DAB-84

Analogue and Digital Data Acquisition and Reproduction Card

Wiring Instructions

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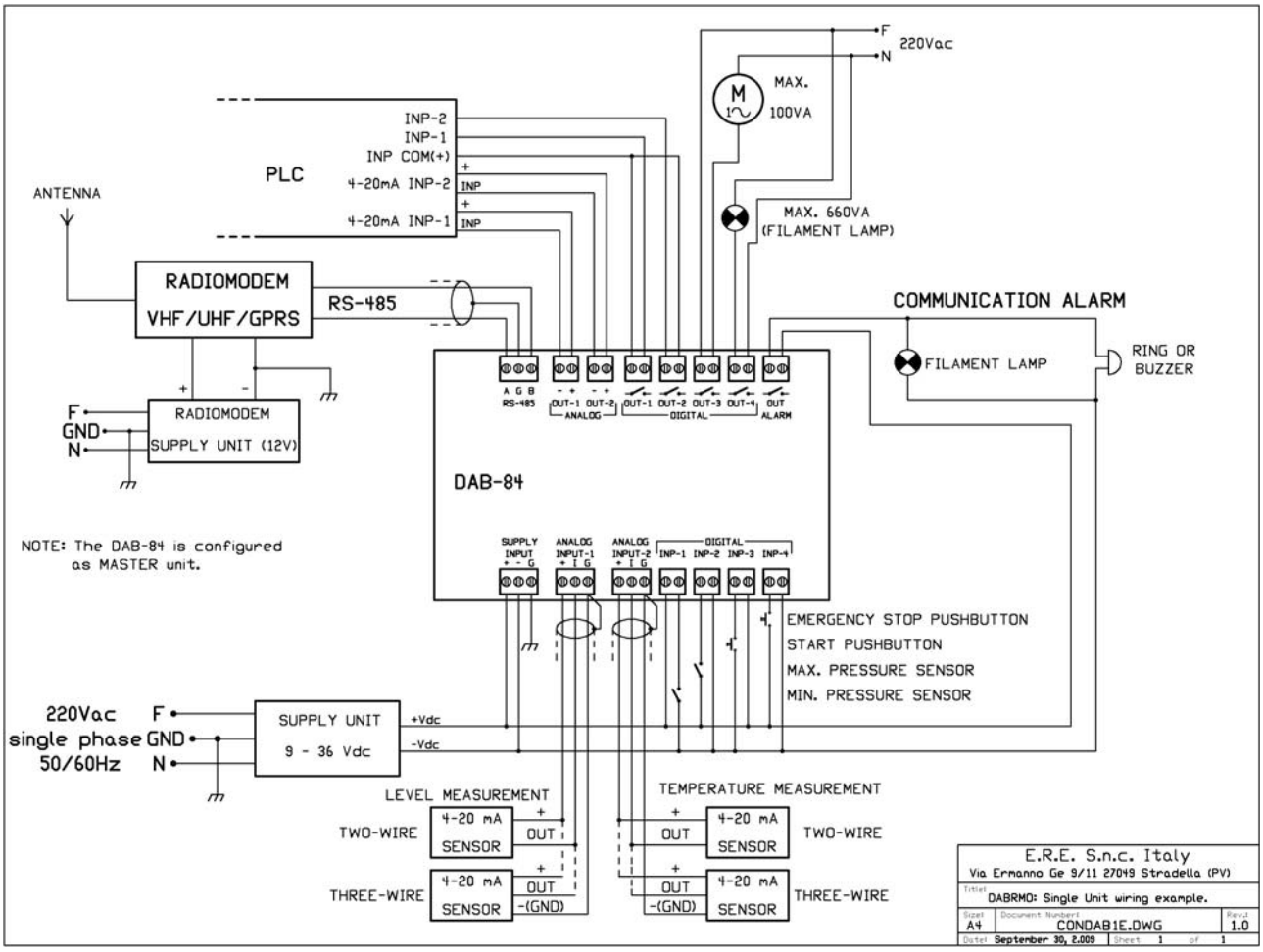
1.0 General Information.

The **DAB-84** card is characterised by a series of a screw connectors for all the supply, digital inputs and outputs, analogue inputs and outputs wire connections.
On the right and left sides of the chassis, three **flat-cable holder** are present to permit the connection between the **Master** and the **Expansion** cards or between the **Master** and the **Auxiliary** card.
The following Fig. 1 shown the typical wiring of a single DAB-84 card in a remote control/metering system. In this case the card is **configured as Master unit**, using the lateral **Master/Expansion Jumper** as explained in the Instruction Manual.

