MODEL SC Serial Communications Guide
Sensotec Part Number: 008-0385-00
Rev. B: AUGUST, 1995

Copyright Notice:
Copyright © 1995 by SENSOTEC, INC.
2080 Arlingate Lane
Columbus, Ohio 43228
U.S.A.
All rights Reserved.
Printed in U.S.A.

TEL (614) 850-5000
FAX (614) 850-1111
1-800-848-6564
# Table Of Contents

## CHAPTER 1 - Introduction
1.1 Guide Organization.............................................1-1

## CHAPTER 2 - Command Format
2.1 Baud Rate, Bits and Parity........................................2-1
2.2 Differences Between Instruments.................................2-2
2.3 Special Order Instruments.........................................2-2
2.4 Two Types of Commands...........................................2-2
2.5 Addressing..........................................................2-3
2.6 Command Format...................................................2-3
2.7 Response Format....................................................2-6

## CHAPTER 3 - RS-232 Installation Notes
3.1 Introduction.......................................................3-1
3.2 Function of Pins..................................................3-1
3.3 Operation Notes...................................................3-2
3.4 Typical Wiring Diagrams..........................................3-4

## CHAPTER 4 -- RS-422/485 Installation Notes
4.1 Introduction.......................................................4-1
4.2 Installation Overview.............................................4-1
4.3 Function of Pins..................................................4-2
4.4 RS-422 Wiring.....................................................4-2
4.5 Black Box PC/At Card Wiring....................................4-3
4.6 RS-485 Wiring.....................................................4-4
4.7 Addressing........................................................4-5
4.8 Operation Notes...................................................4-6

## CHAPTER 5 -- Applications Programs
5.1 Introduction.......................................................5-1
5.2 Sample Turbo C Program.........................................5-1
5.3 Sample QBasic Programs.........................................5-4
5.4 Hints for Procomm Plus for DOS...............................5-6
5.5 Hints for Windows 3.1 Terminal.................................5-6
Table Of Contents

CHAPTER 6 -- System Commands
6.1  F0 Transmit Front Panel Display................................. 6-2
6.2  F1 Display Receive Characters...................................... 6-3
6.3  FL Transmit Readings.................................................. 6-4
6.4  W1 Write Baud Rate.................................................... 6-5
6.5  W2 Write Automatic Line Setting................................. 6-6
6.6  W4 Write Instrument Address....................................... 6-7
6.7  W9 Write System Excitation......................................... 6-8
6.8  WA Write Setpoints for Limits 1-4............................... 6-9
6.9  WB Write Return point for Open-collector Limits .........6-10
6.10 WC Write Operation Byte for Limits 1-4....................... 6-11
6.11 RC Read Operation Byte for Limits 1-4......................... 6-11
6.12 WL Write Multiple Reading Setup............................... 6-14
6.13 RL Read Multiple Reading Setup................................. 6-14
6.14 RS Read Software Revision........................................ 6-15
6.14 WS Write System Display Source................................. 6-16
6.15 RS Read System Display Source.................................... 6-16

CHAPTER 7 -- Strain Gage Channel Commands
7.1  F0 Transmit Track Data.............................................. 7-2
7.2  F1 Active Tare......................................................... 7-3
7.3  F2 Clear Tare........................................................... 7-4
7.4  F3 Calibrate Analog-to-Digital Converter....................... 7-5
7.5  F5 Apply Shunt Resistor and Transmit Reading.............. 7-6
7.6  F9 Transmit Stored Peak Reading................................. 7-7
7.7  FA Transmit Stored Valley Reading............................... 7-8
7.8  FB Clear Stored Peak and Valley................................. 7-9
7.9  FE Transmit Serial Number of Transducer..................... 7-10
7.10 FH Write DAC Manual Control Value............................. 7-11
7.11  W5 Write Full Scale Value......................................... 7-12
7.12  W6 Write Engineering Units....................................... 7-13
7.13  W7 Write Full Scale mV/V Value.................................. 7-14
7.14  R5 Read Full Scale Value........................................... 7-12
7.15  R6 Read Engineering Units......................................... 7-13
7.16  R7 Read Full Scale mV/V Value.................................. 7-14
Table Of Contents

7.14 W8 Write Shunt Calibration Value.......................... 7-15
    R8 Read Shunt Calibration Value.......................... 7-15
7.15 WK Write Known Load Calibration Values.................. 7-16
    RK Read Known Load Calibration Values................. 7-16
7.16 WM Write Digital-to-Analog Converter Source.......... 7-17
    RM Read Digital-to-Analog Converter Source.......... 7-17
7.17 WN Write Digital-to-Analog Converter Zero Scale..... 7-18
    RN Read Digital-to-Analog Converter Zero Scale..... 7-18
7.18 WQ Write Digital-to-Analog Converter Full Scale...... 7-19
    RO Read Digital-to-Analog Converter Full Scale...... 7-19
7.19 WP Write Amplifier Operations Byte.................... 7-20
    RP Read Amplifier Operations Byte.................... 7-20
7.20 WQ Write Amplifier Display Settings Byte............ 7-21
    RQ Read Amplifier Display Settings Byte............. 7-21
7.21 WU Write Analog-to-Digital Converter Update Rate... 7-22
    RU Read Analog-to-Digital Converter Update Rate... 7-22

CHAPTER 8 -- Relay/DAC Channel Commands
8.1 FH Write DAC Manual Control Value........................... 8-2
     RM Read Digital-to-Analog Converter Source.......... 8-3
8.2 WN Write Digital-to-Analog Converter Zero Scale..... 8-4
     RN Read Digital-to-Analog Converter Zero Scale..... 8-4
8.4 WQ Write Digital-to-Analog Converter Full Scale..... 8-5
     RO Read Digital-to-Analog Converter Full Scale..... 8-5

CHAPTER 9 -- Split Display Channel Commands
9.1 WS Write Display Source.................................. 9-2
    RS Read Display Source................................ 9-2

CHAPTER 10 -- Math Channel Commands
10.1 F0 Transmit Track Data.................................. 10-2
    F9 Transmit Stored Peak Reading........................ 10-3
10.3 FA Transmit Stored Valley Reading..................... 10-4
10.4 FB Clear Stored Peak and Valley....................... 10-5
10.5 W6 Write Engineering Units............................ 10-6
    R6 Read Engineering Units............................. 10-6
10.6 WQ Write Display Settings Byte....................... 10-7
    RQ Read Display Settings Byte........................ 10-7
Table Of Contents

Chapter 11 -- Amplified Transducer Commands

11.1  F0 Transmit Track Data ........................................... 11-2
11.2  F1 Activate Tare .................................................... 11-3
11.3  F2 Clear Tare .......................................................... 11-4
11.4  F3 Calibrate Analog-to-Digital converter ..................... 11-5
11.5  F5 Apply Shunt Resistor and Transmit Reading ... 11-6
11.6  F9 Transmit Stored Peak Reading ......................... 11-7
11.7  FA Transmit Stored Valley Reading ......................... 11-8
11.8  FB Clear Stored Peak and Valley ............................ 11-9
11.9  FE Transmit Serial Number of Transducer ............... 11-10
11.10 FH Write DAC Manual Control Value ................... 11-11
11.11 W5 Write Full Scale Value ....................................... 11-12
      R5  Read Full Scale Value ..................................... 11-12
11.12 W6 Write Engineering Units ..................................... 11-13
      R6  Read Engineering Units .................................... 11-13
11.13 W7 Write Full Scale Input Range ............................. 11-14
      R7  Read Full Scale Input Range .............................. 11-14
11.14 W8 Write Shunt Calibration Value ......................... 11-15
      R8  Read Shunt Calibration Value ............................ 11-15
11.15 WK Write Known Load Calibration Values ................. 11-16
      RK  Read Known Load Calibration Values ................ 11-16
11.16 WM Write Digital-to-Analog Converter Source ......... 11-17
      RM  Read Digital-to-Analog Converter Source .......... 11-17
11.17 WN Write Digital-to-Analog Converter Zero
      Scale Value ....................................................... 11-18
      RN  Read Digital-to-Analog Converter Zero
      Scale Value ....................................................... 11-18
11.18 WO Write Digital-to-Analog Converter Full
      Scale Value ....................................................... 11-19
      RO  Read Digital-to-Analog Converter Full
      Scale Value ....................................................... 11-19
11.19 WP Write Amplifier Operations Byte .................... 11-20
      RP  Read Amplifier Operations Byte ....................... 11-20
11.20 WQ Write Amplifier Display Settings Byte ............. 11-21
      RQ  Read Amplifier Display Settings Byte ............... 11-21
11.21 WU Write Analog-to-Digital Converter
      Update Rate ....................................................... 11-22
      RU  Read Analog-to-Digital Converter
      Update Rate ....................................................... 11-23
Chapter 1

INTRODUCTION

The Serial Communications Guide contains information about the wiring and protocol used for serial communications by SENSOTEC’s SC series instruments. Nearly all of the SC’s features available via its front panel switches, indicators, display and rear panel connectors are also available through its serial communications interface. This guide is primarily intended for those SC users already familiar with RS-232 and RS-422/RS-485 serial communications interfaces and wish to use the SC remotely using them. If you are not familiar with serial communications terms such as "baud rate" and "ASCII character", you may wish to review the subject before using this guide.

The information and programs contained in this manual are believed to be correct, however no warranty is expressed or implied including fitness for a particular purpose. The capabilities of the VG are continuously being improved upon, and the information in this manual is subject to change without notice.

1.1 Guide Organization

Chapter 1, "Introduction," offers general information about the different types of hardware and software serial communications options available on SC series instruments.

Chapter 2, "Command Format," describes the software protocol used by the SC series instruments, which is the same for both RS-232 and RS-485 equipped SC instruments.
Chapter 3, "RS-232 Installation Notes," provides wiring examples and hardware information for those connecting RS-232 equipped SC's to an IBM-PC compatible computer's built-in serial port or other RS-232 host.

Chapter 4, "RS-422/RS-485 Installation Notes," provides wiring examples and hardware information for those connecting RS-485 equipped SC's to an IBM-PC compatible computer (with an additional RS-422/RS-485 interface) or other host.

Chapter 5, "Application Programs," includes the source code for simple communications programs for an IBM-PC compatible computer, which can be the start of your own program development. The source is given in both Turbo C and QuickBASIC languages. Also included are hints for communicating with an SC using Procomm Plus or the Microsoft Windows 3.1 Terminal.

Chapter 6, "System Commands," describes in detail the commands that affect the operation of the entire SC instrument.

Chapter 7, "Strain Gage Channel Commands," describes in detail the commands that affect the operation of a strain gage amplifier channel.

Chapter 8, "Relay/DAC Channel Commands," describes in detail the commands that affect the operation of an optional Relay/DAC (Digital-to-Analog converter) channel.

Chapter 9, "Split Display Channel Commands," describes in detail the commands that affect the operation
of an optional split display channel.

Chapter 10, "Mathematics Channel Commands," describes in detail the commands that affect the operation of an optional mathematics channel.

Chapter 11, “Amplified Transducer Channel Commands,” describes in detail the commands that affect the operation of an amplified transducer channel.
Chapter 2

COMMAND FORMAT

All SC instruments have a standard DB-25 type female connector which is used for both serial communications and other control functions. One of two communications hardware interfaces are available, RS-232 or RS-485. Instruments equipped with the RS-485 two-wire interface can also be used in an RS-422 four-wire type setup; thus this interface is sometimes called RS-422/RS-485. Regardless of the type of hardware interface used, the SC uses the same software command set, the general format of which is described in this chapter.

2.1 Baud Rate, Bits and Parity

SC Instruments always use 8 data bits, one start bit and one stop bit and no parity bits (often described as "N81") for serial communications. Baud rates of 300, 1200, 2400, 4800, or 9600 baud are available. As shipped from the factory, SC Instruments are set to communicate at 9600 baud. The baud rate can be viewed from the front panel but can only be changed over the serial communications link using the \texttt{w1} system command. For details on changing the baud rate, see the \texttt{w1} command in Chapter 6, "System Commands."
2.2 Differences between Instruments

The commands described in this guide may not be available on all versions of SC series instruments. For example, since the model SC100 does not have “limits” or “peak/valley” functions, commands relating to this functionality will not work with a model SC100 or model SC102. If a command is not available on such an instrument, it will be mentioned in the description for that command.

Likewise, if your instrument is not equipped with an optional Relay/DAC channel, commands relating to relays and DAC outputs will not work on your instrument.

2.3 Special Order Instruments

Special versions of the SC series instruments may use an expanded or reduced software command set. Additions or deletions to the commands described in this guide may be included with your instrument and supersede information found in this guide.

2.4 Two Types of Commands

Two types of commands are available to be sent to the SC, system commands and channel commands. System commands are commands that apply to the entire SC. For example, the SC has one serial communications port, so all commands that apply to serial communications are system commands.

Channel commands are those which affect the operation of only one particular channel. For example, if the full scale range of a transducer amplifier channel is altered, it applies only to a single channel of the SC and not the entire instrument.
2.5 Addressing

Every SC on the communications loop must have a unique two-character address. As shipped from the factory, every SC has an address of "00" (ASCII codes decimal 30, decimal 30). This address can only be viewed, not changed, from the front panel. An SC's address can only be changed over the serial communications link using the "W4" command. For details on addressing, see Chapter 3, "RS-232 Installation Notes" or Chapter 4, "RS-422/RS-485 Installation Notes", depending on your application.

2.6 Command Format

An example command is shown below:

```
#0002WO1.2^>
```

where:

```
#  is called the "come alive" character, which alerts all SC's that a command is being transmitted to them. This character is ASCII code decimal 35.

00  is the two-character address of the SC to be communicated with. Each character must be a number or an uppercase letter.

02  is used only for the channel commands. It is the two-numeric-ASCII-character channel number to which this command will apply. A channel number should not be used for system commands!
```
WO is the two-character command code to be executed. A list of the valid system command codes is given at the beginning of Chapter 5. A list of the valid standard and optional command codes is given in the remaining chapters.

1.2 is a value in the optional information field needed by commands that write data to the SC. The information field can contain up to 15 ASCII characters, including a decimal point, if needed.

^ represents the carriage return (ASCII code decimal 13) which indicates the end of the command.

For example, the system command string "#00W12", followed by a carriage return, will cause the SC addressed as "00" to process the "W1" command with an information input of "2". The W1 system command changes the baud rate to the number represented by "2", which is 2400 baud.

An example of an amplifier channel command string is "#0301F1". This command, followed by a carriage return, causes the SC addressed as "03" to process the "F1" command on channel "01". The "F1" command activates the tare function, and thus this command string activates the tare function for amplifier channel 01.
The first character of each two-character command code signifies if that command is a function command ("F"), a read operating parameter command ("R"), or a write operating parameter command ("W"). Read and write commands can be used instead of the front panel setup menus to configure the operation of the instrument. Function commands are used as an alternative to the front panel to gather data from the instrument or to cause it to perform an operation.

All characters received before the pound sign are ignored. Therefore, one or more SC instruments can share a single communications link with other "foreign instruments" (within the physical limits of the RS-232 or RS-422/RS-485 interface, of course) as long as the host or the "foreign instruments" do not use the "#" character.

When the "#" character is sent to an SC, the instrument enters its receive mode and will attempt to parse out the rest of the characters before the carriage return as a possible message. If the SC then does not receive a carriage return within 10 seconds of receiving the "#" character, the SC leaves its receive mode. Likewise, if you believe that any stray or garbled characters have been sent to a SC, sending the SC a carriage return will also cause the instrument to leave its receive mode.

If a garbled character is received by an SC, or if the character received has an ASCII value larger than 127, then the entire message sent is ignored.
2.7 Response Format

A SC instrument will give a response over the serial communications link for every valid and invalid command given that uses its unique two-character address. There are four types of responses used by an SC:

* "OK", which is sent after an SC has accepted the data presented with a write operating parameter ("W") command, or when a function ("F") command has been completed.

* "ERROR", which is sent when an SC has been asked to perform an invalid command, or when invalid information is given with a write operating parameter ("W") command.

* "N/A", which is sent when you are requesting information from the SC which is not applicable to its present setup. For example, requesting limit setup information from an SC100 will cause this message to be sent.

* a floating point number as the result of a read operating parameter ("R") or function ("F") command.

* other ASCII strings, such as serial numbers, dates, the front panel contents, etc.

To signal the end of a response, the SC will send a carriage-return (ASCII code decimal 13) if the Auto-Linefeed function is off, or a linefeed/carriage-return (ASCII codes decimal 10, decimal 13) when the Auto-Linefeed is on. The Auto-Linefeed status can be viewed from the front panel but can only be changed over the serial communications link using the "w2" system command. For details on changing the Auto-Linefeed status, see the "w2" command in Chapter 5, "System Commands."
3.1 Introduction

This chapter provides wiring examples and hardware information for RS-232 communication with the Model SC. "DTE" (Data Terminal Equipment) will be used to refer to the personal computer, programmable controller, terminal, data acquisition system, etc. to which the SC is connected.

3.2 Function of Pins

Although there are 25 pins on the SC's Microprocessor connector, only a few of these are used by the Model SC for RS-232 communication with your DTE. The remaining pins are used for limit ("alarm") outputs, remote tare, remote peak reset or other special functions. The table below lists the pins that are used for RS-232 by the SC.

