ST SPC58 4B Line Emulation Adapter

Hardware User Manual

V2.3, February 2024

isystem.com/start

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

ST SPC58 (Chorus) 4B Line Emulation Adapter primary use case is providing Nexus trace functionality for the SPC58 4B Line devices in the QFP packages, where Nexus trace port is not available. It is based on the 176-pin "superset" device with 2MB program and provides the adaptation to:

- 64-pin
- 100-pin and
- 144-pin Target package.

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

Alternative use case is also a Standalone operation. In this case customer can start developing and testing the application while his target may not be available yet.

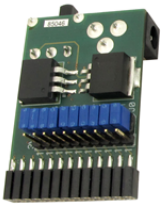
Complete Emulation Adapter is split into individual parts which makes it flexible when support for different target packages is required. A typical setup in conjunction with the target contains:

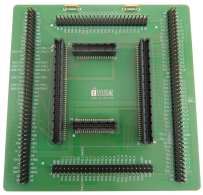
- IEA-SPC584B (Microcontroller part)
- Conversion board
- Solder part

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

Package content

ST SPC58 C line Emulation Adapter is delivered with all components required for Standalone operation. Adaptation packages for Target board adaptation must be **ordered separately**.

ST SPC58 4B Line Emulation Adapter	Power supply package	
	Power converter	**Power adapter**
Ordering code: IEA-SPC584B	Ordering code: IEA-PS	Ordering code: IT9V-PS
		

GND Wire	Crystal 20 MHz	Measurement board (optional)
Ordering code: BB-WIRE		Ordering code: IAMSPC584B
		

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

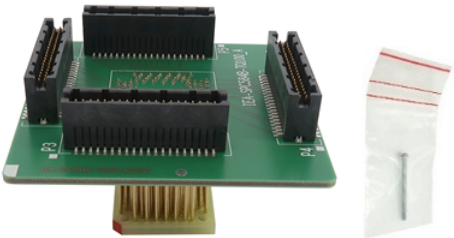
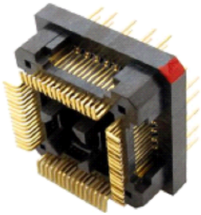
Adaptation packages content

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

Pin number	Conversion Board	Type	Solder part
64	IEA-SPC584B-ATQ64	Fixed	IA64ATQ-SOLDER
100	IEA-SPC584B-TQ100	Fixed	IA100TQ-SOLDER
144	IEA-SPC584B-TQ144	Fixed	IA144TQ-SOLDER

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
	

Operation

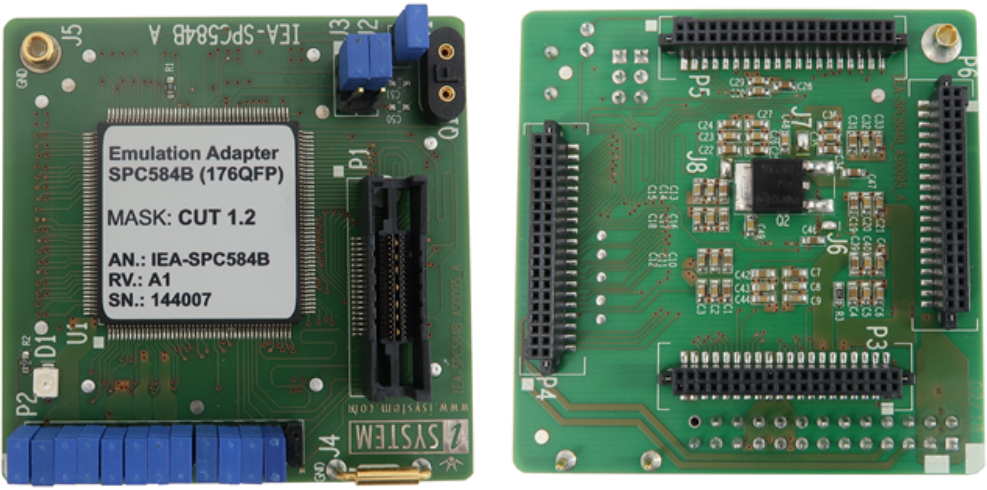
Device overview

The Emulation Adapter can be used in conjunction with iSYSTEM iC5000 and iC5700 BlueBox or any other third party tool supporting ST SPC58 4B Line Nexus trace port. The tool connects to 38-pin Mictor connector (P1) providing debug and Nexus trace interface connection.

