Crowcon Technical Note

Document Reference:	**GEN-105**
Document applies to:	**GM Systems, Xgard Bright, XgardIQ, IRmax**
Release Date:	**12/05/2021**
Subject:	**Addressable Communications - Guidelines and Fault Finding**

Introduction:

This document consists of the three parts:

- Design guidelines for Crowcon specified RS-485 addressable systems
- Installation guidelines for those installing Crowcon specified RS-485 addressable systems
- Troubleshooting guide

It has been written for a controller (GM-xx) and Xgard Bright as the detectors; however, the main topology and guidelines can be transferred to any other Crowcon addressable products, such as XgardIQ and IRmax.

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Detecting Gas Saving Lives

Crowcon Technical Note

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1. Glossary of Terms

Term	Glossary
AWG	American Wire Gauge
CSA	Cross-sectional area
TR	Termination resistor

2. Design Guidelines

2.1 Cable Specification

	Minimum CSA for runs <100m	Recommended for runs >100m	Twisted Pair	Characteristic Impedance (1 MHz)	Sheathed	Shielded
Signal conductors	24AWG (0.2mm CSA)	22AWG (0.33mm CSA) or greater	Yes	120 ± 12 Ohm	Yes	Recommended
Power conductors	Calculate volt drop	Calculate volt drop	Recommended	N/A	Yes	Recommended

Example Signal Cables (without Power alongside)

6412 SL001 | Alpha Wire 1 Pair Aluminium/Mylar Tape Multipair Industrial Cable Grey | RS Components (rs-online.com)

6454 BK005 | Alpha Wire 1 Pair Foil and Braid Multipair Industrial Cable 0.456 mm²(CE, CSA, UL) Black 30m Alpha Essentials Series | RS Components (rs-online.com)

If power is being run at the same time – check voltage drop against conductor size (and use Crowcon voltage drop calculator spreadsheet):

6451 SL005 | Alpha Wire Multipair Data Cable 1.65 mm²(CE, CSA, UL) Grey 30m Alpha Essentials Series | RS Components (rs-online.com)

24L45467-F21-W6.pdf (armadacables.com)

Microsoft Word - 22ABDY.docx (fscables.com)

2.2 Voltage Drop

Calculations for voltage drop should be taken at worst case scenario, and use the voltage drop calculator spreadsheet. If the requirements are greater than using 2.5mm^2 CSA cable, external/local power supplies should be utilized.

2.3 Maximum Units per Loop

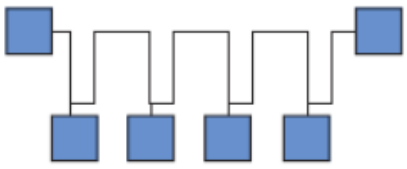
There should be a maximum of 32 units per loop. If there is requirement for greater than 32 units per loop, an extender should be used, or additional loops. See Repeaters/Extenders.

2.4 Combinations of detectors and gas types

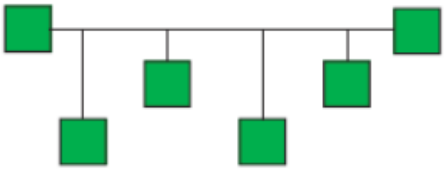
A combination of detectors and gas types can be used, provided they are calculated in the voltage drop calculations above, due to different current consumptions.

2.5 RS485 Network Topology

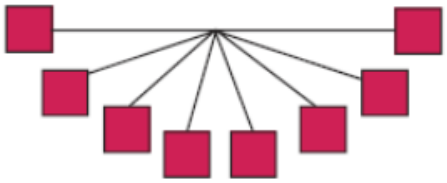
All of Crowcon's addressable detectors should be arranged in a daisy chain/bus topology. Careful consideration must be given if different detector types are to be connected on the same network: the Baud Rate and other parameters will need to be aligned. The detectors each connect to a main trunk/bus, with the stubs being kept as short as possibly (ideally the units should run from one to another, removing stubs entirely).



