Jomitek Power & Interface box for the Lightning Sensor & Analyzer (LSA)

- User manual -

- Updated March 22, 2019 -

Contents

1 Introduction to the Power & Interface box for the LSA

1.1 Power & Interface box overview

The Power & Interface box for the Jomitek LSA , in short Interface box , adds two primary supporting capabilities to the functionality of the Jomitek Lightning Sensor & Analyzer.

- Uninterruptible power supply (UPS) / multiple power supply sources
- Alarm relay interfacing including manual alarm handling

The LSA may be used without the Interface box , however in this case it will only report lightning alarms via Ethernet communication (see LSA manual), and with no inherent UPS capability. Note, that if the Interface box is not used, it is strongly recommended to ensure UPS capability, as lightning strikes may otherwise interrupt the power supply to the LSA at the critical time of lightning strike recording. This may as an example be accommodated by ensuring battery backup supply for the PoE switch or injector supplying power to the LSA.

The alarm relay interfacing including manual alarm handling ensures full backward compatibility with the output and configuration options of the Jomitek Classical Lightning Sensor.

For the latest documentation, please visit the Power & Interface box for the Jomitek LSA support web site at http://jomitek.dk/en/support/lsa

1.2 Quick start guide

Note that any turbine vendor specification for exact placement, installation and test procedures must be followed, and superseeds below steps. The RJ45 connectors used must be a match for the IP67 receptable of the Interface box (see fig. 1). Otherwise the device IP rating is degraded to IP22, which implies a tightly controlled environment must be ensured in terms of dust and moisture levels throughout the operational lifetime. When the RJ45 connectors are not in use, they must be sealed with matched blind plugs.

Figure 1: Connectors at the bottom of the Interface box .

Installation

1. Attach the Interface box to a DIN rail inside the wind turbine.
2. Connect an external power supply using either 230VAC via an IEC C13 connector, or a DC power supply in the range 12-24VDC using the included M12 8-pole connector, or using PoE on the RJ45 connector marked 'Ethernet Control'. Multiple power supplies may be connected at the same time, enabling added power redundancy.

3. Unscrew the lid on the battery compartment. Insert the 2-pole pin on the battery into the matched 2-pole receptacle inside the battery compartment, and slide the now connected battery back into the compartment. Close the lid securely. See fig. 2
4. Connect the RJ45 connector marked 'Ethernet Sensor' with the LSA RJ45 connector.

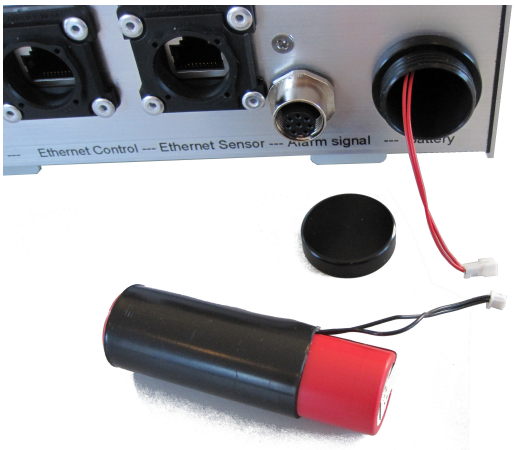

Figure 2: Connection of the battery.

Front panel LED indications

- 'Battery Charging' will light red, when the battery is charging, and green when fully charged.
- 'DC Power In' will light green, when an active DC supply is detected.
- 'PoE Power Out' will light green, when the PoE supply to the LSA is active.
- '230V AC Power In' will light green, when the 230V AC supply is detected.
- 'Lightning Alarm' will light red, when a lightning alarm is active.

Figure 3: Frontpanal buttons and LED indicators.

If relay signalling of power and lightning alarm is used, note that the steps below where alarms are raised and cleared, should also be verified with the wind turbine SCADA (Supervisory Control and Data Acquisition) receiving the respective alarms.

Testing

- If any equipment is configured to receive a power alarm, test the power alarm by pressing the 'Test Power Alarm' button on the front panel. The alarm is only raised as long as the button is pushed.
- Press both buttons marked 'Test Lightning Alarm' for more than 5 seconds to generate a lightning alarm. The alarm is cleared when either of the buttons are released again.

1.3 Interface options and requirements

The Interface box features 4 physical interfaces at the bottom of the box, of which at least 2 must be used during normal operation. These 2 are the RJ45 connection to the sensor, and either of the interfaces delivering external power supply. Starting from the left hand side, see 1, an IEC C13 connector may be used to feed power via a 230VAC mains supply. The 2nd interface from the left is an IP67 rated Ethernet connector, which may be used as PoE power supply input and/or Ethernet communication with the LSA. The 3rd interface is another RJ45 connector, physically similar to the 2nd interface, going to the LSA, which features both power supply, relay signalling and Ethernet communication to and from the LSA. The last interface is an M12 8-pole connector, which may be used for relay signal connectivity to e.g. a wind turbine control system, and/or it may be used to provide a DC power supply within the range 12-24V.

