ABM300-CGC4
RS485 Cellular Gateway
Installation Manual

730 The Kingsway Peterborough, ON K9J6W6 Canada
Tel: (705) 740 — 2010 Web: www.abmsensor.com
Fax: (705) 740 — 2563 E-mail: info@abmsensor.com

A – Introduction

This manual describes the requirements to successfully connect up to eight ABM radar level sensor products in an RS485 network hosted by the ABM300 RS485 Cellular Gateway.

The Gateway not only acquires data from these sensors but can also control them. Users have access to remotely change all alarm related functions, while ABM experts can remotely recalibrate and fine-tune the sensors for optimized performance in their respective environments.

The Gateway can also be used to power any DC version ABM radar level sensor (ABM300 series), which can simplify cable routing in many cases.

B - Requirements

Cellular Network

The key to reliable Gateway operation is suitable cellular phone network access. While urban and developed areas typically provide excellent cellular signal strength, there may be some installations where the cellular signal is weak. For such locations, it is highly recommended that the installer determine an optimal mounting location by using a cell phone display to assess the signal strength.

The standard antenna supplied with the Gateway has a magnetic-base and a 6’ (2m) cable that allows mounting on top of a tank or structure for optimal signal strength while mounting the Gateway in a more sheltered or accessible area. The optional SMA-mounted antennas have slightly higher gain. For difficult installations, the ABM Sensor technical team can provide advice regarding the use of directional antenna and extension cables.

Power Supply

The Gateway requires an input supply voltage of 12 to 30Vdc. Peak power is 6W (1A at 6V down to 0.2A at 30V). This peak only occurs for a very short period during cellular transmissions.

If the Gateway is connected to supply DC-powered ABM sensors (see Appendix), it supplies an output of ≥18V, provided the following requirements are met for the supply input voltage (V_{IN}):

- For 1 to 3 sensors, $V_{IN} \geq 12$Vdc
- For 4 sensors, $V_{IN} \geq 15$Vdc
- For 5 sensors, $V_{IN} \geq 18$Vdc
- For 6 to 8 sensors, $V_{IN} \geq 21$Vdc

The number and type of ABM sensors connected to the Gateway determine its total power requirement. Input current up to 600mA at 21-30Vdc may be required for an eight sensor configuration.

Environmental

The Gateway is designed for operation over the temperature range of -40°F to +140°F (-40°C to +60°C).

The Gateway enclosure is rated for NEMA 4/4X ingress protection – suitable for exposed outdoor applications. However, the selected antenna must be suitable for the installation environment. ABM offers the following:

- A remote magnetic-mount outdoor antenna with a 6' (2m) SMA extension cable (standard configuration).
- An outdoor antenna (IP66 rated) that mounts directly on the enclosure's SMA connector.
- An indoor-only antenna mounted on the SMA connector (as shown in the above product photo).

If installed outdoors and unsheltered, the Gateway must be mounted vertically, such that the wiring exits from the bottom and the antenna from the left side, to prevent a build up of water, snow or ice around the cable glands or the SMA antenna connector. The mounting feet may be relocated to the sides of the enclosure (rather than the top and bottom as shown in the above product photo) for further mounting flexibility.

C - Installation:

Physical Configuration

Following the proper installation of each sensor according to its supplied instructions, the Gateway should then be installed in any location with suitable cellular reception and environmental conditions. The Gateway's 6ft (2m) pigtail can in many cases be wired directly to a sensor – otherwise, a junction box is required to connect it to the RS485 and DC power buses.

It is not necessary to install the Gateway at one end of the RS485 bus (as shown in several examples in Section D) – it can be located anywhere in the network. The RS485 cabling must be connected in a multi-drop or daisy-chain configuration, as star configurations (i.e. with long branches) are not recommended. Short stubs are acceptable (maximum 6ft/2m) when connecting sensors using junction boxes.

Cabling

The Gateway is supplied with two 6ft (2m) #24AWG shielded twisted-pair pigtail cables – the minimum recommended wire size. ABM supplies all other sensor products with terminal blocks suitable for up to #14AWG wires. These terminals also accept two #18AWG conductors, which allows for direct wiring without junction boxes in some cases (see Section D Examples 1 and 4).

