TLL90S Digital Protractor User Guide

Features:

1) TLL90S: High accuracy ±0.005°, high resolution 0.001°
2) Dual and Single axis with user friendly LCD display angle
3) Laser module installed for alignment
4) Rechargeable
5) V Shape Aluminum metal case for easy to fit at the corner or pipe.
6) 2 Side Magnetic base with milled surface
7) Audible alarming at settable angle range
8) Any angle measurement with gyro
9) USB / Bluetooth to pc connection need adapter
10) PLC Modbus RS485 connection with 6P6C socket, connect up to 255 unit in one network

Specifications

Gravity Measurement Accuracy:	0 to 20°: ± (0.005°) 20 to 70°: ± (0.01°) 70 to 90°: ± (0.005°) *After Calibrated
Measuring range:	Single axis: 360°, Dual axis: ±40°
Resolution:	0.001°
Gyro Measurement Accuracy:	0.5°
Gyro Measurement Accuracy:	0.1°
Gyro Rotation Speed:	<50°/s
Display Response time:	<0.6 second
Audio sound:	60dB @ 30cm
Zero offset drift angle per °C:	0.002° (typical)
Operating temperature:	0 to 50°C
Storage temperature:	-10 to 60°C
User Interface:	Mono-color LCD with backlight
Supply Power:	Rechargeable Li-Polymer 3.7V
Charger port:	5V 500mA Mini type-B USB port

Power Consumption:	Standby: 10uA, Operation: 20mA.
Standby Battery Life:	4000 hours
Operating Battery Life:	30 hours
Dimensions (in mm):	93(L) x 66(W) x 28(H)
Magnetic Base:	affix at 2 face
Magnetic Force:	N35
Weight:	120gram

Button Functions

Button	Function Descriptions	
	Normal Mode	**MENU Mode**
LASER DATA	This button turns the device ON. Press and release will turn laser on/ off. Long Press for 3 seconds will turn off.	Serves as the escape key at menu mode
Zero	When pressed, the current reading is set to zero; subsequent measurements are relative to this reading. The LCD will show the icon to indicate the device is in zero mode. Press and hold for 3 seconds to enable or disable sound. The icon on LCD will be displaced	Serves as the upward key for option selection

	accordingly. The buzzer alarming could be set at different accuracy level. Refer to section "**Angle Alarming**".	
Hold	When pressed, the current value will freeze; the unit icon flashes to indicate the reading is on hold. Press and hold for 3 seconds to switch the measurement mode Degree -> mm/M -> Gradient %	Serves as the downward key at menu mode
Angle /Set	Press and hold for 3 seconds to enter MENU mode, for set mode options.	Serves as the Set key.

Angle /Set	Any angle measurement start button. Refer to section “Any Angle” Press and hold for 3 seconds to enter MENU mode, for set mode options.	Serves as the Set key.

LCD Icons Representations

	Battery status indication icons These icons indicate the battery level. There are 3 levels representing empty, half and full.
	In dual-axis mode, the LCD displays the direction of tilt graphically. It will show as E bubble to display the direction of tilt
	Degree mode. Flash when unit is in HOLD mode
mm	mm/M, the height of one end for 1m long plate.
%	Gradient % mode. Flash when unit is in HOLD mode
	Sound notification on. Blank as off

	Show this logo as relative value is showing. When the Zero button is pressed, the unit reset current angle to zero.
	Direction of tilt icons, show the tilt angle direction
	Dual-Axis Mode. Both the X and Y axis angle will be showed. Dual axis mode measures inclination up to +-40 degree for each axis before it automatically switch to single axis mode.
	Single Axis Mode. Measure slope up to +-90 degree. The triangle icon indicates the direction of tilt with respect to the bottom right corner of the unit.

Battery Charging

It has a built in Lithium Ion rechargeable battery. A standard charger is supplied that the input voltage is 110V to 240V AC, 50/60Hz, and the output is 5V DC, 500mA. The charger operating procedure is list below:

1) Plug the Charger into AC socket, the RED indicator on the charger should turned ON,
2) Plug the USB charging cable to the Charger,
3) Insert the other end of the USB cable to the unit,
4) The battery icon on the LCD blinks to indicate charging in process. Upon charging complete, the icon stops blinking.
5) The charging time is approx. 3 hours.

The unit could also be charged by connecting the USB cable to the unit and a computer’s USB port. This has the same effect when charging the unit with the provided adaptor.
Note: When the unit is turned OFF, and plug in the USB charge cable, the LCD will no show anything, it is NORMAL. Once the unit is turned ON, the battery icon should flash indicating the unit is in charging mode.

