NXP S32K344 Emulation Adapter

Hardware User Manual

V1.5, 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

NXP S32K344 Emulation Adapter is based on the 257-pin S32K344 superset device and provides full trace capabilities for the:

- 48-pin
- 100-pin
- 172-pin

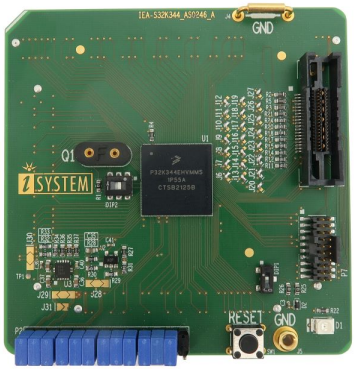
NXP S32K344 / 342 / 341 / 324 / 322 / 314 / 312 / 311 microcontroller, where the trace port is not available or lacks the full trace capability.

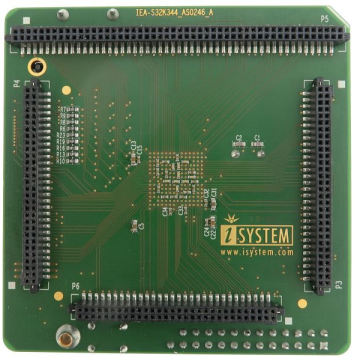
> The Emulation Adapter might differ in some peripherals from the target device; therefore, the device datasheet should be checked.

Emulation Adapter supports the following debug and trace interfaces:

- JTAG or SWD debug interface;
- HTM/ETM/ITM trace to trace Cortex-M7 program execution; Trace data is connected to the ARM CoreSight 20 and ARM Mictor 38-pin connector provided on the Emulation Adapter;
- ETF trace to trace Cortex-M7 program execution; Trace data is stored in up to 2 kB of dedicated RAM memory and read out through JTAG or SWD;
- Serial wire viewer (SWV) and printf() style debugging through a Single Wire Output (SWO) “trace” pin on Cortex-M7.

The Emulation Adapter can also be used as a standalone device for microcontroller evaluation purposes or for development and testing of an embedded application ahead of target board availability.





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Package content

NXP S32K344 Emulation Adapter is delivered with all the components required for a standalone operation. Target adaptation parts for the Target board adaptation and the Power adapter must be **ordered separately**.

NXP S32K344 Emulation Adapter	Power supply package	
	Power converter	Power adapter
Ordering code: IEA-S32K344	Ordering code: IEA-PS	Ordering code: IT9V-PS

GND Wire	Crystal
Ordering code: BB-WIRE	Crystal 16 MHz

If you purchase the Power supply package individually, the Power adapter (IT9V-PS) must be ordered separately.

Options

Target adaptation

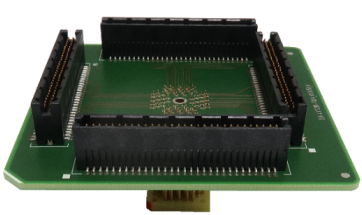
The Emulation Adapter adaptation to a specific target microcontroller pincount and package is done via a Conversion board and a Solder part. Sometimes also an optional Extender is available. Conversion boards connect between the Emulation Adapter and the matching Solder part, which is being soldered on the embedded target side. Available Conversion boards, Solder parts and optional Extenders are listed in the table below.

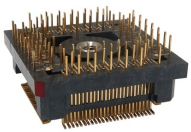
Package (Pitch)	Conversion board (Ordering code)	Type	Extender (Ordering code)	Solder part (Ordering code)
QFP48 (0.5 mm)	IEA-S32K344-311F48TQ	Fixed	/	IA48TQ-SOLDER
HDQFP100 (0.5 mm)	IEA-S32K344-312F100M		IA100MQFP-EXTENDER	IA100MQFP-SOLDER
	IEA-S32K344-342F100M			
HDQFP172 (0.5 mm)	IEA-S32K344-312F172M		IA172MQFP-EXTENDER	IA172MQFP-SOLDER
	IEA-S32K344-344F172M			

QFP Fixed Adaptation

The adaptation is elivered with a slot screw, which can be used to achieve a more solid and stable fixing of the Conversion board and the Solder part.