Several basic rules apply to cabling:

- For ingress protection, it is important that only one cable per cable gland be used. Each ABM300 sensor is supplied with two cable entries, facilitating direct connection in a multi-drop network.
- AC versions sensors (ABM400 or ABM430) require one gland for AC power, leaving only one gland for network connections. Line voltage (AC) conductors must not share a cable with low voltage (DC) conductors such as RS485 or mA Output.
- When junction boxes are used to meet the above requirements, the branch cable must not exceed 2m/6' in length.
- Conduits can be used instead of cable glands to allow runs of multiple cables or wire pairs, but line voltage cables or conductors cannot share a conduit with low voltage cables or conductors.

Shielding

Shielding is required for all Gateway-connected cables. See the Appendix for identification by ABM model number of the sensors discussed in the following shielding rules:

- Most important: the shield shall be connected to earth-ground in only one location. Connections at multiple points will create a ground-loop that can result in significant ground differential voltages and currents, which can adversely affect communication and even damage installed equipment.
- Ideally, the sole earth-ground connection to the system's cable shield should be made at either end (as opposed to somewhere in the middle) of a multi-drop cable run. In most cases, especially if a line-powered DC supply is used, it is best to ground it at the power supply.
- The shields of all low-voltage cables should be connected together. Twisting together is acceptable, but screw terminals, wire nuts or soldered connections are more reliable.
- The installer must prevent the bare shield wires from touching any metal housing or any other conductors.
- AC powered sensors must have an earth-ground wire directly connected to Terminal 6 for electrical safety as part of the AC supply. Terminal 6 is internally connected to Terminal 3 on all sensors. Therefore, the cabling system shield can use Terminal 3 on one AC sensor as its grounding point – as long as it is not already grounded elsewhere.
- DC powered sensors are not required to have an earth-ground wire connecting to Terminal 3 or 6, as low-voltage installation rules do not require such. However, DC sensors with metal housings may be indirectly grounded through their mounting – for instance, where a metal or otherwise conductive tank is grounded to earth through its base and the sensor is installed without an isolating mount such as an aiming device. If a DC sensor is not indirectly grounded in this manner, nor grounded through an earth-ground wire connected to either Terminal 3 or 6, then the system shield wire should be connected to Terminal 3 or 6.

The above shielding rules are illustrated throughout the configuration examples in Section D.

RS485 Common Connection

While it is common practice to implement RS485 wiring with only two wires ("A" and "B"), this is risky over long distances and multiple network nodes. Best practice, per the RS485 standards, is to provide a Common connection between nodes.

The Gateway's Common connection is the black wire of the red/black pair of both pigtail cables. The white/black pair of the 2-pair cable provides the A/B connections.

For sensors that are not powered through the Gateway, such as AC powered sensors, the Common connection is to be made through Terminal 4, which is Common for both the RS485 and the mA loop current output. For all DC powered sensors, Terminal 4 connects internally to Terminal 7 (labelled "L2/N").

RS485 Network Initialization

ABM sensors are supplied with a factory-default SID = 2, unless they were specifically ordered from ABM for a Gateway network configuration with a pre-assigned Serial ID (SID) sequence. The connection of more than one sensor having the same SID will result in communications failure.

Therefore, installation of more than one factory-default sensor to the Gateway requires that the installer only add one sensor at a time to the RS485 bus (the black/white twisted pair) to re-assign its SID to a unique number, as described in the Cellular Gateway User Manual.

D - Installation Examples

1. Single AC Powered Sensor

The following example shows an AC powered sensor (ABM400 or ABM430 series), without a current output connection, connected to a Gateway.

As the current loop output of the sensor is unused, the Gateway, located within 6ft (2m), is shown directly wired to the sensor through one cable gland, while the AC supply requires a second separate cable gland.

As the Gateway is not supplying sensor power, the red wire is either cut off or insulated with tape inside the sensor. The black wire from the red/black pair is still connected to provide a signal common for the RS485 link, so it is connected to Common at Terminal #4 (mA Output "-").

