Mounting a Hat on –STK Version

- Acquire M-F standoffs using selection guidance provided below
- Install the M-F standoffs and F-F standoffs onto the PIBK01*
- Install the Raspberry Pi
- Install the screws thru the Raspberry Pi into the F-F standoffs
- Install the hat
- Install the screws thru the hat into the M-F standoffs
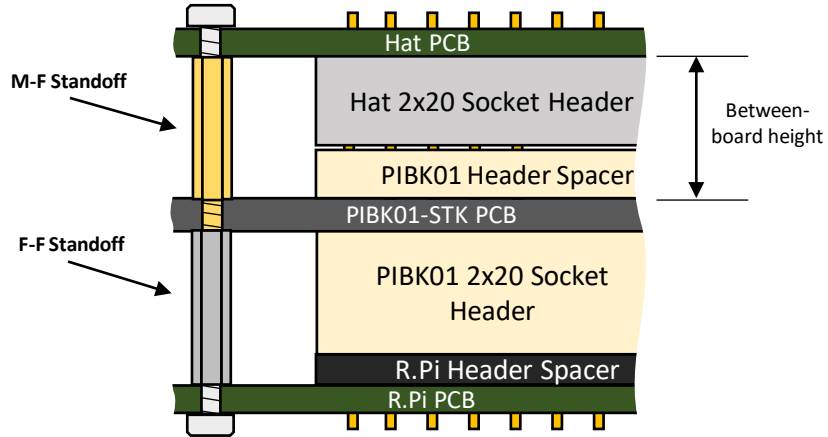
*For the M-F standoff, the length of threaded portion that protrudes thru the PCB is a little less than typical due to the thicker PCB that is used (94 mils vs typical 62 mils). Considering the standoff material (nylon), please be careful to not overtighten the standoffs.

M-F Standoff Selection Guidance

- M-F standoffs should be selected based on the required distance between the hat and the PIBK01, which depends on the socket header that is used on the hat.
- The M-F standoff between-board height should be just a bit more than the height of the hat's header plus the height of the PIBK01 spacer (0.15"). The chart below provides some guidance for some typical header heights
- Be aware that a large hat used with short standoffs my result in an interference between the hat and the terminal blocks on the PIBK01.
- If the M-F standoff selected is too long, the hat's socket header may not properly connect to the PIBK01 pin header.

| Height of Hat Header	M-F Standoff between Hat and PIBK01 (between-board height)
0.33"	0.5" (1/2")
0.4"	0.563" (9/16")
0.45"	0.625" (5/8")
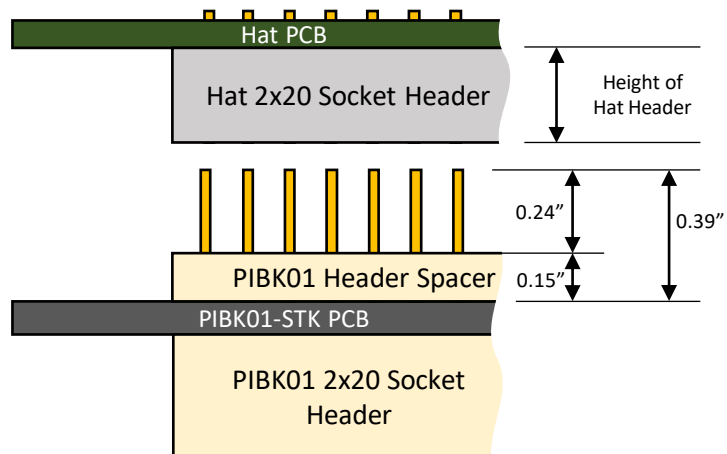
GLOBAL_EN, RUN, PoE signals

The Raspberry Pi 4 includes the following signals, not included on the 2x20 header:

      PoE (Power over Ethernet) signals at J14 (2x2 header, installed)

      GLOBAL_EN and RUN signals at J2 (1x3 header, not installed)

