Laser Technology, Inc.

TruSense® S100

User's Manual

LASER TECHNOLOGY INC
Measurably Superior®

LTI TruSense® S100 User's Manual
3rd Edition Part Number 0144846

Printed in the United States of America

LTI Contact Information:

Laser Technology, Inc.
6912 S. Quentin Street
Centennial, CO 80112

Phone: 1-303-649-1000
1-877-OWN-A-LIT (USA and Canada)
Fax: 1-303-649-9710
Web Site: www.lasertech.com
Email: service@lasertech.com

LTI TruSense S100 User's Manual (p/n 0144846) Change Log

- **3rd Edition** July 2015
  - Added LTI-brand cover page with hex design, inside cover page with copyright/patent/trademark/LTI contact information. Pages i-ii
  - Added the Change Log Page 1
  - Deleted sentence about PDF version of the LTI Limited Warranty being available on S100 CD. Page 30
  - Updated Internal Cable Diagram. Page 31
- **2nd Edition** April 2011
  - Updated Internal Cable Diagram to 7054664_01 Cable Rear Plate. Page 31
- **1st Edition** May 2010

Table of Contents

Introduction

Basic Package

- ☐ S100 Sensor or S100 OEM Sensor
- ☐ Communication Cable with Flying Leads
- ☐ LTI Limited Warranty

Developer's Kit

- ☐ Power/Communication Cable
- ☐ CDROM
  (includes the Interface Software and User's Manual)

Accessory Items

- ☐ Rear Plate Cable
  (for OEM Power/Communication cable adapt)
- ☐ 4" Tank Adaptor with Housing
- ☐ Tilt/Rotate Mounting Bracket
- ☐ Sun Shade
- ☐ DB9 to USB Adaptor

Safety Precautions

- Avoid staring directly at the laser beam for prolonged periods. The TruSense S100 is designed to meet FDA eye safety requirements and is classified as eye safe to FDA (CFR21) Class I 7 mm limits, which means that virtually no hazard is associated with directly viewing the laser output under normal conditions. As with any laser device, however, reasonable precautions should be taken in its operation.

- It is recommended that you avoid staring into the transmit aperture while firing the laser. The use of optical instruments with this product may increase eye hazard.

- Never point the instrument directly at the sun. Exposing the lens system to direct sunlight, even for a brief period, may permanently damage the laser transmitter.

Mounting the TruSense S100

IMPORTANT!
When mounting the S100, always use a washer between housing feet and screw head.
Do not exceed 5 inch-pounds of torque when securing.

Getting Started

You may choose to get familiar with the sensor performance and configuration in a controlled environment. After unpacking, power on the unit with the supplied cabling and connect the DB9 pin serial connector to a serial I/O device such as a PC. A DB9 to USB adaptor is available from LTI.

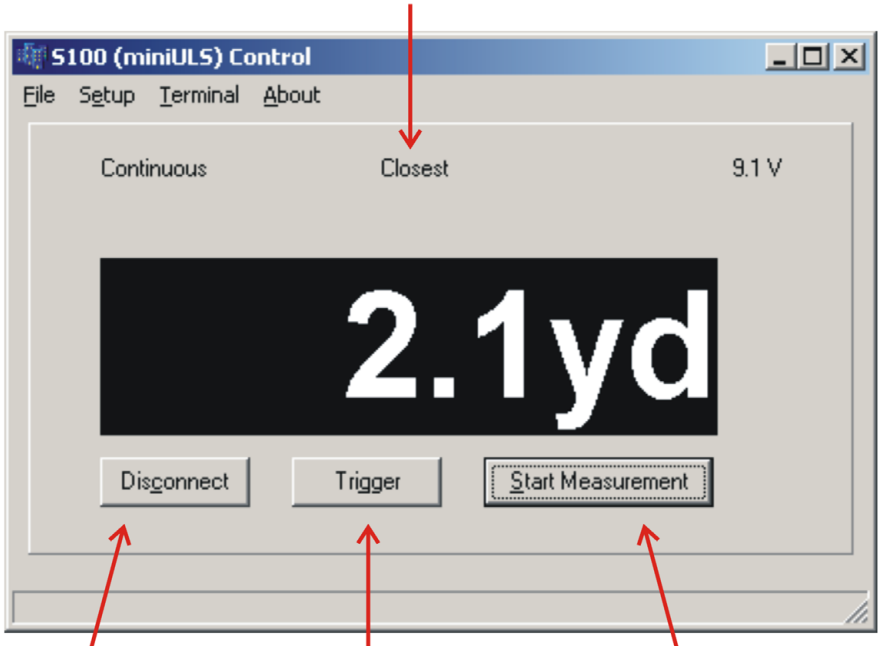
Connect using either the supplied Interface software or a terminal emulation program such as Hyperterminal. Defaults=115200 baud rate, no parity, 8 data bits, 1 stop bit, no flow control.



Configuration

You may choose to use the supplied Interface Software to configure the sensor. A terminal emulation program may also be used. For information about the Serial Communication Protocol see Page 10.

Screen capture shows Continuous Measurement Mode, Closest Target Mode, and 9.1 VDC supply voltage.



Disconnect before powering down unit.

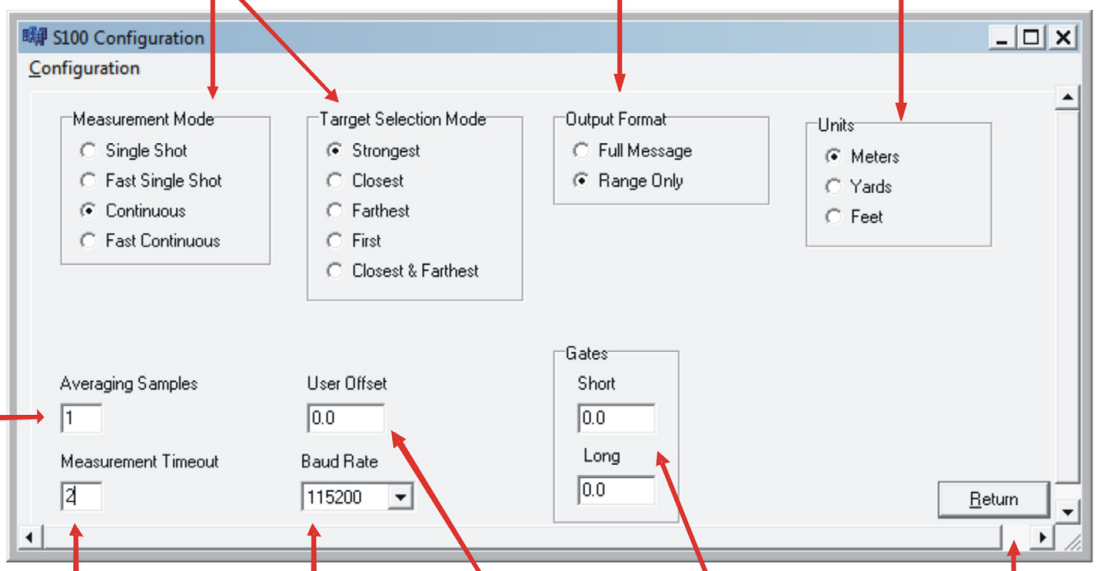
This button represents a trigger to awaken the S100 from Sleep Mode. It is not functional with this interface software or with a terminal emulation program

Stop measurement before selecting Setup on the toolbar. This will prevent screen lock.

