

Feature ESC Measurements

Remote Site Management

USER GUIDE

PRELIMINARY

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1 Introduction

This document describes the “ESC Measurements” feature of Remote Site Management (RSM) nodes, for example the Ericsson Site Controller (ESC).

1.1 Basic Characteristics

This section describes the basic characteristics of the feature.

Feature identity: FAJ 901 801/1

Optional or Required: Optional

This feature is prerequisite for all other optional features.

The feature requires the “Basic SW” feature, FAJ 901 800/3, to be operational.

1.2 Feature Overview

The “ESC Measurements” feature provides the following functions:

- Access to all ports on the front of the ESC (except burglar alarm ports)
- Alarm handling for all hardware interfaces of the ESC (except the burglar alarm interface)
- AC and DC metering

The functions are described in Section 2 on page 1.

2 Feature Details

This section describes the functions of the feature.

2.1 Analog Measurements

RSM nodes can measure voltage and, with the aid of additional equipment, direct current. Measurements are performed by the A/D input interface, which is

accessible through the ports of the RSM node. The analog input signals of the A/D interface are abbreviated “AD_IN n +” and “AD_IN n –”, where each input pair has an identification number, n .

Ericsson Site Controller Description, Reference [7], provides a technical specification of the A/D interfaces of the ESC.

2.1.1 Voltage Measurements

Voltage measurements, for example across batteries, are made by connecting an analog input pair across relevant circuit points. The RSM node, for example an ESC, can be configured to raise alarms at high and low voltage limits.

Figure 1 shows an ESC that measures the voltage across a 9 V battery. To receive a positive voltage measurement value, the “AD_IN1+” connection point is connected to the 9 V pole and the “AD_IN1–” connection point is connected to the 0 V pole.

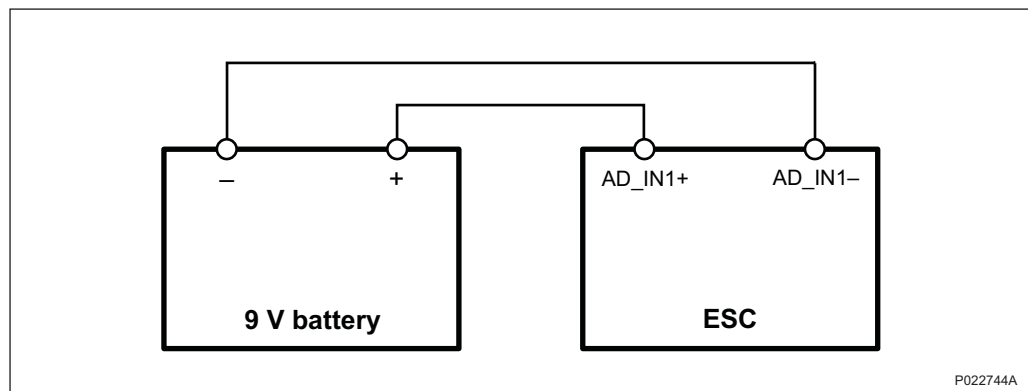


Figure 1 Voltage Measurement of a 9 V Battery

Figure 2 shows an ESC that measures the voltage across a –48 V RBS battery. To receive a negative voltage measurement value, the “AD_IN1+” connection point is connected to the –48 V pole and the “AD_IN1–” connection point is connected to the 0 V pole of the –48 V RBS battery.

