



GENMITSU CNC ROUTER 3018-PROVer

USER MANUAL

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Welcome

Thank you for purchasing the Genmitsu 3018-PROVer CNC Router from SainSmart.

Included in your package will be a SD card. SD card or both depending on the specific package you purchased.

These contain:

- Instructional videos
- Manuals and diagrams
- Windows USB Driver
- GrblControl/Candle operating software for Windows
- Sample files
- Offline Controller control files

These files can also be downloaded from the SainSmart Wiki Page <http://wiki.sainsmart.com/index.php/101-60-3018PROVER> which also contains some extra files such as wiring diagrams and Laser connections.

Before attempting to assembly the 3018 PROVer, please watch the assembly video on the SD card that came with your machine. This will save time and avoid mistakes.

Help and support is normally available from our Facebook group.

(SainSmart Genmitsu CNC Users Group, <https://www.facebook.com/groups/SainSmart.GenmitsuCNC>)

For any warranty or support problems please email us at support@sainsmart.com.

Warnings

As with any power tool it is essential you take proper precautions and care in its use.

Proper care and use includes but is not limited to

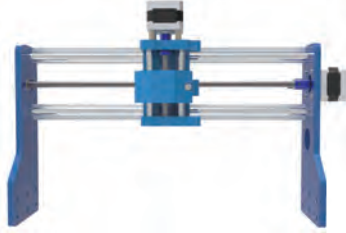






- Follow all instructions carefully
- Wear appropriate eye protection
- Depending in the materials being cut make sure the Router is in a well ventilated area and appropriate breathing protection is used
- Take extra precautions for any material which may produce harmful dust or fumes
- Ensure the Emergency stop button is easily accessible at all times
- Do not leave the Router unattended while it is operating
- Use this CNC router under adult supervision if you are underage




Any modification of the Router or the use of accessories provided by a third party will void any warranty.

SainSmart does not accept any responsibility or liability for any use or misuse of the Router including any accessories.




Parts List

NAME	DETAILS	PICTURE	QTY.	CODE
Gantry assembly	X and Z axes		1	VER-1
Base assembly	Y Axis		1	VER-2
Spindle Motor	775 with ER11 Tool Holder		1	VER-3
ER11 Collet	3.175mm (1/8")		1	VER-4
Side Plates	5mm Acrylic		2	VER-5










Parts List

NAME	DETAILS	PICTURE	QTY.	CODE
SainSmart GRBL Offline Controller	1.8" screen		1	VER-6
GRBL Motherboard GC3D3	With open case fitted		1	VER-7
USB cable	USB-A to USB-B		1	VER-8
24V power supply	24V 5A		1	VER-9
Power cable (US)	1.2M		1	VER-10
Power cable (EU)	1.2M		1	VER-11
Limit Switch			6	VER-12






Parts List

NAME	DETAILS	PICTURE	QTY.	CODE
Offline Controller Cable	50cm		1	VER-13
Limit Switch Cables	X LIM+ 15cm		1	VER-14
	X LIM- 53cm		1	VER-15
	Y LIM+ 30cm		1	VER-16
	Y LIM- 60cm		1	VER-17
	Z LIM+ 34cm		1	VER-18
	Z LIM- 40cm		1	VER-19
Stepper motor Cables	X Axis 17cm		1	VER-20
	Y Axis 52cm		1	VER-21
	Z Axis 28cm		1	VER-22
Spindle motor Cable			1	VER-23
Emergency Stop Button	With 35cm Cable attached		1	VER-24

Parts List

NAME	DETAILS	PICTURE	QTY.	CODE
Work Clamp set			1	VER-25
Z-Probe kit			1	VER-26
Engraving Bits	20° V Bit, 3.175mm (1/8") Shank.		10	VER-27
Allen Keys	2.0mm, 2.5mm, 3.0mm, 4.0mm, 5.0mm		5	VER-28
ER11 Spanners			2	VER-29
Screwdriver			1	VER-30
Gantry Alignment tool			1	VER-31
Cable Ties			30	VER-32
Cable holder			10	VER-33

Parts List


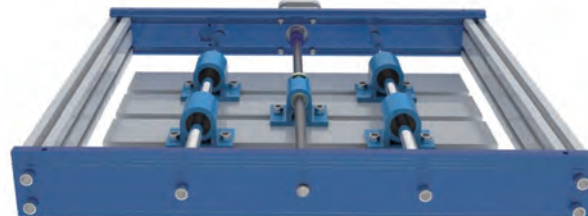
NAME	DETAILS	PICTURE	QTY.	CODE
Sealing strip (Y Axis)	270mm		1	VER-34
Sealing strip (X Axis)	340mm		1	VER-35
Cable Protector	340mm		1	VER-36
Offline Controller Micro SD Card	Contains: Manuals, Videos, Sample files and Offline Controller files.		1	VER-37
USB Micro SD card reader			1	VER-38
User Manual			1	VER-39

Parts List

NAME	DETAILS	PICTURE	QTY.	CODE
Base Assembly Rubber Feet	12*8*7		4	VER-40
M5 bolt	M5*10mm		8	VER-41
	M5*14mm		12	VER-42
M6 bolt	M6*16mm		2	VER-43
M3 screw	M3*20mm		2	VER-44
	M3*5mm		16	VER-45
	M3*8mm		4	VER-46
T Nut	20M3		4	VER-47
T Nut	20M5		8	VER-48
ABS spacer	7mm*M3.2*14mm		2	VER-49

Finishing the Assembly

Secure the Bed to the base assembly

Secure the Bed to the base assembly				
	NAME	CODE	QTY.	BEFORE
Parts Used	Base assembly	VER-2	1	<div>VER-2</div> <div>VER-43 x2Pcs</div> <div>Cutting here</div> 
	M6 Bolts M6*16mm	VER-43	2	
Tools	Allen Key (5mm)			AFTER
Steps	Slide the Aluminum Bed to align the holes on the threaded screw carrier over the pre-installed nuts in the center slot of the Bed. Insert and tighten the two M6 bolts. Remove the cable tie on the bearing mount (only used for shipping purposes).			
Check	All the other screws securing the bed and frame are tight.			

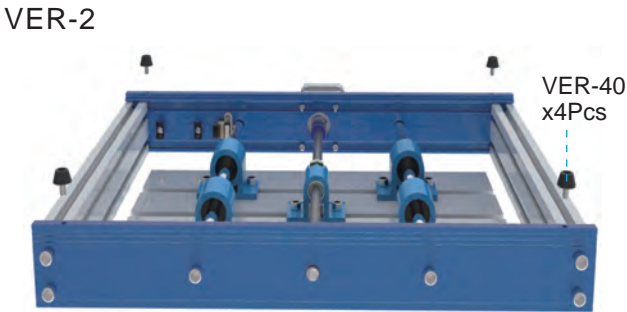
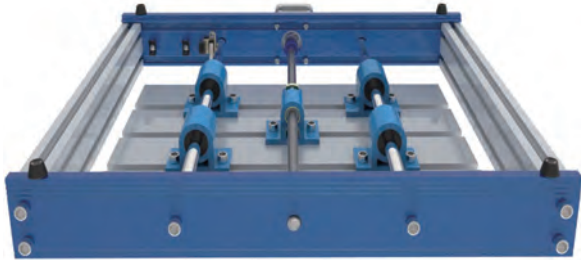
Finishing the Assembly

Install Y axis Limit switches and Cable Holders on the Base assembly

	NAME	CODE	QTY.	BEFORE
Parts Used	Base assembly	VER-2	1	<p>VER-2</p> <p>VER-45 x10Pcs</p> <p>VER-12 x2Pcs</p> <p>VER-33 x6Pcs</p>
	Limit switch	VER-12	2	
	Cable holder	VER-33	6	
	Screw M3*5mm	VER-45	10	
Tools	Screwdriver			AFTER
Steps	<p>Attach 2 cable holders on the inside of the rear frame and 2 on the outside using the same holes using the M3 screws.</p> <p>Attach a limit switch on the inside of the rear frame with the solder side of the PCB in the cutout on the frame using the M3 screws.</p> <p>Attach 2 cable holders on the inside of the front frame using the M3 screws.</p> <p>Attach a limit switch on the inside of the front frame with the solder side of the PCB in the cutout on the frame using the M3 screws.</p>			

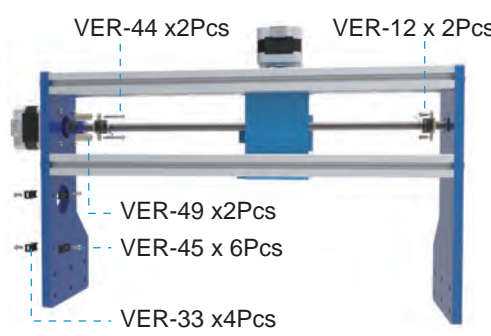

Finishing the Assembly

Install the Anti Vibration feet on the Base Assembly

	NAME	CODE	QTY.	BEFORE
Parts Used	Base assembly	VER-2	1	
	Rubber Feet	VER-40	4	
Tools	Allen Key (3mm)			AFTER
Steps	Screw them in firmly, do not over tighten them as the rubber can deform.			


