



Smart Display Modules for Raspberry Pi Compute Module 3

PIQUE Expansion I/O

The PIQUE Smart Display Module was designed to suit a wide variety of applications with careful attention paid to not include unnecessary features. To serve the widest-possible application domain, the PIQUE includes internally-connected USB ports and a flexible expansion I/O connector.

The internal expansion connector, J7, permits access to a bank of Compute Module 3+ (and CM3) GPIO signals and peripheral pins. J7 connects via a 26-pin 0.5mm FPC cable to The Circuit Foundry's expansion boards, a prototyping adapter, or your custom circuitry.

IMPORTANT NOTE

J7's signals are not 5V tolerant. Connecting signals that drive to 5VDC may work for a short time, but will eventually cause a failure.

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J7 Signals

Pin	GPIO Function	ALT0 Function	ALT1 Function	ALT2 Function	ALT3 Function	ALT4 Function	ALT5 Function	Note
1	do not connect							
2	GPIO30	I2C Interrupt Input to CM3+ (may be shared with other open-drain outputs)						
3	GPIO31	I2C Reset Output from CM3+ (may be used to reset devices connected to J7)						
4	GPIO32	GPCLK0	SOE_N	RING_OCLK	TXD0 (P)		TXD1 (M)	0=PL011 UART, 1=miniuart
5	GPIO33	FL1	SA0	TE1	RXD0 (P)		RXD1 (M)	0=PL011 UART, 1=miniuart
6	GND							
7	GPIO36	SPI0_CE0_N	SD0	TXD0 (P)	SD1_DAT0			
8	GND							
9	GPIO37	SPI0_MISO	SD1	RXD0 (P)	SD1_DAT1			
10	GND							
11	GPIO38	SPI0_MOSI	SD2	RTS0 (P)	SD1_DAT2			
12	GND							
13	GPIO39	SPI0_SCLK	SD3	CTS0 (P)	SD1_DAT3			
14	GND							
15	GPIO40	PWM0	SD4		SD1_DAT4	SPI2_MISO	TXD1 (M)	
16	GND							
17	GPIO41	PWM1	SD5	TE0	SD1_DAT5	SPI2_MOSI	RXD1 (M)	backlight brightness drive from CM3+
18	GPIO42	GPCLK1	SD6	TE1	SD1_DAT6	SPI2_SCLK	RTS1 (M)	
19	GPIO43	GPCLK2	SD7	TE2	SD1_DAT7	SPI2_CE0_N	CTS1 (M)	
20	GPIO44	GPCLK1	SDA0	SDA1	TE0	SPI2_CE1_N		
21	GPIO45	PWM1	SCL0	SCL1	TE1	SPI2_CE2_N		
22	3.3 VDC							
23	GPIO28	SDA0	SA5	PCM_CLK	FL0			shared with touch, RTC, etc.
24	GPIO29	SCL0	SA4	PCM_FS	FL1			shared with touch, RTC, etc.
25	5.0 VDC							
26	do not connect							

(P) PL011 full-featured UART

(M) mini UART

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J7 Recommended Usages

While any J7 pin can be used per the table above, most applications use the signals as follows:

UART: pins 4/5
 I2C: pins 20/21
 PWM: pin 15

SPI: pins 7/9/11/13
 Shared I2C: pins 23/24/2/3
 Backlight PWM: pin 17

Pin	Recommended Use
1	do not connect
2	I2C Interrupt Input to CM3+ (may be shared with other open-drain outputs)
3	I2C Reset Output from CM3+ (may be used to reset devices connected to J7)
4	UART TXD
5	UART RXD
6	GND
7	SPI0_CE0_N
8	GND
9	SPI0_MISO
10	GND
11	SPI0_MOSI
12	GND
13	SPI0_SCLK
14	GND
15	PWM0
16	GND
17	backlight brightness drive from CM3+ (or disable on CM3+ and drive with circuit)
18	GPIO42
19	GPIO43
20	I ² C SDA – not shared
21	I ² C SCL – not shared
22	3.3 VDC
23	I ² C SDA - shared with touch, RTC, etc.
24	I ² C SCL - shared with touch, RTC, etc.
25	5.0 VDC
26	do not connect