The shield is shown grounded at the power supply and not connected in the sensor. As AC powered sensors have both Terminals 3 and 6 earth-grounded for electrical safety, the shield could instead have been left unconnected at the power supply and connected to Terminal 3 in the sensor.

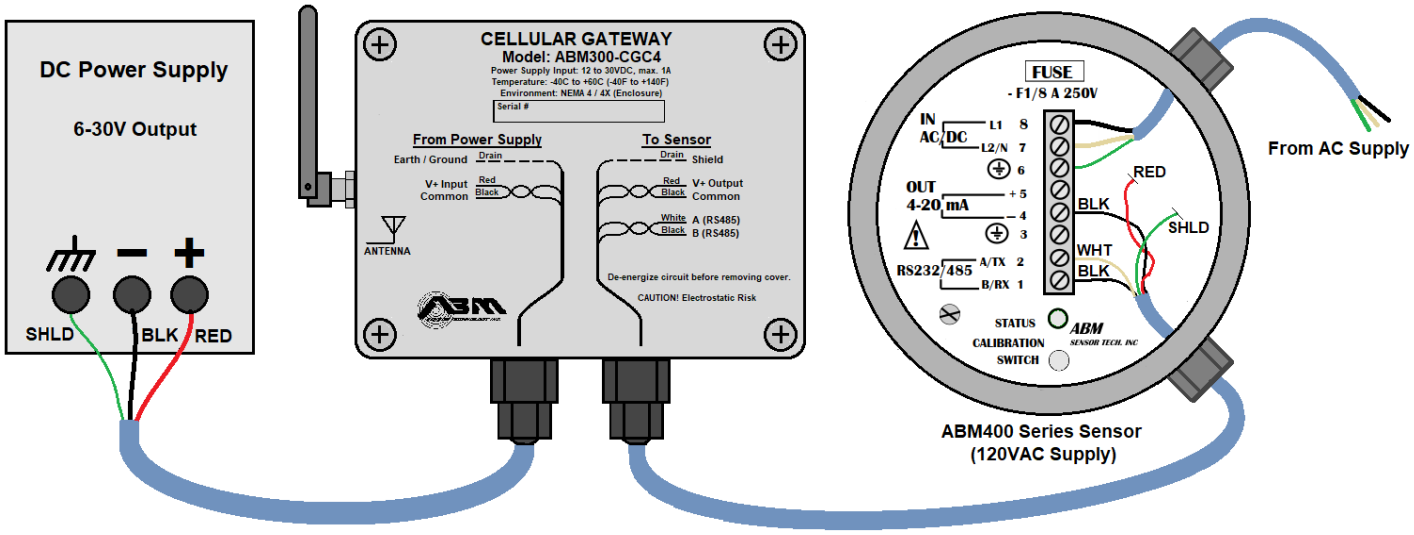

Figure 1 – AC Supply Sensor Connections (No Current Output) Using Gateway Pigtail

2. Single AC Powered Sensor with Current Output

The following example is a variation of the first, but with the current output implemented.

As the sensor is AC supplied, there is only one free cable gland for all low voltage wiring, so an external junction box is required to break out the current output.

The shield is shown being earth-grounded at the sensor since, being AC powered, Terminal 3 must be earthed through Terminal 6. Optionally, the shield could be earth-grounded at the junction box (but not at the sensor or power supply).

As Terminal 4 (mA Output "-") is the signal common for both the current output and the RS485 in the sensor, it is acceptable to provide this connection through the one black wire to the junction box as shown - thus avoiding the requirement for a 3-pair connection to the sensor.

