

RAD 3200 SERIES SOFTWARE REQUIREMENTS SPECIFICATION

RAD2 V5.11

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RAD CONTROL AND CONFIGURATION

The operation of each RAD is controlled by sending commands to selected units via the network. The RAD returns data or information over the same network to the requesting client/host.

RAD COMMANDS

This section describes the commands used to control the RAD. The RAD software performs the following general tasks:

- 1) Read and filter the raw A/D counts that represent pressure and temperature.
- 2) Convert the pressure A/D counts to user chosen pressure units.
- 3) Receive and execute commands via the Ethernet, Serial or Local.
- 4) Output converted data, status, setup and calibration data over the Ethernet, Serial, or Local outputs.

NOTES: When a RAD module is in a "not ready" mode, all commands are disabled except STATUS and STOP.

If the software has not connected to a RAD unit using the Login command, all operations will be performed on the default RAD unit. The default RAD unit is the RAD with the lowest serial number. When a communications variable is modified, the RAD system computer must be restarted, in order for the changes to take effect.

COMMAND FORMAT

Each of the commands are explained with the following sections: command, syntax, arguments, description, and returns.

COMMAND lists the name of the command.

SYNTAX lists the format of the command. The following conventions are used:

- BP** Boldface letters indicate command keywords and operators. Within the discussion of syntax, bold type indicates that the text must be entered exactly as shown.
- expression* Words in italics indicate place holders for information you must supply, or information returned by the calibrator, such as a coefficient name or pressure data.
- [/H] Items in square brackets are optional.
- ,
- <CR> Items in angle brackets are used for names of keys on a typical keyboard. The carriage-return key, sometimes marked as a bent arrow, Enter, or Return on the key board, is called <CR>.

Spaces, as used in the syntax, are entered as spaces.

DESCRIPTION describes the function of the command.

RETURNS lists the format of the information that the unit returns to the host.

A **PROMPT (>)** will be output when the RAD is ready to accept a command.

TCP/IP does not guarantee that packet boundaries will be maintained between a Host and a RAD module. Therefore, **ALL** commands from a Host **MUST** be terminated properly with one of two options using the NL configuration variable. The two options are:

CR-LF (ASCII 13 - ASCII 10) or CR (ASCII 13)

RAD COMMAND LIST

COMMAND SYNTAX	BANK A MODE BANKA <CR>
ARGUMENTS	None
DESCRIPTION	Commands the RAD to switch the DOUTS set in the configuration variable: BANKA. This command is intended for use with ZOC22, 23, and 33 modules but could be used in any situation where DOUT settings must be changed quickly.
RETURNS	<n/> nl - end of line
EXAMPLE	To switch the valves in a ZOC 22, 23, or 33 to measure the pressures applied to the Bank A inputs: Enter the command: BANKA The RAD will switch the outputs based on the setting of the configuration variable: BANKA. This command assumes that the configuration variable is set correctly.

COMMAND SYNTAX	BANK B MODE BANKB <CR>
ARGUMENTS	None
DESCRIPTION	Commands the RAD to switch the DOUTS set in the configuration variable: BANKB. This command is intended for use with ZOC22, 23, and 33 modules but could be used in any situation where DOUT settings must be changed quickly.
RETURNS	<n/> nl - end of line
EXAMPLE	To switch the valves in a ZOC 22, 23, or 33 to measure the pressures applied to the Bank B inputs: Enter the command: BANKB The RAD will switch the outputs based on the setting of the configuration variable: BANKB. This command assumes that the configuration variable is set correctly.

COMMAND SYNTAX	BANK USER MODE BANKUSR <CR>
ARGUMENTS	None
DESCRIPTION	Commands the RAD to switch the DOUTS set in the configuration variable: BANKUSR. This command is intended for use with ZOC22, 23, and 33 modules but could be used in any situation where DOUT settings must be changed quickly.
RETURNS	<n/> nl - end of line
EXAMPLE	To switch the valves in a ZOC 22, 23, or 33 to a special mode of operation as defined in the configuration variable BANKUSR: Enter the command: BANKUSR The RAD will switch the outputs based on the setting of the configuration variable: BANKUSR. This command assumes that the configuration variable is set correctly.

COMMAND SYNTAX	CALIBRATE CAL <i><press></i> <i><channels></i> <CR>
ARGUMENTS	<i><press></i> - a real number that represents the calibration pressure for this point. <i><channels></i> - a combination of: <i>module-port</i> for one channel; or: <i>module-port,module-port</i> for multiple modules; or <i>module-port...module-port</i> for a range of modules. <i>Module</i> is the physical location of the module in the system. <i>Port</i> is a single pressure sample point within a module.
DESCRIPTION	This command reads one averaged frame of pressure and temperature counts. The data returned from this command will be lost if it is not captured in a log file or by the Host computer. NOTE: The RAD does not control the calibration. It will only read the information when commanded.
RETURNS	INSERT <i><temp></i> <i><channel></i> <i><press></i> <i><press counts></i> M <i><nl></i> temp - the temperature plane channels - the channel in module-port notation press - the pressure in EU press counts - the A/D pressure counts(or bits) nl - end of line
EXAMPLE	If a user wanted to calibrate a module connected to A/D position 3 at 15 psi: Apply the appropriate Control pressures for the module Connect a pressure standard to the CAL input. Enter the command: CAL 15 3-1..3-32<CR> The RAD will measure the counts for each channel and return the appropriate INSERT commands.
NOTES	When BIN is set to 1 and the BINADDR is set to a value other than zero, the data from the AUX or CAL commands are converted to a BINARY format and output over the UDP binary port specified in the BINADDR variable. The data format is: <ID byte> - 1 byte, the value will be 1 if the data are from a calibrator or 2 if the data are from an auxiliary unit. <pressure> - 4 bytes of floating point binary pressure data

COMMAND
SYNTAX

CALIBRATE INSERT
CALINS *<press>* *<channels>*<CR>

ARGUMENTS

<press> - a real number that represents the calibration pressure for this point.
<channels> - a combination of:
module-port for one channel; or:
module-port,module-port for multiple modules; or
module-port...module-port for a range of modules.
Module is the physical location of the module in the system.
Port is a single pressure sample point within a module.

DESCRIPTION

This command reads one averaged frame of pressure and temperature counts and stores the information in memory in the INSERT format shown in the CALIBRATE Command. **NOTE:** The RAD does not control the calibration. It will only read the information when commanded.

RETURNS

<n/> - end of line

When this command returns the prompt, a SAVE command must be issued. The RAD will insert the stored data in the Module Profile Files.

EXAMPLE

If a user wanted to calibrate a module connected to A/D position 3 at 15 psi:
Apply CTL1 and CTL2 Control pressures
Connect a pressure standard to the CAL input.
Enter the command:

CALINS 15 3-1..3-32<CR>

The RAD will measure the counts for each channel and write the new master plane information into memory.

COMMAND SYNTAX	CALIBRATE ZERO CALZ <CR>
ARGUMENTS	None
DESCRIPTION	Commands the RAD to perform a zero calibration. This operation produces A/D count values for each pressure channel that is subtracted from the raw pressure counts before conversion to the engineering units. The data are stored in a Zero Array and a Delta Array. These values may be read by executing a ZERO or DELTA command. This command places the RAD in the CALZ Mode until the command is completed or a STOP command is issued. CALZ requires approximately 15 seconds to complete.
RETURNS	<n/> nl - end of line
EXAMPLE	To update the current ZERO file and correct for any zero drift of the transducers: Enter the command: CALZ The RAD will measure the zero counts for each channel and update the Zero and Delta Arrays. The RAD will write the information into the file, ZERO.CFG when a SAVE Command is executed.
NOTE	It is very important that a user execute a CALZ after the RAD and ZOC modules have been allowed to stabilize after power up. Also a CALZ should be executed if power is cycled, or if a RESTART or RELOAD command is executed. The Zero and Delta Arrays are cleared when the RAD is powered down or when a RESTART or RELOAD command is executed. The data in the ZERO.cfg file is intended to be historical data. The Zero and Delta values are not reloaded at power up or restart because it is impossible to determine how long the power has been off. This also is designed to insure that a new set of zeros is acquired if modules have been switched.

COMMAND SYNTAX	CALIBRATE ZERO ALL RADS CALZ ALL<CR>
ARGUMENTS	None
DESCRIPTION	Commands all connected RAD units to perform a zero calibration. This operation produces A/D count values for each pressure channel that is subtracted from the raw pressure counts before conversion to the engineering units. The data are stored in a Zero Array and a Delta Array. These values may be read by executing a ZERO or DELTA command. This command places each connected RAD in the CALZ Mode until the command is completed or a STOP command is issued. CALZ ALL requires approximately 15 seconds to complete.
RETURNS	<n/> nl - end of line
EXAMPLE	To update the current ZERO file and correct for any zero drift of the transducers for all connected RAD units: Enter the command: CALZ ALL Each connected RAD will measure the zero counts for each channel and update the Zero and Delta Arrays. Each connected RAD will write the Zero and Delta information into file, ZERO.CFG in the folder for that RAD unit when a SAVE Command is executed.
NOTE	It is very important that a user execute a CALZ or CALZ ALL after the RAD and ZOC modules have been allowed to stabilize after power up. Also a CALZ ALL should be executed if power is cycled, or if a RESTART or RELOAD command is executed. The Zero and Delta Arrays are cleared when the RAD is powered down or when a RESTART or RELOAD command is executed. The data in the ZERO.cfg file is intended to be historical data. The Zero and Delta values are not reloaded at power up or restart because it is impossible to determine how long the power has been off. This also is designed to insure that a new set of zeros is acquired if modules have been switched.

COMMAND SYNTAX **CHANNEL**
CHAN *<scan group>* <CR>

ARGUMENTS *<scan group>* - a number, 1 to 8, that represents the scan group number.

DESCRIPTION This command outputs the channel configuration for the scan group entered in the argument.

RETURNS CHAN: <group><sequence><mod><port><lpress> <hpress><numchan><eu><nl>
group - the scan group, 1 to 8
sequence - the scan port number
mod - the module number
port - the port number in the module
lpress - the minimum pressure value
hpress - the maximum pressure value
numchan - the number of channels in the module
eu - the eu conversion setting, 0 = raw counts, 1 = EU
nl - end of line

EXAMPLE To verify the which channels have been assigned to SCAN GROUP 1:

Type:
CHAN 1 <CR>

The RAD will return:

```

CHAN: 1 1 1 1 -6.100000 6.100000 32 1
CHAN: 1 2 1 2 -6.100000 6.100000 32 1
CHAN: 1 3 1 3 -6.100000 6.100000 32 1
CHAN: 1 4 1 4 -6.100000 6.100000 32 1
CHAN: 1 5 1 5 -6.100000 6.100000 32 1
CHAN: 1 6 1 6 -6.100000 6.100000 32 1
CHAN: 1 7 1 7 -6.100000 6.100000 32 1
CHAN: 1 8 1 8 -6.100000 6.100000 32 1
CHAN: 1 9 1 9 -6.100000 6.100000 32 1
CHAN: 1 10 1 10 -6.100000 6.100000 32 1
:: :: : : : : : : :: :: :: : :
CHAN: 1 31 1 31 -6.100000 6.100000 32 1
CHAN: 1 32 1 32 -6.100000 6.100000 32 1
>

```

This shows that all 32 ports of a 32 channel module have been assigned in sequence to Scan Group 1. The module is connected to input one. The minimum full scale pressure value is -6.1 engineering units. The maximum pressure value is 6.1 engineering units. The output data will be in engineering units

COMMAND SYNTAX	CLEAR CLEAR<CR>
ARGUMENTS	None
DESCRIPTION	Commands the RAD to clear any errors that have occurred. The errors are sent to the client in response to a ERROR command.
RETURNS	<i><n/></i> nl - end of line.
EXAMPLE	To clear any errors listed in the ERROR Buffer, the following command would be issued: CLEAR <CR> The ERROR buffer will be cleared

COMMAND SYNTAX	CLOSE SCAN FILE CLOSE<CR>
ARGUMENTS	None
DESCRIPTION	Commands the RAD to close the current open scan file created when CONOUT is set to 3 and a SCAN command is issued. The CLOSE command will close the file and set file counter so the next SCAN command will open a new scan file. The scan files are automatically named scanxxx.dat. The scan file counter is reset when the program is exited.
NOTE:	If a CLOSE command is not issued to close an open scan file, the data collected from the next SCAN command will be appended to the open file. If a CLOSE command is not issued before the RAD.exe program is shut down, all data from the open file will be lost.
RETURNS	<n/> nl - end of line.
EXAMPLE	Data collection has commenced. FILEOUT is set to 1 and a SCAN command has been issued. A scan file named: scan000.dat is opened. When the SCAN function is complete, Type: CLOSE This will close the file: scan000.dat. When the next SCAN command is issued, a new file named: scandat001 is opened. When this scan is complete, Type: CLOSE This will close the file: scan001.dat

COMMAND	CONTROL PRESSURE RESET
SYNTAX	DOUTPU<CR>
ARGUMENTS	<i>none.</i>
DESCRIPTION	Resets the control pressures to the power up condition. This will reset control pressures if the BANKA, BANKB, and BANKUSR commands are used to modify control pressure settings from the power up condition. This also will reset DOUTS that have manually set. Scanivalve Corp recommends that all ZOC22, ZOC23, and ZOC33 modules have all control pressures removed if the modules will be powered on for a long time.
RETURNS	<n/> nl - end of line.
EXAMPLE	To reset the control pressures to the power up mode after several operations of the BANK(x) commands, Type: DOUTPU<Enter>

COMMAND
SYNTAX

CREATE SENSOR PROFILE FILE
CREATESPF <sensor serial number> <channel number> <CR>

ARGUMENTS

sensor serial number - the serial number of the replacement sensor
channel number - the location of the new sensor in position-port format

DESCRIPTION

Commands the RAD to copy the coefficients from the specified channel to a Sensor Profile File so the sensor can be used as a replacement sensor. Generally this would only be used at the Scanivalve Factory, but it could be used by an end user to move a sensor from one module to another.
The command may be entered from the local input or a host computer. The RAD must be in the READY mode to accept the command.
This command **DOES NOT** modify the tables in the RAD system computer memory. The Sensor Profile File will be stored in the RAD Folder. The file may be transferred to a host computer using a file transfer.

RETURNS

A file named: Tnnnnnnn.spf or Snnnnnnn.spf where T or S indicates the type of sensor and nnnnnnn indicates the sensor serial number. The file contains
LPRESS <Maximum Low Pressure>
HPRESS <Maximum High Pressure>
NEGPTS <Number of Negative Points>
<temp index> <pressure> <pressure counts>
<temp index> <pressure> <pressure counts>
:: :: :: :: :: :: :: ::
<temp index> <pressure> <pressure counts>
<n/>

temp index - The temperature in °C multiplied by four.
pressure - The applied pressure
pressure counts - The measured pressure counts
nl - End of line.

