LASER TECH

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TruPulse i Series
Communication Protocols & Commands

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NOTE: This document supplements the "LTI TruPulse Communications" document.

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Measurement Output Messages

NOTE: Measurement output messages are automatically output from the TruPulse 200i & 360i following the completion of any measurement or measurement sequence.

Name	Format / Description	Example	Notes
TP 200i Horizontal Vector	**$PLTIT,HV,***HDvalue,HDunits,AZvalue,AZunits,INCvalue,INCunits,SDvalue,SDunits*csum* **<CR><LF>**	**$PLTIT,HV,18.00,F,,,6.90,D,18.00,F*66**	
	$PLTIT : Message Header : (LTI Criterion)		
	HV : Message Type : (Horizontal Vector)		
	HDvalue : Calculated Horizontal distance : (1-2 decimal places)		Decimal resolution depends on SD target quality and output resolution (see below). HD decimal precision is same as SD.
	HDunits : Measurement units : **F** =feet / **M** =meters		
	AZvalue : Empty field is azimuth value		For the AZ value, empty field is azimuth value and do not show the units "D".
	AZunits : Measurement units : **D** =degrees		
	INCvalue : Measured Inclination : (2 decimal places / May be positive or negative value)		
	INCunits : Measurement units : **D** =degrees		
	SDvalue : Measured Slope Distance : (1-2 decimal places)		1 decimal place for low quality target and 2 decimal places for a high quality target. Target quality is determined by internal ranging algorithm.
	SDunits : Measurement units : **F** =feet / **M** =meters		
	**csum* : An asterisk followed by a hexadecimal checksum (calculated by XORing all characters between the dollar sign and the asterisk)		
	<CR> : Carriage return delimiter		
	<LF> : Linefeed		
Note:	HDvalues, INCvalues, and SDvalues always include two decimal places: XX.YY		
	Range values (HD & SD) depend on the target quality: High or Low. The difference will be designated in the values of the output string with decimal points: Low XX.Y, High XX.YY		
Example:	High Quality Target: $PLTIT,HV,18.00,F,185.20,D,6.90,D,18.00,F*66		
	Low Quality Target: $PLTIT,HV,7.0,M,0.00,D,3.0,D,7.0,M*64		

Name	Format / Description	Example	Notes
TP 360i Horizontal Vector	**$PLTIT,HV,***HDvalue,HDunits,AZvalue,AZunits,INCvalue,INCunits,SDvalue,SDunits*csum* **<CR><LF>**	**$PLTIT,HV,18.00,F,185.20,D,6.90,D,18.00,F*66**	
	$PLTIT : Message Header : (LTI Criterion)		
	HV : Message Type : (Horizontal Vector)		
	HDvalue : Calculated Horizontal distance : (1-2 decimal places)		Decimal resolution depends on SD target quality and output resolution (see below). HD decimal precision is same as SD.
	HDunits : Measurement units : **F** =feet / **M** =meters		
	AZvalue : Measured Azimuth : (2 decimal places)		
	AZunits : Measurement units : **D** =degrees		
	INCvalue : Measured Inclination : (2 decimal places / May be positive or negative value)		
	INCunits : Measurement units : **D** =degrees		
	SDvalue : Measured Slope Distance : (1-2 decimal places)		1 decimal place for low quality target and 2 decimal places for a high quality target. Target quality is determined by internal ranging algorithm.
	SDunits : Measurement units : **F** =feet / **M** =meters		
	**csum* : An asterisk followed by a hexadecimal checksum (calculated by XORing all characters between the dollar sign and the asterisk)		
	<CR> : Carriage return delimiter		
	<LF> : Linefeed		
Note:	HDvalues, INCvalues, and SDvalues always include two decimal places: XX.YY		
	Range values (HD & SD) depend on the target quality: High or Low. The difference will be designated in the values of the output string with decimal points: Low XX.Y, High XX.YY		
Example:	High Quality Target: $PLTIT,HV,18.00,F,185.20,D,6.90,D,18.00,F*66		
	Low Quality Target: $PLTIT,HV,7.0,M,0.00,D,3.0,D,7.0,M*64		

