

XL-CCC Contact Closure Card

XL-CCC User Manual

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Table of Contents

Disclaimer	i
1 Overview	3
2 Physical Layout.....	4
3 Usage and Configuration	6
3.1 Settings	6
3.1.1 Channel Select.....	6
3.1.2 Channel Enable	6
3.1.3 Channel Mode.....	6
3.1.4 Channel sensitivity	8
3.1.5 Retune time	9
3.1.6 Actuation delay time.....	9
3.1.7 Actuation hold time	10
3.1.8 Device Pairing.....	10
3.1.9 Configuring Settings Using Serial	Error! Bookmark not defined.
3.2 Installation	11
3.2.1 Overview	11
3.2.2 Loop Termination.....	12
3.2.3 Contact Closure Termination	13
3.2.4 Device Pairing.....	13
4 Firmware Upgrade	15
4.1 Hardware Configuration	15
4.2 Reprogramming using Windows HyperTerminal	15
4.2.1 Setup and Running HyperTerminal	15
4.2.2 Reprogramming	15

1 Overview



The XL-CCC is a standalone loop-based detector that provides four (4) optically isolated contact closure outputs. In addition, the device can be paired with a second XL-CCC by means of the supplied DIN-rail TBUS connector to achieve a total of eight (8) channels. The XL-CCC can be powered with 5 – 12V DC and consumes up to 120 mA in operation.

The contact closure output is a solid state 60V/0.2AMP optically isolated relay 'dry' contact which may be connected to either AC or DC with an appropriate resistance value. The outputs are available through the screw terminals on the bottom of the DIN enclosure. The detector channel output terminals correspond to the input channel number.

The rear panel has provision for field loop feeder connections via suitable screw terminal inputs. The terminals are designated 1 through 4. Best detection performance is achieved with a 4 turn two metre square loop in close proximity to the cabinet or a 5 turn two metre square loop for loops with 100-200 metres of feeder. Excel does not guarantee performance where loop feeder cable exceeds road authority guidelines and/or specifications.

2 Physical Layout

The bottom side of the enclosure has provision for field loop feeder connections via suitable screw terminal inputs. The terminals are designated one through four as a loop pair (1-4) for easy connection. A standard Excel Field Termination Panel may also be used if lightning and surge protection is required.



Fig 1: XL-CCC bottom view (loop input terminals).

The top side of the enclosure has provision for contact closure connections via similar screw terminal inputs. The terminals are designated one through four as a contact closure pair (1-4). There is also a two way screw terminal to supply power to the device.

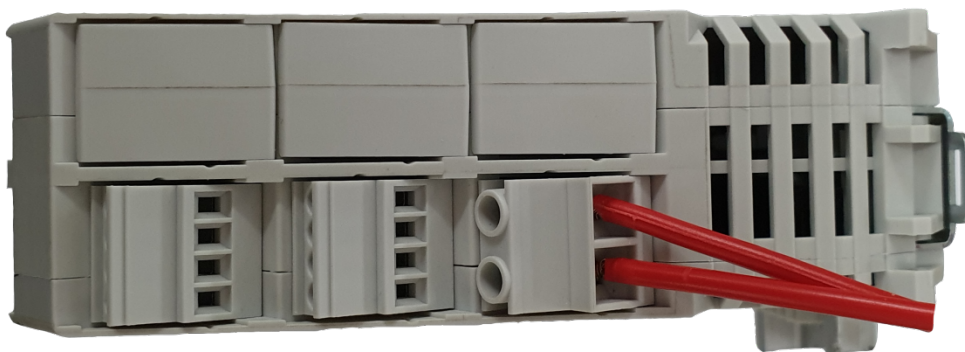


Fig 2: XL-CCC top view (contact closure and power screw terminals).

The front panel includes a 1.28" LCD display and three buttons for configuring the device. LED's are provided as means to indicate loop detections and loop faults via an illuminated display. There is also a DB9 serial maintenance port for firmware updates.