EXAMPLE

Replacement sensors have been calibrated in a module. The data must be moved to Sensor Profile Files. The RAD must be powered up and the sensor data must be in memory for this command to function correctly. The file containing the data will be named Tnnnnnnn.spf or Snnnnnnn.spf, where T indicates a replacement sensor for DSA3016 and S indicates a replacement sensor for a ZOC22, ZOC23, or ZOC33. The serial number of the sensor is indicated by nnnnnnn.

To create a Sensor Profile File for sensor T355 in port 8 of a module installed in position 3 of a RAD :

Type: CREATESPF t355 3-8<CR>

The file: T355.spf will be created and written to the RAD Folder in the RAD

To create a Sensor Profile File for sensor S42778 in port 21 of a module installed in position 7 of a RAD :

Type: CREATESPF s42778 7-21<CR>

The file: S42778.spf will be created and written to the RAD Folder in the RAD

COMMAND
SYNTAX

DELETE
DELETE <start temp><end temp>[<channels>]<CR>

ARGUMENTS

<start temp> - an integer from 0 to 69 that represents the low point of the temperature planes to be deleted.
<end temp> - an integer from 0 to 69 that represents the high point of the temperature planes to be deleted.
[<channels>] - optional, a channel to be deleted. This may be in the format: *module-port* or *serial number-port* for a single module.
module-port..module-port or *serial number-port..serial number-port* for a range of channels

DESCRIPTION

Converts all pressure points within temperature planes between the low and high temperature range, inclusive, to "calculated". This allows new MASTER points to be entered via the INSERT command.

NOTE: Refer to the description of the FILL command for more information.

RETURNS

<n/>

nl - end of line.

EXAMPLE

To delete the master points for all modules in a system using eight 32 channel modules, the following command would be issued:

```
DELETE 0 69 1-1..8-32<CR>
```

To delete the master points for channels 49 through 56 in a ZOC33 connected to input six, the following command would be issued:

```
DELETE 0 69 6-49..6-56<CR>
```

To delete the master points for channel 3 in a ZOC17 connected to input four, the following command would be issued:

```
DELETE 0 69 4-3<CR>
```

COMMAND
SYNTAX

DELETE FILE
DELFILE <filename><CR>

ARGUMENTS

<filename> - the file to be deleted in the format: scanxxx.dat

DESCRIPTION

Deletes data files from the local hard disk drive.

RETURNS

<n/>

nl - end of line.

EXAMPLE

To delete the file, SCAN002.dat from the hard drive:

Type: DELFILE SCAN002.dat

To verify that the file was deleted, refer to the List Files Command.

COMMAND SYNTAX	DELETE ERROR LOG FILE DELETELOGFILE <CR>
ARGUMENTS	<i>None</i>
DESCRIPTION	Deletes the Error Log file from the local hard disk drive. The error log file in the RAD folder is a log of major activity in the RAD. All major activity will be appended to this file from the time it is created until the file is deleted. This file can aid a user in troubleshooting a problem. The file is created during the initial installation of the RAD software. The RAD software will re-create the file after it has been deleted.
NOTE:	The DSAENCL has limited disk storage space. It is recommended that this file not be allowed to exceed 5 megabytes. When the file size reaches 5242880 Bytes, an error will be logged. If IFUSER is set to 1, the error will be displayed immediately and logged in the Error log file. If IFUSER is set to 0, the error will only be logged in the Error log file and in the error buffer.
RETURNS	<n/> nl - end of line.
EXAMPLE	To delete the file, ERROR.TXT from the RAD folder on the DSAENCL hard drive: Type: DELETELOGFILE

COMMAND SYNTAX **DELTA**
DELTA <module><CR>

ARGUMENTS <module> - the module position 1 through 8.

DESCRIPTION Lists the active delta zero correction values that resulted from a CALIBRATE ZERO. These values are used in the conversion of raw counts to Engineering Units (EU). These variables can only be set by executing a CALIBRATE ZERO command. If a module number is not entered, the DELTA values for all active modules are listed.

RETURNS DELTA: <channel> <value> <nl>
DELTA: <channel> <value> <nl>
: : : :
DELTA: <channel> <value> <nl>

channel - the channel in module-port format
value - the zero correction values
nl - end of line.

EXAMPLE To view the DELTA values for the module connected to input one:
Type: DELTA 1<CR>
The RAD will return the current delta values
DELTA: 1-1 40
DELTA: 1-2 38
DELTA: 1-3 29
DELTA: 1-4 31
:: :: :: ::
DELTA: 1-10 34
DELTA: 1-11 35
DELTA: 1-12 27
:: :: :: ::
DELTA: 1-29 30
DELTA: 1-30 29
DELTA: 1-31 20
DELTA: 1-32 29
>

NOTES Delta values are the difference between the current CALZ zero value and the zero value stored in the calibration coefficients. The values tend to be low when a module has been recently calibrated and increase slowly over time as the sensors drift.

It is very important that a user execute a CALZ after the RAD and ZOC modules have been allowed to stabilize after power up. Also a CALZ should be executed if power is cycled, or if a RESTART or RELOAD command is executed.

The Zero and Delta Arrays are cleared when the RAD is powered down or when a RESTART or RELOAD command is executed. The data in the ZERO.cfg file is intended to be historical data. The Zero and Delta values are not reloaded at power up or restart because it is impossible to determine how long the power has been off. This also is designed to insure that a new set of zeros is acquired if modules have been switched.

COMMAND
SYNTAX

DOUT
DOUT <discrete channel><status><CR>

ARGUMENTS

<discrete channel> - a Digital Output channel 1 through 64.
<status> - 1 = On
0 = Off

DESCRIPTION

Commands the Discrete Output channel on or off.

RETURNS

<n/>
n/ - end of line.

NOTE

The DOUT channels correspond to a channel in an RDS3200 module. If the corresponding RDS module is not installed, an error will be reported. For more information on the operation of the RDS module, please refer to the hardware manual.

EXAMPLE

In this example, digital output channel 1(RDS number 1, channel 1 in address location 9) will be energized:

DOUT 1 1 <CR>

In this example, digital output channel 11 (RDS number 2 channel 3 in address location 10)will be de-energized.

DOUT 11 0 <CR>

DOUT Channel Assignments

Position	Channels
9	1 - 8
10	9 - 16
11	17 - 24
12	25 - 32
13	33 - 40
14	41 - 48
15	49 - 56
16	57 - 64

COMMAND SYNTAX	ERROR ERROR <CR>
ARGUMENTS	None
DESCRIPTION	Lists the errors that have occurred since the last CLEAR. Only the first 30 errors will be listed. If more than 30 errors have occurred, the message: ERROR: Greater than 30 errors occurred" will appear at the end of the list.
RETURNS	ERROR: <error message><n/> ERROR: <error message><n/> : : : : ERROR: <error message><n/> error message - an error message shown in the error list. nl - end of line.
EXAMPLE	To read the contents of the Error Buffer: Type: ERROR The RAD will return the last 30 errors in the format:: ERROR: Module or Port not found ERROR: List MI no group number ERROR: Group not between 1 and 8 If no errors have been logged, the RAD will return: ERROR: No errors
NOTE	The Error Buffer is only updated if the configuration variable: IFUSER , is set to 0. When IFUSER is set to 1, errors will be displayed as they occur.

COMMAND SYNTAX	FILE FILE <filename> <CR>
ARGUMENTS	<filename> - The file to be opened. If the file is not in the RAD Folder, then a path must be specified.
DESCRIPTION	Opens the named file. It is assumed that this file will be a command or a series of commands. If the file is a calibration file, the INSERT commands will be executed. It is imperative that a DELETE command be executed prior to opening a calibration coefficient file to prevent Master Point Overwrite Errors. This command will not support commands such as CALZ unless it is the only command in the file. The FILE command is not a Macro function, that is, it will execute each command in the file in order without waiting for each command to be completed.
RETURNS	<n/> nl - end of line.
EXAMPLE	<p>A startup command list may be sent to the RAD. A file: scan.cmd may contain the commands:</p> <pre> SET FPS1 1 SCAN </pre> <p>This file should be located in the RAD Folder. If not, a path must be specified.</p> <p>Example 1</p> <p>The file: scan.cmd is located in the RAD folder. To execute the file, Type: FILE scan.cmd<CR></p> <p>Example 2</p> <p>The file: scan.cmd is located in the RADCMD folder. To execute the file, Type: FILE C:\RADCMD\scan.cmd<CR></p>

COMMAND SYNTAX	FILL FILL <CR>
ARGUMENTS	None
DESCRIPTION	<p>Fills the Conversion Table with calculated pressure points and temperature planes using the MASTER (M) calibrated points as guides. These "filled" points are marked as CALCULATED(C).</p> <p>The FILL command NEVER overwrites MASTER(M) points. It does overwrite old points marked as CALCULATED(C) or INVALID(I).</p> <p>The method used to FILL the conversion tables is determined by the setting of the variable: FILLONE. This variable is in the Conversion Group.</p> <p>If FILLONE is set to zero, the FILL command will fill the conversion tables by calculating the temperature planes between Master Planes.</p> <p>If FILLONE is set to one, the FILL command will copy the data in the first Master Plane encountered to all other planes. If a second Master Plane is encountered, the FILL will be terminated, and an error will be logged.</p>
RETURNS	<p><n/>> nl - end of line.</p>
EXAMPLE	<p>In this example, new MASTER points have been loaded and the coefficient table must be completed.</p> <p style="padding-left: 40px;">Type: FILL<CR></p> <p>The FILL command only needs to be used if MASTER points are added to the coefficients and the program is not restarted. When the program is started, restarted, or reloaded, The MASTER points are loaded into memory from the Module Profile Files and a FILL is executed by the program.</p>

COMMAND
SYNTAX

INSERT
INSERT <temp><channel><press><press counts> M<CR>

ARGUMENTS

- <temp> - an integer from 0 to 69 that represents the temperature in degrees Celsius.
- <channel> - a combination of *module* and *port*. Syntax is:
module-port or *serial number-port* for one channel.
- <press> - a real number that represents the calibration pressure point.
- <press counts> - a signed integer from 32767 to -32768 that represents the current pressure counts from the sensor.

DESCRIPTION

Inserts one pressure-pressure counts entry into the Correction Table. Only master points are accepted.
The LIST MASTER and LIST ALL commands download the contents of the conversion table in the format required by this INSERT command.
If a MASTER plane is overwritten, an error will be generated.

RETURNS

<n/>

nl - End of line.

EXAMPLE

Although INSERT commands are most often entered from a Module Profile File, they may be entered from a keyboard.

The following command will insert a master point at 30.5°C for channel 1 of the module installed in position 3. The applied pressure is 11.9998 psi, the measured counts are 26376.

```
INSERT 30.50 3-1 11.9998 26376 M
```

The following command will insert a master point at 48.75°C for channel 59 of the module installed in position 3. The applied pressure is 10.9998 psi, the measured counts are 20254.

```
INSERT 48.75 3-59 10.9998 20254 M
```

The following command will insert a master point at 43.75°C for channel 26 of module serial number 209. The applied pressure is -2.4864 psi, the measured counts are -6651.

```
INSERT 43.75 209-26 -2.4864 -6651 M
```

COMMAND
SYNTAX

LIST ALL CONVERSION COEFFICIENTS
LIST A <start temp><end temp> <channels><CR>

ARGUMENTS

<start temp> - The lowest temp plane to be returned.
<end temp> - The highest temp plane to be returned.
<channels> - a combination of *module* and a *port*. Syntax is:
module-port or *Serial number-port* for one channel

DESCRIPTION

Lists all of the master, calculated and invalid points in the temperature-pressure correction matrix. This command places the RAD in the LIST mode until the command is completed or a STOP command is issued.

RETURNS

INSERT <temp><channel><press><press counts><M, C, or I><n/>
INSERT <temp><channel><press><press counts><M, C, or I><n/>
: : : :
INSERT <temp><channel><press><press counts><M, C, or I><n/>

temp - the temperature plane
channel - the channel in module-port notation
press - the pressure in EU
press counts - the A/D counts of pressure
M - a Master Plane generated from a calibration
C - a Calculated Plane generated during a FILL
I - an Invalid Plane, the value cannot be accurately calculated
nl - end of line.

EXAMPLE

To list all of the coefficients from 16°C to 20°C for channel 1 in a module calibrated from 17°C to 40°C

Type: LIST a 16 20 1-1<CR>

The RAD will return a list of INSERT commands showing the temperature, channel, applied pressure, counts and the type of plane.

```
INSERT 16.00 1-1 0.000000 0 I
INSERT 16.00 1-1 19.000000 0 I
INSERT 16.00 1-1 25.000000 0 I
:: :: :: :: :: :: :: ::
INSERT 17.00 1-1 -45.949100 -26184 M
INSERT 17.00 1-1 -31.250000 -17763 C
INSERT 17.00 1-1 -19.969601 -11302 M
INSERT 17.00 1-1 -6.250000 -3425 C
INSERT 17.00 1-1 0.000000 162 M
INSERT 17.00 1-1 19.984600 11636 M
INSERT 17.00 1-1 25.000000 14523 C
INSERT 17.00 1-1 35.000000 20281 C
INSERT 17.00 1-1 45.949100 26586 M
:: :: :: :: :: :: :: ::
INSERT 20.00 1-1 -45.949100 -26166 C
INSERT 20.00 1-1 -31.250000 -17750 C
INSERT 20.00 1-1 -19.969601 -11292 C
INSERT 20.00 1-1 -6.250000 -3424 C
INSERT 20.00 1-1 0.000000 160 C
INSERT 20.00 1-1 19.984600 11629 C
INSERT 20.00 1-1 25.000000 14514 C
INSERT 20.00 1-1 35.000000 20267 C
```

COMMAND SYNTAX	LIST CALIBRATION VARIABLES LIST C <CR>
ARGUMENTS	None
DESCRIPTION	Lists the Conversion configuration variables from Group C.
RETURNS	<pre>SET <variable> <value> <nI> : : : : SET <variable> <value> <nI> variable - the configuration variable name value - the current setting nI> - end of line.</pre>

EXAMPLE To view the current conversion variable settings:

Type: LIST C<CR>

The RAD will return the current conversion settings. They could appear as follows.

```
SET ZC 1
SET UNITSCAN psi
SET CVTUNIT 1.000000
SET BIN 0
SET EU 1
SET CALZDLY 5
SET MPBS 0
SET CALPER 500
SET CALAVG 32
SET MAXEU 9999.00
SET MINEU -9999.00
SET STARTCALZ 0
SET FILLONE 0
>
```

For more information, refer to the Conversion Variable information in this manual.

