure[*n*]: TEMPerature

Purpose: Reads or sets the temperature to use if the selected pressure unit is "inWa:
Command: "UNIT:PRES[*n*]:TEMP *TEMPERATURE*"
Query: "UNIT:PRES[*n*]:TEMP?"
Suffix *n:* '1' to access the Hi RPT (default)
'2' to access the optional Lo RPT
Parameters: *TEMPERATURE:* "4" for 4°C (default)
"20" for 20°C
"60" for 60°F
Query reply: *TEMPERATURE:* "4"|"20"|"60"
Notes: Each RPT can be assigned a different "inWa" temperature setting. This only affects the "inWa" pressure unit.
See Also: 3.2.2 [UNIT]

UNIT[:PRESsure]:USER

Purpose: Get or set the user definable pressure unit.
Command: "UNIT:USER *COEF*"
Query: "UNIT:USER?"
Parameters: *COEF:* Coefficient to multiply pressure in Pascal to get pressure in the current default pressure units.
LABEL 'The text label to assign to the user unit (1 to 4 characters. No white spaces)
Query reply: *COEF, LABEL*
See Also: 3.3.2 PresU

4.5 STATUS SYSTEM

The status system includes the status reporting system which reports general MODEL 785 events and the status subsystem which reports RPT dependent events to the status reporting system. The user can select which MODEL 785 events will cause a status change event These events are then reported to the status system (bit7 and bit3 of the status byte register), which also must be configured for the STATus subsystem to generate the service requests described in 4.5.1 Status Reporting System.

There are two 16 bit event registers that make up the top layer of the status subsystem. The OPERation status register handles conditions that are normal for the MODEL 785, while the QUEStionable status register handles events that could cause measurements to be made under questionable conditions. Other registers layered below these two registers provide the structure necessary to handle the two RPT channels and to enable the events and event transitions. Bit15 of all of these registers is not used because Bit15 represents a sign bit on some computer systems.

4.5.1 Status Reporting System

The MODEL 785 status reporting system is used to track and report system status and errors. The status subsystem is layered under and reports to the status reporting system. It follows the model of the IEEE Std 488.2 and works for the COM1 and the IEEE-488 port with slight differences. The MODEL 785 can be programmed to respond to various status conditions by asserting the SRQ of the IEEE-488 interface. The COM1 port cannot be supported in this manner, so polling must be used. Descriptions of the commands that support the status report system are covered in 4.4.3.1 IEEE Std. 488.2 Common and Status Commands.

4.5.1.1 SCPI Status Subsystem

The STATus subsystem commands support the status system by providing registers that allow selection of MODEL 785 events that are reported to the status system. A description of this subsystem and it's commands is provided (see 4.4.3.7 Status Subsystem!

4.5.1.2 Error Queue

The MODEL 785 uses an error queue to keep track of remote errors. When an error occurs, it is pushed onto the error queue. If you are using the COM1 port, a reply to each command **must** be read before issuing another command. The COM1 will reply "ERROR" whenever an error message is placed in the error queue.

The "SYSTem:ERRor?" query can then be used to read and remove the error(s) one at a time from the error queue in it's numeric and descriptive text format. The error queue will accumulate errors until 20 entries are in the queue unless they are read and remove from the queue. If you do not have the MODEL 785 setup for issue of a service request when the error queue is not empty or you are using the COM1 port, you should periodically check the error queue for new entries, and make sure to read and empty it . The error queue should also be checked following a query response time out to if the query resulted in an error rather than a response. If you receive the reply "0, No error" to the error query, then the error queue is empty.

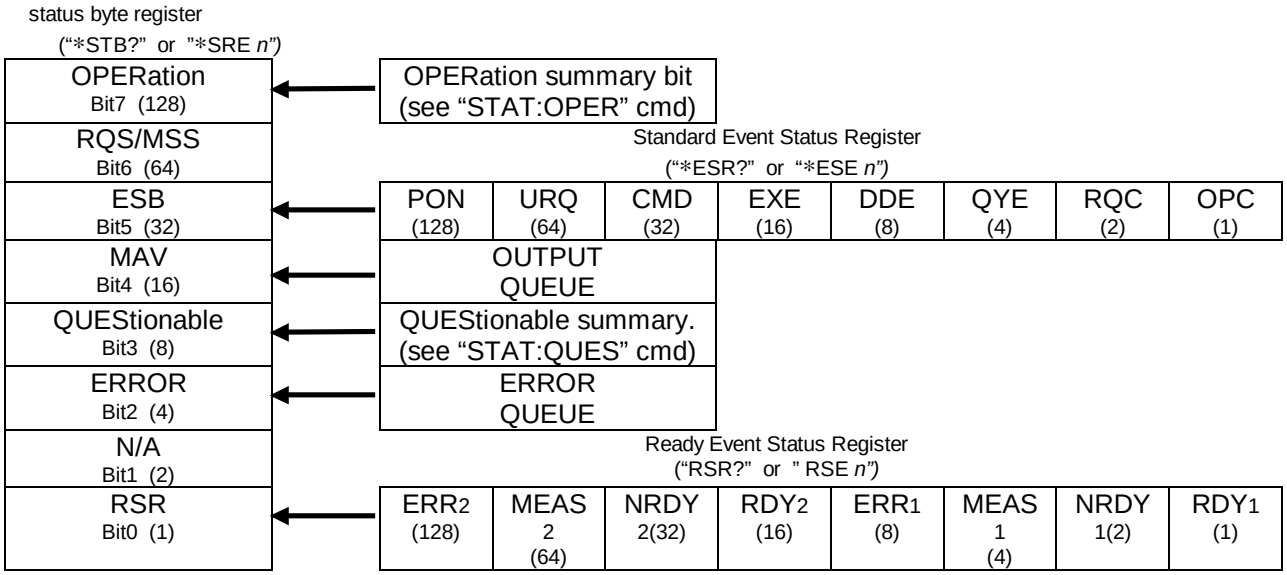
4.5.1.3 Status Byte Register

The MODEL 785 contains an 8 bit status byte register that reflects the general status of the MODEL 785:

Table 1. 8 Bit Status Byte Register

OPER (128)	RQS/MSS (64)	ESB (32)	MAV (16)	QUES (8)	ERROR (4)	N/A (2)	RSR (1)

This register is affected by the MODEL 785 reply output queue, the error queue, the Standard Event Status register the Ready Event Status register, and the STATus subsystem:



The status byte register can be read using the **"*STB?"** query, or by performing a serial poll on the IEEE-488 bus. If you read this using a serial poll then Bit 6 is the RQS. If the **"*STB?"** query is used, then bit 6 is the MSS bit. All of the other bits are common to both types of query.

Each of these status bits can cause a SRQ to occur. The Service Request Enable Register ("*SRE" program message) determines which of these flags are able to assert the SRQ line. This enable register has a matching set of bits that each will enable the designated bit to cause a SRQ, except for the RQS/MSS bit(s) which cannot cause a SRQ. If you set this register to 20 ($14 hex), an SRQ will occur if the MAV or the ERROR bit are set. The description of these bits are given as:

- **OPER:** OPERational event register summary bit Bit 7 (128)

  This bit is set and clears by the OPERational summary bit controlled by the STATus subsystem (See the "STATus:OPEReration" commands below)

- **RQS:** Requested Service Bit 6 (64)

  Indicates that the SRQ line of the IEEE-488 interface has been asserted by the MODEL 785. This bit is cleared when a serial poll is performed on the MODEL 785, and is a part of the status byte register when read using a serial poll. This bit does not apply if the COM1 port is being used.

- **MSS:** Master Summary Status Bit 6 (64)

  Indicates that an event or events occurred that caused the MODEL 785 to request service from the Host, much like the RQS bit. Unlike the RQS bit, it is READ ONLY and can be only cleared when the event(s) that caused the service request are cleared.

- **ESB:** Event Summary Bit 5 (32)

  Indicates if an enabled bit in the Standard Event Status Register became set. (See the section below)

- **MAV:** Message Available Bit 4 (16)

  Indicates that at least one reply message is waiting in the MODEL 785 IEEE-488 output queue.

- **QUES:** QUEStionable event register summary Bit 3 (8)

  This bit is set and clears by the QUEStionabl summary bit controlled by the STATus subsystem (See the "STATus:QUEStionable" commands below)

- **ERR:** Error Queue not empty Bit 2 (4)

  Indicates that at least one command error message is waiting in the MODEL 785 IEEE-488 error message queue. Use the "SYSTem:ERRor?" query to get this message.

- **RSB:** RPT ready summary Bit 0 (1)

  Indicates that an enabled bit in the RPT ready status register became set.

4.5.1.4 Standard Event Register

The MODEL 785 contains an 8 bit Standard event register that reflects specific MODEL 785 events that are not RPT dependent. Enabled events in this register will set or clear the ESB bit of the status byte register.

Table 2. Standard Event Register

PON (128)	URQ (64)	CMD (32)	EXE (16)	DDE (8)	QYE (4)	RQC (2)	OPC (1)

This register can be read using the "*ESR?" query, Each of these status bits can set the ESB bit of the status byte register, causing a SRQ to occur IF the ESB bit is enabled to do so. The Standard Event Status Enable Register ("∗ESE" program message) determines which of these flags are able to assert the ESB bit. The description of these bits are given as:

- **PON:** Power On Bit 7 (128)

  Indicates that the MODEL 785 power has been cycled since the last time this bit was read or cleared.