<table>
<thead>
<tr>
<th>PIN</th>
<th>RS-232C FUNCTION</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>TXD</td>
<td>(input) Data to the SC from the DTE.</td>
</tr>
<tr>
<td>3</td>
<td>RXD</td>
<td>(output) Data from the SC to the DTE.</td>
</tr>
<tr>
<td>4</td>
<td>RTS</td>
<td>(internally connected to pin 5) Not used by SC.</td>
</tr>
<tr>
<td>5</td>
<td>CTS</td>
<td>(internally connected to pin 4) Not used by SC.</td>
</tr>
<tr>
<td>6</td>
<td>DSR</td>
<td>(output) &quot;Ready to accept commands&quot; signal from SC.</td>
</tr>
<tr>
<td>7</td>
<td>GND</td>
<td>(ground) Reference pin.</td>
</tr>
<tr>
<td>8</td>
<td>DCD</td>
<td>(output) Control signal (+5V) when SC is powered.</td>
</tr>
</tbody>
</table>
Pins 4 (Ready to Send) and pin 5 (Clear To Send) are not used by the SC but are internally connected in case the DTE (such as the IBM-PC) uses RTS/CTS-style hardware handshaking. Pin 8 (Data Carrier Detect) is also always at a high level in case the DTE (such as the IBM-PC) requires DCD to be high.

3.3 Operation Notes

If the DTE wishes to send a command to the SC, it should first wait for the DSR line (pin 6) to be high. Then, the DTE can send the SC a command string (which starts with the '#' character and ends in a Carriage Return). If a "#" character is sent without a Carriage Return, the SC will wait 10 seconds for the Carriage Return before resetting its internal communications buffer. If a garbled character is received by the SC, or if the character received has an ASCII value larger than 127, then the entire message is ignored.

If the address sent by the DTE matches the address of the SC and the command string is valid, then the SC pulls the DSR line low to indicate that it is busy processing the command string. After the SC has finished processing the command string, the SC will pull the DSR line high (to indicate that new commands will be accepted) and will send the response.

3.4 Typical Wiring Diagrams

Two example wiring diagrams are given in Figures 1 and 2 below. Figure 1 is used when the DTE has a 25-pin RS-232 serial port, and Figure 2 is used when the DTE has a 9-pin RS-232 serial port.
Figure 3-1: Wiring to 25-pin DTE
Model SC
DB-25 connector
DCE

Computer or Terminal
DB-9 connector
DTE

Figure 3-2: Wiring to 9-pin DTE
4.1 Introduction

This chapter provides wiring examples and hardware information for RS-422/RS-485 communication with the Model SC. "Bus master" will be used to refer to the personal computer, programmable controller, terminal, data acquisition system, etc. which is controlling SC instruments over the RS-422/RS-485 communications bus.

4.2 Installation Overview

Every SC on the communications bus must have a unique 2-character address. Before wiring multiple SC's into an RS-422/RS-485 communications bus, it is recommended that you read this document thoroughly and then follow the sequence given below to avoid problems during installation.

1) Determine if the bus master has an RS-422 interface or a RS-485 interface. Wire up one, and only one, SC to the communications loop according to the wiring diagrams in the figures.

2) Determine the address used by this SC (factory default is "00") by using the front panel setup menus. This procedure is explained in the "Addressing" section of this chapter. Use this address to establish communications with this SC.

3) Change this SC's address to another unique value, such as "01", using the "W4" command as explained in the "Addressing" section of this chapter.
4) Wire the next SC to the communications loop and repeat steps 2-4 until the last unit is on-line.

4.3 Function of Pins

Although there are 25 pins on the SC's Microprocessor connector, only a few of these are used by the Model SC for RS-422/RS-485 communication with your bus master. The remaining pins are used for limit ("alarm") outputs, remote tare, remote peak reset or other special functions. The table below lists the pins that are used for RS-422/RS-485 by the SC.

<table>
<thead>
<tr>
<th>PIN</th>
<th>RS-422 FUNCTION</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>Transmit A</td>
<td>(output+) Data from the SC to the bus master.</td>
</tr>
<tr>
<td>12</td>
<td>Transmit B</td>
<td>(output-) Data from the SC to the bus master.</td>
</tr>
<tr>
<td>25</td>
<td>Receive A</td>
<td>(input+) Data to the SC from the bus master.</td>
</tr>
<tr>
<td>24</td>
<td>Receive B</td>
<td>(input-) Data to the SC from the bus master.</td>
</tr>
</tbody>
</table>

4.4 RS-422 Wiring

RS-422 uses two pairs of wires to communicate between one bus master and up to 10 slave devices. It is a full-duplex system, i.e. the bus master can transmit and receive data from the slaves at the same time. Use the wiring diagram in Figure 4-1 when connecting SC instruments to a RS-422 bus.
4.5 Black Box PC/At Card Wiring

The instructions for Black Box's "PC 422/485 Serial Interface Card" (part number IC030) includes a misleading connector pinout. The standard designators "A" and "B" for "positive" and "negative" have been reversed. Use the wiring diagram given in Figure 4-2 when connecting SC instruments to this card. Many other distributors of industrial PC equipment provide PC/AT RS-422/RS-485 interface cards, and this does not constitute an endorsement by SENSOTEC of Black Box products.
4.6 RS-485 Wiring

An RS-485 balanced differential communications bus uses one or two pairs of wires to allow up to 32 devices to send and receive data. A two-wire RS-485 system is a half-duplex system, which means that no device can transmit and receive data at the same time, and that only one device can "drive" or "talk" on the bus at a time. An SC Instrument is configured as a two-wire RS-485 device when "Transmit A" (pin 13) is connected to "Receive A" (pin 25), and "Transmit B" (pin 12) and "Receive B" (pin 24) are connected together. Use the wiring diagram of Figure 4-1 for a four-wire RS-485 communications bus and use Figure 4-3 when connecting SC Instruments to a two-wire RS-485 communications bus.
4.7 Addressing

Every SC on the RS-422/RS-485 communications bus must have a unique 2-character address. Each SC as shipped from the factory has its address set at "00" (i.e. ASCII code 30 decimal, 30 decimal).

To determine what address an SC is using from the front panel:

1) Enter the setup menus by pressing <UP> and <CLEAR/DOWN> together. The display will read "SETUP" and then "LIMIT 1 MENU" (which is the top-most item on the setup menus).

2) Press and release <CLEAR/DOWN> until the display reads "SERIAL COM. MENU". Press <ENTER> to enter the SERIAL COM. menu.
3) The display will read "ADDRESS". Press <ENTER> and the display will show this SC's address, for example "ADDRESS 00". The address cannot be changed from the front panel, only from the serial port.

4) Press <EXIT> to exit the menus and restart the system.

To change the address of an SC:

1) Establish communication with the SC, using its present address. For example, if the SC's present address is '00", the command string "#00F0" followed by a carriage return will cause the SC to transmit the contents of the display. If the SC's response appears garbled, this may be caused by improper wiring, having two or more SC's on the bus with identical addresses, or having the bus master's baud rate not match that of the SC. SC's ship from the factory set at 9600 baud.

2) Use the "W4" command to change the SC's address. For example, if you wish to change the address of an SC from "00" to "01", send it the command string "#00W401" followed by a carriage return.
4.8 Operation Notes

The SC monitors the communications bus for a valid command string (which starts with the "#" character and ends in a Carriage Return). If a "#" character is sent without a Carriage Return, the SC will wait 10 seconds for the Carriage Return before resetting its internal communications buffer. If a garbled character is received by the SC, or if the character received has an ASCII value larger than 127, the entire message is ignored.

If the address sent by the bus master matches the address of the SC and the command string is valid, the SC will process that command.
Chapter 5

APPLICATION PROGRAMS

5.1 Introduction

Two program listings are included which implement a simple terminal program for communicating with Model SC instruments using an PC/AT computer. One program listing is written in BASIC and the other is written in C. These programs are intended to be starting places for your own custom programs. When the program is run, it will simply send the characters that you type on the keyboard out of the serial port and display any characters that are received on the screen.

Another BASIC program is provided which demonstrates how data can be read from an SC as often as possible by using the SC's Continuous Transmit function.

Also included are hints for communicating with an SC using Procomm Plus or the Microsoft Windows 3.1 Terminal.

5.2 Sample Turbo C Program

Listing 1 is a sample terminal program for Turbo C or Borland C. Be sure to change the "SETTINGS" definition to match the COM port and the baud rate that you are using to communicate with the SC. This program uses the polled serial communications routines found in every PC compatible ROM BIOS. This means that:
1) For RS-232 connections, make sure that the cable you are using matches one of the wiring diagrams from Chapter 3, "RS-232 Installation Notes" to fulfill the ROM BIOS' need for total hardware handshaking.

2) An internal RS-422/RS-485 card will satisfy the ROM BIOS routines need for handshaking itself. However, if you are using the PC's RS-232 port connected to an RS-422/RS-485 converter, carefully read the converter's manual to verify that the RS-232 handshaking pins are being used.

3) The ROM BIOS routines are slow, and characters may be lost by 8088 based PC's and XT's at 9600 baud. If you are using a PC or XT, or are running this program under Microsoft Windows or Quarterdeck's DESQView, you may wish to configure the SC with the \w command to use a slower baud rate.

To avoid these problems when programming in C, you may wish to use an interrupt-driven communications package such as "The Essential Communications Library" from South Mountain Software, 76 S. Orange Ave., Suite 3, South Orange, NJ, 07079. (201)762-6965. Other communication libraries for C are available, and this does not constitute as an endorsement of this product.
/* SCTERM.C Sample Turbo C terminal program to communicate to Senso-
 tec Model SC */
#include <bios.h>
#include <conio.h>
#define COMINIT 0
#define COMSEND 1
#define COMRECEIVE 2
#define COMSTATUS 3
/* Model SC always uses no parity, 8 data bits, 1 stop bit */
#define COM8DATA 0x03
#define COM1STOP 0x00
#define COMNOPARITY 0x00
/* Model SC available baud rates. Shipped from factory at 9600 baud */
#define COM300BAUD 0x40
#define COM600BAUD 0x60
#define COM1200BAUD 0x80
#define COM2400BAUD 0xa0
#define COM4800BAUD 0xc0
#define COM9600BAUD 0xe0
#define COM1 0
#define COM2 1
#define DATA_READY 0x100
#define TRUE 1
#define FALSE 0
#define SETTINGS ( COM9600BAUD | COM8DATA | COM1STOP | COMNOPARITY)

int main(void)
{
    int in, out, status, DONE = FALSE;
    bioscom(COMINIT, SETTINGS, COM1);
    printf("\r");
    printf("SCTERM-Sample C terminal program for the Model SC\n");
    printf("\nPress <ESC> to exit...\n");
    while (!DONE)
    {
        status = bioscom(COMSTATUS, 0, COM1);
        if (status & DATA_READY)
            if ((out = bioscom(COMRECEIVE, 0, COM1) & 0x7f) != 0)
            {
                outch(out);
            }
        if (kbhit())
            {
                if ((in = getch()) == '\x1b')
                    DONE = TRUE;
                bioscom(COMSEND, in, COM1);
            }
    }
    printf("\n\nSCTERM: done.\n");
    return 0;
}

Listing 1: Sample Turbo C Terminal Program
5.3 Sample QBasic Programs

Below are sample terminal programs for Microsoft QBasic or QuickBasic. Microsoft includes a copy of QBasic with every version of MS-DOS after 5.0. Be sure to change the "OPEN" statement to match the COM port and the baud rate that you are using to communicate with the SC. The QBasic communications routines will only work with COM1 or COM2.

The QBasic programs below cannot be used on an RS-485 two-wire bus. This is because QBasic does not assert and de-assert the RTS line between characters, and on most RS-422/RS-485 interface cards and converters the RTS line is used to control the output driver. The QBasic program can be used on a four-wire bus since having the PC continuously driving its Transmit lines will not prevent the PC from receiving characters on its Receive line.

Listing 2, the simple terminal program, reads characters from the computer's communications buffer one at a time.

REM SC TERM.BAS
REM Sample Microsoft QBasic or QuickBasic program to communicate to Sensotec Model SC.
REM
PRINT "SC TERM-Sample Microsoft QBasic program for Sensotec Model SC."
PRINT
REM The "CS0" turns off the checking of CTS handshaking.
OPEN "COM1:9600,N,8,1,CS0,TSB2048,RB2048" FOR RANDOM AS #1
PRINT "Press <ESC> to exit..."
DO WHILE done=0
  IF LOC(1) > 0 THEN in$=INPUT$(1, #1); PRINT in$;
  out$=INKEY$: IF LEN(out$) <> 0 THEN PRINT #1,out$;
  IF out$=CHR$(27) THEN done=1
LOOP
CLOSE #1
PRINT "SC_TERM: done."
END

Listing 2: Sample QBasic Terminal Program
Listing 3 shows how data can be read as often as possible when the SC has its Continuous Transmit feature enabled. Because the BASIC "LINE INPUT #" statement will not work when it receives a Line-Feed/Carriage Return combination, the SC's Automatic Line-Feed function must be disabled before using "LINE INPUT ".

The "WL" command as shown in listing 3 will print out the track readings from channels 1, 2, and 3 of a multi-channel SC. If your SC has less than 3 channels, make certain that you change the parameters of the "WL" command or the program will not work.

```
REM SC_CTRAN.BAS
REM Sample Microsoft QBASIC or QuickBASIC to demonstrate
REM the use of the continuous transmit function to read
REM data as quickly as possible from the Sensotec Model
REM SC.

PRINT "SC_CTRAN-Sample Microsoft QBASIC program for Model SC."

REM The "CS0" turns off the check for CTS handshaking
OPEN "COM2:9600, N, 8, 1, CS0, TB2048, RB2048" FOR RANDOM AS #1
PRINT #1, "#00W20" 'makes certain AUTO LINE_FEED function is off
LINE INPUT #1, in$ 'eats the response
PRINT #1, "#00W10203" 'multiple readings sends ch1.tk,ch2.tk,ch3.tk
LINE INPUT #1, in$ 'eats the response
PRINT #1, "#00W12" 'enable continuous transmit of multiple readings
LINE INPUT #1, in$ 'eats the response
PRINT "Press <ESC> to exit..."
DO WHILE done = 0
   LINE INPUT #1, in$ 'read response
   PRINT TIFF, in$
   out$ = INKEY$
   IF out$ = CHR$(27) THEN done = 1
LOOP

CLOSE #1
PRINT "SC_CTRAN: done."
END
```

Listing 3: Sample QBASIC Program for SC Continuous Transmit
5.4 Hints for Procomm Plus for DOS

Since SC series instruments do not use either "RTS/CTS" or "XON/XOFF" handshaking, you must change the standard Procomm Plus for DOS setup. To do this, enter the "Procomm Plus Setup Utility" by pressing <ALT-S>, then select "Terminal Options." Change both the "Soft flow ctrl (XON/XOFF)" and the "Hard flow control (RTS/CTS)" options to OFF.

5.5 Hints for Windows 3.1 Terminal

Since SC series instruments do not use either hardware or "XON/XOFF" flow control, you must change the communications settings of the Windows Terminal. To do this, select "Settings > Communications" and then change the screen to match the one shown below. Of course, the "Connector" and "Baud Rate" will change according your application.

![Communications Settings](image)

*Figure 5-1: Windows 3.1 Terminal Communications Settings*
Chapter 6

SYSTEM COMMANDS

Below is a list of system commands for SC series instruments. No channel number is required after the instrument address when sending these commands since they affect the operation of the entire SC instrument.

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>F0</td>
<td>Transmit whatever is on display</td>
</tr>
<tr>
<td>F1</td>
<td>Display received characters</td>
</tr>
<tr>
<td>FL</td>
<td>Transmit multiple readings</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Write Command</th>
<th>Read Command</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1</td>
<td></td>
<td>Serial communications baud rate</td>
</tr>
<tr>
<td>W2</td>
<td></td>
<td>Serial communications Automatic linefeed</td>
</tr>
<tr>
<td>W4</td>
<td></td>
<td>Serial communications address</td>
</tr>
<tr>
<td>W9</td>
<td>R9</td>
<td>Excitation setting</td>
</tr>
<tr>
<td>WA</td>
<td>RA</td>
<td>Limit setpoint values</td>
</tr>
<tr>
<td>WB</td>
<td>RB</td>
<td>Limit return point values</td>
</tr>
<tr>
<td>WC</td>
<td>RC</td>
<td>Limit operation values</td>
</tr>
<tr>
<td>WI</td>
<td></td>
<td>Continuous Transmit Setting</td>
</tr>
<tr>
<td>WL</td>
<td>RL</td>
<td>Multiple reading setup</td>
</tr>
<tr>
<td>WS</td>
<td>RS</td>
<td>System Display Source Information</td>
</tr>
</tbody>
</table>

Each command is described in this chapter.
6.1 \texttt{F0} Transmit Front Panel Display

\textbf{SYNOPSIS}

\texttt{F0} - \textit{Transmits the contents of the front panel display}

\textbf{DESCRIPTION}

The \texttt{F0} function transmits whatever reading is on the front panel.