COMMAND	LIST DIGITAL VARIABLES
SYNTAX	LIST D <CR>
ARGUMENTS	None
DESCRIPTION	Lists the Digital Configuration variables from Group D.
RETURNS	<pre> SET <variable> <value> <nl> SET <variable> <value> <nl> : : : : SET <variable> <value> <nl> </pre> <p> variable - the configuration variable name value - the current setting nl - end of line. </p>

EXAMPLE To view the current digital variable settings:

Type: LIST D<CR>

The RAD will return the current digital settings. They could appear as follows.

```

SET DOUTPU 5
SET DOUTCALZ e
SET DOUTPGSEQ 0
SET DOUTPG 0
SET DOUTSCAN 20
SET DLYPGSEQ 1
SET DLYPG 10
SET DOUTREADY 40
SET BANKA 0
SET BANKB 0
SET BANKUSR 0

```


COMMAND SYNTAX	LIST FILES DIRFILE <CR>
ARGUMENTS	None
DESCRIPTION	Lists the data files stored In the RAD folder on the RAD system computer hard disk drive. Filenames are in the format: scanxxx.dat, where xxx is automatically incremented whenever a new scan file is created.
RETURNS	<pre><filename> <n/ > : : :: <filename> <n/ > <n/ ></pre> <p>filename - The data file name nl - end of line.</p>
EXAMPLE	<p>To list all data files stored In the RAD folder on the RAD system computer hard disk drive:</p> <p style="padding-left: 40px;">Type: DIRFILE<CR></p> <p>The RAD will return a file list</p> <pre style="padding-left: 80px;">FILE: SCAN000.DAT FILE: SCAN001.DAT FILE: SCAN002.DAT FILE: SCAN003.DAT FILE: End of Files</pre>

COMMAND
SYNTAX

LIST GAIN VARIABLES
LIST G <module> <CR>

ARGUMENTS

None

DESCRIPTION

Lists the active temperature gain set for the module from the Temperature Gain Group, Group G. Module may be the position or the serial number. These data are used to convert temperature counts to degrees Celsius. This is the "M" term in the temperature characterization equation. The value of this term will vary based on the module type. Refer to the section on Temperature Gain Values in the Configuration Variable Section of this manual for more information on the values for the "M" terms.

RETURNS

SET TEMPMn <value><n/>
n - The module position or the serial number
value - The temperature gain value for module n
nl - end of line.

EXAMPLE

To verify the temperature gain setting for the module serial number 253,

Type: LIST g 253<CR>

The RAD will return:

SET TEMPM253 0.0228

The gain settings may also be verified by module location. To verify the temperature gain setting of the module connected to input 6,

Type: LIST g 6<CR>

The RAD will return:

SET TEMPM6 0.0228

The temperature gain settings may be verified for all modules connected to the RAD.

Type: LIST g<CR>

The RAD may return:

SET TEMPM1 0.0371
SET TEMPM2 0.0371
SET TEMPM3 0.0371
SET TEMPM4 0.0371
SET TEMPM5 0.0371
SET TEMPM6 0.0371
SET TEMPM7 0.0371
SET TEMPM8 0.0371
>

COMMAND	LIST IDENTIFICATION VARIABLES
SYNTAX	LIST I <CR>
ARGUMENTS	None
DESCRIPTION	Lists the Identification configuration variables from Group I.
RETURNS	<pre> SET <variable> <value> <nl> SET <variable> <value> <nl> : : : : SET <variable> <value> <nl> variable - the configuration variable name value - the current setting nl - end of line. </pre>

EXAMPLE To verify the general module configuration settings:

Type: LIST i<CR>

The RAD may return:

```

SET NL 0
SET FORMAT 0
SET IFUSER 1
SET ECHO 0

```

COMMAND
SYNTAX

LIST MASTER CONVERSION COEFFICIENTS
LIST M <start temp><end temp> [<channels>]<CR>

ARGUMENTS

<start temp> - The lowest temp plane to be returned.
<end temp> - The highest temp plane to be returned.
[<channels>] - channels is a the combination of *module* and a *port*. Syntax
is: *module-port* or *Serial Number-port* for one channel

DESCRIPTION

Lists all of the Master Points in the temperature-pressure correction matrix. This command places the RAD in the LIST mode until the command is completed or a STOP command is issued.

RETURNS

INSERT <temp><channel><press><press counts>M<nl>
 : : : :
INSERT <temp><channel><press><press counts> M<nl>

temp - the temperature plane
channel - the channel in module-port or serial number-port notation
press - the pressure in EU
press counts - the A/D counts of pressure
M - indicates this is a Master Plane
nl - end of line

EXAMPLE

To view the Master Points between 10°C and 40°C for channel 1 of the module connected to input 1:

 Type: List m 10 40 1-1<CR>

The RAD may return:

```
INSERT 14.00 1-1 -5.958100 -21594 M
INSERT 14.00 1-1 -4.476100 -15127 M
INSERT 14.00 1-1 -2.994200 -8646 M
INSERT 14.00 1-1 -1.470100 -1973 M
INSERT 14.00 1-1 0.000000 4467 M
INSERT 14.00 1-1 1.470100 10917 M
INSERT 14.00 1-1 2.994200 17594 M
INSERT 14.00 1-1 4.476100 24098 M
INSERT 14.00 1-1 5.958100 30603 M
INSERT 23.25 1-1 -5.958100 -21601 M
INSERT 23.25 1-1 -4.476100 -15161 M
INSERT 23.25 1-1 -2.994300 -8714 M
INSERT 23.25 1-1 -1.470100 -2077 M
INSERT 23.25 1-1 0.000000 4332 M
INSERT 23.25 1-1 1.470100 10746 M
INSERT 23.25 1-1 2.994200 17397 M
INSERT 23.25 1-1 4.476100 23863 M
INSERT 23.25 1-1 5.958100 30333 M
INSERT 32.75 1-1 -5.958100 -21636 M
INSERT 32.75 1-1 -4.476100 -15214 M
INSERT 32.75 1-1 -2.994200 -8784 M
INSERT 32.75 1-1 -1.470100 -2162 M
INSERT 32.75 1-1 0.000000 4228 M
INSERT 32.75 1-1 1.470100 10615 M
INSERT 32.75 1-1 2.994200 17246 M
INSERT 32.75 1-1 4.476100 23691 M
INSERT 32.75 1-1 5.958100 30136 M
```

COMMAND
SYNTAX

LIST MODULE INFORMATION VARIABLES
LIST MI <module><CR>

ARGUMENTS

<module> - module group 1 through 8 or module serial number.

DESCRIPTION

Lists the configuration variables from Groups M1 through M8. If the module is not identified, all modules are listed. Each Module Information Group has provisions for up to four comment lines. These lines may be used to aid in the identification of the module group.

RETURNS

```
REM<module> 1 <comment> <nl>
REM<module> 2 <comment> <nl>
REM<module> 3 <comment> <nl>
REM<module> 4 <comment> <nl>
SET <variable> <value> <nl>
SET <variable> <value> <nl>
  : : : :
SET <variable> <value> <nl>
variable      - the configuration variable name
value         - the current setting
nl            - end of line.
```

EXAMPLE 1

To view the configuration of the module connected to RAD A/D 1,
Type: LIST mi 1<CR>
The RAD may return:

```
REM1 1 Comment line 1
REM1 2 Comment line 2
REM1 3 Comment line 3
REM1 4 Comment line 4
SET TYPE1 0
SET ENABLE1 1
SET NUMPORTS1 32
SET NPR1 5
SET LPRESS1 1..32 -6.100000
SET HPRESS1 1..32 6.100000
SET NEGPTS1 1..32 4
SET MODTEMP1 0 1.000000
>
```

COMMAND SYNTAX	LIST OFFSET VARIABLES LIST O <module><CR>
ARGUMENTS	None
DESCRIPTION	Lists the active temperature offsets set for the module from the Temperature Offset Group, Group O. These data are used to convert temperature counts to degrees Celsius. This is the "B" term in the temperature characterization equation. The value of this term will vary based on the module type. Refer to the section on Temperature Gain Values in the Configuration Variable Section of this manual for more information on the values for the "B" terms.
RETURNS	<pre>SET TEMPBn <value> <n/></pre> <p>n - the module position or serial number value - the current setting nl - end of line.</p>
EXAMPLE	<p>To verify the the temperature offset setting for the module serial number 253,</p> <p style="padding-left: 40px;">Type: LIST o 253<CR></p> <p>The RAD will return:</p> <p style="padding-left: 80px;">SET TEMPB253 -259.7403</p> <p>The offset settings may also be verified by module location. To verify the temperature offset setting of the module connected to input 6,</p> <p style="padding-left: 40px;">Type: LIST o 6<CR></p> <p>The RAD will return:</p> <p style="padding-left: 80px;">SET TEMPB6 -259.7403</p> <p>The temperature offset settings may be verified for all modules connected to the RAD.</p> <p style="padding-left: 40px;">Type: LIST o<CR></p> <p>The RAD may return:</p> <pre>SET TEMPB1 -259.7403 SET TEMPB2 -259.7403 SET TEMPB3 -259.7403 SET TEMPB4 -259.7403 SET TEMPB5 -259.7403 SET TEMPB6 -259.7403 SET TEMPB7 -259.7403 SET TEMPB8 -259.7403 ></pre>

COMMAND SYNTAX	LIST PROFILE LIST SETTINGS LIST P <CR>
ARGUMENTS	None
DESCRIPTION	Lists the Installed module serial numbers from the Serial Number Profile Group, Group P. These data are used to create Module Profile Files that will hold module specific configuration variables.
RETURNS	<pre>SET RADSN <value> <nl> SET SN1 <value> <nl> SET SN2 <value> <nl> : : : : SET SN8 <value> <nl></pre> <p>value - the serial number of the module installed at that location nl - end of line.</p>
EXAMPLE	<p>To Verify the module input configuration</p> <p style="padding-left: 40px;">Type: LIST p<CR></p> <p>The RAD may return:</p> <pre style="padding-left: 40px;">SET RADSN 18 SET SN1 253 SET SN2 2000 SET SN3 3000 SET SN4 4000 SET SN5 5000 SET SN6 6000 SET SN7 7000 SET SN8 8000 ></pre>
NOTE:	If a module is not detected at boot up, during a RESTART, or after a LIST SYS U command, the software will use a default serial number (1000 to 8000) based on the module position.

COMMAND SYNTAX	LIST PROFILE LIST SETTINGS FOR ALL RAD UNITS LIST P ALL <CR>
ARGUMENTS	None
DESCRIPTION	Lists the Installed module serial numbers from the Serial Number Profile Group, Group P. These data are used to create Module Profile Files that will hold module specific configuration variables.
RETURNS	<pre> SET RADSND <value> <nl> SET SN1 <value> <nl> SET SN2 <value> <nl> : : : : SET SN8 <value> <nl> SET RADSND <value> <nl> SET SN1 <value> <nl> SET SN2 <value> <nl> : : : : SET SN8 <value> <nl> </pre> <p>value - the serial number of the module installed at that location nl - end of line.</p>
EXAMPLE	<p>To Verify the module input configuration</p> <p style="padding-left: 40px;">Type: LIST p<CR></p> <p>The RAD may return:</p> <pre> SET RADSND 18 SET SN1 253 SET SN2 2000 SET SN3 3000 SET SN4 4000 SET SN5 5000 SET SN6 6000 SET SN7 7000 SET SN8 8000 SET RADSND 201 SET SN1 306 SET SN2 295 SET SN3 318 SET SN4 118 SET SN5 5000 SET SN6 6000 SET SN7 7000 SET SN8 8000 > </pre>
NOTE:	If a module is not detected at boot up, during a RESTART, or after a LIST SYS U command, the software will use a default serial number (1000 to 8000) based on the module position.

COMMAND	LIST SCAN VARIABLES
SYNTAX	LIST S <CR>
ARGUMENTS	None
DESCRIPTION	Lists the General Scan configuration variables from Group S.
RETURNS	<pre> SET <variable> <value> <nl> SET <variable> <value> <nl> : : : : SET <variable> <value> <nl> variable - the configuration variable name value - the current setting nl - end of line. </pre>
EXAMPLE	<p>This command is used to verify the general scan settings of the RAD</p> <p style="padding-left: 40px;">Type: LIST s<CR></p> <p>The RAD will return:</p> <pre> SET PERIOD 500 SET ADTRIG 0 SET SCANTRIG 0 SET PAGE 0 SET QPKTS 0 SET BINADDR 0 0.0.0.0 SET NETOUT 0 SET IFC 62 0 SET TIMESTAMP 1 SET TEMPPOLL 1 SET FILEOUT 0 SET FILEPREFIX scan > </pre>

COMMAND SYNTAX	LIST SCAN GROUP VARIABLES LIST SG <group><CR>
ARGUMENTS	<group> - scan group 1 through 8
DESCRIPTION	Lists the Scan Group configuration variables from Groups G1 through G8.
RETURNS	<pre>SET <variable> <value> <nl> SET <variable> <value> <nl> : : : : SET <variable> <value> <nl></pre> <p>variable - the configuration variable name value - the current setting nl - end of line.</p> <p>If no channels are assigned to a scan group, the following will be returned for a channel variable: <pre>SET CHAN< scan group >0<nl></pre> For more information, refer to the CHAN Scan Variable in the SG Group</p>
EXAMPLE	<p>To verify or modify the configuration settings of Scan Group 1, Type: LIST SG 1<CR></p> <p>A typical RAD with a 32 channel module will return:</p> <pre>SET AVG1 100 SET FPS1 0 SET SGENABLE1 1 SET CHAN1 1-1..1-32 ></pre>
NOTE	<p>When the SET CHANn parameter is modified, it must be set to 0 before the new channel configuration is entered. If not, the new configuration will be appended to the existing configuration.</p> <p>For example: if a 64 channel module is assigned to Scan Group 1, the SET CHAN variable will be:1-1..1-64, If the module is changed to a 32 channel module and the channel assignment is not set to 0 before the new assignment: 1-1..1-32 is added, the channel assignment will appear as follows:</p> <pre>SET CHAN1 1-1..1-64 SET CHAN1 1-1..1-32</pre> <p>This also applies in cases where a user has software to configure the scan groups prior to a test. If a scan group has channels defined and the channels are defined again without setting the channels to 0 first, the channel assignment will appear twice. If Scan Group 1 has a 32 channel module assigned and it is re-assigned by an initialization program, the channel assignments will appear as follows:</p> <pre>SET CHAN1 1-1..1-32 SET CHAN1 1-1..1-32</pre>

COMMAND
SYNTAX

LIST SYSTEM COMPONENTS
LIST SYS [<U> or <S>] <CR>

ARGUMENTS

blank - the existing system information, as determined at power up, will be displayed. No data will be updated.
<U> - the system information will be updated and displayed.
<S> - system information will be displayed using simulated ID chips.