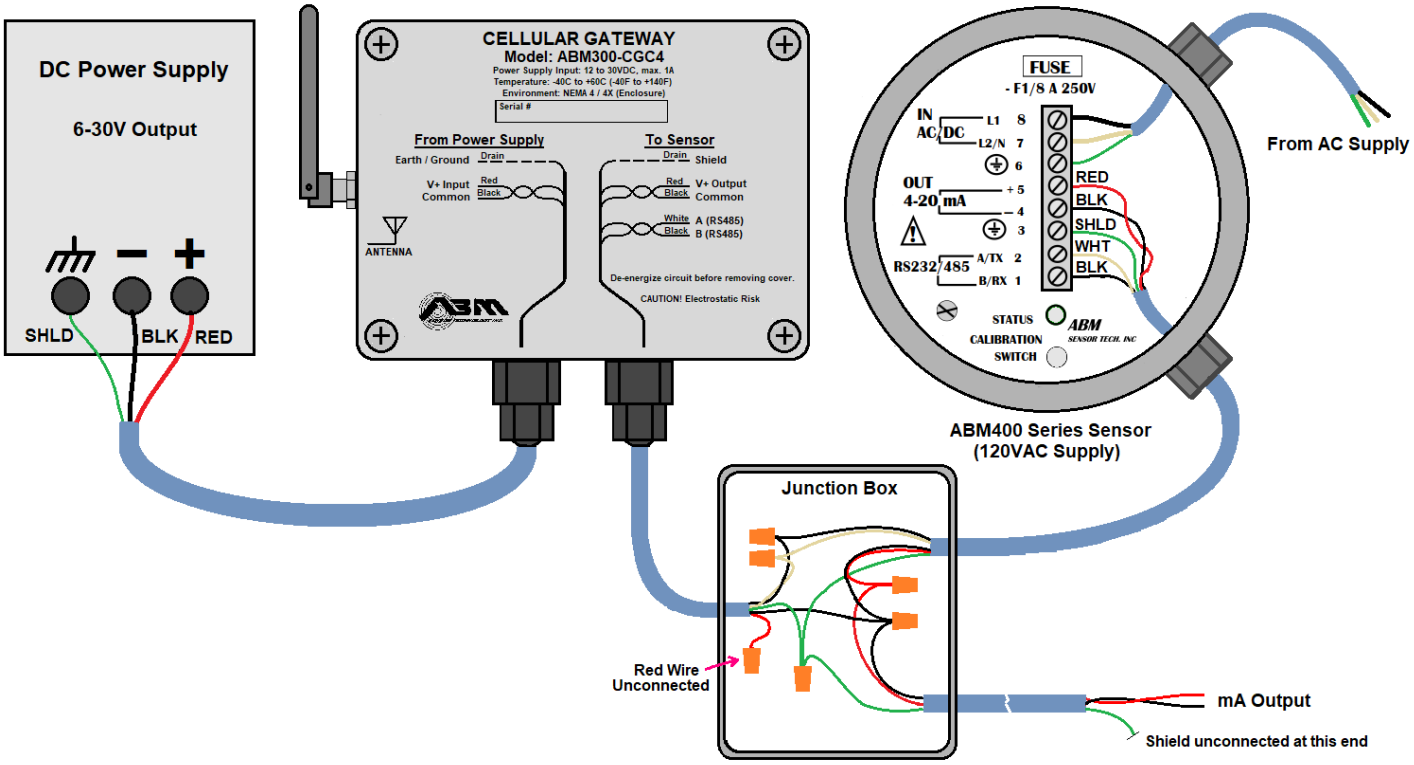

Figure 2 – AC Supply Sensor Connections (With Current Output) Using Junction Box

3. Single DC Powered Sensor

The following example is a variation of the previous two, except that the line-powered DC supply is remotely located and the Gateway does not supply the power to the sensor.

The junction box is required, since there are conductors from three cables that need to be routed to the sensor. In this case, the Gateway supply output pair (red/black) is not connected.

Note that the common (black wire) of the Gateway supply cable is internally connected to the common of the Gateway sensor cable (black of the red/black pair). Only one of these should be connected for signal common.

This example illustrates the case where the sensor body is not providing an earth-ground connection, so the shield wire must be connected to Terminal 3 in the sensor. This may occur if the sensor is mounted on a non-metallic tank or uses a sensor aiming mount that electrically insulates the housing from earth-ground.