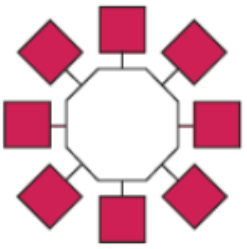
Daisy chain (best)



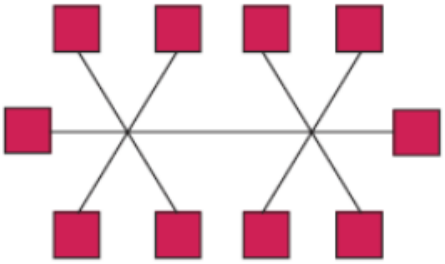
Backbone with stubs (workable)



Star network (avoid)

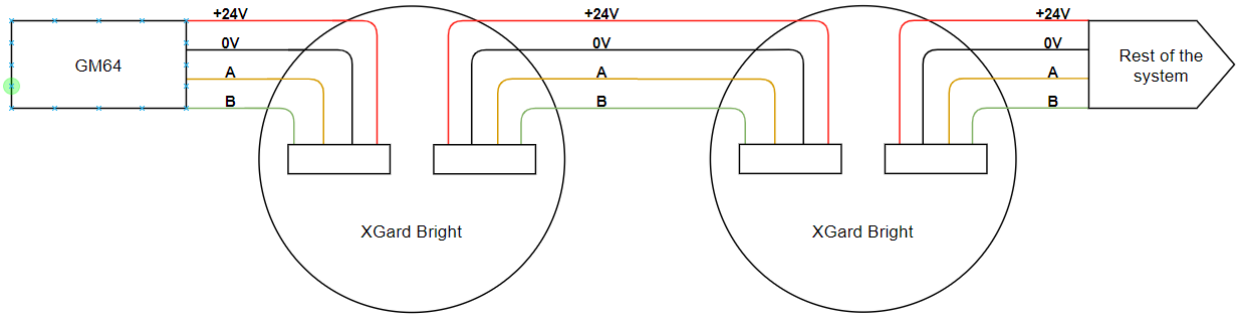


Ring (avoid)



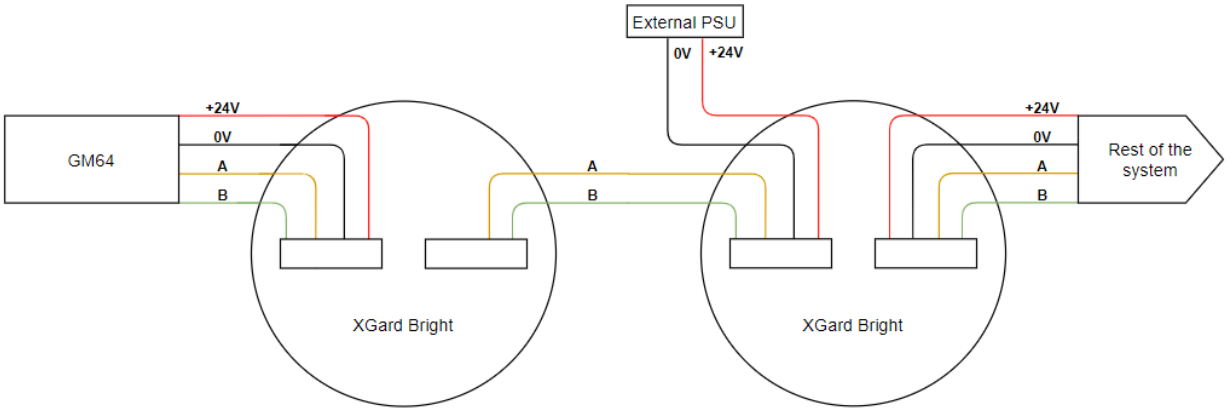
Backbone with stars or clusters (avoid)

Each detector should be directly connected to the bus as detailed below. Junction boxes should be avoided where possible. If use of a junction box is necessary; it must be suitably sized for the intended number of connections, must contain enough terminals to allow a maximum of two conductors per terminal and must be supported with a connection diagram with all wires numbered and referenced.



