1 Description

CambridgeIC's CTU and resonant inductive encoder ICs measure the position of contactless, inductively coupled targets relative to sensors.

The MultiComms Adapter connects these processor ICs to a PC for demonstration, evaluation and prototype programming.

The MultiComms Adapter includes a dual core ARM M0+ Cortex processor: the RP2040 from Raspberry Pi. This performs low-level interactions with a connected CambridgeIC processor IC over a customer's choice of interface. The MultiComms Adapter is controlled by CambridgeIC software running on a host PC. It can stream measurement data to a PC at high speed.

The MultiComms Adapter supersedes CambridgeIC's Streaming Adapter; it adds MultiComms support, switched power supplies and indicator LEDs.

Product identification	
Part no.	**Description**
013-7008	MultiComms Adapter including USB Cable

Features

- Fast SPI interface
- MultiComms interface supporting:
  - BiSS-C point to point
  - SENT
- LEDs to display ABN state for quadrature ABN
- Switched 3.3V and 5V power outputs
- USB connection to a host PC
- Streams measurement data to a PC at high speed
- Internal software upgradeable over USB
- USB powered

Applications

- Demo and evaluation of CambridgeIC processor ICs
- Programming and updates to these ICs

Compatible CambridgeIC software applications include:

- CTU Streaming Demo (CAM204, CAM312, CAM502)
- CAM622 Configuration Tool
- CAM622 Read Position
- Firmware Update tool (all CambridgeIC processors)

The MultiComms Adapter is NOT compatible with old CambridgeIC CTU Software.

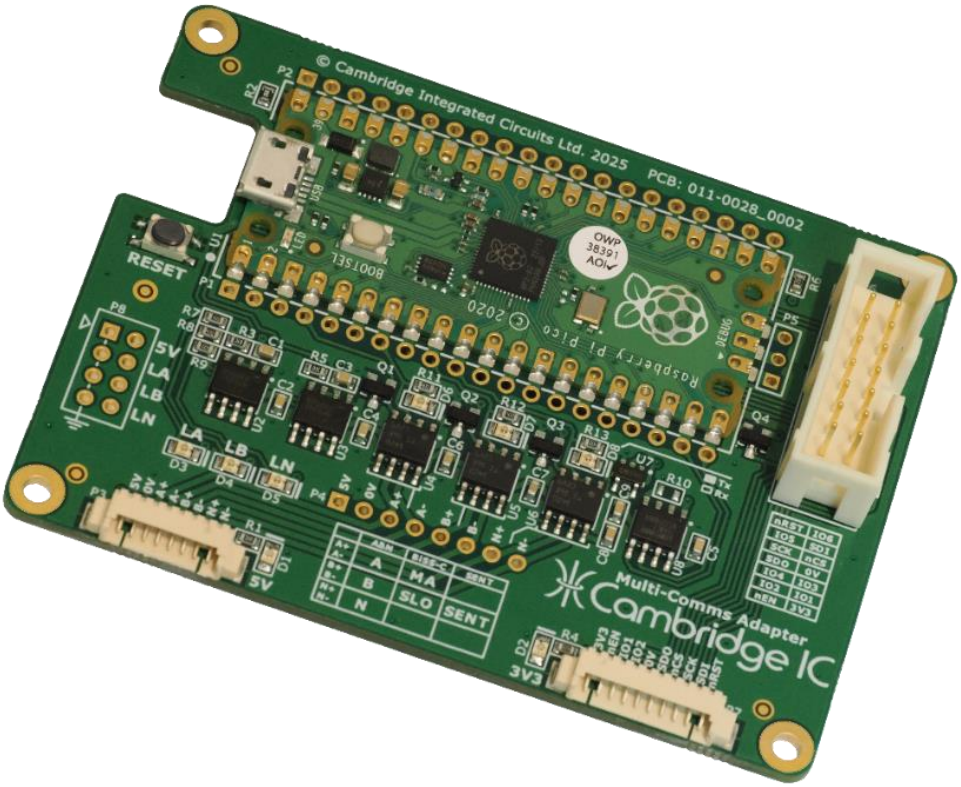

Figure 1 MultiComms Adapter

2 Mechanical Design

The mechanical design of the MultiComms Adapter is illustrated in Figure 2.