\textbf{EXAMPLE}

\texttt{#00F0}

The above command, when followed by a carriage return, will cause the instrument addressed as "00" to transmit the contents of the front panel display. For example, if the presently displayed reading was the high point of channel 2, the transmission might look like this:

\texttt{2 HI 5670.5 LBS}

\textbf{WHEN TO USE IT}

This function is usually used to verify that communications with the SC have been established. You would normally want to read a particular channel's information regardless of which channel a person walking by the SC happened to have set the front panel to monitor. To read a particular channel's data, use the \texttt{F0, F9, or FA} commands described in Chapter 7, "Strain Gage Channel Commands".
6.2 \textbf{FI} Display Received Characters

\textbf{SYNOPSIS}

\texttt{FI(text)} - Displays \texttt{text} for about 3 seconds

\textbf{DESCRIPTION}

The \texttt{FI} function will take the character string provided in the \textit{information field} and display it on the front panel in place of the existing display. Lower case characters in the string are displayed as upper case characters.

The selected character string is displayed for about 3 seconds. During this time the instrument is completely "frozen", i.e. no transducers, front or rear panel inputs will be processed. After this time has elapsed, the instrument will return to normal operation.

The SC will acknowledge the command by responding with "OK".

\textbf{EXAMPLE}

\texttt{#00FIHELLO WORLD}

The above command, when followed by a carriage return, will cause the instrument addressed as "00" to display the string "HELLO WORLD" for about three seconds.

\textbf{WHEN TO USE IT}

This function is usually used to verify that serial communications to the SC have been established. For RS-232 equipped instruments, this test insures that the "GND" and "TXD" pins from the master terminal or computer are connected properly.

To verify that serial communications from the SC is working, use the front panel SETUP menus to access the "SERIAL COM" menu, then select the "TRANSMIT TEST" menu item. This will cause the SC to immediately transmit the message "ADDRESS nn TEST" where "nn" is the SC's address. For RS-232 instruments, this insures that the "GND" and "RXD" pins to the master terminal or computer are connected properly. Please see the instrument User's Guide "SERIAL COM Menu" section for further information.
6.3 FL Transmit Multiple Readings

SYNOPSIS

\textit{FL} - Transmits a set of multiple readings, as defined by the \textit{WL} command

DESCRIPTION

The \textit{FL} function will transmit the user defined set of multiple readings as entered by the \textit{WL} command. Up to 8 readings from any channel and source can be simultaneously transmitted with the \textit{FL} Multiple Reading function. Each reading is separated by a comma (ASCII code decimal 44). All of the transmitted readings are the most recent ones available from each channel in the SC instrument. The format of each transmitted reading is the one that would be used to display the reading on the front panel.

Because some types of channels do not acquire or calculate data of their own, the data read from these channels will be "0". Examples of these channel types include the Relay/DAC Channel and the Split Display Channel.

Please see the system command "\textit{WL}" (Write Continous Transmit Settings) for information on how you can obtain your desired data from the SC as quickly as possible.

EXAMPLE

Suppose that the \textit{WL} command has been previously used as shown:

\[
\#00WL01110212
\]

Next, the following command, terminated by a carriage return, is sent to the SC:

\[
\#00FL
\]

The SC might respond with a message that looks like this:

\[-0001.2, 0051.3, 000.05, 100.31\]

Which means that ".1.2" and "51.3" are the most recent track and peak data points available from channel 1, and ".05" and "100.31" are the most recent track and peak data points available from channel 2.

WHEN TO USE IT

You would use this function command to gather data from more than one channel inside the SC at the same time.

This function can only be used after it has been setup with the \textit{WL} (Write Multiple Reading Setup) command.
6.4  **W1 Write Baud Rate**

**SYNOPSIS**

W1{baud rate information from table below}

**DESCRIPTION**

The W1 command changes the system baud rate used for serial communications according to the numeric value in the information field. After using this command, you would normally change the host's baud rate to match that of the instrument so that communications will be maintained. A list of the available baud rates and the corresponding value to be placed in the information field is given below.

<table>
<thead>
<tr>
<th>information</th>
<th>baud rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>9600</td>
</tr>
<tr>
<td>4</td>
<td>4800</td>
</tr>
<tr>
<td>3</td>
<td>2400</td>
</tr>
<tr>
<td>2</td>
<td>1200</td>
</tr>
<tr>
<td>1</td>
<td>600</td>
</tr>
<tr>
<td>0</td>
<td>300</td>
</tr>
</tbody>
</table>

The SC will acknowledge the command by responding with "OK" before the SC changes to the new baud rate.

To check which two-character address is being used by an SC instrument from the front panel, the setup menus may be used as follows:

1) Enter the setup menus by pressing <UP> and <CLEAR/DOWN> together. The display will read "SETUP" and then "LIMIT 1 MENU" (which is the top-most item on the setup menus).
2) Press and release <CLEAR/DOWN> until the display reads "SERIAL". Press <ENTER> to enter the SERIAL menu.
3) The display will read "BAUD RATE". Press <ENTER> and the display will show the baud rate, for example "9600". The baud rate cannot be changed from the front panel, only from the serial port with the W1 command.
4) Press <EXIT> to leave the setup menus and re-start the instrument.

**EXAMPLE**

#0W10

The above command, when followed by a carriage return, will cause the instrument addressed as "00" to use a baud rate of 300 for all subsequent serial communications.

**WHEN TO USE IT**

As shipped from the factory, SC instruments are set to communicate at 9600 baud. If the communications cable is very long (>100 feet), or if the host will not support this baud rate, the baud rate used by the SC must be changed.
6.5 **W2 Write Automatic Linefeed Setting**

**SYNOPSIS**

\[ W20 \] - Turns automatic linefeed off

\[ W21 \] - Turns automatic linefeed on

**DESCRIPTION**

The \[ W2 \] command toggles the automatic linefeed function on or off. If the first character in the information field is a 1, the automatic linefeed function is turned on. An ASCII linefeed character (decimal 10) will then be transmitted just before the carriage return that signifies the end of the instrument's response.

If the first character in the information field is a 0, the automatic linefeed function is turned off and messages from the instrument end with a carriage return. This is the default setting when the instrument is shipped from the factory.

The SC will acknowledge the command by responding with "OK".

To check the state of the SC's automatic linefeed function from the front panel, the setup menus may be used as follows:

1) Enter the setup menus by pressing <UP> and <CLEAR/DOWN> together. The display will read "SETUP" and then "LIMIT 1 MENU" (which is the topmost item on the setup menus).

2) Press and release <CLEAR/DOWN> until the display reads "SERIAL". Press <ENTER> to enter the SERIAL menu.

3) The display will read "AUTO LINE-FEED". Press <ENTER> and the display will show the baud rate, for example "ON". The automatic linefeed function cannot be toggled from the front panel, only from the serial port with the \[ W2 \] command.

4) Press <EXIT> to leave the setup menus and re-start the instrument.

**EXAMPLE**

\#00W21

The above command, when followed by a carriage return, will turn on the automatic linefeed for the instrument addressed as "00".

**WHEN TO USE IT**

If the SC is connected to a dumb terminal or to a printer, inserting a linefeed before the carriage return will make each message sent by the instrument appear on a separate line and thus be easier to read.
6.6 **W4 Write Instrument Address**

**SYNOPSIS**

W4{new two-character address}

**DESCRIPTION**

The **W4** changes the two-character address which identifies the instrument during serial communications. The *information field* holds the new address. Lower case letters are converted to upper case letters. A control character (ASCII values less that decimal 32) in the *information field* will cause the entire command to be ignored and the string "ERROR" to be sent out on the serial port.

The default address for SC instrument's as they are shipped from the factory is "00" (ASCII codes decimal 30, decimal 30).

The SC will acknowledge the command by responding with "OK".

To check which two-character address is being used by an SC instrument from the front panel, the setup menus may be used as follows:

1) Enter the setup menus by pressing <UP> and <CLEAR/DOWN> together. The display will read "SETUP" and then "LIMIT 1" (which is the top-most item on the setup menus).

2) Press and release <CLEAR/DOWN> until the display reads "SERIAL". Press <ENTER> to enter the SERIAL menu.

3) The display will read "ADDRESS". Press <ENTER> and the display will show this SC's address, for example "ADDRESS 00". The address cannot be changed from the front panel, only from the serial port with the **W4** command.

4) Press <EXIT> to leave the setup menus and re-start the instrument.

**EXAMPLE**

```
#00W4AA
```

The above command, when followed by a carriage return, will change the two-character address of the instrument addressed as "00" to "AA".

**WHEN TO USE IT**

When using only a single instrument with a host, changing the address is not necessary. On an RS-485 communications bus with multiple SC's, each SC instrument must have an unique address. As each SC is added one at a time to the communications bus, its address must be changed from the default of "00" to a unique address.
6.7 **W9 Write System Excitation**  
**R9 Read System Excitation**

**SYNOPSIS**

**W90** - *Change excitation voltage for all Strain Gage channels to 5 VDC*

**W91** - *Change excitation voltage for all Strain Gage channels to 10 VDC*

**R9** - *Read excitation voltage for all Strain Gage channels*

**DESCRIPTION**

The **W9** command toggles the system excitation voltage between 5 and 10 volts DC. If the first character in the *information field* is a 0, the system excitation voltage is set to 5 volts DC. If the first character in the *information field* is a 1, the system excitation voltage is set to 10 volts DC.

If any of the transducers attached to the SC are equipped with *Signature Calibration*, this value may be automatically changed when a transducer is connected to the SC.

The SC will acknowledge the write command by responding with "OK". The system excitation voltage can also be examined and changed from the front panel setup menus.

This command only affects excitation voltage of all Strain Gage channels. The excitation voltage for other types of channels (such as Amplified Transducer channels) is not affected.

The **R9** command will read the present excitation voltage.

**EXAMPLE**

```
#00W91
```

The above command, when followed by a carriage return, will change the system excitation voltage to 10 volts DC.

**WHEN TO USE IT**

The system excitation voltage is set automatically when using a transducer equipped with *Signature Calibration*. Also, the system excitation voltage is set at the factory if the instrument was purchased with a SENSOTEC transducer. This command is only needed if the instrument is being used with a transducer that was not purchased from SENSOTEC.
6.8 **WA** Write Setpoints for Limits 1-4

**RA** Read Setpoints for Limits 1-4

**SYNOPSIS**

*WA01(value)* - Change setpoint for limit 1 to \{value\}

*WA02(value)* - Change setpoint for limit 2 to \{value\}

*WA03(value)* - Change setpoint for limit 3 to \{value\}

*WA04(value)* - Change setpoint for limit 4 to \{value\}

*RA01* - Read setpoint for limit 1

*RA02* - Read setpoint for limit 2

*RA03* - Read setpoint for limit 3

*RA04* - Read setpoint for limit 4

**DESCRIPTION**

The **WA** command changes the setpoints for each of the four open-collector limit outputs on the SC's Microprocessor connector. The first character given in the *information field* is the number of the limit to change; the remaining characters are the value in the engineering units of the source channel for that particular limit. The source channel for a limit is selected, along with other limit parameters, with the **SC** command.

The return point for each limit may be changed with the **MB** command. For a complete explanation of limit parameters, please see the "Understanding Limits and Setpoints" in the instrument *User's Guide*.

The SC200 will acknowledge the write command by responding with "OK". An SC100 will ignore the write command and respond with "N/A". The limit setpoints can also be examined and changed from the front panel setup menus.

The **RA** command is used to read the limit setpoints. An SC100 will ignore the read command and respond with "N/A".

**EXAMPLE**

`#00WA01325.2`

The above command, when followed by a carriage return, will change the setpoint of open collector limit 1 to 325.2.

**WHEN TO USE IT**

Limit parameters may be set at any time according to your particular application.
6.9 **WB** Write Return point for Open-collector Limits 1-4

**RB** Read Return point for Open-collector Limits 1-4

**SYNOPSIS**

- **WB01{value}** - Change return point for limit 1 to `{value}`
- **WB02{value}** - Change return point for limit 2 to `{value}`
- **WB03{value}** - Change return point for limit 3 to `{value}`
- **WB04{value}** - Change return point for limit 4 to `{value}`

**RB01** - Read return point for limit 1

**RB02** - Read return point for limit 2

**RB03** - Read return point for limit 3

**DESCRIPTION**

The **RB** command changes the return point values for each of the four open-collector limit outputs on the SC's Microprocessor connector. The first two characters in the *information field* is the number of the limit to change; the remaining characters are the value in the engineering units of the source channel for that particular limit. The source channel for a limit is selected, along with other limit parameters, with the **XC** command.

The setpoint for each limit may be changed with the **WA** command. For a complete explanation of limit parameters, please see the "Understanding Limits and Setpoints" in the instrument User's Guide.

The SC will acknowledge the write command by responding with "OK". An SC100 will ignore the write command and respond with "N/A". The return points can also be examined and changed from the front panel setup menus.

The **RB** command is used to read the limit return point values. An SC100 will ignore the read command and respond with "N/A".

**EXAMPLE**

```
$00WB0415.5
```

The above command, when followed by a carriage return, will change the setpoint of open collector limit 4 to 15.5.

**WHEN TO USE IT**

Limit parameters may be set at any time according to your particular application.
6.10 **WC Write Operation Byte for Limits 1-4**  
**RC Read Operation Byte for Limits 1-4**

**SYNOPSIS**

- WC01\{value\} - Change operation byte of limit 1 to \{value\}
- WC02\{value\} - Change operation byte of limit 2 to \{value\}
- WC03\{value\} - Change operation byte of limit 3 to \{value\}
- WC04\{value\} - Change operation byte of limit 4 to \{value\}
- RC01 - Read operation byte of limit 1
- RC02 - Read operation byte of limit 2
- RC03 - Read operation byte of limit 3
- RC04 - Read operation byte of limit 4

**DESCRIPTION**

The WC command changes the manner of operation of the four open-collector limit outputs on the SC's Microprocessor connector. The decimal value given in the *information field* is created by adding together the values of the desired options according to the chart below. Only one value from each section may be selected.

<table>
<thead>
<tr>
<th>Enable</th>
<th>Source</th>
<th>Channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF = 0</td>
<td>TRACK = 0</td>
<td>CHANNEL1= 256</td>
</tr>
<tr>
<td>ON = 1</td>
<td>PEAK = 4</td>
<td>CHANNEL2= 512</td>
</tr>
<tr>
<td></td>
<td>VALLEY= 8</td>
<td>CHANNEL3= 768</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CHANNEL4= 1024</td>
</tr>
</tbody>
</table>

**Latching**

- Energize
  - OFF = 0 Signal<Setpoint=0: CHANNEL5= 1280 CHANNELE= 3584
  - ON = 2 Signal>Setpoint=16: CHANNEL6= 1536 CHANNELF= 3840

For a complete explanation of limit parameters, please see the "Understanding Limits and Setpoints" in the instrument *User's Guide*. The SC will acknowledge the write command by responding with "OK". The limit operation can also be examined and changed from the front panel setup menus. The RC command is used to read the limit operation byte. An SC100 will ignore the write and read commands and respond to them with "N/A".
EXAMPLE
It is desired to set open-collector limit 1 to operate in the following manner:

- Limit will monitor channel 1 = 256
- Source of limit is Track data = 0
- Enable the limit for operation = 1
- Do not latch limit after it energizes = 0
- Limit will energize above setpoint = 16

Total: 273

The command below, when followed by a carriage return, will change the operation of limit 1 as described above.

`#00WC01273`
6.11 **W1 Write Continuous Transmit Setting**

**SYNOPSIS**

**W10** - Turns off continuous transmission

**W11** - Turns on continuous transmission of front panel display

**W12** - Turns on continuous transmission of multiple readings

**DESCRIPTION**

The W1 command controls whether or not the SC will continuously transmit data.

If the first character in the information field is a "0", the SC will only transmit when requested. This is the default setting when the instrument is shipped from the factory.

If the first character in the information field is a "1", the SC will transmit the contents of the front panel display as often as possible. This is equivalent to sending the system command "F0" repeatedly. The SC will still respond to other commands normally.

If the first character in the information field is a "2", the SC will perform the "FL" Transmit Multiple Readings command as often as possible. This is equivalent to sending the system command "FL" repeatedly. The SC will still respond to other commands normally.

The SC will acknowledge the command by responding with "OK" or respond to errors with "ERROR".

The state of the SC's continuous transmit function cannot be checked from the front panel.

**EXAMPLE**

`#00W11`

The above command, when followed by a carriage return, will cause the instrument addressed as "00" to transmit the contents of the display as quickly as possible, one reading after another.

**WHEN TO USE IT**

If the SC is connected to a dumb terminal or to a printer, this you can have the SC transmit data automatically.

This command is the easiest way to ensure that you are obtaining data from the SC as quickly as possible.
6.12 **WL** Write Multiple Reading Setup  
**RL** Read Multiple Reading Setup  

**SYNOPSIS**

WL{setup} - Change response of FL Multiple Reading function according to {setup}

RL - Read Multiple Reading setup

**DESCRIPTION**

The **WL** command is used to change how the **FL** Multiple Reading function operates. Up to 8 readings from any channel and source can be simultaneously transmitted with the **FL** Multiple Reading function.