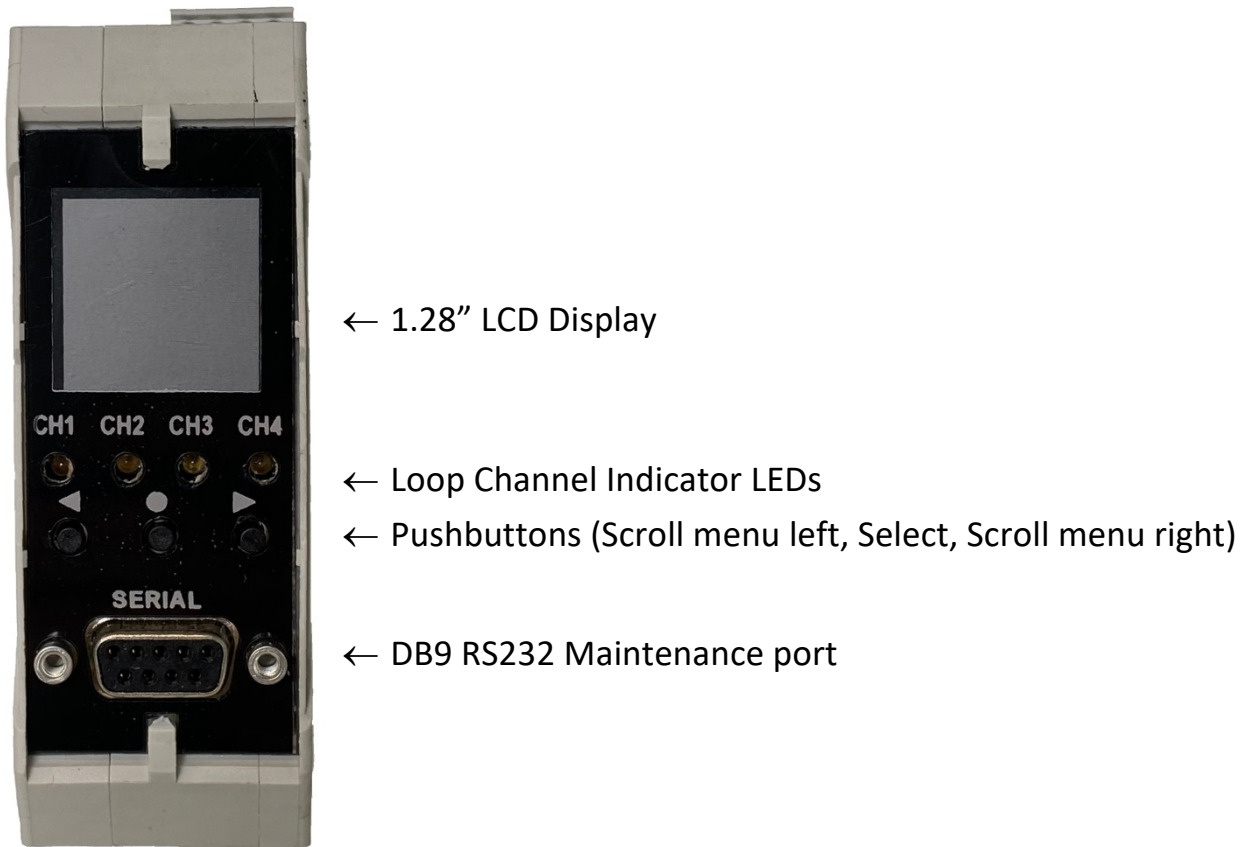


Fig 3: XL-CCC front panel.

There is a DIN-rail TBUS connector that allows multiple devices to share power and communicate with each other. It is possible to pair up to two devices.