Relative/ Absolute Measurement

Relative Measurement
LCD Icon:

Absolute Measurement
LCD Icon: **Blank**

Relative and Absolute Mode Switching:

1 Press and release the “ZERO” key to set the relative measurement zero point
2 Press and release the “ZERO” key to cancel the relative zero point and back to absolute measurement mode.

Hold Function

Holding Mode:
LCD Icon blinking:

Holding function:

1. Press and release the “HOLD” key to activate holding function, digit will freeze.
2. Press and release the “HOLD” key to cancel the holding function.

Auto Power Off

For no movement in 30 minutes, the unit will power off.
Or we can set to never sleep mode at below instruction.
Power auto off setting:

1. Press and hold “SET” / “ANGLE” key and enter MENU mode
2. Select “POWER” by “ZERO” and “HOLD” key, press “SET” key to enter Power mode
3. Scroll “NEVER” or “30MIN” by “ON/OFF” and “HOLD” key
4. Press “SET” key to confirm NEVER or 30MIN (30 minutes) sleep

Restore Factory Setting

When you find that the unit is abnormal, you can restore the unit to factory setting.
All tilt mode calibration setting will be restored to factory setting.

Not suggest restore to factory setting in normal status, for accuracy drift, please follow **Calibration. After factory set, please redo calibration to ensure the accuracy.*

Restore to factory setting:

1. Press and hold “SET” / “ANGLE” key and enter MENU mode
2. Select “FACTORY SET” by “ZERO” and “HOLD” key, press “SET” key to enter FACTORY SET mode
3. Scroll “YES” or “NO” by “ZERO” and “HOLD” key
4. Press “SET” key to confirm

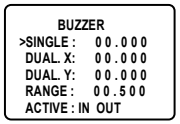
Angle Alarming

Alarming Mode:

LCD Icon:

Alarming Angle setting:

1. Press and hold “SET” / “ANGLE” key and enter MENU mode
2. Select “BUZZER” by “ZERO” and



“HOLD” key, press “SET” or “ANGLE” key to enter BUZZER setting

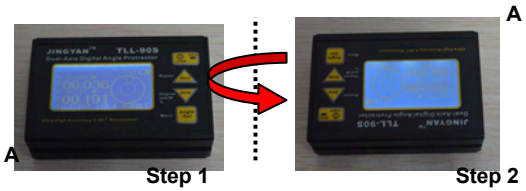
Press and hold “ZERO” and “HOLD” key for fast scrolling the digit.

3. Press “SET” or “ANGLE” to enter setting value

SINGLE	Vertical / Single axis mode alarming angle (Degree)
DUAL.X	Horizontal/ Dual axis mode X axis alarming angle (Degree)
DUAL.Y	Horizontal/ Dual axis mode Y axis alarming angle (Degree)
RANGE	The range (Degree)that will trigger the audible alarming For example: SINGLE. set to 20.000 RANGE set to 01.000 While the unit is in +19° to +21°or -19 ° to -21°, the unit will alarm
ACTIVE	IN or OUT to set the alarm will alarm in of range or out of range

Calibration

Calibrate the unit, once you found that there is accuracy drift on the unit. You can verify the accuracy at below step:



At Step1, you measured X and Y value, X1 and Y1

At Step2, you measured X2 and Y2, in theory X1=-X2, Y1=-Y2.

If the error is too large, you can enter calibration mode to eliminate the error

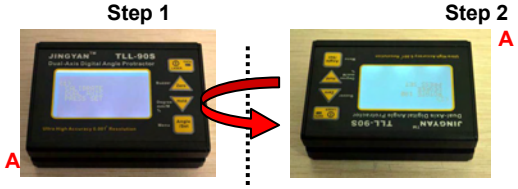
Accuracy drift is causing by large ambient temperature change (5 to 10 Degree Celsius) or the unit has been dropped.

Calibration Procedure:

Step 1: Press and hold the “Angle/Set” key enter Menu mode. Select “Calibration” mode, press “SET”. Place the unit on a flat table (no need perfect level table)

LCD display “CALIBRATE DUAL AXIS PRESS SET”, press “SET” and buzzer will beep; wait until the beep sound stop. While the buzzer is beeping keep the unit stable.

Step 2: Then rotate the unit 180 degree with the other side against the same place. Press the Set button again, and wait for the beep finished.



Step 3: LCD display “CALIBRATE HORIZONTAL PRESS SET”. Place the unit horizontal like the picture “STEP 3” and then press “SET”, wait until the beep sound stop.

Step 4: Then rotate the unit 180 degree at the same place. Press the “ZERO” button again, and wait for the beep finished.

Step 5: LCD display “CALIBRATE VERTICAL PRESS SET”, mention that the ON/OFF Key at upper side, hold on a flat wall. And then press “SET” Key. Wait for the “Beep” sound stop.