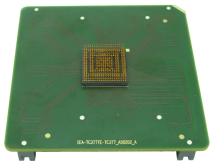
Conversion board	Solder part

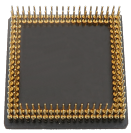


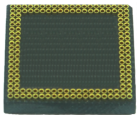


HDQFP Fixed Adaptation

Conversion board	Extender (optional)	Solder part



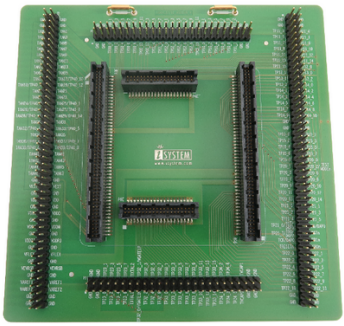


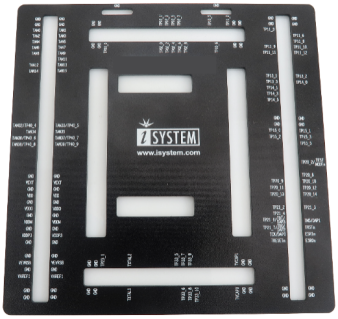


Measurement board (optional)

The Measurement board connects between the Emulation Adapter and the Conversion board. Embedded targets often do not have access to all the MCU pins / connected signals to connect with measurement equipment (oscilloscope, logic analyzer), its use provides easy access to all MCU pins. It is delivered together with an Layout board (chip signals are clearly marked), which is placed over the Measurement board.

Measurement board	Layout board example for the Measurement board
Ordering code: IAMS32K344	





Operation

How to connect?

- How to connect Emulation Adapter (video) - short link: isystem.com/ea-intro
- How to connect TASKING Hardware (video) - short link: isystem.com/connect-hardware

Configuration

DIP1: Target reset configuration

DIP switch DIP1 connects the Emulation Adapter reset line and the target reset line and is on (position next to the white dot) by default. The Emulation Adapter also features a Reset push button (SW1).
If having problems establishing the initial debug session with the Emulation Adapter, adjust the DIP switch DIP1 to the off position (position away from the white dot) and try again.

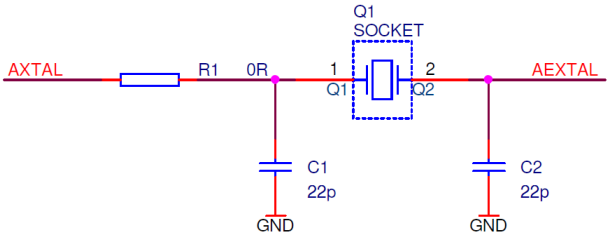
DIP2: Clock source configuration

DIP switch DIP2 selects a clock source for the emulation device.
When the switch is in position next to the white dot (default setting), it selects the crystal circuit oscillator from the target.
When the crystal circuit of the emulation adapter is to be used instead of the target board's crystal circuit, adjust the switch in the position away from the white dot. In this case, the Q1 socket on the Emulation Adapter must also be populated with an adequate crystal.

The Emulation Adapter may not operate when your target board's crystal circuit is used as the clock source. A typical design guideline is that the crystal should be as close as possible to the microcontroller. The crystal on your target board might not oscillate in conjunction with the Emulation Adapter when the clock lines (XTAL, EXTAL) between the crystal and the emulation device on the Emulation Adapter become too long, thus affecting the impedance of the crystal circuit.

Separately packed 16 MHz crystal can be used as a 16 MHz external clock (XOSC) source to the emulation device. If a different clock frequency is required, insert an adequate crystal into the Q1 socket and replace C1 (default 22pF populated) and C2 (default 22pF populated) accordingly. Crystal socket Q1 is by default not populated (NP).