See Configuration Tree for setup guide.
- Farthest is advantageous for penetrating dust or fog.

Allows you to change the number of characters output in the serial data string.

Distance units are user selectable.



This is how many samples are averaged for each measurement.
- Minimum = 1
- Maximum = 1000

Maximum time in seconds the sensor has to acquire a target.

Minimum = 1 second
Maximum = 1800 seconds (0.5 hour)

Sensor ships with 115200 baud rate default.

The User Offset is added to or subtracted from the overall distance.

Offset distance is from the face plate of the sensor.

There is no minimum or maximum and can be positive or negative.

Short Gate: sensor ignores readings in front of the desired target.

Long Gate: sensor ignores readings behind the desired target.

When setting a gate, always set slightly beyond or in front of the actual object you want to ignore.

Examples:
Short Gate: to ignore a target at n feet, set the gate slightly greater than n feet.
Long Gate: to ignore a target at n feet, set the gate slightly less than n feet.

If setting both gates, the minimum distance between the short and long gates should be 2 feet or 0.6 meters.

Pressing Return uploads and saves the configuration to the sensor. When the unit is powered off, the settings are retained in sensor memory.

Target Modes

The TruSense S100 has five targeting modes that allow the unit to be optimized for varying measurement conditions. When selecting a mode, you will need to consider your specific situation and application.

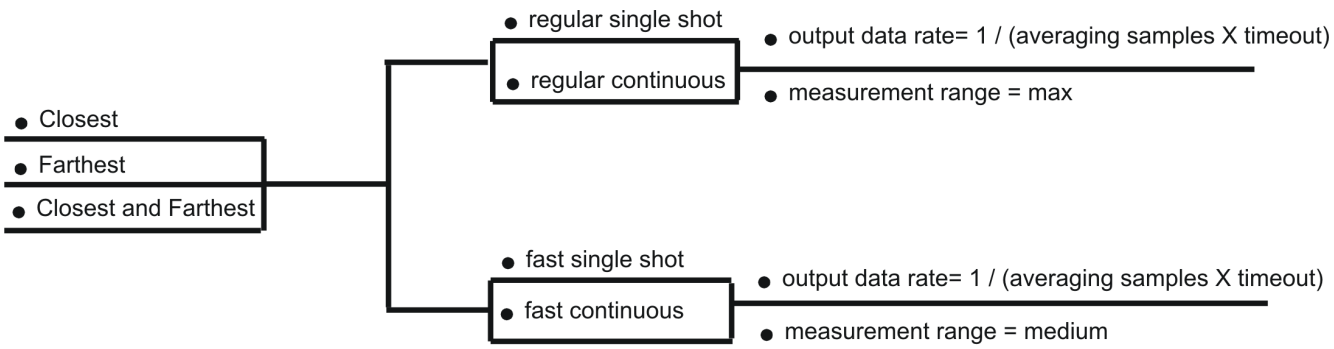
Mode	Description
First	The unit takes a single measurement, transmits the output results and stops. The measurement output represents the distance to the first target the unit sees that is above the minimum detection level.
Strongest	The unit takes a single measurement, transmits the output results and stops. The measurement output represents the distance to the strongest target the unit sees that is above the minimum detection level.
Closest	Multiple-target operating mode. Allows the unit to detect multiple target reflections along the measurement sight line and output the distance to the closest target it sees. The unit continues to gather target data along the sight line, allowing weaker close-in targets to eventually be detected in front of stronger, distant targets. Example: measuring a utility pole in front of a building.
Farthest	Multiple-target operating mode. Allows the unit to detect multiple target reflections along the measurement sight line and output the distance to the farthest target it sees. The unit continues to gather target data along the sight line, allowing weaker distant targets to eventually be detected beyond stronger, close-in targets. Example: measuring a distant building while shooting through close-in brush.
Closest and Farthest	Multiple-target operating mode. The unit outputs the two distances, (1) the distance to the closest target and (2) the distance to the farthest target that the unit sees.

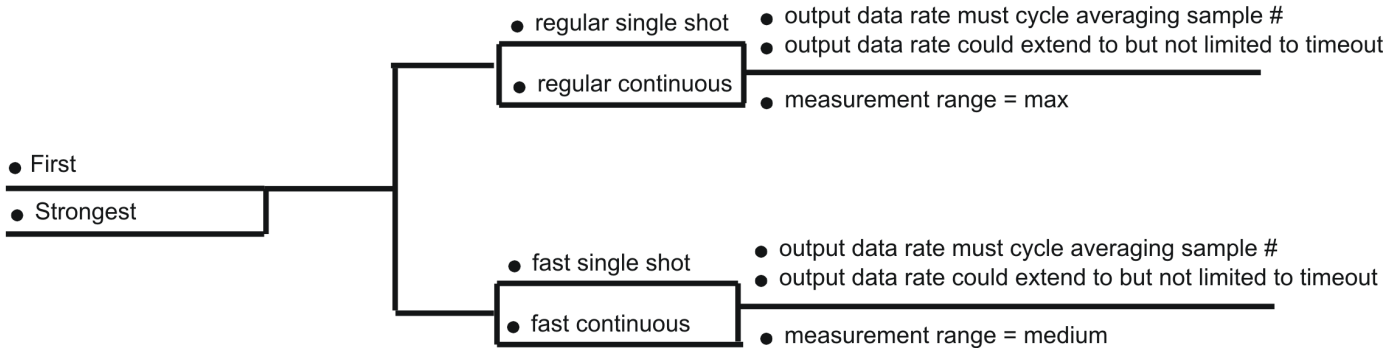
Measurement Modes

The TruSense S100 has four measurement modes that allow the unit to be optimized for varying measurement conditions. When selecting a mode, you will need to consider your specific situation and application.

Mode	Description
Single Shot	The unit will take a single measurement, transmit the output result and stop. The measurement output represents the distance to the target chosen by Target Mode (Page 12). To initiate a new measurement the Ext-Trig line must be deactivated and reactivated.
Continuous	*When the measurement is initiated via hardware control,* the unit will continue to output results as long as the Ext-Trig line is held active. *When the measurement is initiated via software control,* the unit will continue to output results until the Stop Distance Measurement command is received (Page 23). The measurement output represents the distance to the target chosen by Target Mode (Page 12).
Fast Single Shot	The instrument completes the measurement within 160 msec and the range is limited to few hundred meters. Refer to description of Single Shot Mode (above).
Fast Continuous	The instrument measures an average of six times per second and range is limited to few hundred meters. Refer to description of Continuous Mode (above).

Configuration Tree





Error Codes

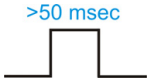
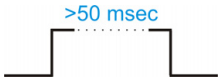
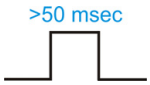
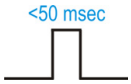
When using the S100 if you experience an error, you may be able to correct it yourself. If you need technical support, please contact LTI Service.

Error Code	Explanation
00	Invalid Command.
01	No Target.
10	Bad Data Checksum.
11	Already Measuring.
12	Invalid Parameter.
21	User Settings Checksum.
22	Factory Settings Checksum.
23	BIST Test.
24	PLL Test.
25	Tx Power.
26	Higher Precision.
27	Receiver.
28	Supply Voltage too High.
29	Supply Voltage too Low.
30	Temperature too High.
31	Temperature too Low.