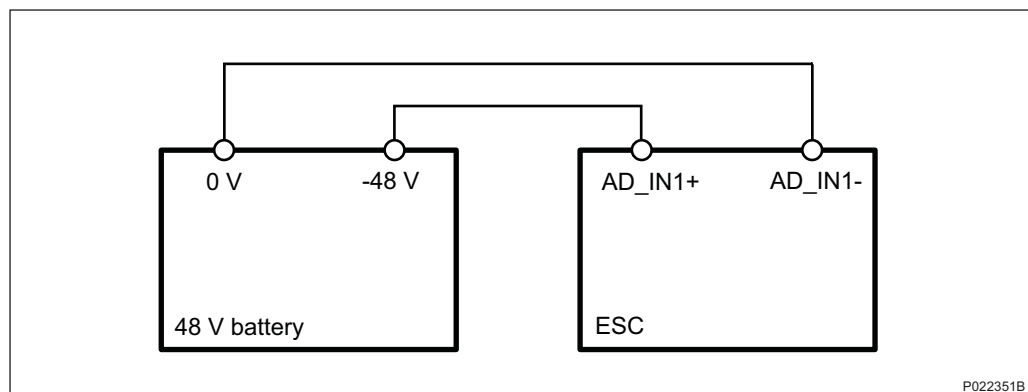


Figure 2 Voltage Measurement of a –48 V RBS Battery



2.1.2

Current Measurements

Sensors that report output values in the form of a direct current are compatible with the analog input interface of an RSM node. Sensors that report the output value by consuming current in proportion to the measured value are also compatible with the analog input interface. The sensor types benefit from the ability to send output signals through long lengths of cable.

As an example, Figure 3 shows a current sensor that is connected to A/D interface of an ESC. The output current of the sensor is converted to a voltage input to the ESC, by using a resistor.

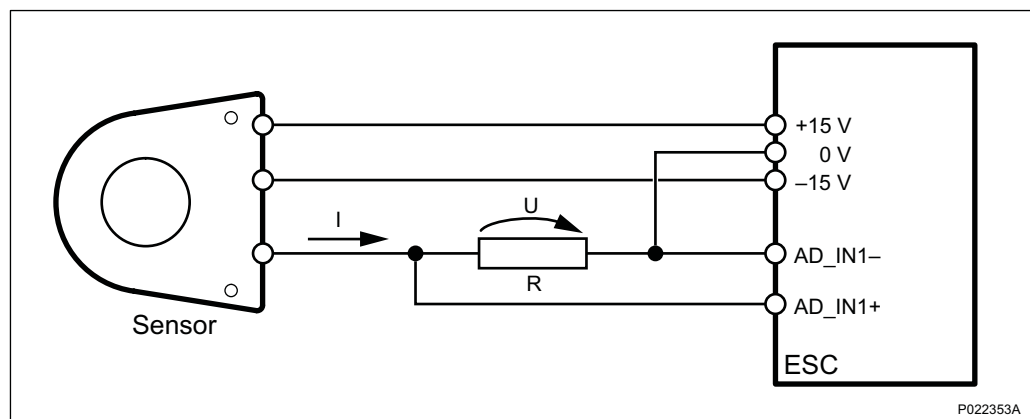


Figure 3 Measurement of Sensor Output Current

The “AD_IN1+” and “AD_IN1–” connection points of the A/D interface measures voltage “U” across the resistor. The voltage shifts when the output from the sensor varies, that is, when current “I” varies. The “AD_IN1–” side of the resistor is connected to the 0 V (ground) port of the ESC power feed, to divert the output current.

Note: To minimize voltage interferences, the cable lengths from the “AD_IN” ports to the resistor must be as short as possible.

Resistance “R” must be calculated to fit the specifications of the sensor. An example of how to calculate the value of the required resistance is described in Section 2.1.2.1 on page 3.

2.1.2.1

Example of Circuit Design for Clamp-On Current Sensor

A current sensor is clamped onto a cable and measures the current through this cable. The output current from this specific sensor is three thousandths (1/3000) of the current through the cable, but is also limited to a maximum of ± 100 mA. The polarity of the measured value depends on the direction of the current. The power feed to the sensor is ± 15 V DC and the output current is estimated to be linear up to an operating voltage of ± 13 V DC.

An appropriate resistor value can be calculated by dividing the maximum operating voltage (that gives an linear current output) by the maximum current output; $13 \text{ [V]} / 0.100 \text{ [A]} = 130 \text{ [\Omega]}$

Also, another sensor operating voltage can be calculated by choosing an appropriate resistance value; $R \text{ [\Omega]} \times 0.100 \text{ [A]} = U \text{ [V]}$.

To make it easier to design the sensor circuit, the calculated resistance can be modified to comply with the E24 or E48 series of resistor values. Because $130 \text{ }\Omega$ is a valid E24 value, no changes are made in this case.

