RS-485 Transducer
Digital Communication

User’s Manual

Firmware Version 218606C

Stellar Technology Incorporated
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Chapter 1

Installation

This chapter describes the steps to install the RS-485 Transducer.

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- Communication Setup .............................................................6
System Connections

The RS-485 provides network addressing for up to 256 nodes. The following diagram illustrates the network of 4 RS-485 transducers.
Communication Setup

The RS-485 Transducer uses an RS-485 interface as a means of communication with a controller. The default communication parameters are as follows:

<table>
<thead>
<tr>
<th>Setting</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baud rate</td>
<td>9600</td>
</tr>
<tr>
<td>Data bits</td>
<td>8</td>
</tr>
<tr>
<td>Stop bits</td>
<td>1</td>
</tr>
<tr>
<td>Parity</td>
<td>none</td>
</tr>
<tr>
<td>Flow control</td>
<td>none</td>
</tr>
</tbody>
</table>

Table 1-1: RS-485 communication settings

Commands are sent in ASCII text using the syntax described Chapter 2, “Using Commands”. All commands must be terminated with a \texttt{carriage-return} / \texttt{line-feed} combination or a \texttt{line-feed-only} character sequence.
CHAPTER 2

Quick-Start Tutorial

This chapter gives you a quick guide on how to connect RS-485 Transducer and start using it’s basic functionality.

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- Basic Measurements .................................................................9
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-485 Transducer response is shown below.

![Figure 2-1: Windows Terminal program](image)

For more commands see Chapter 4, “Command Reference”.
The RS-485 Transducer is controlled through the RS-485 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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- Command Entry ............................................................................13
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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:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; &gt;</td>
<td>Defined element</td>
</tr>
<tr>
<td>:: =</td>
<td>Is defined as</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>{}</td>
<td>Group; one element is required</td>
</tr>
<tr>
<td>[]</td>
<td>Optional; can be omitted</td>
</tr>
<tr>
<td>...</td>
<td>Previous element(s) may be repeated</td>
</tr>
<tr>
<td>()</td>
<td>Comment</td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;Header&gt;</td>
<td>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 (*).</td>
</tr>
<tr>
<td>&lt;Mnemonic&gt;</td>
<td>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.</td>
</tr>
</tbody>
</table>
Chapter 3: Using Commands

Table 3-2: Command Message Elements

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;Argument&gt;</td>
<td>A quantity, quality, restriction, or limit associated with the header. Not all commands have multiple arguments. Arguments are separated from the header by a &lt;Space&gt;. Arguments are separated from each other by a &lt;Comma&gt;.</td>
</tr>
<tr>
<td>&lt;Comma&gt;</td>
<td>The comma between arguments of multiple-argument commands. It may optionally have white space characters before and after the comma.</td>
</tr>
<tr>
<td>&lt;Space&gt;</td>
<td>A white space character between command header and argument. It may optionally consist of multiple white space characters.</td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>ASCII Code</th>
<th>Key Stroke</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Control + j</td>
<td>Line feed</td>
</tr>
<tr>
<td>13</td>
<td>Control + m</td>
<td>Carriage return</td>
</tr>
</tbody>
</table>

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:
Chapter 3: Using Commands

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"

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;QString&gt;</td>
<td>Quoted string value</td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;NZDig&gt;</td>
<td>a non-zero digit character, in the range 1-9</td>
</tr>
<tr>
<td>&lt;Dig&gt;</td>
<td>A digit character, in the range 0-9</td>
</tr>
<tr>
<td>&lt;DChar&gt;</td>
<td>A character with the hex equivalent of 00 through FF hexadecimal (0 through 255 decimal)</td>
</tr>
</tbody>
</table>
| <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:
Communication Timing Specifications

To ensure error-free communication with a network of RS-485 Transducer devices the following timing specifications must be taken into consideration:

1. Allow at least 50 mS between commands which don’t return a value;
2. Allow at least 150 mS after query commands.

Refer to Chapter 5 for a complete listing of commands.
CHAPTER 4

Command Reference

This chapter describes each of the commands used to configure and control the RS-485 Transducer pressure transducer. The command reference is broken down into several groups of related functionality.

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- Measure Subsystem ...............................................................20
- Instrument Subsystem .........................................................22
- Test Commands .................................................................23
- System Commands ..............................................................24
Measure Subsystem

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

MEAS: PRES

Returns a pressure measurement.

**Syntax**

\[\text{MEAS: PRES?}\]

**Remarks**
The unit of measure is PSI.

**Example**

meas:pres?

14.1340

MEAS: TEMP

Returns a temperature measurement. This is the temperature of the pressure sensing element which approximates that of the medium.

**Syntax**

\[\text{MEAS: TEMP [channel]?}\]

**Suffix**

*channel*

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>none</td>
<td>Temperature from the on-chip temperature sensor (default)</td>
</tr>
<tr>
<td>0</td>
<td>Temperature from the on-chip temperature sensor</td>
</tr>
<tr>
<td>1</td>
<td>Temperature from the RTD (optional)</td>
</tr>
</tbody>
</table>

**Remarks**
The unit of measure is degrees Fahrenheit.

**Example**

meas:temp?

78.0910
MEAS : ALL

Returns a pressure and temperature measurements.

Syntax

MEAS : ALL?

Remarks

First value - pressure measurement, second value - on-chip temperature measurement, third value - RTD temperature if there is one present.

Example

meas : all?
78.5000, 123.2430
**Instrument Subsystem**

The instrument subsystem includes commands for selecting and activating a device on an RS-485 network.

**INST:SEL**

Selects an instrument.

**Syntax**  
INST:SEL instrument

**Parameters**  
instrument  
Six digit serial number.

**Remarks**  
The instrument’s state may be changed only if the instrument is selected.

**Example**  
inst:sel 123456

**INST:STAT**

Changes the state of the selected instrument.

**Syntax**  
INST:STAT state

**Parameters**  
state  
1 - on  
0 - off.

**Remarks**  
All communications on the RS-485 network will be addressed only to the instrument with the state set to 1 (on).

**Example**  
inst:stat 1
Test Commands

Test commands allow to calibrate digital output of the RS-485 Transducer.

TEST:INP

Reads digital counts from selected channels.

**Syntax**  TEST:INP [channel]?

**Suffix**  channel

Possible values: 5

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Digital pressure and temperature counts, Board temperature</td>
</tr>
</tbody>
</table>

**Example**  test:inp5?

1177507,49985,67.332
System Commands

System commands includes those relating to identification and resetting the unit.

*IDN

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

Syntax

*IDN?

Example

*idn?
STELLAR TECHNOLOGY INC,IT2001-15A-101,007713,0

*RST

Resets the it2001 to power-up status. All parameters return to their default state.

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 50
$span$:set?
50.000
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