Crystal socket Q1 schematics below:



Trace port

The superset microcontroller device being used on the Emulation Adapter features Slow and Fast trace signals. Slow trace signals are connected to ARM Mictor 38 and ARM CoreSight 20 target connectors provided by the Emulation Adapter. Fast trace signals share microcontroller I/O ports with other peripheral functionalities, and for this reason, they are connected towards the target for the user to use them according to their target application configuration and usage.

List of used microcontroller ports:

- TRACECLK - PTG6
- TRACEDATA[0] - PTG7
- TRACEDATA[1] - PTG15
- TRACEDATA[2] - PTG16
- TRACEDATA[3] - PTF31
- TRACEDATA[4] - PTG17
- TRACEDATA[5] - PTF28
- TRACEDATA[6] - PTG18
- TRACEDATA[7] - PTG19
- TRACEDATA[8] - PTG20
- TRACEDATA[9] - PTG21
- TRACEDATA[10] - PTG22
- TRACEDATA[11] - PTG23
- TRACEDATA[12] - PTG24
- TRACEDATA[13] - PTG25
- TRACEDATA[14] - PTG26
- TRACEDATA[15] - PTG27

winIDEA configuration

By running the New Workspace Configuration Wizard, the correct emulation adapter trace port will be configured. In the Wizard, select iSYSTEM S32K344 Emulation Adapter.

P2: Power supply configuration

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

Signal direction	Signal	Pin	Pin	Signal	Signal direction
Target board	TVDD_HV_A	1	2	VDD_HV_A	Emulation device
Target board	TVDD_HV_B	3	4	VDD_HV_B	Emulation device
Not Connected	TVREFH	5	6	VREFH	Not Connected
Not Connected	NC	7	8	NC	Not Connected
Not Connected	NC	9	10	NC	Not Connected
Not Connected	NC	11	12	NC	Not Connected
Not Connected	NC	13	14	NC	Not Connected
Not Connected	NC	15	16	NC	Not Connected
Not Connected	NC	17	18	NC	Not Connected
Not Connected	NC	19	20	NC	Not Connected
Ground	GND	21	22	GND	Ground
Ground	GND	23	24	GND	Ground
Ground	GND	25	26	KEY	

P2 Signal description

Signal Direction is described from the BlueBox perspective.

By default, all jumpers are set to connect your target power supply to the microcontroller on the Emulation Adapter. Note that only pins 1-2, 3-4 and 5-6 of the P2 connector must be bridged

with jumpers, but for the convenience and ease of use, all jumpers are set. Pin 26 is the Key pin preventing incorrect connection of the IEA-PS Power converter when being used and plugged in.

If, for some reason, a power supply is not provided from the target side (e.g., a standalone operation), all jumpers must be removed and, depending on the application, 3V3 or 5V must be applied to the following pins:

- P2 **pin 2** - VDD_HV_A
- P2 **pin 4** - VDD_HV_B
- P2 **pin 6** - VREFH

An enclosed Power supply package (Power converter and Power adapter) provides these voltages by simply plugging in the Power converter to the P2 header row.
LED D1 indicates if the Emulation Adapter is powered.

Refer to the microcontroller documentation for more details on VDD_HV_A, VDD_HV_B and VREFH signals.

J28: VREFH limiting circuit

The Emulation adapter holds a limiting circuit to prevent VREFH exceeding VDD_HV_A. By default, the limiting circuit is enabled by J28 in position 2-3 (default). In case the user would like to bypass the limiting circuit, the J28 jumper should be set to 1-2.

J30: 1V5 power

1V5 can be generated on the Emulation Adapter or provided from the target board. By default, 1V5 is generated on the Emulation Adapter by J30 in the position 2-3 (default). In case the user would like to provide it from the target board, the J30 jumper should be set to 1-2.

J31: VDD_HV_B power

In case the target device does not provide VDD_HV_B, voltage to the mentioned rail should be provided via VDD_HV_A. This can be achieved by enabling J31. By default, J31 is disabled. In standalone mode, J31 should be disabled.

J4 and J5: GND connection points

In case a good ground connection is required, connection points bridge J4 and pin J5 provide easy access to the Emulation Adapter's GND potential.