A list of up to 8 codes can be provided in the *information field*. Each code is made up of two characters. The first corresponds to the source and the second to the channel. A list of source and channel codes is given below.

<table>
<thead>
<tr>
<th>Source (first character)</th>
<th>Channel (second character)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRACK = 0</td>
<td>CHANNEL1= 1</td>
</tr>
<tr>
<td>PEAK = 1</td>
<td>CHANNEL2= 2</td>
</tr>
<tr>
<td>VALLEY = 2</td>
<td>CHANNEL3= 3</td>
</tr>
<tr>
<td></td>
<td>CHANNEL4= 4</td>
</tr>
<tr>
<td></td>
<td>CHANNEL5= 5</td>
</tr>
<tr>
<td></td>
<td>CHANNEL6= 6</td>
</tr>
<tr>
<td></td>
<td>CHANNEL7= 7</td>
</tr>
<tr>
<td></td>
<td>CHANNEL8= 8</td>
</tr>
<tr>
<td></td>
<td>CHANNEL9= 9</td>
</tr>
<tr>
<td></td>
<td>CHANNELA= A</td>
</tr>
<tr>
<td></td>
<td>CHANNELB= B</td>
</tr>
<tr>
<td></td>
<td>CHANNELC= C</td>
</tr>
<tr>
<td></td>
<td>CHANNELD= D</td>
</tr>
<tr>
<td></td>
<td>CHANNELE= E</td>
</tr>
<tr>
<td></td>
<td>CHANNELF= F</td>
</tr>
</tbody>
</table>

The SC will acknowledge the write command by responding with "OK". The Multiple Reading setup cannot be examined or changed from the front panel. An SC100 will ignore write commands that include a source of anything other than "track" and respond to them with "N/A".

The **RL** command is used to read the Multiple Readings setup.

**EXAMPLE**

It is desired to setup the Multiple Readings function, **FL**, to transmit the track, peak and valley of channel 3. The command to do this is:

```
#00WL031323
```
6.13 **RR** Read Software Revision

**SYNOPSIS**

*RR-* **Read software revision level**

**DESCRIPTION**

The **RR** command reads the instrument’s software part number and software revision level.

The front panel menus can also be used to examine the software revision level.

**EXAMPLE**

The command "*00RR*", when followed by a carriage return, produces a response similar to:

```
084-1204-00 1.0
```
6.14  **WS** Write System Display Source  
**RS** Read System Display Source

**SYNOPSIS**

**WS**(value) - Change system display source to {value}

**RS** - Read system display source

**DESCRIPTION**

The **WS** command changes which channel the SC's front panel display is monitoring. The decimal value given in the information field is created by adding together the values of the desired options according to the chart below. Only one value from each section may be selected.

<table>
<thead>
<tr>
<th>Source</th>
<th>Channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRACK = 0</td>
<td>CHANNEL1 = 1</td>
</tr>
<tr>
<td>PEAK = 16</td>
<td>CHANNEL2 = 2</td>
</tr>
<tr>
<td>VALLEY = 32</td>
<td>CHANNEL3 = 3</td>
</tr>
<tr>
<td></td>
<td>CHANNEL4 = 4</td>
</tr>
<tr>
<td></td>
<td>CHANNEL5 = 5</td>
</tr>
<tr>
<td></td>
<td>CHANNEL6 = 6</td>
</tr>
<tr>
<td></td>
<td>CHANNEL7 = 7</td>
</tr>
<tr>
<td></td>
<td>CHANNEL8 = 8</td>
</tr>
<tr>
<td></td>
<td>CHANNEL9 = 9</td>
</tr>
</tbody>
</table>

The SC will acknowledge the write command by responding with "OK". An SC100 will ignore a write command with a value larger than 15 and respond with "N/A".

To change the display source from the front panel, press the <UP> button. To change the display channel, press and release the <TEST> button.

The **RS** command is used to read the system display source.

**EXAMPLE**

It is desired to have the front panel display the peak data of channel 2.

\[
\begin{align*}
\text{Display will monitor channel} & = 2 \\
\text{Source of display is Peak data} & = 16 \\
\text{Total:} & = 18
\end{align*}
\]

The command below, when followed by a carriage return, will change the operation of the front panel display as described above.

```
#00WS18
```

---

6-16  **System Commands**
Chapter 7

STRAIN GAGE COMMANDS

Below is a list of standard strain gage channel commands for the SC series instruments. A channel number is required after the instrument address when sending these commands.

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>F0</td>
<td>Transmit track data</td>
</tr>
<tr>
<td>F1</td>
<td>Activate Tare</td>
</tr>
<tr>
<td>F2</td>
<td>Clear Tare</td>
</tr>
<tr>
<td>F3</td>
<td>Calibrate Analog-to-Digital Converter</td>
</tr>
<tr>
<td>F5</td>
<td>Apply Shunt Resistor and Transmit Reading</td>
</tr>
<tr>
<td>F9</td>
<td>Transmit Peak Reading</td>
</tr>
<tr>
<td>FA</td>
<td>Transmit Valley Reading</td>
</tr>
<tr>
<td>FB</td>
<td>Clear Stored Peak and Valley</td>
</tr>
<tr>
<td>FE</td>
<td>Transmit Transducer Serial Number</td>
</tr>
<tr>
<td>FH</td>
<td>Write DAC Manual Control Value</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Write Command</th>
<th>Read Command</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>W5</td>
<td>R5</td>
<td>Full Scale Value</td>
</tr>
<tr>
<td>W6</td>
<td>R6</td>
<td>Engineering Units</td>
</tr>
<tr>
<td>W7</td>
<td>R7</td>
<td>Full Scale millivolt/Volt</td>
</tr>
<tr>
<td>W8</td>
<td>R8</td>
<td>Shunt Calibration Value</td>
</tr>
<tr>
<td>WK</td>
<td>RK</td>
<td>Known load Calibration Values</td>
</tr>
<tr>
<td>WM</td>
<td>RM</td>
<td>DAC Source Info</td>
</tr>
<tr>
<td>WN</td>
<td>RN</td>
<td>DAC Zero Scale value</td>
</tr>
<tr>
<td>WO</td>
<td>RO</td>
<td>DAC Full Scale value</td>
</tr>
<tr>
<td>WP</td>
<td>RP</td>
<td>Amplifier Operations Byte</td>
</tr>
<tr>
<td>WQ</td>
<td>RQ</td>
<td>Channel Display Operations Byte</td>
</tr>
<tr>
<td>WU</td>
<td>RU</td>
<td>Analog-to-Digital Converter Update Rate</td>
</tr>
</tbody>
</table>

Each command is described in this chapter.
7.1 F0 Transmit Track Data

SYNOPSIS

{channel}F0 - Transmits track data for channel {channel}

DESCRIPTION

The F0 function transmits one data point from the tracking output of the specified channel. The amplifier channel is continuously reading the transducer and this function transmits the latest data point computed.

As described in Chapter 6, "System Commands", the F0 function is also a system command which causes the SC to transmit its display contents.

EXAMPLE

#0001F0

The above command, when followed by a carriage return, will cause the instrument addressed as "00" to transmit the track data from channel 1. For example,

5670.5 LBS
7.2 **F1 Activate Tare**

**SYNOPSIS**

 `{channel}F1 - Activates Tare operation on channel {channel}`

**DESCRIPTION**

The F1 function performs exactly the same operation as either pressing the <TARE> button on the front panel, or connecting the TARE rear panel control pin to the DGND pin. The Tare function forces the display to read zero and turns on the front panel TARE indicator light.

To deactivate the Tare function, you can 1) send the channel the F2 command, 2) press the <TARE> button on the front panel display when the channel is displayed, or 3) connect the CLEAR TARE rear panel control pin to DGND when the channel is displayed.

**EXAMPLE**

#0002F1

The above command, when followed by a carriage return, will cause the instrument addressed as "00" to activate the Tare function of channel 2 and force the track display to read zero.
7.3  **F2** Clear Tare

**SYNOPSIS**

\{(channel)\}F2 - Clears Tare operation on channel \{(channel)\}

**DESCRIPTION**

The **F2** function performs exactly the same operation as either pressing the
<TARE> button on the front panel, or connecting the CLEAR TARE rear panel
control pin to the DGND pin. Clearing the Tare function removes the offset which
was applied to the data when the Tare operation was activated, and turns off the
front panel TARE indicator light.

To activate the Tare function, you can 1) send the channel the **F1** command, 2)
press the <TARE> button on the front panel display when the channel is dis-
played, or 3) connect the TARE rear panel control pin to DGND when the channel
is displayed.

**EXAMPLE**

#0002F2

The above command, when followed by a carriage return, will cause the instru-
ment addressed as "00" to clear the Tare operation from channel 2 and remove
the offset from the track display.
7.4 \textbf{F}^3 Calibrate Analog-to-Digital Converter

\textbf{SYNOPSIS}

\{(channel)\textbf{F}^3\} - Calibrates the analog-to-digital (A/D) converter of channel
\{channel\}

\textbf{DESCRIPTION}

The \textbf{F}^3 function tells the analog-to-digital converter chip of the amplifier channel
to perform it's calibration. This removes the effects of temperature error on the
analog-to-digital converter's readings. Performing this command will also clear
the stored peak and valley data.

The A/D converter chip is also calibrated when the SC instrument is powered up,
and whenever the instrument performs the Auto-Check function.

\textbf{EXAMPLE}

\#0001F3

The above command, when followed by a carriage return, will cause the instru-
ment addressed as "00" to tell channel 1's analog-to-digital converter chip to per-
form a calibration.

\textbf{WHEN TO USE IT}

The A/D converter chip is calibrated whenever the instrument is powered up or
whenever the instrument performs an Auto-Check. You would only need to use
this command if you know that instrument experiences a large change in ambient
temperature with the Auto-Check feature turned off while the instrument is always
powered up.
7.5 **F5** Apply Shunt Resistor and Transmit Reading

**SYNOPSIS**

**(channel)**F5 - Applies the Shunt Resistor and transmits the reading for channel \((channel)\)

**DESCRIPTION**

The **F5** function applies the shunt resistor (usually 59,000 ohms for SENSOTECH transducers) on the amplifier channel to two transducer leads (usually +SIG and -SENSE for SENSOTECH transducers) and transmits the reading. The same result can be obtained by applying pressing and holding the <TEST> button while the channel is displayed.

**EXAMPLE**

#0001F5

The above command, when followed by a carriage return, will cause the instrument addressed as "00" to apply the shunt resistor to the transducer on channel 1 and transmit the reading.

**WHEN TO USE IT**

This can be used as quick check to verify that a strain gauge transducer is connected and operating properly.
7.6 **F9** Transmit Stored Peak Reading

**SYNOPSIS**

\( \text{(channel)} F^9 \text{ - Transmit peak reading of channel (channel)} \)

**DESCRIPTION**

The \( F^9 \) function transmits the stored peak value for a channel. The peak value is the highest reading for a channel since the unit was powered up, the channel's peak and valley were cleared, the Tare of that channel was activated, or the channel was recalibrated.

If the Fast Peak function is off, the peak reading is updated by doing a digital comparison of the track reading. Therefore, the selected update rate of the Analog-to-Digital converter chip determines the minimum pulse width of the peaks which can be captured. The \( \text{VF} \) command (q.v.) can be used to change the Analog-to-Digital converter update rate.

If the Fast Peak function is on, the peak is read from the analog peak detector to yield a faster response time (i.e. peaks with a smaller pulse width can be detected).

An SC100 will ignore this function command and respond with "N/A".

**EXAMPLE**

\( \#0002F9 \)

The above command, when followed by a carriage return, will cause the instrument addressed as "00" to transmit the peak reading for channel 2.
7.7 **FA** Transmit Stored Valley Reading

**SYNOPSIS**

\[(\text{channel})^{\text{FA}} - \text{Transmit valley reading of channel (channel)}\]

**DESCRIPTION**

The \text{FA} function transmits the stored valley value for a channel. The valley value is the lowest reading for a channel since the unit was powered up, the channel's peak and valley were cleared, the Tare of the that channel was activated, or the channel was recalibrated. The valley reading is updated by doing a digital comparison of the track reading. Therefore, the selected update rate of the Analog-to-Digital converter chip determines the minimum pulse width of the peaks which can be captured. The \text{NU} command (q.v.) can be used to change the Analog-to-Digital converter update rate.

An SC100 will ignore this function command and respond with "N/A".

**EXAMPLE**

\#0002\text{FA}

The above command, when followed by a carriage return, will cause the instrument addressed as "00" to transmit the valley reading for channel 2.
7.8  **FB**  Clear Stored Peak and Valley

**SYNOPSIS**

{channel}**FB** - Clear stored peak and valley data

**DESCRIPTION**

The **FB** function performs exactly the same operation as either pressing the <CLEAR> button on the front panel, or connecting the CLEAR PEAK rear panel control pin to the DGND pin. The peak and valley data are both set to the present track reading. If the Fast Peak option for this amplifier channel is turned on, the analog peak detector is reset to the lowest possible voltage which can be digitized by the analog-to-digital converter.

An SC100 will ignore this function command and respond with "N/A".

**EXAMPLE**

```
#0001FB
```

The above command, when followed by a carriage return, will cause the instrument addressed as "00" to clear the peak and valley data stored for channel 1.
7.9 \textbf{FE} Transmit Serial Number of Transducer

SYNOPSIS

\{(channel)\textbf{FE} - Transmits the serial number of the transducer on channel (channel)\}

DESCRIPTION

The \texttt{FE} function reads the serial number of the transducer from its Signature Module. If the transducer does not have Signature Calibration, the instrument will transmit "NONE".

There is no serial communications command to change the serial number data stored inside a transducer equipped with Signature Calibration. It can only be changed at the factory.

EXAMPLE

\texttt{#0003FE}

The above command, when followed by a carriage return, will cause the instrument addressed as "00" to transmit the serial number of the transducer with Signature Calibration connected to channel 3. For example:

301656

WHEN TO USE IT

The serial number of a transducer can be used to determine which transducer is connected to the SC remotely.
7.10 **FH** Write DAC Manual Control Value

**SYNOPSIS**

\{channel\}**FH**(value) - Forces the DAC on channel (channel) to manual control and to produce (value) fraction of its full scale signal.

\{channel\}**FH**AUTO - Forces the DAC back to its normal state of automatic control.

**DESCRIPTION**

The **FH** function will force a channel's Digital-to-Analog converter output at the rear connector of a channel to either manual or automatic control. When the SC instrument is powered up, every channel's Digital-to-Analog Converter is said to be on automatic control. That is, the DAC will produce a signal according to the channel, source, full-scale value and zero-scale value as entered from either the **MN**, **MN** or **NO** commands or as entered from the front panel SETUP menus.

After the **FH** command has been used with a value between -1 and +1 in its *information field*, the DAC is forced to manual control. That value is then used to drive the DAC. A value of -1 will cause the DAC to produce a minus full scale output, a value of 0 produces the zero-scale output (0 volts or 4mA), and a value of 1 produces a full-scale signal (5 volts or 20mA).

If the word **“AUTO”** is used in place of a value, the DAC is restored to automatic operation.

**EXAMPLE**

```
#0002FH .5
```

The above command, when followed by a carriage return, will cause channel 2's DAC to produce an analog signal halfway between the zero scale signal and the full scale signal. This could be +2.5 volts or optionally 12mA.

**WHEN TO USE IT**

You might wish to force a channel's DAC to a certain output in order to more easily calibrate the data system, meter, or other connected device.
7.11 **W5** Write Full Scale Value  
**R5** Read Full Scale Value

**SYNOPSIS**

 `(channel)W5(value) - Change full scale of amplifier channel (channel) to {value} engineering units`  
 `(channel)R5 - Read full scale value of amplifier channel (channel)`

**DESCRIPTION**

The `W5` command changes the full scale value for a given amplifier channel number. The numeric value given in the information field is in the engineering units for that amplifier channel.

If another transducer equipped with Signature Calibration is connected to this amplifier channel, this value may be automatically changed when the SC is powered-up or re-started. Likewise, this command does not change the value which is stored inside a transducer equipped with Signature Calibration. To copy the value in the amplifier channel to a transducer’s Signature Module, use the front panel menus to access the “UPDATE SIG. MOD.” menu item.

The SC will acknowledge the write command by responding with “OK”. The full scale value can also be examined and changed from the front panel setup menus. The `R5` command is used to read the full scale value.

**EXAMPLE**

The command below, when followed by a carriage return, will change the full scale value of amplifier channel 1 to 30.75.

```
#001W530.75
```

**WHEN TO USE IT**

The full scale value is set automatically when using a transducer equipped with Signature Calibration, or if the instrument was purchased with a SENSOTEC transducer. This command is only needed if the instrument is being used with a transducer that was not purchased from SENSOTEC, or a SENSOTEC transducer without Signature Calibration was purchased separately from the SC.
7.12 **W6** Write Engineering Units

**R6** Read Engineering Units

**SYNOPSIS**

\{(channel)\}W6\{text\} - Change 4 character engineering units label of amplifier channel \{channel\} to \{text\}

\{(channel)\}R6 - Read 4 character engineering units label of amplifier channel \{channel\}

**DESCRIPTION**

The **W6** command changes the 4-character engineering units label for a given amplifier channel number. The text given in the information field placed on the right side of the front panel display when this channel is selected for display. The text is also transmitted out of the serial port when the "R0" command is used.