The abovementioned connectivity options are illustrated in 4.

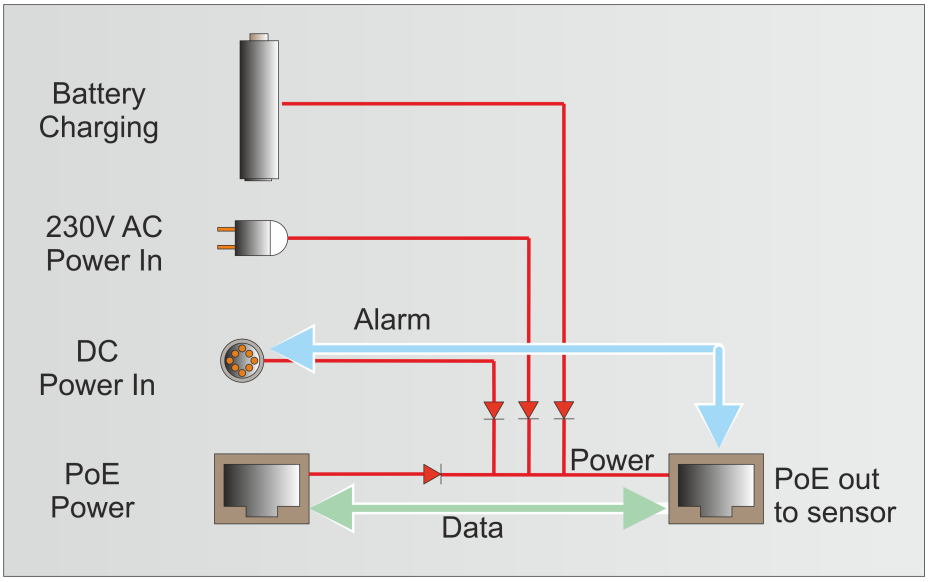

Figure 4: Connectivity options for the Interface box . Red illustrates power supply sources, blue is relay signalling for receiving and clearing alarms, and green is Ethernet communication. Note that the battery is integrated in the Interface box .

2 Installation and system integration

Below description extends the information in section 1.2, which must be read before continuing.

2.1 Box mounting

The DIN rail which the Interface box is mounted on must be horizontally oriented, and placed such that the connectors of the box is pointing downwards. Ensure sufficient distance below the box, to avoid critical bending of cables (see the following).

2.2 Cable routing

All cables going to and from the Interface box must follow the turbine vendor installation specifications, and as a minimum ensure good mounting practices, including:

- Any cable bend must ensure a minimum radius of 5cm
- The cables must be placed in protected guides
- Ethernet cables should not be placed in immediate contact with AC power cables. As a rule of thumb, keep at least 5cm separation
- Ensure that vibrations, moving parts, and similar will not allow the cable shielding to be compromised, e.g. by having grates at the end of a protection pipe, where the cable bends close to the grates
- On the outside of the wind turbine, it should be considered to guide the cable in a protective pipe fastened with rubber coated magnets, allowing for simplified mounting

2.3 Default cable kit

The Interface box should be ordered with a cable kit, including the following (custom cable kits available on request):

- 1x 5m IP67-to-IP20 Ethernet cable, for connection to a turbine control router/switch, or a cellular or radio modem. See fig. 5
- 1x 15m IP67-to-IP67 Ethernet cable, for connection between the Interface box and the LSA
- 1x 3m 8-pole M12 connector with no connector at the other end (blank wires). See fig. 6
- 1x IEC C13 connector with mains connector relevant for the sales region (e.g. C13EU)

Figure 5: 5m IP67-to-IP20 Ethernet cable

Figure 6: 1x 3m 8-pole M12 connector

Note that the RJ45 IP67 connector to the LSA requires a 40mm wide opening to the outside of the wind turbine. As an alternative only 5mm is required, if the connector is assembled on-site.

2.4 Relay signal and DC power interfacing

The far end of the 8-pole connector (blank wires), must be connected according to the following specification:

1. WHITE - Power Failure Relay pin A
2. BROWN - Power Failure Relay pin B
3. GREEN - Alarm Reset (-)
4. YELLOW - Alarm Reset (+)
5. GREY - Lightning Alarm Relay pin A
6. PINK - Lightning Alarm Relay pin B
7. BLUE - DC Supply (+/-)
8. RED - DC Supply (-/+)

2.5 Relay signal interfacing

As a reference design for interfacing relay signals to a wind turbine control computer, using a button/switch for clearing of lightning alarm, please see fig. 7. For interfacing including visual LED indication, and digital clearing of lightning alarm, please see fig. 8.