- **URQ:** User Request Bit 6 (64)

  Indicates that the MODEL 785 was set to local operation manually from the front panel by the user (pressing the ESC key)

- **CMD:** Command Error Bit 5 (32)

  Indicates that a remote command error has occurred. A command error is typically a syntax error in the use of a correct program message.

- **EXE:** Execution Error Bit 4 (16)

  Indicates if a remote program message cannot be processed due to device related condition.

- **DDE:** Device Dependent Error Bit 3 (8)

  Indicates that an internal error has occurred in the MODEL 785 such as a transducer time-out.

- **QYE:** Query Error Bit 2 (4)

  Indicates that an error has occurred in the protocol for program message communications. This is typically caused by a program message being sent to the MODEL 785 without reading a waiting reply.

- **RQC:** Request Control Bit 1 (2)

  This bit is not supported as the MODEL 785 cannot become the active controller in charge.

- **OPC:** Operation Complete Bit 0 (1)

  Indicates that the MODEL 785 has completed all requested functions.

4.5.1.5 RPT Ready Status Register

The MODEL 785 contains an 8 bit RPT ready status register that reflects MODEL 785 RPT measurement and stability ready events for the high or (optional) low RPT. Enabled events in this register will set or clear the RSR bit of the Status Byte Register.

Table 3. 8 Bit RPT Ready Status Register

ERR2 (128)	MEAS2 (64)	NRDY2 (32)	RDY2 (16	ERR1 (8)	MEAS1 (4)	NRDY1 (2)	RDY1 (1)

This register can be read using the **"*RSR?"** query, Each of these status bits can set the RSR bit of the Status Byte Register, causing a SRQ to occur IF the RSR bit is enabled to do so. The Standard Event Status Enable Register ("∗RSE" program message) determines which of these flags are able to assert the RSR bit. The description of these bits are given as:

- **RDY1:** Stability ready Bit 0 (1)

  Indicates that the high RPT (channel1) has made a transition from outside the stability limit to inside the stability limit as defined by the control settings (See the "CALCulate:STABility1:LIMIT" command).

- **NRDY1:** Stability not ready Bit 1 (2)

  Indicates that the high RPT (channel1) has made a transition from inside the stability limit to outside the stability limit as defined by the control settings (See the "CALCulate:STABility1:LIMIT" command).

- **MEAS1:** Measurement complete Bit 2 (4)

  This bit is set when the high RPT (channel1) measurement is complete. You do not have to initiate the measurement cycle to use this bit.

- **ERR1:** RPT error Bit 3 (8)

  Indicates that the high RPT (channel1) has exceeded the maximum pressure for the current high RPT range. See section 4.4.2.

- **RDY2:** Stability ready Bit 4 (16)

  Indicates that the low RPT (channel2) has made a transition from outside the stability limit to inside the stability limit as defined by the control settings (See the "CALCulate:STABility2:LIMIT" command).

- **NRDY2:** Stability not ready Bit 5 (32)

  Indicates that the low RPT (channel2) has made a transition from inside the stability limit to outside the stability limit as defined by the control settings (See the "CALCulate:STABility2:LIMIT" command).

- **MEAS2:** Measurement complete Bit 6 (64)

  This bit is set when the low RPT (channel2) measurement is complete. You do not have to initiate the measurement cycle to use this bit.

- **ERR2:** RPT error Bit 7 (128)

  Indicates that the low RPT (channel2) has exceeded the maximum pressure for the current low RPT range. See section 3.2.4 [UL] (UPPER LIMIT)

4.5.2 Status Subsystem

The status subsystem reports RPT channel dependent events to the status report system (see 4.5.1 Status Reporting System). This subsystem is a hierarchy of registers that allow selection and monitoring of RPT events that are reported to the status report system. If a user sets up and

enables events to be report in the sub system, the status report system also must be setup to allow these events to generate a IEEE-488 service request. The top level of the status subsystem includes the OPERation and QUEStionable register structures. These two are very similar in structure and usage, and provide independent event reporting for each of the (up to) two RPT's in the MODEL 785.

4.5.2.1 Operation Register Structure

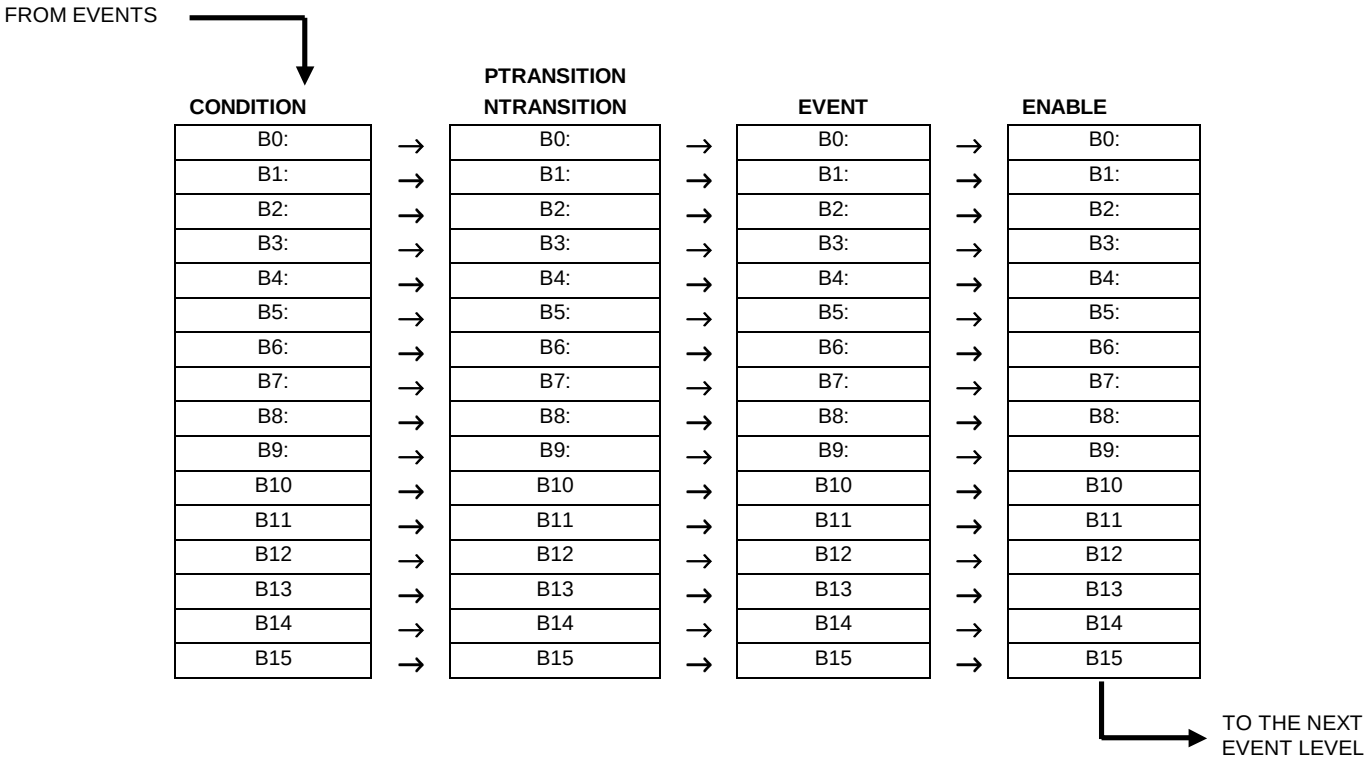
The OPERation status register has only one bit that is used by the MODEL 785. Bit13 is set by either bit0 or bit1 of the operation instrument event register. These bits are in turn set whenever enabled bits of either the ISUMmary1 or :ISUMmary2 event registers are set. This allows separate status registers for the HIGH or LOW RPT channels. When bit13 of the OPERation register is set, this can set bit7 of the status byte register (see 4.5.1 Status Reporting System), which can cause a service request if configured to do so.