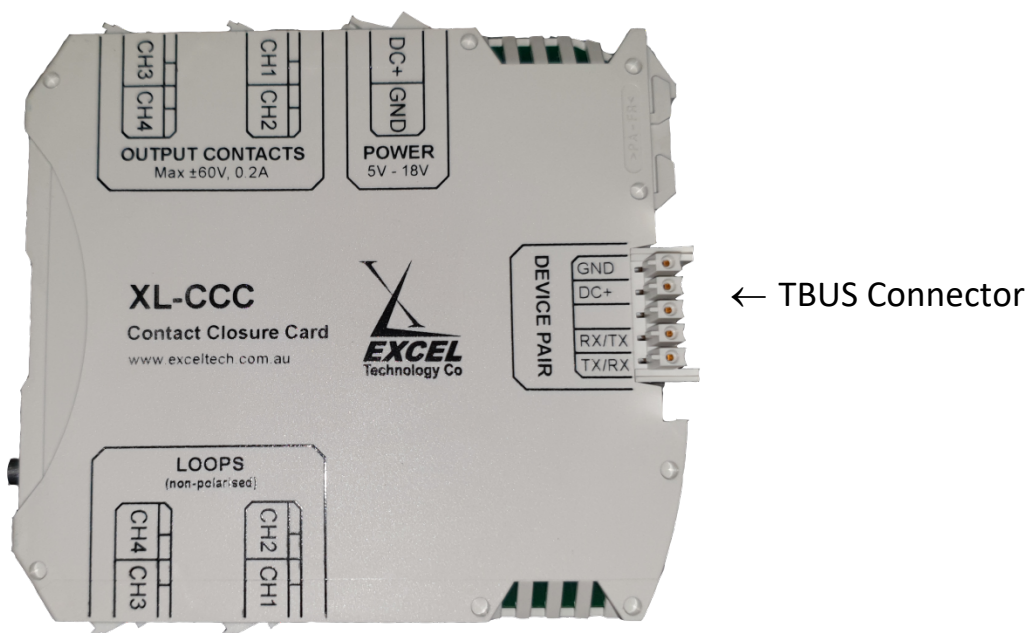


Fig 4: XL-CCC side view showing TBUS connector.

3 Usage and Configuration

3.1 Settings

The XL-CCC has a 1.28" LCD display and three buttons to allow the user to easily configure the device. There is also one status LED for each channel. When a channel is enabled, the LED will illuminate to indicate that the output contact is closed and will flash if the loop is in a fault state. The detection parameters of each loop channel can be configured individually using the graphical interface. The left and right buttons are used to scroll between settings. Once the desired setting is reached, the middle button focuses the current page. This will highlight the menu title. The left and right buttons can then be used to adjust the setting's value. Pressing the middle button saves the setting and defocuses the page, allowing you to scroll between settings again. If no button is pressed for 30 minutes then the Excel Logo will appear as a screensaver.

3.1.1 Channel Select

The user can select which channel will be affected by subsequent setting changes. It is possible to select channels individual or select all channels at once to adjust settings quickly. In the other settings menus the selected channel will be displayed in the top right corner. The channel select screen also displays the status of each loop. A loop can be OC (open circuit), SC (short circuit) or if the loop is not in a fault state, the frequency of the loop will be displayed in kilohertz.

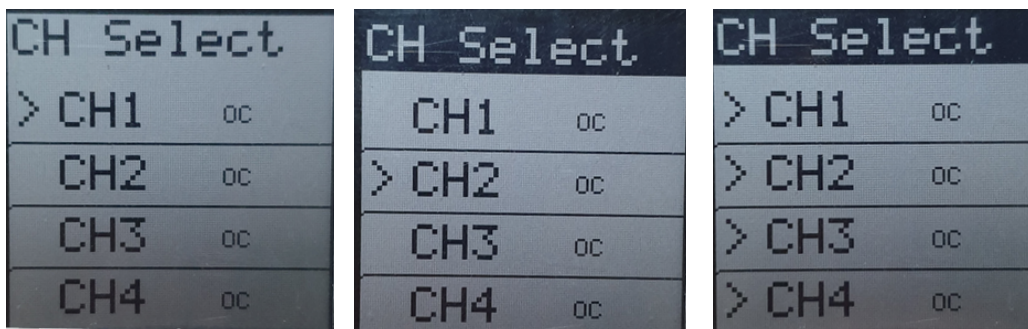


Fig 5: Channel select menu - a) CH1 selected b) Menu focused, CH2 selected c) Menu focused, ALL selected