This command does not mathematically scale anything. If less than 4 characters are entered, the remaining characters are filled with spaces (ASCII code decimal 32).

If another transducer equipped with *Signature Calibration* is connected to this amplifier channel, the text may be automatically changed when the SC is powered-up or re-started. Likewise, this command does not change the text which is stored inside a transducer equipped with *Signature Calibration*. To copy the text in the amplifier channel to a transducer's *Signature Module*, use the front panel menus to access the "UPDATE SIG. MOD." menu item.

The SC will acknowledge the write command by responding with "*OK*". The 4 characters of text can also be examined and changed from the front panel setup menus. The **R6** command is used to read the engineering units text.

**EXAMPLE**

The command below, when followed by a carriage return, will change the text that appears when this channel is displayed to "CATS".

```
#0001W6CATS
```

**WHEN TO USE IT**

The engineering units text is set automatically when using a transducer equipped with *Signature Calibration*, or if the instrument was purchased with a SENSOTEC transducer. This command is only needed if the instrument is being used with a transducer that was not purchased from SENSOTEC, or a SENSOTEC transducer without *Signature Calibration* was purchased separately from the SC.
7.13 \textbf{W7} Write Full Scale mV/V Value
\textbf{R7} Read Full Scale mV/V Value

\textbf{SYNOPSIS}

\{channel\} \textbf{W7} \{value\} - Change full scale value of amplifier channel \{channel\} to \{value\}

\{channel\} \textbf{R7} - Read full scale value of amplifier channel \{channel\}

\textbf{DESCRIPTION}

The \textbf{W7} command changes the full scale millivolt/volt value for a given amplifier channel number, which changes the gain of the amplifier circuit. The numeric value given in the \textit{information field} is in the units of millivolts/volt. This information is found on a transducer's calibration record as the "calibration factor."

If another transducer equipped with \textit{Signature Calibration} is connected to this amplifier channel, this value may be automatically changed when the SC is powered-up or re-started. Likewise, this command does not change the value which is stored inside a transducer equipped with \textit{Signature Calibration}. To copy the value in the amplifier channel to a transducer's \textit{Signature Module}, use the front panel menus to access the "UPDATE SIG. MOD." menu item.

The SC will acknowledge the write command by responding with "OK". The full scale value millivolt/volt value can also be examined and changed from the front panel setup menus. The \textbf{R7} command is used to read the full scale millivolt/volt value.

\textbf{EXAMPLE}

The command below, when followed by a carriage return, will change the full scale value of amplifier channel 1 to 3.75 mV/V.

\#0001W73.75

\textbf{WHEN TO USE IT}

The full scale millivolt/volt value is set automatically when using a transducer equipped with \textit{Signature Calibration}, or if the instrument was purchased with a SENSOTEC transducer. This command is only needed if the instrument is being used with a transducer that was not purchased from SENSOTEC.

This command changes the gain of the amplifier circuit to always maintain at least 20,000 A/D counts between 0 mV/V input and the given full-scale mV/V input (typically between 25,000 and 30,000). It also performs a calibration of the A/D converter.

---

7-14 Strain Gage Amplifier Channel Commands
7.14 **W8** Write Shunt Calibration Value

**R8** Read Shunt Calibration Value

**SYNOPSIS**

{channel}W8(value) - Change shunt calibration value of amplifier channel {channel} to {value} engineering units

{channel}R8 - Read full scale value of amplifier channel {channel}

**DESCRIPTION**

The **W8** command changes the shunt calibration value for a given amplifier channel number. The numeric value given in the information field is in the engineering units for that amplifier channel.

When the SC is calibrated to the transducer using the "Shunt Calibration Method", the internal shunt calibration resistor is connected across two transducer leads (-SIGNAL and -SENSE for SENSOTEC transducers) and the output of the transducer is scaled to this value.

If another transducer equipped with *Signature Calibration* is connected to this amplifier channel, this value may be automatically changed when the SC is powered-up or re-started. Likewise, this command does not change the value which is stored inside a transducer equipped with *Signature Calibration*. To copy the value in the amplifier channel to a transducer’s *Signature Module*, use the front panel menus to access the "UPDATE SIG. MOD." menu item.

The SC will acknowledge the write command by responding with "OK". The shunt calibration value can also be examined and changed from the front panel setup menus. The **R8** command is used to read the shunt calibration value.

**EXAMPLE**

The command below, when followed by a carriage return, will change the shunt calibration value of amplifier channel 1 to 750.12.

```
#0001W8750.12
```

**WHEN TO USE IT**

The shunt calibration value is set automatically when using a transducer equipped with *Signature Calibration*, or if the instrument was purchased with a SENSOTEC transducer. This command is only needed if the instrument is being used with a transducer that was not purchased from SENSOTEC.

This value is only used when calibrating with the "Shunt Calibration Method."
7.15 **WK** Write Known Load Calibration Values  
**RK** Read Known Load Calibration Values

**SYNOPSIS**

- `{channel}WK01{value}` - Change "known load pt 1" to `{value}`
- `{channel}WK02{value}` - Change "known load pt mid" to `{value}`
- `{channel}WK03{value}` - Change "known load pt 2" to `{value}`
- `{channel}RK01{value}` - Read "known load pt 1" calibration value
- `{channel}RK02{value}` - Read "known load pt mid" calibration value
- `{channel}RK03{value}` - Read "known load pt 2" calibration value

**DESCRIPTION**

The **WK** command changes the known load calibration values for a given amplifier channel number. The numeric value given in the *information field* is in the engineering units for that amplifier channel.

When the SC is calibrated to the transducer using the "Known Load 2 Point Method" or the "Known Load 3 Point Method", these are the values that the instrument asks for during calibration. The "known load pt mid" calibration value is not used by the "Known Load 2 Point Method."

If transducer equipped with *Signature Calibration* is connected to this amplifier channel after these values have been entered, these values do not change to reflect the different transducer.

The SC will acknowledge the write command by responding with "OK". The known load calibration values can also be examined and changed from the front panel setup menus. The **RK** command is used to read the known load calibration values.

**EXAMPLE**

The command below, when followed by a carriage return, will change the "known load pt 2" calibration value of amplifier channel 3 to 20000.

```
#0003WK0320000
```

**WHEN TO USE IT**

The known load calibration values must be changed to match the precision loads that you have available to calibrate your transducers. These values are not used by the "Shunt Calibration Method" or the "mV/V Calibration Method."
7.16 **WM** Write Digital-to-Analog Converter Source  
**RM** Read Digital-to-Analog Converter Source  

**SYNOPSIS**  
{channel}**WM**(value) - Change source used to drive DAC on channel {channel} to {value}  
{channel}**RM** - Read source used to drive DAC on channel {channel}  

**DESCRIPTION**  
The **WM** command changes which channel and source are used to drive the Digital-to-Analog output at the rear connector of a channel. The decimal value given in the *information field* is created by adding together the values of the desired options according to the chart below. Only one value from each section may be selected.  

<table>
<thead>
<tr>
<th>Source</th>
<th>Channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRACK = 0</td>
<td>CHANNEL1= 1</td>
</tr>
<tr>
<td>PEAK = 16</td>
<td>CHANNEL2= 2</td>
</tr>
<tr>
<td>VALLEY = 32</td>
<td>CHANNEL3= 3</td>
</tr>
<tr>
<td></td>
<td>CHANNEL4= 4</td>
</tr>
<tr>
<td></td>
<td>CHANNEL5= 5</td>
</tr>
<tr>
<td></td>
<td>CHANNEL6= 6</td>
</tr>
<tr>
<td></td>
<td>CHANNEL7= 7</td>
</tr>
<tr>
<td></td>
<td>CHANNEL8= 8</td>
</tr>
<tr>
<td></td>
<td>CHANNEL9= 9</td>
</tr>
</tbody>
</table>

The SC will acknowledge the write command by responding with "OK". An SC100 will ignore a write command with a value larger than 15 and respond with "N/A".  
DAC operation can also be examined and changed from the front panel setup menus.  
The **RM** command is used to read the DAC source information. The DAC’s zero scale value can be changed with the **WM** command, and the DAC’s full scale value can be changed with the **RM** command.  

**EXAMPLE**  
It is desired to have channel 2’s DAC output reflect the valley data of channel 1.  

\[
\begin{align*}
\text{Display will monitor channel 1} & = 1 \\
\text{Source of display is Valley data} & = 32 \\
\text{Total:} & = 33
\end{align*}
\]

The command below, when followed by a carriage return, will change the operation of channel 1’s DAC as described above.  

`#0001WM33`
7.17 **WN** Write Digital-to-Analog Converter Zero Scale Value

**RN** Read Digital-to-Analog Converter Zero Scale Value

**SYNOPSIS**

*(channel)*\text{\texttt{[\textnormal{value}]}* - Change to *\textnormal{value}* engineering units where DAC on channel *(channel)* produces zero scale analog output.

*(channel)*\text{\texttt{[\textnormal{value}]}}* - Reads zero scale value used by the DAC on channel *(channel)*

**DESCRIPTION**

The **WN** command changes the value for a given amplifier channel number that causes its Digital-to-Analog converter to produce its zero scale analog output. Unless otherwise specified by the customer, all instruments are shipped such that the DAC will produce 0V on the analog output at zero scale. Optional amplifier cards may produce 4mA at zero scale. The numeric value given in the *information field* is in the engineering units for the source channel which has been selected to drive the DAC.

The SC will acknowledge the write command by responding with "OK". The DAC’s zero scale value can also be examined and changed from the front panel setup menus. The **RN** command is used to read the zero scale value. The DAC’s full scale value can be changed with the **RO** command, and the channel and source used to drive the DAC can be changed using the **WN** command.

**EXAMPLE**

The command below, when followed by a carriage return, will cause the DAC on channel 1 to produce zero scale analog output when the source of the channel driving the DAC is 0.

```
#0001\text{\texttt{[\textnormal{W][N]}}}
```

**WHEN TO USE IT**

Digital-to-Analog converter parameters may be set at any time according to your particular application.
7.18  **WO** Write Digital-to-Analog Converter Full Scale Value

**RO** Read Digital-to-Analog Converter Full Scale Value

**SYNOPSIS**

\texttt{\{channel\}WO\{value\} - Change to \{value\} engineering units where DAC on channel \{channel\} produces full scale analog output.}

\texttt{\{channel\}RO\{value\} - Reads full scale value used by the DAC on channel \{channel\}}

**DESCRIPTION**

The **WO** command changes the value for a given amplifier channel number that causes its Digital-to-Analog converter to produce its full scale analog output. Unless otherwise specified by the customer, all instruments are shipped such that the DAC will produce +5V on the analog output at full scale. Optional amplifier cards may produce 20mA at full scale. The numeric value given in the *information field* is in the engineering units for the source channel which has been selected to drive the DAC.

The SC will acknowledge the write command by responding with "OK". The DAC's full scale value can also be examined and changed from the front panel setup menus. The **RO** command is used to read the full scale value. The DAC's zero scale value can be changed with the **WN** command, and the channel and source used to drive the DAC can be changed using the **WN** command.

**EXAMPLE**

The command below, when followed by a carriage return, will cause the DAC on channel 1 to produce full scale analog output when the source of the channel driving the DAC is 100.

\texttt{#0001WO100}

**WHEN TO USE IT**

Digital-to-Analog converter parameters may be set at any time according to your particular application.
7.19 WP Write Amplifier Operations Byte
RP Read Amplifier Operations Byte

SYNOPSIS

{channel}WP{value} - Change operation byte of amplifier channel {channel} to {value}

{channel}RP - Read operation byte of amplifier channel {channel}

DESCRIPTION

The WP command changes the manner of operation of an amplifier channel. The decimal value given in the information field is created by adding together the values of the desired options according to the chart below. Only one value from each section may be selected.

<table>
<thead>
<tr>
<th>Fast Peak</th>
<th>Auto-Zero</th>
<th>Auto-Check</th>
<th>Power-On Cal.</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF = 0</td>
<td>OFF = 0</td>
<td>OFF = 0</td>
<td>OFF = 0</td>
</tr>
<tr>
<td>ON = 1</td>
<td>ON = 2</td>
<td>ON = 4</td>
<td>ON = 8</td>
</tr>
</tbody>
</table>

The SC will acknowledge the write command by responding with "OK". Amplifier operation can also be examined and changed from the front panel setup menus. The RP command is used to read the amplifier operation byte.

EXAMPLE

It is desired to set amplifier channel 2 to operate in the following manner:

- Fast Peak off = 0
- Auto-Zero on = 2
- Auto-Check off = 0
- Power-On Calibration on = 0
- Total: = 2

The command below, when followed by a carriage return, will change the operation of amplifier channel 2 as described above.

#0002WP2

WHEN TO USE IT

Amplifier operation information is not stored inside transducers equipped with Signature Calibration, and so you may need to change the amplifier operation according to your application.

---

7-20 Strain Gage Amplifier Channel Commands
7.20 \textbf{WQ} Write Amplifier Display Settings Byte
\textbf{RQ} Read Amplifier Display Settings Byte

\textbf{SYNOPSIS}

\{(channel)WQ(value)\} - Change display settings byte of amplifier channel \{(channel)\} to \{value\}

\{(channel)RQ\} - Read display settings byte of amplifier channel \{(channel)\}

\textbf{DESCRIPTION}

The \textbf{WQ} command changes the way that values for an amplifier channel are formatted when they are sent out the serial port or displayed and entered on the front panel. The decimal value given in the \textit{information field} is created by adding together the values of the desired options according to the chart below. Only one value from each section may be selected.

<table>
<thead>
<tr>
<th>Digits after Decimal Point</th>
<th>Count-By (Dummy Digits)</th>
<th>Bi-polar or Unipolar</th>
<th>Track Display Averaging</th>
</tr>
</thead>
<tbody>
<tr>
<td>NONE</td>
<td>0</td>
<td>BIPLOAR = 0</td>
<td>OFF = 0</td>
</tr>
<tr>
<td>ONE</td>
<td>1</td>
<td>10 = 8</td>
<td>UNIPOLAR = 32</td>
</tr>
<tr>
<td>TWO</td>
<td>2</td>
<td>100 = 16</td>
<td></td>
</tr>
<tr>
<td>THREE</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FOUR</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FIVE</td>
<td>5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For a complete explanation of amplifier operation, please see the instrument \textit{USERS GUIDE}. The SC will acknowledge the write command by responding with "OK". The amplifier display settings can also be examined and changed from the front panel setup menus. The \textbf{RQ} command is used to read the amplifier display settings byte.

\textbf{EXAMPLE}

It is desired to set amplifier channel 3 to operate in the following manner:

\begin{align*}
\text{Two digits after decimal point} &= 2 \\
\text{One Dummy Digit} &= 1 \\
\text{Bi-polar Display} &= 0 \\
\text{Total:} &= 3
\end{align*}

The command below, when followed by a carriage return, will change the display setup for channel 3 as described above.

\texttt{#0003WQ3}

\textbf{WHEN TO USE IT}

Amplifier display settings are not stored inside transducers equipped with \textit{Signature Calibration}, and so you may need to change the display settings according to your application.
7.21 **WU** Write Analog-to-Digital Converter Update Rate  
**RU** Read Analog-to-Digital Converter Update Rate  

**SYNOPSIS**

*{channel} WU{value} - Change Analog-to-Digital converter update rate of amplifier channel* {channel} to {value} updates per second  
*{channel} RU - Read Analog-to-Digital converter update rate of {channel}*

**DESCRIPTION**
The *WU* command changes the Analog-to-Digital converter update rate for a given amplifier channel number. The numeric value given in the *information field* is the number of times per second that the A/D converter yields a digitized reading of the transducer. This value can be from 10 to 500; any other values may be accepted by the SC but might cause improper operation. The A/D converter's update rate, cutoff frequency, step input response, power line noise rejection ability and overall system accuracy are all related as shown in the table below for some typical A/D update rates.

<table>
<thead>
<tr>
<th>A/D converter update rate</th>
<th>A/D cutoff frequency (f_{3dB})</th>
<th>A/D step input response</th>
<th>maximum 60Hz rejection?</th>
<th>maximum 50Hz rejection?</th>
<th>accuracy of A/D conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 Hz</td>
<td>2.62 Hz</td>
<td>300 ms</td>
<td>yes</td>
<td>yes</td>
<td>.01%</td>
</tr>
<tr>
<td>15 Hz</td>
<td>3.93 Hz</td>
<td>200 ms</td>
<td>yes</td>
<td>yes</td>
<td>.01%</td>
</tr>
<tr>
<td>20 Hz</td>
<td>5.24 Hz</td>
<td>150 ms</td>
<td>yes</td>
<td>yes</td>
<td>.01%</td>
</tr>
<tr>
<td>30 Hz</td>
<td>7.86 Hz</td>
<td>100 ms</td>
<td>yes</td>
<td>no</td>
<td>.01%</td>
</tr>
<tr>
<td>50 Hz</td>
<td>13.09 Hz</td>
<td>60 ms</td>
<td>no</td>
<td>yes</td>
<td>.01%</td>
</tr>
<tr>
<td>60 Hz</td>
<td>15.70 Hz</td>
<td>50 ms</td>
<td>yes</td>
<td>no</td>
<td>.01%</td>
</tr>
<tr>
<td>100 Hz</td>
<td>26.24 Hz</td>
<td>30 ms</td>
<td>no</td>
<td>yes</td>
<td>.01%</td>
</tr>
<tr>
<td>120 Hz</td>
<td>31.39 Hz</td>
<td>25 ms</td>
<td>no</td>
<td>no</td>
<td>?</td>
</tr>
<tr>
<td>250 Hz</td>
<td>65.60 Hz</td>
<td>12 ms</td>
<td>no</td>
<td>no</td>
<td>?</td>
</tr>
<tr>
<td>500 Hz</td>
<td>131 Hz</td>
<td>6 ms</td>
<td>no</td>
<td>no</td>
<td>?</td>
</tr>
</tbody>
</table>

The "A/D converter update rate" is not necessarily equal to the update rate of the display, limits, or analog output. It is, however, the rate of valley detector operation as well as the rate of peak detector operation when the channel's "FAST PEAK" option is OFF. Please note that the accuracy of the A/D conversion decreases as the update is increased above 60 Hz.

