



Infineon TC234LF Emulation Adapter

Hardware User Manual

V2.1, February 2024

General safety instructions

Please read the following safety precautions carefully before putting this device to use to avoid any personal injuries, damage to the instrument, or to the target system. Use this instrument only for its intended purpose as specified by this manual to prevent potential hazards.

Use included power cord and power supply

The enclosed power supply has been approved for use by iSYSTEM. Please contact iSYSTEM if you need to consider an alternative power.

Use grounding wire

Prior to applying power to either the BlueBox or the target, connect the device and the target system together with the included grounding wire. This is to avoid potential damage caused by any voltage difference between the device and the target system.

Use proper overvoltage protection

Ensure proper protection to avoid exposing the BlueBox device or the operator to overvoltage surges (e.g. caused by thunderstorm, mains power).

Do not operate without cover

Do not operate the device with cover removed.

Avoid circuit and wire exposure

Do not touch exposed components or wires when the device is powered.

Do not operate with suspected damage

If you suspect damage may have occurred, the BlueBox device must be inspected by qualified service personnel before further operation.

Do not operate the device outside its rated supply voltage or environmental range

Consult with iSYSTEM before using equipment outside of the parameters provided in this manual.



This symbol is used within the manual to highlight further safety notices.

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Introduction

Infineon TC234LF Emulation Adapter primary use case is providing the trace capability for the 100-pin:

- TC233
- TC223

devices featuring no trace functionality.

 The Emulation Adapter might differ in some peripherals from the target device; therefore, the device datasheet should be checked.


The Emulation Adapter is based on the emulation device featuring on-chip trace and provides the target adaptation to the 100-pin QFP target package. Infineon TC234LF Emulation Adapter is based on the TC234LF emulation device (step AB) in the QFP100 package, on which the on-chip trace buffer is available providing the trace support.

Alternative use cases is a [standalone operation](#) without connecting the emulation adapter to the target. In this case application development and testing can start before the target is available.

The iC5000 or the iC5700 BlueBox providing the trace functionality connects to the Emulation Adapter through the Infineon 10-pin 1.27mm Infineon DAP2 Wide Debug Adapter (ordering code IC50163-2).

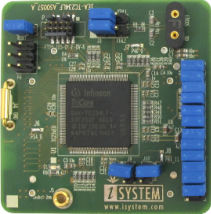




Complete Emulation Adapter is split into individual parts. A typical setup in conjunction with the target contains:

- IEA-TC234LF-ST (Microcontroller part)
- Conversion board
- Solder part

 More information about our products on www.isystem.com or via sales@isystem.com.

Package content


Infineon TC234LF Emulation Adapter is delivered with all components required for Standalone operation. [Adaptation package](#) for the Target board adaptation must be **ordered separately**.

Infineon TC234LF Emulation Adapter	Power supply package	
	Power converter	Power adapter
Ordering code: IEA-TC234LF-ST	Ordering code: IEA-PS	Ordering code: IT9V-PS
		
GND Wire		Measurement board (optional)
Ordering code: BB-WIRE		Ordering code: IAMTC234LF100
		
<div><div><div></div><div>i</div></div><div>If you purchase the Power supply package individually, the Power adapter (IT9V-PS) must be ordered separately.</div></div>		

Adaptation packages content

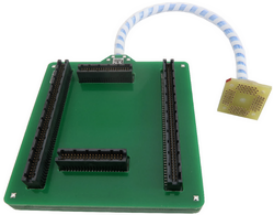



Conversion board connects between the Emulation Adapter and the matching Solder part which is being soldered on the Target side.

Pin number	Conversion board	Type	Solder part	Socket cover
100	IEA-TC234LF-BTQ100W	Flex	IAYQPACK100SE IANQPACK100SE	/
	/	Flex	IANQPACK100SE	IAPACK100SE

 Socket cover HQ Pack is used together with the production device and the Solder part NQ Pack. For assembly instructions please refer to [HQ Pack Assembly](#).