Emulation Adapter offers the following adaption setup:

- Fixed Adaptation

IEA-SPC584B Emulation Adapter

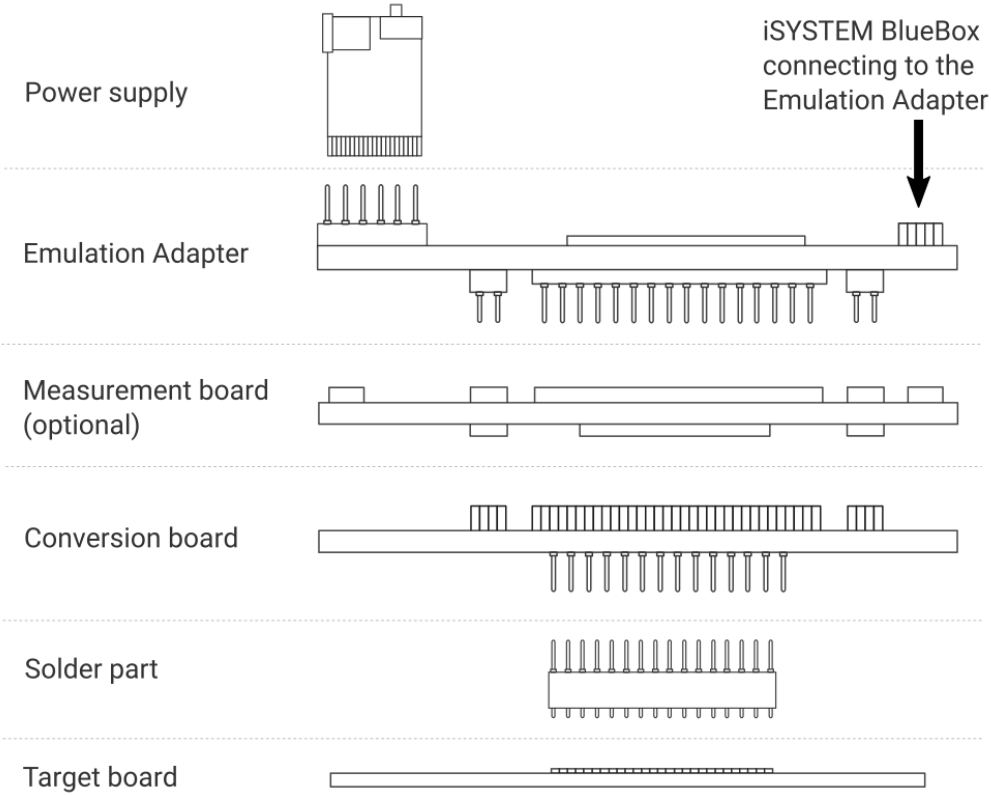


Top/bottom side of the Emulation Adapter

[Introduction to Emulation Adapter (video)](#)
isystem.com/ea-intro

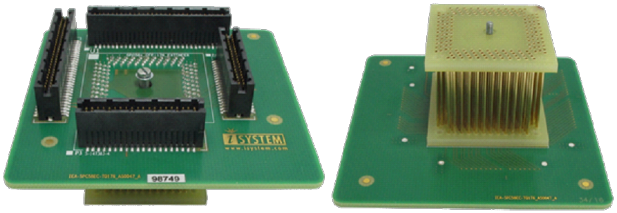
[How to connect Hardware (video)](#)
isystem.com/connect-hardware