Name	Format / Description	Example	Notes
TP200i & TP360i Height	**$PLTIT,HT,***HTvalue,HTunits*csum* **<CR><LF>**	**$PLTIT,HT,22.10,F*0C**	Only the final HT result is sent out.
	$PLTIT : Message Header : (LTI Criterion)		
	HT : Message Type : (Height)		
	HTvalue : Calculated Height : (2 decimal places)		
	HTunits : Measurement units : **F** =feet / **M** =meters		
	**csum* : An asterisk followed by a hexadecimal checksum (calculated by XORing all characters between the dollar sign and the asterisk)		
	<CR> : Carriage return delimiter		
	<LF> : Linefeed		
TP 200i Missing Line	**$PLTIT,ML,***HDvalue,HDunits,AZvalue,AZunits,INCvalue,INCunits,SDvalue,SDunits*csum* **<CR><LF>**	**$PLTIT,ML,8.10,F,,,3.20,D,8.10,F*74**	Only the final ML result is sent out.
	$PLTIT : Message Header : (LTI Criterion)		
	ML : Message Type : (Missing Line)		
	HDvalue : Calculated Horizontal distance : (2 decimal places)		
	HDunits : Measurement units : **F** =feet / **M** =meters		
	AZvalue : Empty field is azimuth value		For the AZ value, empty field is azimuth value and do not show the units "D".
	AZunits : Measurement units : **D** =degrees		
	INCvalue : Calculated Inclination : (2 decimal places / May be positive or negative value)		
	INCunits : Measurement units : **D** =degrees		
	SDvalue : Calculated Slope Distance : (2 decimal places)		Always output to decimal places regardless of the target quality of shot 1 and shot 2
	SDunits : Measurement units : **F** =feet / **M** =meters		
	**csum* : An asterisk followed by a hexadecimal checksum (calculated by XORing all characters between the dollar sign and the asterisk)		
	<CR> : Carriage return delimiter		
	<LF> : Linefeed		
Note:	HDvalues, INCvalues, and SDvalues always include two decimal places: XX.YY		
	Range values (HD & SD) depend on the target quality: High or Low. The difference will be designated in the values of the output string with decimal points: Low XX.Y, High XX.YY		
Example:	High Quality Target: $PLTIT,HV,18.00,F,185.20,D,6.90,D,18.00,F*66		
	Low Quality Target: $PLTIT,HV,7.0,M,0.00,D,3.0,D,7.0,M*64		

Name	Format / Description	Example	Notes
TP360i Missing Line	**$PLTIT,ML,***HDvalue,HDunits,AZvalue,AZunits,INCvalue,INCunits,SDvalue,SDunits*csum* **<CR><LF>**	**$PLTIT,ML,8.10,F,316.90,D,3.20,D,8.10,F*74**	Only the final ML result is sent out.
	$PLTIT : Message Header : (LTI Criterion)		
	ML : Message Type : (Missing Line)		
	HDvalue : Calculated Horizontal distance : (2 decimal places)		
	HDunits : Measurement units : **F** =feet / **M** =meters		
	AZvalue : Calculated Azimuth : (2 decimal places)		
	AZunits : Measurement units : **D** =degrees		
	INCvalue : Calculated Inclination : (2 decimal places / May be positive or negative value)		
	INCunits : Measurement units : **D** =degrees		
	SDvalue : Calculated Slope Distance : (2 decimal places)		Always output to decimal places regardless of the target quality of shot 1 and shot 2
	SDunits : Measurement units : **F** =feet / **M** =meters		
	**csum* : An asterisk followed by a hexadecimal checksum (calculated by XORing all characters between the dollar sign and the asterisk)		
	<CR> : Carriage return delimiter		
	<LF> : Linefeed		
Note:	HDvalues, INCvalues, and SDvalues always include two decimal places: XX.YY		
	Range values (HD & SD) depend on the target quality: High or Low. The difference will be designated in the values of the output string with decimal points: Low XX.Y, High XX.YY		
Example:	High Quality Target: $PLTIT,HV,18.00,F,185.20,D,6.90,D,18.00,F*66		
	Low Quality Target: $PLTIT,HV,7.0,M,0.00,D,3.0,D,7.0,M*64		