2.2 External Alarm Monitoring and PWM Measurements

The external alarm interface of an RSM node, for example the ESC, is used to determine if external alarms (that is, external circuit loops) are open or closed. The RSM node can be configured to raise an alarm when a circuit opens or closes.

External alarm circuit loops can be designed by using the following trigger types:

- Relay switches, as described in Section 2.2.1 on page 4
- Open collector drivers, as described in Section 2.2.2 on page 5

Some of the external alarm input ports can measure Pulse-Width Modulation (PWM) signals, as described in Section 2.2.3 on page 6.

2.2.1 Monitoring of Relay Switches

Using relay switches, connections are made to connector pairs in the external alarms connector on the RSM node. These are designated 1P and 1N, 2P and 2N, and so on. There is no requirement to connect the external alarms in any predefined order.

The 1P connector is supplied with +12 V DC and the 1N connector with –12 V DC, see Figure 4.

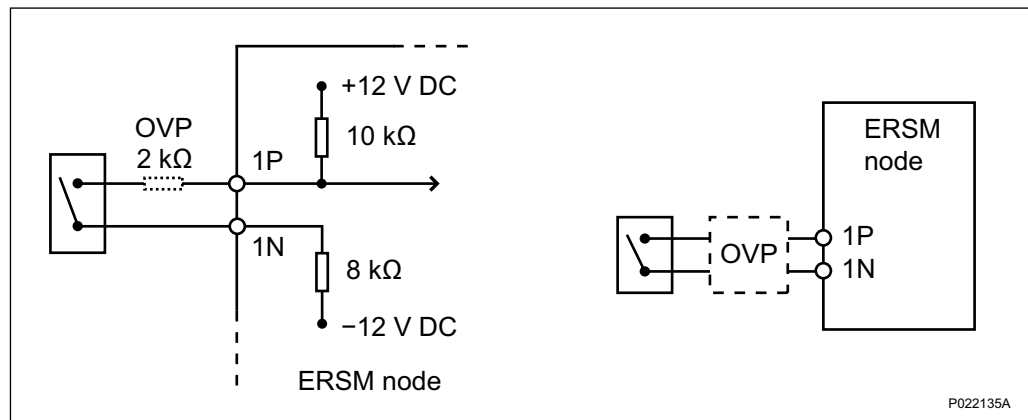


Figure 4 Connecting External Alarms with Relay Switch and Optional OVP Module

When the relay switch is closed, the current through the external alarm circuit is 1.0 mA to 1.4 mA. When the switch closes and opens, a small spark burns off any possible oxide on the contacts to keep the contact surfaces clean. This method is called relay wetting.

When the relay switch is open, the RSM node senses that the voltage on the 1P connector is +12 V DC.

When the relay switch is closed, the RSM node senses that the voltage on the 1P connector drops below +1.0 V DC. This is registered as an external alarm.

Optionally, the relay switch can be connected to the RSM node through an OVP module with 2 kΩ internal resistance.

The control of the relay switch is designed by the customer. All monitored relays must be potential free contacts, as shown in Figure 5.

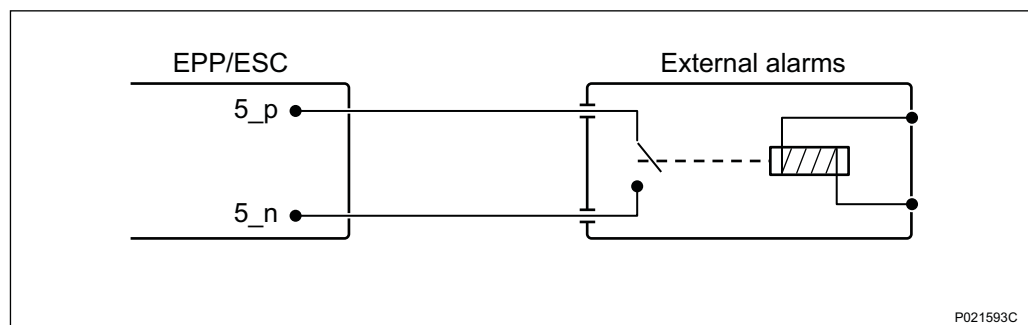


Figure 5 External Alarms

2.2.2

Monitoring of Open Collector Drivers

Using open collector drivers, connections are made to connector pairs in the external alarms connector on the RSM node. These are designated 1P and

GND, 2P and GND, and so on. There is no requirement to connect the external alarms in any predefined order.