Step 6: Then rotate the unit 180 degree with the other side against the same place of wall (ON/OFF Key at upper side). Press the Set button again, and wait for the beep finished. Now, the LCD should go back to the selection menu. The calibration is done, by selecting “Back” to go back for normal operation

Wall

Wall

Step 5

Step 6

ANY ANGLE measurement:

Any angle measurement is using gyro technique.
You can measure the angle between two faces, not only in earth gravity direction.

1) Press Angle key at the first face, and then rotate slowly and must keep the rotation axis to another testing face
2) It will then show the angle once you not move the unit.

The rotation axis:

Any Angle Measurement Method:
Example: Measure angle between two wooden walls is 88.2°

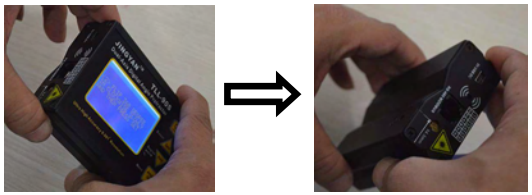
Place at the first position, press Angle

Rotate to final position, keep the rotational axis, LCD show the angle

Calibrate Gyro

1) Place Unit At Flat Table And then Press Set

2) Flip 360 degree in clockwise and then press set
Please rotate slowly to increase the accuracy



3) Place unit at flat table and then press set

4) Flip 360 degree counter clockwise and then press set
Please rotate slowly to increase the accuracy

Data Communication

Communication is in MODBUS format:
Baud Rate 9600
Can connect up to 255 TLL90 in the same RS485 network
Choose the output port

1. Press and hold “Angle/Set” key and enter MENU mode
2. Select “POWER” by “ZERO” and “HOLD” key, press “SET” key to enter Data communication
3. Scroll “USB” or “RS485” by “Zero” and “HOLD” key
4. Press “SET” key to confirm which port to communicate

Set the address

1. Press and hold “Angle/Set” key and enter MENU mode
2. Select “POWER” by “ZERO” and “HOLD” key, press “SET” key to enter Data communication
3. Set the device address by “Zero” and “HOLD” key
4. Press “SET” key to confirm

RS485 is 6P6C socket
Pin1&2 is power DC 6 to 9V
Pin 3 is RS485 A

Pin 4 is RS485 B
Pin 5&6 is ground.

USB port:
It is not standard USB protocol, but serial port
Pin 1 is VBUS to provide 5VDC
Pin 2 is D-, RS232 TX transmission pin in cmos 3.3V level
Pin 3 is D+, RS232 RX transmission pin in cmos 3.3V level
Pin 4 is not connected
Pin 5 is GND ground
** can order a RS232 adapter to convert to USB serial port and connect to computer.

Modbus protocol of communication

Sent to read (16 bit) (example to modify display mode)		
Hex	Dec	Purpose
0x01	1	Address of device
0x03	3	Function read
0x00	0	High Byte of register address (100 Display mode)
0x66	102	Low Byte of register address (100 Display mode)
0x00	0	High Byte of number of register to read (Always 0)
0x02	2	Low Byte of number of 16 bit register to read
0x24	36	Low Byte of CRC
0x14	20	High Byte of CRC

Sent to write (16bit) (example to set measuring mode)		
Hex	Dec	Purpose
0x01	1	Address of device
0x06	6	Function write
0x01	1	High Byte of register address (300 Measuring mode)
0x2C	44	Low Byte of register address (300 Measuring mode)
0x00	0	High Byte of number of register to write
0x01	1	Low Byte of number of register to write
0x3F	63	Low Byte of CRC
0x88	136	High Byte of CRC

Register to read

Address	**Purpose (16 bit data)**		
0x0064	Display Tilt Mode	0	Single Axis
		1	Dual Axis
0x0065	Measuring format	0	Degree
		1	mm/M
		2	Gradient (Slope)
0x0066	High 16 bit	X axis/ Single axis tilt angle: 32 bit signed integer 2’s complement 00001= 00.001 degree	
0x0067	Low 16 bit		
0x0068	High 16 bit	Y axis tilt angle: 32 bit signed integer 2’s complement 00001= 00.001 degree	
0x0069	Low 16 bit		
0x006A	High 16 bit	Gyro value: 32 bit signed integer 2’s complement 0001= 000.1 Degree	
0x006B	Low 16 bit		
0x006C	High 16 bit	Sensor’s temperature 00001=000.01 degree Celsius	
0x006D	Low 16 bit		

Register to Write

Address	**Purpose (16 bit data)**		
0x12C	Measuring Mode	0	Tilt angle reading mode
		1	Gyro measuring mode
0x12D	Measuring Format	0	Degree
		1	mm/M
		2	Gradient (Slope)