Only a few of the ISUMMARY event bits are supported by the MODEL 785. The definition of the bits that are defined and used by this register are as follows:

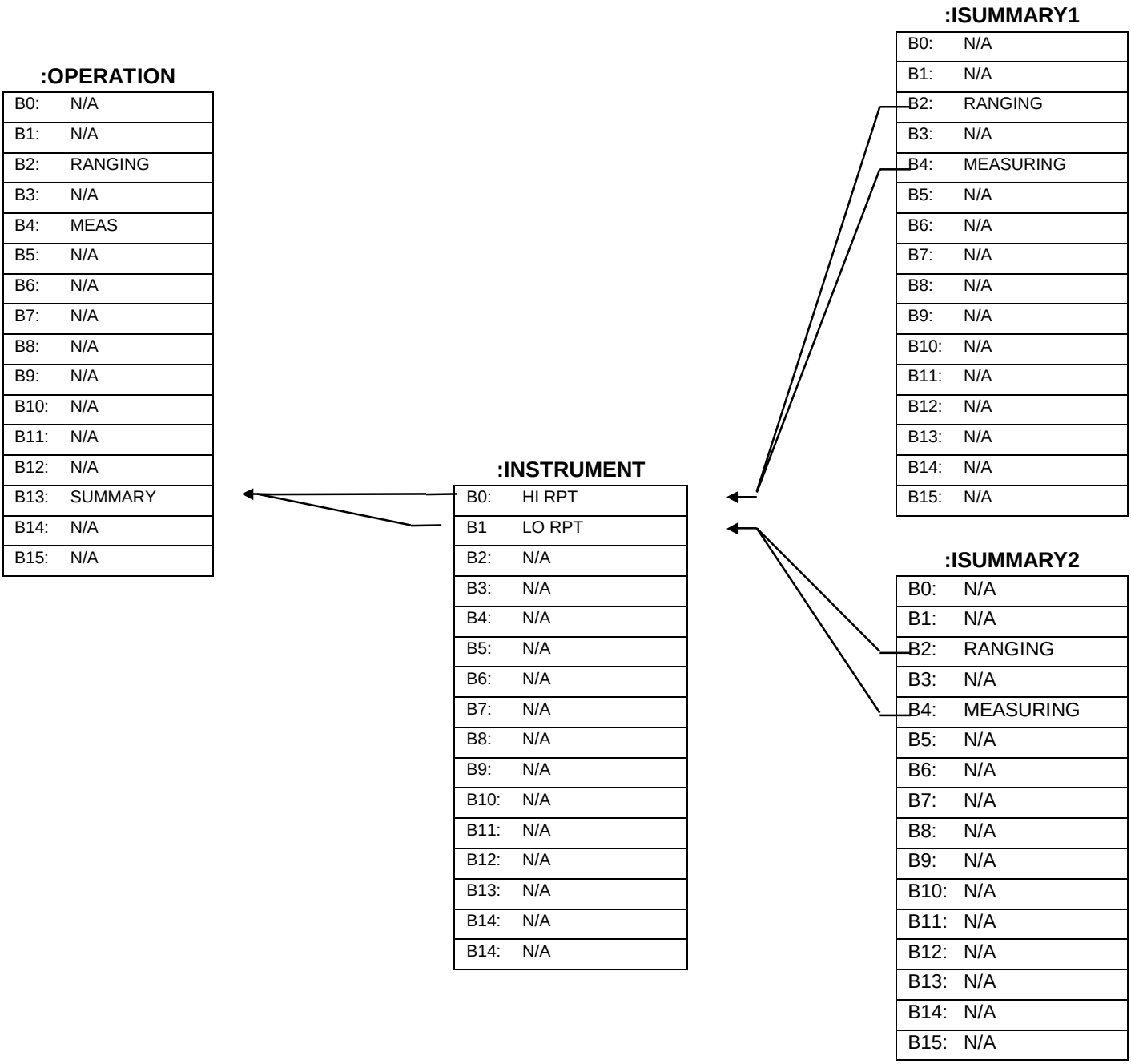
- Bit2: The MODEL 785 is currently changing a range.
- Bit4: The MODEL 785 is executing a remote measurement cycle.

Each register has an associated positive and negative transition filter register, an EVENT register, and an ENABle register that determine if a false to true and/or a true to false event bit causes the event to be reported. The condition register (OPERation, INSTrument or ISUMmary) is the start of the events that occur and is fed into the positive and negative transition filters (PTRansition / NTRansition) where it is determined if a false to true or true to false transition will create an event. This result is stored in the EVENt register (OPERation, INSTrument or ISUMmary). The ENABle register determines which of these events will be reported to the next level. All of these registers exist within the OPERation, INSTrument and ISUMmary registers.

Illustration of this structure duplicated for each of the OPERation, INSTument, and ISUMmary registers:



Relationship of the OPERtion register and its support registers:



4.5.2.2 Questionable Register Structure

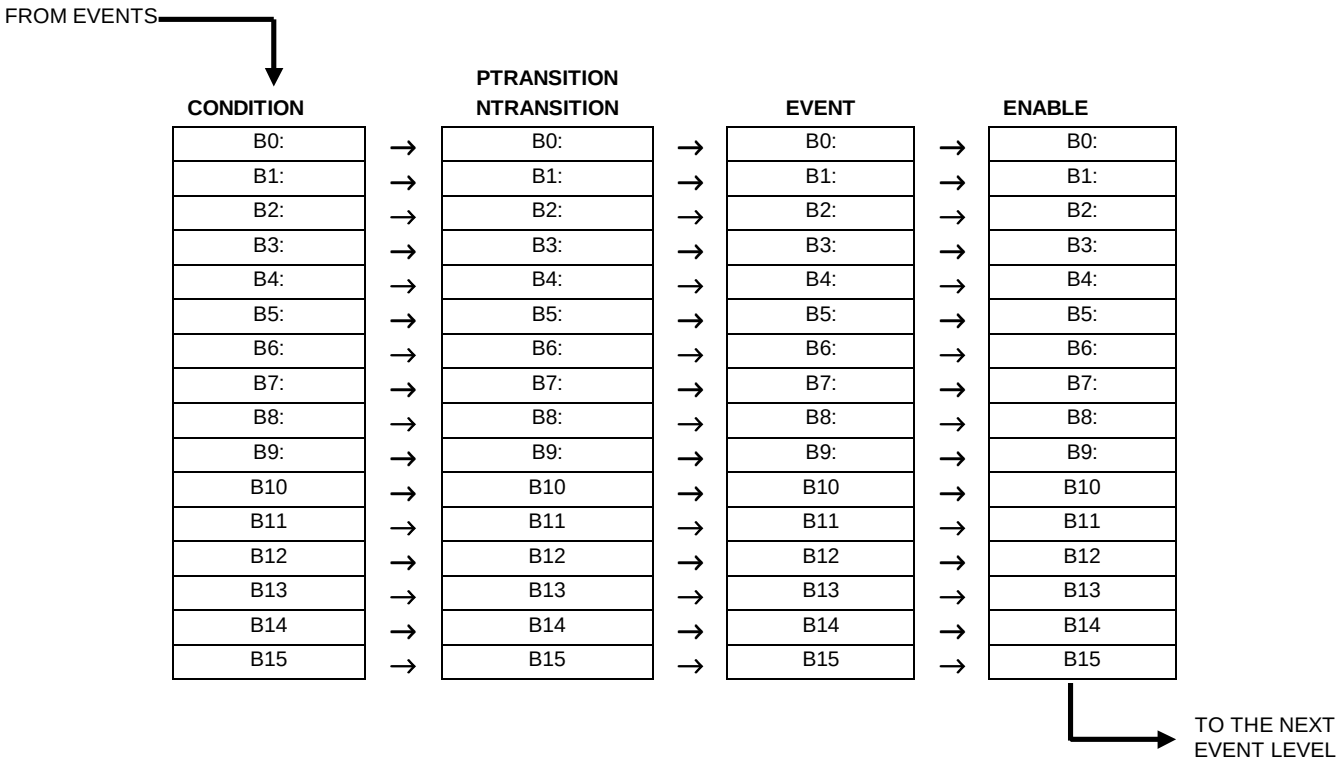
The QUEStionable status register has only one bit that is used by the MODEL 785. Bit13 is set by either bit0 or bit1 of the questionable instrument event register. These bits are in turn set whenever enabled bits of either the ISUMmary1 or :ISUMmary2 registers are set. This allows separate status registers for the Hi or Lo RPT channels. When bit13 of the QUEStionable register is set, this can set bit3 of the status byte register, which can cause a service request if configured to do so (see 4.5.1 Status Reporting System).

Only a few of the ISUMMARY bits are supported by the MODEL 785. The definition of the bits that are defined and used by the MODEL 785 QUEStionable register as follows:

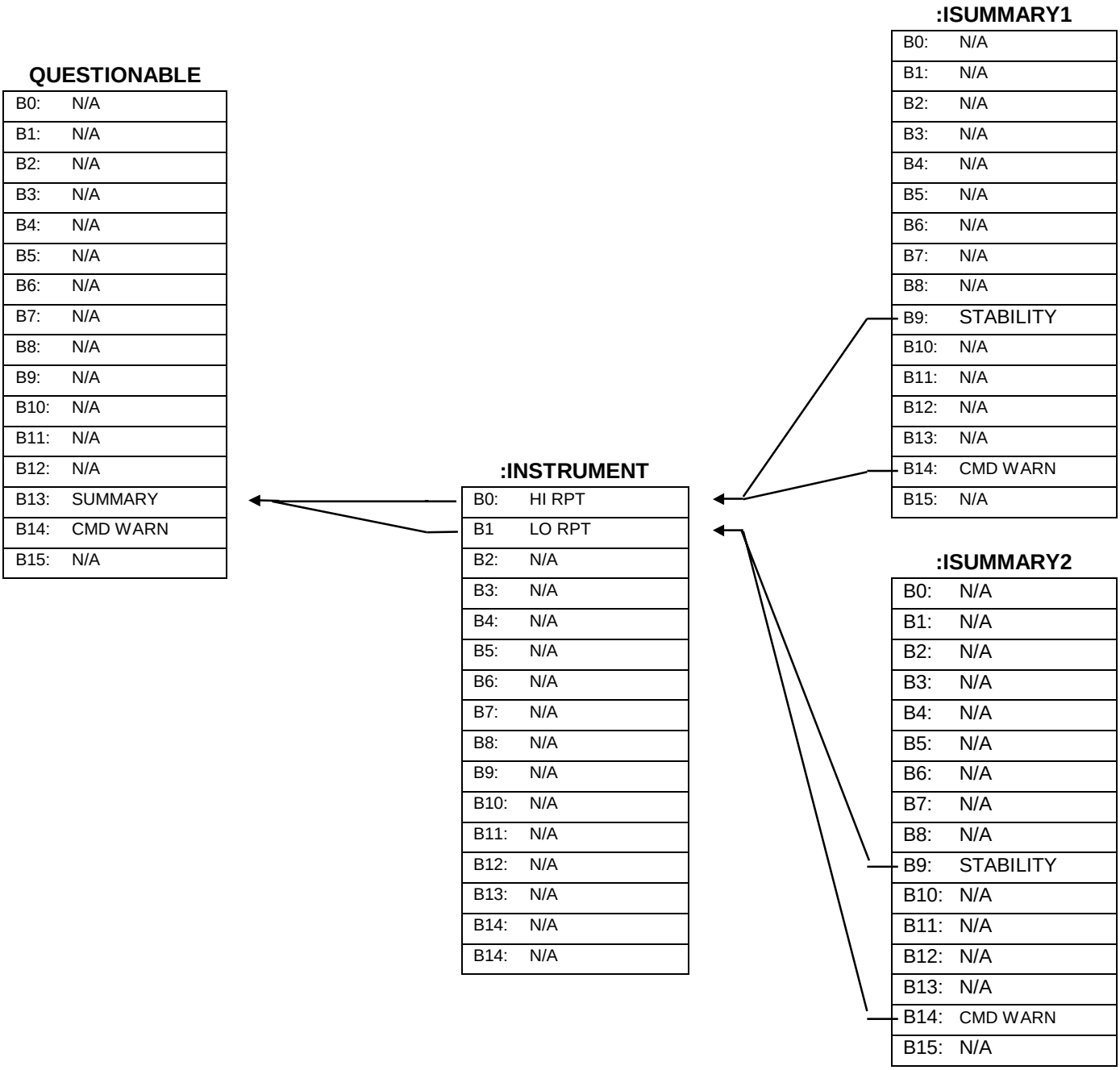
- Bit9: The MODEL 785 is not within the stability limit defined by the CALC:STAB:LIMIT setting.
- Bit14: The MODEL 785 has received and executed a command that contained data that could not be used and may result in unexpected behavior.

Each register has an associated positive and negative transition filter register, an EVENT register, and an ENABle register that determine if a false to true and/or a true to false event bit causes the event to be reported. The condition register (QUEStionable, INSTrument or ISUMmary) indicates the start of events that occur and is fed into the positive and negative transition filters (PTRansition / NTRansition) where it is determined if a false to true or true to false transition will create an event. This result is stored in the EVENt register (QUEStionable, INSTrument or ISUMmary). The ENABle register determines which of these events will be reported to the next level. All of these registers exist within the QUEStionable, INSTrument and ISUMmary registers.

Illustration of this structure duplicated for each of the OPERation, INSTument, and ISUMmary registers:



Relationship of the QUEStionable registers and its support registers:



5. MAINTENANCE, ADJUSTMENTS AND CALIBRATION

5.1 INTRODUCTION

MODEL 785 was designed for maintenance free operation. No maintenance is required other than:

- Rezeroing of reference transducers (RPT) as needed (see 3.2.9 [AutoZ)
- Regular reference transducer calibration (see 5.2 CALIBRATION OF REFERENCE PRESSURE TRANSDUCERS).
- Adjustment of the on-board barometer as needed (see 5.3 ADJUSTMENT OF ON-BOARD BAROMETER).

This section provides information on maintenance, adjustment and calibration procedures, certain repair functions and recommended overhaul procedures.

MODEL 785 is a sophisticated pressure measuring instrument with advanced on-board features and functions. Before assuming that unexpected behavior is caused by system defect or breakdown, use this manual and other training facilities to become thoroughly familiar with MODEL 785 operation. For rapid assistance in specific situations, see Section 6. TROUBLESHOOTING.

MODEL 785 is covered by a limited 1 year warranty. Unauthorized service or repair during the warranty period is undertaken at the owner's risk and may cause damage that is not covered under warranty and/or may void the warranty.

5.2 CALIBRATION OF REFERENCE PRESSURE TRANSDUCERS

5.2.1 Principle

MODEL 785 has one or two reference pressure transducers (RPT) that are the source of accurate pressure measurement for the system. Each transducer has three independent ranges.

To calibrate a range, pressures from a standard are applied to the RPT at ascending and descending points over the range. The pressure defined by the standard and the corresponding RPT readings are recorded at each point. After all of the pressures have been applied and recorded, adjustments are made to fit the RPT pressure readings to the standard. Fitting the readings means performing a least squares linear regression to arrive at the lowest value of the residuals of errors of the transducer relative to the standard. The transducer readings are adjusted by user setable coefficients: PA (an adder or offset) and PM (a multiplier or span set) (see PA/PM Coefficients below).

The calibration process is performed independently on each range of each RPT to arrive at the optimal fit for each range. This technique allows improved accuracy for individual ranges lower than the RPT's maximum range by taking into account specific transducer performance characteristics, in particular localized non-linearity and/or excursion dependent hysteresis. Independent range calibration also makes it possible to calibrate only certain ranges if ranges are on different calibration intervals or not all ranges are needed.

The normal calibration process for absolute RPTs has a second step which is the determination of the value of ZNATERR (see Setting ZNATERR below). This added step is necessary to receive the full benefit of the autozero function between calibrations (see 3.4.1 AutoZ, PRINCIPLE). It is only needed if the RPT will be operated in absolute measure mode.

➢ **CalTool software, provided as part of the standard delivery of each new MODEL 785, supports the RPT calibration process. CalTool is supplied on a 3.5" installation disc and includes a complete manual. Most users should use CalTool software to assist in the calibration of MODEL 785.**

MODEL 785 is delivered with an interactive RPT calibration utility that steps the operator through the complete reference transducer calibration procedure including applying the necessary pressures to each range, automatically collecting data, calculating new PA/PM values, previewing the results of the new calibration, determining ZNATERR and activating the results of the new calibration (see the CalTool for MODEL 785 manual). MODEL 785 also provides complete local and remote access and control of RPT calibration parameters so that RPT calibrations can be performed without using CalTool software. (see 5.2.7 RPT Calibration/Adjustment Without MODEL 785 CalTool Software).

PA/PM Coefficients

The coefficients used to adjust RPT readings are designated PA (an adder or offset) and PM (a multiplier or span set). The coefficients affect the RPT reading following:

Corrected reading = (uncorrected reading • PM) + PA

PA is expressed in units of pressure (always the SI unit, Pascal [Pa]).

PM is dimensionless.

There are individual PA/PM values for each of MODEL 785's six ranges. The PA/PM values currently in use can be viewed in the calibration function (see 5.2.5 Editing and Viewing RPT Calibration Information). PA/PM values are automatically edited when CalTool software is used and the results are activated. PA/PM values can also be edited manually under the MODEL 785 calibration function (see 5.2.5 Editing and Viewing RPT Calibration Information).

As editing PA/PM values will change RPT calibration, they should only be edited by qualified personnel as part of the calibration process. Caution should be taken to avoid accidental editing (see 3.4.8 Level).

➢ **A new MODEL 785 is delivered with PA/PM values set to zero and 1 respectively for all ranges. This does not mean that the MODEL 785 has not been calibrated. For the original factory calibration, privileged factory coefficients are used for calibration adjustment.**

Setting ZNATERR

Setting ZNATERR is necessary on absolute RPTs that will be used in the absolute measurement mode if the AutoZ function that "rezeros" the reference transducers between calibrations is to function optimally (see 3.4.1 AutoZ, PRINCIPLE).

Setting ZNATERR is procedurally identical to running the AutoZ function but the result is changes to the ZNATERR value rather than the ZOFFSET value. The ZNATERR setting procedure is prompted automatically by CalTool software. It can also be run separately under **[SPECIAL]**, **<4Internal>**, **<2Cal>**.

As ZNATERR must reflect the "natural" error between the RPT and ZSTD at the time the reference transducer is calibrated, the run ZNATERR function should not be executed between calibrations. Only the AutoZ function should be used to "rezero" the reference transducer between calibrations (see 3.4.1 AutoZ, PRINCIPLE).

Order of Operations

If the MODEL 785 has an absolute Lo RPT (AXXXX) and an absolute Hi RPT (AXXXX), and the Hi RPT will be autozeroed by the Lo RPT (see 3.4.1 AutoZ, PRINCIPLE), calibrate and determine the ZNATERR of the Lo RPT Range3 prior to calibrating the Hi RPT. This is necessary since the ZNATERR determinations for the Hi RPT ranges will be made relative to the Lo RPT Range 3 (L3).

As Received/As Left Data

Frequently, calibration reports require that as received and as left data be reported. The necessary information to report as received and as left data on the calibration of MODEL 785 RPTs can be obtained in several ways.