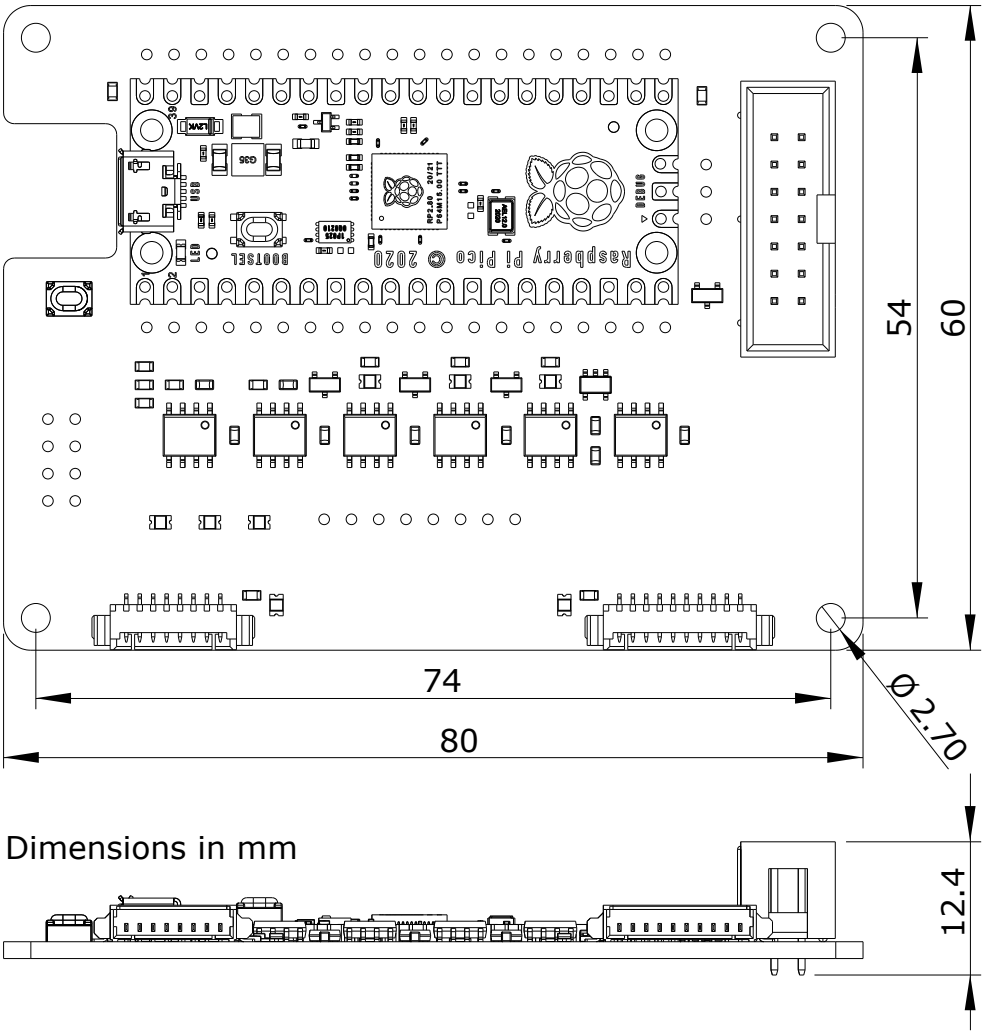

Figure 2 MultiComms Adapter mechanical drawing

The 4 corner holes illustrated in Figure 2 include grounded pads all around, visible as gold rings in Figure 1. These connect to the GND (0V) net of the MultiComms Adapter's circuitry, which in turn connects to the incoming USB GND from the PC and the connected device's GND. If the MultiComms Adapter is to be screwed to a metal part at a different electrical potential then plastic screws or insulating washers must be used to avoid ground loop current.