Fig. 1: Example of wiring of a single card DAB-84 configured as Master Unit.



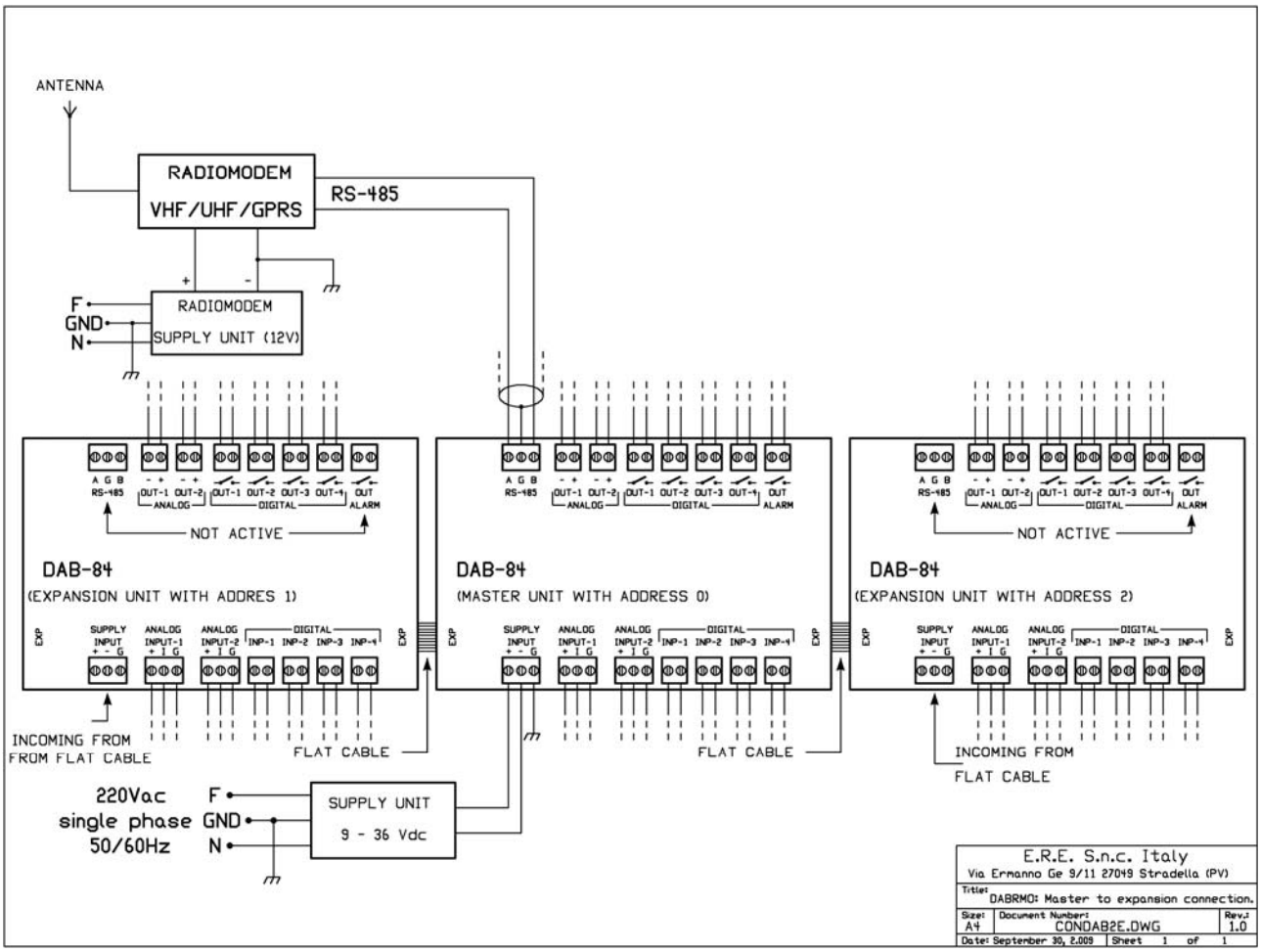
2.0 Supply and Digital Inputs and Outputs wiring.

In this chapter will be examined the supply connection and the digital inputs and outputs connections, including the **RS-485 Serial Port** wiring.

