RS-232 Transducer Digital Communication

User's Manual

Firmware Version 217928G

Stellar Technology Incorporated

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Part number: 222133 Rev A

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CHAPTER 1

Installation

This chapter describes the steps to install the RS-232 Transducer.

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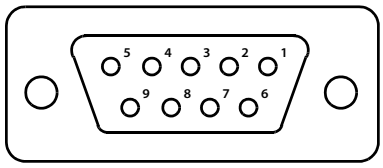
RS-232 Connector

Serial data is transmitted and received using only three signals of the RS-232 connector. All digital output signals are galvanically isolated from the transducer excitation supply.



Pin 2 - TxD

Pin 3 - RxD

Pin 5 - D_{GND}

Figure 1-1: RS-232 pin assignments

Communication Setup

The RS-232 Transducer uses an RS-232 interface as a means of communication with a controller. The default communication parameters are as follows:

Setting	Value
Baud rate	9600
Data bits	8
Stop bits	1
Parity	none
Flow control	none

Table 1-1: RS-232 communication settings

Commands are sent in ASCII text using the syntax described Chapter 3, “Using Commands”. All commands must be terminated with a *carriage-return* / *line-feed* combination or a *line-feed-only* character sequence.

CHAPTER 2

Quick-Start Tutorial

This chapter gives you a quick guide on how to connect Series it2000 Pressure Transducer and start using it's basic functionality.

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Basic Measurements

To make basic digital pressure or temperature measurements you may use the standard Windows Terminal program with appropriate settings.

Steps required to make one digital pressure measurement using the Terminal program:

1. Run Terminal program
2. Set communication port settings
3. Type in the command: meas:pres? terminated with the command terminator (see Chapter 3, "Using Commands")
4. An example of a RS-232 Transducer response is shown below.

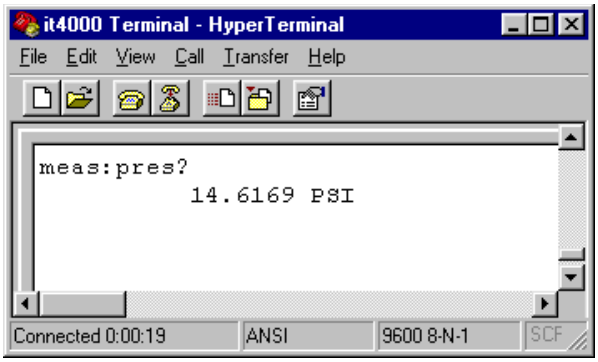

Figure 2-1: Windows Terminal program

For more commands see Chapter 4, "Command Reference".

CHAPTER 3

Using Commands

The RS-232 Transducer is controlled through the RS-232 interface using a large group of commands and queries. This chapter describes the syntax these commands and queries use and the conventions the transducer uses to process them. The commands and queries themselves are listed in Chapter 4, “Command Reference”.

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Commands are transmitted to the transducer using the American Standard Code for Information Interchange (ASCII) character encoding.

This manual uses Backus-Naur Form (BNF) notation and syntax diagrams to describe commands and queries. The following BNF symbols:

Symbol	Meaning
< >	Defined element
::=	Is defined as
|	Exclusive OR
{}	Group; one element is required
[]	Optional; can be omitted
...	Previous element(s) may be repeated
()	Comment

Table 3-1: BNF Symbols and Meanings

Command and Query Structure

Commands consist of set commands and query commands (usually simply called commands and queries). Commands modify instrument settings or tell the transducer to perform a specific action. Queries cause the transducer to return data and information about its status.

Most commands have both a set form and a query form. The query form of the command is the same as the set form but with a question mark at the end. For example, the set command `INPut:GAIN` has a query form `INPut:GAIN?`. Not all commands have both a set and a query form; some commands are set only and some are query only.

A command message is a command or query name, followed by any information the transducer needs to execute the command or query. Command messages consist of five different element types, defined as follows:

Symbol	Meaning
<Header>	The basic command name. If the header ends with a question mark, the command is a query. The header may begin with a colon (:) character; if the command is concatenated with other commands the beginning colon is required. The beginning colon can never be used with a command beginning with an asterisk (*).
<Mnemonic>	A header sub-function. Some commands headers have only one mnemonic. If a command header has multiple mnemonics, they are always separated from each other by a colon (:) character.

Symbol	Meaning
<Argument>	A quantity, quality, restriction, or limit associated with the header. Not all commands have multiple arguments. Arguments are separated from the header by a <Space>. Arguments are separated from each other by a <Comma>.
<Comma>	A single comma between arguments of multiple-argument commands. It may optionally have white space characters before and after the comma.
<Space>	A white space character between command header and argument. It may optionally consist of multiple white space characters.