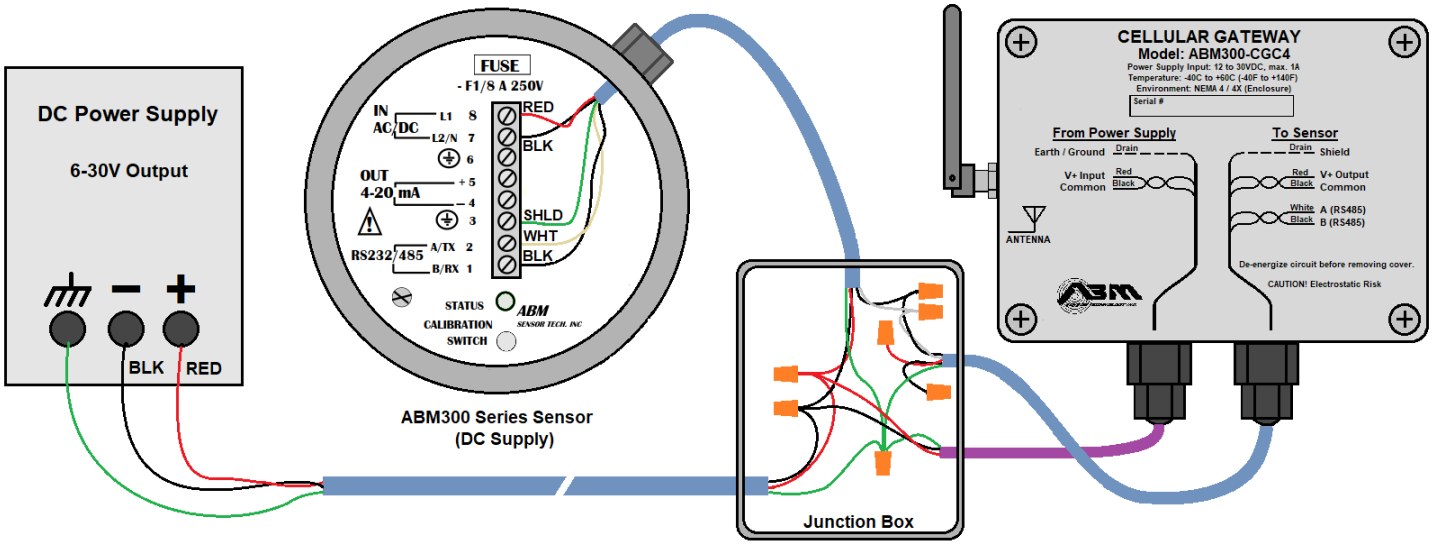

Figure 3 – Simple DC Sensor Connections (No Current Output)

Note that if the DC power supply is located at a significant distance, and the junction box has an available earth-ground connection much closer to the Gateway and sensor, it may be more desirable to ground the shield wire at the junction box instead of at the power supply.

Over long distances with multiple RS485 connections, it is preferred to earth-ground the shield at one end or the other. There are exceptions, of course, depending on the total length of the cable, proximity of electrical noise sources (such as motors) and the quality of the grounding connection available. For instance, a sensor grounded through a metal tank mounted on dry ground may not be as effective as a connection to the earth-ground from the AC line supply (as in Figure 2) – the latter typically implemented with a buried grounding rod or plate.

4. Multiple DC Powered Sensors

The following example shows the Gateway wired to control multiple sensors.

As shown, the lower sensor is grounded through its metal housing, so the shield wire should not connect to either Terminals 3 or 6 in that sensor. However, the shield wire is connected to the upper (isolated) sensor.

In multiple sensor configurations powered by the Gateway, the voltage of the power supply must be adequate to be able to meet the load requirements (see section "B – Requirements - Power Supply" above).