Flex Adaptation with Wire adapter

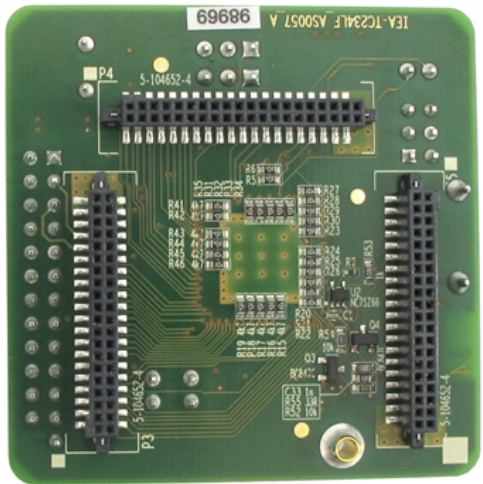
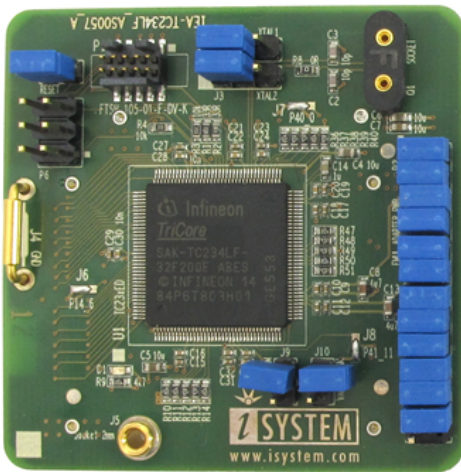
This part provides a flexible connection of the Emulation Adapter to the Solder part as an alternative to the fixed connection.

Conversion board	Connecting part	Solder part	Socket cover (optional)
			

Operation

Emulation Adapter offers the following setup:

- [Flex Adaptation](#) (with Wire adapter)



Top / Bottom side of the Emulation Adapter

[Introduction to Emulation Adapter \(video\)](#)