TruPulse 200i & 360i Commands

Name	Format / Description	Response	Example	Notes
Instrument Identification	**$ID<CR><LF>**	**$ID**,*model,versionid, date, serial number*csum* **<CR><LF>**	**$$BV**	
	$ID : Command type	**$ID** : Command type		
	<CR> : Carriage return delimiter	*model* : Instrument model name		*model* = **TP200i** or **TP360i**
	<LF> : Linefeed	*versionid* : Firmware revision number		
		date : Product manufacture date (format = *YYYYMMDD*)		Decided on format = **YYYYMMDD**
		**csum* : An asterisk followed by a hexadecimal checksum (calculated by XORing all characters between the dollar sign and the asterisk)		
		<CR> : Carriage return delimiter		
		<LF> : Linefeed		
Get Battery Status	**$TS<CR><LF>**	**$TS**,*n*	**$TS,2**	Battery voltage Mid
		Where:		
		n = 1: Low		
		n = 2: Mid		
		n = 3: High		
		n = 4: Max		
Get Battery Voltage	**$BV<CR><LF>**	**$BV**,*n*	**$BV,3125**	Battery voltage = 3.125V
		n = millivolts		
Start Measurement	**$GO<CR><LF>**	**$OK**	$GO $OK $PLTIT,HV,15.00,F,245.90,D,1.50,D,15.00,F*69	

Sending the $GO command fires the laser and it should also update the Display with the measurements acquired.
For the $GO and $ST Commands, it does depend on which Targeting Mode (STD, CLO, FAR, CONT, FILT) you have set as an option.
- STD: Starts measurement for a single measurement (High Quality X.XX or Low Quality X.X), stop measuring once target is acquired. Output the measurement results.
- Closest & Farthest: Starts measurement, all acquired targets/measurements are continuously output.
  - The $ST command is sent to stop measurements/laser firing. Last measurement acquired is output.
  - If the $ST Command is not sent before the laser timeout of 6 seconds, the laser stops firing and last measurement is outputted.
  - If in CLO, only the Closest acquired targets are output.
  - If in FAR, only the Farthest acquired targets are output.
  - The $ST command is sent to stop measurements/laser firing. If a new CLO/Far measurement is acquired then output, if not no output measurement from the last acquired measurement.
- Continuous: Starts measurement, all acquired targets/measurements are continuously output.
  - The $ST command is sent to stop measurements/laser firing. Last measurement acquired is output.
  - The laser does not have a timeout and can only stop measurements with the $ST command.

Stop Measurement	**$ST<CR><LF>**	**$OK**		Stop command accepted

Set Distance Units	**$DU,*n* <CR><LF>**	**$OK**		Command accepted
	n = 0 : Meters & Degrees (TP360i AZ Degrees)			
	n = 1 : Invalid command			
	n = 2 : Feet & Degrees (TP360i AZ Degrees)			
	n = 3 : Meters & Percentage (TP360i AZ Degrees)			
	n = 4 : Feet & Percentage (TP360i AZ Degrees)			
Get Distance Units	**$DU<CR><LF>**	**$DU,*n* <CR><LF>**	**$DU,2**	Units = Feet & Degrees
		n = 0 : Meters & Degrees (TP360i AZ Degrees)		
		n = 1 : Invalid command		
		n = 2 : Feet & Degrees (TP360i AZ Degrees)		
		n = 3 : Meters & Percentage (TP360i AZ Degrees)		
		n = 4 Feet & Percentage (TP360i AZ Degrees)		
Set Compass Declination (TP360i Only)	**$DE,*n.n* <CR><LF>**	**$OK**	**$DE,2.7**	Set compass declination = 2.7 degrees n Value Limits = 0 to 39.9 degrees : 1 decimal place
Get Compass Declination (TP360i Only)	**$DE<CR><LF>**	**$DE,*n.n* <CR><LF>**	**$DE,1.2**	Current compass declination = 1.2 degrees
Set Measurement Mode	**$MM,*n* <CR><LF>**	**$OK**	**$MM,4**	Set Height measurement mode
	n = 0 : Horizontal Distance w/ Inclination, (TP360i AZ)			
	n = 1 : Vertical Distance w/ Inclination, (TP360i AZ)			
	n = 2 : Slope Distance w/ Inclination, (TP360i AZ)			
	n = 4 : Height			
	n = 6 : Missing Line			
Get Measurement Mode	**$MM<CR><LF>**	**$MM,*n* <CR><LF>**	**$MM,2**	Measurement mode = Slope Distance
		n = 0 : Horizontal Distance w/ Inclination, (TP360i AZ)		
		n = 1 : Vertical Distance w/ Inclination, (TP360i AZ)		
		n = 2 : Slope Distance w/ Inclination, (TP360i AZ)		
		n = 4 : Height		
		n = 6 : Missing Line		