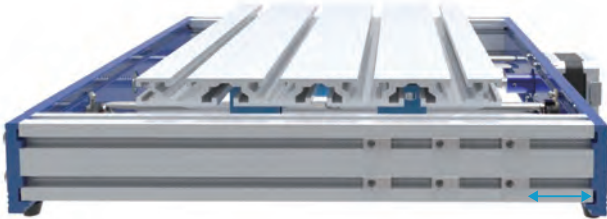
Finishing the Assembly

Install X axis Limit switches and Cable Holders on the Gantry Assembly

	NAME	CODE	QTY.	BEFORE
Parts Used	Gantry assembly	VER-1	1	
	Limit switch	VER-12	2	
	Cable holder	VER-33	4	
	ABS spacer	VER-49	2	
	Screw M3*5mm	VER-45	6	
	Screw M3*20mm	VER-44	2	
Tools	Screwdriver			AFTER
Steps	<p>(Left side is as viewed from the back, see photo.) The motor mount can be moved by rotating the threaded screw.</p> <p>Attach 2 cable holders on the inside and 2 on the outside of the left upright (using the same holes) with the M3*5mm screws.</p> <p>Attach a limit switch on the inside of the left upright with the ABS spacer over the M3*20mm screw to hold it out from the gantry upright, the cable socket on the switch should point to the back of the gantry.</p> <p>Attach a limit switch on the inside of the right upright using the M3*5mm screws with the solder side of the PCB in the cutout on the gantry upright, the cable socket on the switch should point to the back.</p>			

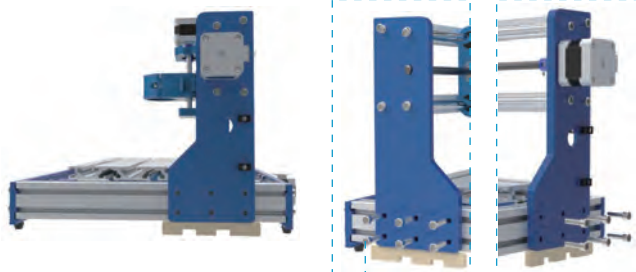

Finishing the Assembly

Position the Gantry attachment Slider nuts

	NAME	CODE	QTY.	BEFORE
Parts Used	Base assembly	VER-2	1	
	Slider nut 20*M5	VER-49	12	
Tools	Gantry Alignment Tool (VER-31) & Allen key			AFTER
Steps	<p>Use an Allen key to insert into the holes of slider nuts and move each of them for certain distance.</p> <p>Place the long end of the Gantry Alignment tool towards the back of the base frame (with the stepper motor) into a channel and align two of the nuts, 1 into each slot, then slide the third nut up to touch the short edge of the tool.</p> <p>Repeat for the other channel.</p> <p>Repeat for the other side.</p>			 <p>31.5mm</p>

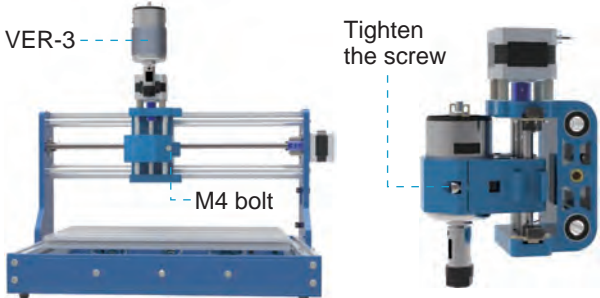
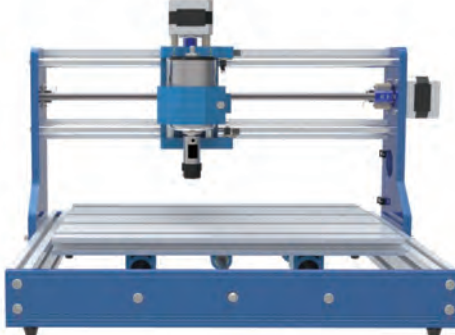
Finishing the Assembly

Install the Gantry assembly onto the Base Assembly

	NAME	CODE	QTY.	BEFORE
Parts Used	Base assembly	VER-2	1	 VER-42 x12Pcs
	Gantry assembly	VER-1	1	
	Bolt M5*14	VER-42	12	
Tools	Gantry Alignment Tool & Allen Key (4mm)			AFTER
Steps	<p>This is a critical part of the assembly, at the end of this the gantry assembly should be vertical to the bed on the base assembly and in line with it horizontally. It's worth taking the extra few minutes to get this right!</p> <p>A. Put the base assembly on its feet bed on a flat surface. B. Slide the gantry over the sides of the Base assembly (It's a tight fit). C. Adjust the gantry position so the holes in the gantry uprights are over the threaded holes in the slider nuts on each side of the base. D. Place the Gantry Alignment Tool under one of the gantries. E. Press the gantry down so it is evenly touching the top of the Alignment tool, the holes should still be aligned over the nuts. F. Insert the nuts and finger tighten. <i>(Repeat for the other side.)</i></p> <p>Place the long edge of the Gantry Alignment Tool into the slots between the gantry upright and the back of the base frame, it should just fit in both!</p> <p>NOTE: Use the Gantry Alignment tool to make sure the distance from the edge of Gantry assembly at the back to the inside of the rear frame should be 31.5mm. <i>(Repeat for the other side.)</i></p> <p>If there is any movement of the Gantry Alignment Tool between the Gantry and the inside of the back frame slacken the bolts and adjust the position of the gantry, recheck and retighten after also placing the Gantry adjustment tool under the gantry and rechecking that it touches along its length. Finally tighten all 12 bolts, quite firmly, but only using the Allen key provided. Check that all the bolts securing the stepper motor and the guide rods are tight.</p>			

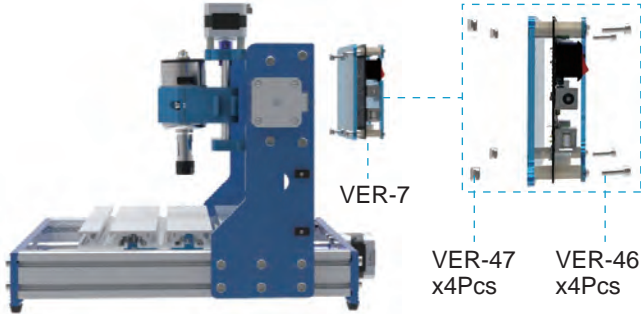
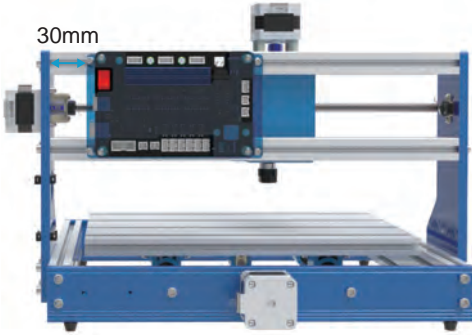
Finishing the Assembly