The connection of external alarms using open collector drivers is shown in Figure 6.

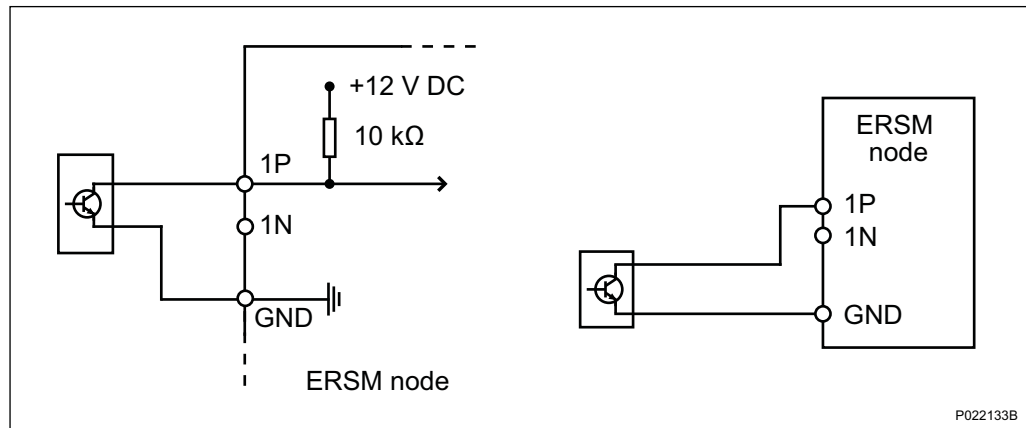


Figure 6 Connecting External Alarms with Open Collector Driver

When the open collector driver is inactive, the RSM node senses that the voltage on the 1P connector is +12 V DC.

When the open collector driver is active, the RSM node senses that the voltage on the 1P connector drops below +1.0 V DC. This is registered as an external alarm.

The control of the open collector driver is designed by the customer.

Note: An open collector driver cannot be connected to the RSM node through an OVP. Therefore, external alarms using open collector drivers must not be installed at locations that are at risk of being exposed to overvoltage.

2.2.3

PWM Measurements

The ESC is able to measure pulse-width modulation signals.

The duty cycle (D) describes the proportion between the time the voltage is “high” (x) and the whole period (y). $D = x/y$, see Figure 7. It is possible to set a high and low duty cycle threshold. The trigger threshold is 1.09 V. It is also possible to set a high and low frequency threshold.

The high “H” and low “L” time in the duty cycle is measured with 1μs accuracy, see Figure 7. It is possible to measure PWM signals down to 1Hz.

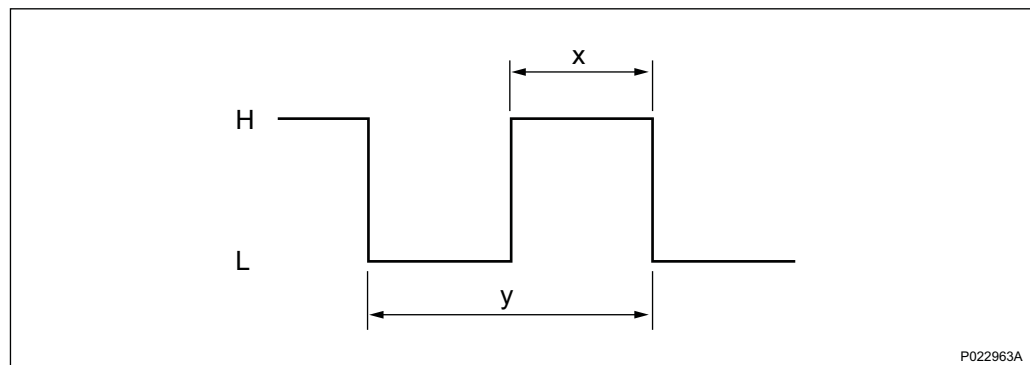


Figure 7 Pulse-width Modulation

Ericsson Site Controller Description, Reference [7], includes a technical specification of the PWM interface of the ESC.