Set Target Mode	**$TM,*n* <CR><LF>**	**$OK**	**$TM,1**	Set Continuous target mode
	n = 0 : Standard (STD)			
	n = 1 : Continuous (CONT)			
	n = 2 : Closest (CLO)			
	n = 3 : Farthest (FAR)			
	n = 4 : Filter (FILT**)**			
Get Target Mode	**$TM<CR><LF>**	**$TM,*n* <CR><LF>**	**$TM,3**	Target mode = Farthest
		n = 0 : Standard (STD)		
		n = 1 : Continuous (CONT)		
		n = 2 : Closest (CLO)		
		n = 3 : Farthest (FAR)		
		n = 4 : Filter (FILT**)**		
Set Shutdown Timeout* (When Bluetooth Option "Off")	**$NT,*n* <CR><LF>**	**$OK**	**$NT,1**	Set shutdown time = 1 minute
	n = 0 to 120 minutes (0 = never shutdown)			
	*NOTE: Shutdown timeout period is for when unit is in low power idle mode following display going off			
Get Shutdown Timeout* (When Bluetooth Option "Off")	**$NT<CR><LF>**	**$NT,*n* <CR><LF>**	**$NT,2**	Current shutdown timeout = 2 minutes
		n = 0 to 120 minutes (0 = never shutdown)		
Set Shutdown Timeout* (Bluetooth Classic or BLE on and connected)	**$BT,*n* <CR><LF>**	**$OK**	**$BT,5**	Set shutdown time = 5 minutes
	n = 0 to 120 minutes (0 = never shutdown)			
Get Shutdown Timeout* (Bluetooth Classic or BLE on and connected)	**$BT<CR><LF>**	**$BT,*n* <CR><LF>**	**$BT,10**	Current shutdown timeout = 10 minutes
Get Shutdown Timeout* (Bluetooth Classic or BLE on and *not* connected)	**$BX,*n* <CR><LF>**	**$BX,*n* <CR><LF>**	**$BX,10**	Current shutdown timeout = 10 minutes
	n = 0 to 120 minutes (0 = never shutdown)	*n* = 0 to 120 minutes (0 = never shutdown)		
Get Shutdown Timeout* (Bluetooth Classic or BLE on and *not* connected)	**$BX<CR><LF>**	**$BX,*n* <CR><LF>**	**$BX,10**	Current shutdown timeout = 10 minutes
		n = 0 to 120 minutes (0 = never shutdown)		
Get Serial Number	**$SN<CR><LF>**	**$SN,n<CR><LF>**	**$SN,000242**	Instrument Serial Number = 000242
		n = Instrument Serial Number		