2.1.0 Supply connection.

The DAB-84 card requires a **direct current supply** in the **8 – 36 Vdc range**, with a consumption of about **500 mA** with the **negative pole** connected to the **metallic chassis**. Both the chassis and the negative pole must be connected to **ground (earth)**. The **3-poles** screw connector simplifies the wiring connecting each wire to the related pole.
The external supply unit can deliver the required current and may be a linear or switching model. In this case, a well shielded model **must be used**, especially in conjunction with a Radiomodem, to minimise the risk of an interference in the radiocommunication. A supply unit, completely closed in a metallic box, is generally adequate. If a system contains more than one DAB-84 card, the supply unit must deliver the total amount of required current that is the total current absorption of the DAB-84 cards more the current of every other loads connected.
The **expansion cards** receive the supply through the same **flat-cable** used for the data communication between the cards, to simplify the system wiring, as shown in the next Figure 2 on page 3.

Fig.2: Simplified example of interconnection between a Master unit with two Expansion units.



NOTE: Radiomodems, especially of medium or high power, generally require a **12Vdc supply** because the internal RF components do not support higher voltage, so may be necessary an other supply unit to energise the radiomodem. In this case the negative poles of the radiomodem and of the DAB-84 supplies **must be connected together** to avoid difference in the reference potential between radiomodem and data acquisition card, as explained in the § 2.1.4.

2.1.1 Digital Inputs connection.

The digital inputs accept **both alternate and direct current**, so isn't necessary to respect the connection polarity.

Each input is **completely insulated** from the others and from ground, be equivalent to a **resistive impedance** of **2 kΩ** and can accept input voltages from **5** to **24 Vac/Vdc**. The insulation between each input and the common ground is of **40 Vac/Vdc**. The current consumption varies linearly with the applied voltage from **2.5** to **12 mA**, so each input can be driven by an **electro-mechanical** contact, such as relays, microswitches and so on, or by **electronic devices** such as **line drivers**, **open-collector** transistors or **open-drain** Mosfets. The lower limit of the AC frequency is **50 Hz** and an internal smoothing filter delete the "passages across the 0" of the optocouplers, so the AC-driven input is completely equivalent to a DC-driven input.

2.1.2 Digital Outputs connection.

The digital outputs are realised by the **Normally Open contact** of a relay. Each output is **completely indipendent** from the others and the insulation between the output and the ground is equal to **250 Vac** or **350 Vdc**. A **275 Vac Varistor (VDR)** is placed across the relay contact, to avoid the arcing during the contact opening with an inductive load.

The maximum current flowing in the output depends on the load typology. A resistive load, as a filament lamp, a heating resistor and so on, allows the maximum contact current while an inductive load as motors, fluorescent lamps and tele-breakers reduces it. A single phase "squirrel-cage" asynchronous motor may be switched by the digital output only if its power is less than **100 VA**, to avoid the contact gluing due to the high starting current of the motor.

2.1.3 . **Practical advice for supply and digital input/outputs connections**.

It's a good practice to make all electrical connections with a wire section equals or higher to the minimum required by the electrical directives on the panel construction. In particular the supply connection must have an wire gauge adequate to the total current consumption. It's important to notice as a long supply cable introduces a considerable voltage drop, that is variable under the current consumption, and, especially at the lower supply voltage, this drop may reduce the available supply voltage below the minimum of 8 Vdc.

All screw connectors accept up to **14 AWG Stranded** cable, or up to **12 AWG Solid** cable, and using the stranded one, it's important to use the proper terminals, to avoid any problems of short circuits between contacts and/or the ground.

2.1.4 RS-485 Serial Port connection.

This serial port uses a 3 poles screw connector for the **"A"** and **"B"** lines and for the **ground.** Both the A and B lines are referred to the ground, and the voltage between each line an the ground **must not exceed** the value shown in the § 2.0.1 of the user manual, to avoid the interface chip destruction.

Theoretically the RS-485 serial line requires only **two cable** but, because in the majority of the applications, the interface circuits are **not insulated** from the ground it's important to carry the ground wire between the users to uniform the reference potential. This is particularly important for long lines where the various users are fed with separate supply units. In the utilisation with a Radiomodem, generally it is into the same panel of the DAB-84 card, so the connection between the two negative poles of the supply unit is enough to avoid differences between the two serial port references. If the radiomodem and its supply unit are in another panel, a third "ground wire" is necessary for the connection between the two negative poles.

The communication speed is of **9,600 bps** and, generally, it's not necessary connect the **120 Ω terminal resistors** on both sides of the serial line. These may be necessary if the serial line is very long.