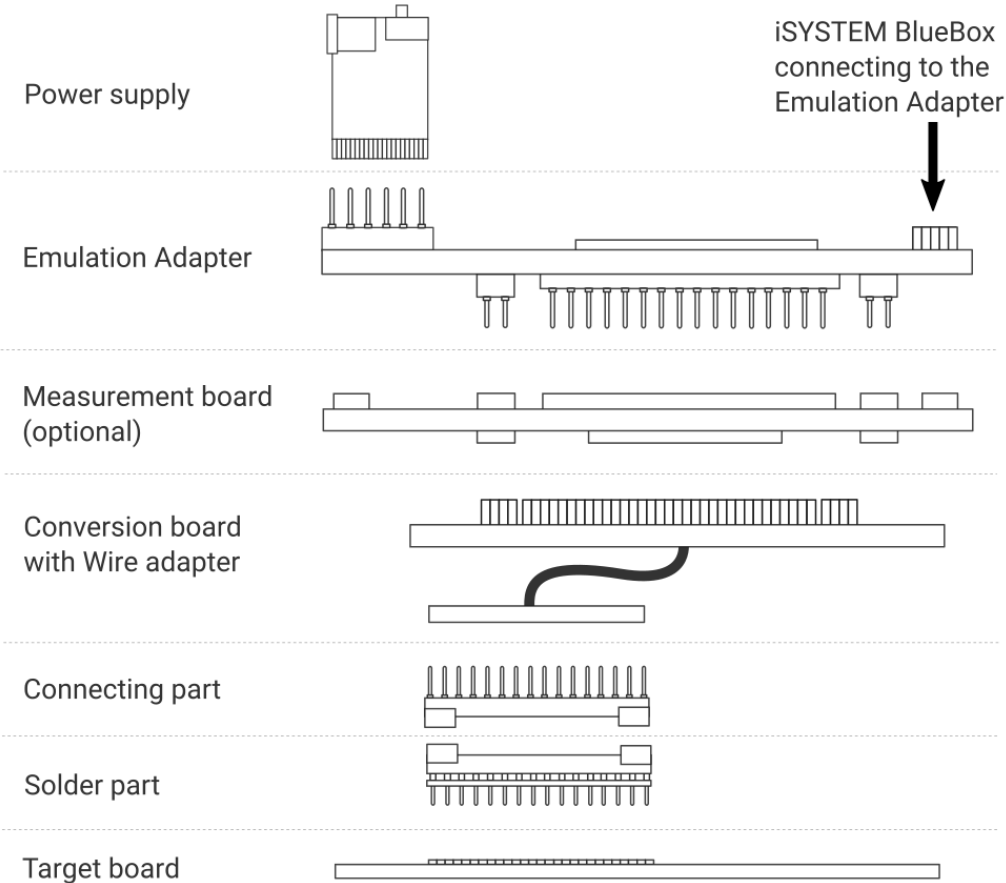
isystem.com/ea-intro

[How to connect Hardware \(video\)](#)

isystem.com/connect-hardware

Adaptation setups

Flex Adaptation



Configuration

J1: Target reset configuration

Jumper J1 connects the TC234LF reset line (PORST) and the target reset line. By default J1 is populated.

When having problems establishing the initial debug session with the emulation adapter, try to remove J1 and see if it makes any difference.

J2 and J3: Clock source configuration

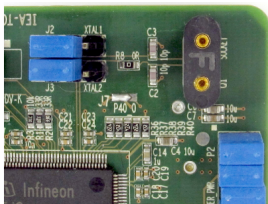
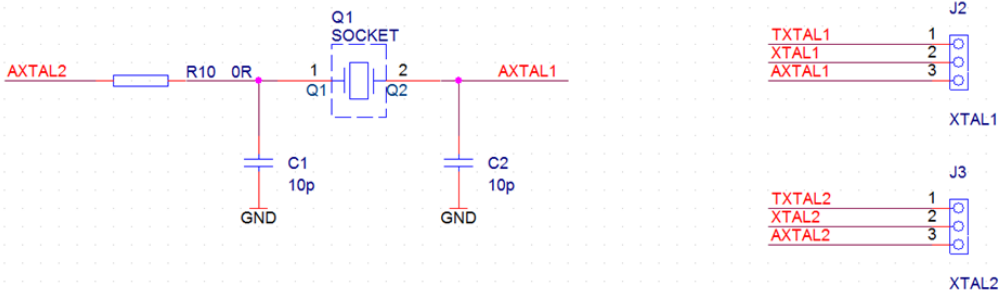
Jumpers J2 and J3 select clock source for the microcontroller on the emulation adapter. Per default, both jumpers are set to position 1-2, which yields the clock source being used from the target.



Note that the emulation adapter may not operate when crystal circuit is used in the target. Typical design guideline is that the crystal should be as close as possible to the microcontroller. However, it may happen that the target crystal may not oscillate in conjunction with the emulation adapter since clock lines (XTAL1, XTAL2) between the target and the emulation device on the emulation adapter can become too long, consequentially affecting the impedance of the crystal circuit too much. There should be no problem if the oscillator is used in the target.

If an oscillator in the target is not an option and the target crystal doesn't oscillate in conjunction with the emulation adapter, clock from the emulation adapter must be used (J2 & J3 position 2-3). In this case, a crystal circuit must be assembled on the emulation adapter.

Crystal circuit is located in the corner of the emulation adapter.



Per default 10pF capacitors are populated for C1 and C2 and the crystal Q1 is not populated.

Note that C1 and C2 values are valid for 20MHz crystal only. If different crystal is used, the default 10 pF capacitors must be replaced with proper value.

J4 & J5: GND connecting points



Original microcontroller in the QFP100 package provides GND connection through the exposed pad. The emulation adapter, replacing the original microcontroller doesn't provide support for the exposed pad and for this reason the GND connection must be established separately. Use J4 or J5 connection pin to established good GND connection between the emulation adapter and the target. The connection should be quality and short as possible. Refer to the Emulation Notes chapter for potential problems with this grounding connection.

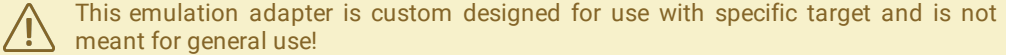
J9 & J10

If the emulation adapter is attached to the target, jumpers J9 and J10 must not be populated since the target takes care of all the microcontroller pin connections already.

