BLTouch: Auto Bed Leveling Sensor for 3D Printers

■ Smart V3.0 Highlights

Logic Voltage Free: 3.3V / 5V logic voltage free(default)

Long Stroke: The stroke is up to 1.6mm longer than before.

■ Smart V2.0 and later versions highlights

Blue & Red LED: Blue and Red LED for checking wiring defects.

Engineering plastic Push-pin: Engineering plastic push-pin can be bent more easily than aluminum pins so that engineering plastic push-pin can be recovered well and the device can be protected.

BLTouch – Smart V3.0

(Smart V3.0 produced since April 5th, 2019)

BLTouch Instruction	Center Of PWM (Available PWM Rage ±20)	G-code	x: Servo Pin or No.	
		Marlin / Duet	Repetier	Smoothieware
Push-pin Down(deploy)	650 us (10°)	M280 Px S10	M340 Px S650	M280 S3.3
Alarm Release & Touch SW Mode(M119)	1165 us (60°)	M280 Px S60	M340 Px S1165	M280 S5.88
Push-pin Up (Stow)	1475 us (90°)	M280 Px S90	M340 Px S1475	M280 S7.43
Self-test (10 Times)	1780 us (120°)	M280 Px S120	M340 Px S1780	M280 S8.99
5V Logic Zmin (Do not activate on 3.3V logic system)	1985 us (140°)	M280 Px S140	M340 Px S1985	M280 S10.01
Logic voltage Free Zmin (default: open drain)	2090 us (150°)	M280 Px S150	M340 Px S2090	M280 S10.53
Alarm Release & Push-pin UP	2190 us (160°)	M280 Px S160	M340 Px S2190	M280 S11.05

※ Depending on your board, you can need to adjust the PWM range or Duty cycle.

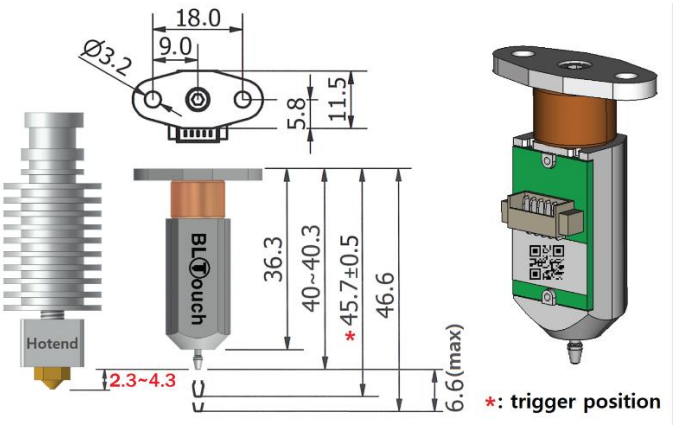
※ 5V Logic Zmin (140°) for unusual board: High Signal is not weak. Stronger than V2.x

☞ For example, Board with large capacity capacitor in end-stop input circuit(Melzi and some of the Creality3D, ANET board, etc.)

☞ **Do not activate 5V logic on 3.3V logic system without 3.3V logic conversion.**

Specification	
Voltage / Current	4.8 ~ 5.1 V
Current Maximum (Peak)	15mA 300mA
Z Probe Output Open Drain VDS / ID	Logic Free (Open Drain: default) or 5V Max VDS = 5V / Max ID = 300mA
PCB / Soldering	OSP / Lead Free
Cable Length	150±5 mm (for retail)
Weight	0.35oz (10g)
Wiring	**3Pin**: Brown (GND), Red (+5V) Orange (control signal) **2Pin**: Black (GND) White (Zmin)
Case & Push-pin	Polycarbonate (PC)
Push-pin stroke	5.6 ~ 6.6 mm (If the stroke is large, push-pin may not deploy)

BLTouch CAD Dimension



※ Additional power supply may be needed in case which your board does not supply enough amperage.

※ Electronic devices can be damaged or even destroyed if connected to the wrong side polarity.

※ **Set Zmin pull-up on your firmware when using Logic Free (In most cases, it is already set up)**

※ If push-pin down error occurs, turn core 180 degrees with Allen-key so that the core is further inside the casing.

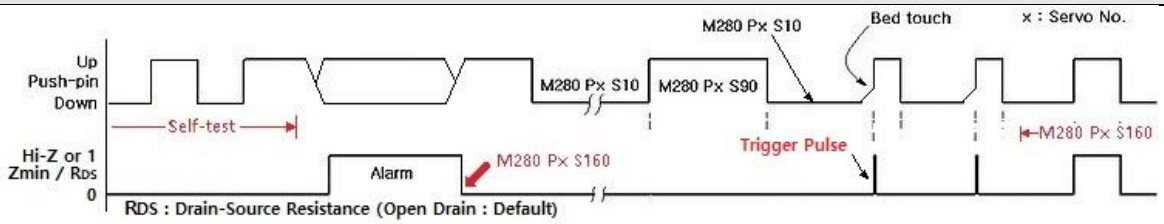
※ Depending on your type of 3D printer, you may need to remove or add some parts of the board.