---

7-22 Strain Gage Amplifier Channel Commands
After the new A/D update rate is sent to the SC, the A/D converter will be re-calibrated before the SC acknowledges the write command by responding with "OK". Slower update rates will cause longer A/D re-calibration times. For instance, it takes several seconds for the A/D to recalibrate itself when it set to update at 10Hz. The A/D converter update rate CANNOT be changed from the from panel. The RU command is used to read the A/D converter update rate.

EXAMPLE

The command below, when followed by a carriage return, will change the Analog-to-Digital converter update rate of amplifier channel 1 to 30 per second as well as recalibrate the A/D converter.

#0001WU30

WHEN TO USE IT

Because this command can decrease the overall accuracy of the instrument from its standard specifications, SENSOTEC recommends that this command not be used unless:

1) it is under the advice of SENSOTEC to allow us to better serve you in your particular application, or

2) you fully understand the ramifications of the information found in the above table.

The Analog-to-Digital converter is normally set at the factory to 60 updates per second. This allows for the maximum rejection of noise from the 60 Hz AC power lines found in North America. If you are using the SC instrument in Europe or other parts of the world that use 50 Hz AC power, you may wish to set the update rate to 50 times per second.
Chapter 8

RELAY/DAC COMMANDS

Below is a list of commands for the optional Relay/DAC channel for the SC series instruments. A channel number is required after the instrument address when sending these commands.

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FH</td>
<td>Write DAC Manual Control Value</td>
</tr>
<tr>
<td>FJ</td>
<td>Write Relay Manual Control Value</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Write Command</th>
<th>Read Command</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>WM</td>
<td>RM</td>
<td>DAC Source Info</td>
</tr>
<tr>
<td>WN</td>
<td>RN</td>
<td>DAC Zero Scale value</td>
</tr>
<tr>
<td>WO</td>
<td>RO</td>
<td>DAC Full Scale value</td>
</tr>
</tbody>
</table>

Each command is described in this chapter.
8.1 **FH** Write DAC Manual Control Value

**SYNOPSIS**

*(channel)*\texttt{FH}(value) - Forces the DAC on channel (channel) to manual control and to produce (value) fraction of its full scale signal.

*(channel)*\texttt{FAUTO} - Forces the DAC back to its normal state of automatic control.

**DESCRIPTION**

The \texttt{FH} function will force a channel's Digital-to-Analog converter output at the rear connector of a channel to either manual or automatic control. When the SC instrument is powered up, every channel's Digital-to-Analog Converter is said to be on automatic control. That is, the DAC will produce a signal according to the channel, source, full-scale value and zero-scale value as entered from either the IMM, KN or NO commands or the front panel SETUP menus.

After the \texttt{FH} command has been used with a value between -1 and +1 in its information field, the DAC is forced to manual control. That value is then used to drive the DAC. A value of -1 will cause the DAC to produce a minus full scale output, a value of 0 produces the zero-scale output (0 volts or 4mA), and a value of 1 produces a full-scale signal (5 volts or 20mA).

If the word "AUTO" is used in place of a value, the DAC is restored to automatic operation.

**EXAMPLES**

\begin{verbatim}
#0002FH .5
\end{verbatim}

The above command, when followed by a carriage return, will cause channel 2's DAC to produce an analog signal halfway between the zero scale signal and the full scale signal. This could be +2.5 volts or optionally 12mA.

\begin{verbatim}
#0002FAUTO
\end{verbatim}

The above command, when followed by a carriage return, will cause channel 2's DAC to return to normal power-up operation as entered from either the IMM, KN or NO commands or the front panel SETUP menus.

**WHEN TO USE IT**

You might wish to force a channel's DAC to a certain output in order to more easily calibrate the data system, meter, or other connected device.
8.2 **WM** Write Digital-to-Analog Converter Source

**RM** Read Digital-to-Analog Converter Source

**SYNOPSIS**

\{(channel)WM\{value\} - Change source used to drive DAC on channel \{channel\} to \{value\}\}

\{(channel)RS\ - Read source used to drive DAC on channel \{channel\}\}

**DESCRIPTION**

The **WM** command changes which channel and source is used to drive the Digital-to-Analog output at the rear connector of a channel. The decimal value given in the *information field* is created by adding together the values of the desired options according to the chart below. Only one value from each section may be selected.

<table>
<thead>
<tr>
<th>Source</th>
<th>Channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRACK = 0</td>
<td>CHANNEL1 = 1</td>
</tr>
<tr>
<td>PEAK = 16</td>
<td>CHANNEL2 = 2</td>
</tr>
<tr>
<td>VALLEY = 32</td>
<td>CHANNEL3 = 3</td>
</tr>
<tr>
<td></td>
<td>CHANNEL4 = 4</td>
</tr>
<tr>
<td></td>
<td>CHANNEL5 = 5</td>
</tr>
<tr>
<td></td>
<td>CHANNEL6 = 6</td>
</tr>
<tr>
<td></td>
<td>CHANNEL7 = 7</td>
</tr>
<tr>
<td></td>
<td>CHANNEL8 = 8</td>
</tr>
<tr>
<td></td>
<td>CHANNEL9 = 9</td>
</tr>
</tbody>
</table>

The SC will acknowledge the write command by responding with "OK". An SC100 will ignore a write command with a value larger than 15 and respond with "N/A".

DAC operation can also be examined and changed from the front panel setup menus.

The **RM** command is used to read the DAC source information. The DAC's zero scale value can be changed with the **WM** command, and the DAC's full scale value can be changed with the **R0** command.

**EXAMPLE**

It is desired to have channel 2's DAC output reflect the valley data of channel 1.

\[
\text{Display will monitor channel 1} = 1 \\
\text{Source of display is Valley data} = 32 \\
\text{Total:} = 33
\]

The command below, when followed by a carriage return, will change the operation of channel 1's DAC as described above.

```
#0001WM33
```
8.3 **WN** Write Digital-to-Analog Converter Zero Scale Value

**RN** Read Digital-to-Analog Converter Zero Scale Value

**SYNOPSIS**

\{channel\}WN\{value\} - Change to \{value\} engineering units where DAC on channel \{channel\} produces zero scale analog output.

\{channel\}RN\{value\} - Reads zero scale value used by the DAC on channel \{channel\}

**DESCRIPTION**

The WN command changes the value for a given amplifier channel number that causes its Digital-to-Analog converter to produce its zero-scale analog output. Unless otherwise specified by the customer, all instruments are shipped such that the DAC will produce 0V on the analog output at zero scale. Optional amplifier cards may produce 4mA at zero scale. The numeric value given in the information field is in the engineering units for the source channel which has been selected to drive the DAC.

The SC will acknowledge the write command by responding with "OK". The DAC's zero scale value can also be examined and changed from the front panel setup menus. The RN command is used to read the zero scale value. The DAC's full scale value can be changed with the WO command, and the channel and source used to drive the DAC can be changed using the RN command.

**EXAMPLE**

The command below, when followed by a carriage return, will cause the DAC on channel 1 to produce zero scale analog output when the source of the channel driving the DAC is 0.

#0001W00

**WHEN TO USE IT**

Digital-to-Analog converter parameters may be set at any time according to your particular application.
8.4 **WO** Write Digital-to-Analog Converter Full Scale Value

**RO** Read Digital-to-Analog Converter Full Scale Value

**SYNOPSIS**

{channel}WO(value) - Change to (value) engineering units where DAC on channel (channel) produces full scale analog output.

{channel}RO(value) - Reads full scale value used by the DAC on channel (channel)

**DESCRIPTION**

The **WO** command changes the value for a given amplifier channel number that causes its digital-to-analog converter (DAC) to produce its full scale analog output. Unless otherwise specified by the customer, all instruments are shipped such that the DAC will produce +5V on the analog output at full scale. Optional amplifier cards may produce 20mA at full scale. The numeric value given in the information field is in the engineering units for the source channel which has been selected to drive the DAC.

The SC will acknowledge the write command by responding with "ok". The DAC's full scale value can also be examined and changed from the front panel setup menus. The **RO** command is used to read the full scale value. The DAC's zero scale value can be changed with the **WZ** command, and the channel and source used to drive the DAC can be changed using the **WS** command.

**EXAMPLE**

The command below, when followed by a carriage return, will cause the DAC on channel 1 to produce full scale analog output when the source of the channel driving the DAC is 100.

```
#001WO100
```

**WHEN TO USE IT**

Digital-to-Analog converter parameters may be set at any time according to your particular application.
Chapter 9

SPLIT DISPLAY COMMANDS

Below is a list of commands for the optional split display channel for SC series instruments. A channel number is required after the instrument address when sending these commands.

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Write Command</th>
<th>Read Command</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>WS</td>
<td>RS</td>
<td>Source of Left or Right Display</td>
</tr>
</tbody>
</table>

Each command is described in this chapter.
9.1 WS Write Display Source
RS Read Display Source

SYNOPSIS

WS00{value} - Change left display source to {value}
WS01{value} - Change right display source to {value}
RS00- Read left display source
RS01- Read right display source

DESCRIPTION
The WS command changes which channel the left or right display is monitoring. The decimal value given in the information field is created by adding together the values of the desired options according to the chart below. Only one value from each section may be selected.

<table>
<thead>
<tr>
<th>Source</th>
<th>Channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRACK = 0</td>
<td>CHANNEL1 = 1</td>
</tr>
<tr>
<td>PEAK = 16</td>
<td>CHANNEL2 = 2</td>
</tr>
<tr>
<td>VALLEY = 32</td>
<td>CHANNEL3 = 3</td>
</tr>
<tr>
<td></td>
<td>CHANNEL4 = 4</td>
</tr>
<tr>
<td></td>
<td>CHANNEL5 = 5</td>
</tr>
<tr>
<td></td>
<td>CHANNEL6 = 6</td>
</tr>
<tr>
<td></td>
<td>CHANNEL7 = 7</td>
</tr>
<tr>
<td></td>
<td>CHANNEL8 = 8</td>
</tr>
<tr>
<td></td>
<td>CHANNEL9 = 9</td>
</tr>
<tr>
<td>CHANNELA = 10</td>
<td></td>
</tr>
<tr>
<td>CHANNELB = 11</td>
<td></td>
</tr>
<tr>
<td>CHANNELC = 12</td>
<td></td>
</tr>
<tr>
<td>CHANNELD = 13</td>
<td></td>
</tr>
<tr>
<td>CHANNELE = 14</td>
<td></td>
</tr>
<tr>
<td>CHANNELF = 15</td>
<td></td>
</tr>
</tbody>
</table>

The SC will acknowledge the write command by responding with "OK". An SC100 will ignore a write command with a value larger than 15 and respond with "N/A".

To change the display source from the front panel, use the SETUP menu for this channel.

The RS command is used to read the left or right display source.

EXAMPLE
It is desired to have the left half of the split display show the peak data of channel 4.

Display will monitor channel 4 = 4
Source of display is Peak data = 16
Total: 20

The command below, when followed by a carriage return, will change the operation of the left half of the split display on channel 3 as described above.

#0003WS20

9.2 Split Display Channel Commands
Chapter 10

MATH CHANNEL COMMANDS

Below is a list of commands for the optional mathematics channel for SC series instruments. A channel number is required after the instrument address when sending these commands.

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>F0</td>
<td>Transmit track data</td>
</tr>
<tr>
<td>F9</td>
<td>Transmit Peak Reading</td>
</tr>
<tr>
<td>FA</td>
<td>Transmit Valley Reading</td>
</tr>
<tr>
<td>FB</td>
<td>Clear Stored Peak and Valley</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Write Command</th>
<th>Read Command</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>W6</td>
<td>R6</td>
<td>Engineering Units</td>
</tr>
<tr>
<td>WQ</td>
<td>RQ</td>
<td>Channel Display Operations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Byte</td>
</tr>
</tbody>
</table>

Each command is described in this chapter.
10.1 \( F^0 \) Transmit Track Data

**SYNOPSIS**

\{channel\} \( F^0 \) - Transmits track data for channel \{channel\}

**DESCRIPTION**

The \( F^0 \) function transmits one data point from the mathematical output of the specified channel. The mathematics channel is continuously evaluating its mathematical expression and this function transmits the latest data point computed.

**EXAMPLE**

\#0005\( F^0 \)

The above command, when followed by a carriage return, will cause the instrument addressed as "00" to transmit the track data from channel 5. For example,

5670.5 LBS
10.2 **F9** Transmit Stored Peak Reading

**SYNOPSIS**

\( \text{(channel)F9} \ - \text{Transmit peak reading of channel \{channel\}} \)

**DESCRIPTION**

The **F9** function transmits the stored peak value for a channel. The peak value is the highest reading for a channel since the unit was powered up or the channel's peak and valley were cleared.

The peak reading is updated by doing a mathematical comparison of the track readings.

An SC100 will ignore this function command and respond with "N/A".

**EXAMPLE**

```
#0005F9
```

The above command, when followed by a carriage return, will cause the instrument addressed as "00" to transmit the peak reading for channel 5.
10.3  \textbf{FA} Transmit Stored Valley Reading

\textbf{SYNOPSIS}

\{channel\}FA - Transmit valley reading of channel \{channel\}

\textbf{DESCRIPTION}

The \textit{FA} function transmits the stored valley value for a channel. The valley value is the lowest reading for a channel since the unit was powered up or the channel's peak and valley were cleared.

The valley reading is updated by doing a mathematical comparison of the track readings.

An SC100 will ignore this function command and respond with "N/A".

\textbf{EXAMPLE}

\#0002FA

The above command, when followed by a carriage return, will cause the instrument addressed as "00" to transmit the valley reading for channel 2.
10.4 **FB Clear Stored Peak and Valley**

**SYNOPSIS**

*{channel}*FB - Clear stored peak and valley data

**DESCRIPTION**

The FB function performs exactly the same operation as either pressing the <CLEAR> button on the front panel or connecting the CLEAR PEAK rear panel control pin to the DGND pin. The peak and valley data are both set to the present track reading.

An SC100 will ignore this function command and respond with "N/A".

**EXAMPLE**

`#0005FB`

The above command, when followed by a carriage return, will cause the instrument addressed as "00" to clear the peak and valley data stored for channel 5.
10.5 \textbf{W6 Write Engineering Units}
\textbf{R6 Read Engineering Units}

\textbf{SYNOPSIS}

\{channel\}W6\{text\} - Change the 4-character engineering units label of mathematics channel \{channel\} to \{text\}

\{channel\}R6 - Reads the 4-character engineering units label of mathematics channel \{channel\}

\textbf{DESCRIPTION}

The \texttt{W6} command changes the 4-character engineering units label for a given channel number. The text given in the \texttt{information field} placed on the right side of the front panel display when this channel is selected for display. The text is also transmitted out of the serial port when the "\texttt{R0}" command is used.

This command does not mathematically scale anything; it merely changes the text that appears on the display. If less than 4 characters are entered, the remaining characters are filled with spaces (ASCII code decimal 32).

The SC will acknowledge the write command by responding with "\texttt{OK}". The 4 characters of text can also be examined and changed from the front panel setup menus. The \texttt{R6} command is used to read the engineering units text.

\textbf{EXAMPLE}

The command below, when followed by a carriage return, will change the text that appears when this channel is displayed to "SUM".

#0001W6SUM

\textbf{WHEN TO USE IT}

You may wish to change the units display of a mathematics channel to more easily identify what the math channel is doing. For example, if this mathematics channel sums other channels, you may wish to change the engineering units to "SUM" or "1+2".

10-6 Mathematics Channel Commands
10.6  **WQ Write Display Settings Byte**

**RQ Read Display Settings Byte**

**SYNOPSIS**

\{channel\}**WQ**\{value\} - Change display settings byte of channel \{channel\} to \{value\}

\{channel\}**RQ** - Read display settings byte of channel \{channel\}

**DESCRIPTION**

The **WQ** command changes the way that values for a mathematics channel are formatted when they are sent out the serial port or displayed on the front panel. The decimal value given in the information field is created by adding together the values of the desired options according to the chart below. Only one value from each section may be selected.