3.1.2 Channel Enable

Each channel can be enabled or disabled. Disabling a channel will cause the contact closure output to remain open regardless of the state of the loop. If a channel is enabled the indicator LED to flash if the loop is in a fault state.

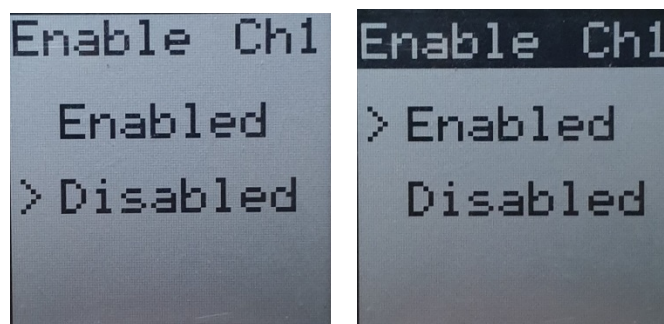


Fig 6: Enable menu - a) CH1 disabled b) Menu focused, CH1 enabled.

3.1.3 Channel Mode

There are three possible modes: Presence, Pulse or Loop Pair.

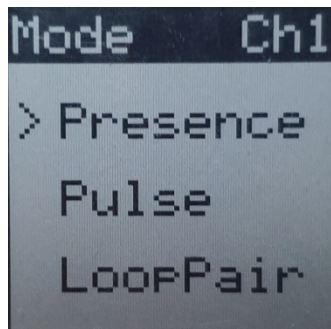


Fig 7: Mode Select menu (focused) CH1 Presence selected.

Presence Mode

In Presence mode (the default mode) the contact closure output will close when a metal mass is over the loop and will open otherwise. The output will operate according to with the delay and hold settings.

Pulse Mode

In Pulse mode the contact closure output will pulse once when a metal mass enters the loop the pulse characteristics can be configured with the delay and hold settings.

Loop Pair Mode

In Loop Pair mode two loops will be used to determine if a valid vehicle event has occurred. A valid vehicle event occurs when a vehicle travels over both loops in sequence. Channel one is always paired with channel two with channel one being leading loop and channel three is always paired with channel four with channel three being the leading loop. Additionally, channel one is always the leading loop of the one, two pair and channel three is always the leading loop for the three, four pair so ensure that the loops are connected such that this constraint is respected.

If a forward vehicle is detected channel one (or channel three for the three/four pair) will pulse. If a reverse vehicle is detected channel two will pulse (or channel four for the three four pair). See sections 3.1.6 and 3.1.7 for delay and hold settings.

3.1.4 Loop Length

When in Loop Pair mode the Loop Length setting becomes available. The loop length parameter can be adjusted with 1 millimeter resolution by cycling through each digit. Each digit can be increased or decreased using the right or left buttons then the middle button can be pressed to move to the next digit. The length can be adjusted from 1000mm to 5000mm.



Fig 8: Loop Length Menu (focused)

3.1.5 Loop Spacing

When in Loop Pair mode the Loop Spacing setting becomes available. The loop spacing parameter can be adjusted with 1 millimeter resolution by cycling through each digit. Each digit can be increased or decreased using the right or left buttons then the middle button can be pressed to move to the next digit. The length can be adjusted from 1000mm to 9999mm.