3 Board Features

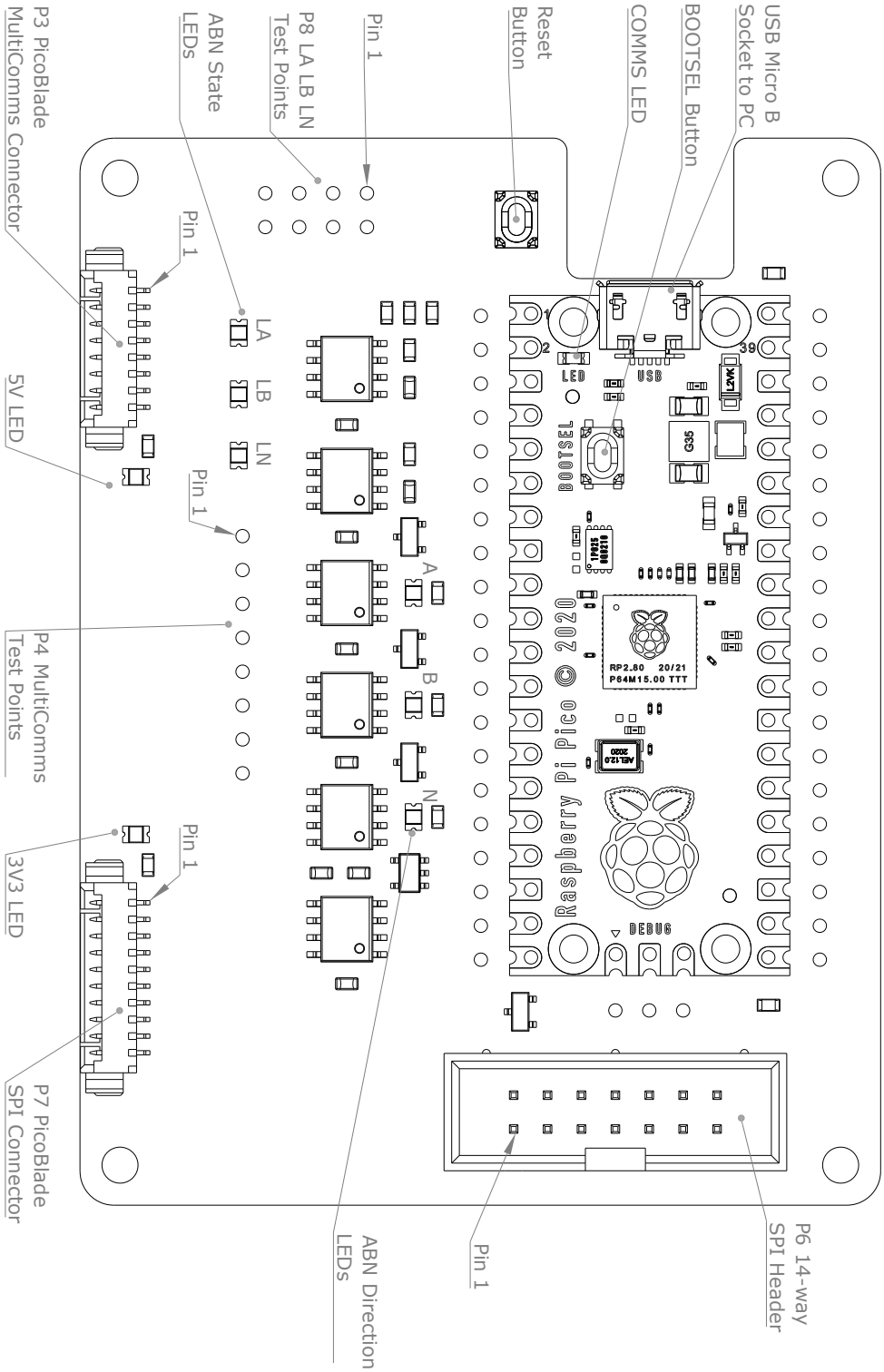

Figure 3 MultiComms Adapter layout

The MultiComs Adapter's layout is illustrated in Figure 1, and Figure 3 labels the main features of interest to a user. It comprises a Raspberry Pi Pico microcontroller board mounted onto a base board. The base board includes components to customise it for the MultiComms Adapter application.

3.1 Connectors

The Raspberry Pi Pico microcontroller board includes a USB Micro B socket for connection to a PC, shown to the top right of Figure 3.

P6 is a 14-way header for connecting to a CambridgeIC Development Board, including SPI, 3.3V power, user IOs and a reset line. Its pinout is shown in Table 1. Figure 6 illustrates how a CAM312 Development Board connects to the MultiComms Adapter.

Table 1 Pin-Out of SPI Header P6

Pin	Signal	Description
1	SW3V3	Switched +3.3V supply out
2	n3VEN	Pulled low when 3.3V supply active
3	IO1	User IOs
4	IO2	
5	IO3	
6	IO4	
7	GND	Supply voltage return (0V)
8	SDO	Serial Data Out of MultiComms Adapter
9	nCS	Chip Select output, active low
10	SCK	Serial Clock output
11	SDI	Serial Data In to MultiComms Adapter
12	IO5	User IOs
13	IO6	
14	nRST	Reset output, active low

P7 is a 10-way PicoBlade connector for connecting to a CAM622 MultiComms Board's SPI, 3.3V power, user IOs and a reset line. It includes a subset of P6's connections, see Table 2.

Table 2 Pinout of SPI PicoBlade Connector P7

Pin	Signal	Description
1	SW3V3	Switched +3.3V supply out
2	n3VEN	Pulled low when 3.3V supply active
3	SI (IO1)	User IOs
4	EXT (IO2)	
5	GND	Supply voltage return (0V)
6	SDO	Serial Data Out of MultiComms Adapter
7	nCS	Chip Select output, active low
8	SCK	Serial Clock output
9	SDI	Serial Data In to MultiComms Adapter
10	nRST	Reset output, active low

P3 is an 8-way PicoBlade connector for connecting to a CAM622 MultiComms Board's MultiComms signals. These support multiple interfaces including quadrature ABN, BiSS-C and SENT. Signals and their function by interface type are shown in Table 3.

Table 3 Pinout of MultiComms PicoBlade Connector P3

Pin	Signal	Interface		
		Quadrature ABN	**BiSS-C**	**SENT**
1	SW5VS	Switched 5V supply out		
2	GND	Supply voltage return (0V)		
3	A+	Differential A signal in	Differential MA signal out	
4	A-			
5	B+	Differential B signal in	Differential SDO signal in	Tx signal in +
6	B-			Tx signal in – or 2.5V
7	N+	Differential N signal in		
8	N-			

Table 3 indicates signal directions; "out" and "in" are relative to the MultiComms Adapter.

A SENT interface is usually a single-ended 5V logic level signal ("Tx signal in +" in Table 3). In this case the B- input should be biased to approximately 2.5V with external circuitry, for example a potential divider. However this is not required when connecting to a MultiComms Adapter, because it generates a differential SENT signal.

Figure 5 illustrates how a CAM622 MultiComms Board connects to the MultiComms Adapter, using P7 (SPI) and/or P3 (MultiComms).