Install the Spindle Motor

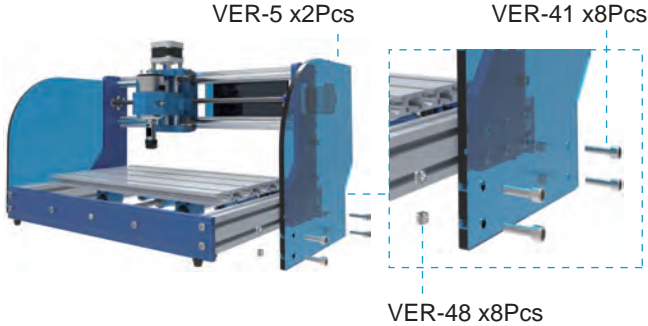
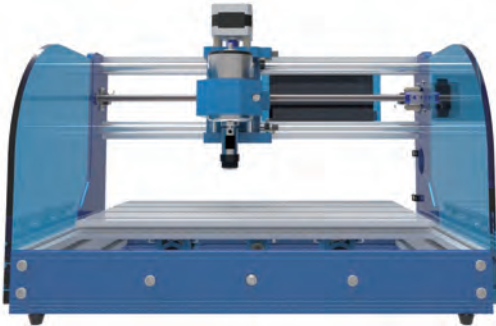
	NAME	CODE	QTY.	BEFORE
Parts Used	Spindle Motor	VER-3	1	 <p>VER-3</p> <p>M4 bolt</p> <p>Tighten the screw</p>
Tools	Allen wrench (3mm)			AFTER
Steps	<p>Loosen the M4 Clamping bolt on the spindle mount. Slide the spindle motor into the mount from the top.</p> <p>NOTE: This can be a very tight fit especially at first. If it won't fit very gently prise open the slot in the motor mount using a wide bladed screwdriver or something similar until it fits.</p> <p>Align the top of the sleeve round the motor to the top of the spindle mount.</p> <p>Tighten the clamping bolt, do not over tighten!</p>			

Finishing the Assembly



Install the Motherboard

	NAME	CODE	QTY.	BEFORE
Parts Used	GRBL Motherboard GC3D3	VER-7	1	 <p>VER-7</p> <p>VER-47 x4Pcs</p> <p>VER-46 x4Pcs</p>
	Bolt M3*8mm	VER-46	4	
	T Nut 20*M3	VER-47	4	
Tools	Allen Key (2.5mm)			AFTER
Steps	<p>Place the bolts into the holes on the motherboard back plate and screw the T Nuts on to the end of the bolt with the flat/stepped edge towards the motherboard. Align the T nuts with the channel and press them in. Slide the Motherboard so the distance between the edge of the back plate and the outer edge of the gantry is 30mm.</p> <p>Tighten (Do not over tighten) the bolts, as you do this the T nuts should turn to be vertical in the slots holding it in place.</p>			 <p>30mm</p>

Finishing the Assembly

Install Side Plates				
	NAME	CODE	QTY.	BEFORE
Parts Used	Side Plates	VER-5	2	
	Bolt M5*10mm	VER-41	8	
	T Nut 20*M5	VER-48	8	
Tools	Allen Key (4mm)			AFTER
Steps	<p>Check the alignment of the plates to the bed and gantry assembly and peel off the protective Paper.</p> <p>Place the bolts through the holes in the side plates from the outside and screw the T Nuts on to the end of the bolts with the flat/stepped edge towards the side plate.</p> <p>Align the T nuts with the channels and press them in.</p> <p>Slide the Side Plate to touch the gantry upright.</p> <p>Tighten (Do not over tighten) the bolts, as you do this the T nuts should turn to be vertical in the slots holding it in place.</p> <p>Repeat for the other side.</p>			

Finishing the Assembly

Install Side Plates				
	NAME	CODE	QTY.	BEFORE
Parts Used	Bed Clamp Set Includes: Clamping plates x 4 Washers x 4 Wing nuts x 4 T Nut 5mm x 4 M5 Screws 35mm x 8	VER-25	1	
Tools	Optional, Thread lock (Not Included)			AFTER
Steps	<p>Screw the wing nut onto a screw, add the washer and place the screw through the slot of the clamping plate and put on the T Nut with the end of the bolt just through the T Nut with the stepped side towards the plate. Screw the second screw through the threaded hole. Repeat for the other 3 clamps. You can add thread lock to the T Nut threads before screwing in the bolt for ease of use.</p> <p><i>To use slide the T nut into a slot in the bed, adjust the single screw so that the plate is level with the top of the stock and tighten the wing nut to securely hold the stock in place.</i></p>			

Wiring it up

General Wiring Notes

Labeling

Each cable is labeled at one end with its purpose and this corresponds to the markings of where it fits into the motherboard. The label end goes into the motherboard.

Cable routing

Most of the cables are static; they will not move as the router working, these must be routed so that in operation they are out of the way of the bed including anything which may be mounted on it and the spindle. There are three sets of cables which will move as the router operates; these are the Spindle motor cable, The Z axis limit switches and the Z axis stepper motor Cable. These must be left free to move allowing the X and Z axis a full range of travel.

Cable Protection

A length of Nylon cable protector is provided which slips over one or more cables and can be held in place with a cable tie at each end. It is strongly recommended that this be used on the free moving cables to protect them from any abrasion damage.

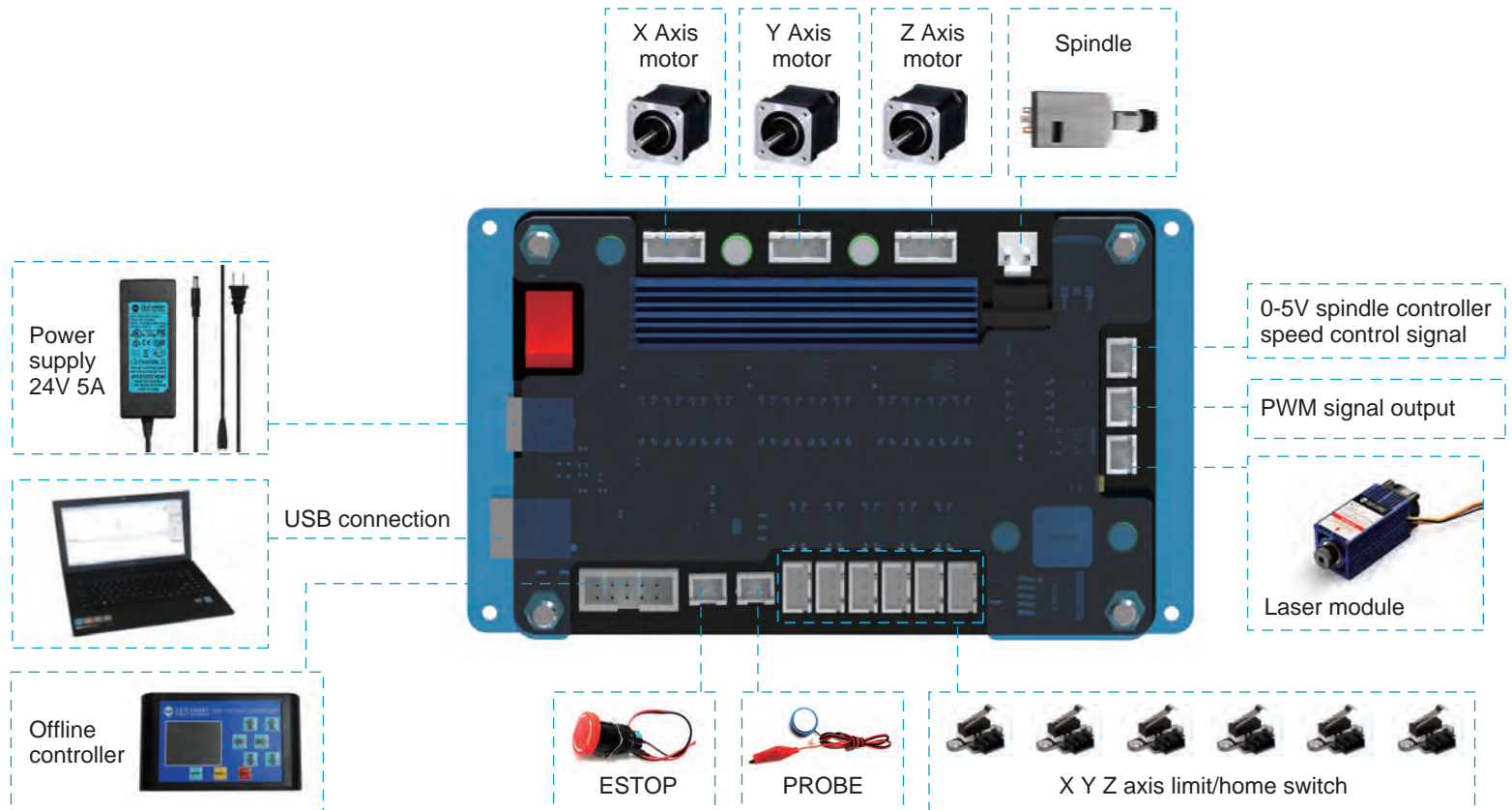
Hint: Tape the plug or plugs to the end of something like a pencil using masking or other tape. Then slide the pencil through the inside of the tube pulling the cable(s) with it, the tape also helps prevent the corners catching on the inside of the tubing.