These are shown in the picture below, as shown in the Raspberry Pi 4 Model B product brief.
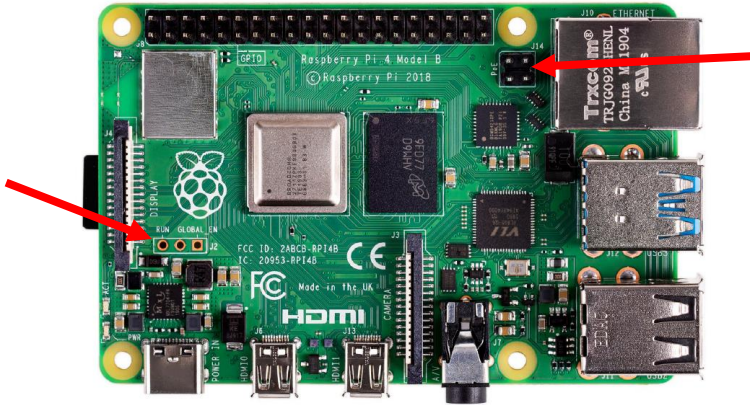
The PIBK01 provides a way for the user to access these signals on the PIBK01 and make them available at a hat if needed (depending on the application situation). However, the user will need to install headers themselves, as summarized in the chart below.

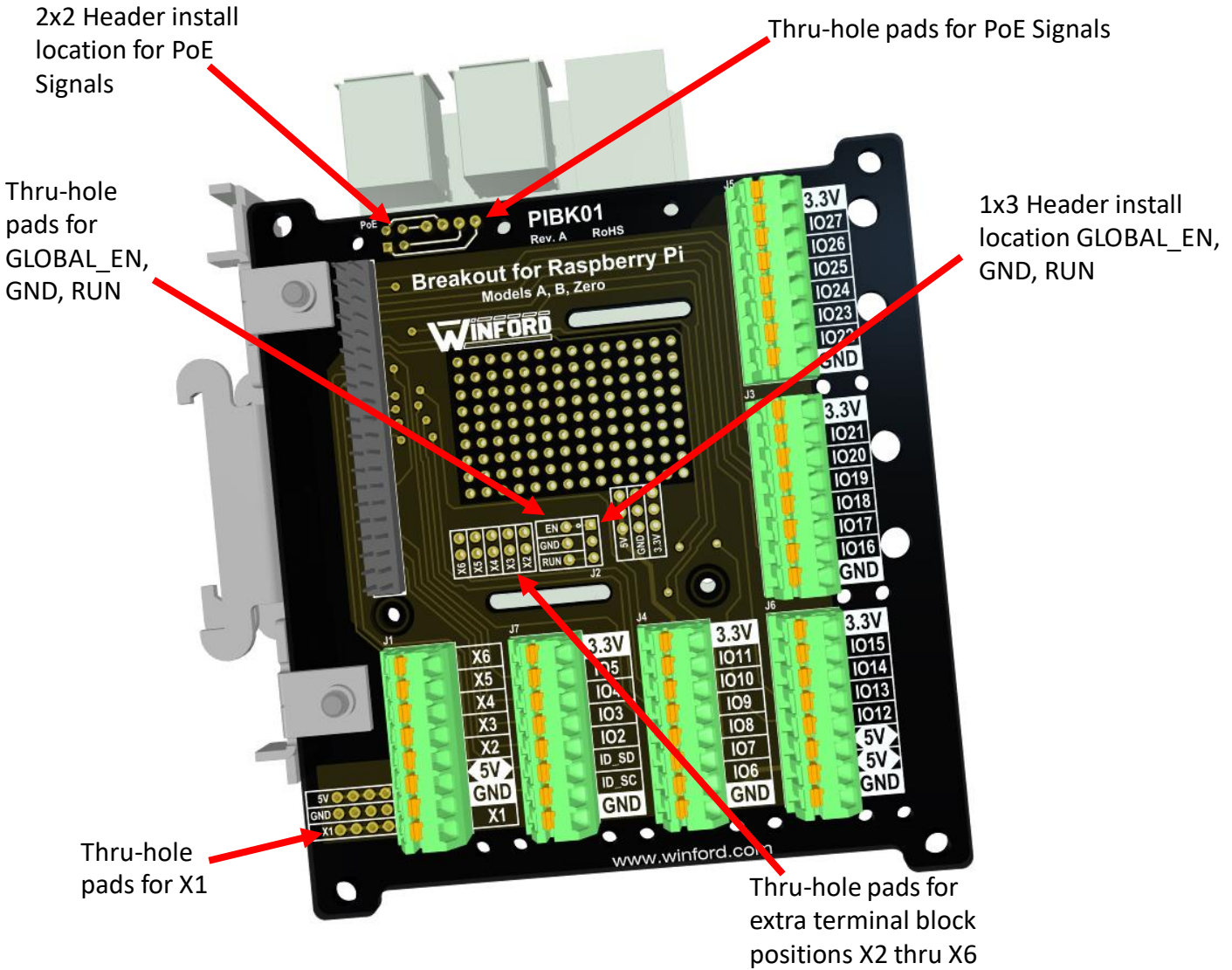| Application Situation	PoE Signals	RUN, GLOBAL_EN signals