Table 3-2: Command Message Elements

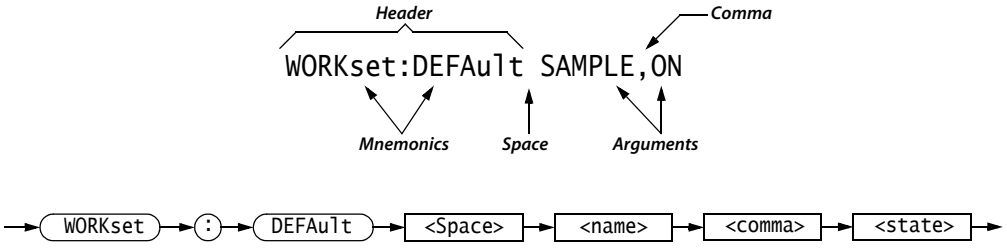


Figure 3-1: Command Message Elements

Commands

Commands cause the transducer to perform a specific function or change one of its settings. Commands have the structure:

```
<Header>[<Space><Argument>[<Comma><Argument>]...]
```

A command header is made up of one or more mnemonics arranged in a hierarchical or tree structure. The first mnemonic is the base or root of the tree and each subsequent mnemonic is a level or branch off the previous one. Commands at a higher level in the tree may affect those at a lower level. The leading colon (:) always returns you to the base of the command tree.

Queries

Queries cause the transducer to return information about its status or settings. Queries have the structure:

```
<Header>?
<Header>?[<Space><Argument>[<Comma><Argument>]...]
```

Command Entry

Follow these general rules when entering commands:

- Commands can be entered in upper or lower case.

- Any command can be preceded with white space characters. White space characters include any combination of the ASCII control characters 00 through 09 and 0B through 20 hexadecimal (0 through 9 and 11 through 32 decimal).
- The transducer ignores commands consisting of any combination of white space characters and line feeds.

Suffixes

Some mnemonics have a plural form. The mnemonic that is expressed in plural form indicates that it represents more than one instance of a subsystem. This is illustrated as follows:

```
TEST:INP5?
```

All suffixes have a default value of one and is used when the suffix is not specified. Suffixes are enclosed in brackets in the command syntax descriptions to indicate their optional inclusion. The brackets are not to be included in actual usage.

Command Termination

All commands are terminated with a *carriage-return* / *line-feed* combination. The SCPI specification also allows for the use of a *line-feed* character only. The ASCII codes for these command terminators are as follows:

ASCII Code	Key Stroke	Description
10	Control + j	Line feed
13	Control + m	Carriage return

Table 3-3: ASCII Codes for Command Termination

Argument Usage

All arguments listed for a command are mandatory and must be specified by at least a placeholder. Multiple arguments must be separated by a comma. String arguments are case-sensitive unless otherwise noted. Those arguments that are actually mnemonics themselves follow the same abbreviation options as described above.

Argument Types

The argument of a command may be in one of several forms. The individual descriptions of each command tell which argument types to use with that command.

Numeric Arguments

Many transducer commands require numerical arguments. The syntax shows the format that the transducer returns in response to a query. This is also the preferred format when sending the command to the transducer though it will accept any of the formats. This manual represents these arguments as follows:

Symbol	Meaning
<NR1>	Signed integer value
<NR2>	Floating point value without an exponent
<NR3>	Floating point value with an exponent

Table 3-4: Numeric Argument Types

The transducer will automatically force most numeric arguments to a valid setting, either by rounding or truncating, when you input an invalid number unless otherwise noted in the command description.

Quoted String Arguments

Some commands accept or return data in the form of a quoted string, which is simply a group of ASCII characters enclosed by a double quote (“). For example:

```
“this is a quoted string”
```

Symbol	Meaning
<QString>	Quoted string value

Table 3-5: Quoted String Argument Type

Follow these rules when you use quoted strings:

- A quoted string can include any character defined in the 7-bit ASCII character set.
- Strings can have upper or lower case characters.
- A string cannot be terminated with the END message before the closing delimiter.
- The maximum length of a quoted string returned from a query is 256 characters.

Block Arguments

Some transducer commands use a block argument form:

Symbol	Meaning
<NZDig>	a non-zero digit character, in the range 1-9
<Dig>	A digit character, in the range 0-9
<DChar>	A character with the hex equivalent of 00 through FF hexadecimal (0 through 255 decimal)
<Block>	A block of data bytes, defined as: <Block> ::= { #<NZDig><Dig>[<Dig>...][<DChar>...] | #0[<DChar>...]<terminator> }

Table 3-6: Block Argument Types

<NZDig> specifies the number of <Dig> elements that follow. Taken together, the <Dig> elements form a decimal integer that specifies how many <DChar> elements follow.