When the emulation adapter is to be used in a so called standalone operation without connecting it to the target, and the microcontroller analog/digital converter is used, the two jumpers should be set. Jumper J9 connects VAGND to VSSM and jumper J10 connects VSSM to the emulation adapter GND potential.

- VAGND (pin 41) – Negative Analog Reference Voltage 0
- VDDM (pin 44) – ADC Power Supply
- VSSM (pin 43) Analog Ground for VDDM

Emulation Notes



Original microcontroller connects the GND potential to the target PCB through the exposed pad located in the center of the microcontroller on the bottom side of the package”.

The emulation adapter connects to the target PCB via Solder part which doesn't provide the exposed pad. That means ground signal remains unconnected. No solder part supporting this QFP100 (0.4 mm pitch) package featuring exposed pad exists in the market (status 2017/Q4). For this reason, emulation adapter provides a dedicated GND connection through a short wire, which has to be connected between the emulation adapter and the target. Note that such setup could exhibit problems since the ground potential is not routed close to the microcontroller pins and the GND path is considerably prolonged comparing to the original microcontroller with the GND connected through the exposed pad.

4k7 ohm pull-up is present on the port P14.2 and 4k7 ohm pull-downs are present on the following ports:

- P00.1-P00.9, P00.12,
- P10.1-P10.3,
- P14.5, P14.7, P14.8
- P15.4, P15.6-P15.8,
- P20.0, P20.3, P20.6, P20.7,
- P21.5,
- P22.0-P22.4,
- P33.0-P33.4, P33.11, P33.12
- P34.0-P34.3

These ports exist on the 144-pin device, which is populated on the emulation adapter, while the 100-pin target device being emulated by the emulation adapter doesn't have these ports. These resistors predefine value of these ports when their input registers are read by the application. This makes sense only when the same application is supposed to run on 100-pin and 144-pin microcontroller. If the application is written for 100-pin device only, it shouldn't read these ports since they don't exist.

At the moment 144-pin TC234LF AB step is populated on the emulation adapter. For the 100-pin TC233LP target device, newer AC step exists already, fixing known issues from the AB step including CAN FD related issues. Refer to Infineon errata documents for more details on known issues and fixes for specific step. Infineon has no plans to do an AC step of the 144-pin TC234LF emulation device (status: 2017/Q1). Consequentially, the application running on the target based on a real 100-pin TC233LP device step AC or newer can behave differently comparing to the application running on the TC234LF emulation adapter.

Startup and Power Supply Mode

The target device TC234 being emulated with this emulation adapter, can have the external nominal system supply either 3.3V or 5V. Both are supported by the emulation adapter. The power supply scheme of the TC234LF at startup is based on the latched status of HWCFG[0:2] pins before PORST release. With the emulation adapter, HWCFG[0:2, 6] pins are left unconnected (floating) while the TC234LF PORST signal is low. This ensures embedded voltage regulators EVR33 and EVR13 are active by default. As soon as the PORST line is released from the low state, the HWCFG[0:2, 6] pins get connected to the target via the emulation adapter logic.

P2: Power supply configuration

Emulation Adapter Power supply is configured via the unshrouded 26-pin 2.54 mm header (P2).

Signal Direction	Signal	Pin	Pin	Signal	Signal Direction
target	VDDP3	1	2	CVDDP3/3v3	CPU
target	VDDM	3	4	CVDDM	CPU
target	VAREF	5	6	CVAREF	CPU
	NC	7	8	NC	
	NC	9	10	NC	
	NC	11	12	NC	
	NC	13	14	NC	
	NC	15	16	NC	
	NC	17	18	NC	
	NC	19	20	NC	
	GND	21	22	GND	
	GND	23	24	GND	
	GND	25	26	KEY	

P2 Signal description

Refer to the microcontroller user’s manual for more details which power supply designation in the above table belongs to which power supply.

By default all jumpers are set and connect target power supply coming from the target to the microcontroller residing on the emulation adapter. In principle, pins 3-4, 5-6, 7-8, must be bridged only but for the convenience and ease of use, all jumpers are set except for pins 25-26. Pin 26 is the polarizer key preventing incorrect connection of the IEA-PS power supply, when connected.