3.2 Test Points

P4 is a row of 8 single in line test point pads on a 0.1" pitch, carrying the same MultiComms signals as Table 3. It may be used to monitor these signals. Alternatively, it may be used to connect 5V power to an external device and its differential A, B and/or N signals, providing P3 is not connected.

P8 is a 4x2 array of 8 test points on a 0.1" pitch. It includes single ended logic level versions of the A, B and N signals, as shown in Table 4. It may only be used to monitor these signals. Injecting signals is not allowed because they are driven internally.

Table 4 Logic Level MultiComms Test Points

Pin	Signal	Description
1	GND	Supply voltage return (0V)
2	SW5VS	Switched 5V supply out
3	GND	Supply voltage return (0V)
4	LA	Logic level A signal
5	GND	Supply voltage return (0V)
6	LB	Logic level B signal
7	GND	Supply voltage return (0V)
8	LN	Logic level N signal

Note that the origin of the LA, LB and LN signals depends on their individual functions. For example the LA signal is generated by U4 configured as a line receiver when quadrature ABN signals are applied, at 5V logic level. However for BiSS-C operation LA is generated by the Raspberry Pi Pico at 3.3V logic level.

3.3 Switches

A Reset Button causes a reset of the MultiComms Adapter's processor, which in turn pulls nRST low to reset a connected IC as well. The Reset Button has the same effect as unplugging the MultiComms Adapter's USB connection.

A BOOTSEL Button on the Raspberry Pico microcontroller board is used when the MultiComms Adapter's Code requires updating (section 4.2).

3.4 LEDs

The MultiComms Adapter includes LEDs to help a user check what state it is in. Their locations are marked in Figure 3. Their functions are shown in Table 5. They appear on the schematic of Figure 7.

Table 5 LEDs

Schematic identifier	Name	Function
-	COMMS	Indicates that the host PC has opened the MultiComms Adapter. Lights while an application is actively using the MultiComms Adapter.
D1	5V	Lights when switched 5V supply active
D2	3V3	Lights when switched 3.3V supply active. May light dimly when it is switched off due to signal outputs powering a connected device.
D3	LA	State of A line, on for high (A+ greater than A-)
D4	LB	State of B line, on for high (B+ greater than B-)
D5	LN	State of N line, on for high (N+ greater than N-)
D6	ADE	A direction, on when A is an output from MultiComms Adapter
D7	BDE	B direction, on when B is an output from MultiComms Adapter
D8	NDE	A direction, on when N is an output from MultiComms Adapter

4 Installation and Software Updates

4.1 Windows Installation

The MultiComms Adapter should install automatically when connected to a Windows PC over USB. It appears as a COM Port. To verify installation, check that a new COM port appears in Device Manager.