Securing to the Cable Holders

Run the cable(s) along the center of the holder then place a tie wrap through the end holes and over the cable(s), wrap it over the top and tighten it. Trim off the end of the tie wrap.

Wiring it up

Motherboard Connections




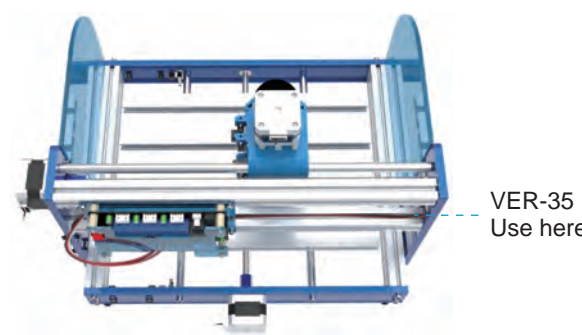
Wiring it up

Motherboard Connection Markings

Marking	Description	Marking	Description
USB	USB interface	-LAS+	12V power for Laser module
24VDC	24V external power supply	-PWM+	PWM signal output for Laser module
ON	24V Power ON	GND 0-5V	0-5V spindle controller speed control signal
OFF	24V Power OFF	Spindle	Spindle motor
Offline controller	SainSmart Offline controller	X	X Axis stepper motor
		Y	Y Axis stepper motor
ESTOP	Emergency stop button	Z	Z Axis stepper motor
PROBE	Z-Probe kit	USB.PWR	LED USB power indicator
XLIM+	X axis limit switch +	24V.PWR	LED 24V power indicator
XLIM-	X axis limit switch -	Status	LED On when talking to PC or Controller
YLIM+	Y axis limit switch +	SPINDLE	LED On when Spindle motor is on
YLIM-	Y axis limit switch -	LASER	LED On when Laser is on
ZLIM+	Z axis limit switch +	ALM	LED On for a Stepper motor driver alarm
ZLIM-	Z axis limit switch -	RUN	LED On when a Stepper motor is moving


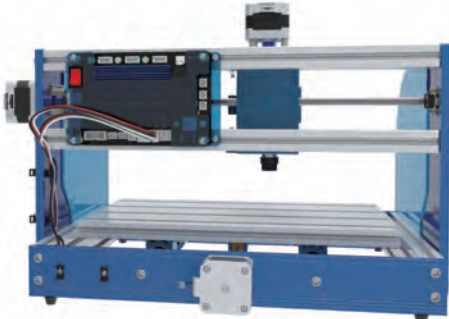
Wiring it up

Connecting the X Axis Limit Switches

	NAME	CODE	QTY.	VIEW 1
Parts Used	Limit Switch Cable X LIM+ 15cm	VER-14	1	
	Limit Switch Cable X LIM- 53cm	VER-15	1	
	Sealing strip 340mm	VER-35	1	
Tools				VIEW 2
Steps	<p>Plug the short cable into the limit switch on the gantry by the stepper motor and the labeled end into the XLIM+ socket on the motherboard.</p> <p>Plug the long cable into the other limit switch.</p> <p>Trim the Sealing strip to fit between the inside of the gantry and the edge of the motherboard, leaving a gap for the cable at each end.</p> <p>Press the sealing strip (flat side out) over the cable into the channel of the bottom member.</p> <p>Feed the plug behind the motherboard to the other side. Plug into the motherboard XLIM- socket.</p>			

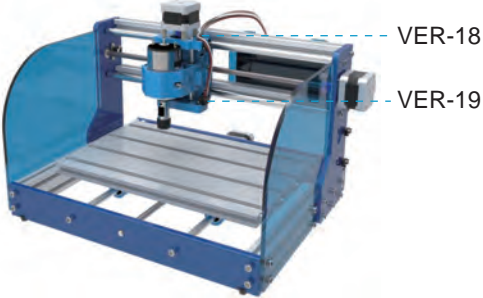

Wiring it up

Connecting the Y Axis Limit Switches

	NAME	CODE	QTY.	VIEW 1
Parts Used	Limit Switch Cable Y LIM+ 30cm	VER-16	1	 <p>VER-16 --- VER-17 VER-32 --- VER-34</p>
	Limit Switch Cable Y LIM- 60cm	VER-17	1	
	Cable Ties	VER-32	6	
	Sealing strip 270mm	VER-34	1	
Tools				VIEW 2
Steps	<p>Plug the end of the long cable into the switch on the front frame and secure into the cable holders.</p> <p>Press the sealing strip (flat side out) over the cable into the upper channel in the side frame.</p> <p>Plug the end of the short cable into the switch on the back frame and secure into the cable holders Route both cables up through the cable holders on the inside of the gantry and secure them.</p> <p>Plug the cable ends into the motherboard into the YLIM- and YLIM+ sockets respectively.</p>			

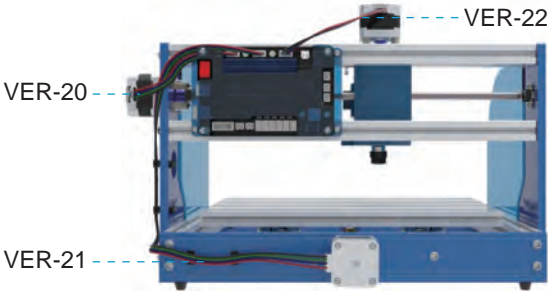
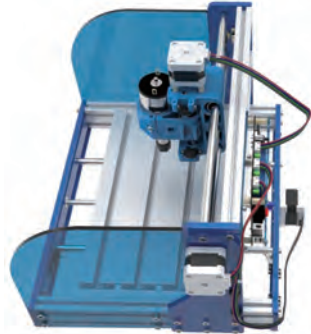
Wiring it up

Connecting the Z Axis Limit Switches

	NAME	CODE	QTY.	VIEW 1
Parts Used	Limit Switch Cable Z LIM+ 34cm	VER-18	1	
	Limit Switch Cable Z LIM- 40cm	VER-19	1	
	Cable Protector	VER-36	30cm	
	Cable Tie	VER-32	1	
Tools				VIEW 2
Steps	<p>Cut a piece of the Cable Protector (~30cm) and slide both cables through it.</p> <p>Plug the longer cable (Z LIM-) into the lower limit switch on the Spindle Motor holder. Note the direction of the slots on the socket is different for each switch.</p> <p>Plug the shorter cable (Z LIM+) into the upper limit switch on the Spindle Motor holder.</p> <p>Secure the cables and the Cable protector together by a cable tie just above the top limit switch. Make sure the bottom cable is straight to keep it out of the way.</p> <p>Plug the cable ends into the motherboard ZLIM- and ZLIM+ sockets respectively.</p>			