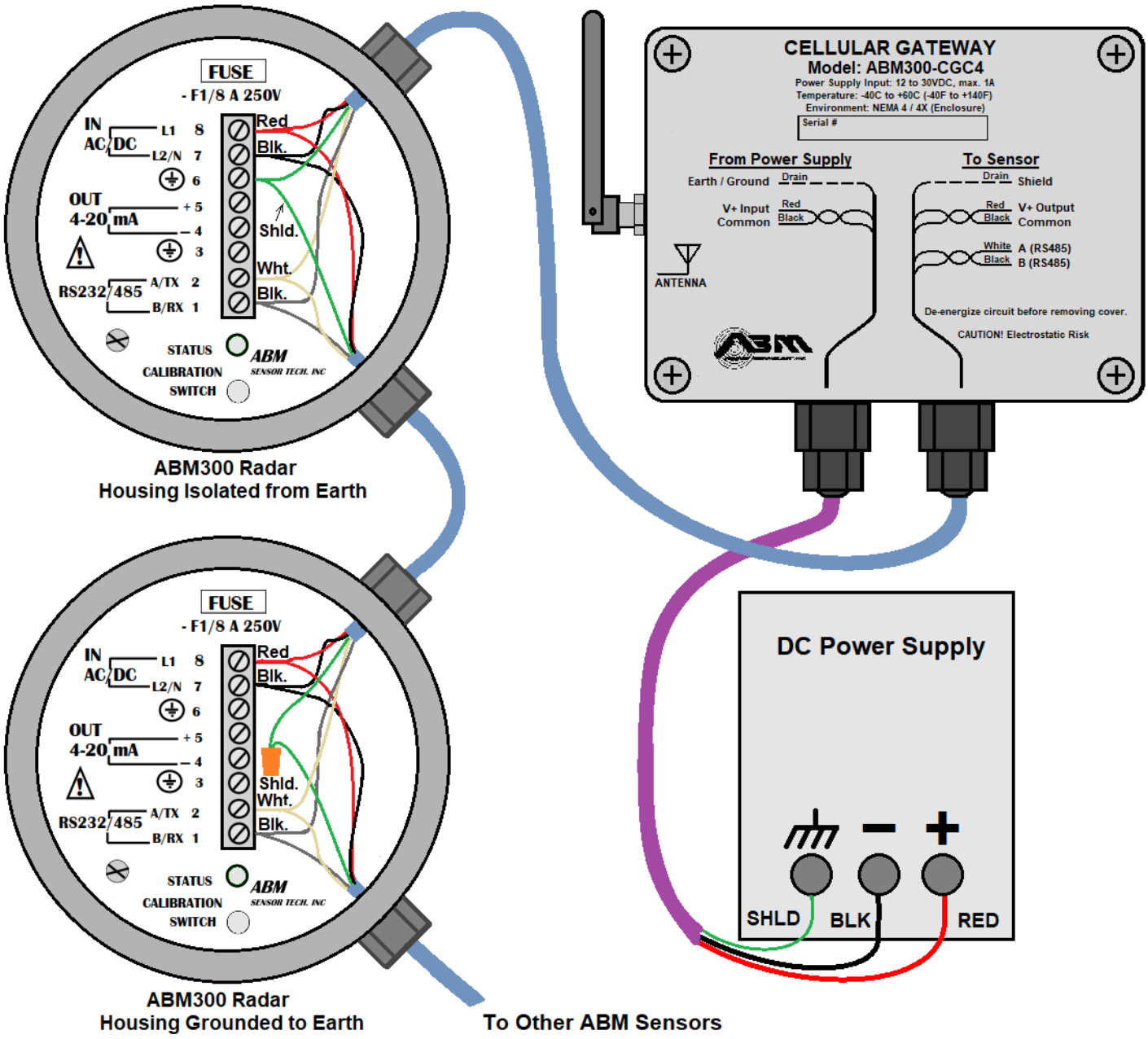

Figure 4 – Multiple DC Sensor Connections - Shield Earth-Grounded at Power Supply

5. Multiple DC Powered Sensors

The following example shows the Gateway wired to multiple sensors, each with a current loop output to the PLC.

As they are all DC version sensors, they are powered directly from the 24Vdc supply. It is shown as a separate power supply, but one could use a 24Vdc supply from the PLC instead. In either case, the Sensor Supply output from the Gateway is not connected in this example.

Note that all three sensors are shown as being isolated from earth/ground at their tanks, so the shield is grounded at the power supply.