DESCRIPTION

Lists the system information. This is the same information displayed at power up. This command must be run when system changes are made after power up.

RETURNS

RAD Serial Number N
LOC A2DSN -MODEL- -SN- CHAN VALVE -NPR1- -NPR2- XDUCER -CAL-DATE-
1
2
3
4
5
6
7
8
LOC -MODEL- -SN- CHAN DESCRIPTION
9
10
11
12
13
14
15
16

NOTE

Positions 1 through 8 are reserved for A/D modules. Positions 9 through 16 are reserved for RDS modules. All positions do not have to be filled. The positions are identified by the setting of the dip switches on the A/D and RDS modules. The first RDS module must always be identified as position 9. If the first RDS is installed in a position other than 9, the DOUT commands will not function. Also, an error will be returned at bootup and after a LIST SYS command.

EXAMPLE 1 To view the current System Information as determined at power up:
Type: LIST SYS<CR>

The RAD will return:

RAD Serial Number 103

LOC	A2DSN	-MODEL-	-SN-	CHAN	VALVE	-NPR1-	-NPR2-	XDUCER	-CAL-DATE-
1	111	ZOC33	300	64	X1	15.00	15.00	DIF	8/16/2002
2	110								
3									
4									
5									
6									
7									
8									

LOC	-MODEL-	-SN-	CHAN	DESCRIPTION
9	RDS	103	8	REMOTE DIGITAL SWITCH [DOUT 1-8]
10				
11				
12				
13				
14				
15				
16				

The RADBASE 3200 is Serial number 103. It has two RAD A/D 3200 modules connected.

RAD A/D 3200 Sn 111 is installed in Location 1, ZOC33 Sn 300 is connected to this A/D module. The ZOC33 has 64 channels. It is not duplexed. The Full Scale pressure range of the module is 15.00 psi. The module is set up as a normal Differential Pressure Module. It was last calibrated August 16, 2002.

RAD A/D 3200 Sn 110 is installed in location 2. If a ZOC module is connected to this A/D, it does not have an ID Chip installed, or the ID Chip is not responding.

RDS3200 Sn 103 is installed in location 9. The DOUT commands will function correctly.

EXAMPLE 2 If the first RDS module is not installed in position 9, the data return will appear as follows:

RAD Serial Number 103

LOC	A2DSN	-MODEL-	-SN-	CHAN	VALVE	-NPR1-	-NPR2-	XDUCER	-CAL-DATE-
1	111	ZOC33	300	64	X1	15.00	15.00	DIF	8/16/2002

2 110

3

4

5

6

7

8

LOC	-MODEL-	-SN-	CHAN	DESCRIPTION
-----	---------	------	------	-------------

9

10	RDS	103	8	REMOTE DIGITAL SWITCH [DOUT 9-16]
----	-----	-----	---	-----------------------------------

11

12

13

14

15

16

WARNING: No RDS present at location 9

COMMAND **LOAD**
SYNTAX LOAD <file name><CR>

ARGUMENTS file name - This file is the file saved from a SAVE command where the optional file name was specified.

DESCRIPTION Commands the RAD to load the configuration variables stored in this file. If the path is not specified, the software will look in the current RAD folder. The current RAD folder is the sub folder in the C:\Program Files\Scanivalve\RAD\ path.
Data stored in the optional file may be loaded after bootup using this command.

RETURNS <n/>>
nl - End of line.

EXAMPLES To load a saved configuration from a file named config.txt,
Type: LOAD config.txt<CR>

COMMAND	LOGIN
SYNTAX	LOGIN <serial number> <CR>
ARGUMENTS	<serial number> - The serial number of the RAD unit.
DESCRIPTION	Logs in to an individual RAD unit. All commands entered after a login command will be directed to the RAD unit selected.
RETURNS	<n/> nl - End of line.
NOTE	If the software has not connected to a RAD unit using the Login command, all operations will be performed on the default RAD unit. The default RAD unit is the RAD with the lowest serial number
EXAMPLE	To connect to a RAD3200 serial number 225: Type: LOGIN 225<CR>

COMMAND SYNTAX	LOGOUT LOGOUT <CR>
ARGUMENTS	none
DESCRIPTION	Logs out of an individual RAD unit. All commands entered after a login command will be directed to the default RAD unit. The default RAD unit is the RAD with the lowest serial number
RETURNS	<i><n/</i> nl - End of line.
EXAMPLE	To disconnect from the current RAD unit: Type: LOGOUT<CR>

COMMAND SYNTAX	MERGE SENSOR PROFILE FILE MERGESPf <sensor profile file> <module profile file> <port number> <CR>
ARGUMENTS	<i>sensor profile file</i> - the file containing the replacement sensor data <i>module profile file</i> - the file where the sensor data will be added <i>port number</i> - the location of the new sensor
DESCRIPTION	<p>Commands the RAD to merge the coefficients for a replacement sensor from a Sensor Profile File into a Module Profile File.</p> <p>The Sensor Profile File must reside in the same directory as the Module Profile File. In a RAD, this will be the RAD Folder. For more information on file transfers, please refer to the file transfer procedures in this manual.</p> <p>The command may be entered from the system computer or a host computer. The RAD must be in the READY mode to accept the command.</p> <p>This command DOES NOT modify the tables in the RAD system computer memory. The new coefficients will not be effective until the program is restarted.</p>
RETURNS	<i><n/ ></i> nl - End of line.
EXAMPLE	<p>To replacement sensor data will be provided on a floppy disk. The file containing the data will be named Tnnnnnnn.spf or Snnnnnnn.spf, where T indicates a replacement sensor for DSA3016 and S indicates a replacement sensor for a ZOC22, ZOC23, or ZOC33. The serial number of the sensor is indicated by nnnnnnn.</p> <p>When the SPF file has been installed on the RAD, the sensor data may be added to the MPF file.</p> <p>To install the coefficients from sensor T355 in port 8 of module serial number 150:</p> <p style="padding-left: 40px;">Type: MERGESPf t355.spf m150.mpf 8<CR></p> <p>To install the coefficients from sensor S42778 in port 61 of module serial number 322:</p> <p style="padding-left: 40px;">Type: MERGESPf s42778.spf m322.mpf 61<CR></p>
NOTE	<p>In both examples the RAD program must be restarted for the new coefficients to be effective. The program may be restarted by the RESTART command or by cycling power.</p>

COMMAND SYNTAX	PURGE PURGE <CR>
ARGUMENTS	None
DESCRIPTION	<p>Commands the RAD to initiate a purge sequence. This command may be initiated by entering the command from the local system computer or a host computer. The RAD must be in the READY mode. The purge sequence is:</p> <ol style="list-style-type: none"> 1. The digital output are set according to the DOUTPGSEQ variable. 2. The output remain set for a delay time set by the DLYPGSEQ variable. 3. When DLYPGSEQ times out, the digital output are set according to the DOUTPG variable. 4. The digital output will remain set until the DLYPG variable is met or until a STOP command is issued. 5. When DLYPG times out or when a STOP command is received the digital output are set according to the DOUTPGSEQ variable. 6. The output remain set for a delay time set by the DLYPGSEQ variable. 7. When DLYPGSEQ times out, the RAD returns to the READY mode. <p>When a purge is initiated by a digital input, the RAD may be in the READY mode or in the SCAN mode. The purge sequence is the same as above unless the RAD is in the SCAN mode. If the RAD is in the SCAN mode, the scanning will be suspended until the purge sequence is completed. At that time scanning will be resumed.</p>
RETURNS	<p><n/> nl - End of line.</p>
EXAMPLE	<p>To initiate a PURGE sequence: Type: PURGE<CR></p>

COMMAND SYNTAX	QUIT QUIT <CR>
ARGUMENTS	None
DESCRIPTION	Commands the RAD system computer to quit the execution of the RAD.exe program.
RETURNS	<n/> nl - End of line.
NOTE	This command should only be used in the local mode. Once the program is quit, it cannot be restarted from the ETHERNET interface.
EXAMPLE	To quit the program, Type: QUIT<CR>

COMMAND	SAVE
SYNTAX	SAVE [<file name>]<CR>
ARGUMENTS	file name - Optional - All configuration parameters will be saved to this file. The saved file can be loaded into memory using the LOAD command.
DESCRIPTION	<p>Commands the RAD to save the configuration variables, and correction tables to disk.</p> <p>If the optional file is not specified, data are saved to a file named cv.gpf in the current RAD folder. The current RAD folder is the sub folder in the C:\Program Files\Scanivalve\RAD\ path.</p> <p>If the optional file is specified, data are saved to that file in the current RAD folder unless a different path is specified. The current RAD folder is the sub folder in the C:\Program Files\Scanivalve\RAD\ path. Data stored in the optional file may be loaded after bootup using the LOAD command.</p>
RETURNS	<p><n/>></p> <p>nl - End of line.</p>
EXAMPLES	<p>To save the current configuration variable settings and conversion coefficients without specifying a file,</p> <p style="padding-left: 40px;">Type: SAVE<CR></p> <p>To save the current configuration variable settings and conversion coefficients to a specific file,</p> <p style="padding-left: 40px;">Type: SAVE config.txt<CR></p>

COMMAND SYNTAX	SCAN SCAN <CR>
ARGUMENTS	None
DESCRIPTION	Commands the RAD to scan the pressure sensors and output scan data. The SCAN function operation depends on the setting of ADTRIG and SCANTRIG.

ADTRIG = 0
SCANTRIG = 0

The SCAN function will be initiated immediately when the SCAN command is received. Data will be acquired at the rate determined by the settings of PERIOD, AVGN and the Number of Channels in the modules being scanned. Data will be output in Averaged Frames as the Frames are ready until FPS is satisfied or a STOP Command is received.

ADTRIG = 0
SCANTRIG = 1

In this case, a hardware trigger will initiate the SCAN function. The Software trigger will not initiate the SCAN function. Data will be acquired at the rate determined by the settings of PERIOD, AVGN and the Number of Channels in the modules being scanned. Scanning will continue until FPS is satisfied or a STOP command is received. Multiple trigger pulses received during a scan will be ignored.

ADTRIG = 1
SCANTRIG = 0

In this case, the SCAN command only enables the scan function. The RAD will enter the WTRIG mode and wait for a hardware or software trigger. When a trigger is received, the RAD will acquire and output one averaged frame of data and re-enter the WTRIG mode. Data will be acquired at the rate determined by the settings of PERIOD, AVGN and the Number of Channels in the modules being scanned. Multiple trigger pulses received during a scan will be ignored. When a Frame has been output, the next trigger will repeat the process. This will continue until the Frames per Scan Variable has been satisfied or a STOP command is received.

RETURNS The format of the returned data is based on the setting of the BIN configuration variable. If BIN is set to 1 the Scan Packets are returned in Binary Format(Refer to the section on Binary Data Packets for more information). If BIN is set to 0, the scan packets are returned in ASCII Format as follows:

```
<group> <frame> <channel> <pressure> <nl>
<group> <frame> <channel> <pressure> <nl>
::      ::      ::      ::      ::
<group> <frame> <channel> <pressure> <nl>
```

- group - the scan group number from 1 to 8
- frame - the current frame number
- channel - the channel in module-port format
- pressure - the pressure in either counts or real number format based on the setting of the EU configuration variable.
- nl - end of line.

EXAMPLE

A scan group is set up to display 16 channels of module 1 with fps set to 1

Type: SCAN<CR>

The RAD returns:

Group=1 Frame=0000001

101= 0.0052	102= .0086	103= -0.0015	104= 0.0017	105= -0.0162	106= 0.0035
107= 0.0036	108= 0.0114	109= 0.0031	110= 0.0073	111= 0.0111	112= -0.0035
113= 0.0057	114= 0.0097	115= 0.0049	116= 0.0086		

NOTES

1. Only channels that are listed with the LIST SGn command are returned.
The field length is not fixed. Scan Groups are returned as they are ready.
2. All frames are separate parsable frames.
3. The RAD.exe console window will display up to 512 channels from a Scan Group.
4. If ADTRIG is set to 1, SCANTRIG must be set to 0. If SCANTRIG is set to 1, ADTRIG must be set to 0.

COMMAND	SCAN ALL RAD UNITS
SYNTAX	SCAN ALL <CR>
ARGUMENTS	none.
DESCRIPTION	Commands all connected RAD units to initiate the SCAN function.
RETURNS	Please refer to the SCAN command for more information.
EXAMPLE	Please refer to the SCAN command for more information.

COMMAND SYNTAX	SET SET <name> <value><CR>
ARGUMENTS	<name> - the Configuration Variable to be set or modified. <value> - the value to be assigned to that Configuration Variable.
DESCRIPTION	Commands the RAD to set one of the Configuration Variables. When Configuration Variables are listed with the LIST command, the variables are output in the format required by the SET command. This enables the user to upload the data from a file that has been created by a LIST download.
RETURNS	<n/> nl - end of line.
EXAMPLE	This command will change configuration variable settings. To set zero correction on Type: SET ZC 1<CR> To change the pressure units to Pascals Type: SET UNITSCAN PA<CR> To change the scan channels in Scan Group 2 from module 2, channels 1 through 64, to module 1, channels 1 through 16: Type: SET CHAN2 0<CR> SET CHAN2 1-1..1-16<CR>

COMMAND SYNTAX	SLOTS SLOTS <channel><CR>
ARGUMENTS	<channel> - The channel in module-port format
DESCRIPTION	Queries the RAD to return the 10 boundary pressures for the 9 pressure slots defined for a given channel.
RETURNS	Press 9 <pressure> <nl> Press 8 <pressure> <nl> Press 7 <pressure> <nl> Press 6 <pressure> <nl> Press 5 <pressure> <nl> Press 4 <pressure> <nl> Press 3 <pressure> <nl> Press 2 <pressure> <nl> Press 1 <pressure> <nl> Press 0 <pressure> <nl>
EXAMPLE	<p>To determine the boundary pressures for channel 1 of the 5 psi module s/n 253</p> <p>Type: SLOTS 253-1<CR></p> <p>The RAD will return:</p> <pre> Press 9 6.10000 Press 8 4.88000 Press 7 3.66000 Press 6 2.44000 Press 5 1.22000 Press 4 0.00000 Press 3 -1.52500 Press 2 -3.05000 Press 1 -4.57500 Press 0 -6.10000 </pre> <p>The pressures applied during a calibration must be selected so that there are not two or more applied pressures in any one slot. The module in the example above has been set up with 4 negative points. By default, it will have 4 positive points as a calibration must always include a zero point.</p> <p>In this example, the slots for channel 1 of a 15 psi module in input 2 is configured for 2 negative points</p> <p>Type SLOTS 2-1<CR></p> <p>The RAD will return:</p> <pre> Press 9 15.00000 Press 8 12.85714 Press 7 10.71429 Press 6 8.57143 Press 5 6.42857 Press 4 4.28572 Press 3 2.14286 Press 2 0.00000 Press 1 -7.50000 Press 0 -15.00000 </pre>