Command Usage Rules

It is important to keep the following rules in mind when using the commands in this reference guide:

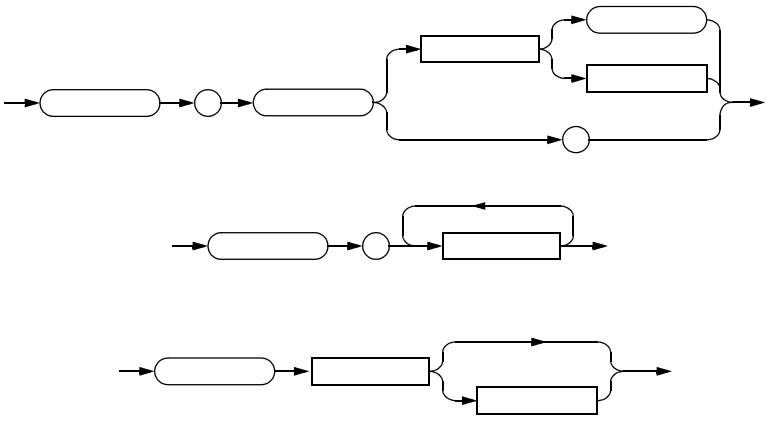
1. Commands are case-insensitive.
2. All commands are terminated by a *carriage-return* / *line-feed* combination or a *linefeed.*
3. All arguments are required.
4. Multiple arguments must be separated by a comma.
5. String arguments are case-sensitive unless they are a mnemonic.

Syntax Diagrams

The syntax diagrams in this manual use the following symbols and notation:

- Circles and ovals contain literal elements. Most elements must be sent exactly as shown. The diagrams show command mnemonics in both upper and lower case to distinguish between complete and abbreviated spellings. These elements are not case sensitive and you can omit the lower case portion of the mnemonic.
- Boxes contain the defined elements described earlier in this section, such as <NR3> or <QString>.
- Elements are connected by arrows that show the allowed paths through the diagram, and thus the orders in which you can send the elements. Parallel paths show that you must take one and only one of the paths. A path around a group of elements shows that those elements are optional. Loops show elements that can be repeated.

Here are some examples of typical syntax diagrams:



CHAPTER 4

Command Reference

This chapter describes each of the commands used to configure and control the RS-232 Transducer. The command reference is broken down into several groups of related functionality.

Contents

- Measure Subsystem 20
- Test Commands 22
- System Commands 24

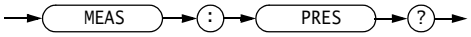
Measure Subsystem

The measure subsystem includes commands for initiating pressure and temperature measurements.

MEAS:PRES

Returns a pressure measurement.

Syntax `MEAS:PRES?`



Remarks The unit of measure is PSI.

Pressure output is fixed at 7 characters, with a first sign character followed by a number with resolution based on a following table:

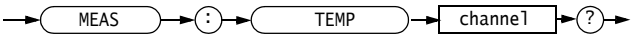
Pressure range	Output format
0<=Range<5	±0.0000
5<=Range<50	±00.000
50<=Range<500	±000.00
500<=Range<5000	±0000.0
5000<=Range	±000000

Example
```
meas:pres?
+14.135
```

MEAS:TEMP

Returns a temperature measurement.

Syntax MEAS:TEMP*[channel]*?



Suffix ***channel***

Parameter	Result
none	Temperature from the on-chip temperature sensor (default)
0	Temperature from the on-chip temperature sensor
1	Temperature from the RTD (optional)

Remarks The unit of measure is degrees Fahrenheit.

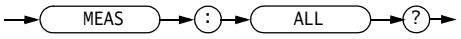
Temperature output is fixed to the following format: ±000.00

Example
```
meas:temp?
+078.91
```

MEAS:ALL

Returns a pressure and temperature measurements.

Syntax MEAS:ALL?



Remarks First value - pressure measurement, second value - on-chip temperature measurement or RTD temperature if there is one present, third value (optional) - on-chip temperature measurement if RTD is present.

Example
```
meas:all?
+078.50,+123.24
```

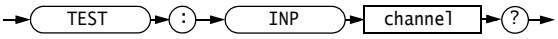
Test Commands

Test commands allow to calibrate digital and analog output of the Series it2000 pressure transducer.

TEST:INP

Reads digital counts from selected channels.

Syntax `TEST:INP[channel]?`



Suffix ***channel***
Possible values: 5

Parameter	Result
5	Digital pressure and temperature counts, Board temperature

Remarks Temperature measurement is the RTD temperature if there is one present, otherwise it is the temperature from the on-chip temperature sensor.