When the MODEL 785 CalTool calibration assistance software is used, as received data is displayed while running the calibration and is automatically recorded and provided in the calibration report, if desired. As left data is also calculated and presented.

At any time after a calibration as received/as left values can be calculated using: the reference pressures applied, the associated RPT readings, PA/PM, ZOFFSET. For example, backing out PA/PM on the as left data yields the transducer readings with PA = 0 and PM = 1. Then applying the as received PA/PM and ZOFFSET values to the readings calculates "as received" readings (the readings that the transducer would have made with the old PA/PM and ZOFFSET).

Paroscientific recommends that "as received" values of PA/PM and ZOFFSET (for absolute RPTs if autozero is used in normal operation) be recorded for each range prior to running the calibration. The current PA/PM for the active range can be viewed using SPECIAL, 6Cal, 1PRT, 1view. ZOFFSET's current value can be viewed under SPECIAL, 1AutoZ, 2view.

5.2.2 Equipment Required

1. **Gas or oil operated piston gauge (deadweight tester),** with the following characteristics:

   Do not use oil on RPTs intended to be operated with gas as the pressurized medium. Once a liquid has been applied to the RPT, special factory cleaning procedures may be required to remove it.

➢ **MODEL 785 RPTs are not sensitive to gas density so any non-corrosive gas may be used for calibration.**

- **Accuracy of ± 0.0035% of reading or better**, if best MODEL 785 accuracy is to be obtained. A lower accuracy standard may be used but MODEL 785 accuracy may be degraded proportionally from published specifications (see 1.3.2 Pressure Measurement Specifications).
- **Able to apply absolute pressures if the RPT is absolute (AXXXX) and will be used in the absolute measure mode:** Absolute pressures may be arrived at either by operation relative to an evacuated bell jar or, for higher pressures, by addition of atmospheric pressure measured by a high accuracy barometer. Absolute RPTs that will **not** be used in absolute measure mode (as is often the case for higher pressure RPTs) do not require the application of absolute pressure for calibration and may be calibrated using a gauge pressure standard.

  Absolute RPTs calibrated in gauge measurement mode by applying gauge reference pressure values are no longer accurate in absolute measurement mode.

- **Able to apply pressures at 20% increments in the range to be calibrated:** It is not necessary that the calibration pressure standard used apply precisely the nominal pressure value requested for a calibration point as long as the exact value of the applied pressure is known. Best results will be obtained if the pressure actually applied is within ± 2 % FS of the range being calibrated from the nominal increment. For the zero point on absolute ranges, use the lowest point the piston gauge can define accurately.

2. **High accuracy barometer:** Needed only if an absolute RPT (AXXXX) is being calibrated and ZNATERR will be set to allow the use of the autozero function between calibrations (see 5.2.6 Setting ZNATERR). Barometer accuracy should be ± 0.01% or better but its most important feature is stability over time. Ideally, the same barometer should be used to set ZNATERR and for subsequent running of the autozero function to update ZOFFSET.

➢ **The recommended source for measuring atmospheric pressure to set ZNATERR and for subsequent autozeroing is a *PAROSCIENTIFIC* MODEL 785 or other Multi-Range Pressure Standard. Contact *PAROSCIENTIFIC* for additional information.**

5.2.3 Set-Up and Preparation

To set-up and prepare the MODEL 785 for calibration of an RPT:

1. Set the MODEL 785 on a stable surface near the calibration standard at a height as close as possible to the calibration standard's reference height. Consider the connections that may need to be made to the rear panel and access to the front panel display and keypad.

2. Connect the calibration standard output to the MODEL 785 rear panel TEST port (1/8" NPT F or HIP H4).

MODEL 785 may have more than one RPT and more than one TEST port. In some cases one TEST port may be for gas operation and the other for liquid operation. To avoid accidental overpressure or RPT contamination by connecting to the wrong TEST port, familiarize yourself thoroughly with the configuration of the RPT before connecting (see 1.3.3 Configurations).

5.2.4 RPT Calibration Using MODEL 785 CalTool Software

To calibrate MODEL 785 using CalTool software (supplied with the MODEL 785), refer to 5.2.1 Principle, 5.2.2 Equipment Required and 5.2.3 Set-Up and Preparation in this manual and then follow the CalTool for MODEL 785 Software Manual.

5.2.5 Editing and Viewing RPT Calibration Information

PRINCIPLE

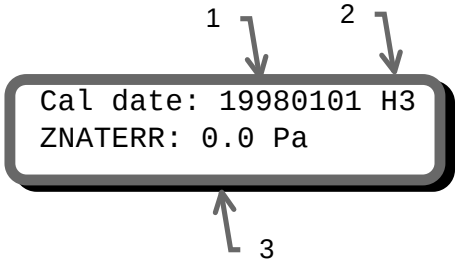
RPT calibration information fields include:

- The calibration date.
- The value of ZNATERR.
- The value of PA.
- The value of PM.

These fields can be viewed and/or edited. Viewing and editing calibration information is range specific.

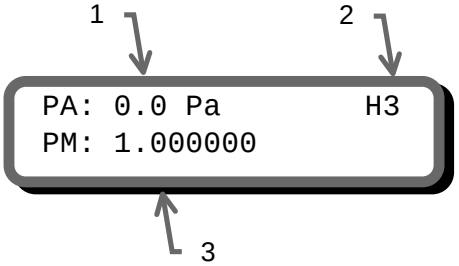
OPERATION

Activate the desired range from the main run screen using **[RANGE]** (see 3.2.1 [RANGE). Then, to view or edit calibration information for the active range, press **[SPECIAL]**, **<6Cal>**, **<1RPT>**. Select **<1view>** or **<2edit>**. The 1view selection displays the calibration information fields, the **<2edit>** function displays the fields and allows them to be edited. The display is:



1. Edit field for calibration date if in edit mode.
2. Active RPT measurement range.
3. Edit field for value of ZNATERR if in edit mode.

Pressing **[ENTER]** from the ZNATERR field goes to the next view/edit screen:



1. Edit field for value of PA if in edit mode.
2. Active RPT measurement range.
3. Edit field for value of PM if in edit mode.

Pressing **[ENTER]** from the PM field returns to the view/edit screen. If editing and changes have been made, confirmation of change activation is requested. Pressing **[ESCAPE]** in any edit screen exits the edit screen without activating any changes.

! As editing PA/PM values will change the calibration of the RPTs, the edit function should only be used by qualified personnel as part of the calibration process. Caution should be taken to avoid accidental editing (see 3.4.8 Level).

➢ **The value of PA is always in Pascal (Pa). The value of PM is dimensionless.**

5.2.6 Setting ZNATERR

PRINCIPLE

Setting ZNATERR is required as part of the calibration process for absolute RPTs that will be used in the absolute measurement mode if the autozeroing feature will be used between calibrations (see 5.2.1 Principle, Setting ZNATERR, 3.4.1 AutoZ, PRINCIPLE).

➢ **ZNATERR is range specific and operating mode specific. There is no ZNATERR for gauge mode.**

Running ZNATERR in an active range and activating the new ZNATERR value automatically sets ZOFFSET to zero for that range.

OPERATION

To set ZNATERR for the active range press **[SPECIAL]**, **<6Cal>**, **<1RPT>**, **<3run ZNATERR>**. Procedurally, running ZNATERR is identical to running AutoZ (see 3.2.9 [AutoZ).

Changing the value of ZNATERR between RPT calibrations may invalidate the autozero function for that range. Run ZNATERR should not be used between calibrations.

5.2.7 RPT Calibration/Adjustment Without MODEL 785 CalTool Software

PRINCIPLE

The reference pressure transducers can be calibrated and adjustments made without using MODEL 785 CalTool software. This requires:

1. Applying pressures with a calibration standard and recording the pressures measured by MODEL 785.
2. Calculating new PA/PM values and entering them.
3. Setting ZNATERR for the calibrated range (if the RPT is absolute, will be operated in absolute measurement mode and the autozero function will be used between calibrations).

Before proceeding to calibrate a reference pressure transducer without using MODEL 785 CalTool software, sections 5.2 CALIBRATION OF REFERENCE PRESSURE TRANSDUCERS, 5.2.1 Principle, 5.2.2 Equipment Required, 5.2.3 Set-Up and Preparation should be reviewed thoroughly.