COMMAND SYNTAX	STATUS STATUS <CR>
ARGUMENTS	None
DESCRIPTION	Commands the RAD to return the current status.
RETURNS	<p>STATUS: <current status><nl></p> <p>Current status - one of the following:</p> <ul style="list-style-type: none"> READY - The module is ready to accept any command. SCAN - The module is in the SCAN mode. The only commands that will be accepted are STATUS or STOP. CALZ - The module is executing a CALIBRATE ZERO command. The only commands that will be accepted are STATUS or STOP. LIST - The module is outputting a list. The only commands that will be accepted are STATUS or STOP. <p>nl - end of line.</p>
EXAMPLE	<p>The STATUS command may be entered at any time. This is one of the commands that will not generate an error if entered while the RAD is not READY.</p> <p>If the STATUS command is entered while the RAD is on, but inactive, the RAD will return:</p> <p style="text-align: center;">STATUS: READY</p> <p>If the STATUS command is entered while the RAD is executing a Calibrate Zero command, the RAD will return:</p> <p style="text-align: center;">STATUS: CALZ</p>
NOTE:	<p>If the RAD has external triggering enabled, and a SCAN command is issued, the RAD will enter the SCAN mode and wait for a trigger. A STATUS command will return SCAN to indicate that the RAD is in the SCAN mode, but data will not be acquired until the external trigger is received.</p>

COMMAND	STOP
SYNTAX	STOP <CR>
ARGUMENTS	None
DESCRIPTION	Commands the RAD to abort the current operation and return to the READY mode.
RETURNS	<n/> nl - end of line.
EXAMPLE	To abort any function or operation: Type: STOP<CR>

COMMAND SYNTAX	STOP ALL STOP ALL<CR>
ARGUMENTS	None
DESCRIPTION	Commands all connected RAD units to abort the current operation and return to the READY mode.
RETURNS	<n/> nl - end of line.
EXAMPLE	To abort any function or operation on all connected RAD units: Type: STOP ALL<CR>

COMMAND
SYNTAX

TEMPERATURE
TEMP <units><CR>

ARGUMENTS

units - May be one of the following:
RAW - Returns the temperature in raw counts.
EU - Returns the temperature in Engineering Units

DESCRIPTION

Lists the current temperatures of all 8 modules. If a module is not connected, the returned temperature will be 0

RETURNS

TEMP: 1 <temp> <n|>
TEMP: 2 <temp> <n|>
 : : :
TEMP: 8 <temp> <n|>
temp - The module temperature in raw counts or engineering units
n|> - End of line.

EXAMPLE

To view the current temperatures of the modules connected to the RAD
Type: TEMP EU<CR>

The RAD will return:

TEMP: 1 28.00
TEMP: 2 105.75
TEMP: 3 00.00
TEMP: 4 00.00
TEMP: 5 00.00
TEMP: 6 00.00
TEMP: 7 00.00
TEMP: 8 00.00

To view the A/D counts of the temperature inputs

Type: TEMP RAW<CR>

The RAD will return:

TEMP: 1 12551
TEMP: 2 32767
TEMP: 3 0
TEMP: 4 0
TEMP: 5 0
TEMP: 6 0
TEMP: 7 0
TEMP: 8 0

NOTE

A counts reading of 32767 indicates an open input. A counts reading of 0 with an engineering unit reading of 0 indicates that the module is not enabled.

COMMAND SYNTAX **TEMPERATURE GRADIENT COMPENSATION**
TGRAD<CR>

ARGUMENTS none

DESCRIPTION This command reads the temperature of the A/D modules and stores this information in a table. This table is then used to estimate the A/D module temperatures during a scan based on the temperature of the RADBASE.

RETURNS <Location> <RADBase Temp> <A/D Temp> <Delta Temp> <n/>
Location - A/D Location, 1 through 8
RADBase Temp- Measured Temperature of the RADBase in degrees C
A/D Temp - Measured Temperature of the RAD A/D Module in this location.
Delta Temp - The calculated Temperature differential for the A/D Module in this location.
nl - End of line.

NOTE The RAD software can only read the temperature of the RADBASE when in the scan mode. The temperature of the A/D modules connected to the RADBASE can be estimated based on the gradient calculation derived from the table generated by this command.

EXAMPLE A RADBase has two A/D modules connected. To calculate and store the temperature differential for these modules, Type:

TGRAD<enter>

The RAD software will calculate the differential temperatures and return:

```

Loc 1 Base 33.187500 Temp 28.562500 Delta -4.625000
Loc 2 Base 33.187500 Temp 27.750000 Delta -5.437500
Loc 3 Base 33.187500 Temp 0.000000 Delta -33.187500
Loc 4 Base 33.187500 Temp 0.000000 Delta -33.187500
Loc 5 Base 33.187500 Temp 0.000000 Delta -33.187500
Loc 6 Base 33.187500 Temp 0.000000 Delta -33.187500
Loc 7 Base 33.187500 Temp 0.000000 Delta -33.187500
Loc 8 Base 33.187500 Temp 0.000000 Delta -33.187500

```

COMMAND SYNTAX	VERSION VER <CR>
ARGUMENTS	none
DESCRIPTION	Requests the version number of the RAD.EXE file.
RETURNS	VERSION: <i><version string></i> <i><n></i>
EXAMPLE	To determine the version of RAD.exe software in use: Type: VER<CR> The RAD will return: VERSION: 5.11

COMMAND **ZERO**
SYNTAX **ZERO <module><CR>**

ARGUMENTS <module> -the module position 1 through 8 or the serial number.

DESCRIPTION Lists the active zero correction values that obtained from a CALIBRATE ZERO command. These data are used in the conversion of raw counts to Engineering Units (EU). These values may only be set by executing a CALIBRATE ZERO. If a module number is not entered, the ZERO values for all modules are listed.

RETURNS ZERO: <channel> <value> <nl>
ZERO: <channel> <value> <nl>
 : : : :
ZERO: <channel> <value> <nl>
channel - the channel in module-port or serial number-port format
value - the zero correction values
nl - end of line.

EXAMPLE To view the current zeros for module 1
 Type: ZERO 1<CR>

 The RAD will return:

```

ZERO: 1-1 160
ZERO: 1-2 165
ZERO: 1-3 68
ZERO: 1-4 131
ZERO: 1-5 41
ZERO: 1-6 162
ZERO: 1-7 145
ZERO: 1-8 233
ZERO: 1-9 158
::  ::  ::  ::
::  ::  ::  ::
ZERO: 1-28 96
ZERO: 1-29 19
ZERO: 1-30 134
ZERO: 1-31 132
ZERO: 1-32 238

```

NOTE If a module number is not entered, the zero values for all enabled modules will be returned.

RAD CONFIGURATION VARIABLES

GENERAL SCAN VARIABLES (Group S)

VARIABLE	ADTRIG <code>
VALID VALUES	0, 1, or 2
DEFAULT VALUE	0
DATA TYPE	integer
DESCRIPTION	This variable determines the method for a Frame Trigger. 0 - Frame timing is controlled by an internal timer set by PERIOD. 1 - Frame timing is controlled by an external hardware or a software trigger. When ADTRIG is enabled, a frame will be triggered whenever a hardware or software trigger input is received. The hardware trigger is a hard wired input to the power input connector. The Software trigger is a TAB, or Ctrl I, character. When a SCAN command is received, the RAD enters a WAIT state until a trigger pulse is received. At that time, the RAD will acquire and output one averaged frame of data and re-enter the WAIT state. This will continue until a STOP command is received or the FPS variable is satisfied. Multiple trigger pulses received during a scan will be ignored. 2 - Sets the Tag Bit Function. This function is only available if SCANTRIG is set to 0. This function allows a user to apply a voltage to the Trigger Input and have that digital state recorded in the data stream. The status of the Tag Bit is placed in bit 7 of the enabled Scan Group(s) in the Binary Packet. Scan Groups are identified in byte 1 of the Scan Packets. The status of the Tag Bit is also shown on the formatted screen of the Console.
NOTE	If ADTRIG is set to 1, SCANTRIG must be set to 0. If ADTRIG is set to 2, SCANTRIG must be set to 0.

VARIABLE	BINADDR <port> <IP address>
VALID VALUES	port - 1 to 5000 IP address - any valid IP address
DEFAULT VALUE	port - 0 IP address - 0.0.0.0
DATA TYPE	integer
DESCRIPTION	When port is set to 0, data are NOT sent out over the binary address port, Data are sent over the standard TCP port. If port is 1 to 5000, data are sent over that port to the IP address identified in a UDP format.

VARIABLE	IFC <char 1> <char 2>
VALID VALUES	char 1 - Any valid ASCII character char 2 - Any valid ASCII character
DEFAULT VALUE	char 1 - 62 char 2 - 0
DATA TYPE	integer
DESCRIPTION	This variable sets the interframe characters to be used when transmitting ASCII unformatted output. If only one character is desired, char 2 must be set to 0. If both characters are set to 0, no interframe characters will be transmitted.
EXAMPLE	If a Carriage Return is desired between frames, the following command would be used: SET IFC 13 0

VARIABLE	PERIOD <period>
VALID VALUES	25 to 65535
DEFAULT VALUE	500
DATA TYPE	integer
DESCRIPTION	This master period variable sets the sample rate, in microseconds, of the pressure A/D converters and the one temperature A/D converter. Period is the dwell time between channels. All Scan Groups use the this variable. Period is only one of the terms required to determine data rate. Data rate is determined by the equation:

$$DataRate = \frac{1}{Period \times Channels \times AVG}$$

Data Rate is expressed in Hertz per channel
 Period is in microseconds
 Channels is the number of channels in the largest module enabled
 AVG is the average term for that scan group

VARIABLE	SCANTRIG <code>
VALID VALUES	0, or 1
DEFAULT VALUE	0
DATA TYPE	integer
DESCRIPTION	Controls scan initiation. 0 - Scanning is initiated by the SCAN command. 1 - Scanning is initiated by an external hardware trigger. When SCANTRIG is enabled, a scan will be initiated whenever a hardware trigger input is received. The hardware trigger is a hard wired input to the power cable. The scan function will continue until the Frames per Scan variable is satisfied or a STOP command is received. Multiple trigger pulses received during a scan will be ignored.
NOTES	If SCANTRIG is set to 1, ADTRIG must be set to 0. A Software Trigger will not initiate the SCAN function.

VARIABLE	TEMPPOLL <code>
VALID VALUES	0 or 1
DEFAULT VALUE	1
DATA TYPE	integer
DESCRIPTION	This variable controls the Temperature Polling function. When this variable is enabled, the temperature of the A/D modules are read at a 5 second period. This variable must be set to zero when the RAD is set to the Enclosure mode. 0 - Temperature polling is disabled. 1 - Temperature polling is enabled.

VARIABLE	TIMESTAMP <code>
VALID VALUES	0 or 1
DEFAULT VALUE	1
DATA TYPE	integer
DESCRIPTION	This variable sets the time stamp units. The Time Stamp is the elapsed time from the start of the scan function. The first time stamp will always be zero. TIMESTAMP data are only output to a file when BIN is set to 1. TIMESTAMP data are never output when the data format is ASCII. 0 - Time is in microseconds 1 - Time is in milliseconds

CONVERSION VARIABLES (Group C)

VARIABLE **BIN <code>**
VALID VALUES 0, 1, or 2
DEFAULT VALUE 0
DATA TYPE integer
DESCRIPTION Sets the format of the output data: (Refer to the packet definitions for more information)
0 - Output is in ASCII
1 - Output is in binary format
2 - Output is in binary format with module-port information
3 - Output is in binary format with RAD serial number and module-port information.

VARIABLE **CALAVG <sample average>**
VALID VALUES 1 to 256
DEFAULT VALUE 64
DATA TYPE integer
DESCRIPTION Sets the calibration sample average. This value should be set to insure that a sufficient number of samples will be acquired to insure a stable, noise free calibration.
NOTE: CALAVG is fixed at 32 in versions 5.10 and higher. Users will not be able to modify the value.

VARIABLE **CALPER <period>**
VALID VALUES 50 to 5000
DEFAULT VALUE 500
DATA TYPE integer
DESCRIPTION Sets the period, in microseconds, of the RAD calibration data acquisition. This is the same as PERIOD in the SCAN Group. This value should be set to insure that a sufficient settling time exists so that the channel samples are stable.
NOTE: CALPER will be set automatically to the value set in PERIOD for all versions 5.10 and higher. Users will not be able to modify the value.

VARIABLE **CALZDLY <delay>**
VALID VALUES 5 to 128
DEFAULT VALUE 15
DATA TYPE integer
DESCRIPTION Sets the delay time, in seconds, before the RAD executes a CALZ Command. This value should be set to insure that a sufficient delay exists so that the Zero Offset data are not biased by residual pressure in the module calibration valves.

VARIABLE **CVTUNIT <value>**
VALID VALUES any real number
DEFAULT VALUE 1.0
DATA TYPE float
DESCRIPTION This is the conversion factor to convert from PSI units to the desired scanning units. This value may be set directly or by setting the UNITSCAN variable.

VARIABLE	EU <code>
VALID VALUES	0, 1
DEFAULT VALUE	1
DATA TYPE	integer
DESCRIPTION	Sets the units of the output data: 0 - Output is in raw counts 1 - Output is in selected engineering units

When the A/D counts reach 32767 or -32768, and EU is set to 1, the RAD will output the values set in **MAXEU** and **MINEU** to indicate that a conversion error may exist. The RAD will also output these values when the maximum or minimum master conversion planes are exceeded.

VARIABLE	FILLONE <code>
VALID VALUES	0, 1
DEFAULT VALUE	0
DATA TYPE	integer
DESCRIPTION	Sets the type of fill that will be performed. 0 - The pressure conversion planes will be filled using several Master Planes 1 - The pressure conversion planes will be filled using a single Master Plane

If FILLONE is set to 1 during the execution of a FILL command, the software will copy the data from the first Master Plane encountered to all other temperature planes. If a second Master Plane is found, the FILL will be terminated and an error will be logged. Normally, a pressure conversion plane is filled using two to nine Master Planes.

NOTE	This function is designed for a who user wishes to calibrate his modules at one temperature and is able to maintain the temperature of the module(s) to $\pm 0.25^{\circ}\text{C}$. If a user is not able to maintain the temperature of his modules to $\pm 0.25^{\circ}\text{C}$, large errors may result. Sensor drift due to temperature can exceed 30 counts per degree C, depending upon the module type. This calculates to a 0.1% error
------	--

If FILLONE is set to 1 when a full set of coefficients are available, and a **FILL** command is issued, the coefficients will all be set to the value of the first Master Plane in the coefficient file.