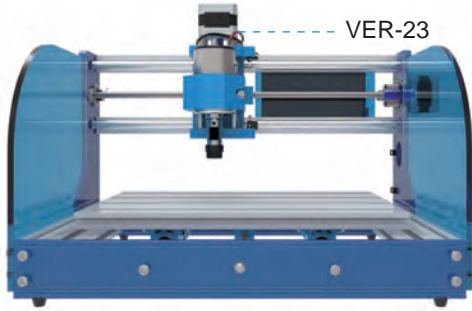
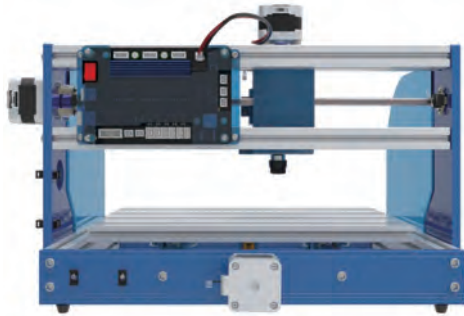
Wiring it up

Connecting the Stepper motors

	NAME	CODE	QTY.	VIEW 1
Parts Used	Stepper motor Cable X Axis 17cm	VER-20	1	
	Stepper motor Cable Y Axis 52cm	VER-21	1	
	Stepper motor Cable Z Axis 28cm	VER-22	1	
	Cable Ties	VER-32	6	
	Cable Protector	VER-36	25cm	
Tools				VIEW 2
Steps	<p>Plug in the cable into the X axis motor (at the side of the gantry) and the labeled end into the motherboard.</p> <p>Plug in the cable to the Y axis motor (at the back of the base), Route the cable along the back through the cable holders, then up through the cable holders on the outside of the gantry and then plug the labeled end into the motherboard.</p> <p>Cut a piece of the Cable protector ~25cm long, slide the Z axis cable through the protector, add a cable tie to secure it at both ends.</p> <p>Plug the cable into the Z axis motor and the labeled end into the motherboard making sure the cable moves freely with Z and X axes travel.</p>			

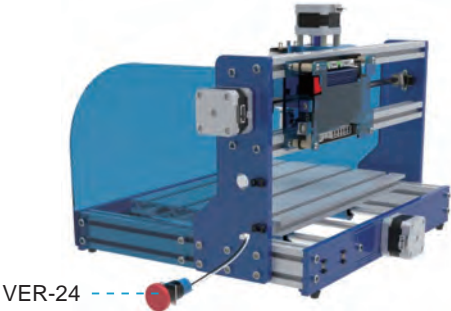
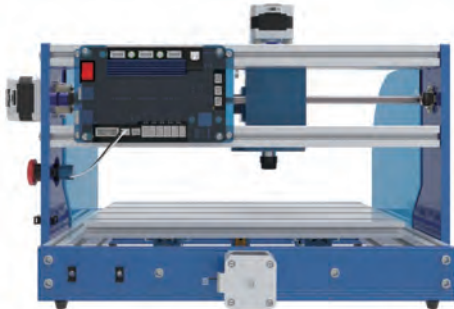
Wiring it up

Connecting the Spindle motor

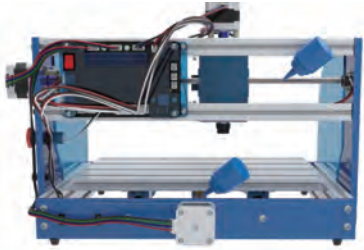
	NAME	CODE	QTY.	VIEW 1
Parts Used	Spindle motor Cable 35cm	VER-23	1	
	Cable Ties	VER-32	2	
	Cable Protector	VER-36	25cm	
Tools				VIEW 2
Steps	<p>Cut a piece of the Cable protector ~25cm long and Slide the Spindle motor cable through it.</p> <p>Plug the cable ends onto the Z axis motor with the red wire to M+ and the black wire to M-.</p> <p>Add a cable ties to secure it at both ends of the cable.</p> <p>Plug the labeled end into the motherboard Spindle socket making sure the cable can move freely as the A and X axes travel.</p>			

Wiring it up

Connecting the X Axis Limit Switches

	NAME	CODE	QTY.	VIEW 1
Parts Used	Emergency Stop Button	VER-24	1	
Tools				VIEW 2
Steps	<p>Remove the holding collar and square plate from the button then thread the wires through the hole in the gantry from the outside.</p> <p>Place the square plate, curved corners first, over the cable followed by the holding collar.</p> <p>Tighten the holding collar onto the button body making sure the square plate is fitted inside the hole on the gantry.</p> <p>Remove the jumper from within the EStop socket on the motherboard and insert the plug.</p>			

Final Checks

Final Checks		
Lubricate the axes	<p>Lubricate the Threaded rods on all the axes, It is suggested to use a 'Dry' PTFE based lubricant or similar (Not included) to help stop any dust sticking to the rods.</p> <p><i>Note: Part of the normal maintenance is to periodically clean the threaded rods and re-lubricate as needed.</i></p>	
Check Cable routing	<p>The bed and anything which will be mounted on it will be able to move fully from front to back without snagging on any cables.</p> <p>The cables connecting the Z Axis and spindle motor will move freely and not restrict the movement of the Z and X axes.</p> <p>Access to the Motherboard 24V power supply and the USB Cable connection are not obstructed.</p>	
Emergency stop button	<p>This is a normally closed switch, so if you ever decide to disconnect it make sure that either the jumper above the EStop socket on the motherboard is in the N position or that the Jumper over the socket pins is present. If not, or if the button is pressed, when powering on the router will be totally unresponsive.</p> <p>Make sure before powering on the Emergency Stop button is released by turning the button in the direction of the arrows and letting it spring out.</p>	
Vref	<p>This controls the current going to the stepper motors. This has been pre-set for the PROVer and no adjustment is necessary or advised.</p>	

A Brief Glossary

Glossary	
Bed	The aluminum base with slots to allow stock to be clamped to it. Moved by the Y axis.
Stock	Whatever material you secure to the bed and cut or engrave.
G-Code	Geometric Code, the language of the commands that the router understands, can be used for specific commands or combined into a file (normally .nc) of instructions to make something.
Stepper Motor	A motor which turns in single steps or fractions of one (microsteps) These are used to drive the motion of the axes as they can accurately move the axis by a very small amount at a time.
ER11 and collet	The tool holder on the Spindle motor is an ER11 type. The Collet is the compressible part that surrounds the bit and is compressed, holding the bit, by tightening the nut at the bottom of the ER11.
Homing Cycle	The process by which the router moves the spindle round looking for the limit switches to be activated on all the axes so that it has a defined 'Home' position.
Origin	The coordinates of the starting position for a particular job, each G-Code file operates in reference to an origin which is often but not always the left/front/top (X/Y/Z) of the material to be cut.
Jogging	A Jog command tells the machine to move on a single axis, normally used to either position the spindle to the start position for a job or just to move it out of the way.

Setting up the Software

This section is for Windows based PCs, you can also just use the offline controller. Software for Apple Macs and Linux which do not have support for installing and running windows programs is available, but is not described here.

All files referenced should be on your SD card or mini CD, if there are any problems with accessing these you can download them from <http://wiki.sainsmart.com/index.php/101-60-3018PROVER>

Install the Windows Serial port driver

Locate the Driver_CH340SER.EXE file and run it (you will need administrator privileges on your PC), follow the prompts provided.

Install Grblcontrol/Candle

This is a free and open source program which talks to your PROVer (or other Grbl based routers) by a serial USB connection and provides a variety of functions. This guide refers to GrblcontrolCandle V1.1.7, referred from now on as just Candle.