Height Routine	**$HR**	$OK	$HR,1	Horizontal distance, Angle 1 inclination and Angle 2 inclination measurements are downloaded via Bluetooth: Enabled does this: HD Measurement: $PLTIT,HV,17.80,M,,,1.80,D,17.80,M*6E Ang 1 Shot : $PLTIT,HV,,,0.00,D,-18.90,D,,*7A Ang 2 Shot: $PLTIT,HV,,,0.00,D,19.10,D,,*5E Height Result: $PLTIT,HT,12.20,M*07
	Where:			
	0 = Disabled			
	1 = Enabled			
	Intermediate results output with the Height routine			
TP200i: 2D Missing Line	**$MR,n**	$OK	$MR,1	Shot 1 and Shot 2 measurements are downloaded via and Bluetooth Shot 1: $PLTIT,HV,15.90,M,,,-0.40,D,15.90,M*4E Shot 2: $PLTIT,HV,5.00,M,,,18.80,D,5.30,M*55 2D ML results: $PLTIT,ML,10.90,M,0.00,D,9.40,D,11.00,M*7D
	Where:			
	0 = Disabled			
	1 = Enabled			
	Intermediate results output with the Missing Line routine			
TP360i: 3D Missing Line	**$MR,n**	$OK	$MR,1	Shot 1 and Shot 2 measurements are downloaded via and Bluetooth Shot 1: $PLTIT,HV,15.90,M,10.00,D,-0.40,D,15.90,M*4E Shot 2: $PLTIT,HV,5.00,M,90.00,D,18.80,D,5.30,M*55 3D ML results: $PLTIT,ML,10.90,M,150.00,D,9.40,D,11.00,M*7D
	Where:			
	0 = Disabled			
	1 = Enabled			
	Intermediate results output with the Missing Line routine			

Get Short Range Gate	$SG<CR><LF>	$SG,n<CR><LF>	$SG,25	Short Range Gate value = 25; UoM matches the Units of Meausurement that is set.
		n = Short Range Gate Value		
Set Short Range Gate	$SG,n	$OK	$SG,10	Set the Short Range gate to value to 10, UoM matches the Units of Meausurement that is set.
	Where			
	n = Short gate measurement value: values (0-X)			
Get Long RangeGate	$LG<CR><LF>	$LG,n<CR><LF>	$LG,1000	Long gate range value = 1000; UoM matches the Units of Meausurement that is set.
		n = Long Gate Range Value		
Set Long Range Gate	$LG,n	$OK	$LG,1000	Set the Long Gate Range to value to 1000; UoM matches the Units of Meausurement that is set.
	Where			
	n = Long gate measurement value: values(2500m -X)			
Get Range Gate	$RG<CR><LF>	**$RG,n<CR><LF>**	$RG,1	Range Gate set for Short Value
		Where		
		n = 0 ,OFF		
		n = 1, NEAR (Short)		
		n = 2, FAR (Long)		
		n = 3, BOTH		
Set Range Gate	$RG,n	$OK	$RG,1	Acivate Short Range Gate
	Where			
	n = 0 ,OFF			
	n = 1, NEAR (Short)			
	n = 2, FAR (Long)			
	n = 3, BOTH			

Get Pulse Option	$PM<CR><LF>	$PM,*n* <CR><LF>	$PM,0	Pulse = Off
		Where:		
		0 = Off		
		1 = On		
Set Pulse On/Off	$PM,n	$OK	$PM,1	Pulse motor turned On
	Where:			
	0 = Off			
	1 = On			
Get Reticle Option	$RD<CR><LF>	$RD,*n* <CR><LF>	$RD,2	Reticle = Crosshair
		Where:		
		1 = Full		
		2 = Crosshair		
		3 = Box		
		4 = Dot		
Set Reticle Options	$RD,n	$OK	$RD,2	Reticle set to Crosshair
	Where:			
	1 = Full			
	2 = Crosshair			
	3 = Box			
	4 = Dot			

Error Messages in TP200i & TP360i Display		
HUD Display	**Description/Action**	**Meaning**
E 52	The temperature is too low	TOO COLD <temperature in Celsius>
E 53	The temperature is too high	TOO HOT <temperature in Celsius>

TruPulse 360i Inclination & Compass Calibration Fail Codes		
Fail1	Excessive motion during calibration. Unit was not held steady.	
Fail2	Magnetic saturation error. Local magnetic field too strong.	
Fail3	Mathematical fit error.	
Fail4	Calibration convergence error	
Fail6	Orientations were wrong during the calibration	

	Serial command Error code responses: $ER, xx	
	Error Code	$ER,XX
		Where:
		10 = INVALID_COMMAND