VARIABLE	MAXEU <value>
VALID VALUES	Any valid floating point number
DEFAULT VALUE	9999
DATA TYPE	Floating point
DESCRIPTION	Sets the maximum Engineering Unit Value. This is the number that will be displayed when an overflow condition occurs When the A/D counts reach 32767, and EU is set to 1, the RAD will output 9999 or whatever has been entered as the MAXEU value to indicate that a conversion error may exist. The RAD will also output these values when the maximum or minimum master conversion planes are exceeded.

VARIABLE	MINEU <value>
VALID VALUES	Any valid floating point number
DEFAULT VALUE	-9999
DATA TYPE	Floating point
DESCRIPTION	Sets the minimum Engineering Unit Value. This is the number that will be displayed when an overflow condition occurs When the A/D counts reach -32768, and EU is set to 1, the RAD will output -9999 or whatever has been entered as the MINEU value to indicate that a conversion error may exist. The RAD will also output these values when the maximum or minimum master conversion planes are exceeded.

VARIABLE	MPBS <number of planes>
VALID VALUES	0 to 140
DEFAULT VALUE	0
DATA TYPE	integer
DESCRIPTION	When an INSERT command is issued and a master point is overwritten, a configurable number of temperature planes on either side of the new MASTER plane are converted to calculated. These points will be recalculated when a FILL command is executed. The number of planes to be entered in this variable may be calculated by the formula: Planes = TEMP * 4 where TEMP is the number of degrees to be changed. For example, if it is desired to have points $\pm 4^\circ$ of the new master plane modified, then MPBS would be set to 16.

VARIABLE	STARTCALZ <code>
VALID VALUES	0, 1
DEFAULT VALUE	0
DATA TYPE	integer
DESCRIPTION	When set to 1, causes the RAD to execute a CALZ at startup. The RAD does not save zeros at power down. If the RAD is set to start scanning immediately or if it is difficult to input commands to the RAD once it is powered up, then this variable should be set to 1. The RAD will then execute a CALZ at the end of the initialization sequence.

VARIABLE **UNITSCAN <units>**
VALID VALUES see list below
DEFAULT VALUE PSI
DATA TYPE string
DESCRIPTION This sets the output engineering units for the RAD. Setting this value will also set CVTUNITS. CVTUNITS may be set to a different value, however UNITSCAN must be set first. The following are the list of units supported:

ATM	FTH2O	KGM2	MH2O	OZFT2
BAR	GCM2	KIPIN2	MMHG	OZIN2
CMHG	INHG	KNM2	MPA	PA
CMH2O	INH2O	KPA	NCM2	PSF
DECIBAR	KGCM2	MBAR	NM2	PSI
				TORR

NOTE If a value other than those listed is entered, The RAD will default to PSI.

VARIABLE **ZC <code>**
VALID VALUES 0, 1
DEFAULT VALUE 1
DATA TYPE integer
DESCRIPTION Enables or disables zero correction of the pressure data
 0 - No zero correction is performed.
 1 - Zero correction is performed.

DIGITAL OUTPUT CONFIGURATION VARIABLES (Group D)

VARIABLE **DLYPG <value>**
VALID VALUES 0 to 3600
DEFAULT VALUE 10
DATA TYPE integer
DESCRIPTION Sets the time, in seconds, that the module inputs will be purged. This is only a part of the total purge sequence time. This timer can be interrupted by a STOP command. When set to 0, the time is infinite and the PURGE sequence can only be terminated by a STOP command.

VARIABLE **DLYPGSEQ <value>**
VALID VALUES 0 to 5
DEFAULT VALUE 1
DATA TYPE integer
DESCRIPTION Sets the time delay, in seconds, before purge air is applied to the modules. If 0 is entered, no delay will occur.

VARIABLE **DOUTCALZ <value>**
VALID VALUES 0 to FF Hexadecimal
DEFAULT VALUE 0
DATA TYPE integer
DESCRIPTION Enables digital outputs for a **CALZ** operation. Output 1 is the least significant binary bit. Output 8 is the most significant binary bit. The variable is entered as 2 hexadecimal digits.

VARIABLE **DOUTPG <value>**
VALID VALUES 0 to FF Hexadecimal
DEFAULT VALUE 0
DATA TYPE integer
DESCRIPTION Enables digital outputs for a **PURGE** sequence. Output 1 is the least significant binary bit. Output 8 is the most significant binary bit. The variable is entered in hexadecimal digits.

VARIABLE **DOUTPGSEQ <value>**
VALID VALUES 0 to FF Hexadecimal
DEFAULT VALUE 0
DATA TYPE integer
DESCRIPTION Enables digital outputs to transition from normal operation to **PURGE** operation. Output 1 is the least significant binary bit. Output 8 is the most significant binary bit. The variable is entered in hexadecimal digits.

VARIABLE	DOUTPU <value>
VALID VALUES	0 to FF Hexadecimal
DEFAULT VALUE	0
DATA TYPE	integer
DESCRIPTION	Enables the digital outputs for normal power up configuration. Output 1 is the least significant binary bit. Output 8 is the most significant binary bit. The variable is entered in hexadecimal digits.

VARIABLE	DOUTSCAN <value> <alarm pattern>
VALID VALUES	0 to FF Hexadecimal
DEFAULT VALUES	value - 40 alarm pattern - 0
DATA TYPE	integer
DESCRIPTION	<p>value - Enables the digital outputs to indicate that the RAD is in the SCAN mode. This variable ONLY affects the DOUT bit that is enabled. All other outputs are masked.</p> <p>alarm pattern - If the alarm pattern is set to a number greater than 0, the pattern will be output when the RAD is in the SCAN mode and: EU = 1 - If MAXEU or MINEU are set by an overpressure or overscale condition. EU = 0 - If A/D counts exceed ± 32767.</p> <p>When the alarm pattern is set in the DOUTSCAN word, the SCAN function will be interrupted momentarily while the DOUTSCAN word is modified, then restarted immediately. The alarm pattern can only be reset by stopping and restarting the SCAN function or by stopping the SCAN function and issuing a DOUT command to clear the bits set in the alarm..</p> <p>Output 1 is the least significant binary bit. Output 8 is the most significant binary bit. The variable is entered in hexadecimal digits.</p>

WARNING: The alarm pattern selected **MUST NOT** include any digital outputs that are used to set control pressures.

VARIABLE	DOUTREADY <value>
VALID VALUES	0 to FF Hexadecimal
DEFAULT VALUE	80
DATA TYPE	integer
DESCRIPTION	Enables the digital outputs to indicate that the RAD is in the READY mode. This variable ONLY affects the DOUT bit that is enabled. All other outputs are masked. Output 1 is the least significant binary bit. Output 8 is the most significant binary bit. The variable is entered in hexadecimal digits.

VARIABLE	BANKA <value>
VALID VALUES	0 to FF Hexadecimal
DEFAULT VALUE	0
DATA TYPE	integer
DESCRIPTION	Enables the digital outputs to switch the control pressures in a ZOC22, 23, or 33 to measure the pressures in the Bank A inputs. Output 1 is the least significant binary bit. Output 8 is the most significant binary bit. The variable is entered in hexadecimal digits.

VARIABLE	BANKB <value>
VALID VALUES	0 to FF Hexadecimal
DEFAULT VALUE	0
DATA TYPE	integer
DESCRIPTION	Enables the digital outputs to switch the control pressures in a ZOC22, 23, or 33 to measure the pressures in the Bank B inputs in a duplex module. Output 1 is the least significant binary bit. Output 8 is the most significant binary bit. The variable is entered in hexadecimal digits.

VARIABLE	BANKUSR <value>
VALID VALUES	0 to FF Hexadecimal
DEFAULT VALUE	0
DATA TYPE	integer
DESCRIPTION	Enables the digital outputs to switch the control pressures in a ZOC22, 23, or 33 to a user defined mode. Output 1 is the least significant binary bit. Output 8 is the most significant binary bit. The variable is entered in hexadecimal digits.

SCAN GROUP CONFIGURATION VARIABLES (Group G1 through G8)

VARIABLE	AVGn <sample average>	Where n = the scan group number
VALID VALUES	1 - 256	
DEFAULT VALUE	16	
DATA TYPE	integer	
DESCRIPTION	Sets the minimum number of samples to average for Scan Group n. Refer to the CHANn variable for information on averaging of modules with a dissimilar number of channels.	

VARIABLE	CHANn <channels>	Where n = the scan group number
VALID VALUES	<channels> - <i>channels</i> is a combination of a <i>module</i> and a <i>port</i> . Syntax is: <i>module-port</i> for one channel <i>module-port,module-port</i> for many channels <i>module-port..module-port</i> for a range of channels <i>Module</i> is the physical location of the module in the rack or the connector supporting the module. <i>Port</i> is a single pressure sample point within a module. When 0 is entered, no channels are assigned to a scan group.	
DEFAULT VALUE	0	
DATA TYPE	string	
DESCRIPTION	Sets the channel assignments in scan group n. Duplicate <i>module-port</i> entries are not permitted in the same module group. For example: the notation: CHAN 1-1,1-1 is not valid.	

If a scan group contains ports from dissimilar modules, for example: a 64 port module and a 16 port module, the smaller module will be sampled more often in order to keep the larger module synchronized with the smaller module. The additional samples from the smaller module are averaged. In the previous example the 16 port module will be sampled 4 times for every one sample of the 64 port module.

The order of the channels in the output frame is determined by the order of entry. Use the LIST SGn command to verify the output frame order.

Setting the channel variable does not automatically erase old channels. The user is responsible to insure that unwanted channels are cleared before new channels are set.

The command :
SET CHAN<scan group>0<enter>
will clear a scan group.

VARIABLE	FPSn <frames>	Where n = the scan group number
VALID VALUES	0 - 2147483648	
DEFAULT VALUE	0	
DATA TYPE	long integer	
DESCRIPTION	Frames per Scan. Sets the number of averaged frames for Scan Group n to be output after a SCAN command is issued. Data will be output at a rate set by the formula below. Averaged frames will be output until the setting of FPS is met. Each Scan group may have a different value of FPS. When set to 0, the scan will continue until a stop command is received.	

$$DataRate = \frac{1}{Period \times Channels \times AVG}$$

Data Rate is expressed in Hertz per channel
 Period is in microseconds
 Channels is the number of channels in the largest module enabled
 AVG is the average term for that scan group

VARIABLE	SGENABLEn <code>	Where n = the scan group number
VALID VALUES	0, 1, 16(Scan Group 1 only), 32(Scan Group 1 only)	
DEFAULT VALUE	0	
DATA TYPE	integer	
DESCRIPTION	Defines if the scan group n is enabled: 0 - Disabled 1 - Normal Scan Mode Enabled 16 - 16 Channel Fast Scan Mode Enabled (Scan Group 1 Only) 32 - 32 Channel Fast Scan Mode Enabled (Scan Group 1 Only)	

NOTE Fast Scan Mode can be enabled for Scan Group 1 only. When Fast Scan Mode is enabled for Scan Group 1, all other Scan Groups must be disabled. Fast Scan Mode is described in detail in the RAD Scan Function Section of this manual.

VARIABLE **NEGPTSn <ports> <negpts>** Where n = the module position number
VALID VALUES <port> - may be defined as: *port* - one port
port,port - many ports
port..port - a range of ports
<negpts> - an integer that defines the number of master negative points. The maximum number of master negative points is 8.

DEFAULT VALUE 1..64 4
DATA TYPE string
DESCRIPTION Defines the number of master negative points for port or ports of the module n.

VARIABLE **NPRn <pressure>** Where n = the module position number
VALID VALUES any valid integer up to 4 digits
DEFAULT VALUE 15
DATA TYPE integer
DESCRIPTION Defines the nominal pressure range for the module installed in position n.

VARIABLE **NUMPORTSn <ports>** Where n = the module position number
VALID VALUES 16,32, or 64
DEFAULT VALUE 64
DATA TYPE integer
DESCRIPTION Defines the number of ports for the module n.

VARIABLE **TYPEn <code>** Where n = the module position number
VALID VALUES 0, 1, 2, 3, or 4
DEFAULT VALUE 0
DATA TYPE integer
DESCRIPTION This variable defines the module n type:
0 - Standard
1 - Absolute
2 - Gauge
3 - True Differential
4 - Electrical Input Module

MODULE PROFILE VARIABLES (Group P)

VARIABLE	RADSN <serial number>
VALID VALUES	Any valid integer up to 4 digits
DEFAULT VALUE	0000
DATA TYPE	Integer
DESCRIPTION	The serial number of the RAD.
NOTE	This is a read only variable

VARIABLE	SNn <serial number>	Where n = the module position number
VALID VALUES	Any valid integer up to 4 digits	
DEFAULT VALUE	0000	
DATA TYPE	Integer	
DESCRIPTION	The serial number of the module installed in slot n.	
NOTE	This is a read only variable	

IDENTIFICATION CONFIGURATION VARIABLES (Group I)

VARIABLE **ECHO <enable>**
VALID VALUES 0 or 1
DEFAULT VALUE 0
DATA TYPE Integer
DESCRIPTION Determines if characters received from the network or the serial host will be echoed back to the host.
 0 - Echo is disabled
 1 - Echo is enabled

VARIABLE **FILEOUT <code>**
VALID VALUES 1, 2, or 3
DEFAULT VALUE 1
DATA TYPE integer
DESCRIPTION Determines if output data are to be sent to the console.
 0 - Data are not saved to a file.
 1 - Binary data are saved to a disk file: scanxxx.dat
 2 - ASCII data are saved to a disk file: scanxxx.dat.
 3 - Binary data are saved to a disk file with header information: scanxxx.dat

NOTES If FILEOUT is set to 1, 2, or 3, the following rules apply.

1. The first SCAN command will open the file: scan000.dat. This file will remain open until a CLOSE command is issued. If the file is not closed, subsequent SCAN commands will append data to that file.
2. When the first file is closed, the next SCAN command will open a new file: scan001.dat. The file name will increment each time a file is closed and a new SCAN command issued.
3. Data are written to the file in the format defined by the variable BIN. If BIN is 0, data are written in ASCII format. If BIN is 1 or 2, data are written in Binary format.
4. If the RAD.exe program is quit before a CLOSE command is received the data buffered for the current open file will be lost.

When FILEOUT is set to 3, an information header is added to the file.

Bytes	Description
2	- Header Size, including the header size (136)
10	- ASCII encoded date of data sample
8	- ASCII encoded time of data sample
32	- FPS(x) – One for each scan group (4 byte integer per group)
16	- AVG(x) – One for each scan group (2 byte integer per group)
16	- Number of channels for each Scan Group (2 byte integer per group)
4	- PERIOD (4 byte float)
2	- ADTRIG (2 byte integer)
2	- A2DCOR (2 byte integer)
4	- CVTUNITS (4 byte float)
4	- MAXEU (4 byte float)
4	- MINEU (4 byte float)
16	- Module Serial Number (x) (2 byte integer per module)
16	- Number of channels per module(x) (2 byte integer per module)

<Frame scan data starts here>

For legacy compatibility, CONOUT 3 will be accepted as FILEOUT 1.