Connectors

P1

The following pinout is valid on the target side for the ARM Mictor 38-pin connector:

Signal Direction	Signal Description	Signal	Pin	Pin	Signal	Signal Description	Signal Direction
	Not Connected	NC	1	2	NC	Not Connected	
	Not Connected	NC	3	4	NC	Not Connected	
	Ground	GND	5	6	TRACECLK	Trace Clock	I
	Not Connected	NC	7	8	NC	Not Connected	
O	Reset	nRESET	9	10	NC	Not Connected	
I/I	JTAG/SWD	TDO/SWO	11	12	VDD_HV_A	Reference Voltage	I
	Not Connected	NC	13	14	NC	Not Connected	
O/O	JTAG/SWD	TCK/SWDCLK	15	16	TRACEDATA[7]	Trace Data	I
O/IO	JTAG/SWD	TMS/SWDIO	17	18	TRACEDATA[6]	Trace Data	I
O	JTAG	TDI	19	20	TRACEDATA[5]	Trace Data	I
O	JTAG	nTRST	21	22	TRACEDATA[4]	Trace Data	I
I	Trace Data	TRACEDATA[15]	23	24	TRACEDATA[3]	Trace Data	I
I	Trace Data	TRACEDATA[14]	25	26	TRACEDATA[2]	Trace Data	I
I	Trace Data	TRACEDATA[13]	27	28	TRACEDATA[1]	Trace Data	I
I	Trace Data	TRACEDATA[12]	29	30	GND	Ground	I
I	Trace Data	TRACEDATA[11]	31	32	GND	Ground	I
I	Trace Data	TRACEDATA[10]	33	34	VDD_HV_A	Reference Voltage	I
I	Trace Data	TRACEDATA[9]	35	36	NC	Not Connected	
I	Trace Data	TRACEDATA[8]	37	38	TRACEDATA[0]	Trace Data	I

ARM Mictor 38-pin connector pinout

Blue colored signals are trace signals.
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.

P7: ARM CoreSight 20 connector

The following pinout is valid on the target side for the ARM CoreSight 20-pin connector:

Signal Direction	Signal Description	Signal	Pin	Pin	Signal	Signal Description	Signal Direction
I	Reference Voltage	VDD_HV_A	1	2	TMS/SWDIO	JTAG/SWD	O/IO
	Ground	GND	3	4	TCK/SWDCLK	JTAG/SWD	O/O
	Ground	GND	5	6	TDO/SWO	JTAG/SWD	O
	Not Connected	NC	7	8	TDI	JTAG	
	Ground	GND	9	10	nRESET	Reset	O
	Ground	GND	11	12	TRACECLK	Reference Voltage	I
	Ground	GND	13	14	TRACEDATA[0]	Not Connected	
	Ground	GND	15	16	TRACEDATA[1]	Trace Data	I
	Ground	GND	17	18	TRACEDATA[2]	Trace Data	I
	Ground	GND	19	20	TRACEDATA[3]	Trace Data	I

ARM CoreSight 20-pin connector pinout

Blue colored signals are trace signals.
Signal Direction is described from the BlueBox perspective.

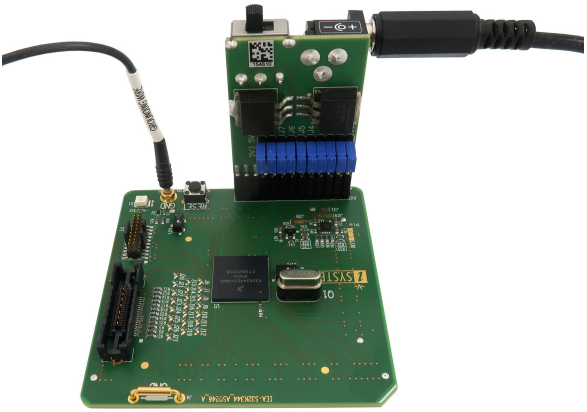
Be aware that debug and trace signals from the Emulation adapter superset device are not connected to the target board. They are exposed only to the connectors on the Emulation adapter.