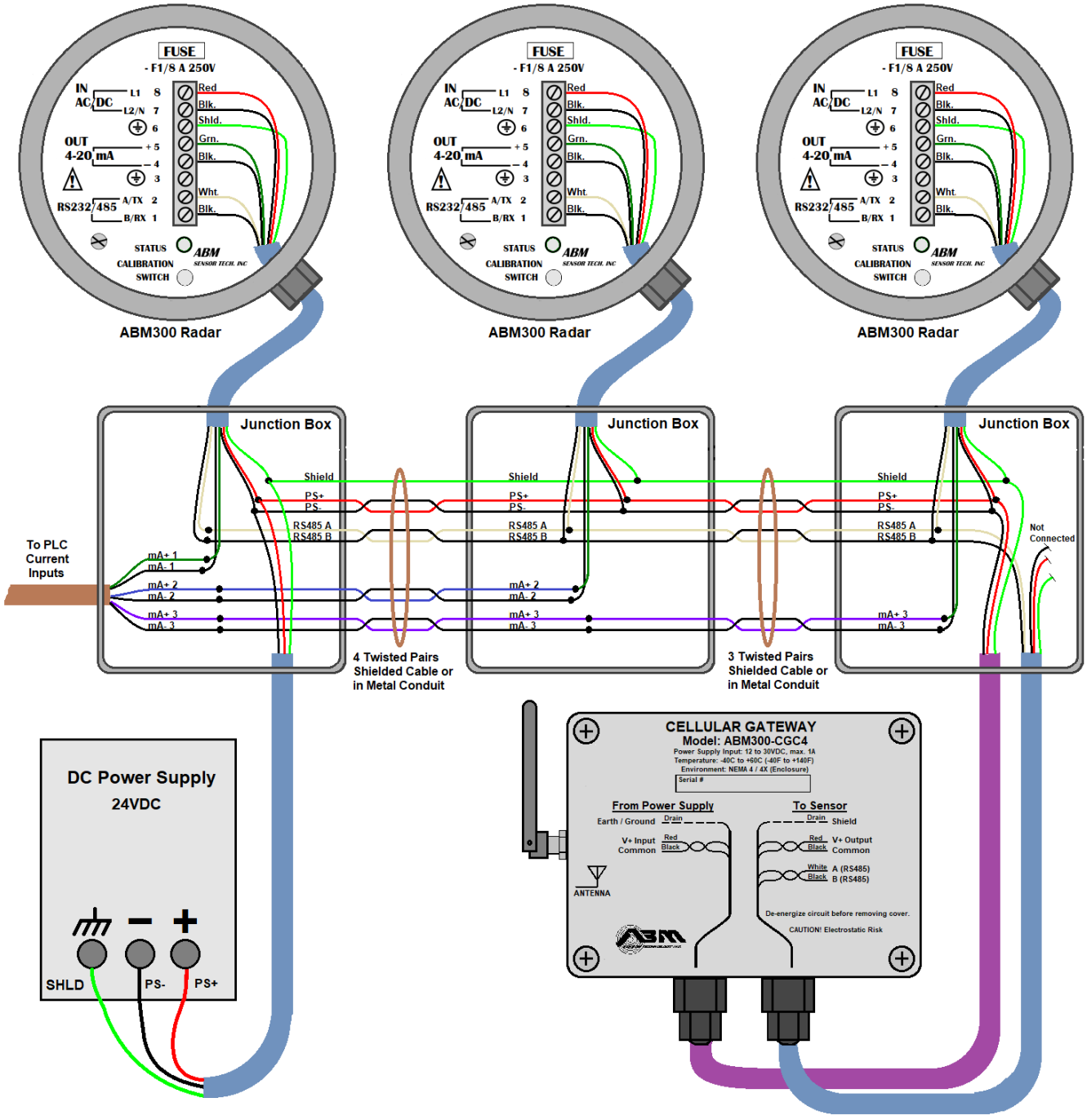

Figure 5 – Multiple DC Sensors with Current Outputs

E - Appendix

Following is a list of ABM sensors that are compatible for use with the Gateway.

- DC Radar: **ABM300-xxx*YY*C4** series:
  - may be indirectly earth-grounded through its mounting configuration (caution required re: shield wire)
  - may be powered from the Gateway sensor power output

- AC Radar: **ABM400-xxx*YY*C4** series and **ABM430-xxx*YY*C4** series:
  - should be earth-grounded through its AC supply (do not connect shield wire)
  - cannot be powered from the Gateway

where xxx = any one of: 017, 033, 050, 100, 140, 240 or 340
and where *YY* = any one of: R2, R5, R6, R2R7 or R6R2