Details of 'Shutdown' and 'Ext-Trig' Control Signals

- **Shutdown**
  When this line is forced to an active state (high level) the entire LRF module is shutdown. While in the shutdown state, the Shutdown signal will draw approximately 250 uA (@5 V level) and the Power Input line will draw less than 100 uA. The unit will remain in the shutdown state as long as the Shutdown signal is held active. Following the transition of the Shutdown line to the inactive state (low level or unconnected), the LRF will fully boot up and be ready for an initial measurement or serial communications within 250 msec.

- **Ext-Trig**
  This control line has dual functionality. It acts similar to the physical trigger/fire button on a conventional handheld laser rangefinder. In normal operating mode, when this line is forced to an active state (high level) the LRF module will initiate a measurement. In Single Shot Mode the laser will fire until the measurement timeout is reached (Page 17). In Continuous Mode the laser will fire as long as the Ext-Trig signal is held active. When the unit is in Sleep Mode after the Shutdown Delay expires, a short pulse (duration not less than 50 msec) on this line will wake up the unit. A pulse longer than 50 msec will wake up the unit and initiate a measurement.

Single Shot Mode	Set high longer than 50 msec.	
Continuous Mode	Set high longer than 50 msec. Hold as long as you want to output measurement results.	
	Set high at least 50 msec and then set low to output single measurement.	
Sleep Mode	Set high less than 50 msec to wake up the unit.	
	Set high longer than 50 msec to wake up the unit and initiate a measurement.	

Serial Communication Protocol

- Each command and reply starts with a '$' sign and ends with <CR><LF>.
- Default communication parameters: baud rate 115200, no parity, 8 data bits, 1 stop bit.
- Issuing mnemonic command without an associated parameter will return a current setting of the given parameter (examples follow).
- Upon applying power, the unit performs an initialization, onboard self-tests and then goes into Sleep Mode if enabled.
- Following initialization, the unit sends a message or error number/message:
  - $OK<CR><LF> if no errors are detected.
  - $ER,nn<CR><LF> if the self-test failed. Where 'nn' indicates the type of failure (Page 16). See Page 19 for information about Error Message Output Format.
- Two methods for initiating a measurement:
  - serial command request (Page 23).
  - hardware control via the Ext-Trig control signal
- The time for an individual measurement will vary depending on the target reflectance and distance. Targets that are closer and more reflective will return a measurement quicker then targets that are farther away and less reflective. During Closest and Farthest Target Modes, the unit will attempt target acquisition for the default 2 seconds after which it will output the measurement or an error message.

Serial Commands

The TruSense S100 responds to four types of serial commands:

Request Only

Instrument Identification

Get: **$ID<CR><LF>**

Instrument Reply: **$ID,MiniULS** *version number date* **<CR><LF>**

where:
$ = message identifier
ID = mnemonic for TruSense S100 Software Version
<CR> = carriage return
<LF> = line feed

Example Reply: $ID,miniULS 0.960 2009-10-05 14:45<CR><LF>

Instrument Serial Number

Get: **$SN<CR><LF>**

Instrument Reply: **$SN, MU***nnnnnn* **<CR><LF>**

where:
$ = message identifier
SN = mnemonic for Serial Number
MU*nnnnnn* = instrument serial number
<CR> = carriage return
<LF> = line feed

Example Reply: $SN,MU012345<CR><LF>

Instrument Status

Get: **$IS<CR><LF>**

Instrument Reply: $IS,*x1*,*x2*,*x3*<CR><LF>

where:

$ = message identifier

IS = mnemonic for Instrument Status

x1,x2,x3 = instrument status bytes in hexadecimal notation

x1 - Instrument Settings

bit7, bit6 - Distance Units
- value 0 (0b00) - meters
- value 1 (0b01) - yards
- value 2 (0b10) - feet

bit5, bit4, bit3 - Measurement Mode
- value 0 (0b000) - single shot mode
- value 1 (0b001) - continuous mode
- value 2 (0b010) - fast single shot mode
- value 3 (0b011) - fast continuous mode

bit2,bit1,bit0 -Targeting Mode
- value 0 (0b000) - the strongest target
- value 1 (0b001) - the closest target
- value 2 (0b010) - the farthest target

x2 - Measurement Status
- bit7 - measurement in progress (1), idle (0)
- bit6 - measurement started by hardware trigger (1), by software (0)
- bit5 - measurement averaging in use (1), no averaging (0)
- bit4 - user offset enabled (non zero) (1), no user offset (0)
- bit3 - short gate enabled (non zero) (1), short gate off (0)
- bit2 - long gate enabled (non zero) (1), long gate off (0)
- bit1 - sleep time out enabled (1), disabled (0)
- bit0 - not used

x3 - System Warnings
- bit7 - supply voltage to low (1), normal (0)
- bit6 - supply voltage to high (1), normal (0)
- bit5 - instrument temperature to low (1), normal (0)
- bit4 - instrument temperature to high (1), normal (0)
- bit3, bit2, bit1. bit0 - not used

<CR> = carriage return

<LF> = line feed

Example Reply: $IS,08,00,00<CR><LF>

Instrument Temperature

Get: **$IT<CR><LF>**
Instrument Reply: **$IT,***n.n***<CR><LF>**

where: **$** = message identifier
IT = mnemonic for Instrument Temperature
n.n = instrument temperature (in degrees C)
<CR> = carriage return
<LF> = line feed

Example Reply: $IT,27.6<CR><LF>

Supply Voltage

Get: **$SV<CR><LF>**
Instrument Reply: **$SV,***n.n***<CR><LF>**

where: **$** = message identifier
SV = mnemonic for Supply Voltage
n.m = supply voltage (in V)
<CR> = carriage return
<LF> = line feed

Example Reply: $SV,9.0<CR><LF>

Measurement Configuration Commands

Target Mode

For information about Target Modes, see Page 6.
Set: **$TM,***tm***<CR><LF>**
Instrument Reply: **$OK<CR><LF>**

Get: $TM<CR><LF>
Instrument Reply: **$TM,***tm***<CR><LF>**

where: **$** = message identifier
TM = mnemonic for Target Mode
tm = *target mode*
FT = First
ST = Strongest (default)
CL = Closest
FA = Farthest
CF = Closest and Farthest
<CR> = carriage return
<LF> = line feed

Example: $TM,CL<CR><LF> Sets Target Mode to Closest.

Note: Enter **$TM,?<CR><LF>** to display the list of Target Mode mnemonics and descriptions.

Measurement Mode

For information about Measurement Modes, see Page 6.

Set: **$MM,*mm*<CR><LF>**
Instrument Reply: **$OK<CR><LF>**

Get: $MM<CR><LF>
Instrument Reply: **$MM,*mm*<CR><LF>**

where:
- **$** = message identifier
- **MM** = mnemonic for Measurement Mode
- *mm* = measurement mode
  - SI = Single Shot (default)
  - CO = Continuous
  - FSI = Fast Single Shot
  - FCO = Fast Continuous

  Note: In fast mode the instrument measures approximately six times per second and range is limited to a few hundred meters.
- **<CR>** = carriage return
- **<LF>** = line feed

Example: $MM,CO<CR><LF> Sets Measurement Mode to Continuous.