2.3 Relay and Open Collector Outputs

The relay or open collector outputs of RSM nodes serve as switches and enable remote control of site equipment. The relay outputs retain their on-off status at a power failure and the open collector outputs do not retain their on-off status at a power failure.

Ericsson Site Controller Description, Reference [7], includes a technical specification of the relay and open collector output interfaces of the ESC.

2.3.1 Relay Outputs

The relay output serves as a switch that can be remotely controlled. The relay output signals of the port interface are abbreviated “Relay_+” and “Relay_–”, where each signal pair has an identification number, “n”.

Note: Do not exceed the voltage and current limits of the relay output interface, which are specified in *Ericsson Site Controller Description*.

Figure 8 shows a site solution in which the relay output of an ESC controls a 230 V AC relay of an AC load.

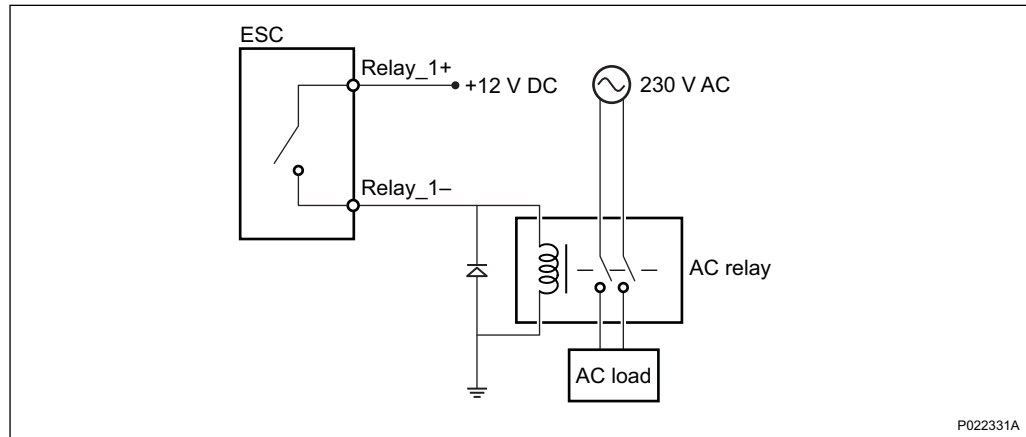


Figure 8 Remote Control of AC Relay

The relay outputs of an RSM node are bi-stable, meaning that they retain their on-off status when the node is turned off. Because the controlled circuit forms a loop that is separate from the node, the ground potential of the circuit is not required to equal the ground potential of the node.

2.3.2 Open Collector Outputs

The open collector output serves as a switch that can be remotely controlled. The open collector output signals of the port interface are abbreviated OpenC_*n*, where each output signal has an identification number, *n*.

Note: Do not exceed the voltage and current input limits of the open collector interface, which are specified in *Ericsson Site Controller Description*.

Figure 9 shows a site solution in which an open collector output controls an example load.

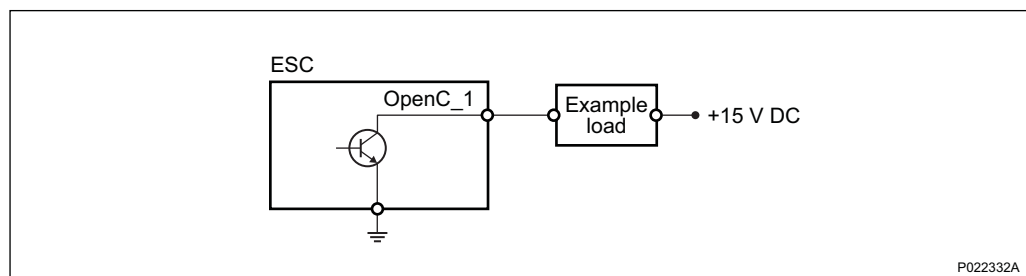


Figure 9 Remote Control of Example Load

When the output port is activated, the open collector output closes the external circuit by connecting it to the internal ground of the RSM node. If the node is turned off, the open collector output opens the circuit. Therefore, open collector outputs are suitable for applications that do not require a closed circuit be retained during a power failure.