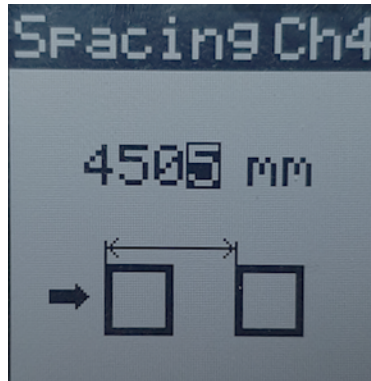


Fig 9: Loop Spacing Menu (focused)

3.1.6 Speed Trigger

When in Loop Pair mode the Speed Trigger setting becomes available. The loop spacing parameter can be adjusted with 1 kilometer resolution by cycling through each digit. Each digit can be increased or decreased using the right or left buttons then the middle button can be pressed to move to the next digit. The length can be adjusted from 0 to 250 kmph.



Fig 10: Speed Trigger Menu (focused)

3.1.7 Channel sensitivity

The sensitivity of each channel can be increased and decreased individually using the right and left buttons. The sensitivity of the loop determines the loop's propensity to actuate in the presence of a vehicle. Adjusting the sensitivity can be useful for compensating inconsistencies in loop installation.

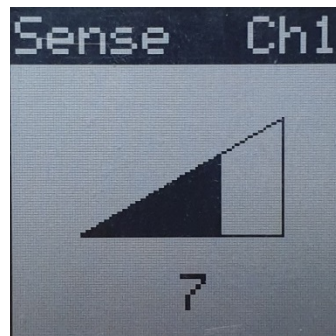


Fig 11: Sensitivity menu (focused) - CH1 sensitivity set to 7.

3.1.8 Retune time

Induction loops are susceptible to drift so it is necessary to periodically 'retune' them. Retuning a loop causes the reference frequency to be set to the current loop frequency. This prevents the loop drifting so much that it misses an actuation. The time between loop retunes can be adjusted (5 mins, 30 mins, 1 hr, 4 hrs, 24hrs, 48hrs) using the left and right buttons. In addition to retuning periodically, if the middle button is held down for three seconds then the selected channel will retune.



Fig 12: Retune menu (focused) - period set to 48hrs.

3.1.9 Actuation delay time

A delay can be added which will cause the output to be delayed until a vehicle has been present over the loop for the specified time. The delay can be increased and decreased using the right and left buttons. The minimum delay is 0ms and the maximum delay is 5 seconds. This delay applies to all modes (presence, pulse and loop pair).



Fig 13: Delay menu (focused) - CH1 delay set to 200 ms.

3.1.10 Actuation hold time

A hold time can be added which will cause the output to persist for the specified time after a vehicle has exited the loops detection zone. The hold time can be increased and decreased using the right and left buttons. The minimum hold time is 0ms and the maximum hold time is 5 seconds. This hold time applies to all modes (presence, pulse and loop pair).



Fig 14: Hold menu (focused) - CH1 hold time set to 300 ms.

3.1.11 Device Pairing

It is possible to connector two devices together via the TBUS DIN-rail connector. The two devices can then share power. To pair two devices one must be set to 'master' and the other set to 'slave'. This will cause the devices to synchronise so that loops connected to both devices will be scanned sequentially, minimising the possibility of crosstalk. For normal single operation the device should be set to 'slave' mode. Changing the pair setting will adjust the setting for the whole device – there is no need to do it for each individual channel. See Section 3.2.4 on how to install two XL-CCCs in this configuration.

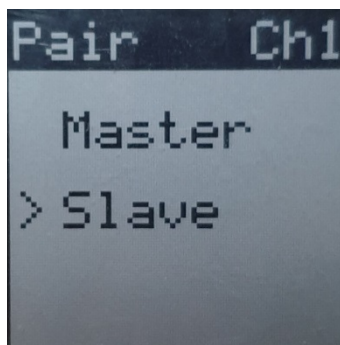


Fig 15: Device Pair menu (focused) - XL-CCC set to slave mode.

3.1.12 Comms Mode

There are two communication protocols available on the XL-CCC. The first option (STREAMS) supports a subset of the STREAMS communication protocol while the second option (Debug) is reserved for real time loop data streaming and serial setting configuration using the supplied terminal application.