<table>
<thead>
<tr>
<th>Digits after Decimal Point</th>
<th>Count-By (Dummy Digits)</th>
<th>Bi-polar or Unipolar</th>
<th>Track Display Averaging</th>
</tr>
</thead>
<tbody>
<tr>
<td>NONE = 0</td>
<td>1 = 0</td>
<td>BIPLOAR = 0</td>
<td>OFF = 0</td>
</tr>
<tr>
<td>ONE = 1</td>
<td>10 = 8</td>
<td>UNIPOLAR = 32</td>
<td>ON = 64</td>
</tr>
<tr>
<td>TWO = 2</td>
<td>100 = 16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>THREE = 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FOUR = 4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FIVE = 5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The SC will acknowledge the write command by responding with "ok". The display settings can also be examined and changed from the front panel setup menus. The **RQ** command is used to read the amplifier display settings byte.

**EXAMPLE**

It is desired to set amplifier channel 3 to operate in the following manner:

- Two digits after decimal point = 2
- One Dummy Digit = 1
- Bi-polar Display = 0
- Total: 3

The command below, when followed by a carriage return, will change the display setup for channel 3 as described above.

```
#0003WQ3
```

**WHEN TO USE IT**

Since the mathematics display settings are set at the factory along with the mathematical expression, you probably do not need to change them.
Chapter 11

AMPLIFIED TRANSDUCER COMMANDS

Below is a list of standard amplified transducer channel commands for the SC series instruments. A channel number is required after the instrument address when sending these commands.

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>F0</td>
<td>Transmit track data</td>
</tr>
<tr>
<td>F1</td>
<td>Activate Tare</td>
</tr>
<tr>
<td>F2</td>
<td>Clear Tare</td>
</tr>
<tr>
<td>F3</td>
<td>Calibrate Analog-to-Digital Converter</td>
</tr>
<tr>
<td>F5</td>
<td>Apply Shunt Resistor and Transmit Reading</td>
</tr>
<tr>
<td>F9</td>
<td>Transmit Peak Reading</td>
</tr>
<tr>
<td>FA</td>
<td>Transmit Valley Reading</td>
</tr>
<tr>
<td>FB</td>
<td>Clear Stored Peak and Valley</td>
</tr>
<tr>
<td>FE</td>
<td>Transmit Transducer Serial Number</td>
</tr>
<tr>
<td>FH</td>
<td>Write DAC Manual Control Value</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Write Command</th>
<th>Read Command</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>W5</td>
<td>R5</td>
<td>Full Scale Value</td>
</tr>
<tr>
<td>W6</td>
<td>R6</td>
<td>Engineering Units</td>
</tr>
<tr>
<td>W7</td>
<td>R7</td>
<td>Full Scale Input Range</td>
</tr>
<tr>
<td>W8</td>
<td>R8</td>
<td>Shunt Calibration Value</td>
</tr>
<tr>
<td>WK</td>
<td>RK</td>
<td>Known load Calibration Values</td>
</tr>
<tr>
<td>WM</td>
<td>RM</td>
<td>DAC Source Info</td>
</tr>
<tr>
<td>WN</td>
<td>RN</td>
<td>DAC Zero Scale value</td>
</tr>
<tr>
<td>WO</td>
<td>RO</td>
<td>DAC Full Scale value</td>
</tr>
<tr>
<td>WP</td>
<td>RP</td>
<td>Amplifier Operations Byte</td>
</tr>
<tr>
<td>WQ</td>
<td>RQ</td>
<td>Channel Display Operations Byte</td>
</tr>
<tr>
<td>WU</td>
<td>RU</td>
<td>Analog-to-Digital Converter Update Rate</td>
</tr>
</tbody>
</table>

Each command is described in this chapter.
11.1 F0 Transmit Track Data

**SYNOPSIS**

\[
\text{(channel}\ F0 \rightarrow \text{Transmits track data for channel } \text{channel})
\]

**DESCRIPTION**

The F0 function transmits one data point from the tracking output of the specified channel. The amplifier channel is continuously reading the transducer and this function transmits the latest data point computed.

As described in Chapter 6, "System Commands", the F0 function is also a system command which causes the SC to transmit its display contents.

**EXAMPLE**

\[
\text{\#0001F0}
\]

The above command, when followed by a carriage return, will cause the instrument addressed as "00" to transmit the track data from channel 1. For example,

\[
5670.5 \text{ LBS}
\]
11.2 **F1 Activate Tare**

**SYNOPSIS**

**(channel)F1** - Activates Tare operation on channel *(channel)*

**DESCRIPTION**

The F1 function performs exactly the same operation as either pressing the **<TARE>** button on the front panel, or connecting the TARE rear panel control pin to the DGND pin. The Tare function forces the display to read zero and turns on the front panel TARE indicator light.

To deactivate the Tare function, you can 1) send the channel the **F2** command, 2) press the **<TARE>** button on the front panel display when the channel is displayed, or 3) connect the CLEAR TARE rear panel control pin to DGND when the channel is displayed.

**EXAMPLE**

`#0002F1`

The above command, when followed by a carriage return, will cause the instrument addressed as "00" to activate the Tare function of channel 2 and force the track display to read zero.
11.3 F2 Clear Tare

**SYNOPSIS**

{(channel)F2 - Clears Tare operation on channel (channel)}

**DESCRIPTION**

The F2 function performs exactly the same operation as either pressing the <TARE> button on the front panel, or connecting the CLEAR TARE rear panel control pin to the DGND pin. Clearing the Tare function removes the offset which was applied to the data when the Tare operation was activated, and turns off the front panel TARE indicator light.

To activate the Tare function, you can 1) send the channel the F1 command, 2) press the <TARE> button on the front panel display when the channel is displayed, or 3) connect the TARE rear panel control pin to DGND when the channel is displayed.

**EXAMPLE**

#0002F2

The above command, when followed by a carriage return, will cause the instrument addressed as "00" to clear the Tare operation from channel 2 and remove the offset from the track display.
11.4 **F3** Calibrate Analog-to-Digital Converter

**SYNOPSIS**

{(channel)F3} - Calibrates the analog-to-digital (A/D) converter of channel {channel}

**DESCRIPTION**

The F3 function tells the analog-to-digital converter chip of the amplifier channel to perform its calibration. This removes the effects of temperature error on the analog-to-digital converter's readings. Performing this command will also clear the stored peak and valley data.

The A/D converter chip is also calibrated when the SC instrument is powered up, and whenever the instrument performs the Auto-Check function.

**EXAMPLE**

`#0001F3`

The above command, when followed by a carriage return, will cause the instrument addressed as "00" to tell channel 1's analog-to-digital converter chip to perform a calibration.

**WHEN TO USE IT**

The A/D converter chip is calibrated whenever the instrument is powered up or whenever the instrument performs an Auto-Check. You would only need to use this command if you know that instrument experiences a large change in ambient temperature with the Auto-Check feature turned off while the instrument is always powered up.
11.5  F5 Apply Shunt Resistor and Transmit Reading

SYNOPSIS

(channel)F5 - Connects the RELAY1 and RELAY2 pins of channel {channel} together and transmits the reading

DESCRIPTION

The F5 function connects the RELAY1 and RELAY2 pins together to activate the amplified transducer’s internal shunt calibration, and then transmits the reading. The same result can be obtained by applying pressing and holding the <TEST> button when the channel is displayed.

EXAMPLE

#0001F5

The above command, when followed by a carriage return, will cause the instrument addressed as "00" to connect the RELAY1 and RELAY2 pins together and transmit the reading.

WHEN TO USE IT

This can be used as a quick check to verify that the transducer is connected and operating properly. If the transducer does not have internal shunt calibration, then this command is not useful.
11.6 **F9** Transmit Stored Peak Reading

**SYNOPSIS**

{channel} F9 - Transmit peak reading of channel (channel)

**DESCRIPTION**

The F9 function transmits the stored peak value for a channel. The peak value is the highest reading for a channel since the unit was powered up, the channel's peak and valley were cleared, the Tare of that channel was activated, or the channel was recalibrated.

If the Fast Peak function is off, the peak reading is updated by doing a digital comparison of the track reading. Therefore, the selected update rate of the Analog-to-Digital converter chip determines the minimum pulse width of the peaks which can be captured. The **WR** command (q.v.) can be used to change the Analog-to-Digital converter update rate.

If the Fast Peak function is on, the peak is read from the analog peak detector to yield a faster response time (i.e. peaks with a smaller pulse width can be detected).

An SC100 will ignore this function command and respond with "N/A".

**EXAMPLE**

#0002F9

The above command, when followed by a carriage return, will cause the instrument addressed as "00" to transmit the peak reading for channel 2.
11.7 **FA** Transmit Stored Valley Reading

**SYNOPSIS**

*(channel)FA* - Transmit valley reading of channel *(channel)*

**DESCRIPTION**

The **FA** function transmits the stored valley value for a channel. The valley value is the lowest reading for a channel since the unit was powered up, the channel's peak and valley were cleared, the Tare of the that channel was activated, or the channel was recalibrated. The valley reading is updated by doing a digital comparison of the track reading. Therefore, the selected update rate of the Analog-to-Digital converter chip determines the minimum pulse width of the peaks which can be captured. The **MU** command (q.v.) can be used to change the Analog-to-Digital converter update rate.

An SC100 will ignore this function command and respond with "N/A".

**EXAMPLE**

#002FA

The above command, when followed by a carriage return, will cause the instrument addressed as "00" to transmit the valley reading for channel 2.
11.8 \textbf{FB} Clear Stored Peak and Valley

**SYNOPSIS**

\{(channel)\textbf{FB} - Clear stored peak and valley data\}

**DESCRIPTION**

The \textbf{FB} function performs exactly the same operation as either pressing the \texttt{<CLEAR>} button on the front panel, or connecting the CLEAR PEAK rear panel control pin to the DGND pin. The peak and valley data are both set to the present track reading. If the Fast Peak option for this amplifier channel is turned on, the analog peak detector is reset to the lowest possible voltage which can be digitized by the analog-to-digital converter.

An SC100 will ignore this function command and respond with "N/A".

**EXAMPLE**

\texttt{#0001FB}

The above command, when followed by a carriage return, will cause the instrument addressed as "00" to clear the peak and valley data stored for channel 1.
11.9 **FE** Transmit Serial Number of Transducer

**SYNOPSIS**

{(channel)FE} - Transmits the serial number of the transducer on channel {channel}

**DESCRIPTION**

The **FE** function reads the serial number of the transducer from its Signature Module. If the transducer does not have *Signature Calibration*, instrument will transmit "NONE".

There is no serial communications command to change the serial number data stored inside a transducer equipped with *Signature Calibration*. It can only be changed at the factory.

**EXAMPLE**

#0003FE

The above command, when followed by a carriage return, will cause the instrument addressed as "00" to transmit the serial number of the transducer with Signature Calibration connected to channel 3. For example:

301656

**WHEN TO USE IT**

The serial number of a transducer can be used to determine which transducer is connected to the SC remotely.
11.10 \textbf{FH} Write DAC Manual Control Value

\textbf{SYNOPSIS}

\{\text{channel}\}.\text{FH}(\text{value}) - Forces the DAC on channel \{\text{channel}\} to manual control and to produce \{\text{value}\} fraction of its full scale signal.

\{\text{channel}\}.\text{FH}\text{AUTO} - Forces the DAC back to its normal state of automatic control.

\textbf{DESCRIPTION}

The \text{FH} function will force a channel's Digital-to-Analog converter output at the rear connector of a channel to either manual or automatic control. When the SC instrument is powered up, every channel's Digital-to-Analog Converter is said to be on automatic control. That is, the DAC will produce a signal according to the channel, source, full-scale value and zero-scale value as entered from either the \text{MN}, \text{WN} or \text{NO} commands or as entered from the front panel SETUP menus.

After the \text{FH} command has been used with a value between -1 and +1 in its information field, the DAC is forced to manual control. That value is then used to drive the DAC. A value of -1 will cause the DAC to produce a minus full scale output, a value of 0 produces the zero-scale output (0 volts or 4mA), and a value of 1 produces a full-scale signal (5 volts or 20mA).

If the word "\text{AUTO}" is used in place of a value, the DAC is restored to automatic operation.

\textbf{EXAMPLE}

\#0002\text{FH} .5

The above command, when followed by a carriage return, will cause channel 2's DAC to produce an analog signal halfway between the zero scale signal and the full scale signal. This could be +2.5 volts or optionally 12mA.

\textbf{WHEN TO USE IT}

You might wish to force a channel's DAC to a certain output in order to more easily calibrate the data system, meter, or other connected device.
11.11 **W5** Write Full Scale Value

**R5** Read Full Scale Value

**SYNOPSIS**

W5{channel}{value} - Change full scale of amplifier channel {channel} to {value} engineering units

R5{channel} - Read full scale value of amplifier channel {channel}

**DESCRIPTION**

The W5 command changes the full scale value for a given amplifier channel number. The numeric value given in the information field is in the engineering units for that amplifier channel.

If another transducer equipped with Signature Calibration is connected to this amplifier channel, this value may be automatically changed when the SC is powered-up or re-started. Likewise, this command does not change the value which is stored inside a transducer equipped with Signature Calibration. To copy the value in the amplifier channel to a transducer’s Signature Module, use the front panel menus to access the “UPDATE SIG. MOD.” menu item.

The SC will acknowledge the write command by responding with “OK”. The full scale value can also be examined and changed from the front panel setup menus. The R5 command is used to read the full scale value.

**EXAMPLE**

The command below, when followed by a carriage return, will change the full scale value of amplifier channel 1 to 30.75.

```
#0001W530.75
```

**WHEN TO USE IT**

The full scale value is set automatically when using a transducer equipped with Signature Calibration, or if the instrument was purchased with a SENSOTEC transducer. This command is only needed if the instrument is being used with a transducer that was not purchased from SENSOTEC, or a SENSOTEC transducer without Signature Calibration was purchased separately from the SC.
11.12  **W6** Write Engineering Units  
**R6** Read Engineering Units

**SYNOPSIS**

\{(channel)W6(text)\} - Change 4 character engineering units label of amplifier channel \{channel\} to \{text\}

\{(channel)R6\} - Read 4 character engineering units label of amplifier channel \{channel\}

**DESCRIPTION**

The **W6** command changes the 4-character engineering units label for a given amplifier channel number. The text given in the *information field* placed on the right side of the front panel display when this channel is selected for display. The text is also transmitted out of the serial port when the "**F0**" command is used.

This command does not mathematically scale anything. If less than 4 characters are entered, the remaining characters are filled with spaces (ASCII code decimal 32).

If another transducer equipped with *Signature Calibration* is connected to this amplifier channel, the text may be automatically changed when the SC is powered-up or re-started. Likewise, this command does not change the text which is stored inside a transducer equipped with *Signature Calibration*. To copy the text in the amplifier channel to a transducer's *Signature Module*, use the front panel menus to access the "UPDATE SIG. MOD." menu item.

The SC will acknowledge the write command by responding with "**ok**". The 4 characters of text can also be examined and changed from the front panel setup menus. The **R6** command is used to read the engineering units text.

**EXAMPLE**

The command below, when followed by a carriage return, will change the text that appears when this channel is displayed to "CATS".

```
#0001W6CATS
```

**WHEN TO USE IT**

The engineering units text is set automatically when using a transducer equipped with *Signature Calibration*, or if the instrument was purchased with a SENSOTEC transducer. This command is only needed if the instrument is being used with a transducer that was not purchased from SENSOTEC, or a SENSOTEC transducer without *Signature Calibration* was purchased separately from the SC.
11.13 \textbf{W7} Write Full Scale Input Range
\textbf{R7} Read Full Scale Input Range

\textbf{SYNOPSIS}
\begin{itemize}
\item \textit{\{channel\}W75000} - Change full scale input range of channel \{channel\} to 5 volts (For voltage input channels only)
\item \textit{\{channel\}W710000} - Change full scale input range of channel \{channel\} to 10 volts (For voltage input channels only)
\item \textit{\{channel\}W7420} - Change full scale input range of channel \{channel\} to 4-20 (For current input channels only)
\item \textit{\{channel\}R7-} Read full scale input range of amplifier channel \{channel\}
\end{itemize}

\textbf{DESCRIPTION}
The \texttt{W7} command changes the full scale input range for a given amplifier channel number, which changes the gain of the amplifier circuit. The numeric value given in the \textit{information field} can be one of the ones listed above.

If another transducer equipped with \textit{Signature Calibration} is connected to this amplifier channel, this value may be automatically changed when the SC is powered-up or re-started. Likewise, this command does not change the value which is stored inside a transducer equipped with \textit{Signature Calibration}. To copy the value in the amplifier channel to a transducer's \textit{Signature Module}, use the front panel menus to access the "UPDATE SIG. MOD." menu item.

The SC will acknowledge the write command by responding with "\texttt{OK}". The full scale input range can also be examined and changed from the front panel setup menus. The \texttt{R7} command is used to read the full scale input range.

\textbf{EXAMPLE}
The command below, when followed by a carriage return, will change the full scale input range of amplifier channel 1 to 5 volts.