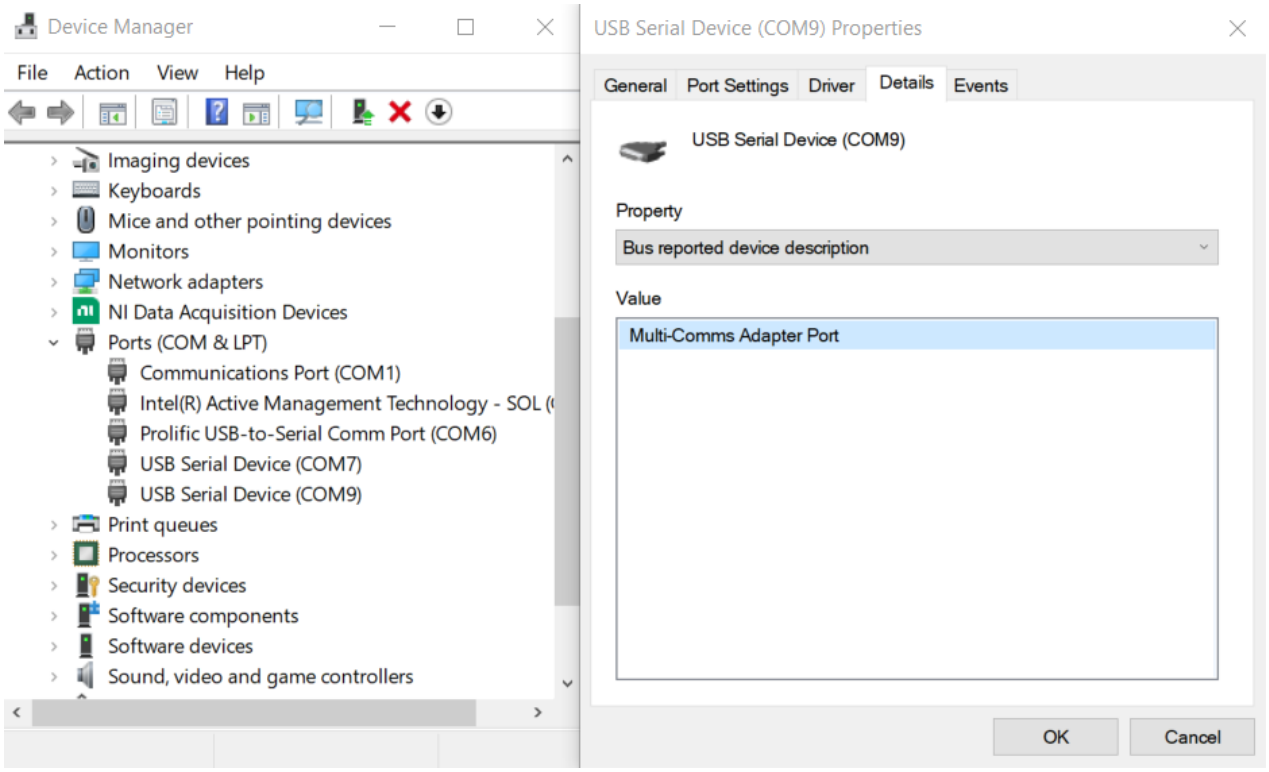

Figure 4 Device Manager screen shot

If there are multiple COM Port devices connected to the PC, it may be difficult to distinguish them. The PC gives each a number, however it may be difficult to establish which number corresponds to which device. The MultiComms Adapter may be identified by its "Bus reported device description", which is set to "MultiComms Adapter Port". To make this property visible in Device Manager, double click on a USB Serial Device in Device Manager. Select the "Details" tab. Then use the drop down box under "Property" to select "Bus reported device description". When the MultiComms Adapter's COM Port is selected, expected results are shown in Figure 4.

4.2 Code Update Process

The MultiComms Adapter includes code running on a Raspberry Pi Pico's ARM M0+ Cortex processor. This code is distributed in USB Flashing Format, as a file with a .uf2 extension. To update the code running on the MultiComms Adapter:

- Connect the MultiComms Adapter to a PC over USB.
- Press and hold the Reset Button.
- Press and hold the BOOTSEL button.
- Release the Reset Button, then wait a couple of seconds.
- Release the BOOTSEL button.

This process makes the MultiComms Adapter appear as a USB drive connected to the PC. The PC will give it a new drive letter. Use File Manager to open the new drive. Open another instance of File Manager and navigate to the directory location where the new .uf2 file is stored. Drag and drop the .uf2 file onto the MultiComms Adapter's File Manager window, as if a normal file is being copied to a USB stick. The MultiComms Adapter should quickly reboot running the new firmware. The drive letter should disappear from the PC, and the COM port should reappear.

If the MultiComms Adapter is in the state where it appears as a USB drive connected to the PC, it is possible to return to normal operation without updating its code by pressing and releasing the Reset Button.

5 Applications

5.1 Use With CAM622 MultiComms Board

Figure 1Figure 5 illustrates how the MultiComms Adapter connects to a CAM622 MultiComms Board.