Candle can also be downloaded for Windows and Linux from <https://github.com/Denvi/Candle>, operating instructions can be found at <https://github.com/Denvi/Candle/wiki>

Candle does not come with an installer; just copy the entire contents of the directory to a folder on your computer, for example to a Program Files (x86)/grblControl directory (you will need administrator privileges for this) or anywhere else on your computer. Once copied create a shortcut to 'Grblcontrol (Candle).exe' and save it anywhere you wish.

To start Candle click on the shortcut or directly open the **Grblcontrol (Candle).exe**

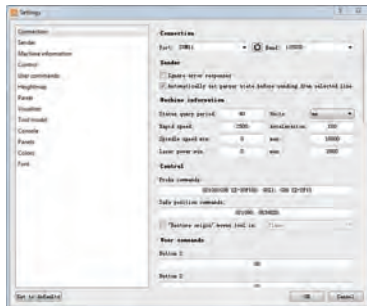
Setting up the Software

Connect your 3018-PROver via the USB cable and start Candle. Ideally you should see something like the screenshot on the left, if not then the one on the right. The red Alarm state in the status box is actually good! The 3018-PROver is fitted with limit



switches and by default has 'Homing' enabled. Until a Homing Cycle has been run it will be in an Alarm state as it has no idea where the spindle is and will accept very few commands. You can also get out of this state by clicking on the padlock icon in the Control section of Candle to unlock the machine.

If it's the one on the right then Candle cannot find your router. Simply select the Service/Settings option from the top menu and you should see the settings menu:

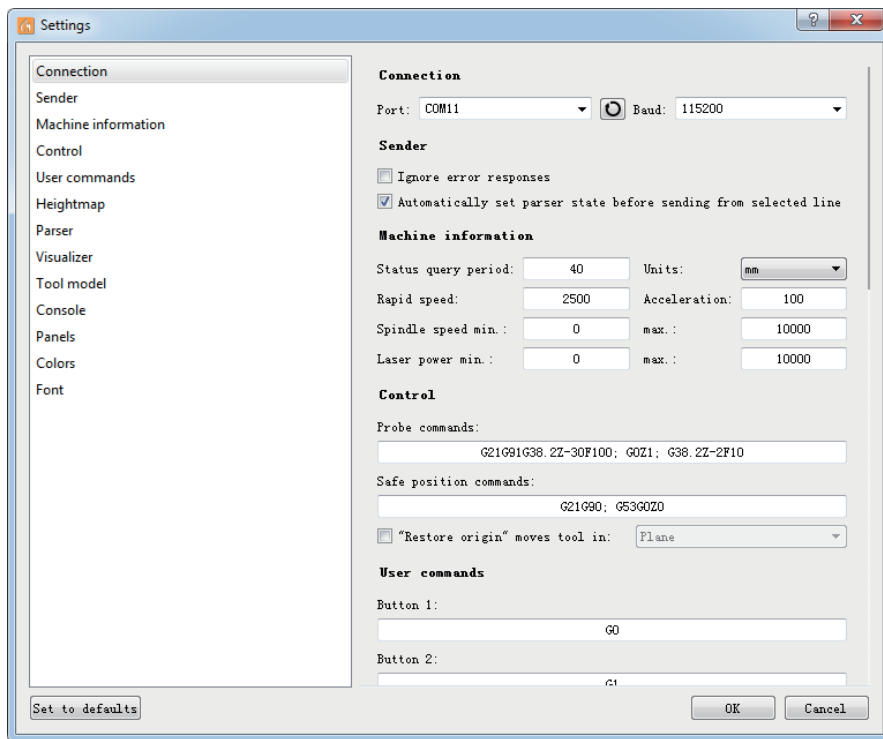


Check that the Baud: value is 115200, if not change it, then Click on the connection/Port dropdown and select the COM port your router is connected to, there should not be many so if necessary try them each in turn. Click on OK and you should see the left hand screen above, if not select the next COM port and retry.

If everything fails check the USB cable connection to the router and retry. Check that the Emergency stop Button is not pressed in!

Setting up the Software

Now check some other settings before we proceed:



In the Machine Information section set/check the following:

Rapid Speed	2000
Spindle Speed Min	0
Spindle Speed Max	10000
Laser Power Min	0
Laser Power Max	10000

And hit OK.

Candle can be customized quite extensively using the settings panel, these are just the basic ones for the 3018-PROVer. Candle tutorials are available online but be careful that any machine, control and user commands are suitable for the 3018-PROVer.

Testing

In order to run a few quick tests click on the padlock icon in the Control section of Candle to unlock the machine, do not run a homing cycle at this point. The Alarm state should now be replaced with an Idle State

Test 1 - All axes move in the right direction

Note: X and Z axes are straightforward but the Y axis can be confusing as the bed moves, not the spindle. The Y+ (hover the mouse over the jog buttons in Candle) should move the bed towards the front, so sending the spindle towards the back of anything mounted on it. Y- sends the bed to the back moving the spindle to the front of anything mounted on it.

- In Candle set the Jog Step: to 10. Make sure the spindle is not close to the edges of the router and is in the middle of the Z movement, if necessary with the power OFF turn the threaded rods by hand to move the spindle.
- Hit the right jog button (X+), the X axis should move 10mm to the right, X- sends it to the left.
- Hit the Up jog button (Y+), the Y axis should move 10 mm towards the front of the bed, Y- sends it back.
- Hit the Z+ (right up arrow of the jog buttons) and the spindle should move away from the bed by 10mm, Z- sends it down.

Test 2 - Free movement of Cables

Using the Jog step distance and arrows to move the Z axis down, close to the bottom of its movement without triggering a limit switch, if you do trigger one hit the Candle Reset icon, followed by the Candle Unlock icon and jog a little away from the switch.

Now using the jog commands move the X axis along its full travel while checking that the Spindle Motor, Z axis limit switch and Z axis stepper motor cables move freely at all times. If they do catch on anything adjust the cable routing accordingly before continuing.

Test 3 - Limit switch operation

Trigger by hand each of the 6 limit switches in turn, as each is triggered the led on both switches on that axis should light.

Testing

Test 4 - Homing Cycle

Hit the Home icon in the Candle Control icons. The router will first move the Z axis to the top until it hits the limit switch, then it will move the spindle to the Front right of the bed. Each time it hits a limit switch it will back off slightly to disengage the switch. At the end the router status will be set to Idle.

Test 5 - Spindle Motor

In the Spindle section of Candle set the Spindle Speed to 1000 and hit the Spindle on/off icon to the right. The spindle should start to rotate and the LED on the spindle motor indicating Forward motion should light. Click the Spindle on/off icon again to stop it.

Test 6 - Emergency Stop Button

Start the Spindle motor as above, then hit the Emergency stop button. The spindle should stop. The motherboard will now be totally unresponsive to any commands from Candle until the Emergency stop button is released by turning the button in the direction of the arrows until it pops back out. Release the button and Candle should now show an Alarm state, effectively the router has just been turned on.

Test 7 - Z-Probe

Before the Z Probe can be tested it first needs measuring and setting up for the exact thickness of the Probe base.

When used the router will lower the bit until it makes an electrical contact with the top of the base, then it will set the Z axis origin to the bottom of the base using the value provided for the thickness of the base. Then raise the bit by 2mm so the Z-Probe base can be easily removed.

Setting up the Z-Probe

Measure the thickness of the Z Probe base as accurately as you can, this can vary slightly due to manufacturing and assembly tolerances. This thickness needs to be in mm and preferably accurate to .01mm.



Testing

There are 2 variations of the G-Code required, one for use in Candle and the other in the probe.txt file used by the Offline Controller, this is just in the way they are formatted, not the content.

In the examples shown below the default value for the Base Height is 14.19mm, substitute this value with the one you measured.

Candle

In Candle select the Service/Settings menu and copy and paste the line below into the Control, Probe commands box replacing whatever was in there. Then modify the 14.19 with your measured value and hit OK.

```
G21G91G38.2Z-45F100; G0Z1; G38.2Z-2F10; G92Z14.19; G0Z2
```

Offline Controller

The commands sent to the router for the Z-Probe command are contained in the probe.txt file in the root directory of the SD card. Place the SD card in the reader and plug it into your PC, open the probe.txt file in a text editor and replace the entire contents of the file with:

(Set for Z-Probe base 14.19mm high)

```
G21 G91
```

```
G38.2 Z-45 F100
```

```
G0 Z1
```

```
G38.2 Z-2 F10
```

```
G92 Z14.19
```

```
G0 Z2
```

```
M2
```

Now substitute your measured value for the 14.19 and save.