Note: Enter **$MM,?<CR><LF>** to display the list of Measurement Mode mnemonics and descriptions.

Distance Units

Set: **$DU,*u*<CR><LF>**
Instrument Reply: **$OK<CR><LF>**

Get: **$DU<CR><LF>**
Instrument Reply: **$DU,*u*<CR><LF>**

where:
- **$** = message identifier
- **DU** = mnemonic for Distance Units
- *u* = distance units
  - M = meters
  - Y = yards
  - F = feet (default)
- **<CR>** = carriage return
- **<LF>** = line feed

Example: $DU,M<CR><LF> Sets Distance Units to meters.

Gates

Short Gate

The Short Gate logic allows the unit to ignore any unwanted, close-in targets that may partially obstruct the measurement beam, such as windows, brush or rain. When a short gate distance is set, the unit will ignore any targets closer then that distance. The set value is always expressed in the current distance units. If the Distance Units setting is modified after a gate value has been set, the gate will automatically be reset to 0.0.

Default value = 0.0 Short Gate logic is disabled.

Set: **$SG,***n.n***<CR><LF>**
Instrument Reply: **$OK<CR><LF>**

Get: **$SG<CR><LF>**
Instrument Reply: **$SG,***n.n***<CR><LF>**

where:
- **$** = message identifier
- **SG** = mnemonic for Short Gate
- *n.n* = short gate distance in the current distance units
  No limitations. ±1 meter resolution.
- **<CR>** = carriage return
- **<LF>** = line feed

Example: $SG,50<CR><LF> Sets the Short Gate to 50.0

Long Gate

The Long Gate logic allows the unit to ignore any unwanted, distant targets that may be beyond the intended target, such as a fence, building or hillside. When a long gate distance is programmed the unit will ignore any targets farther then that distance. The set value is always expressed in the current distance units. If the Distance Units setting is modified after a gate value has been set, the gate will automatically be reset to 0.0.

Default value = 0.0. Long Gate logic is disabled.

Set: **$LG,***n.n***<CR><LF>**
Instrument Reply: **$OK<CR><LF>**

Get: **$LG<CR><LF>**
Instrument Reply: **$LG,***n.n***<CR><LF>**

where:
- **$** = message identifier
- **LG** = mnemonic for Long Gate
- *n.n* = long gate distance in the current distance units
  No limitations. ±1 meter resolution.
- **<CR>** = carriage return
- **<LF>** = line feed

Example: $LG,200<CR><LF> Sets the Long Gate to 200.0

User Offset

The User Offset value is a fixed offset that is added to the actual measured distance before the result is output via the serial communications interface. This essentially allows for an adjustable "zero distance measurement point" for variations in the mechanical mounting of the unit. For example, if the unit is mounted on a moving platform and must be physically located behind the edge of the platform, but it is desired to have the distance output be referenced to the platform edge, this can be achieved by entering a user offset value. If a negative User Offset value is entered, it is possible for the unit to output a negative distance measurement. If the Distance Units setting is modified after a distance offset value has been set, the offset will automatically be reset to 0.0.

Default value = 0.0.

Set: **$OS,***n.n***<CR><LF>**
Instrument Reply: **$OK<CR><LF>**

Get: **$OS<CR><LF>**
Instrument Reply: **$OS,***n.n***<CR><LF>**

where:
- **$** = message identifier
- **OS** = mnemonic for User Offset Value
- *n.n* = user offset value in the current distance units.
- **<CR>** = carriage return
- **<LF>** = line feed

Example: $OS,2<CR><LF> Sets the User Offset to 2.0

Instrument Configuration Commands

Baud Rate

Sets the serial communications data rate. The reply message to this command is sent at the previous baud rate. Thereafter all communications are at the new baud rate.

Default value = 115200 baud.

Set: **$BR,***n***<CR><LF>**
Instrument Reply: **$OK<CR><LF>**

Get: **$BR<CR><LF>**
Instrument Reply: **$BR,***n***<CR><LF>**

where:
- **$** = message identifier
- **BR** = mnemonic for Baud Rate
- *n* = baud rate:
  - 4800
  - 9600
  - 19200
  - 38400
  - 57600
  - 115200
- **<CR>** = carriage return
- **<LF>** = line feed

Example: $BR,9600<CR><LF> Sets the Baud Rate to 9,600

Diagnose Instrument

Get: **$DI,*n*<CR><LF>**

Instrument Reply: See examples below.

where:
- **$** = message identifier
- **DI** = mnemonic for Diagnose Instrument
- *n* = test number:
  - 0 = all tests
  - 1 = User Settings Checksum Test
  - 2 = Factory Settings Checksum Test
  - 3 = ASIC Tests
  - 4 = Tx Power Test
  - 5 = Precision Path Test
  - 6 = Rx Diode Test
- **<CR>** = carriage return
- **<LF>** = line feed

Example Requests & Replies:

$DI,1<CR><LF>	$OK,121,User Settings Checksum
$DI,2<CR><LF>	$OK,122,Factory Settings Checksum
$DI,3<CR><LF>	$OK,123,ASIC Bist
	$OK,124,ASIC Pll
$DI,4<CR><LF>	$OK,125,Tx Power
$DI,5<CR><LF>	$OK,126,Higher Precision
$DI,6<CR><LF>	$OK,127,Receiver

Example Error Messages:

$ER,00<CR><LF>	Invalid Command.
$ER,01<CR><LF>	No Target.
$ER,10<CR><LF>	Bad Data Checksum.
$ER,11<CR><LF>	Already Measuring.
$ER,12<CR><LF>	Invalid Parameter.
$ER,21<CR><LF>	User Settings Checksum
$ER,22<CR><LF>	Factory Settings Checksum
$ER,23<CR><LF>	BIST Test
$ER,24<CR><LF>	PLL Test
$ER,25<CR><LF>	Tx Power
$ER,26<CR><LF>	Higher Precision
$ER,27<CR><LF>	Receiver
$ER,28<CR><LF>	Supply Voltage too High
$ER,29<CR><LF>	Supply Voltage too Low
$ER,30<CR><LF>	Temperature too High
$ER,31<CR><LF>	Temperature too Low

These error messages are examples of the Minimal Error Message format (Page 19).

Go to Sleep

Puts the unit in Sleep Mode (minimal current consumption). The unit can only be awakened by toggling the external trigger line or disconnecting and then reconnecting the power supply.

Set: **$GS<CR><LF>**
Instrument Reply: **$Sleep<CR><LF>**

where:
$ = message identifier
GS = mnemonic for Go to Sleep
<CR> = carriage return
<LF> = line feed

Measurement Time Out

The Measurement Time out is the maximum time the unit will fire the laser (while the Ext-Trig control is activated) to attempt a measurement before stopping and transmitting an output data string.