Signals need to be available on the PIBK01 breakout, but not required for a hat	A 2x2 pin header is already installed on the Raspberry Pi.
	
	Install 2x2 socket header on bottom side of PIBK01.
	   (Samtec ESW-102-12-L-D)*
		Install 1x3 pin header on Raspberry Pi *(Samtec HTSW-103-07-F-S)*
		
		Install 1x3 socket header on bottom side of PIBK01
		    (Samtec ESW-103-12-L-S)*

Signals need to be passed thru the PIBK01 to a hat	A 2x2 pin header is already installed on the Raspberry Pi.
	
	Install 2x2 stacking header, socket on bottom side of PIBK01, long pins extending thru PCB.
	   (Samtec ESQ-102-14-L-D)*
		Install 1x3 pin header on Raspberry Pi *(Samtec HTSW-103-07-F-S)*
		
		Install 1x3 stacking header, socket on bottom side of PIBK01, long pins extending thru PCB.
		   (Samtec ESQ-103-14-G-S)*

*Representative header part numbers are provided as a courtesy to assist the user in the selection of appropriate headers that are generally available from common distributors. There is no affiliation between the supplier(s) and Winford Engineering, LLC, and a supplier may change their parts at any time without notice. If using the reference parts, please review latest supplier drawings and specifications to confirm suitability.

GLOBAL_EN, RUN, PoE signals (continued)

2x2 Header install location for PoE Signals

Thru-hole pads for PoE Signals

Thru-hole pads for GLOBAL_EN, GND, RUN

1x3 Header install location GLOBAL_EN, GND, RUN

Thru-hole pads for X1

Thru-hole pads for extra terminal block positions X2 thru X6

With headers installed, the given signals (PoE, RUN, GLOBAL_EN) are available on the PIBK01 at thru-hole pads. If any of these signals need to come out to a terminal block, the uncommitted extra terminal block positions (X1 thru X6)* may be used. Just connect a wire from the pad for the given signal to the pad for X2, X3, etc.

*While not strictly required, it is generally advised to save X1 in case it is needed for powering the Raspberry Pi from a voltage rail greater than 5V (e.g., 24V rail available in a cabinet for PLCs, etc), along with a user-added DC/DC converter.

Adding 5V Regulator

In some applications, such as an installation in a cabinet in which only a 24V or 12V rail is available, there is not a great way to power the Raspberry Pi (5V required). Rather than purchase a 5V supply, the user can fairly easily add a DC-DC converter to the PIBK01, allow the unit to supply 5V to the Raspberry Pi while being powered from a higher voltage rail.

This is accomplished by using the pads for X1, GND, and 5V. If the R.Pi is not going to be consuming a large amount of current, then a simple 3-terminal DC-DC converter such as Traco TSR 2-2450 can be installed, as shown below. Then, simply apply power (e.g., 12V, 24V) to terminal block position X1, and the DC-DC converter will provide the 5V needed for the Raspberry Pi.