VARIABLE
VALID VALUES
DEFAULT VALUE
DATA TYPE
DESCRIPTION

FILEPREFIX <string>
 Any alphanumeric string
 scan
 String
 Determines the filename prefix when FILEOUT is set to 1, 2, or 3. Data written to a disk will be stored in a file named: <fileprefix>xxx.dat. Where: xxx is a unique number assigned by the RAD software.

VARIABLE
VALID VALUES
DEFAULT VALUE
DATA TYPE
DESCRIPTION

FORMAT <code>
 0, 1, or 2
 0
 Integer
 Determines if data are to be scrolled on the display.
 0 - data are scrolled
 1 - data are displayed in place, formatted for a VT100 terminal.
 2 - data are scrolled with a prompt between frames

VARIABLE
VALID VALUES
DEFAULT VALUE
DATA TYPE
DESCRIPTION

IFUSER <code>
 0, 1, 2, or 3
 1
 Integer
 Determines the method of logging errors and if a sign on message will be issued to the host.

- 0 - All errors will be logged. Errors may only be accessed by issuing an ERROR command and cleared by issuing a CLEAR command. A sign on message will not be issued to the host.
- 1 - All errors will be displayed as they occur. A sign on message will be issued to the host.
- 2 - All errors will be displayed as they occur. A sign on message will be issued to the host. All user messages are displayed with the RAD serial number in the prompt.
- 3 - All errors will be logged. Errors may only be accessed by issuing an ERROR command and cleared by issuing a CLEAR command. A sign on message will not be issued to the host. All user messages are displayed with the RAD serial number in the prompt.

VARIABLE
VALID VALUES
DEFAULT VALUE
DATA TYPE
DESCRIPTION

NETOUT <code>
 0, 1, or 2
 2
 Integer
 Determines if data are to be output to a network .
 0 - never output data to the network
 1 - always output data to the network
 2 - output data to the network if command is initiated from the network

VARIABLE	NL <code>
VALID VALUES	0 or 1
DEFAULT VALUE	0
DATA TYPE	integer
DESCRIPTION	Determines the new line character(s) for all output. 0 - <CR><LF> 1 - <CR>

TEMPERATURE OFFSET VARIABLES (Group O)

VARIABLE **TEMPBn <value>** Where n = the module position number
 VALID VALUES any real number
 DEFAULT VALUE -259.7403
 DATA TYPE float
 DESCRIPTION The "B" term in the conversion equation used to convert temperature counts to degrees Celsius. If a module number is not specified, all modules will be displayed. This value is for a Platinum RTD(500Ω at 0°). The conversion formula is:

$$^{\circ}\text{C} = \text{TempM} \times (\text{Counts}) - \text{TempB}$$

TEMPERATURE GAIN VARIABLES (Group G)

VARIABLE **TEMPMn <value>** Where n = the module position number
 VALID VALUES any real number
 DEFAULT VALUE 0.0371
 DATA TYPE float
 DESCRIPTION The "M" term in the conversion equation used to convert temperature counts to degrees Celsius. If a module number is not specified, all modules will be displayed. This value is for a Platinum RTD(500Ω at 0°). The conversion formula is:

$$^{\circ}\text{C} = \text{TempM} \times (\text{Counts}) - \text{TempB}$$

Some ZOC modules use different RTD's for temperature measurement. The values of TEMPBx and TEMPMx may have to be modified by the user when a different RTD is used. The following table lists the other RTD's that could be installed and the values of TEMPB and TEMPM for each one.

RTD	TEMPB	TEMPM	MODULES
Nickel- Iron 604 Ω at 0°C	-192.9757	0.0228	ZOC16TC (Std.) ZOC22B (Standard) ZOC23B (Standard) DSA3016 (Std.) DSA3216 (Std.)
Platinum 100 Ω at 0°C	-259.7403	0.1853	ZOC22B (Special) ZOC23B (Special) ZOC33 (Special)
Platinum 500 Ω at 0°C	-259.7403	0.0371	ZOC33 (Standard)
Platinum 1000 Ω at 0°C	-259.7403	0.0185	ZOC22B (Special) ZOC23B (Special) ZOC33 (Special)

Error and Event Log File (ERRLOG.TXT)

An Error and Event Log File was added to Version 2.00 of the RAD Software. All events and errors are logged to this file. The file will be created by the software if it does not exist. All events and errors are appended to the file as they occur. The file will be opened each time the RAD software is started and closed when the RAD software is shutdown. This file will not be automatically erased, but the file may be deleted manually. Old errors and events may be deleted from the file using a text editor. The file is in the RAD Folder. An example of entries showing the startup of the RAD software with some errors and events concluded by a normal shutdown is shown below.

```
----- ERRLOG Opened at Date:1/15/2004 Time:0:2:40.766
DsmRad Ver 2.00 Copyright (c) Scanivalve Corp. 2002 - 2004 at Date:1/15/2004 Time:0:2:40.766
WARNING: No RDS present at location 9 at Date:1/15/2004 Time:0:3:42.284
EVENT: Scan started at Date:1/15/2004 Time:1:21:6.292
EVENT: Scan stopped, stop received Scangroup 0 Frame 16 at Date:1/15/2004 Time:1:21:11.449
EVENT: Calz started at Date:1/15/2004 Time:1:21:15.966
ERROR: CalZ temp or module out of range at Date:1/15/2004 Time:1:21:23.667
EVENT: Calz finished at Date:1/15/2004 Time:1:21:23.687
EVENT: Scan started at Date:1/15/2004 Time:1:21:50.405
ERROR: Invalid command at Date:1/15/2004 Time:1:23:27.875
EVENT: Scan stopped, stop received Scangroup 0 Frame 7 at Date:1/15/2004 Time:1:21:53.99
EVENT: Scan started at Date:1/15/2004 Time:4:54:54.798
EVENT: Scan stopped, stop received Scangroup 0 Frame 15 at Date:1/15/2004 Time:4:54:59.535
EVENT: Scan started at Date:1/15/2004 Time:4:55:14.787
EVENT: Scan stopped, stop received Scangroup 0 Frame 107 at Date:1/15/2004 Time:4:55:43.258
EVENT: Scan started at Date:1/15/2004 Time:4:55:58.750
EVENT: Scan stopped, stop received Scangroup 0 Frame 49 at Date:1/15/2004 Time:4:56:12.149
----- ERRLOG Closed at Date:1/15/2004 Time:7:46:0 145
```

RAD Scan Function

When a SCAN function is initiated, the RAD will scan all of the channels in the modules enabled in the software. In the Standalone Mode, all modules are scanned in parallel. In the Enclosure Mode, A/D1 scans modules 1 to 4, and A/D2 scans modules 5 - 8. Each channel in a module will be accessed at the rate set in the configuration variable, PERIOD. Data from each channel are accumulated in a buffer until the AVG term is met. The data from each channel are averaged and then output as a FRAME. This process will continue until the number of frames set in the variable, FPS, have been output, or a STOP command is received.. When FPS has been met, or a STOP command received, the Scan function will stop and the RAD will return to the READY mode. If FPS is set to 0(zero), the SCAN function will continue indefinitely until a STOP command is received. A STOP Command may be entered by typing STOP from the Local or remote keyboard, or by pressing the Escape Key on either input.

Two configuration variables, ADTRIG and SCANTRIG, determine how the SCAN function will be implemented.

Internal Trigger

When these variables are set to 0 (disabled), the SCAN function will be controlled by an internal clock trigger. The SCAN function will be initiated by a SCAN command issued from the RAD computer or an external Host computer. Scanning will commence approximately 5 milliseconds after the SCAN command is received. Each Frame will be acquired as soon as the previous Frame acquisition is complete. The SCAN function will remain active until FPS is met or a STOP Command is received.

External Trigger

The RAD3200 SCAN function may be controlled with external triggers. The settings of SCANTRIG and ADTRIG determine how the SCAN function will be initiated and how each Frame will be acquired. ADTRIG and SCANTRIG cannot be enabled at the same time.

When SCANTRIG is set to 1(enabled), the SCAN function will be initiated by an external hardware trigger. Frame triggering will be controlled by an internal clock trigger. Scanning will commence approximately 5 milliseconds after the hardware trigger is received. Each Frame will be acquired as soon as the previous Frame acquisition is complete. The SCAN function will remain active until FPS is met or a STOP Command is received. Multiple trigger pulses received while the SCAN function is active will be ignored. When the SCAN function is complete, another trigger will repeat the process.

When ADTRIG is set to 1(enabled), the SCAN function will be initiated by the SCAN command. The RAD will enter the WTRIG mode and wait for a hardware or software trigger. When a trigger is received, the RAD will acquire and output one averaged Frame of data and re-enter the WTRIG mode. Multiple trigger pulses received during a Frame Scan will be ignored. When a frame has been output, the next trigger will repeat the process. This will continue until the Frames per Scan Variable has been satisfied or a STOP command is received.

Hardware Trigger

The Hardware Trigger input is optically isolated to prevent grounding problems. It is a TTL level, edge sensing device. It requires a minimum signal of 9 Vdc @ 6.5 mA. It may accept voltages as high as 15 Vdc. The external trigger input is on pins 8 and 9 of the RAD Power input connector.

Software Trigger

The Software Trigger is a <TAB> character, or Ctrl I.

RAD Fast Scan Mode

The speed limitation of a RAD in “normal mode” is determined by the shortest time that a ZOC module can switch between channels and still provide accurate pressure data. For a ZOC33, with 64 channels, this time is nominally 25µs yielding a per-channel scan rate of 625 Hz. For a ZOC22, with 32 channels, this time is nominally 50µs yielding a per-channel scan rate of 625 Hz, but with half the channel count compared to a ZOC33.

“Fast mode” can increase the per-channel scan rate by not scanning the module’s high numbered channels and re-sampling the module’s lower number channels. The split between low and high channels is configurable through the fast mode maximum port value. Fast Scan Mode may be set for Scan Group 1 only. When Fast Scan Mode is enabled for Scan Group 1, all other Scan Groups must be disabled.

The range of ports, in a module, to be sampled always starts at one. The maximum port to be sampled is determined by the value of SGENABLE1. When SGENABLE1 is set to 0, the scan group is disabled. If SGENABLE1 is set to 1, scanning will be normal, that is channels will be sampled in order to the setting of NUMPORTS. In this case, the maximum channel count will be set to the greatest NUMPORTS setting. If a system has a mix of 32 and 64 channels, the channel count scanned will be 64.

In Fast Scan Mode, ports greater than the fast mode maximum port, are never sampled. Once the fast mode maximum port has been sampled, the RAD resets its port address selection lines and starts sampling at port one again. This cycle continues through the scan process.

Configuring Fast Mode

The configuration variable SGENABLE1 allows the user to disable the scan group, enter normal mode or enter fast mode. When the SGENABLE1 parameter is 16 or 32 fast mode is enabled. The following table shows the valid settings:

Divisor settings for SGENABLE1

SGENABLE1	Description	Ports sampled NUMPORTSn = 64	Ports sampled NUMPORTSn = 32
0	Scan group disabled	None	None
1	Scan group enabled, normal mode	64	32
32	Scan group enabled 32 channel fast scan mode enabled	First 32	First 32
16	Scan group enabled 16 channel fast scan mode enabled	First 16	First 16

An error is generated if a channel in the channel list would not be sampled because of the fast mode setting.

Example

This example shows how the frame number, sampled ports and scan rate are affected by fast mode. The example system consists of one ZOC22 module in position one, with a period setting of 50µs. The channel configuration variable is set to include all channels in the module (1-1..1-32) The table shows the effect of changing the value of SGENABLE1 to 1 and 16.

Mode	Max Port	Period (μs)	Calculation	Rate
Normal Mode	1	50	1/(50μs x 32 chan)	625 Hz
Fast Mode	16	50	1/(50μs x 16 chan)	1250 Hz

Elapsed Time (μs)	Normal Mode		Fast Mode Max Port = 16	
	Port#	Frame#	Port#	Frame#
0	1	1	1	1
50	2	1	2	1
100	3	1	3	1
150	4	1	4	1
200	5	1	5	1
250	6	1	6	1
300	7	1	7	1
350	8	1	8	1
400	9	1	9	1
450	10	1	10	1
500	11	1	11	1
550	12	1	12	1
600	13	1	13	1
650	14	1	14	1
700	15	1	15	1
750	16	1	16	1
800	17	1	1	2
850	18	1	2	2
900	19	1	3	2
950	20	1	4	2
1000	21	1	5	2
1050	22	1	6	2
1100	23	1	7	2
1150	24	1	8	2
1200	25	1	9	2
1250	26	1	10	2
1300	27	1	11	2
1350	28	1	12	2
1400	29	1	13	2
1450	30	1	14	2
1500	31	1	15	2
1550	32	1	16	2
1600	1	2	1	3
1650	2	2	2	3
1700	3	2	3	3
1750	4	2	4	3
1800	5	2	5	3
1850	6	2	6	3
1900	7	2	7	3
1950	8	2	8	3
2000	9	2	9	3
2050	10	2	10	3
2100	11	2	11	3
2150	12	2	12	3
2200	13	2	13	3
2250	14	2	14	3
2300	15	2	15	3
2350	16	2	16	3
2400	17	2	1	4
2450	18	2	2	4
2500	19	2	3	4
2550	20	2	4	4
2600	21	2	5	4
2650	22	2	6	4
....

RAD Profile File

When the RAD.EXE program is started, including a RELOAD or RESTART, a RAD Profile file will be generated. This file is named RADnnn.DPF, where nnn is the serial number of the RAD. This file is an ASCII text file and contains the following information:

```
RAD Serial Number: <serial number><CR><LF>
Module Serial Number in Position 1: <module serial number><CR><LF>
Module Serial Number in Position 2: <module serial number><CR><LF>
Module Serial Number in Position 3: <module serial number><CR><LF>
Module Serial Number in Position 4: <module serial number><CR><LF>
Module Serial Number in Position 5: <module serial number><CR><LF>
Module Serial Number in Position 6: <module serial number><CR><LF>
Module Serial Number in Position 7: <module serial number><CR><LF>
Module Serial Number in Position 8: <module serial number><CR><LF>
```

If a RADnnn.DPF file exists when the RAD.EXE program starts up, it will be overwritten by the information obtained from the polling of the ID chips.

Module Profile File

Each module has a unique Module Profile File which is created during the initial calibration of the module. This file is updated each time a SAVE command is executed by the RAD. These files are read when the RAD.EXE program is started, including RELOAD and RESTART.