※ In principle, Board with large capacitor on end stop input circuit is not supported.(You may need to remove the capacitor from your board.)

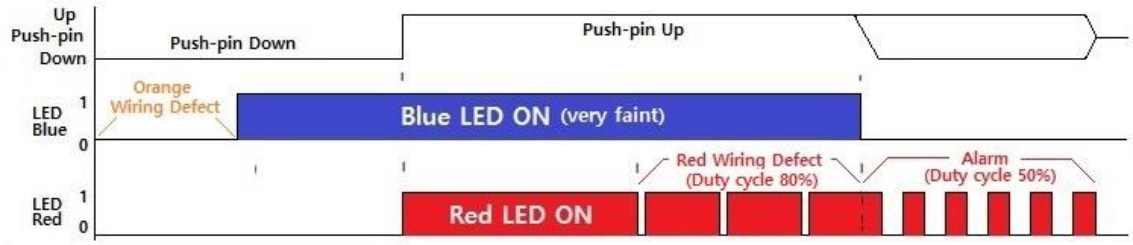
※ If noise, etc. interference is expected, you should use a anti-interference extension cable (Shielded or Twisted Cable).

※ Selling price and specifications are subject to change without prior notice.

■ Signal Timing Diagram



■ Blue & Red LED (Please check wiring defects with Blue and Red LED(Smart V2.0 and later).



※ **Red wiring defect : When the BLTouch was disconnected and reconnected during normal operation. Unlike previous versions, it does not perform self-test even if wiring defects occur during printing.**

■ Wiring : Soldering and firmware update might be needed in rare case

	I can find a servo pin on my board. ☜ click here RAMPS1.3/1.4, MKS-Gen V1.3, MKS-Base V1.4, etc.
	I can not find any Servo pin on my board. ☜ click here MKS-Base V1.2, mini-Rambo, etc.
	I can not find Servo Pin on my board and ☜ click here #define SERVO0_PIN is not included in pins_YourMotherboard.h. Sanguinololu1.3a, Melzi , Ender-3, Anet, FlashForge, Azteeg X3, etc. ※ Depending on your type of 3D printer, you may need to remove or add some parts of the board.
	32bit board ☜ click here Smoothieboard, MKS-Sbase, BBP1S, Alligator, AZSMZ, STEVAL-3DP001V1, Duet, etc.

■ Insert the following G-code into Slic3r or Cura

Depending on your board, you can choose between the following two.

1. **Logic voltage free(default) mode (Recommended) ← Both 3.3V /5V Logic are available**

```
M280 P0 S160 ; BLTouch alarm release
G4 P100 ; delay for BLTouch
G28 ; home
G29 ; auto bed leveling
```

2. **If the nozzle is in contact with the bed after missing the trigger signal(A board with large capacity capacitor in end-stop input circuit, such as the Melzi).**

```
M280 P0 S140   ← Only 5V Logic mode(Do not activate 5V logic on 3.3V logic system without 3.3V logic conversion)
G4 P2000 ; delay for BLTouch
M280 P0 S160 ; BLTouch alarm release
G4 P100 ; delay for BLTouch
G28 ; home
G29 ; auto bed leveling
```

Boards with large capacity capacitor in end-stop input circuit: Melzi and some of the Creality3D, ANET board, etc.
(Select 1 if you have already removed the capacitor from your board)

■ Setting (e.g. Marlin firmware)

Please refer to other auto bed leveling setting documents (Youtube etc.).

Marlin-bugfix-2.0.x Setting

https://github.com/MarlinFirmware/Marlin/archive/bugfix-2.0.x.zip

Step 1: Copy the file below and overwrite at the Marlin folder. <== e.g. default
Marlin-bugfix-2.0.x₩config₩default₩Configuration.h
Marlin-bugfix-2.0.x₩config₩default₩Configuration_adv.h
Step 2: Look at the Configuration.h at your previous firmware and edit Configuration.h at Marlin.
Step 3: Check your 3D printer works well.
Step 4: Please install your BLTouch.
Step 5: Edit Configuration.h and Configuration_adv.h like below.