OPERATION

A typical procedure for calibrating an RPT range is:

1. Set-up and prepare the MODEL 785 for calibration (see 5.2.2 Equipment Required, 5.2.3 Set-Up and Preparation).
2. From the main run screen, using **[RANGE]**
   - Select the reference transducer and range to be calibrated (see 3.2.1 [RANGE).
   - Set the HEAD to zero using **[HEAD]** (see 3.2.7 [HEAD).
   - Turn AutoZ on if it is left on in normal MODEL 785 operation (see 3.4.1.1 AutoZ On/Off).
   - Turn SDS off if SDS is present (see 3.1.2.6 SDS Self Defense System).
3. Using **[SPECIAL]**, **<6Cal>**, **<1RPT>**, **<1view>**, read and record the current values of PA/PM.
4. Using **[SPECIAL]**, **<1Autoz>**, **<2View>**, read and record the current value of ZOFFSET (for absolute RPT in absolute mode only).
5. Run the calibration pressures (generally 20% increments ascending and descending) for the range recording the pressure applied by the standard and the MODEL 785 reading at each calibration point. Dwell at least two minutes after setting the reference pressure at each point to allow full stabilization The data recorded is the "as received" data for this calibration.
6. Enter the calibration pressure and MODEL 785 readings into a spreadsheet. Calculate the "non-corrected" MODEL 785 readings by backing out the PA, PM and ZOFFSET (absolute RPTs only) recorded in 3. and 4. above, following:

   non-corrected reading = (corrected reading - PA + ZOFFSET)/PM

7. Perform a linear regression to find the offset and slope that best fit the non-corrected MODEL 785 readings to the calibration standard pressures. The offset is the new value of PA, the slope is the new value of PM.
8. Under **[SPECIAL]**, **<6Cal>**, **<1RPT>**, **<2edit>** write the new calibration date and the new values of PA/PM for the RPT and range calibrated.

9. Under **[SPECIAL]**, **<6Cal>**, **<1RPT>**, **<3run ZNATERR>**, run the ZNATERR routine (absolute RPTs only) (see 5.2.6 Setting ZNATERR).

10. Calculate as "left data" for the calibration if desired:

as left reading = (non-corrected reading • new PM) + new PA

11. Verify as "left data" for the calibration by reapplying reference pressures if desired:

5.3 ADJUSTMENT OF ON-BOARD BAROMETER

PURPOSE

To adjust the output of the on-board barometer (see 1.3.2.2 On-Board Barometer).

PRINCIPLE

The on-board barometer output can be adjusted using PA and PM values in the same manner as for the reference pressure transducers (see 5.2.1 Principle).

- **The on-board barometer is used only for measuring changes in atmospheric pressure over short periods of time (see 3.4.1 AutoZ, Gauge Mode with an Absolute RPT, Compensation for Atmospheric Pressure). MODEL 785 measurement accuracy does not depend on the absolute accuracy of the on-board barometer.**

OPERATION

To view or edit the values of PA and PM for the barometer, press **[SPECIAL]**, **<6cal>**, **<2barometer>**. Pressing **[ENTER]** steps through displays of the calibration date [YYYYMMDD] and PA/PM. In edit mode, the values can be edited. Pressing **[ENTER]** after the last screen activates the edited values.

- **To view the current atmospheric pressure measurement made by the on-board barometer use [SPECIAL], <3Atm>.**

- **A pressure standard may be connected to the on-board barometer by connecting to the ATM port on the rear panel (10-32 UNF). The operating span of the barometer is 10 psi (70 kPa) to 16 psi (110 kPa).**

- **Never apply a pressure greater than 16 psi (110 kPa) to the barometer port. Overpressure and possible damage can result.**

5.4 OVERHAUL

If calibration of the reference pressure transducers (RPT) is included as part of the overhaul procedure, the calibration procedure must be performed last as other overhaul procedures may affect RPT calibration.

Any or all of the following items may be included as part of a system maintenance overhaul:

1. Clean front panel.
2. Clean threads of rear panel fittings. Check for damage and replace if necessary.
3. Check that top cover mounted cooling fan operates when MODEL 785 is powered.

- **To open the MODEL 785 case, remove the pop-off screw covers on the top of the case. Then remove the four case screws. Lift off the cover taking care not to damage the electrical leads connecting the MODEL 785 man board to the cover mounted cooling fan. Disconnect the cooling fan at the main board terminal to completely remove the cover. Reconnect when reassembling.**

4. Disassemble SDS valving assembly (if present) and clean valve components.
5. Check that internal screws, bolts and nuts are tight.
6. Verify that internal barometer reads atmospheric pressure within ± 0.15 psi (1 kPa). Adjust if necessary (See 5.3 ADJUSTMENT OF ON-BOARD BAROMETER).
7. Perform system leak and operational check.
8. Perform calibration of reference pressure transducers if necessary.

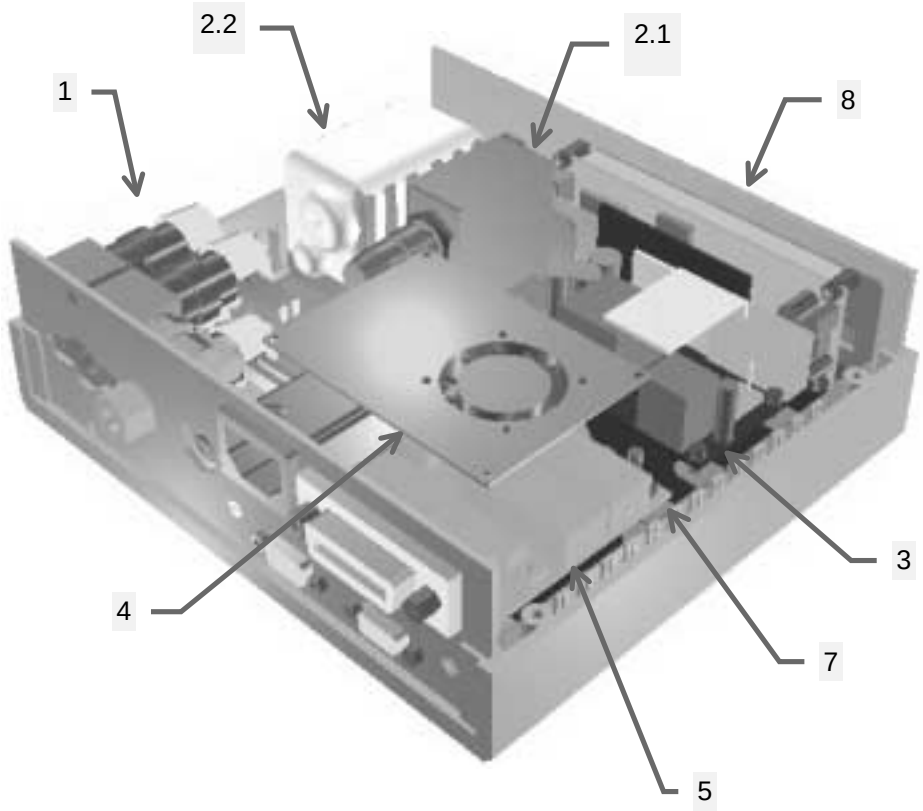
5.5 RELOADING EMBEDDED SOFTWARE INTO FLASH MEMORY

1. MODEL 785 uses FLASH memory. This allows the embedded software that controls MODEL 785 operations and functions to be loaded into MODEL 785 over its COM1 port from a personal computer with a simple FLASH loading utility.
2. To replace corrupted software or upgrade your software, your *PAROSCIENTIFIC* authorized service provider can provide you with a FLASH memory loading utility along with a file containing the MODEL 785 embedded software.
3. If the embedded software is suspected of a problem, record all symptoms and contact *PAROSCIENTIFIC*.

- **The *PAROSCIENTIFIC* flash software loading utility and MODEL 785 embedded software are available for download from the "SOFTWARE" section of the *PAROSCIENTIFIC* world wide web site at http://www.Paroscientific.com.**

5.6 SUBASSEMBLY DESCRIPTION AND LOCATION

5.6.1 Internal View



1. SDS module (may be single, dual channel, or not present depending on RPTs. Dual channel shown here)
2. 1. Hi RPT (changes with RPT selection, b Type Group 1 shown here)
2. 2. Lo RPT (changes with RPT selection, standard Type Group 1 shown here)
3. Power Supply
4. Cooling fan (mounted on cover)
5. Micro board
6. Main board (not visible, under micro board and power supply)
7. On-board barometer (on main board)
8. Display

➢ **MODEL 785 RPT, SDS and rear panel configurations vary depending on RPT selection. See 1.3.3 Configurations for configuration details.**

5.6.1.1 SDS Module

SDS consists of a manifold equipped with 12 V solenoid valves that switch an RPT from being open to the TEST port and shut off from the ATM port (when valves are energized, SDS off) to being shut off from the TEST port and open to the ATM port (valves not are energized, SDS on).

SDS is present on RPTs designated A1000 or lower (Group 1 RPTs). If the MODEL 785 has two Group 1 RPTs, SDS is dual channel with a single four valve manifold connected to a single TEST port. If the MODEL 785 has only one Group 1 RPT, SDS is single channel with a two valve manifold and connected to the Group 1 RPT test port. For additional information on SDS see 3.1.2.6 SDS Self Defense System, 3.2.8 [SDS] (SELF DEFENSE SYSTEM), 3.4.2 SDS. For additional information on MODEL 785 RPT dependent configurations see 1.3.3 Configurations.

5.6.1.2 RPTs

Three different RPT mechanical configurations are available for MODEL 785:

- standard RPT, up to A500: rectangular, foam boot.
- standard RPT, A1000 to A10000: cylindrical foam boot.
- standard RPT, >A10000: cylindrical metal can

In a single RPT MODEL 785 the RPT is designated the Hi RPT. In dual RPT models the Hi RPT is the RPT with the higher designation, the Lo RPT is the RPT with the lower designation.

For additional information on MODEL 785 RPT dependent configurations see 1.3.3 Configurations

5.6.1.3 Power Supply

MODEL 785 has one power supply with two voltage outputs:

+12 V DC (±5%) @ 0.9Amps: for valve excitation, b Type RPT supply and analog circuit.