P3–P6: Emulation device pinout

Connectors P3, P4, P5 and P6 on the bottom side of the Emulation Adapter expose all emulation device signals toward the Conversion board, through which the Emulation Adapter adapts to different pin count packages.

Standalone operation

The Emulation Adapter is delivered with all the components required for a Standalone operation.



Power supply

Use the enclosed IEA-PS Emulation Adapter Power converter and adapter.
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.

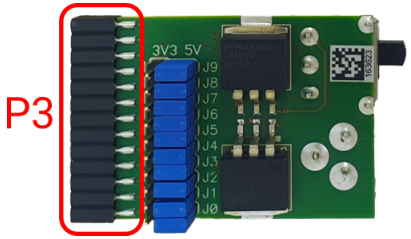
The Power converter can supply either 3.3 V or 5 V. The array of jumpers J0–J9 selects 3.3 V or 5 V voltage on the P3 connector, which connects to the Emulation Adapter.

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 the 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 a maximum voltage 3.3 V! Refer to the microcontroller documentation for detailed information on power supply.



P3 connector on the Power Supply board

External power supply requirements:

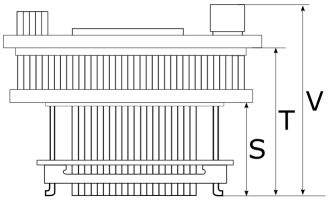
Min Voltage	Max Voltage	Min Power	
8 V	12 V	5 W	

Clock source

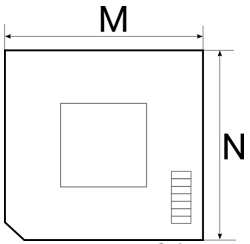
If the target's crystal circuit microcontroller oscillator (if available) is not an adequate clock source, insert the appropriate crystal into the Q1 socket, replace the default 22pF C1 and C2 capacitors when necessary, and DIP switch DIP2 to position away from the white dot.

Mechanical information

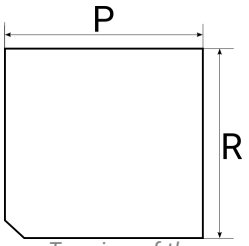
Emulation Adapter



Side view of the Emulation adapter complete setup - QFP Fixed Adaptation



Top view of the Emulation Adapter

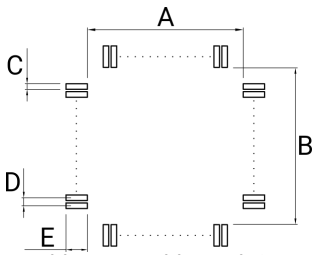


Top view of the Conversion board

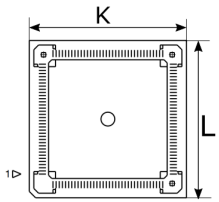
Ordering code	Unit (mm)						
	M	N	P	R	S	T	V
IEA.S32K344	70	70			32.6	36.4	47.5
IEA-S32K344-xxxxx			70	70			

Solder parts

QFP



Solder part Solder pad view



Top view of the Solder part

In the case of soldering the Solder part manually, it's highly recommended to prolong the solder pad E on the outer side (e.g., for 1.5–2 mm) during the PCB design. Note that without this modification, it's very difficult to solder the Solder part manually.

Recommended PCB footprint dimensions:

Ordering code	Unit (mm)

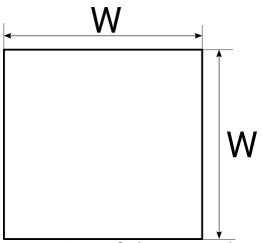
	A	B	C	D	E	K	L
IA48TQ-SOLDER	9	1.005	10	10	1.75	12	12

HDQFP

For recommended HDQFP PCB footprint dimensions, follow the link: NXP HDQFP100 or NXP HDQFP172.