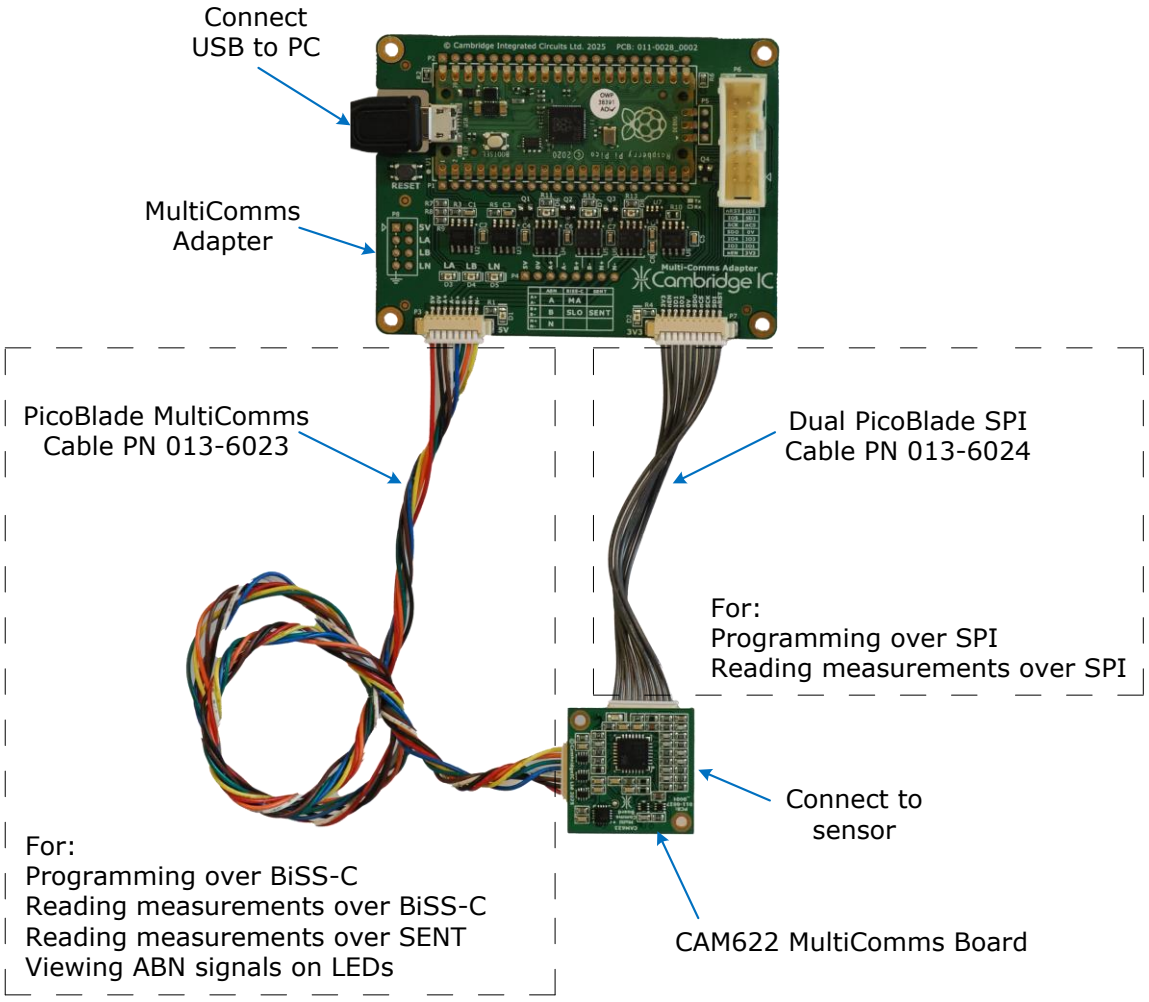

Figure 5 Connecting a CAM622 MultiComms Board to the MultiComms Adapter

There are two methods of connecting between a MultiComms Adapter and CAM622 MultiComms Board. The SPI connection (cable PN 013-6024) is used for programming configuration for the first time, reading measurements over SPI and for updating CAM622 Application Code. The MultiComms connection (cable PN 013-6023) is used for programming configuration over BiSS-C, reading CAM622 measurements over BiSS-C or SENT, and for viewing ABN signal states on LEDs.

When connected over SPI alone, the CAM622 MultiComms board can only be powered form 3.3V through the SPI cable. When connected over the MultiComms cable alone, the CAM622 MultiComms Board can only be powered over 5V through the MultiComms cable. SPI and MultiComms cables may be connected at the same time. In this case power will come from the 5V supply, providing it is enabled (5V LED lit). Otherwise power will come from the 3.3V supply. Note that the 5V supply is required for MultiComms operations including BiSS, SENT and ABN interfaces.

Figure 5 shows the CAM622 MultiComms Board connected to the MultiComms Adapter with a Dual PicoBlade Cable PN 013-6024. It is also possible to use a PicoBlade SPI Cable PN 013-6020 instead, connecting to the MultiComms Adapter's 14-way header P6 instead of P7.

The arrangements of Figure 5 will also work with the CAM622 ABN Board. However since this lacks bidirectional ABN signals it is not capable of BiSS-C operation.

5.2 Use with CAM312 Development Board

Figure 6 illustrates how the MultiComms Adapter connects to a CAM312 Development Board.

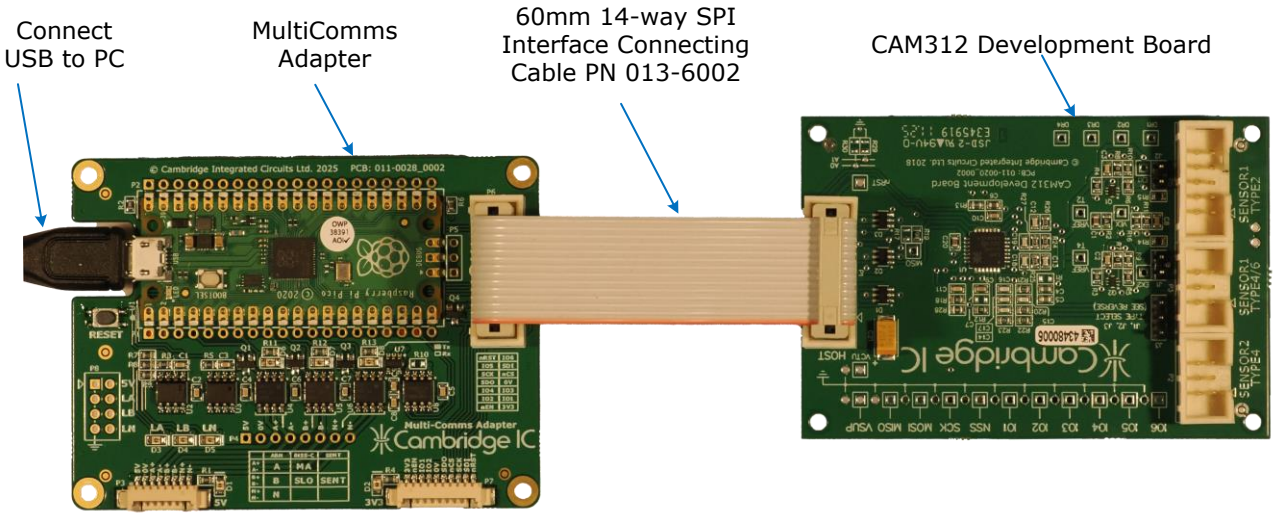

Figure 6 Connecting a CAM312 Development Board to the MultiComms Adapter

A 60mm 14-way SPI Interface Connecting Cable PN 013-6002 is used to connect the boards. Use the same cable for connecting to other CTU Development Boards including the CAM204 and CAM502.