Fixed Adaptation



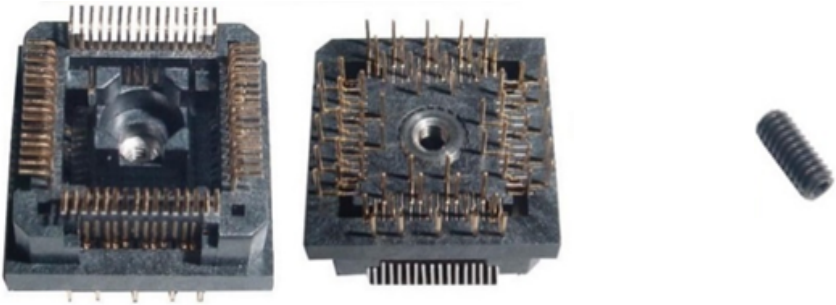
Slot screw

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.



Short Hexagon socket screw

Short Hexagon socket screw, which comes with the Solder part, is not applicable with this Emulation Adapter setup.



J1: Target reset configuration

Jumper J1 connects the reset line between the emulation device and the target. By default J1 is populated.

J2 and J3: Clock source configuration

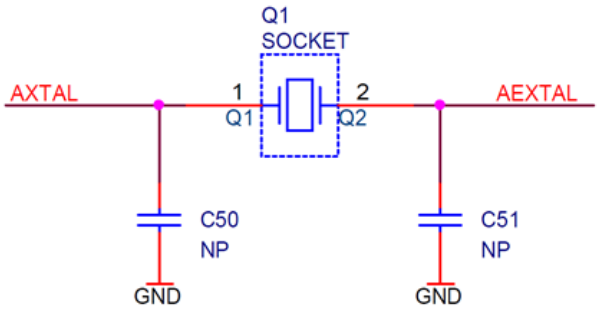
Jumpers J2 and J3 select external clock source (XOSC) for the emulation device. Per default, both jumpers are set to position 1-2, which yields the external clock (XOSC) source being used from the target.

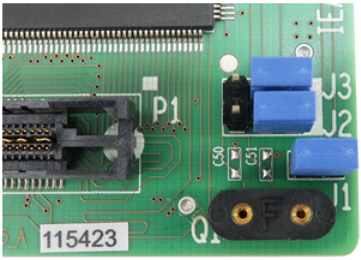
If an oscillator in the target is not an option and the target crystal doesn't oscillate in conjunction with the emulation adapter, the emulation adapter can also provide the external clock (XOSC) source by setting jumpers J2 and J3 in position 2-3. In this case, a crystal circuit must be built on the emulation adapter.

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.
It can happen that the target crystal does not oscillate in conjunction with the Emulation Adapter since clock lines (XTAL, EXTAL) between the target crystal and the emulation device on the Emulation Adapter become too long, inevitably too much affecting the impedance of the crystal circuit. If a "standalone" oscillator is used instead of the crystal circuit, no problems are expected.

The crystal packed separately in the antistatic bag comes along the Emulation Adapter. It can be used to feed an external clock source (XOSC) to the emulation device by inserting the crystal into the Q1 socket. If a different clock frequency is required, use suitable crystal and insert it into the Q1 socket.
The emulation adapters of revision A2 or lower were delivered with a 40 MHz crystal, while the adapters of revision A3 or higher are delivered with a 20 MHz crystal.

Crystal Q1 is located in the corner of the emulation adapter, next to the 38-pin Mictor connector P1 and per default not populated.





Capacitors C50 and C51, for which pads are provided on the emulation adapter PCB, are not populated since the microcontroller provides already the internal load capacitors for 20MHz/40MHz crystal oscillator operation.

J4 and J5: GND connecting points

Real target microcontroller in the QFP package provides an exposed GND pad in the middle of the microcontroller at the bottom side of the package. This provides GND connection between the microcontroller and the target.