Extenders

Side view of the Extender



Top view of the Extender

Ordering code	Unit (mm)	
	W	Z
IA100MQFP-EXTENDER	22	3.25
IA172MQFP-EXTENDER	16	3.25

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

Assembly

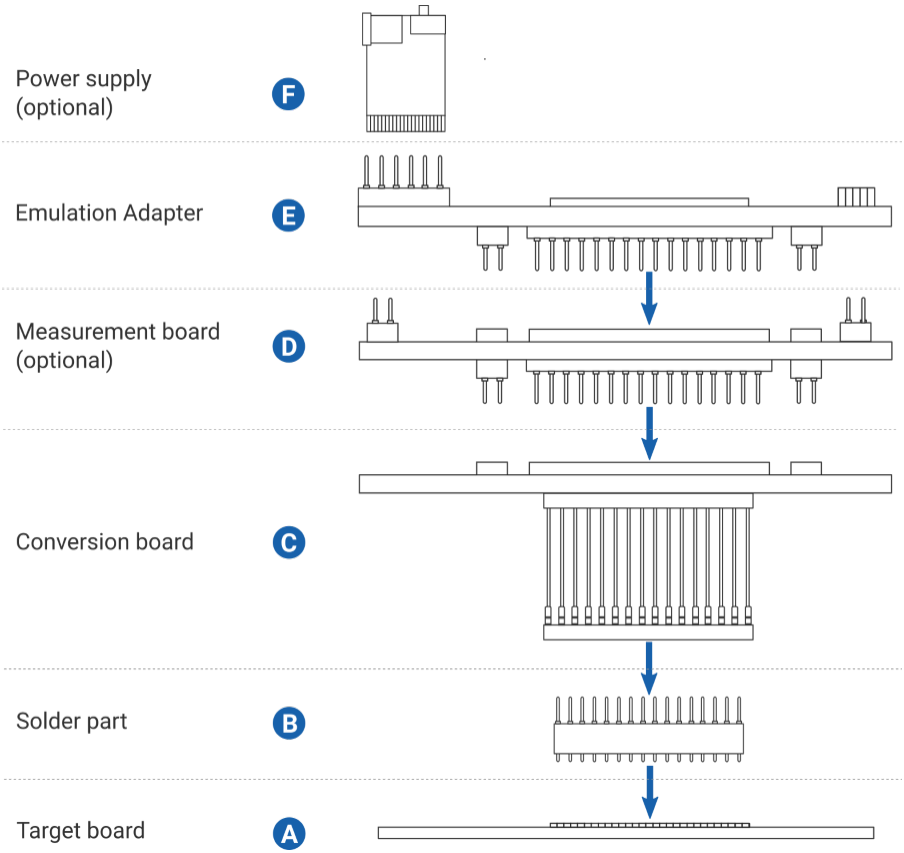
QFP Fixed

Watch out that the pin 1 position and alignment of all pins. Avoid disassembling and reassembling the hardware setup too frequently.

1. Solder the Solder part [**B**] on the target PCB [**A**] to get a **BA setup**.

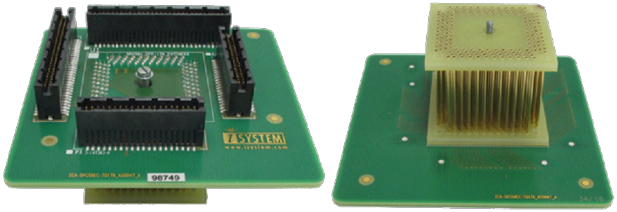
Use the Surface Mount Technology (SMT) to solder the Solder parts to the target instead of the original microcontroller. We provide this soldering service on request.

2. Assemble the in order: Emulation Adapter [**E**], optional Measurement board [**D**], the Conversion board [**C**], together to get an **E(D)C setup**.
3. Assemble the **E(D)C setup** with the **BA setup** by connecting the Conversion board of the **E(D)C setup** to the Solder part of the **BA setup**.



Slot screw

The Slot screw (30mm) is used to fix the Conversion board to the Solder part. The setup becomes mechanically more robust.Screw the Conversion board to the Solder part first, before the Emulation Adapter is attached on top and watch out not to break out the Solder part, e.g., if you accidentally hit the Emulation Adapter from the side.