Default value = 2 seconds

Set: **$MT,*n*<CR><LF>**
Instrument Reply: **$OK<CR><LF>**

Get: **$MT<CR><LF>**
Instrument Reply: **$MT,*n*<CR><LF>**

where:
$ = message identifier
MT = mnemonic for Measurement Time out
n = time out in seconds: 1 to 1800 seconds (30 minutes)
<CR> = carriage return
<LF> = line feed

Example: $MT,30<CR><LF> Sets the Measurement Time out to 30 seconds

Number of Averaged Samples

Single Shot Mode

Default value = 1

Set: **$SA,*n*<CR><LF>**
Instrument Reply: **$OK<CR><LF>**

Get: **$SA<CR><LF>**
Instrument Reply: **$SA,*n*<CR><LF>**

where:
$ = message identifier
SA = mnemonic for Averaged Samples in Single Shot Mode
n = number of averaged samples in single shot mode:
As *n* increases, the precision increases.
maximum = 1000
<CR> = carriage return
<LF> = line feed

Example: $SA,10<CR><LF> Sets the Number of Averaged Samples in Single Shot Mode to 10.

Continuous Mode

Default value = 1

Set: **$CA,*n*<CR><LF>**
Instrument Reply: **$OK<CR><LF>**

Get: **$CA<CR><LF>**
Instrument Reply: **$CA,*n*<CR><LF>**

where:
- **$** = message identifier
- **CA** = mnemonic for Averaged Samples in Continuous Mode
- *n* = number of averaged samples in continuous mode:
  As *n* increases, the precision increases.
  maximum = 1000
- **<CR>** = carriage return
- **<LF>** = line feed

Example: $CA,20<CR><LF> Sets the Number of Averaged Samples in Continuous Mode to 20.

Fast Measurement Mode

Default value = 1

Set: **$FA,*n*<CR><LF>**
Instrument Reply: **$OK<CR><LF>**

Get: **$FA<CR><LF>**
Instrument Reply: **$FA,*n*<CR><LF>**

where:
- **$** = message identifier
- **FA** = mnemonic for averaged samples in Fast Measurement mode
- *n* = number of averaged samples
  As *n* increases, the precision increases.
  maximum = 1000
- **<CR>** = carriage return
- **<LF>** = line feed

Example: $FA,2<CR><LF> Sets Number of Averaged Samples in Fast Single Shot Measurement Mode and Fast Continuous Measurement Mode to 2.

Output Format

Measurement Output Format

Default value = N

Set: **$MO,*f*<CR><LF>**
Instrument Reply: **$OK<CR><LF>**

Get: **$MO<CR><LF>**
Instrument Reply: **$MO,*f*<CR><LF>**

where:
- **$** = message identifier
- **MO** = mnemonic for Measurement Output Format
- *f* = measurement output format:
  - N = Full message
  - F = ASCII floating point range only
- **<CR>** = carriage return
- **<LF>** = line feed

Example: $MO,F<CR><LF> Sets Measurement Output Format to ASCII floating point range only.

Error Message Output Format

Default value = V

Set: **$EO,*f*<CR><LF>**
Instrument Reply: **$OK<CR><LF>**

Get: **$EO<CR><LF>**
Instrument Reply: **$EO,*f*<CR><LF>**

where:
- **$** = message identifier
- **EO** = mnemonic for Error Message Format
- *f* = error message format:
  - N = minimal (Enn)
  - V = verbose error number and text (Enn,text)
- **<CR>** = carriage return
- **<LF>** = line feed

Example: $EO,N<CR><LF> Sets Error Message Format to minimal (Enn).

Reset Instrument

Resets the unit as if power has been applied.

Set: **$RI<CR><LF>**
Instrument Reply: **$OK<CR><LF>**

where:
- **$** = message identifier
- **RI** = mnemonic for Reset Instrument
- **<CR>** = carriage return
- **<LF>** = line feed

Sleep Delay

The Sleep Delay is how long the unit will wait before going into Sleep Mode following the last communication or measurement activity.

Default value = 0.

Set: **$SD,*n*<CR><LF>**
Instrument Reply: **$OK<CR><LF>**

Get: **$SD<CR><LF>**
Instrument Reply: **$SD,*n*<CR><LF>**

where:
- **$** = message identifier
- **SD** = mnemonic for Sleep Delay
- *n* = delay in seconds:
  - maximum = 1000
  - 0 = never enter Sleep Mode
- **<CR>** = carriage return
- **<LF>** = line feed

Example: $SD,300<CR><LF> Sets Sleep Delay to 5 minutes.

Temperature

High Temperature Warning

Default value = 55.0° C

Set: **$HTW,*n.n*<CR><LF>**
Instrument Reply: **$OK<CR><LF>**

Get: **$HTW<CR><LF>**
Instrument Reply: **$HTW,*n.n*<CR><LF>**

where:
- **$** = message identifier
- **HTW** = mnemonic for High Temperature Warning
- *n.n* = temperature in degrees Centigrade
- **<CR>** = carriage return
- **<LF>** = line feed

Example: $HTW,50<CR><LF> Sets High Temperature Warning to 50.0° C.

Low Temperature Warning

Default value = -45.0° C

Set: **$LTW,*n.n*<CR><LF>**
Instrument Reply: **$OK<CR><LF>**

Get: **$LTW<CR><LF>**
Instrument Reply: **$LTW,*n.n*<CR><LF>**

where:
- **$** = message identifier
- **LTW** = mnemonic for Low Temperature Warning
- *n.n* = temperature in degrees Centigrade
- **<CR>** = carriage return
- **<LF>** = line feed

Example: $LTW,0<CR><LF> Sets Low Temperature Warning to 0° C.

User Text

Free form text. 64 characters per line and a maximum of 4 lines.

Set: **$UT,***n,text***<CR><LF>**
Instrument Reply: **$OK<CR><LF>**

Get: **$UT,***n***<CR><LF>**
Instrument Reply: **$UT,***n,text***<CR><LF>**

where:
- **$** = message identifier
- **UT** = mnemonic for User Text
- *n* = line number:
  - 1 = first line of user text
  - 2 = second line of user text
  - 3 = third line of user text
  - 4 = fourth line of user text
- *text* = maximum 64 characters per line
- **<CR>** = carriage return
- **<LF>** = line feed

Example: $UT,1,example text<CR><LF> Sets line #1 of user text to *example text*

Delete User Text

Used to delete existing free form user text. 64 characters per line and a maximum of 4 lines.

Set: **$DT,***n***<CR><LF>**
Instrument Reply: **$OK<CR><LF>**

where:
- **$** = message identifier
- **DT** = mnemonic for Delete User Text
- *n* = line number:
  - 1 = first line of user text
  - 2 = second line of user text
  - 3 = third line of user text
  - 4 = fourth line of user text
- **<CR>** = carriage return
- **<LF>** = line feed

Example: $DT,3<CR><LF> Deletes the third line of user text.

Voltage

Low Supply Voltage Warning

Default value = 5.5 V

Set: **$LSW,***n.n***<CR><LF>**
Instrument Reply: **$OK<CR><LF>**

Get: **$LSW<CR><LF>**
Instrument Reply: **$LSW,***n.n***<CR><LF>**

where:
- **$** = message identifier
- **LSW** = mnemonic for Low Supply Voltage Warning
- *n.n* = voltage
- **<CR>** = carriage return
- **<LF>** = line feed

Example: $LSW,6<CR><LF> Sets Low Supply Voltage Warning to 6.0 V.

High Supply Voltage Warning

Default value = 9.0 V

Set: **$HSW,***n.n***<CR><LF>**
Instrument Reply: **$OK<CR><LF>**

Get: **$HSW<CR><LF>**
Instrument Reply: **$HSW,***n.n***<CR><LF>**

where:
- **$** = message identifier
- **HSW** = mnemonic for High Supply Voltage Warning
- *n.n* = voltage
- **<CR>** = carriage return
- **<LF>** = line feed

Example: $HSW,8.5 <CR><LF> Sets Low Supply Voltage Warning to 8.5 V.