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Transitioning I/O from a Raspberry Pi

Products using only Raspberry Pi GPIOs are very easy to transition to PIQUE. For products that use Raspberry Pi 3 peripherals, product designers transitioning from a typical Raspberry Pi 3 should substitute I/O signals in hardware and in code as follows:

PI3 pin	PI3 signal	CM3+ signal	PIQUE pin	Note
27	GPIO0	GPIO28 if used as EEPROM SDA	J7 pin 23	use I ² C0
28	GPIO1	GPIO29 if used as EEPROM SCL	J7 pin 24	use I ² C0
3	GPIO2	GPIO44 if used as SDA	J7 pin 20	
5	GPIO3	GPIO45 if used as SCL	J7 pin 21	
7	GPIO4	GPIO42 if used as GPCLK0	J7 pin 18	change to GPCLK1
29	GPIO5	use any available		
31	GPIO6	use any available		
26	GPIO7	GPIO36 if used as SPI CE1	J7 pin 7	use GPIO+logic to create CE1
24	GPIO8	GPIO36 if used as SPI CE0	J7 pin 7	
21	GPIO9	GPIO37 if used as SPI MISO	J7 pin 9	
19	GPIO10	GPIO38 if used as SPI MOSI	J7 pin 11	
23	GPIO11	GPIO39 if used as SPI SCK	J7 pin 13	
32	GPIO12	GPIO45 if used as PWM0	J7 pin 21	change to PWM1
33	GPIO13	GPIO45 if used as PWM0	J7 pin 21	
8	GPIO14	GPIO32 if used as UART TX	J7 pin 4	use UART 1 (PL011)
10	GPIO15	GPIO33 if used as UART RX	J7 pin 5	use UART 1 (PL011)
36	GPIO16	use any available		
11	GPIO17	use any available		
12	GPIO18	find other solution if used as PCMCLK		
35	GPIO19	find other solution if used as PCM FS		
38	GPIO20	find other solution if used as PCM DIN		
40	GPIO21	find other solution if used as PCM DOUT		
15	GPIO22	use any available		
16	GPIO23	use any available		
18	GPIO24	use any available		
22	GPIO25	use any available		
37	GPIO26	use any available		
13	GPIO27	use any available		

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Controlling Backlight Brightness

To override the CM3+ control of the display backlight brightness and drive it with your own circuit, configure GPIO41 as an input on the CM3+, then provide a PWM signal to J7 pin 17:

PWM High Input Level	V_{PMH}	1.2VDC
PWM Low Input Level	V_{PML}	0.4 VDC
PWM Control Frequency	F_{PWM}	5-20 kHz
PWM duty (brightness)		10-100%

USB Expansion

In many situations, the PIQUE's 5-pin 0.1" headers provide a useful expansion option using inexpensive off-the-shelf USB I/O adapters. These can serve as a temporary or permanent solution.

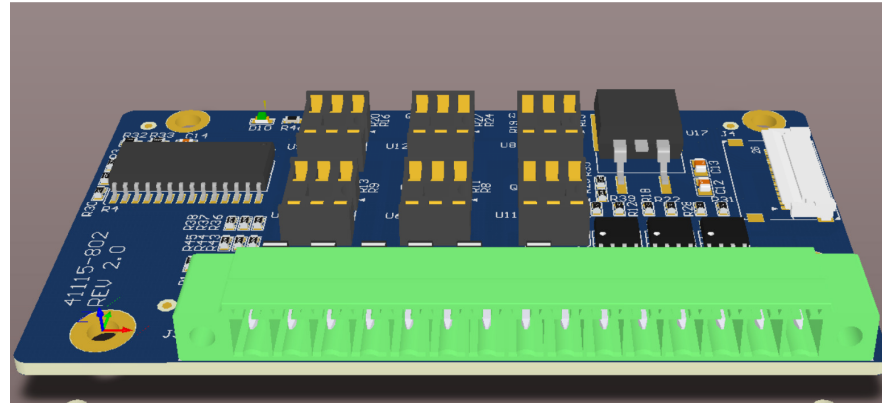
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Available Expansion Boards