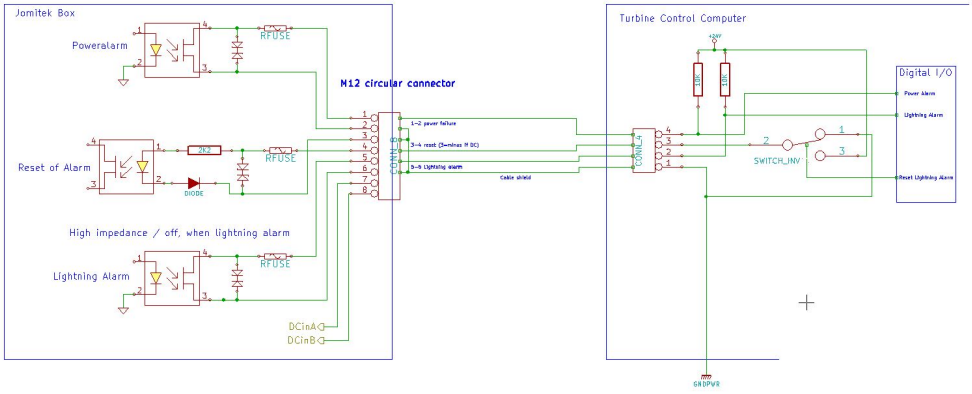

Figure 7: Reference design, relay signal interfacing to a control computer/RTU/PLC

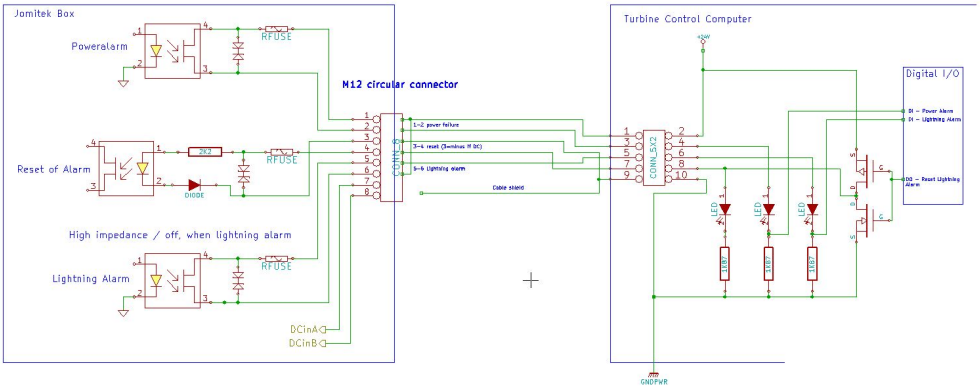

Figure 8: Reference design, relay signal interfacing to a control computer/RTU/PLC, incl. LED signal indication

3 Functional description

3.1 Power prioritization

When multiple external power sources are connected to the Interface box the power draw will be prioritized as follows:

1. PoE (Ethernet Control)
2. 230VAC
3. DC (via M12 8-pole connector)
4. Internal battery backup

All power sources are connected to the same power bus internally, and the next power source in the priority order will instantly be used, should a higher prioritized power source disappear. Note that the priority order has been arranged, such that an external battery backup source in the 12-24V DC range may be supplied via the M12 8-pole connector.

3.2 Alarm trigger criteria

Lightning Alarm

When manually triggering the Lightning Alarm via the buttons on the Interface box , the alarm will be visible via the Lightning Alarm LED on the Interface box , as well as any interface in the wind turbine control configured to receive the state of the relay signal.

A Lightning Alarm originating in the Lightning Sensor & Analyzer may be triggered in two ways:

- An actual lightning event has occured, within the trigger criteria set for the LSA
- A magnetic field test pulse is applied around the LSA box, for an end-to-end test of the operational setup

In both of the mentioned cases, the Lightning Alarm will be represented both as a relay output, and associated data files for the key lightning parameter and time series data will be available via the Ethernet connection to the LSA.

The Lightning Alarm may be cleared via the Lightning Sensor & Analyzer web interface (button at the top of the web page), using the Reset Alarm buttons on the Interface box or via any interface in the wind turbine control configured to clear the Lightning Alarm signal.

Power Alarm

The Power Alarm signal is raised when either of below conditions are met:

- The Test Power Alarm button is actively being pushed
- No external power source supplies power
- The internal battery detects a critically low or high temperature (<-20 or >80 degrees Celcius)

3.3 Internal battery charge and decharging characteristics

The internal battery is configured to charge at a maximum rate of 0.4W, and will take up to 48 hours to fully charge from a depleted SoC. During normal operation it will be trickle-charging when needed from time to time. Whenever it is in a charging state, the Battery Charging LED will be lit red. When external power sources are all missing, the battery will supply power for operation of the Interface box itself, as well as a single connected LSA for at least 2 hours, assuming a fully charged battery.