Measurement Control Commands

A distance measurement can be initiated by one of two methods: via a serial command request or by hardware control via the Ext-Trig control signal. The exact instrument response to either of these methods will depend upon the current Target Mode (Page 12) and Measurement Mode (Page 13).

Start Distance Measurement

This command will make the unit respond the same as if the Ext-Trig control signal is activated and held active.

Set: **$GO<CR><LF>**
Instrument Reply: **$OK<CR><LF>**

where:
- **$** = message identifier
- **GO** = mnemonic for Start Distance Measurement
- **<CR>** = carriage return
- **<LF>** = line feed

Note: For information about Measurement Output Messages see Page 24.

Stop Distance Measurement

This command is only effective if the 'GO' command has been previously sent to the unit. This command will make the unit respond the same as if the Ext-Trig control signal is deactivated.

Set: **$ST<CR><LF>**
Instrument Reply: **$OK<CR><LF>**

where:
- **$** = message identifier
- **ST** = mnemonic for Stop Distance Measurement
- **<CR>** = carriage return
- **<LF>** = line feed

Measurement Output Messages

When a distance measurement is initiated, the unit will always respond with one of two output messages; either the measured range or an error message. The output message will be predicated by one of three actions:

- Completion of a valid measurement.
- Deactivation of the Ext-Trig control signal during a measurement.
- Reaching the Measurement Time out limit (Page 17).

Distance Measurements

Output Format: **$DM,***n.n,DU,TM,MM,Tn***<CR><LF>**

Where:

$ = message identifier
DM = mnemonic for Distance Measurement

n.n = measured distance
Will be in tenths of units, with a minimum field size of one leading and one trailing digit. Example: 0.0; 0.4; 3.2; 132.0; etc.

DU = Distance Units
- M = meters
- Y = yards
- F = feet

TM = Target Mode
- ST = Strongest
- CO = Continuous
- CL = Closest
- FA = Farthest

MM = Measurement Mode
- SI = Single Shot
- CO = Continuous
- FSI = Fast Single Shot
- FCO = Fast Continuous

Tn = number of detected targets
- *n* = number of targets

<CR> = carriage return
<LF> = line feed

Example: $DM,76.7,M,ST,SI,T1<CR><LF>

measured distance	= 76.7
Distance Units	= meters
Target Mode	= Strongest
Measurement Mode	= Single Shot
number of detected targets	= 1

Error Messages

Error message format is set using the $EO command (Page 19).

For a list of possible error codes, Page 8.

Minimal

$ER,*nn*<CR><LF>

Where:
- **$** = message identifier
- **ER** = mnemonic for error message
- *nn* = indicates the error message code
  - 01 = No target acquired
  - 02 = Unstable target
- **<CR>** = carriage return
- **<LF>** = line feed

Examples:
$ER,00<CR><LF>
$ER,01<CR><LF>

Verbose Error Number and Text

$ER,*nn,error text***<CR><LF>**

Where:
- **$** = message identifier
- **ER** = mnemonic for error message
- *nn,error text* = indicates the Error Message code
  - 01,no target acquired
  - 02,unstable target
- **<CR>** = carriage return
- **<LF>** = line feed

Examples:
$ER,01,invalid command<CR><LF>

$ER,01,no target acquired<CR><LF>

Reference

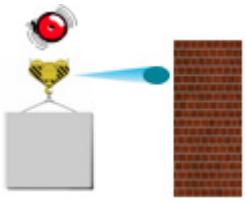
Application Examples

These examples are not absolute - sensor setup configuration varies depending on ambient conditions, target integrity, distance, constraints, and user requirements.

Aircraft Altitude and Mapping

Consideration: Measure the farthest target past potential sea mist or ground cover.

Crane Collision Avoidance



Consideration: Measure the first target encountered quickly.

Perimeter Detection

Consideration: Measure the fence and object in front of the fence and ignore light brush 6 yards in front of the sensor.

Frequently Asked Questions

What measurement technique is used with the S100?

The S100 uses infrared laser light to measure distance. This invisible light is emitted from the transmit lens of the sensor, reflects off of the target and returns to the receive lens of the senor. The exact distance is then calculated by comparing the return time to the speed-of-light constant.

Can the sensor measure to my target?

The ability of a laser sensor to measure to a target depends on the target's reflectance and any interference between the sensor and target such as dust, fog, foliage or other. Reflectance is determined by color, opacity, distance, and the reflection angle as well as the density of any ambient interference between the sensor and the target. For example, a lighter target is more reflective than a darker one and thick dust will reduce the signal strength more than light dust.

The S100 is a highly-sensitive precision sensor and can measure to most targets within its range specification. This includes penetrating dust or fog using the Farthest target mode for instance. A good rule of thumb when measuring through fog or dust is if you can visually see the target, the sensor likely can as well.

What is the beam diameter?

Beam Diameter at the Target = Free Aperture + (Divergence x Range)

Example:	Distance to the Target	= 100 m
	Divergence	= 3 mrad
	Free Aperature	= 23 mm
	Beam Diameter at the Target	= 0.023 + (0.003 x 100) = 323 mm

Therefore, beam diameter is 32.3 cm at 100 m or 12.7 in at 328 ft.

Which side is the Transmit lens?

Left side referencing the frontal view as shown in the figure to the right.

The measured distance is using what reference?

Distance measurements are from the sensor front plate to the target as shown in the figure to the right.

Does the sensor need additional protection when using outdoors?

The sunshade accessory is recommended to keep direct moisture and sun rays (heat) from coming in contact with the sensor. Direct sun rays on the sensor housing can easily heat the sensor above its operating temperature.

What is Sleep Mode?

Sleep mode saves power when not measuring. A trigger pulse of +3 to +15 VDC, 50 msec or longer will reactivate the sensor for measuring.

Is the beam eye safe?

Yes, but it is always a good practice not to stare directly into the transmit aperture of any light transmitting device.

How do I protect the housing from damage in vulnerable location?

The heavy duty housing accessory is recommended.

How do I align the S100?

An external method is required as the S100 is not equipped with alignment optics.

Alignment can be performed using an inexpensive laser pointer. Place a reflective sheet on the target to increase visibility. Reference the offset from the pointer to the transmit lens center of the S100 and this offset will be the same on the reflective sheet.

How can I adjust the sensor after mounting?

The tilt/rotate mounting bracket accessory is recommended.

How do I mount to measure into a tank or silo?

The heavy duty housing with dust tube accessory is recommended.

What considerations are there when measuring through a window?

When measuring through a window, ensure the face plate of the sensor is 3 mm or closer to the window. Reflections will increase with a larger gap and could result in measurement error. This is due to "crosstalk". Crosstalk occurs when a reflection off of a very close reflector like a window is combined with the actual target reflection and could lead to an inaccurate measurement.