If the whole system is placed in a noisy environment, may be necessary to use a **shielded cable** to connect the serial line. Using this cable, its **shielding braid must be connected** to ground **only on one side** of the cable, to avoid any current flow in the shield. In this mode the shielding braid remains **equipotential**, achieving the maximum shielding effect. If the "ground wire" is required, the shielded cable **must be tri-polar**, using one of the three inner cable for the ground connection, while the shielding braid must be connected to ground as above specified.

3.0 Analogue Inputs and Outputs wiring.

In this section will be examined the connection to the Analogue Inputs and Outputs, both realised using the **4-20 mA** standard, the most used system, in industrial environment, to connect remote sensors to the data acquisition/conversion card for the many advantages in terms of practicality and reliability.

3.1.0 Analogue Inputs connection.

Both analogue inputs are designed for the connection with a 4 –20mA remote sensor, using a **two-wire** or a **three-wire** system. In the first case the sensor is **self-energised** while in the second it receive the supply through a supplementary wire.

The analogue input connector is a three-poles screw connector with the following contacts:

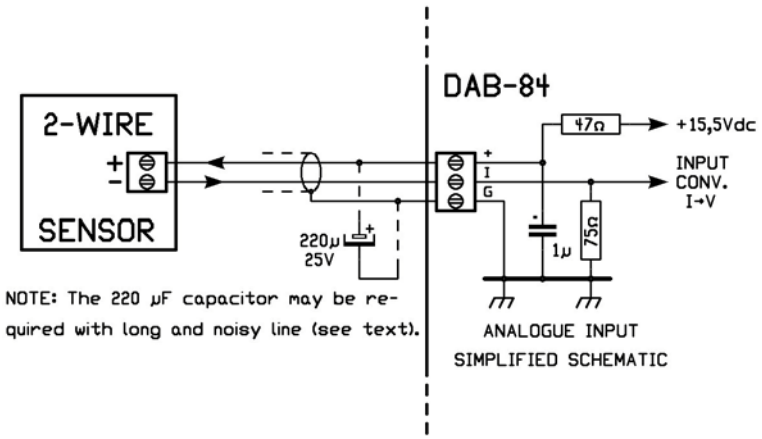
"+" A **Supply output** for the sensor energising in both two or three wire systems.

"I" The **Current Input** of the analogue **4-20 mA** signal, connected to **ground** through a **75 Ω 1%** precision resistor.

"G" The **Ground connection** for the negative pole of the sensor supply in the three-wire systems.

The wiring schemes for the two-wire sensors and for three-wire ones are shown in the following Figure 3 and Figure 4 on page 5.

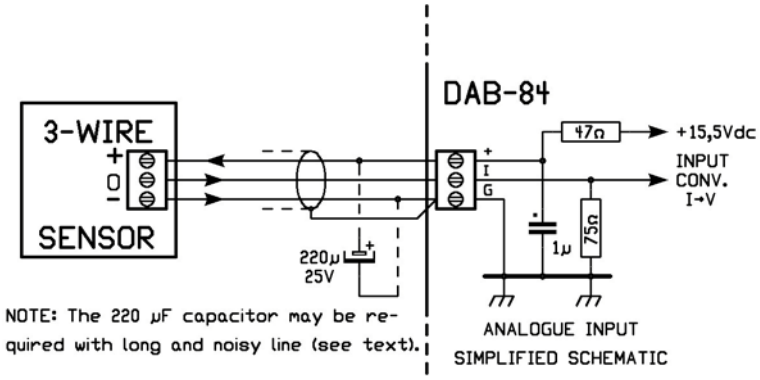
Figure 3: Wiring of a two-wire analogue sensor.



As appears on the above and following figures the positive supply available at the **"+"** connection is derived from a **stabilized supply voltage** of **15.5 ± 0.2 Vdc** through a resistor of **47 Ω** making a low-pass filter with the **1 µF** capacitor to minimise any noise in the supply line. An **external** electrolytic **polarised** capacitor of **220 µF 25V,** connected between the **"+"** and **"G"** terminals, may be necessary, if the line is very long and if a high noise is present. The **current to voltage converter** is characterised by an internal low-pass filter, to reduce the received noise.

The low current consumption of the sensors, generally less than 50 mA, causes a low voltage drop across the supply resistor so the available supply voltage does not fall below 12,90 Vdc.