Some RSM nodes, such as the ESC, provide +15 V DC outputs for use with the open collector interface. The +15 V DC output is connected in series with a 1.5 k Ω resistor, as shown in Figure 10.

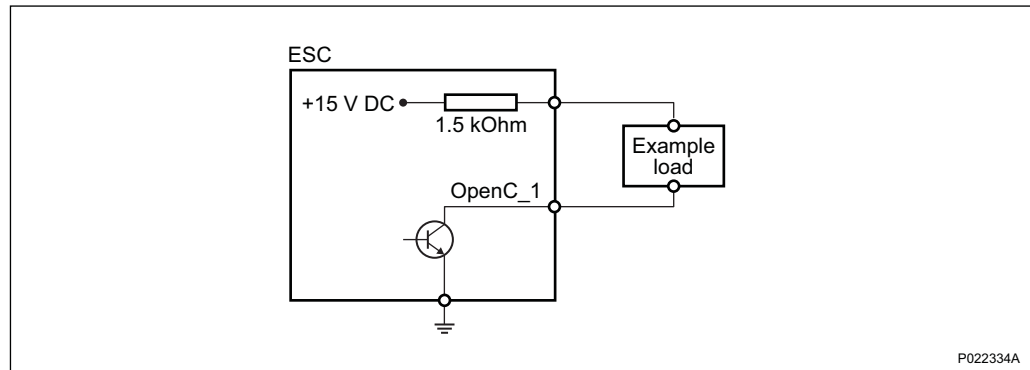


Figure 10 RSM Node With +15 V DC Output

2.3.3

Inductive Loads on Relay and Open Collector Outputs

An inductive load that is connected to the relay or open collector output interface of an RSM node requires a flyback diode. The flyback diode protects the node from the voltage spike that can occur when the circuit is opened by the relay or open collector output. Figure 11 shows a flyback diode mounted in parallel to an inductive load of an open collector output.

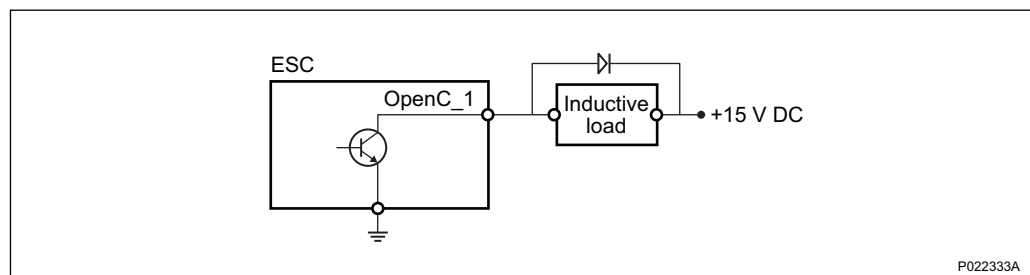


Figure 11 Inductive Load with Flyback Diode

The following are desired characteristics of a flyback diode:

- High tolerance of forward peak current
- Low forward voltage drop
- Reverse breakdown voltage that is higher than the power supply voltage

2.4

1-Wire Communication

Some RSM nodes, such as the ESC, can make use of equipment that communicate through a 1-Wire interface. A compatible node has an external port that provides access to the 1-Wire interface signals 1-WIRE_BUS (data)

and 1-WIRE_GND (ground). All sensors connect in parallel, as shown in Figure 12.

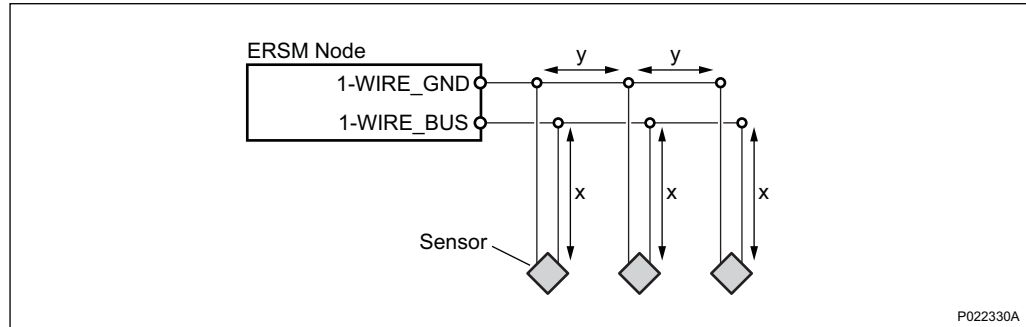


Figure 12 Line Formation of 1-Wire Sensors

The following requirements must be met to avoid signal interferences in the 1-Wire network:

- The cable sections that are marked “X” in Figure 12 and must be of the same length.
- The cable sections that are marked “Y” in Figure 12 and must be as short as possible, preferably not longer than 0.1 m.
- The total length of the cables that are used in a 1-Wire network must not exceed 100 m.

The 1-Wire bus only reads sensor values on command and requires about one second per network sensor to respond to a request of a value. The functionality of the “Scripting” feature makes it possible to automate these requests.

Sensors that are based on 1-Wire communication must not be used in any of the following cases:

- If the alarm design requires a response time (to a measured value) that must be faster than one second per sensor.
- If the alarm design requires a response to a signal that exceeds the alarm threshold during less than one second per sensor.

For example, the response time of a 1-Wire network that has six sensors is approximately six seconds. The same 1-Wire network will often not respond to a sensor input parameter that lasts during less than six seconds.

2.5 AC Metering

The RSM uses a direct connected active energy meter for AC metering. The three-watt meter method uses a neutral conductor, see Figure 13, where a direct connected 3-element meter is measuring the active energy E consumed by a load.

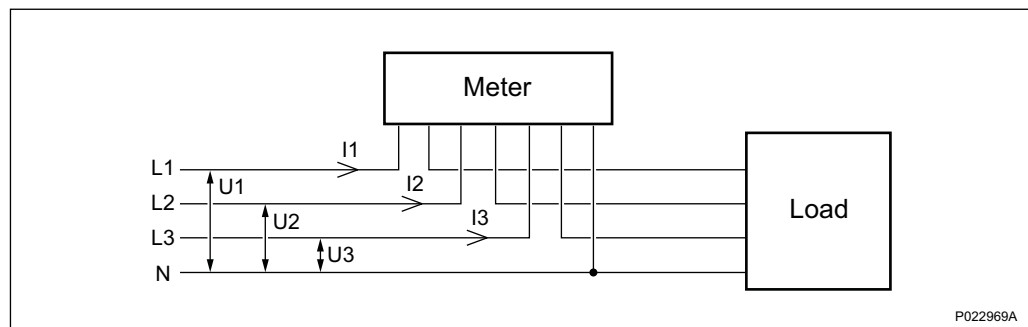


Figure 13 3-element measurement.

In a 3-element meter the neutral voltage is used as the voltage reference and the voltage difference between the neutral voltage and the L1, L2 and L3 voltages are measured and multiplied by its respective current. The active energy consumed by the load is the product of momentary voltages U_1 , U_2 and U_3 and the currents I_1 , I_2 and I_3 integrated over the desired measuring time period.

It is possible to configure the AC meter to send an alarm if a set threshold is exceeded per day or per hour. It is also possible to configure the AC meter to send an alarm for one phase if:

- The AC phase voltage is under threshold value.
- The AC phase voltage is over threshold value.
- The AC phase current is over threshold value.

For more information on how to configure the AC meter see *Configuring Energy Measurements*, Reference [3].

2.5.1 AC Meter Specifications

Table 1 describes the specifications for the energy meter.

Table 1 AC Meter Specifications

Type	Value
Nominal voltage	3 x 57-288 / 100-500 V (4-wire, 3-element)
Maximum current	80 A
Terminal wire area	1.0–25 mm ²
Recommended tightening torque	2.5 Nm
Frequency	50/60 Hz 5%



Type	Value
Dust and water protection	According to IEC 60529 protection class IP51 mounted in protective enclosure IP20 on terminal block without protective enclosure
Operating temperature range	−40°C to +55°C
Storage temperature range	−40°C to +70°C
Humidity	75% yearly average, 95% on 30 days/year

2.6 DC Metering

For DC metering the RSM uses current sensors that report output values in the form of a direct current. This is described in Section 2.1.2 on page 3.