Board temperature is the temperature from the on-chip temperature sensor expressed in degrees Celcius.

Example
```
test:inp5?
11775507,41600,34.5
```

TEST:OUTPV

Sets analog voltage output corresponding to a given count.

Syntax `TEST:OUTPV count`

Parameters ***count***

Possible values: 0-4095

The count is a value which will be send to the digital-to-analog converter to set the analog output.

Remarks This command is used to calibrate a transducer's analog output during the factory calibration process.

Example

```
test:outpv 2768
```

System Commands

System commands includes those relating to identification, resetting the unit, setting a timer.

SYST:VERS:FIRM

Returns the firmware version.

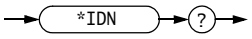
Syntax `SYST:VERS:FIRM?`

Example
```
syst:vers:firm?
217928G
```

*IDN

Returns the transducer part number, serial number and a revision.

Syntax `*IDN?`



Example
```
*idn?
STELLAR TECHNOLOGY INC,IT2000-15A-101,007713,0
```

*RST

Resets the it2000 to power-up status.

Syntax `*RST`

Remarks Executing this command is equivalent to executing a power-up sequence.

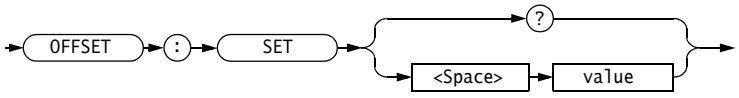
Example
```
*rst
```

OFFSET:SET

Sets or returns the value for the input offset.

Syntax `OFFSET:SET` *`offset`*

`OFFSET:SET?`



Parameters ***`offset`***

Real numeric value.
This signed value will be added to the digital output prior to displaying it. Input offset will also affect the analog output.

Remarks Input offset value is always in PSI.

Example

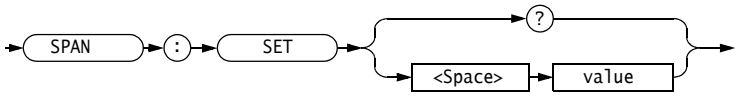
```
offset:set 3.4
offset:set?
3.40
```

SPAN:SET

Sets or returns the value for the span.

Syntax `SPAN:SET` *`span`*

`SPAN:SET?`



Parameters ***`span`***

Real numeric value from (0..150] interval.
The pressure transducer's span will be set to the span% of the original value.

Remarks Default value is 100.

Example

```
span:set 101
```

If the pressure transducer has 0-5 V output at 0-100 PSIG, after setting span=101 analog output will be 0-5.05 V at 0-100 PSIG. Digital output will be 0-101 PSIG.

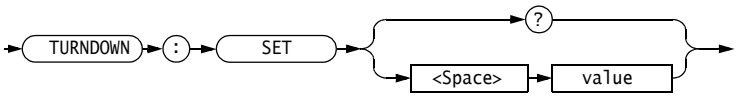
```
span:set?
101.00
```

TURNDOWN:SET

Sets or returns the value for the turndown.

Syntax `TURNDOWN:SET` *`turndown`*

`TURNDOWN:SET?`



Parameters ***turndown***

Real numeric value from [1..100] interval.
The pressure transducer's pressure range will be set to the turndown% of the original value.

Remarks Default value is 100.

Example `turndown:set 50`

If the pressure transducer has 0-5 V output at 0-200 PSIG, after setting turndown=50 output will be 0-5 V at 0-100 PSIG. Digital pressure measurement is not affected.

`turndown:set?`

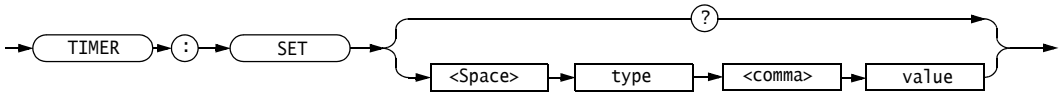
`50.000`

TIMER:SET

Sets or returns timer settings. The it2000 will send pressure and temperature readings over a RS-232 in the specified time interval.

Syntax `TIMER:SET` *`type, value`*

`TIMER:SET?`



Parameters ***type***

This value specifies a time interval type.
Possible values: 0-3.

Parameter	Result
0	Interval measured in 1/128 of a second
1	Interval measured in seconds
2	Interval measured in minutes
3	Interval measured in hours

value

Numeric value from 0 to 255.
This value determines a time interval in specified units of measure.

Remarks Value set to 0 will stop the timer function.

In 1/128 mode not every setting will result in a proper response rate due to the IT2000 performance limitations.

Example

```
timer:set 1, 100
timer:set?
sec,100
```

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