Fig 16: Comms Select menu (focused)

3.2 Installation

3.2.1 Overview

Each installation site requires the following ETC equipment:

- XL-CCC Contact Closure Card
 - Standalone unit incorporates power connection, loop connection and contact closure connection.
 - In-pavement loops connect via corresponding loop feeder cable CH1-4 as designated (right-hand side) screw terminals.
 - Contact closure outputs – output pairs as designated (right-hand side) screw terminals which convey the contact closure channels CH1-4
- 5 – 12V Power supply
 - The XL-CCC has a two-way screw terminal that accepts 5 – 12V to power the device. This input has reverse polarity protection.

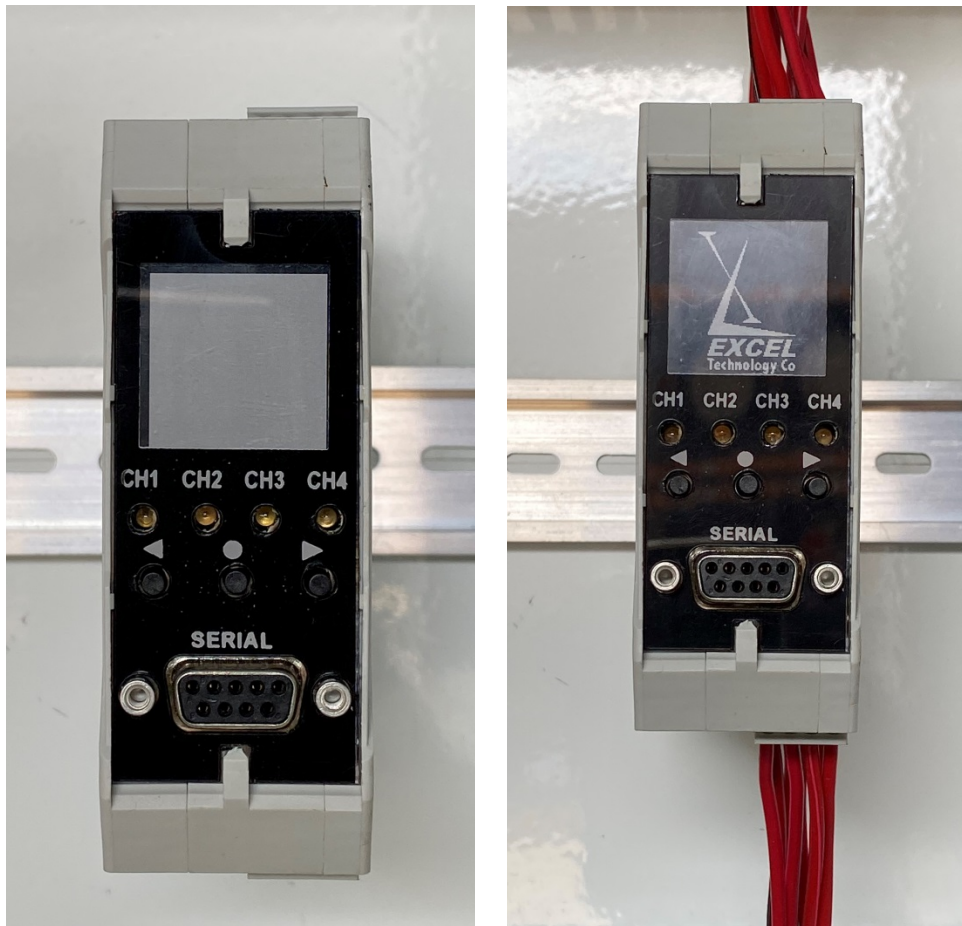


Fig 17: XL-CCC Mounted in cabinet - a) Device mounted b) Loops/outputs terminated and power connected.