P1: DAP2 trace port

iSYSTEM BlueBox supports Infineon DAP debug interface connects to the connector P1. 10-pin 1.27mm connector P1 has the following pinout:

Signal Description	Signal	Pin	Pin	Signal	Signal Description
Reference Voltage	Vref	1	2	DAP1	DAP Data pin
Ground	GND	3	4	DAP0	DAP clock
Ground	GND	5	6	DAP2	Optional 2nd Data pin
Not Connected	NC	7	8	USER_IN	User specific
Ground	GND	9	10	RESET	Reset

10-pin DAP pinout

Signal Direction is described from the BlueBox perspective.



Be aware that debug and trace signals from the Emulation adapter superset device are not connected to the target board. They are exposed only to the connectors on the Emulation adapter.

Power supply package

A Power supply package, which is delivered with the Emulation Adapter, is required when:


- The Emulation Adapter is used as a **standalone device** .
- The target board doesn't provide an accurate supply voltage.
- The target board doesn't provide sufficient current for the Emulation Adapter operation.

The Power converter can supply either 3.3 V or 5 V. Array of jumpers J0 – J9 select 3.3 V or 5 V voltage on the P3 connector, which connects to the Emulation Adapter.

Signal	Pin	Pin	Signal
NC	1	2	J0
NC	3	4	J1
NC	5	6	J2
NC	7	8	J3
NC	9	10	J4
NC	11	12	J5
NC	13	14	J6
NC	15	16	J7
NC	17	18	J8
NC	19	20	J9
GND	21	22	GND
GND	23	24	GND
GND	25	26	KEY


P3 connector and J0-J9 jumper correlation table

For example, when J2 is in the 3V3 position, it supplies 3.3 V to pin 6 of the P3 connector. When J2 is in 5V position, it supplies 5 V to pin 6 of the P3 connector pin.



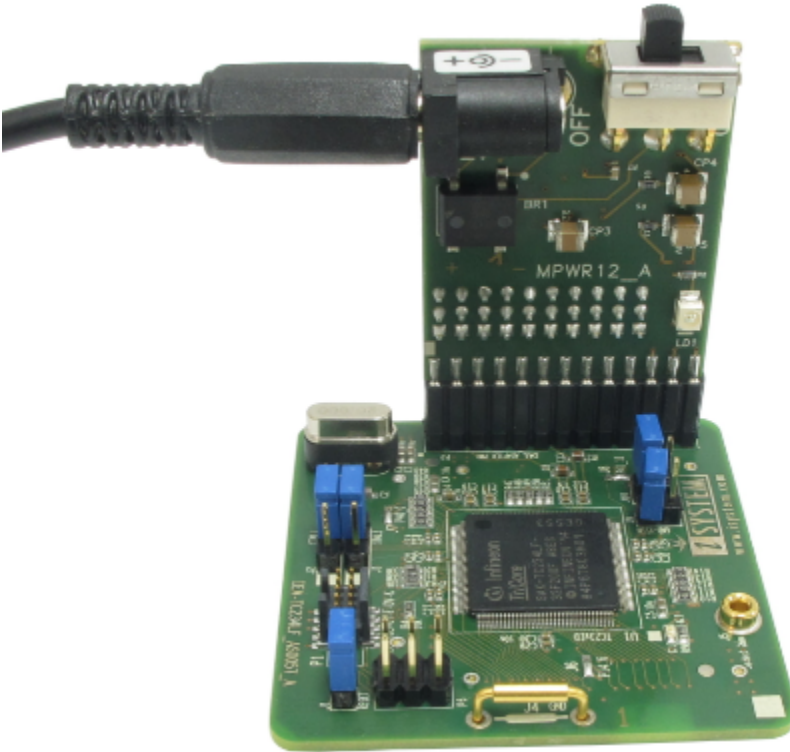
Be careful not to supply 5 V to the microcontroller power supply pin which has declared maximum voltage 3.3 V! Refer to microcontroller documentation for detailed information.