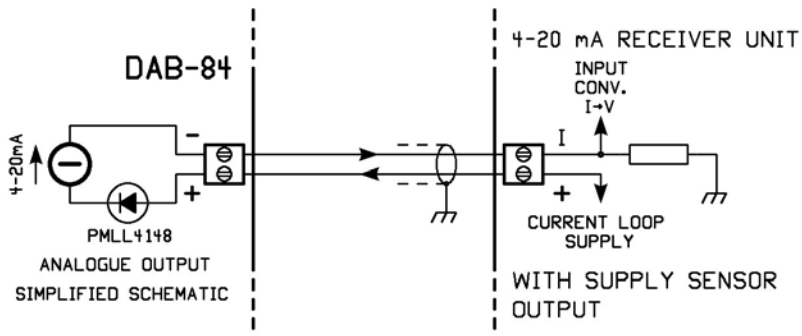
Figure 4: Wiring of a three-wire analogue sensor.



The input low resistance causes a **1.5 Vdc ±1% voltage drop**, so the total available supply voltage for the remote sensor does not fall under 11.40 Vdc. This supply voltage is generally sufficient to ensure a normal operating condition of the sensor.
If the line length is high, may be necessary use a **shielded cable** as explained for the RS-485 serial port connection.
As a general rule it's important to avoid an excessive closeness between the **main power lines** and any **analogue signal lines** because the high magnetic field created by the power lines generates, into the analogue signal lines, an important level of AC noise that may be difficult to eliminate. Theoretically to minimise this magnetic field, the power line wires **must be interlaced** with a **constant interlacement pitch**, so the magnetic field created by each conductor is compensated by the other ones.
The wire section may be small, because the current intensity is very small.
The line length depends on the maximum voltage drop admissible on the line. For example, using a two-wire AWG 25 shielded cable, and a two-wire sensor with an internal voltage drop of 9 Vdc, the maximum line length is of **556 m** or **607 yd** while, using, in the same operating conditions, a two-wire AWG 23 shielded cable, the maximum length increases up to **887 m** or **970 yd**.

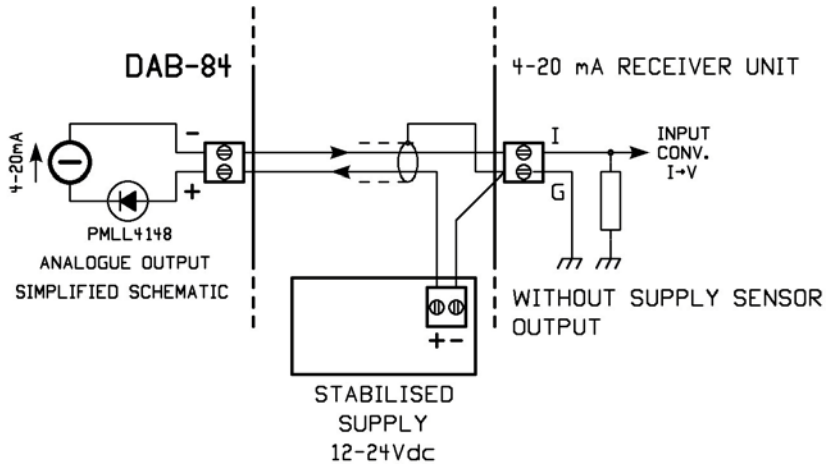
3.1.1 Analogue Outputs connection.
Both the analogue outputs simulate a **two-wire** sensor that recovers its supply from the current loop. The **minimum voltage drop** of these analogue outputs, to assure stable operation, is of **8 Vdc** so that the required minimum supply voltage of the current loop, depending on line and receiver input drops, varies from **11** to **14 Vdc**.
The following Figures 5 and 6 shows the wiring schemes to connect these outputs to the analogue inputs of an acquisition card on PC or PLC with the possible variation on the current loop supply methods. In Figure 5 the loop supply is derived from the receiver input, as in our DAB-84, while in the Figure 6 on page 6 an external supply unit is required.
The simplest solution is, of course, the one shown in Figure 5.

Figure 5: Analogue Outputs wiring with current loop supply delivered by the Receiver unit.



The current loop supply voltage in both cases must be sufficient to ensure a normal operation of the DAB-84 analogue outputs. Generally a minimum supply voltage of 11 Vdc is required and, if the supply voltage delivered by the receiver unit is lower, an external supply is required, as shown in the Figure 6.
If the supply unit feeding the DAB-84 card is stabilised and noiseless, this may be used to supply the current loop, according to the scheme of Figure 6.

Fig. 6: Analogue outputs wiring with external supply unit for current loop.



If a shielded cable is required, the same considerations on the shielding braid connections explained in the serial port connection, are applicable to the analogue outputs wiring.