■ Configuration.h

```
//============================= Endstop Settings ============================
#define USE_ZMIN_PLUG // a Z probe
#define ENDSTOPPULLUPS                              // BLTouch Smart V3.0 and Later
#define ENDSTOP_INTERRUPTS_FEATURE

//============================= Z Probe Options =============================
#define Z_MIN_PROBE_USES_Z_MIN_ENDSTOP_PIN


#define BLTOUCH
#if ENABLED(BLTOUCH)
  //#define BLTOUCH_DELAY 500          // *option: Minimum Command delay (ms). Enable and increase if needed
  //#define BLTOUCH_FORCE_5V_MODE   // only for 5V logic mode of Smart V3.0 : Do not remove // on 3.3V logic system
#endif

#define PROBING_HEATERS_OFF      // *option
#define PROBING_FANS_OFF         // *option
#define X_PROBE_OFFSET_FROM_EXTRUDER 0        //Depend on your BLTouch installation value
#define Y_PROBE_OFFSET_FROM_EXTRUDER -22      //Depend on your BLTouch installation value
#define Z_PROBE_OFFSET_FROM_EXTRUDER -2.35   //Depend on your BLTouch installation value
#define MIN_PROBE_EDGE 20
#define Z_CLEARANCE_DEPLOY_PROBE       15      // set up at least 15
#define Z_CLEARANCE_BETWEEN_PROBES   10      // set up at least 10

//============================= Bed Leveling ================================
// Choose a line of below lines and remove // at the start of the line
//#define AUTO_BED_LEVELING_3POINT
//#define AUTO_BED_LEVELING_LINEAR
#define AUTO_BED_LEVELING_BILINEAR
//#define AUTO_BED_LEVELING_UBL
//#define MESH_BED_LEVELING

//============================= Extra Featurest ============================
#define NUM_SERVOS 3                                // set up at least 1
#define SERVO_DELAY {300, 300, 300}
```

Marlin 1.1.x(1.1.9) Setting

https://github.com/MarlinFirmware/Marlin/archive/1.1.x.zip

Step 1: Copy the file below and overwrite at the Marlin folder. <== e.g. Delta
Marlin₩example_configurations₩delta₩generic₩Configuration.h
Marlin₩example_configurations₩delta₩generic₩Configuration_adv.h
Step 2: Look at the Configuration.h at your previous firmware and edit Configuration.h at Marlin 1.1.x
Step 3: Check your 3D printer works well.
Step 4: Please install your BLTouch.
Step 5: Edit Configuration.h and Configuration_adv.h like below.

■ Configuration.h

```
//============================= Endstop Settings ============================
#define USE_ZMIN_PLUG // a Z probe
#define ENDSTOPPULLUPS                                  // BLTouch Smart V3.0 and Later
#define ENDSTOP_INTERRUPTS_FEATURE
//============================= Z Probe Options =============================
#define Z_MIN_PROBE_USES_Z_MIN_ENDSTOP_PIN
//#define Z_MIN_PROBE_ENDSTOP
//#define FIX_MOUNTED_PROBE
#define BLTOUCH
#if ENABLED(BLTOUCH)
  #define BLTOUCH_DELAY 100       // *option
#endif
#define PROBING_HEATERS_OFF       // *option
#define PROBING_FANS_OFF          // *option
#define X_PROBE_OFFSET_FROM_EXTRUDER 0        //Depend on your BLTouch installation value
#define Y_PROBE_OFFSET_FROM_EXTRUDER -22      //Depend on your BLTouch installation value
#define Z_PROBE_OFFSET_FROM_EXTRUDER -2.35    //Depend on your BLTouch installation value
#define MIN_PROBE_EDGE 20
//#define Z_PROBE_ALLEN_KEY
#define Z_CLEARANCE_DEPLOY_PROBE       15     // set up at least 15
#define Z_CLEARANCE_BETWEEN_PROBES     10     // set up at least 10
//============================= Bed Leveling ================================
// Choose a line of below lines and remove // at the start of the line
//#define AUTO_BED_LEVELING_3POINT
//#define AUTO_BED_LEVELING_LINEAR
#define AUTO_BED_LEVELING_BILINEAR
//#define AUTO_BED_LEVELING_UBL
//#define MESH_BED_LEVELING

//============================= Additional Features ===========================
#define EEPROM_SETTINGS // Enable for M500 and M501 command

//============================= Extra Featurest ===============================
#define NUM_SERVOS 3                                    // set up at least 1
#define SERVO_DELAY {300, 300, 300}
```

Previous Versions before Marlin RC7

■ Configuration.h

```
//============================= Mechanical Settings ===========================
const bool Z_MIN_ENDSTOP_INVERTING = false;

//============================= Z Probe Options ============================
//#define Z_MIN_PROBE_ENDSTOP                           // *RC4 ~ RC6
#define Z_MIN_PROBE_USES_Z_MIN_ENDSTOP_PIN            // *RC4 ~ RC6

//============================= Bed Auto Leveling ===========================
#define AUTO_BED_LEVELING_FEATURE
#define X_PROBE_OFFSET_FROM_EXTRUDER 20               //Your BLTouch X_PROBE_OFFSET_FROM_EXTRUDE
#define Y_PROBE_OFFSET_FROM_EXTRUDER -20              //Your BLTouch Y_PROBE_OFFSET_FROM_EXTRUDE
#define Z_PROBE_OFFSET_FROM_EXTRUDER -1.0             //Your BLTouch Z_PROBE_OFFSET_FROM_EXTRUDE
#define Z_SAFE_HOMING

//============================= R/C SERVO support ===========================
#define NUM_SERVOS 3
#define SERVO_ENDSTOP_ANGLES {{0,0}, {0,0}, {10,90}}                // 10=deploy, 90=retract
//#define DEACTIVATE_SERVOS_AFTER_MOVE
```