6 Schematic and Component Placement

Figure 7 is a schematic for the MultiComms Adapter, and Figure 8 is a component placement drawing. It is built around a Raspberry Pi Pico microcontroller board. This interacts with a PC over USB, provides 3.3V and 5V power and connects to the remaining circuitry with its general purpose IOs ("GPx").

A Reset Switch SW1 pulls the Raspberry Pi Pico's RUN line low when pressed. This resets the Raspberry Pi Pico board.

A buffer IC U7 generates an nRST signal for resetting the connected CambridgeIC processor IC, including when the Raspberry Pi Pico is held in reset. In this case GP26 (nPRST) is pulled low by a weak pull-down, and the buffer serves to boost the current capacity of this signal.

Power supply switch U2 switches 5V power to externally connected devices, allowing PC software to control the SW5VS rail. This is important for putting a connected CAM622 device into its BiSS-C programming state when both BiSS-C and ABN interfaces are enabled.

Similarly U3 switches 3.3V power to externally connected devices. When U3 is switched on a MOSFET Q4 is turned on as well, to pull the n3VEN line low. This switches off the 5V regulator on a CAM622 MultiComms Board, to prevent this regulator from also powering the 3.3V rail.

U4, U5 and U6 are line transceiver devices, driving or receiving on A, B and N differential pairs. Each can individually be configured as either a line transmitter or a line receiver under control of the ADE, BDE and NDE lines. This allows software such as the CAM622 Configuration Tool to configure the MultiComms Adapter for different applications, having different signal directions for the A, B and/or N lines. For example in the case of quadrature ABN, the MultiComms Adapter acts as a receiver on all of A, B and N, while for BiSS-C point to point the MultiComms Adapter transmits MA on A and receives data on SDO.