The information contained in the Module Profile File is:

```
REMn 1 <comment><CR><LF>
REMn 2 <comment><CR><LF>
REMn 3 <comment><CR><LF>
REMn 4 <comment><CR><LF>
SET TYPEEn <module type><CR><LF>
SET NUMPORTSn <number of ports><CR><LF>
SET NPRn <Nominal Full Scale Pressure Value><CR><LF>
SET TEMPMn <temperature gain factor><CR><LF>
SET TEMPBn <temperature offset factor><CR><LF>
SET LPRESSn <channels> <pressure><CR><LF>
SET HPRESSn <channels> <pressure><CR><LF>
SET NEGPTSn <channels> <number of negative points><CR><LF>
INSERT <temperature> <channels> <pressure> <pressure counts> M<CR><LF>
INSERT <temperature> <channels> <pressure> <pressure counts> M<CR><LF>
::      ::::      ::      ::      ::::      :  ::  ::
INSERT <temperature> <channels> <pressure> <pressure counts> M<CR><LF>
```


Binary Scan Packets

Packets without Module-Port Information

Byte	Name	Value
0	Binary ID	1 = EU (EU = 1) 2 = Raw (EU = 0)
1	Group ID	1 to 8 If Tag Bit is set, 80 Hex will be merged with the Scan Group Number. (81 to 88)
2 and 3	Number of Channels	0 to 512
4 through 7	Frame Number	1 to 2^{32}
8 through 11	Time in milliseconds	0 to 2^{32}
12 through 15	Channel 1 Data	4 bytes per channel
16 through 19	Channel 2 Data *	4 bytes per channel
: : : : :	: : : :	: : : :
(4n + 8) through (4n + 11)	Channel n Data *	4 bytes per channel

* Optional based on Number of Channels setting.

Packets with Module-Port Information

Byte	Name	Value
0	Binary ID	3 = EU with channels (EU =1) 4 = Raw with channels (EU = 0)
1	Group ID	1 to 8 If Tag Bit is set, 80 Hex will be merged with the Scan Group Number. (81 to 88)
2 and 3	Number of Channels	0 to 512 (Byte 2 is LSB)
4 through 7	Frame Number	1 to 2 ³²
8 through 11	Time in milliseconds	0 to 2 ³²
12 through 19	Channel 1 Data	Data (4 bytes), Module (2 bytes), Port (2 bytes)
20 through 27	Channel 2 Data *	Data (4 bytes), Module (2 bytes), Port (2 bytes)
: : : : : :	: : : :	: : : :
(8n + 4) through (8n + 11)	Channel n Data *	Data (4 bytes), Module (2 bytes), Port (2 bytes)

* Optional based on Number of Channels setting.

When BIN is set to 1 and the BINADDR is set to a value other than zero, the data from the AUX or CAL commands are converted to a BINARY format and output over the UDP binary port specified in the BINADDR variable. The data format is:

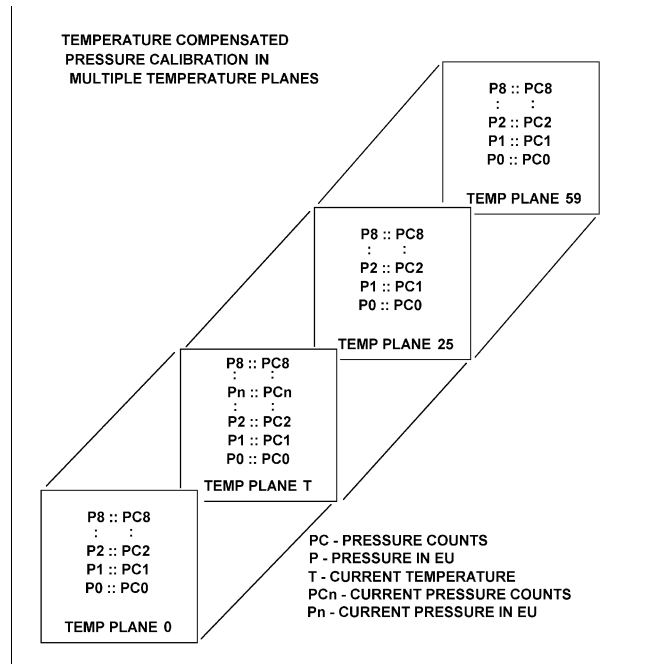
<ID byte> - 1 byte, the value will be 1 if the data are from a calibrator or 2 if the data are from an auxiliary unit.
<pressure> - 4 bytes of floating point binary pressure data

Packets with RAD Serial Number Information

Byte	Name	Value
0	Binary ID	8 = EU with channels (EU = 1) 9 = Raw with channels (EU = 0)
1	Group ID	1 to 8 If Tag Bit is set, 80 Hex will be merged with the Scan Group Number. (81 to 88)
2 and 3	Number of Channels	0 to 512 (Byte 2 is LSB)
4 and 5	RAD Serial Number	1 to 2^{16}
6 through 9	Frame Number	1 to 2^{32}
10 through 13	Time in milliseconds	0 to 2^{32}
14 through 21	Channel 1 Data	Data (4 bytes), Module (2 bytes), Port (2 bytes)
22 through 29	Channel 2 Data *	Data (4 bytes), Module (2 bytes), Port (2 bytes)
: : : : :	: : : :	: : : :
(8n + 4) through (8n + 13)	Channel n Data *	Data (4 bytes), Module (2 bytes), Port (2 bytes)

* Optional based on Number of Channels setting.

APPENDIX A - TEMPERATURE COMPENSATED PRESSURE CONVERSION



FORMULAS:

Pressure interpolation within current temperature plane:

$$P_{n_t} = \frac{1}{PC_{1_t} - PC_{0_t}} ((PC_{1_t} - PC_{n_t})P_{0_t} - (PC_{0_t} - PC_{n_t})P_{1_t})$$

Calculation of entries in current temperature plane:

$$P_{n_t} = \frac{1}{PC_{1_t} - PC_{0_t}} ((PC_{1_t} - PC_{n_t})P_{0_t} - (PC_{0_t} - PC_{n_t})P_{1_t})$$

Calculation of entries in current temperature plane:

$$P_t = \frac{1}{T_{25} - T_0} ((T_{25} - T)P_{0_0} - (T_0 - T)P_{0_{25}})$$

APPENDIX B - ENGINEERING UNIT CONVERSION CONSTANTS

UNITSCAN Setting	Engineering Unit	PSI to EU 1 psi =	EU to PSI 1 EU =
ATM	Atmospheres	0.068046 A	14.6960 psi
BAR	Bars	0.068947 b	14.5039 psi
CMHG	Centimeter of Mercury	5.17149 cmHg	0.193368 psi
CMH2O	Centimeter of Water	70.308 cmH ₂ O	0.014223 psi
DECIBAR	Decibar	0.68947 db	1.4504 psi
FTH2O	Foot of Water	2.3067 ftH ₂ O	0.43352 psi
GCM2	Gram per square Centimeter	70.306 g/cm ²	0.014224 psi
INHG	Inch of Mercury @ 0°C	2.0360 inHg	0.491159 psi
INH2O	Inch of Water @ 4°C	27.680 inH ₂ O	0.036127 psi
KGCM2	Kilogram per square Centimeter	0.0703070 kg/cm ²	14.2235 psi
KGM2	Kilogram per square Meter	703.069 kg/m ²	0.0014223 psi
KIPIN2	kips per square inch(ksi)	0.001 kip/in ²	1000.0 psi
KNM2	Kilonewton per square Meter	6.89476 kN/m ²	0.145038 psi
KPA	Kilopascal	6.89476 kPa	0.145038 psi
MBAR	Millibar	68.947 mb	0.014504 psi
MH2O	Meter of Water	0.70309 mH ₂ O	1.42229 psi
MMHG	Millimeter of Mercury	51.7149 mmHg	0.0193368 psi
MPA	Megapascal	0.00689476 Mpa	145.038 psi
NCM2	Newton per square Centimeter	0.689476 N/cm ²	1.45038 psi
NM2	Newton per square Meter	6894.76 N/m ²	0.000145038 psi
OZFT2	Ounce per square Foot	2304.00 oz/ft ²	0.000434028 psi
OZIN2	Ounce per square Inch	16.00 in/ft ²	0.062500 psi
PA	Pascal	6894.76 Pa	0.000145038 psi
PSF	Pound per square Foot	144.00 lb/ft ²	0.00694444 psi
TORR	Torr	51.7149 T	0.0193368 psi

APPENDIX C - CHANGE LIST

This section contains change information to assist a user in determining the differences between different versions of software.

Version 1.00 - December 5, 2002

First release.

Version 1.01 - February 13, 2003

Added support for RDS Modules

Increased DOUT Channels to 64 to support 8 RDS Modules.

Added error checking for USB on startup.

Version 1.02 - March 21, 2003

Improved USB error tolerance

Corrected " No ID Read " error in some computers

Corrected Local Sign on errors

No changes in commands or configuration variables.

Version 1.03 - Not Released

Version 1.04 - April 11, 2003

Added CLOSE Command to close scanxxx.dat file. Valid only when CONOUT is set to 3.

Added support to write Binary Data to Local Hard Disk.

Version 1.05 - May 2003

Enabled Immediate Scan when SCANTRIG is set to 1

Corrected bug in the Scan Function when ADTRIG set to 1

Corrected bug in DOUT settings when Scan Function is exited

Deleted Digital Input Variables DINCALZ, DINPG, DINSCAN, DINSTRIG.

Version 2.00 - February 2004

Software modified to support a new USB driver

VID - 0BD7

PID - A020

Authorization Key - 5484A968A36F1FF4

APAUSB.SYS

APAUSB2K.INF

APAUSBPROP.DLL

Added Tag bit function - ADTRIG option 2

Added No QUEUE option

Added support for DSA3216 Enclosure

TWOAD

Added Scan Recovery Options

RESCAN

Added A/D Correction for Non-Temperature Compensated A/D Modules

A2DCAL

A2DCALC

LIST A2DCOR

Added A/D Correction for Temperature Compensated A/D Modules
A2DTCAL
A2DTCALC
LIST A2DTCOR
Added Temperature Gradient Compensation
TGRAD
Added A/D Module Temperature Polling
TEMPPOLL
Added Error and Event Log File
ERRLOG.TXT

Version 2.01 - released February 2004

Corrected a bug in the RESTART Command
Eliminated a possible duplication of the SET CHANNEL assignments in Scan Group 1
Added an Error output if A/D correction values are not valid when A2DCOR is enabled

Version 2.02 - Released February 2004

Added a TCP/IP function to prevent data loss when transferring large amounts of TCP/IP data.

Version 2.03 - Released February 2004

Corrected a bug in the Analog to Digital Correction function when TWOAD is set to 1.

Version 2.04 - Released March 2004

Corrected a channel alignment problem in CAL, CALINS and CALZ commands when in the TWOAD mode.

Version 2.05 - Not Released

Version 2.06

Repaired a bug in the RESTART Command to re-initialize the RAD.hex file without crashing the program.
Added support for DSM RTD values from MPF files (DSM Temp A/D's have lower gain than RAD A/D's)
Added support for ID Chip information in Enclosure mode of Operation
Added support for the Temperature Gradient Calculation
Added BankA, BankB, and BankUsr Commands to the Digital group
Revised the A2DTCALC algorithm
Restored Support for CALCMD and AUXCMD Commands
Improved the response time of the LIST SYS Command - ID chips are not polled if the U option is not used.
Added Temperature ID chip selection for the RADBASE
Changed default of CurrentA2DT from 0.0 to 35
Fixed a bug in the CALCMD Command
Corrected an A/D temperature coefficient mapping error when in the enclosure mode.
Corrected a RTD mapping error when in the enclosure mode.

Version 3.00

Changed RAD.exe to use blocking threads on input to yield processor time back to Windows.
Switched to the Windows default TCP/IP socket buffer
Increased the maximum setting of FM to 20.
Added the command: DELETEDLOGFILE.
Added test for Error Log file size greater than 5242880

Version 3.01 - Released February 2005

Removed the GETFILE command
Added DOUTPU command
Added a limit check to the Scan Group Average Variables
Corrected a bug in the external trigger
Corrected a bug in the TRIG command
Corrected a bug in STARTCALZ

Version 3.02 - Released March 2005

Added ID chip support of EIM Voltage Scanners

Version 2.10 - Released May 2005

Reverted back to the non-blocking thread version to improve stability and data transfers. The command and configuration variables in this version are identical to v3.02.

Version 5.01 - Released February 2007

Rewrote RAD.exe to run as a service in Windows XP instead of an application.
Removed Commands: DIN
Added Commands: LIST P ALL, CALZ ALL, SCAN ALL, STOP ALL, LOGIN, LOGOUT,
Removed Variables: CONOUT, FM, QPKTS, HAVENET, NETIN, TROAD
Added Variables: FILEOUT, FILEPREFIX,
Password protect Commands: LIST ID, LIST IDP, IDPWRITE, RESTORE, A2DCAL, A2DTCAL,
A2DCALC, A2DTCALC, LIST A2DCOR, LIST A2DTCOR
Password protect Variables: A2DCOR, IDP

Version 5.02 - Released May 2007

Corrected a bug in the averaging

Version 5.03 - Not Released

Version 5.04 - Released August 2007

Corrected a bug in the TEMPPOLL function
Removed RESTART and RELOAD commands

Version 5.05 - Released September 2007

Corrected a bug in the ID chip polling

Version 5.06 - Released October 2007

Corrected a bug in the Scan All Command
Added support for Legacy Rad modules at bootup

Version 5.07 - Released January 2008

Corrected problem with DOUTPU.
Write points to event log during fill.
Use 0 C master point below 0C.

Version 5.08 - Released October 2008

Corrected a bug in the Digital Outputs

Added support for "legacy" RAD and ZOC modules - without ID chips

Added "Fast Scan" mode to scan 16 channel blocks in ZOC22 and ZOC33 modules.

Version 5.09 - Not Released

Version 5.10 - Released May 2009

Modified data stored in files saved under the SAVE <file> command

Modified data stored in the EVENTLOG.txt file to minimize file size

Improved support of "legacy" RAD and ZOC modules

Added error output pattern to the DOUTSCAN variable - Pattern will be set if data from any module exceeds or equals ± 32767 A/D counts when EU is set to 0

Added error output pattern to the DOUTSCAN variable - Pattern will be set if data from any module sets MAXEU or MINEU when EU is set to 1

Added SET SNx command to the Advanced commands (Password Protected)

CALPER is now fixed at the value set in PERIOD

CALAVG is fixed at 32

Version 5.11 - Released April 2011

Added a gain code of 2 for special A/D modules

Corrected a timing problem that caused A/D #2 to always indicate 1.00 degree C after a TGRAD