Specifications

Performance:	Min. Range:	1.5 feet (0.46 meters)
	Max.Range (reflective/non-reflective):	7546/5249 feet (2300/1600 meters)
	Accuracy:	±3.3 feet (1 meter)
	Resolution:	0.1 feet (0.1 meter)
	Pulse Repetition Frequency:	1,000 Hz
	Data Output Rate	1 to 6 Hz depending on target integrity
	Target Modes:	First, Strongest, Closest, Farthest, Closest and Farthest
	Self Check:	On boot up
	Timing:	From shutdown to ready = 90 msec From sleep to ready = 0.1 msec
	Wavelength:	905 nm (near IR)
	Beam Divergence:	3 mrad (equal to 1 foot beam diameter at 328 feet or 30 cm at 100 meters)
	Free Aperture:	0.91 inch (23 mm)
	Cordset:	Male gender, straight, shielded, 6 pin Turck Picofast PSG 6M-*/S90/S618 (* = cable length)
	I/O:	Pin1 = shutdown, Pin2 = ground, Pin3 = RS232 Tx, Pin4 = RS232 RX, Pin5 = power input, Pin6 = ext trigger
	Baud Rate (min./max.):	4800/230400
	Input Power:	6 to 11 VDC
Optical & Electrical:	Current Draw:	Measuring = 140 mA Idle = 50 mA Sleep = 30 mA

Physical:	Dimensions (LxWxH)	4.11 in x 3.22 in x 1.64 in (104.4 mm x 81.7 mm 41.6 mm)
	Weight:	OEM = 2.7 oz (76 g) Standard = 4.8 oz (138.6 g)
	Housing & Frame Material:	Glass filled polycarbonate
	Eye Safety:	Class I, 7mm (FDA CFR21) Class 1m (IEC 60825-1:2001)
	Shock Vibration:	MIL-STD-810E
Environmental:	Moisture:	IP67, NEMA 6 (S100 in housing only) *** S100 in housing only. Does not apply to the S100 OEM Sensor.*
	Operating Temperature:	-20° F to 140° F (-28° C to 60° C)

Care and Maintenance

Operating Temperature

The S100 is rated for a temperature range of -20° F to 140° F (-28° C to 60° C. Do not operate the instrument in temperatures outside of that range.

Moisture and Dust Protection

The sun shade is recommended if the sensor is exposed to the elements. The lenses of the sensor should be kept clear of excessive contamination for optimal performance.

Cleaning

Excess Moisture:	Towel off excess moisture and air dry the instrument at room temperature.
Exterior Dirt:	Wipe exterior surfaces clean.
Dirty lenses:	Use a brush to remove surface dust and loose particles from the transmit and receive lenses. To clean a lens, moisten it with lens cleaning solution and wipe it clean with a lens cloth or lens tissue.

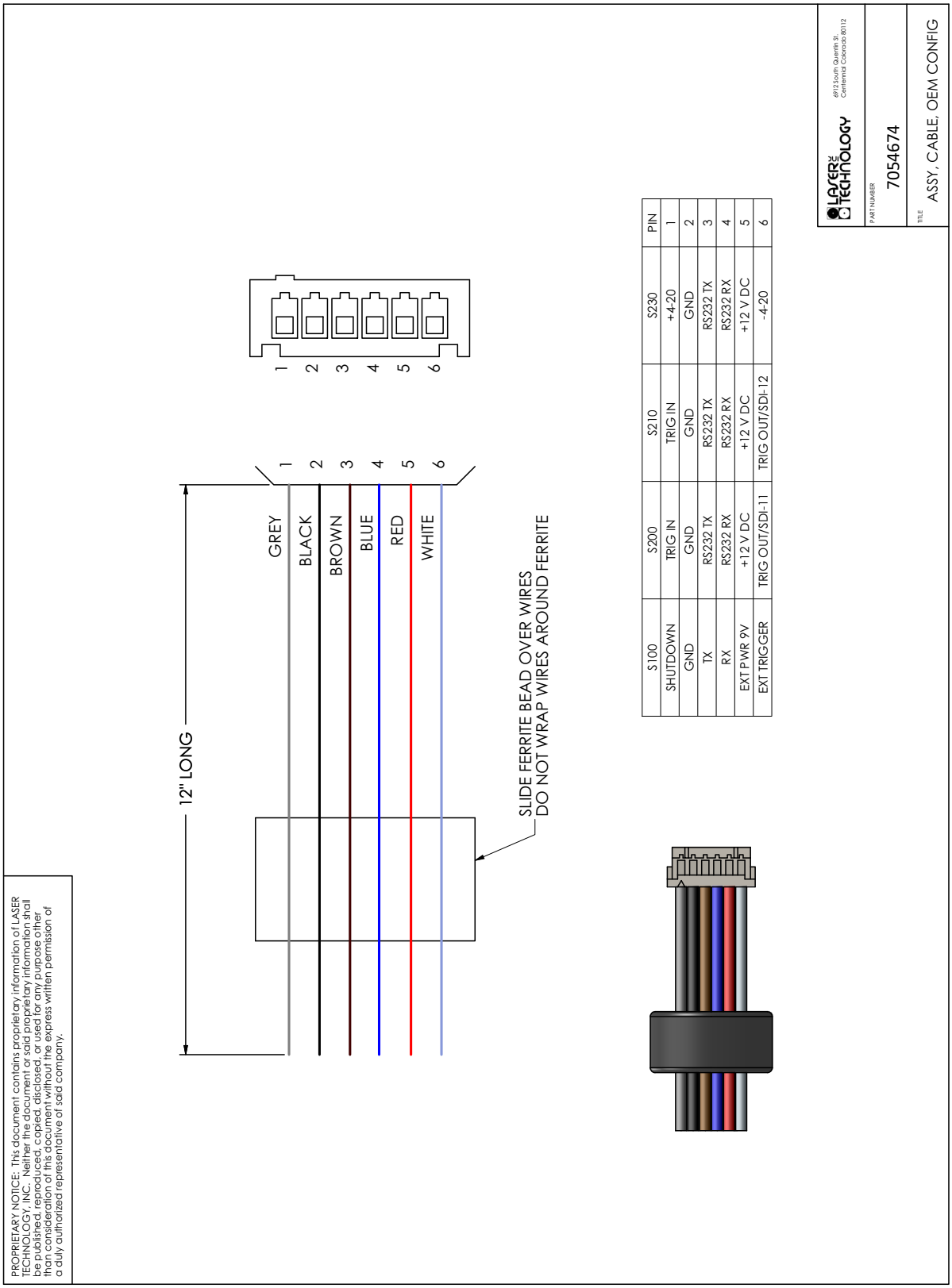
Warranty

The TruSense S100 is covered by the one-year LTI Limited Warranty. When you received your TruSense S100, you should have received the current copy of the LTI Limited Warranty. If you did not receive a copy or if you cannot locate your copy, please contact LTI.