External power supply requirements:

Min Voltage	Max Voltage	Min Power	
8 V	12 V	5 W	

Standalone operation

Emulation Adapter is delivered with all components required for a Standalone operation: IEA-PS Emulation Adapter Power converter adapter. IEA-PS emulation adapter power supply simply plugs into the P2 header row, providing the necessary power supply for emulation adapter standalone operation. Double check that the IEA-PS emulation adapter power supply is configured properly for this particular emulation adapter.

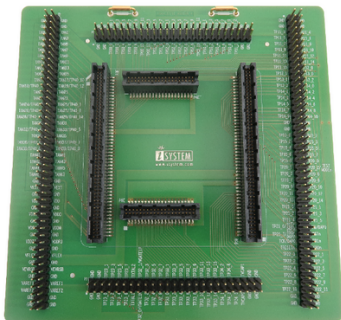


If a different power source is to be used, all jumpers must be removed and power source must be applied to CVDDP3/3v3 (pin 2), CVDDM (pin 4), and CVAREF (pin 6) signals.

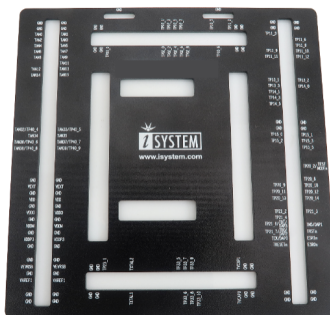
Measurement board

With the Measurement board you gain easy access to all MCU pins respectively, because modern targets do not have accessible all the MCU pins / connected signals to connect with a measurement equipment (oscilloscope, logic analyzer).

The Measurement board is optional and connects between the Emulation Adapter and the Conversion Board. It comes together with an applicable Layout board (black panel where all the CPU signals are nicely marked) that matches your order. The black panel is placed over the Measurement board.



Top view of the Measurement board

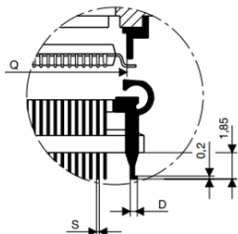
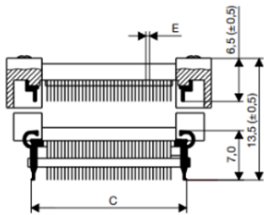


Layout board example for the Measurement board

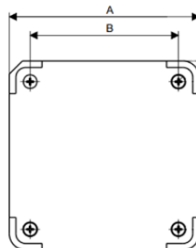


Not available in every Emulation Adapter or every MCU pin count.

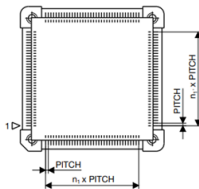
Mechanical information



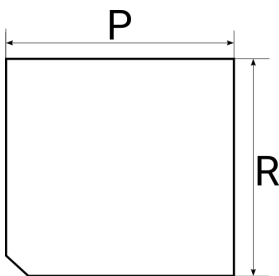
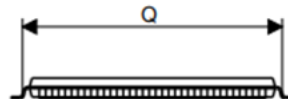
Side view of the Solder part



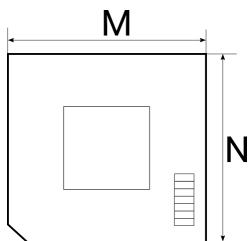
Solder part solder upper view



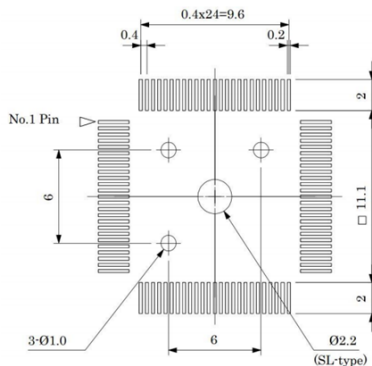
Solder part solder bottom view



Top view of the Conversion board



Top view of the Emulation Adapter



NQPACK Solder pad view

Solder part

Recommended foot pattern shown is for the NQPACK soldering. Refer also to the IC package foot pattern recommended by the microcontroller manufacturer when the microcontroller is meant to be soldered on the same foot pattern.