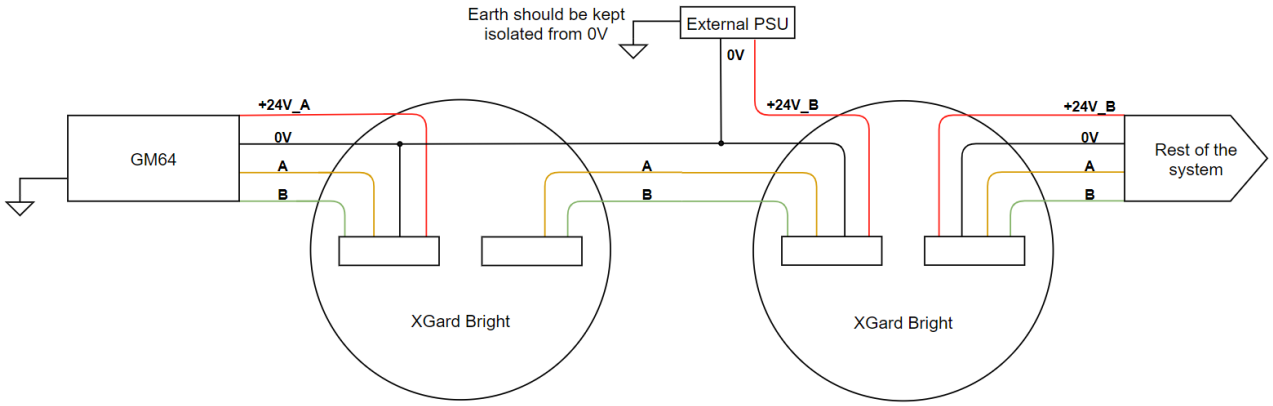
The cable screen on the field cable must be connected to earth at the control panel only. Ensure the continuity of the cable screen between each detector and within junction boxes if used.

If an external/local power supply is being utilized:

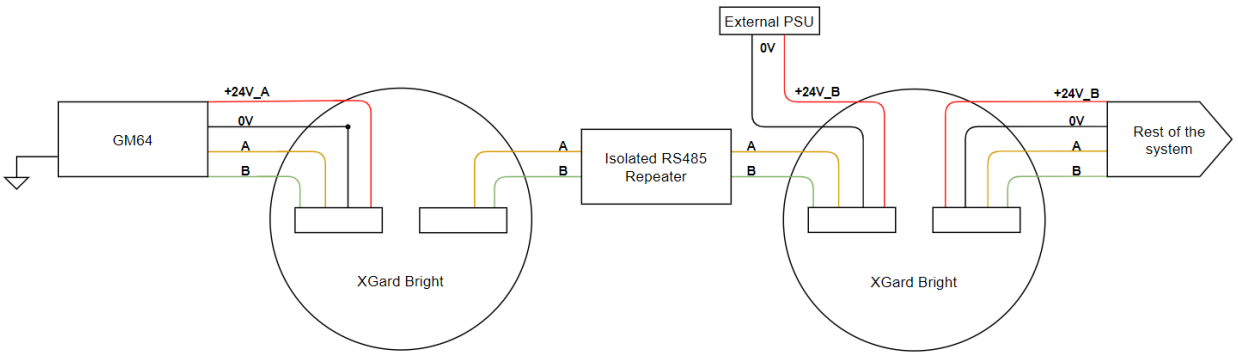


2.6 External Power Supplies

The RS485 transceivers need to have a common ground reference that does not differ more than 7V. If external power supplies (PSU's) are being utilised, a 0V wire should be installed between the separate PSU's to keep the potential the same across all RS-485 transceivers. To prevent an earth current loop, the 0V should be kept isolated from the common ground reference. The +24Vdc connection from each PSU must be isolated to the group of detectors that each PSU is powering; PSU +24Vdc wires must not be connected to each other. A guideline wiring diagram is specified in the image below.



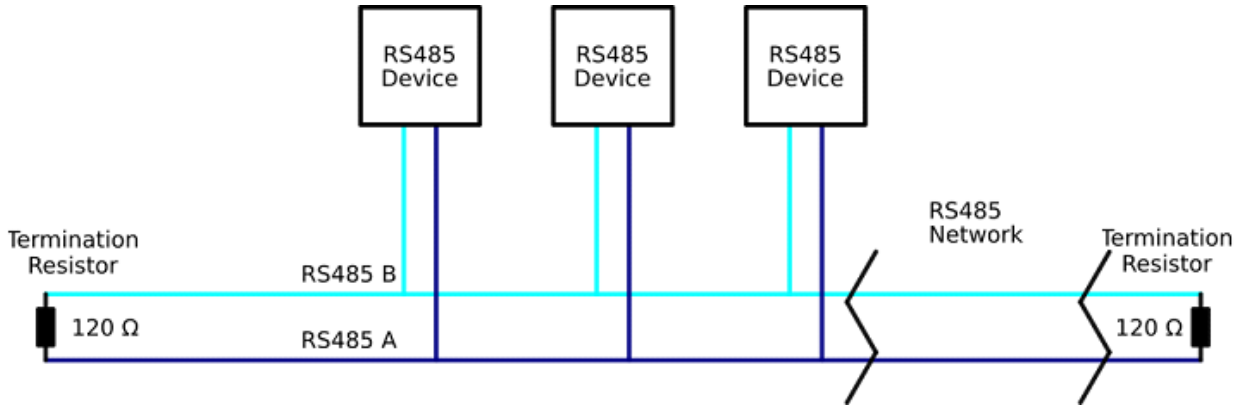
If 0V cannot be connected between the separate power supplies (usually due to a non-isolated power supply or earthing requirements), an isolated RS-485 repeater should be used, as detailed below:



2.7 Termination Resistors

The first unit on the bus (usually the GM64) should have a termination resistor (TR) in-place: the GM64 has a built-in TR, either through software (see GM64 manual) or a header pin (on the older models).