+5 V DC (±5%) @ 2.5 Amps: for micro board, main board, display fan and standard RPT supply.

5.6.1.4 Cooling Fan

The cooling fan is mounted to the MODEL 785 top cover and connected to the main board. It is a 5V brushless DC fan, max. air flow 0.13 m3 (4.6 cfm).

5.6.1.5 Micro Board

The micro board supports a Motorola 68302 micro-controller, EPROM, EERPOM, 128k x 16 bit NVRAM, 8 Mbit flash memory; RS-232 and IEEE-488.2 communications; keypad and display control. An I/O port controls other ports and devices in MODEL 785.

5.6.1.6 Main Board

The main board is controlled by the micro board (see 5.6.1.5 Micro Board). it supports the 12V drivers for SDS solenoid valve excitation; the on-board barometer with digital thermometer and the beeper. It also includes a two channel frequency counter for reading standard RPTs.

5.6.1.7 On-board Barometer

The on-board barometer is mounted on the main board and tubed to the rear panel ATM port.

The on-board barometer includes a piezoresistive micro-machined silicon pressure sensor and digital thermometer for temperature compensation.

5.6.1.8 Display

2 x 20 vacuum fluorescent alpha-numeric display mounted to front panel.

6. TROUBLESHOOTING

MODEL 785 is a sophisticated pressure setting and measuring instrument with advanced on-board features and functions. Before assuming that unexpected behavior is caused by a system defect or breakdown, the operator should use this manual and other training facilities to become thoroughly familiar with MODEL 785 operation. This troubleshooting guide is intended as an aid in identifying the cause of unexpected MODEL 785 behavior and determining whether the behavior is due to normal operation or an internal or external problem.
Identify the symptom or unexpected behavior you are observing from the Symptom list below. A Probable Cause is provided and a Solution is proposed included references to manual sections providing information that may be of assistance.

Symptom	Probable Cause	Solution
Will not power up.	Blown fuse.	Replace fuse.
Measured pressure display has too much/not enough resolution.	Resolution setting needs to be changed.	Use **[RES]** to change resolution setting (3.2.5 [RES] (RESOLUTION)).
Resolution of values other than measured pressure is too high or too low	Display resolution of values other than the measured pressure are controlled by the RES setting of the current range and current RES setting is too high or to low.	Change ranges to a range with desired resolution or change resolution setting for active range (3.2.1 [RANGE, 3.2.5 [RES] (RESOLUTION))
Front panel keys seem to be disabled.	"Remote" command has been sent from a host computer.	Send "local" command from host computer or cycle MODEL 785 power.
Front panel display is dim.	Screen saver option has activated.	Press any key to resume full screen power, adjust activation time if desired. (3.4.7.1 ScrSav)
Keypad presses make undesired sounds or no sounds.	Keypad sound settings are incorrect.	Use keypad function to set keypad sounds as desired, (3.1.2.2 Sounds, 3.4.7.2 Sound)
Cannot access certain functions. **<>ACCESS RESTRICTED<>**	User levels have been set that restrict access to certain functions.	Change user level or consult system manager (3.4.8 Level)
Displays **<FATAL ERROR>** or **<FATAL FAULT>**.	Encountered unresolved internal software conflict.	Cycle power to clear. Please record conditions leading up to event including the numbers displayed when enter is pressed and report to Authorized Service Provider.
Displays **<TIME-OUT>**	MODEL 785 cannot read RPT.	Cycle MODEL 785 power. If problem persists contact authorized service center.
Bottom line of display has changed and you want to change it back.	The DISPLAY function has been used to change the display.	Use **[DISPLAY]** to set bottom line to desired display. (3.2.6 [DISPLAY])

Symptom	Possible Cause	Solution
Bottom line of display is blank.	DISPLAY mode is “clean”.	Operation is normal. Use **[DISPLAY]** to change bottom line display if desired. (3.2.6 [DISPLAY)
Pressure display is flashing and beeper is sounding.	Current upper limit of active range has been exceeded.	Reduce pressure applied to TEST port to correct UL condition. Change UL and/or active range if desired (3.2.1 [RANGE, 3.2.4 [UL] (UPPER LIMIT)
“RR RPT EXCEEDED PMAX” displays alternating with normal display.	MODEL 785 has been overpressured (Pmax! exceeded).	Correct the overpressure condition and cycle power on and off to clear(3.2.4.1 Over-pressure Function (Pmax!), 1.3.3 Configurations)
!!!PMAX!!!	Current measured pressure is greater than the maximum acceptable pressure (Pmax!) for the active range.	Reduce pressure and recycle power to clear overpressure condition. (3.2.4.1 Over-pressure Function (Pmax!)
SDS is displayed alternating with the measured pressure.	SDS is on.	Operation is normal. Turn SDS off if desired. (3.1.2.6 SDS Self Defense System, 3.2.8 [SDS] (SELF DEFENSE SYSTEM), 3.4.2 SDS)
Pressure indicated by MODEL 785 never becomes stable.	These is a leak in the pressure system to which MODEL 785 is connected..	Find and correct leak. Consider using MODEL 785 leak check function. (3.3.5 Leak).
A "ready" indication is never achieved.	Stability criterion is never being met.	Adjust stability criterion or stabilize applied pressure. (3.1.2.4 Pressure Ready/Not Ready Indication, 3.3.4 Stab (Stability)).
Range will not change. Displays “Pressure on RR RPT exceeds RR upper limit”.	The pressure currently applied to the range that is being selected exceeds the UL (upper limit) currently set for that range.	Reduce pressure applied to test port to less than UL of target range. (3.2.4 [UL] (UPPER LIMIT)
Display update rate of indicated pressure changes when changing pressure.	MODEL 785 automated read rate function is on to automatically adjust read rate depending upon rate of change of pressure.	Operation is normal. Turn automated read rate function off if desired. (3.3.3 ReadRt)
Display update of indicated pressure is too slow when pressure is changing quickly	MODEL 785 automated read rate function is off.	Turn automated read rate function on to automatically adjust read rate depending on pressure rate of change. (3.3.3 ReadRt)

Symptom	Possible Cause	Solution
Pressure is changing but display of pressure is not and the bottom right hand corner of the display is a numerical countdown followed by **<avg>.**	Average DISPLAY function is on and pressure display is updating only with the average value at the end of each averaging cycle.	Go to a DISPLAY function other than average or press **[+/-]** to get the instantaneous value Average DISPLAY. (3.2.6.1 Avg (Average)
Is not reading pressure applied to the test port and ***SDS*** is flashing over the pressure indication.	SDS is "on" so the pressure applied to the test port is not getting to the RPT.	After taking precautions to assure that pressure applied to test port is safe for the RPT, turn SDS off. (3.1.2.6 SDS Self Defense System, 3.2.8 [SDS] (SELF DEFENSE SYSTEM), 3.4.2 SDS ,1.3.3 Configurations)
Is not reading pressure applied to the TEST port.	MODEL 785 may have two TEST ports and the pressure to be measured is connected to the wrong port.	Familiarize yourself with your MODEL 785 configuration. Connect pressure to be measured to correct TEST port. (1.3.3 Configurations).
Is not reading pressure applied to TEST port	MODEL 785 may have two TEST ports and pressure to be measured is connected to correct port but active RPT is not the RPT on that TEST port.	Familiarize yourself with your MODEL 785 configuration. Set active RPT and range to read on desired test port. (1.3.3 Configurations, 3.2.1 [RANGE)
SDS won't turn off for the RPT shown on the second line in the RPT DISPLAY function.	SDS can only be turned off using direct SDS control.	Use direct SDS control to turn SDS off. (3.1.2.6 SDS Self Defense System, 3.4.2 SDS, 1.3.3 Configurations)
SDS was left off on one RPT when ranges were changed. When you come back to it, its on again.	When ranges are switched from one RPT to another, SDS is always turned on for the "old" RPT.	Operation is normal. (3.1.2.6 SDS Self Defense System, 3.2.8 [SDS] (SELF DEFENSE SYSTEM), 3.4.2 SDS)
Disagreement between Hi and Lo reference transducer or between transducer ranges appears excessive.	Difference is actually in tolerance and represents "natural" disagreement..	Compare differences observed to tolerances on reference transducer measurements (1.3.2 Pressure Measurement Specifications)
Disagreement between measurements made by different ranges at the same pressure is not zero but an autozero routine was just executed.	Readings by different ranges at the same pressure can disagree even after a valid autozero due to ZNATERR.	Check that ZOFFSET value is in tolerance and verify value of ZNATERR. (3.4.1 AutoZ, PRINCIPLE, 3.4.1.2 View AutoZ, 5.2.5 Editing and Viewing RPT Calibration Information.
AutoZ was just run in gauge mode but measurement indication is not zero. "h" is displayed on top line of screen..	A head correction is applied and current indication is the value of the head.	Operation is normal. (3.2.7 [HEAD, 3.4.1 AutoZ, PRINCIPLE)