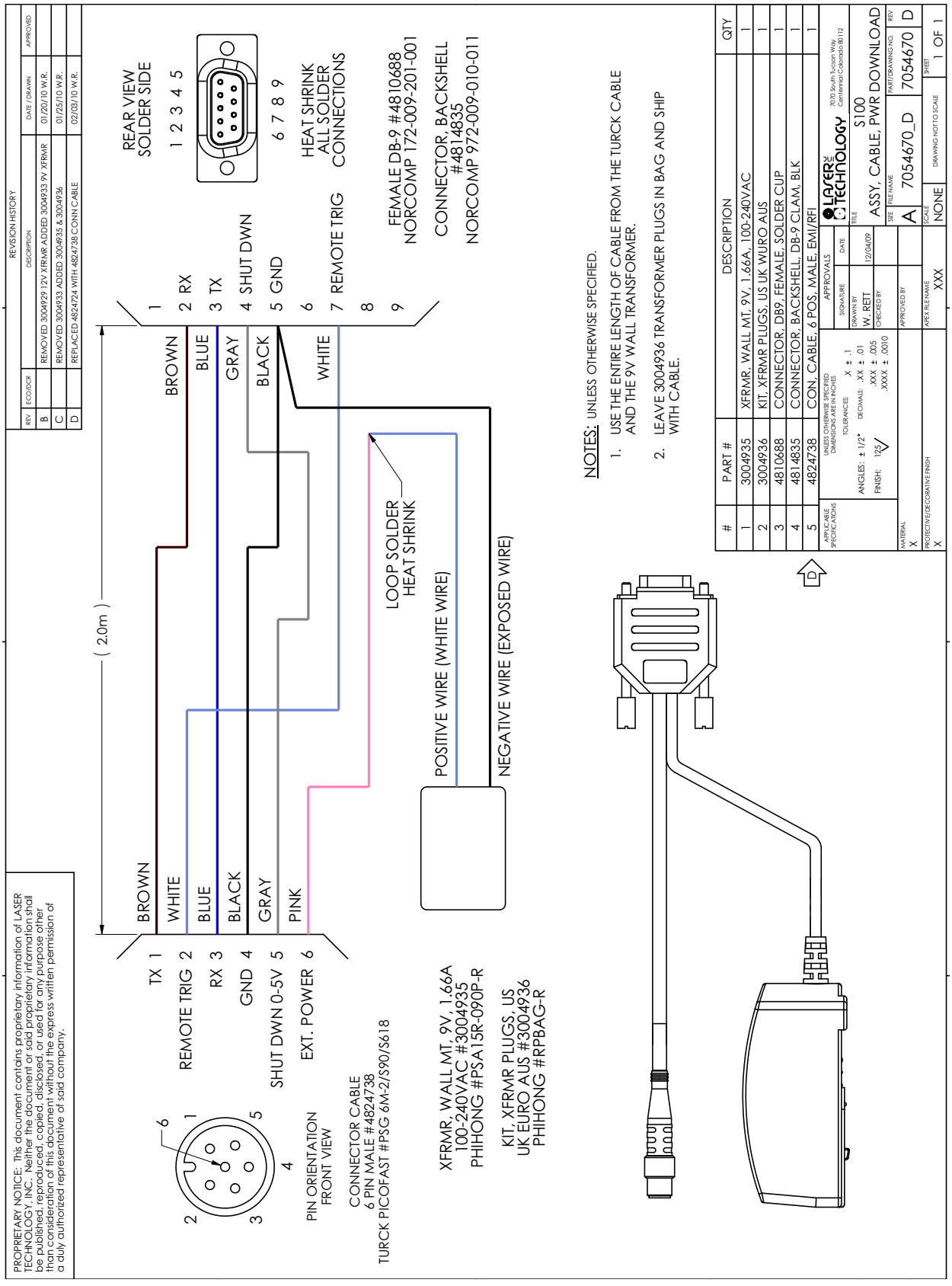
To register your TruSense S100, please visit the LTI web site: www.lasertech.com/Warranty-Registration.aspx

Diagrams

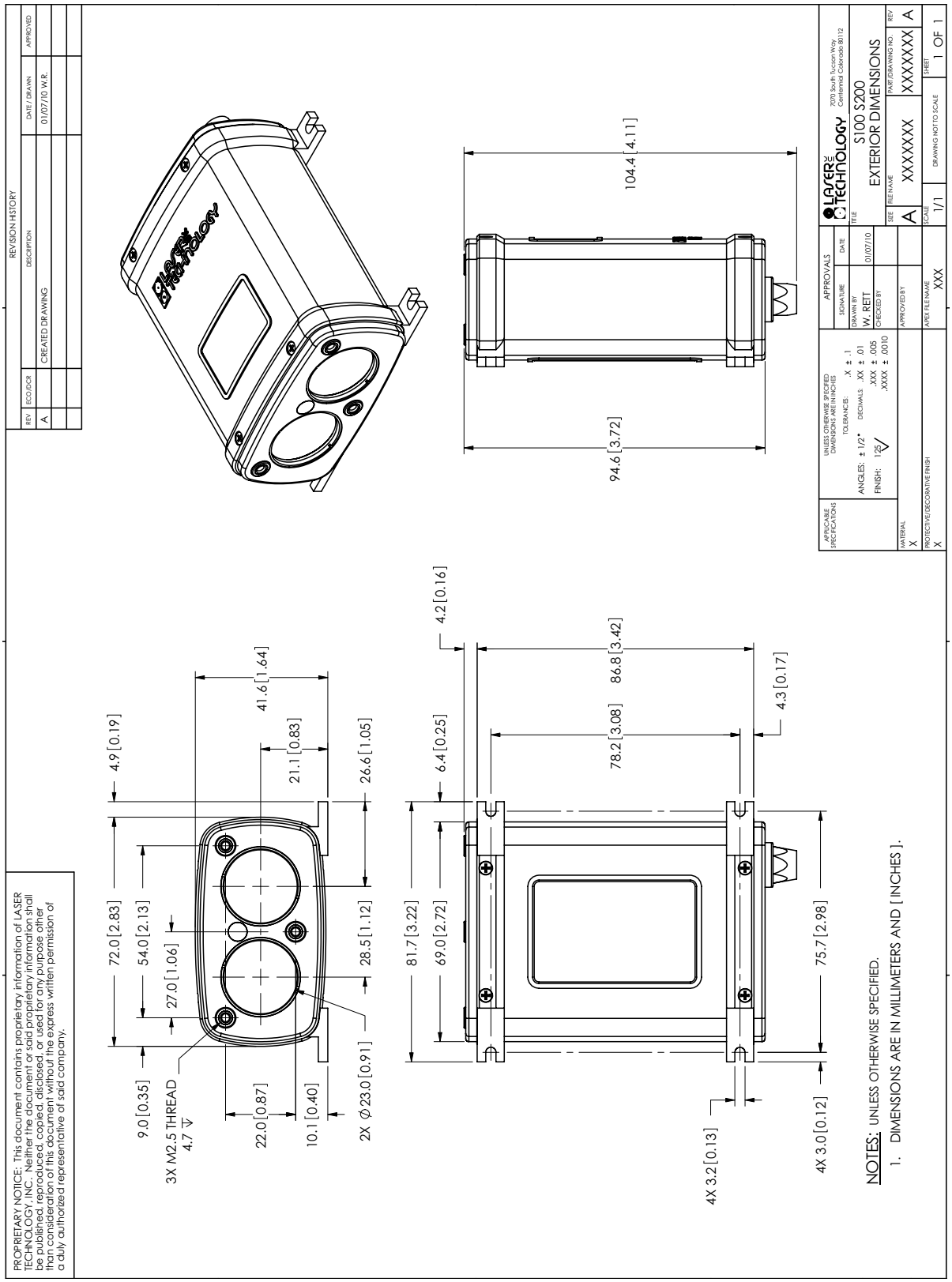
Internal Cable



External Cable



Housed Model Dimensions



OEM Model Dimensions