The last detector on the bus should also have a TR (usually installed by placing a jumper across two pins). No other detector on the entire RS485 should have a TR installed, see diagram:



2.8 Stubs

Stubs should be avoided, or a repeater added at the stub node. The maximum cumulative stub length of the entire system (sum of all stubs) should be less that 10ft (3m), if the system is running typically at 9600 baud.

2.9 System Length

The entire cable length of the communication system should be less than 4000ft (1.2km). If the system is longer, a repeater should be added at least every 4000ft (1.2km).

2.10 Repeaters/Extenders

All RS-485 repeaters should work with the GM-64, Xgard IQ, Xgard Bright and IRmax. An example is here: 485OPDR B+B SmartWorx | Mouser United Kingdom

3. Installation Guide

3.1 Assigning of Wires

Assign A & B an easily distinguishable colour to prevent communication crossover. A should be connected to A, and B to B.

eg – A = Orange, and B = Blue

3.2 Cable Identification

Cables must be identified for traceability according to appropriate guidelines. In the event a wiring convention is not published, the following is suggested: cables should be labelled at either end with the terminal number and corresponding terminal destination. For example:

3.3 Power

The last unit on the system should be checked to ensure the voltage present is above the minimum specified for the detector (eg 10Vdc for Xgard Bright).

4. Troubleshooting

Description	Issue	Test	Expected Results	Troubleshooting
Termination Resistor	If the entire bus (or large sections) aren't communicating	Inhibit the COM port from the controller and measure the resistance between A & B when the system is powered.	60 ± 12 Ohm, or 120 ± 12 Ohm if the controller is disconnected.	If the reading is lower, there is more than one termination resistor connecter. If the reading is higher, check the controller and end of line controller has a TR installed.
Voltage	If one or more Xgard Bright's aren't powering up	Measure the voltage at the terminal of each Xgard Bright	Between 10V & 27V. Note: ensure there is some headroom above 10Vdc as the voltage is likely to reduce when detectors are in full alarm state.	If the voltage is lower than 10V, the unit will not function correctly. An external power supply is required, or a recalculation of the voltage drop across the existing supply.
RS485 signals	Bus shorted to power rail	Measure the resistance between A to 24V, and B to 24V	Greater than 10k Ohm.	If the resistance is lower, check that 24V is not connected to either A or B.

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	Bus shorted to Gnd rail	Measure the resistance between A to 0V, and B to 0V	Greater than 10k Ohm.	If the resistance is lower, check that 0V is not connected to either A or B.
	A & B short circuit	Disconnect the controller, and measure the resistance between A & B	Greater than 120 Ohm	If the resistance is lower, make sure A & B aren't crossed anywhere in the system
	A or B not connected	Disconnect the controller, and measure the resistance between A & B	120 Ohms ± 20 Ohms	If the resistance is higher, check continuity of A & B through the system.
	If a single Xgard Bright isn't working	Press scroll three times to get the screen displayed in the figure below:  *Diagram 7: Gas status screen* 1. Serial number 2. Firmware version, Hardware version 3. HART ID 4. Detector 485 Address, 485 packets received, 485 packets address match, Polling address 5. Detector supply voltage 6. Due time in format YYYYMMDD Check the four figures located in row three (number 4 in Diagram 7). 1. The first number is the RS485 address of that detector. It should match the address on the controller screen. 2. This number should be incrementing more than once a second. If the number is not incrementing, the detector is not receiving the comms signal from the controller. Check the wiring to the detector, and if necessary, replace the Bright. 3. The number of packets that the Bright is sending back to the controller, and will increment more slowly than (2). If the number is not incrementing, check the wiring to the detector, and if necessary replace the Bright. 4. This number is the address that the controller is currently polling. The address of the detector should occasionally be displayed on this. If not, check the settings of the controller, and check that it matches the address of the detector.		

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