As of this writing, The Circuit Foundry offers several useful expansion boards to connect to J7:

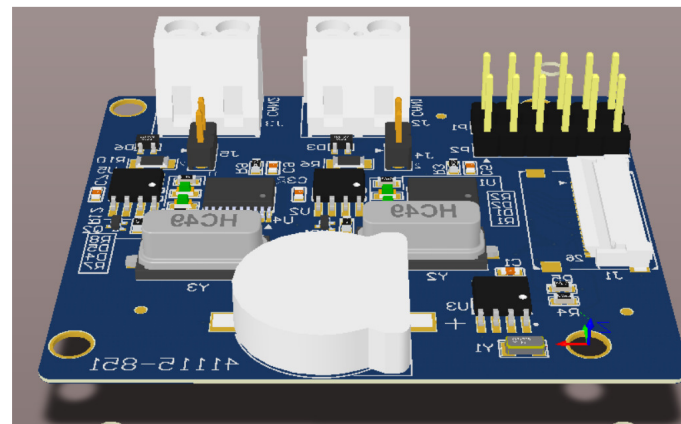
Electrically-isolated inputs and outputs

For driving motors and valves, and reading sensors and switches from an isolated system.



Dual CAN bus adapter

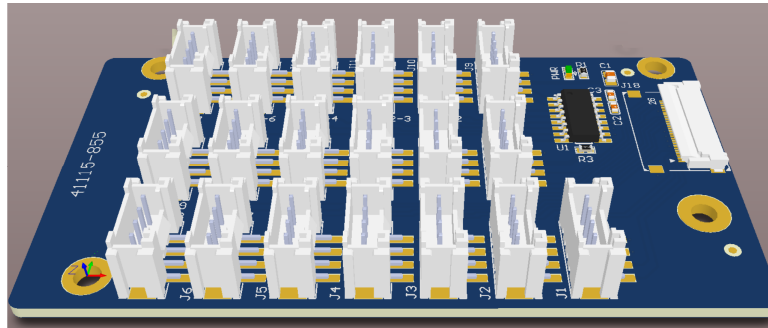
For automotive and machine applications that require multiple isolated communication channels.



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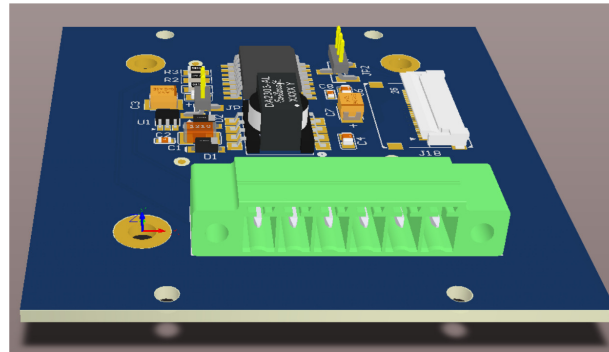
4-pin connector board

Compatible with many Grove™ system peripherals. Digital I/O, analog input, I²C. Non-isolated.



Isolated RS-485 port

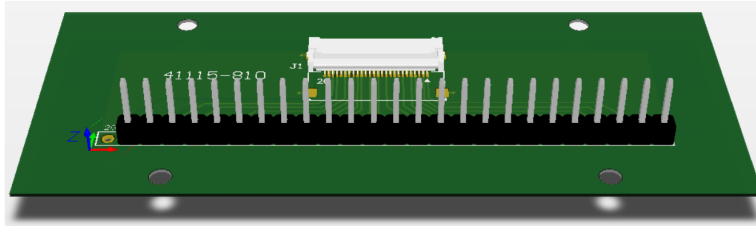
For communications with an electrically-isolated system board.



Header board for prototyping (0.1" pitch)

26-pin FPC connector to 0.1" pitch header for use in prototyping.

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Please see The Circuit Foundry's website for information about these and other expansion peripherals that may be available.