In case of the emulation adapter usage, the solder part (IA100TQ-SOLDER or IA64ATQ-SOLDER) is soldered instead of the microcontroller. Note that the available solder parts at the introduction of this emulation adapter, did not provide support for the exposed GND pad. For this reason, user must ensure replacement GND connection between the emulation adapter and the target using a dedicated GND wire. Without this connection, the system will not work. Use provided GND wire which comes along the emulation adapter and plug it to the pin J5 (see picture above) on the emulation adapter. Connect the other side to the ground potential on the target - as close as possible to the microcontroller respectively solder part being soldered instead of the microcontroller. This connection must be quality and reliable otherwise debugging and tracing over the Nexus trace port may not work. Alternatively, GND connection can be also established over the J4 ground bridge

P2: Power supply configuration

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

Signal direction	Signal	Pin	Pin	Signal	Signal direction
Not connected	NC	1	2	NC	Not connected
Target	VDD_HV_OSC	3	4	CVDD_HV_OSC	Emulation device
Target	VDD_HV_ADV_S	5	6	CVDD_HV_ADV_S	Emulation device
Target	VDD_HV_ADR_C	7	8	CVDD_HV_ADR_C	Emulation device
Target	VDD_HV_IO_MAIN	9	10	CVDD_HV_IO_MAIN	Emulation device
Target	VDD_HV_FLA	11	12	CVDD_HV_FLA	Emulation device
Target	VDD_HV_IO_FLEX	13	14	CVDD_HV_IO_FLEX	Emulation device
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

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, 9-10, 11-12 and 13-14 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 being connected.

If a different power source is to be used (e.g., in case of a standalone operation), all jumpers must be removed and power source must be applied to:

- CVDD_HV_OSC (pin 4),
- CVDD_HV_ADV (pin 6),
- CVDD_HV_ADR_S (pin 8),
- CVDD_HV_IO_MAIN (pin 10),
- CVDD_HV_FLA (pin 12),
- CVDD_HV_IO_FLEX (pin 14),
- GND (pins 22, 24, 26) signals.

The EA comes delivered together with the IEA-PS emulation adapter power supply, which simply plugs into the P2 header row, providing the necessary power supply for Emulation Adapter standalone operation. Double check that the power supply is configured properly for this particular Emulation Adapter.

P1: Nexus trace port

38-pin Mictor connector P1 exposes Nexus trace port and has the following pinout:

Signal	Pin	Pin	Signal
NC	1	2	NC
NC	3	4	NC
MDO9	5	6	NC
NC	7	8	MDO8
RSTIN	9	10	EVTIN
TDO	11	12	Vref
MDO10	13	14	NC
TCK	15	16	MDO7
TMS	17	18	MDO6
TDI	19	20	MDO5
NTRST	21	22	MDO4
MDO11	23	24	MDO3
NC	25	26	MDO2
NC	27	28	MDO1
NC	29	30	MDO0
NC	31	32	EVTO
NC	33	34	MCKO
NC	35	36	MSEO1
NC	37	38	MSEO0

38-pin Mictor 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.

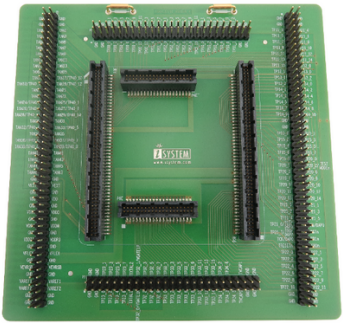
Power supply

Use enclosed IEA-PS Emulation Adapter Power converter.

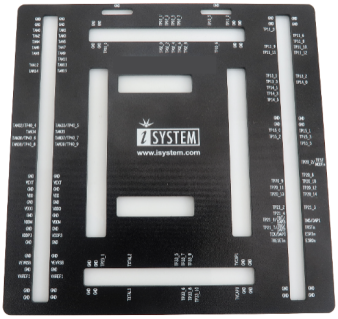
Measurement board

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.