It is possible to configure the current sensor to send an alarm if a set energy threshold is exceeded per day or per hour.

For more information on how to configure the current sensor see *Configuring Energy Measurements*, Reference [3].

2.6.1 Current Sensor Specifications

Table 2 describes the specifications of the current sensor.

Table 2 Current Sensor Specifications

Type	Value
Measure resistor	@±300Amax 110(max) @±600Amax 36(max)
Offset drift	−40 ~ 85

3 Installation Processes

This section describes the feature installation processes.



3.1 Analog Measurement Installation

Table 3 describes the installation process for installing and configuring analog measurements.

Table 3 Installation Process for Analog Measurements

Step	Process Stage	Document Reference
1	Installing hardware on the site	<i>Installing Analog Measurements,</i>
2	Configuring the ESC	<i>Configuring Analog Measurements, Reference [2]</i>

3.2 External Alarm and PWM Measurement Installation

Table 4 describes the installation process for installing and configuring external alarms and PWM measurements.

Table 4 Installation Process for External Alarms and PWM Measurements

Step	Process Stage	Document Reference
1	Installing hardware on the site	<i>Installing External Alarms and PWM Measurements,</i>
2	Configuring the ESC	<i>Configuring External Alarms, Reference [4]</i> <i>Configuring PWM Measurements, Reference [5]</i>

3.3 Relay and Open Collector Output Installation

Table 5 describes the installation process for installing and configuring circuits using relay and open collector outputs.

Table 5 Installation Process for Using Relay and Open Collector Outputs

Step	Process Stage	Document Reference
1	Installing hardware on the site	<i>Installing Circuits for Relay and Open Collector Control,</i>
2	Configuring the ESC	<i>Configuring Relay and Open Collector Outputs, Reference [6]</i>

3.4 1-Wire Equipment Installation

Table 6 describes the installation process for installing and configuring 1-Wire equipment.

*Table 6 Installation Process for 1-Wire Equipment*

Step	Process Stage	Document Reference
1	Installing hardware on the site	<i>Installing 1-Wire Equipment,</i>
2	Configuring the ESC	<i>Configuring 1-Wire Equipment, Reference [1]</i>

3.5 AC and DC Energy Meter Installation

Table 7 describes the installation process for installing and configuring energy meters.

Table 7 Installation Process for Energy Meters

Step	Process Stage	Document Reference
1	Preparing for installation	<i>Preparing Energy Meter Installation, Reference [13]</i>
2	Installing hardware on the site	<i>Installing AC Meter, Reference [9]</i> <i>Installing DC Current Sensor, Reference [11]</i>
3	Configuring the ESC for AC and DC energy metering	<i>Configuring Energy Measurements, Reference [3]</i>

4 Operation and Maintenance

Information on how to use the feature ESC measurements can be found in *Using the ESC Manager, Reference [14]*.



Glossary

ESC

Ericsson Site Controller

PWM

Pulse-Width Modulation

RSM

Remote Site Management

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Reference List

- [1] *Configuring 1-Wire Equipment*, 43/1543 - LZA 701 0003
- [2] *Configuring Analog Measurements*, 45/1543 - LZA 701 0003
- [3] *Configuring Energy Measurements*, 31/1553-LZA 701 0003
- [4] *Configuring External Alarms*, 46/1543 - LZA 701 0003
- [5] *Configuring PWM Measurements*, 33/1553-LZA 701 0003
- [6] *Configuring Relay and Open Collector Outputs*, 47/1543 - LZA 701 0003
- [7] *Ericsson Site Controller Description*, 25/1551-LZA 701 0003
- [8] *Installing 1-Wire Equipment*,
- [9] *Installing AC Meter*, 50/1531-LZA 701 0003
- [10] *Installing Circuits for Relay and Open Collector Control*,
- [11] *Installing DC Current Sensor*, 51/1531-LZA 701 0003
- [12] *Installing External Alarms and PWM Measurements*,
- [13] *Preparing Energy Meter Installation*, 51/1543-LZA 701 0003
- [14] *Using the ESC Manager*, 28/1553-LZA 701 0003