3.2.2 Loop Termination

Loops are terminated in the screw terminals on the bottom of the unit. The loop channels are labelled CH1, CH2, CH3 and CH4. These are paired terminals that are non-polarised. The loops are isolated from the electronic circuitry by an isolation transformer.

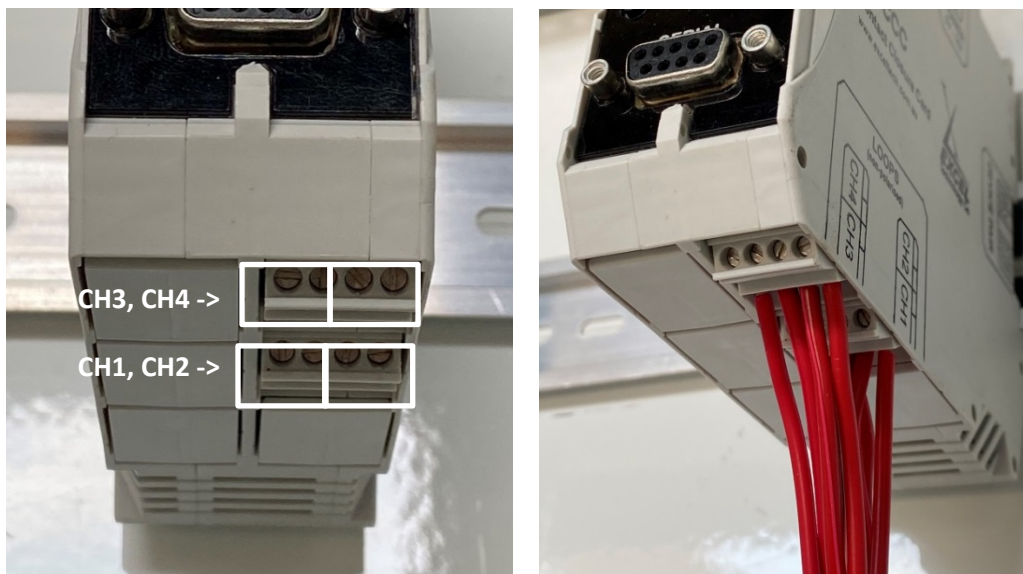


Fig 18: Loop termination - a) XL-CCC underside b) Loops terminated.

3.2.3 Contact Closure Termination

The screw terminals on the top of the unit designated CH1, CH2, CH3 and CH4 correspond to the loop numbers. The contact closure output is a solid state 60V/0.5A, 0.4W photovoltaic relay 'dry' contact which may be connected to either an AC or DC signal with an appropriate resistance value.