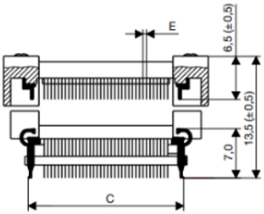
Top view of the Measurement board

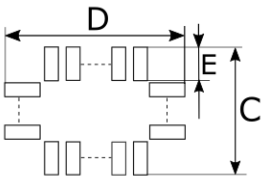


Layout board example for the Measurement board

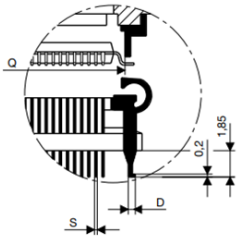
Not available in every Emulation Adapter or every MCU pin count.

Mechanical information

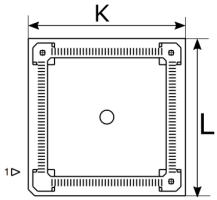




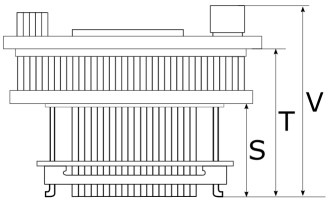
Solder part solder pad view



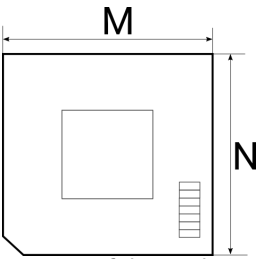
Side view of the Solder part



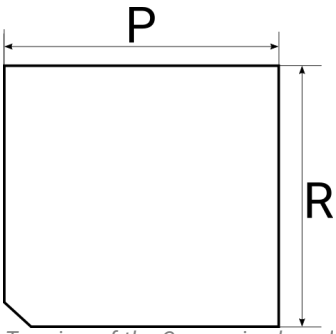
Top view of the Solder part



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



Top view of the Emulation Adapter



Top view of the Conversion board

Solder parts

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:

	Unit (mm)						
	A	B	C	D	E	K	L
IA64ATQ-SOLDER	12	1.505	13.0	13.0	2.3	14	14
IA100TQ-SOLDER	16.5	1.125	17.0	17.0	2.15	19.55	19.55
IA144TQ-SOLDER	22	1.125	23.0	23.0	2.15	25.05	25.05

Use the Surface Mount Technology (SMT) to solder the Solder parts to the user target board instead of the original microcontroller. iSYSTEM provides this soldering service on request too.

Emulation Adapter

	Unit (mm)						
	M	N	P	R	S	T	V
IEA-SPC584B	56	56			32.6	36.4	47.5
IEA-SPC584B-xxxx			56	56			

Connectors P3-P6 pinout

Next picture shows a pinout of the four connectors P3-P6 on the bottom side of the EA.

P6

GND	GND	133	135	137	nc	141	143	145	148	nc	156	158	160	162	164	166	168	170	173
GND	GND	134	136	138	140	142	144	146	nc	155	157	159	161	163	nc	167	169	nc	174

P5

131	132
129	130
127	128
125	126
nc	124
nc	122
119	120
116	nc
nc	nc
nc	nc
nc	nc
108	109
nc	107
nc	nc
nc	GND
98	nc
96	97
90	95
GND	GND
GND	GND

P3

1	2
3	4
5	6
7	8
9	10
11	12
13	14
15	16
17	18
19	22
23	nc
nc	26
27	28
29	30
31	38
39	40
41	42
43	44
GND	GND
GND	GND

P4

GND	GND	85	83	81	79	77	75	nc	67	65	63	61	59	57	55	GND	GND	47	45
GND	GND	88	84	82	80	78	76	74	nc	66	64	62	60	58	56	nc	nc	48	46

nc – Not Connected

Optionally, the you could also design the target directly providing connection to the EA via P1-P4 connectors. Connectors being used on the EA are female Tyco Electronics connectors, part number 0-0104652-4 (40 pin).

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