HDQFP Fixed

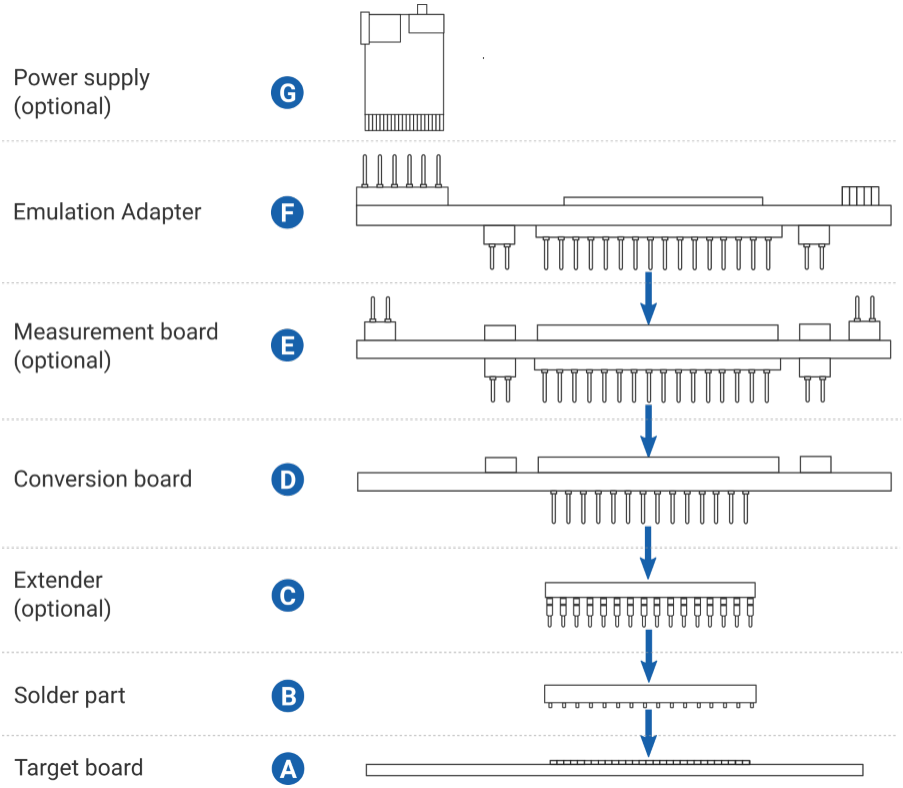
1. Solder the Solder part **B** on the Target **A**.
2. (optional, recommended) Connect Extender **C** to the Solder part **B**.

The Extender protects from damaging the Solder part if the Emulation Adapter setup is frequently assembled and disassembled. Be careful and gentle during this procedure because all parts of the setup are extremely sensitive, and pins can easily bend or even break in the worst-case scenario.

More Extenders can be stacked to gain height between the Emulation Adapter and the Target, if surrounding components so high that they prevent connecting the Emulation Adapter. Keep the number of Extenders C at minimum since every Extender degrades the signal integrity of the electrical signals.

3. Assemble in order: Emulation Adapter **F**, optional Measurement board **E**, Conversion board **D**.

4. Connect Conversion board **D** to:
   - Solder part or
   - Extender


Power supply (optional)
G
Emulation Adapter
F
Measurement board (optional)
E
Conversion board
D
Extender (optional)
C
Solder part
B
Target board
A

Accessories

Ordering Code	Description
IC5700	iC5700 BlueBox
IC5000	iC5000 BlueBox
IC57031	IOM6 Hub (3 x FNet & FBridge)
IC57040	IOM6 CAN/LIN
IC57041	IOM6 ADIO

Debug Adapters

Listed Debug Adapters provide tracing functionality for the Emulation Adapter.

Ordering Code	Description
IC50118-2	20-pin 1.27mm CoreSight Debug Adapter
IC50115	38-pin Mictor ARM Parallel 16-bit Debug Adapter

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

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