\texttt{#0001W75000}

\textbf{WHEN TO USE IT}
The full scale millivolt/volt value is set automatically when using a transducer equipped with \textit{Signature Calibration}, or if the instrument was purchased with a SENSOTEC transducer. This command is only needed if the instrument is being used with a transducer that was not purchased from SENSOTEC.

This command changes the gain of the amplifier circuit to always maintain at least 20,000 A/D counts between 0 volts/0 millamps input and the given full-scale input (typically between 25,000 and 30,000). It also performs a calibration of the A/D converter.
11.14  \textbf{W8} Write Shunt Calibration Value
\textbf{R8} Read Shunt Calibration Value

\textbf{SYNOPSIS}

\{channel\}W8\{value\} - Change shunt calibration value of amplifier channel \{channel\} to \{value\} engineering units

\{channel\}R8 - Read full scale value of amplifier channel \{channel\}

\textbf{DESCRIPTION}

The \textbf{W8} command changes the shunt calibration value for a given amplifier channel number. The numeric value given in the \textit{information field} is in the engineering units for that amplifier channel.

When the SC is calibrated to the transducer using the “Shunt Calibration Method”, the transducer’s shunt calibration is activated by connecting the RELAY1 and RELAY2 pins together and the output of the transducer is scaled to this value.

If another transducer equipped with \textit{Signature Calibration} is connected to this amplifier channel, this value may be automatically changed when the SC is powered-up or re-started. Likewise, this command does not change the value which is stored inside a transducer equipped with \textit{Signature Calibration}. To copy the value in the amplifier channel to a transducer’s \textit{Signature Module}, use the front panel menus to access the "UPDATE SIG. MOD." menu item.

The SC will acknowledge the write command by responding with "OK". The shunt calibration value can also be examined and changed from the front panel setup menus. The \textbf{R8} command is used to read the shunt calibration value.

\textbf{EXAMPLE}

The command below, when followed by a carriage return, will change the shunt calibration value of amplifier channel 1 to 750.12.

\#0001W8750.12

\textbf{WHEN TO USE IT}

The shunt calibration value is set automatically when using a transducer equipped with \textit{Signature Calibration}, or if the instrument was purchased with a SENSOTEC transducer. This command is only needed if the instrument is being used with a transducer that was not purchased from SENSOTEC.

This value is only used when calibrating with the “Shunt Calibration Method.”
11.15 **WK** Write Known Load Calibration Values
**RK** Read Known Load Calibration Values

**SYNOPSIS**

{channel}WK01{value} - Change "known load pt 1" to {value}
{channel}WK02{value} - Change "known load pt mid" to {value}
{channel}WK03{value} - Change "known load pt 2" to {value}

{channel}RK01{value} - Read "known load pt 1" calibration value
{channel}RK02{value} - Read "known load pt mid" calibration value
{channel}RK03{value} - Read "known load pt 2" calibration value

**DESCRIPTION**

The **WK** command changes the known load calibration values for a given amplifier channel number. The numeric value given in the information field is in the engineering units for that amplifier channel.

When the SC is calibrated to the transducer using the "Known Load 2 Point Method" or the "Known Load 3 Point Method", these are the values that the instrument asks for during calibration. The "known load pt mid" calibration value is not used by the "Known Load 2 Point Method."

If transducer equipped with Signature Calibration is connected to this amplifier channel after these values have been entered, these values do not change to reflect the different transducer.

The SC will acknowledge the write command by responding with "OK". The known load calibration values can also be examined and changed from the front panel setup menus. The **RK** command is used to read the known load calibration values.

**EXAMPLE**

The command below, when followed by a carriage return, will change the "known load pt 2" calibration value of amplifier channel 3 to 20000.

```plaintext
#0003WK0320000
```

**WHEN TO USE IT**

The known load calibration values must be changed to match the precision loads that you have available to calibrate your transducers. These values are not used by the "Shunt Calibration Method" or the "mV/V Calibration Method."
11.16 **WM** Write Digital-to-Analog Converter Source

**RM** Read Digital-to-Analog Converter Source

**SYNOPSIS**

*{channel}RM(value)* - Change source used to drive DAC on channel *{channel} to *{value}*

*{channel}RM* - Read source used to drive DAC on channel *{channel}*

**DESCRIPTION**

The **WM** command changes which channel and source are used to drive the Digital-to-Analog output at the rear connector of a channel. The decimal value given in the *information field* is created by adding together the values of the desired options according to the chart below. Only one value from each section may be selected.

<table>
<thead>
<tr>
<th>Source</th>
<th>Channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRACK = 0</td>
<td>CHANNEL1= 1</td>
</tr>
<tr>
<td></td>
<td>CHANNELA= 10</td>
</tr>
<tr>
<td>PEAK = 16</td>
<td>CHANNEL2= 2</td>
</tr>
<tr>
<td></td>
<td>CHANNELB= 11</td>
</tr>
<tr>
<td>VALLEY= 32</td>
<td>CHANNEL3= 3</td>
</tr>
<tr>
<td></td>
<td>CHANNELC= 12</td>
</tr>
<tr>
<td></td>
<td>CHANNEL4= 4</td>
</tr>
<tr>
<td></td>
<td>CHANNELD= 13</td>
</tr>
<tr>
<td></td>
<td>CHANNEL5= 5</td>
</tr>
<tr>
<td></td>
<td>CHANNELE= 14</td>
</tr>
<tr>
<td></td>
<td>CHANNEL6= 6</td>
</tr>
<tr>
<td></td>
<td>CHANNELF= 15</td>
</tr>
<tr>
<td></td>
<td>CHANNEL7= 7</td>
</tr>
<tr>
<td></td>
<td>CHANNEL8= 8</td>
</tr>
<tr>
<td></td>
<td>CHANNEL9= 9</td>
</tr>
</tbody>
</table>

The SC will acknowledge the write command by responding with "OK". An SC100 will ignore a write command with a value larger than 15 and respond with "N/A".

DAC operation can also be examined and changed from the front panel setup menus.

The **RM** command is used to read the DAC source information. The DAC's zero scale value can be changed with the **WM** command, and the DAC's full scale value can be changed with the **RD** command.

**EXAMPLE**

It is desired to have channel 2's DAC output reflect the valley data of channel 1.

```
Display will monitor channel 1 = 1
Source of display is Valley data = 32
Total: 33
```

The command below, when followed by a carriage return, will change the operation of channel 1's DAC as described above.

```
#0001WM33
```
11.17 **WN** Write Digital-to-Analog Converter Zero Scale Value

**RN** Read Digital-to-Analog Converter Zero Scale Value

**SYNOPSIS**

\{(channel)\}**WN**\{(value)\} - Change to \{(value)\} engineering units where DAC on channel \{(channel)\} produces zero scale analog output.

\{(channel)\}**RN**\{(value)\} - Reads zero scale value used by the DAC on channel \{(channel)\}

**DESCRIPTION**

The **WN** command changes the value for a given amplifier channel number that causes its Digital-to-Analog converter to produce its zero scale analog output. Unless otherwise specified by the customer, all instruments are shipped such that the DAC will produce 0V on the analog output at zero scale. Optional amplifier cards may produce 4mA at zero scale. The numeric value given in the information field is in the engineering units for the source channel which has been selected to drive the DAC.

The SC will acknowledge the write command by responding with "OK". The DAC's zero scale value can also be examined and changed from the front panel setup menus. The **RN** command is used to read the zero scale value. The DAC's full scale value can be changed with the **NO** command, and the channel and source used to drive the DAC can be changed using the **WN** command.

**EXAMPLE**

The command below, when followed by a carriage return, will cause the DAC on channel 1 to produce zero scale analog output when the source of the channel driving the DAC is 0.

```
#0001WN0
```

**WHEN TO USE IT**

Digital-to-Analog converter parameters may be set at any time according to your particular application.
11.18 \textbf{WO} Write Digital-to-Analog Converter Full Scale Value

\textbf{RO} Read Digital-to-Analog Converter Full Scale Value

\textbf{SYNOPSIS}

\{channel\}WO\{value\} - Change to \{value\} engineering units where DAC on channel \{channel\} produces full scale analog output.

\{channel\}RO\{value\} - Reads full scale value used by the DAC on channel \{channel\}

\textbf{DESCRIPTION}

The WO command changes the value for a given amplifier channel number that causes its Digital-to-Analog converter to produce its full scale analog output. Unless otherwise specified by the customer, all instruments are shipped such that the DAC will produce +5V on the analog output at full scale. Optional amplifier cards may produce 20mA at full scale. The numeric value given in the \textit{information field} is in the engineering units for the source channel which has been selected to drive the DAC.

The SC will acknowledge the write command by responding with “OK”. The DAC's full scale value can also be examined and changed from the front panel setup menus. The RO command is used to read the full scale value. The DAC's zero scale value can be changed with the WN command, and the channel and source used to drive the DAC can be changed using the WN command.

\textbf{EXAMPLE}

The command below, when followed by a carriage return, will cause the DAC on channel 1 to produce full scale analog output when the source of the channel driving the DAC is 100.

\#0001WO100

\textbf{WHEN TO USE IT}

Digital-to-Analog converter parameters may be set at any time according to your particular application.
11.19 **WP** Write Amplifier Operations Byte  
**RP** Read Amplifier Operations Byte

**SYNOPSIS**

\{channel\}**P**{value} - Change operation byte of amplifier channel \{channel\} to \{value\}

\{channel\}**P** - Read operation byte of amplifier channel \{channel\}

**DESCRIPTION**

The **WP** command changes the manner of operation of an amplifier channel. The decimal value given in the *information field* is created by adding together the values of the desired options according to the chart below. Only one value from each section may be selected.

<table>
<thead>
<tr>
<th>Fast Peak</th>
<th>Auto-Zero</th>
<th>Auto-Check</th>
<th>Power-On Cal.</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF = 0</td>
<td>OFF = 0</td>
<td>OFF = 0</td>
<td>OFF = 0</td>
</tr>
<tr>
<td>ON = 1</td>
<td>ON = 2</td>
<td>ON = 4</td>
<td>ON = 8</td>
</tr>
</tbody>
</table>

The SC will acknowledge the write command by responding with "OK". Amplifier operation can also be examined and changed from the front panel setup menus. The **RP** command is used to read the amplifier operation byte.

**EXAMPLE**

It is desired to set amplifier channel 2 to operate in the following manner:

- Fast Peak off
- Auto-Zero on
- Auto-Check off
- Power-On Calibration on

Total: 2

The command below, when followed by a carriage return, will change the operation of amplifier channel 2 as described above.

```
#0002WP2
```

**WHEN TO USE IT**

Amplifier operation information is not stored inside transducers equipped with *Signature Calibration*, and so you may need to change the amplifier operation according to your application.
11.20 \textbf{WQ} Write Amplifier Display Settings Byte
\textbf{RQ} Read Amplifier Display Settings Byte

\textbf{SYNOPSIS}

\{\text{channel}\}\textbf{WQ}\{\text{value}\} - \text{Change display settings byte of amplifier channel (channel) to (value)}

\{\text{channel}\}\textbf{RQ} - \text{Read display settings byte of amplifier channel (channel)}

\textbf{DESCRIPTION}

The \textbf{WQ} command changes the way that values for an amplifier channel are formatted when they are sent out the serial port or displayed and entered on the front panel. The decimal value given in the \textit{information field} is created by adding together the values of the desired options according to the chart below. Only one value from each section may be selected.

<table>
<thead>
<tr>
<th>Digits after Decimal Point</th>
<th>Count-By (Dummy Digits)</th>
<th>Bi-polar or Unipolar</th>
<th>Track Display Averaging</th>
</tr>
</thead>
<tbody>
<tr>
<td>NONE</td>
<td>0</td>
<td>BIPOAR = 0</td>
<td>OFF = 0</td>
</tr>
<tr>
<td>ONE</td>
<td>1  = 0</td>
<td>BIPOAR = 0</td>
<td>OFF = 0</td>
</tr>
<tr>
<td>TWO</td>
<td>10 = 8</td>
<td>UNIPOLAR = 32</td>
<td>ON = 64</td>
</tr>
<tr>
<td>THREE</td>
<td>2</td>
<td>100 = 16</td>
<td></td>
</tr>
<tr>
<td>FOUR</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FIVE</td>
<td>5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For a complete explanation of amplifier operation, please see the instrument \textit{USERS GUIDE}. The SC will acknowledge the write command by responding with "\textit{OK}". The amplifier display settings can also be examined and changed from the front panel setup menus. The \textbf{RQ} command is used to read the amplifier display settings byte.

\textbf{EXAMPLE}

It is desired to set amplifier channel 3 to operate in the following manner:

\begin{align*}
\text{Two digits after decimal point} & = 2 \\
\text{One Dummy Digit} & = 1 \\
\text{Bi-polar Display} & = 0 \\
\text{Total:} & = 3
\end{align*}

The command below, when followed by a carriage return, will change the display setup for channel 3 as described above.

\texttt{#0003WQ3}

\textbf{WHEN TO USE IT}

Amplifier display settings are not stored inside transducers equipped with Signature Calibration, and so you may need to change the display settings according to your application.
11.21 **WU** Write Analog-to-Digital Converter Update Rate

**RU** Read Analog-to-Digital Converter Update Rate

**SYNOPSIS**

{channel}WU(value) - Change Analog-to-Digital converter update rate of amplifier channel {channel} to (value) updates per second

{channel}RU- Read Analog-to-Digital converter update rate of {channel}

**DESCRIPTION**

The WU command changes the Analog-to-Digital converter update rate for a given amplifier channel number. The numeric value given in the information field is the number of times per second that the A/D converter yields a digitized reading of the transducer. This value can be from 10 to 500; any other values may be accepted by the SC but might cause improper operation. The A/D converter's update rate, cutoff frequency, step input response, power line noise rejection ability and overall system accuracy are all related as shown in the table below for some typical A/D update rates.

<table>
<thead>
<tr>
<th>A/D converter update rate</th>
<th>A/D cutoff frequency (f_{3dB})</th>
<th>A/D step response</th>
<th>maximum 60Hz rejection?</th>
<th>maximum 50Hz rejection?</th>
<th>accuracy of A/D conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 Hz</td>
<td>2.62 Hz</td>
<td>300 ms</td>
<td>yes</td>
<td>yes</td>
<td>.01%</td>
</tr>
<tr>
<td>15 Hz</td>
<td>3.93 Hz</td>
<td>200 ms</td>
<td>yes</td>
<td>yes</td>
<td>.01%</td>
</tr>
<tr>
<td>20 Hz</td>
<td>5.24 Hz</td>
<td>150 ms</td>
<td>yes</td>
<td>yes</td>
<td>.01%</td>
</tr>
<tr>
<td>30 Hz</td>
<td>7.86 Hz</td>
<td>100 ms</td>
<td>yes</td>
<td>no</td>
<td>.01%</td>
</tr>
<tr>
<td>50 Hz</td>
<td>13.09 Hz</td>
<td>60 ms</td>
<td>no</td>
<td>yes</td>
<td>.01%</td>
</tr>
<tr>
<td>60 Hz</td>
<td>15.70 Hz</td>
<td>50 ms</td>
<td>yes</td>
<td>no</td>
<td>.01%</td>
</tr>
<tr>
<td>100 Hz</td>
<td>26.24 Hz</td>
<td>30 ms</td>
<td>no</td>
<td>no</td>
<td>?</td>
</tr>
<tr>
<td>120 Hz</td>
<td>31.39 Hz</td>
<td>25 ms</td>
<td>no</td>
<td>no</td>
<td>?</td>
</tr>
<tr>
<td>250 Hz</td>
<td>65.60 Hz</td>
<td>12 ms</td>
<td>no</td>
<td>no</td>
<td>?</td>
</tr>
<tr>
<td>500 Hz</td>
<td>131 Hz</td>
<td>6 ms</td>
<td>no</td>
<td>no</td>
<td>?</td>
</tr>
</tbody>
</table>

The "A/D converter update rate" is not necessarily equal to the update rate of the display, limits, or analog output. It is, however, the rate of valley detector operation as well as the rate of peak detector operation when the channel's "FAST PEAK" option is OFF. Please note that the accuracy of the A/D conversion decreases as the update is increased above 60 Hz.

11.22 Amplified Transducer Channel Commands
After the new A/D update rate is sent to the SC, the A/D converter will be re-calibrated before the SC acknowledges the write command by responding with "OK". Slower update rates will cause longer A/D re-calibration times. For instance, it takes several seconds for the A/D to recalibrate itself when it set to update at 10Hz. The A/D converter update rate CANNOT be changed from the front panel. The RU command is used to read the A/D converter update rate.

EXAMPLE
The command below, when followed by a carriage return, will change the Analog-to-Digital converter update rate of amplifier channel 1 to 30 per second as well as recalibrate the A/D converter.

#0001WU30

WHEN TO USE IT
Because this command can decrease the overall accuracy of the instrument from its standard specifications, SENSOTEC recommends that this command not be used unless:

1) it is under the advice of SENSOTEC to allow us to better serve you in your particular application, or

2) you fully understand the ramifications of the information found in the above table.

The Analog-to-Digital converter is normally set at the factory to 60 updates per second. This allows for the maximum rejection of noise from the 60 Hz AC power lines found in North America. If you are using the SC instrument in Europe or other parts of the world that use 50 Hz AC power, you may wish to set the update rate to 50 times per second.