Testing

To test the Z-probe operation:

- 1) Mount a bit into the spindle tool holder.
- 2) Jog the bit so it is over the center of one of the slots in the bed. NOTE: this is partly verifying the thickness measurement of the Z-Probe base, so if for any reason this is incorrect placing the bit over a slot will allow it to descend as needed minimizing any chance of damage to the bed or the bit.
- 3) Place the Z-Probe base flat on the bed underneath the bit.
- 4) Attach the alligator clip to the bit. NOTE: The bit must be conductive and clean, do not use with diamond tipped bits or similar which are non conductive. If the bit is not clean debris on the tip may prevent it from making an electrical contact with the Z-Probe base resulting in damage.
- 5) In Candle hit the Z-Probe Control Icon (magnifying glass with a down arrow over a line inside).
- 6) The bit will descend until it makes contact with the Z-Probe base, then raise slightly and go back down slowly to obtain a more accurate reading, then raise up slightly to allow the Z Probe base to be removed.
- 7) Remove the Z-Probe base and the alligator clip from the bit.
- 8) In Candle enter G90 G0 Z0 F50 into the console command box and hit enter. This sets the router into absolute coordinate mode and goes to position 0 on the Z axis at a slow feed rate.
- 9) The bit should descend slowly until it is level with the top of the bed.
- 10) Use Jog commands to carefully move the Y axis so the bit moves out of the slot and approaches the top of the bed to verify the position.

Testing

TROUBLESHOOTING

Hopefully everything works as expected, but if not:

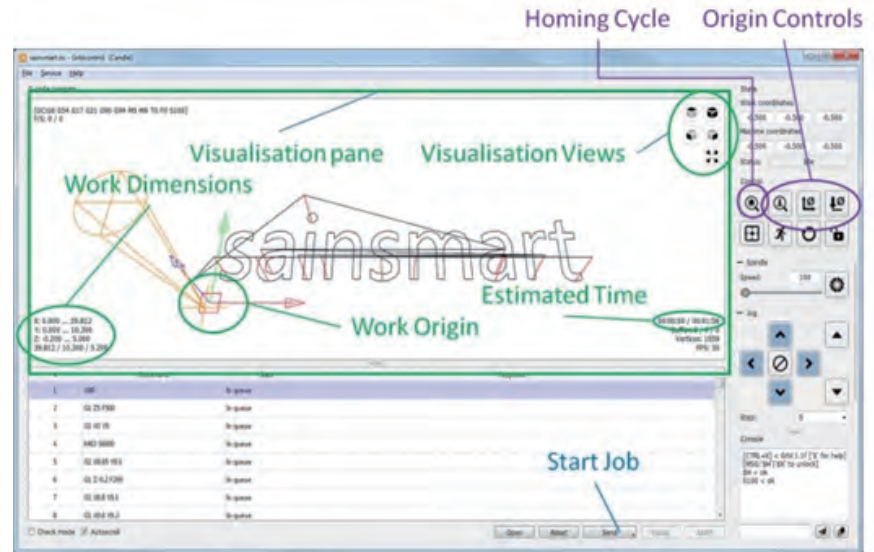
Symptom	Check
Candle shows a Serial port error message in the Console window	The USB cable is inserted correctly. The USB Driver has been installed correctly. The correct COM Port and a baud rate of 115200 are set in Candle. The Offline Controller is not connected.
Candle can communicate with the router but nothing moves.	Ensure the On/Off switch on the motherboard is ON. Verify the 24V external power supply is connected correctly.
Router is totally unresponsive to Candle	The Emergency Stop Button is in the Out position. <i>(If the Emergency Stop Button is not connected that the Jumper setting is in the N position on the motherboard or the jumper is in place in the motherboard socket.)</i>
An Axis does not move	The Stepper motor wiring is correct.
The wrong Axis moves	The Stepper motors are connected to the correct motherboard ports.
Limit switch does not work	The cable connections for the limit switch.
Spindle motor does not turn	The cable connections for the spindle motor.
Spindle motor turns but the LED does not light	The Spindle motor cable Red wire is connected to M+ on the spindle motor and the Black wire to the M-.
Limit switch LED stays on	The spindle is not too close to the edge of the axis.
Homing Cycle fails	Limit switch connections and cabling.
Z-Probe fails	The bit is conductive and clean. The Z-Probe connection to the motherboard is correct.
After running a Z-Probe the tip of the bit is not level with the top of the bed	Adjust the Z-Probe base height in the Z-Probe code accordingly

Testing

Run a test engraving

Start Candle and connect to the PROVer by the USB cable, make sure the 24V power supply is connected and the router is turned on. Load the sample G-Code file `sainsmart.nc` (File/Open). Run a homing cycle.

Examine the Work Origin and Work Dimensions in the Visualisation Pane; the Work Origin is wherever you set the XYZ axes positions. The Work Dimensions tell you how far to the left ... right etc. each axis will move during the job. In this case the Work Origin is at the bottom left, at the top of the stock and the X axis will cut 0 to the left and 39.812mm to the right of the origin, the Y axis will cut 0 to the front and 10.3mm to the back. The Z axis will move down by 0.2mm and up by 5mm (*Note: the Z axis down movement is normally the depth of cut, the 5mm is the distance it will move above the stock when positioning the bit*).



Fit one of the supplied engraving bits into the spindle and tighten the tool holder using the spanners. Make sure it is mounted so the tip can reach the desired depth of cut, in this case at least 0.2mm below the top of the stock.

Select a piece of wood of the needed size or larger, (~40mm x ~11mm x ~1mm) is the area that is engraved, this must be clear of any clamps so allow enough extra size to allow for the clamps!).

Mount the wood onto the bed securely using the Work Clamps, it should have a flat base and surface, the cut will only be 0.2mm deep so if it's not flat the cut will be of an uneven depth.

Testing

Using jog commands position the bit on the XY axes to where you want the job to start and using the Origin Control button zero the XY axes.

Place the Z-Probe base underneath the bit, connect the alligator clip to the bit and hit the Z-Probe origin control button. Remove the Z-Probe base and the alligator clamp and set them aside.

Hit Send (at the bottom of the window) to start the job. The Elapsed time and an estimate of the total time needed is given in the Estimated Time in the Visualisation Pane.



TROUBLESHOOTING

Hopefully everything works as expected, but if not:

Symptom	Check
The depth of cut is uneven, only parts are cut.	That the stock used is flat and level.
Nothing at all is cut or the cut is too deep.	The measurement of the Z-Probe base and that Candle and the probe.txt file for the offline controller have been modified accordingly.
A limit switch was activated during the job	Verify the positioning of the stock and the origin position allows enough travel for the dimensions of the job.

Recovering from activating a limit switch

If at any time during a job a limit switch is activated the job will be aborted and the router will stop and it will also lose its position information.

Before you can re run a homing cycle you must first make sure the limit switch is de-activated as if when the router is told to search for the limit switches being activated (A Homing Cycle) and one is already active it will just stop.

1. Hit Unlock in Candle
2. Make sure the jog step is set to 10
3. Jog away from the activated limit switch
4. Now run a homing cycle

Using the Offline Controller

Depending on the package you purchased with the 3018-PROVer an Offline Controller may be provided. If not this can be purchased separately from SainSmart

The Offline Controller connects directly to the PROVer and is used to control the router, setting homing, origin position etc. and to send the contents of the files directly to the router without needing a PC connected to it via a USB cable.

The Offline Controller uses a micro SD card as the medium to transfer files between the design process and the router, a USB card reader is included.

If no SD card is detected at startup a 'No SD Card' message will be displayed at the top of the screen. Disconnect the Offline controller, insert an SD Card and reconnect the Offline Controller.