Symptom	Possible Cause	Solution
Pressure applied is zero gauge but reading is not zero.	Need to run AutoZ to rezero in gauge mode.	Run AutoZ. (3.2.9 [AutoZ)
Poor pressure measurement characterized by instability and sudden small pressure changes when using a gas operated RPT.	The MODEL 785 is measuring in a gas system that is contaminated with liquids or the MODEL 785 itself is contaminated with liquids.	Purge and clean affected systems (1.3.3 Configurations, 5.4 Overhaul).
Poor pressure measurement characterized by offsets and span changes when using a b Type RPT.	RPT has been contaminated with liquids.	Contact Paroscientific Service Department.
Apparent inaccurate pressure measurements and little or no response from reference transducer:	Reference transducer destroyed by overpressure.	Contact Paroscientific Service Department.
Apparent inaccurate pressure measurement and “h” is displayed on top line of screen.	An unplanned "head" correction is active or head height or medium is incorrect.	Remove or change "head" correction (3.2.7 [HEAD, 3.3.1 Head).
Apparent inaccurate pressure measurement.	Incorrect pressure units and/or measurement mode (gauge or absolute).	Set desired pressure units and/or measurement mode. Consider reference temperature if unit is inWa (3.2.2 [UNIT, 3.2.3 [MODE).
Pressure applied is zero gauge but reading is not zero.	Current measurement mode is absolute and MODEL 785 is indicating atmospheric pressure.	Check measurement mode setting and set to gauge if gauge pressure measurements are desired. (3.2.3 [MODE)
Pressure applied is atmospheric but MODEL 785 indicates near zero.	Current measurement mode is gauge and MODEL 785 is indicating zero gauge pressure	Check measurement mode setting and set to absolute if absolute pressure measurements are desired (3.2.3 [MODE) .
Apparent inaccurate pressure measurement.	RPT calibration coefficients have been altered or lost.	Check and correct calibration coefficients if needed (5.2 CALIBRATION, PRINCIPLE).
Apparent inaccurate pressure measurement and “z” is displayed on top line of screen..	AutoZ has been run with incorrect ZSTD applied.	Check value of ZOFFSET. Rerun AutoZ with a valid ZSTD reference (3.2.9 [AutoZ, 3.4.1 AutoZ, PRINCIPLE,).
Apparent inaccurate pressure measurement and “z” is not displayed on top line of the screen	AutoZ is off and it should be on.	Turn AutoZ on. (3.4.1.1 AutoZ On/Off, 3.4.1 AutoZ, PRINCIPLE)

7. APPENDIX

7.1 PRESSURE UNIT CONVERSIONS

MODEL 785 performs all internal calculations in SI units. Numerical values input or output in other units are converted to SI immediately after entry and back to other units just before output as needed.

The tables below provide the conversion coefficients used by MODEL 785 to convert numerical values expressed in SI units to corresponding values expressed in other units.

To Convert from Pa to		Multiply by
Pa	*Pascal*	1.0
mbar	*millibar*	1.0 E-02
kPa	*kilo Pascal*	1.0 E-03
bar	*bar*	1.0 E-05
mmWa @ 4°C	*millimeter of water*	1.019716 E-01
mmHg @ 0°C	*millimeter of mercury*	7.50063 E-03
psi	*pound per square inch*	1.450377 E-04
psf	*pound per square foot*	1.007206 E-06
inWa @ 4°C	*inch of water*	4.014649 E-03
inWa @ 20°C	*inch of water*	4.021732 E-03
inWa @ 60°F	*inch of water*	4.018429 E-03
inHg @ 0°C	*inch of mercury*	2.953 E-04
kcm^2	*kilogram force per centimeter square*	1.019716 E-05
user	*user*	User defined coefficient
ft	*feet of altitude*	see ***Altitude Note*** below
m	*meter of altitude*	see ***Altitude Note*** below

Altitude Note: *Quantities expressed in units of altitude follow MIL-STD-859A "Static Pressure, p, in Inches of Mercury for Values of Pressure Altitude, H, in Geopotential Feet." MIL-STD-859A provides tables of pressure in inches of mercury as a function of altitude in feet. MODEL 785 uses a set of equations to model the pressure/altitude relationship. The worst case deviation between the MIL-STD-859A table and the calculated pressure is 0.0001 inches of mercury (0.3 Pa). The pressure quantity expressed in inches of mercury is converted to Pascal following the table above. For altitude expressed in meters, meters are converted to feet using 1 m = 3.28084 ft.*

7.2 WARRANTY STATEMENT

General

Products manufactured by the Seller are warranted against defects in materials and workmanship for twelve (12) months from the date of shipment thereof to the Customer. Refer to the terms and conditions stated on the reverse side of the Sales Order Acknowledgement or Packing Slip.

Model 785, Multi-Range Pressure Standard

Except to the extent limited or otherwise provided herein, Paroscientific, Inc. warrants for one year from purchase, each new product sold by it, only against defects in workmanship and/or materials under normal service and use. Products which have been changed or altered in any manner from their original design, or which are improperly or defectively installed, serviced or used are not covered by this warranty.

Model 785, Digiquartz® Pressure Transducers

All transducers include a limited five year warranty with the first two years covered at 100%. This warranty does not apply to units broken due to over-pressure or excessive mechanical shock. Contact Paroscientific for details of the transducer warranty.

7.3 GLOSSARY

Absolute mode Measurement mode in which the RPT indicates absolute pressure (difference from vacuum).

Active RPT The RPT of which a range is currently the active range.

ATM Ref The on-board barometer reading.

ATMOFFSET The difference between the reading of the on-board barometer at the last tare and the current reading of the on-board barometer. Used to dynamically compensate the atmospheric offset (ZOFFSET) when operating in gauge measurement mode with an absolute RPT and AutoZ on.

Autozero A process by which an RPT range and measurement mode is rezeroed (offset) relative to a standard.

Barometer MODEL 785's on-board atmospheric pressure measuring sensor. Also referred to as on-board barometer.

Clean A DISPLAY function in which the second line of the display is blank (clean).

Deviation A DISPLAY function in which the deviation from a target value is calculated and displayed. The value of the difference between the target and the current pressure reading.

DUT Device Under Test.

Freeze A DISPLAY function in which the current reading of the RPT can be captured and displayed by pressing ENTER.

FS Abbreviation of "full scale". The full scale value is the maximum pressure or the span of a measurement range. Limits and specifications are often expressed as % FS.

Gauge mode Measurement mode in which the RPT indicates gauge pressure (difference from atmospheric pressure).

Head A difference in height between the MODEL 785 reference level and another level at which pressure is to measured.

Hi/Lo A DISPLAY function in which the highest and lowest pressure measurements since reset are recorded and displayed.

Inactive RPT The RPT on which no range is currently the active range. A range of the inactive RPT maybe displayed on the second line of the MODEL 785 display using the RPT DISPLAY function.

Measurement mode Whether pressure is being measured relative to absolute zero or vacuum (absolute mode) or relative to atmospheric pressure (gauge mode).

PA Pressure adder, used to offset an RPT range or barometer in calibration.

PM Pressure multiplier, used to adjust span of an RPT range or barometer in calibration.

Pmax! The maximum pressure limit of a range. If the pressure measured by a range exceeds Pmax! an overpressure condition occurs.

Rate The rate of change of the current pressure. Indicated in the main run screen when control is suspended.

ReadRt or Automated Read Rate An MODEL 785 feature that automatically adjusts the pressure reading and display update rate as a function of the rate of change of the measured pressure.

Ready/Not Ready Indication of when pressure is stable within stability limit.

RPT Reference Pressure Transducer. The transducer used by MODEL 785 for high accuracy pressure measurement. The RPT in a single RPT MODEL 785 or the higher pressure range RPT in a dual RPT MODEL 785 is referred to as the Hi RPT. The lower pressure range RPT in a dual RPT MODEL 785 is referred to as the Lo RPT. RPTs are designated by a leading A or G (absolute or gauge) followed by four or five numbers indicating the maximum range of the RPT in psi (e.g. A0100). These are standard b type RPTs.

Stability limit A limit expressed in units of pressure per second (e.g. psi/second). The stability limit is used as the "ready/not ready" criterion (ready if inside stability limit, not ready if stability limit is exceeded).

SDS Self Defense System A system to protect RPTs from overpressure made up of isolation and vent valves and internal operating logic. Applies only to RPTs designated A1000 or lower.

Target The value from which deviations are measured in the Deviation DISPLAY function.

UL Same as Upper Limit.

Upper limit A range specific maximum value of pressure not be exceeded and at which MODEL 785 will sound an intermittent beep.

User level Level of security that can be set to protect certain MODEL 785 functions from being accessed.

ZNATERR The disagreement between the RPT indication and ZSTD at the autozero pressure just after an RPT range has been calibrated.

ZCURERR The disagreement between the RPT indication and ZTSD at some time after an RPT range has been calibrated.

ZOFFSET ZCURERR corrected for ZNATERR (the value used to autozero the RPT range).

ZSTD The value indicated by the device used as the reference in determining ZNATERR and ZCURERR.

7.4 NON-STANDARD CONFIGURATION

P/N 1340-006 Consists of 2 EA. 1000 psi or less transducers, one transducer with SDS and one transducer without SDS

P/N 1340-007 Consists of an enclosure only (no internal transducers) with provisions for electrically connecting to an external transducer (or transducers).