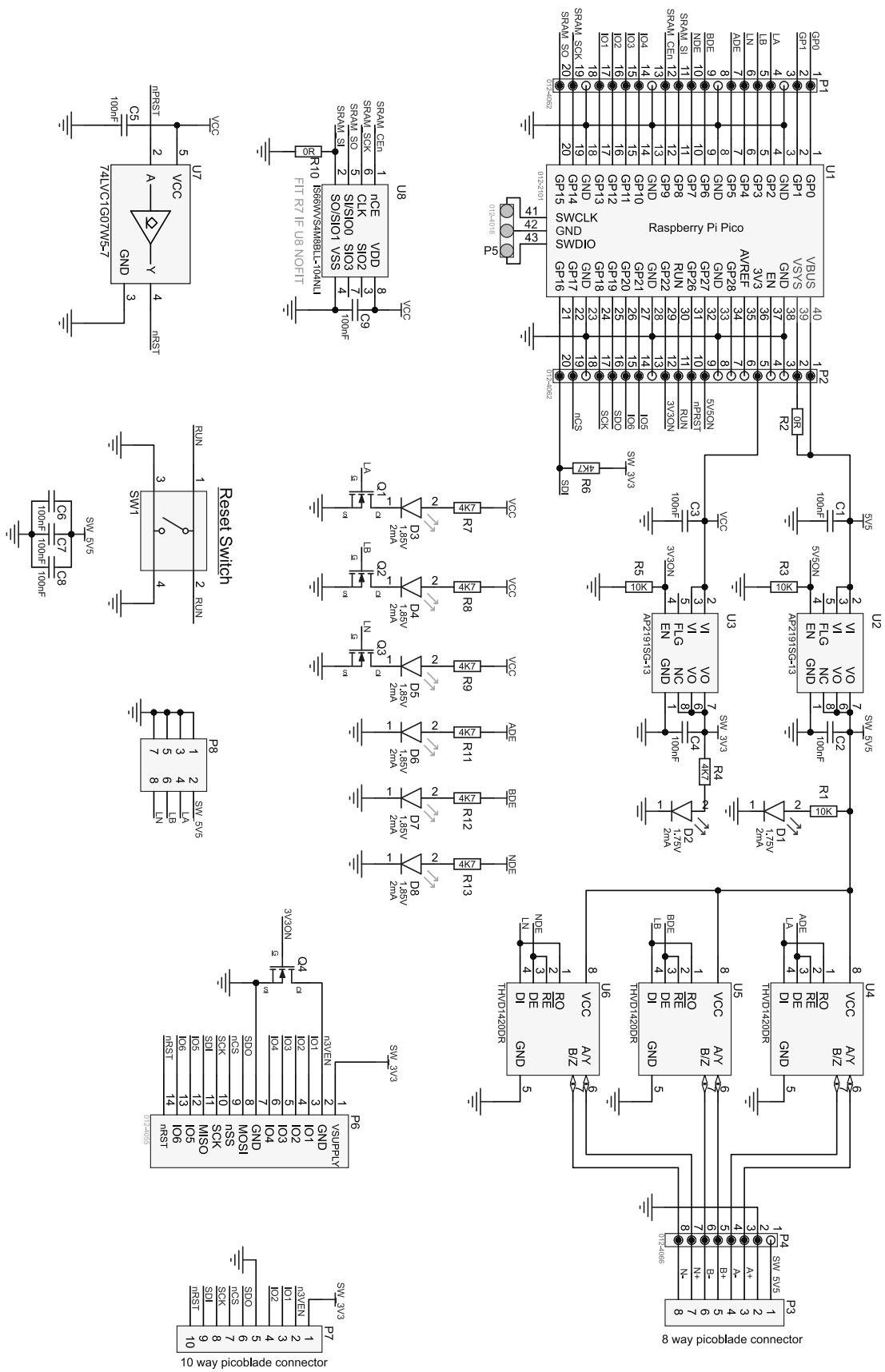

Figure 7 MultiComms Adapter Schematic

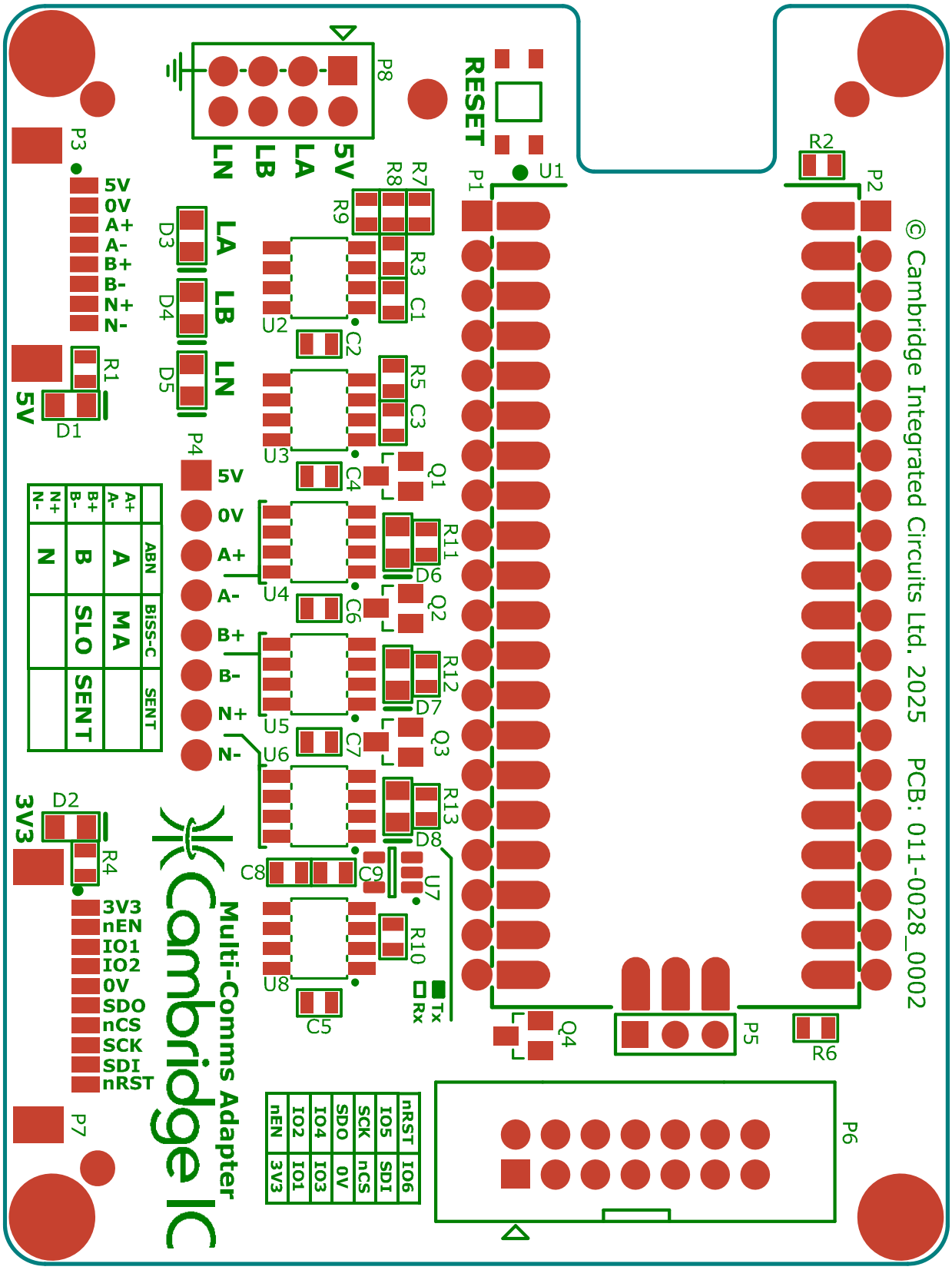

Figure 8 MultiComms Adapter Component Placement

7 Document History

Revision	Date	Reason
0001	10 Nov 2025	First draft
0002	9 January 2026	Added note about biasing B- input to 2.5V for single-ended SENT input

8 Contact Information

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