Note that while this example DC-DC converter allows a rail up to 36V to be used, it is only rated for 2A output current. For heavy processing on the Raspberry Pi 4, this might not be sufficient. In this case, it may be necessary to use a larger DC-DC converter, utilizing the 0.1" grid proto area to implement the required connections.

DC-DC Converter (5V out)

Supply Rail (e.g. 24V)
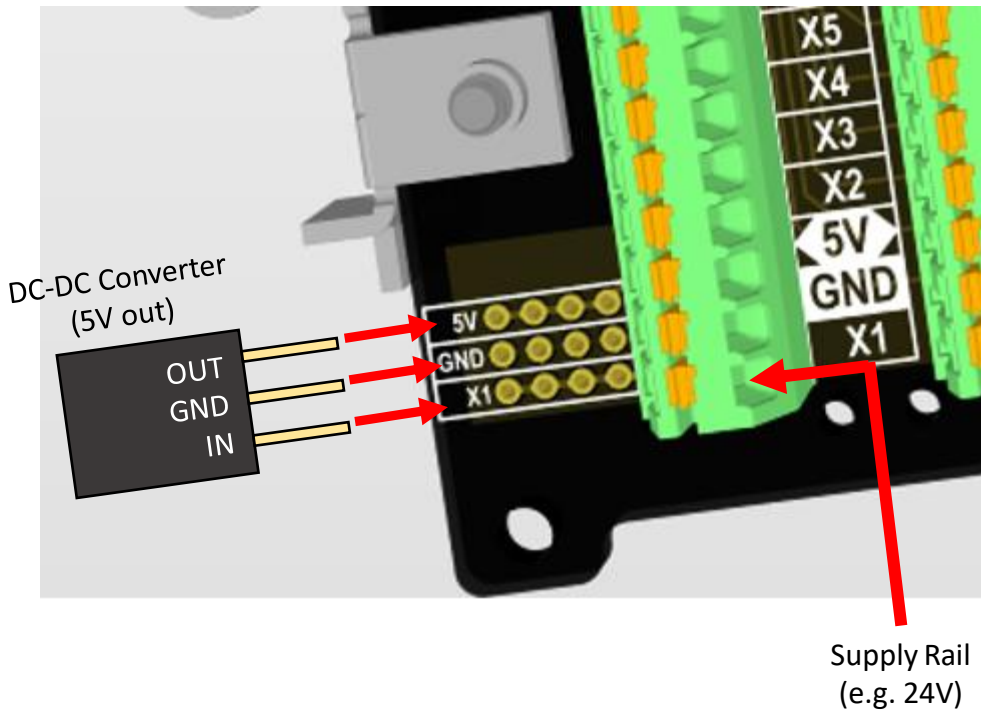
2x20 Header: Compliant-Pin Technology

Did we forget to solder the 2x20 header pins? No, we didn't forget – but at first glance, it may look like it!

One of the challenges with manufacturing a double-sided circuit card assembly (components on both sides) is the matter of getting all the thru-hole pins soldered. Soldering the components on one side is pretty straightforward, but doing the second side has some challenges. A selective-solder operation can be used in many cases. However, this is not possible when the component to be soldered is a stacking header with long pins. This type of component could be soldered by hand, but this is a labor-intensive endeavor with low process repeatability and a potential for quality concerns (e.g., solder wicking up the pin).

An effective solution is to use compliant-pin (sometimes called press-fit) technology. In this assembly method, there is no soldering operation. The component, with its pins having retention features that are slightly oversized relative to the hole in the PCB, are simply pressed into place. This creates a very reliable connection, with no heat cycle or solder or cleaning cycle needed.

Compliant-pin technology has been used for decades, and it is common in safety-critical, high-reliability, high-quality applications (e.g., automotive). For those who are interested in learning more about this technology, a couple helpful web pages are listed below for reference.

ept Connectors: "Press-fit System"
https://www.ept-automotive.com/index.php?press-fit-technology

Connector Tips: "Why Use Compliant Pins in Connector Designs" by Mary Gannon, January 16, 2014.
https://www.connectortips.com/use-compliant-pins-connector-designs/