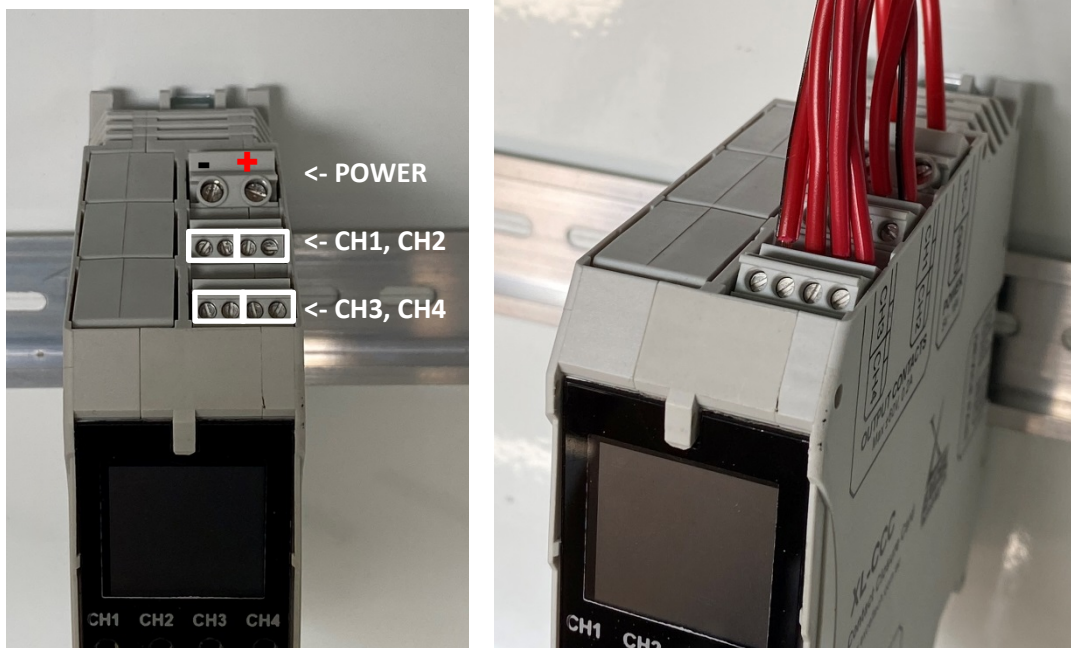


Fig 19: Output termination - a) XL-CCC underside b) Outputs terminated and power connected.

3.2.4 Device Pairing

When pairing two XL-CCCs, they must both be positioned adjacently on the DIN-rail so that they can connect via the TBUS connector. The devices share power and comms through this connection so only one device needs to receive power through the top screw terminal.

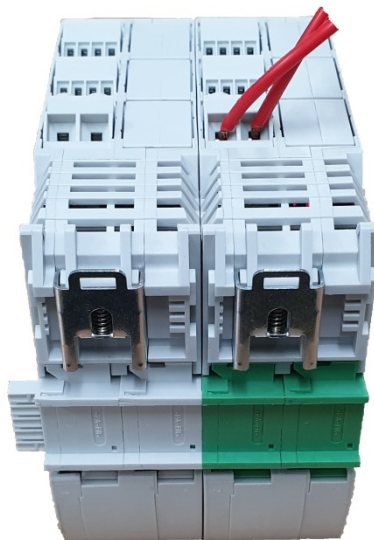


Fig 20: Pairing two XL-CCCs with TBUS connector.



Fig 21: Two XL-CCCs configured for synchronised scanning.

4 Firmware Upgrade

4.1 Hardware Configuration

Reprogramming the XL-CCC firmware is performed via the serial connector on the front panel. For reprogramming you will need:

- A straight through DB9 female-to-female serial cable
- Computer with a serial COM port running Windows HyperTerminal or similar terminal emulator with XMODEM upload capabilities
- Firmware binary.

4.2 Reprogramming using Windows HyperTerminal

The following directions are for reprogramming using Windows XP HyperTerminal.

4.2.1 Setup and Running HyperTerminal

The first step is to connect the computer to the XL-1000.

1. Connect the serial cable from the COM port of the computer to the serial port of the XL-CCC.
2. Start windows and point to Start > Programs > Accessories > Communications.
3. Click the HyperTerminal icon to start the program.
4. The Connection Description screen will now be displayed, enter a name for the connection, for example 'XL-CCC'. Click OK.
5. The Connect To screen will now be displayed, choose the correct COM port from the drop down box and click OK.
6. The COM Properties screen will now be displayed. Set the bits per second to 115200, data bits to 8, parity to none, stop bits to 1, and importantly flow control to none. Click Ok.
7. HyperTerminal should now be connected. Rather than perform this setup process every time, save the connection by clicking File > Save As and choosing an easy to remember location. Next time you want to connect to the XL-CCC, open the saved connection description instead and the

HyperTerminal will start with all the old settings.

4.2.2 Reprogramming

The second step is to reprogram the firmware.

1. Cycle the power on the XL-CCC. The figure below shows an example of a complete transcript of the reprogramming sequence. After cycling the power the first line of this will be displayed.
2. Press the <Shift>+<P> keys within two seconds of the first line appearing to enter the boot loader.