NOTE: The router cannot be connected to the Offline Controller and by a USB cable at the same time! Before connecting the Offline Controller disconnect the USB cable from the router and vice versa.

Supported Files

- Long filenames are supported but only up to 19 characters including the extension will be displayed when selecting a file.
- The Offline Controller will process a file regardless of the file extension but it must contain only valid G-Code with each line separated by a CR/LF (Carriage Return/Line Feed) Files generated by some software only separates the lines of G-Code by a single Line Feed character, before using they must be converted to standard files using a CR/LF sequence to separate each line.
- Only files located in the root directory of the SD card are recognized, subdirectories may be present but they are not displayed.

Special Files

There are two special files which should be located in the root directory of the SD Card, these are used by functions in the Control menu. These are probe.txt which is used by the Probe function and Spindle Laser.txt for the Spindle/Laser function, these are provided on the included SD card. Selecting one of these functions in the control menu sends the G-Code in the relevant file to the router.

Using the Offline Controller

Setting up the Z-Probe

Measure the thickness of the Z Probe base as accurately as you can, this can vary slightly due to manufacturing and assembly tolerances. This thickness needs to be in mm and preferably accurate to .01mm.

In the examples shown below the default value for the Base Height is 14.19mm, substitute this value with the one you measured.

The commands sent to the router for the Z-Probe command are contained in the probe.txt file in the root directory of the SD card.

Place the SD card in the provided USB Card reader and plug it into your PC. Open the probe.txt file in a text editor and replace the entire contents of the file with:

(Set for Z-Probe base 14.19mm high)

G21 G91

G38.2 Z-45 F100

G0 Z1

G38.2 Z-2 F10

G92 Z14.19

G0 Z2

M2

Now substitute your measured value for the 14.19 and save. Eject the SD card from your computer and plug it back into the Offline Controller.



Using the Offline Controller

Navigating

The offline controller is powered from the Router Motherboard, no batteries or other power supply is needed. Plug the cable into the offline controller and the Router motherboard. Connect the router to the 24V external power supply and turn it on.

The Main menu will be shown as below. *Note: if there is a 'no SD card' message shown unplug the offline controller, insert the SD card and plug the Offline Controller back in.*



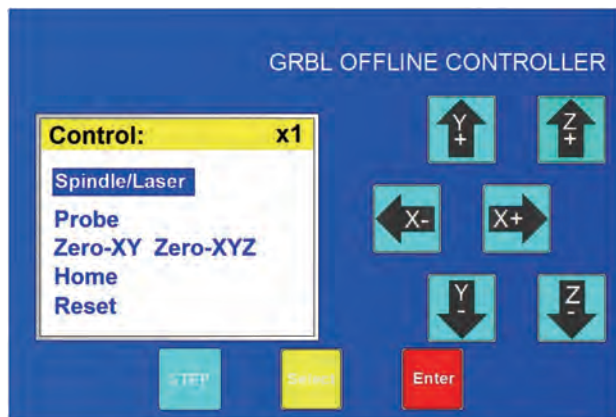
Button	Description (For All menus)
STEP	Cycles through the Jog distance (0.1,1,10 and 100mm) This changes the xnn display at the top right of the screen where nn is the current step distance in mm.
Select	Switches between the top menu options, Selects the next item in the File and Control Lists, a long press returns to the previous page or top of the list
Enter	Selects or executes the selected item, A long press returns to the main or previous menu
X- X+	Jog on the X axis, left and right by the selected Step Distance.
Y+ Y-	Jog on the Y axis, back and front by the selected Step Distance.
Z+ Z-	Jog on the Z axis, up and down by the selected Step Distance.

Using the Offline Controller

Menus

Highlight the File or Control menu by using Select and then press Enter.

Control Menu



The Step and Jog functions are active in this menu.

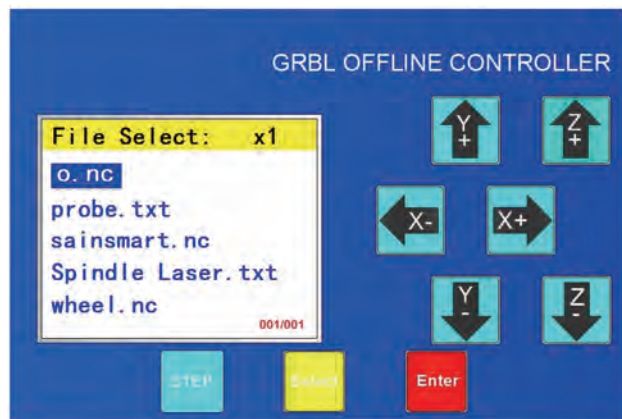
To return to the main menu press and hold the Enter button.

Function	Description
Spindle/Laser	Turn on the spindle or laser, to turn off select Reset and enter.
Probe	Send Z-Probe commands to automatically zero the Z Axis at the bottom of the Z-Probe Base. The Z-Probe base must be in position under the bit and the alligator clip connected to a clean and conductive spindle before using this.
Zero-XY	Set the X and Y work origin to the current XY bit position. Use this when using the Z-Probe to zero the Z axis.
Zero-XYZ	Set the X Y Z work origin to the current XYZ bit position. Use this if not using the Z-Probe.
Home	Run a Homing Cycle, move the Spindle to the Home position.
Reset	Reset the Router.

Using the Offline Controller

File Menu

Presents a series of pages displaying the files on the SD card, scroll down (or back up) the list until the file you want is highlighted.
The Step and Jog functions are active in this menu.



At the bottom right of the display the current page and a guide to the number of pages available is shown.

Function	Description
STEP	Cycles through the Jog distance (0.1,1,10 and 100mm)
Select	Selects the next file in the list, if the last file on the page is already selected the next page will be displayed. A long press will go to the top of the previous page.
Enter	Selects the highlighted file to run. A long press returns to the main menu.
X- X+	Jog on the X axis, left and right by the selected Step Distance.
Y+ Y-	Jog on the Y axis, back and front by the selected Step Distance.
Z+ Z-	Jog on the Z axis, up and down by the selected Step Distance.

Using the Offline Controller

Run a File

When a file is selected from the File menu the following menu will be shown with the state shown as Stop.

Jog and step buttons are disabled on this menu and while running a file.



Press the Enter button to run the file:

The Percent: value shows the percentage of the commands in the file that have been sent to the Router, not the time taken to complete the Job. After the Offline controller shows the job is complete it is normal for the router to continue to run until it has performed all the commands it has received and buffered for execution.

To pause the job press the enter button, the state will change to Pause and the Offline controller will suspend sending commands to the Router. Pausing a job stops the online controller sending any more G-Code lines to the Router, the router will continue to perform any commands it has already been sent and has buffered for execution. The router will not stop until these commands have completed.

In the Stop or Pause state, press and hold the Enter button to cancel the job and return to the main menu.

Using the Offline Controller

Summary of running a file using the Offline Controller

- 1) Go to the Control Menu
- 2) Using the Step button to control the distance moved and the Jog buttons position the bit to the work origin in the X and Y axes and select the Zero XY command and hit enter.
- 3) Place the Z-Probe base under the bit, connect the alligator clip to the bit shank and select the Probe command.
- 4) Remove the Z-Probe base and the alligator clip.
- 5) Return to the main menu by a press and hold of the enter button.
- 6) Select File and press Enter
- 7) Scroll down the list until the file you want to use is selected and press the Enter button.
- 8) Press the Enter button to start the job.
- 9) When complete press and hold the Enter button to return to the Main Menu.

NOTES: There is one other file which can be modified if required and must be present on the SD Card to work. This is the Spindle/Laser command in the Control menu which sends the contents of the file Spindle Laser.txt to the router.

This turns on the Spindle or Laser and the default contents are

M3

S10000

This will turn the Spindle or laser on at maximum power. To turn them off send a reset command to the router.



www.sainsmart.com

support@sainsmart.com

2711 Centerville Road, Wilmington, DE, 19808, United States