	Unit (mm)								
	A	B	C	D	E	Q	S	n1	Pitch
IANQPACK100SE	21	14.65	14.1	0.5	0.18	13.20	0.18	24	0.4



You must be familiar with the SMT (Surface Mount Technology) soldering to solder the NQPACK to the PCB. On request, iSYSTEM provides this service too.

Emulation Adapter


	Unit (mm)						
	M	N	P	R	S	T	V
IEA-TC234LF-ST	52	52			32.6	38	47.5
IEA-TC234LFBTQ100W			52	52			

NQ Pack Assembly

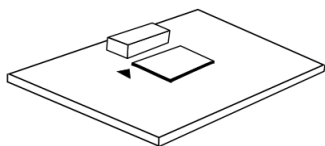
First check that the pin 1 positions on the pad pattern and all of the components are correctly aligned.

1. Mount the NQPACK on the Target.

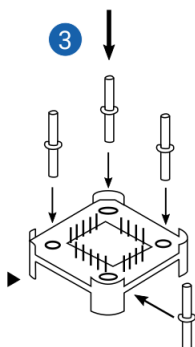
2. Install the YQPACK after checking for a match with the position of pin 1 for the NQPACK. Then use the guides to affix the YQPACK to the NQPACK.

 Do NOT use the screws included with the YQPACK for fixing the YQPACK. Do NOT use the screwdriver included with the NQPACK for fixing the Guides. Note that you need to provide your own screwdriver.

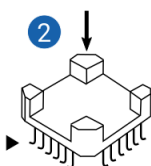
3. Connect the Emulation Adapter after checking for a match with the position of pin 1 for the YQPACK, and connect the Debug Adapter / Active Probe from the BlueBox to the connector on the Emulation Adapter. For more information on how to connect iSYSTEM hardware refer to isystem.com/connect.



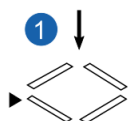
Emulation Adapter



YQPACK with guides



NQPACK

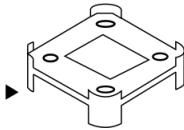


Electronic circuit PCB

HQ Pack Assembly

First check that the pin 1 positions on the pad pattern and all of the components are correctly aligned.

1. Solder the NQPACK on the Target after checking for a match with the position of pin 1 on the Target.
2. Install the Microcontroller after checking for a match with the position of pin 1 on the NQPACK.
3. Mount the HQPACK Socket Cover after checking for a match with the position of pin 1 on the Microcontroller.



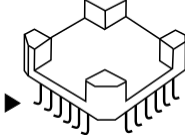
HQPACK Socket Cover



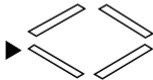
Microcontroller




NQPACK



Electronic circuit PCB



 To view Emulation Adapter schematics, use the short link isystem.com/schematics.

Below is a pinout of the four connectors P3-P6 on the bottom side of the emulation adapter:

45	47	49	51	62	64	66	NC	NC	NC	82	84	86	NC	NC	NC	97	NC	GND	GND
46	48	50	61	63	65	69	NC	73	81	83	85	NC	NC	NC	96	98	NC	GND	GND

GND	GND
GND	GND
NC	NC
44	NC
42	43
40	41
38	39
36	37
34	35
32	33
30	31
28	29
26	27
24	25
NC	23
9	11
7	8
5	6
3	4
1	2

P3

P4

102	NC
104	103
106	105
108	107
110	109
112	111
118	114
121	119
124	122
128	126
130	129
132	131
134	133
136	135
138	137
143	139
NC	144
NC	NC
GND	GND
GND	GND

P5

NC – Not Connected

Connectors expose only signals from the 144-pin emulation device, which exist on the 100-pin TC233 device. Green colored pins depict pins where pin numbering stops being continuously incremented by one.

Optionally, the target can be custom designed in a way directly providing connection for the emulation adapter through the P3, P4 and P5 connector. This way a high quality electrical and mechanical connection is established. Connectors being used on the emulation adapter side are TE connectivity female connectors, part number: 0-0104652-4 (40-pin connector). The target must feature male matching connectors. Contact iSYSTEM for technical details on the location of the three connectors.

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