TENDER SPECIFICATION

DIRIS Digiware

Multi-circuit power and residual current monitoring system for electrical installations

**Purpose of the specification**

This specification describes a multi-function, multi-circuit measurement system with associated current sensors designed for measuring, monitoring and managing electrical energy within an electrical installation.

The technical benchmark reference is SOCOMEC DIRIS Digiware or a similar solution that has been approved by us.

1. **General characteristics**

The multi-function measurement system shall be CE-marked, UL-listed and be a compact modular multi-circuit PMD\* compliant with IEC standard 61557-12.

The Plug & Play system shall be based on modules that can be interconnected without tools. It shall automatically detect the type of network, circuit and current sensor rating, shall check the current flow direction, and automatically detect and assign a Modbus address to the connected modules.

The measurement system will accept a maximum of 32 modules, allow to monitor a large number of circuits.

The system comprises the following:

* **A 24VDC power supply** for the entire system.
* **A system interface** to centralise and communicate measurement data via RS485 or Ethernet over multiple communication protocols, and to display measurements locally or on a web-based interface.
* **A single voltage measurement module** for the entire system,
* **One or multiple current measurement modules**.

These modules must have integrated current sensors to measure circuits of up to 63 A or must be connected to external current sensors via an RJ connection to measure circuits of higher currents.

The current measurement modules will have up to 6 independent current inputs to simultaneously measure several types of circuit (three-phase, single-phase, etc.).

* **One or multiple residual current monitoring (RCM) modules**

RCM modules shall combine power monitoring and residual current monitoring functions by connecting to external current sensors for power monitoring purposes and residual current transformers to monitor residual currents (IΔ and IPE).

The connection to current sensors or residual CTs is made using dedicated colour coded RJ12 cables to avoid wiring errors.

The RCM module shall have a minimum of 6 independent inputs to measure several types of circuits (three-phase, single-phase etc.).

* **Optional Input/Output modules**.



An RJ45 bus shall interconnect the modules. This bus distributes the 24 VDC power supply and communication to all modules and synchronises the single voltage measurement with the current measurements for all circuits. This technology consolidates the voltage measurement at a single point.

All modules can be fitted on a DIN rail or back plate.

Associating the measurement modules with current sensors will guarantee a global accuracy **class 0.5** for the global measurement chain (measurement module and current sensors) for the active power (kW) **according to IEC 61557-12** from 2 to 120% of the rated current

*\*PMD: Power Metering and Monitoring Device in accordance with IEC 61557-12.*

1. **Components of the power monitoring system**
   1. **Communication and power supply interfaces C-31, M-50, M-70, D-50, D-70**

* **Interface module: DIRIS Digiware C-31: RS485 Modbus RTU version**

The module shall have the following characteristics:

* A 24 VDC power supply
* DIN rail mounting
* An RS485 port for Modbus RTU communication
* **DIRIS Digiware M-50 gateway: RS485/Ethernet – Multi-protocol version**

The gateway shall have the following characteristics

* A 24 VDC power supply
* An internal battery to ensure that the date and time of the complete measurement system is not reset after an outage.
* DIN rail mounting
* RS485 port for Modbus RTU communication and Ethernet port for Modbus TCP, BACnet IP, SNMPv1, v2, v3, Traps
* SNTP time-synchronisation
* Email notifications in the event of an alarm (SMTP/SMTPS)
* Embedded webserver WEB-CONFIG for configuration of communication settings of the system
* Integrated Cyber-security
* **DIRIS Digiware M-70 gateway: RS485/Ethernet – Multi-protocol version with web-visualisation WEBVIEW-M**

The gateway shall have the following characteristics

* A 24 VDC power supply
* An internal battery to ensure that the date and time of the complete measurement system is not reset after an outage.
* DIN rail mounting
* RS485 port for Modbus RTU communication and Ethernet port for Modbus TCP, BACnet IP, SNMPv1, v2, v3, Traps
* SNTP time-synchronisation
* Email notifications in the event of an alarm (SMTP/SMTPS)
* Embedded web software to remotely display data from an internet browser
* Integrated Cyber-security
* **Display DIRIS Digiware D-50: RS485/Ethernet – Multi-protocol version**

The display shall have the following characteristics:

* A 24 VDC power supply to avoid dangerous voltages on panel doors
* An internal battery to ensure that the date and time of the complete measurement system is not reset after an outage.
* A high-resolution graphic display
* 10 keys for direct access to measurement data, circuit selection and device settings
* IP65 degree of protection for the front panel
* RS485 port for Modbus RTU communication and Ethernet port for Modbus TCP, BACnet IP, SNMPv1, v2, v3, Traps
* SNTP time-synchronisation
* Email notifications in the event of an alarm (SMTP/SMTPS)
* Embedded webserver WEB-CONFIG to configure the system’s communication settings
* Integrated Cyber-security
* **Display DIRIS Digiware D-70: multi-protocol RS485/Ethernet + Webserver embedded**

The display shall have the following characteristics:

* A 24 VDC power supply to avoid dangerous voltages on panel doors
* An internal battery to ensure that the date and time of the complete measurement system is not reset after an outage.
* A high-resolution graphic display
* 10 keys for direct access to measurement data, circuit selection and device settings
* IP65 degree of protection for the front panel
* RS485 port for Modbus RTU communication and Ethernet port for Modbus TCP, BACnet IP, SNMPv1, v2, v3, Traps
* Embedded web software to remotely display data from an internet browser
* SNTP time-synchronisation
* Email notifications in the event of an alarm (SMTP/SMTPS)
* Integrated Cyber-security

WEB-CONFIG is embedded to the M-50 gateway / D-50 display and shall:

* Be reachable from any web browser
* Allow the configuration of communication settings
* integrate cyber-security features (TLS/SSL certificates, firewall, restriction or deactivation of specific peripherals/, ports or services)
* Allow to automatically export data via FTP(S)

WEBVIEW-M is embedded to the M-70 gateway / D-70 display and shall:

* Be reachable by multiple users from any web browser without any licence fees
* Allow the configuration of communication settings
* Integrate cyber-security features (TLS/SSL certificates, firewall, restriction or deactivation of specific peripherals/, ports or services)
* Allow to automatically export data via FTP(S)
* Display real-time and logged measurement data
* Display on-going alarms and keep a log of finished alarms
* Allow a manual export of measurement data over a specific time period
  1. **DIRIS Digiware U-xx, voltage measurement modules**
* **DIRIS Digiware U-10: metering**

The voltage measurement module shall measure the following parameters in real-time values:

* Voltages V1, V2, V3, U12, U23, U31
* Frequency F

The module shall also include the following alerts:

* System alarm (incorrect phase rotation)
* **DIRIS Digiware U-20: monitoring**

The voltage measurement module shall measure the following parameters in real-time values:

* Voltages V1, V2, V3, U12, U23, U31
* Frequency F
* THD V1, V2, V3, U12, U23, U31

The module will also include the following alarms:

* System alarms (incorrect phase rotation)
* **DIRIS Digiware U-30: analysis**

The voltage measurement module shall measure the following parameters in real-time values, average values, min/max timestamped real-time values, min/max timestamped averages:

* Voltages V1, V2, V3, U12, U23, U31, Usystem, Vsystem (average of the 3 phases)
* Frequency F
* THD V1, V2, V3, U12, U23, U31, system (average of the 3 phases)
* Individual harmonics U and V up 63rd
* Unbalance of Ph-N and Ph-Ph voltages with direct, inverse and zero-sequence symmetrical components
* Power quality events (swells, dips and interruptions) according to EN 50160 based on a half-cycle sampling rate (10 ms at 50 Hz)

The module shall also include the following alarms:

* System alarm (incorrect phase rotation)
* Timestamped alarms for real-time or average values based on the above electrical parameters
* Boolean combination of alarms
  1. **DIRIS Digiware S-xx / I-xx, current measurement modules**

There are several types of module that can be added to the power monitoring system:

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| * **Metering** |
| * + **DIRIS Digiware S-130: all-in-one with 3 built-in sensors up to 63 A**   The module shall measure the following real-time parameters:   * I1, I2, I3, IN, * Partial and total energies: ± kWh, ± kvarh (leading and lagging), kVAh * ∑P, ∑Q, ∑S, ∑PF   The module shall also include the following alarms:   * System alarms for incorrect voltage/current association indicating a possible wiring error   The module shall also offer advanced technologies based on a voltage detection of conductors, enabling to:   * Monitor the upstream protective device (ON/OFF position, tripping, operation and trip counters) without the use of auxiliary contacts. This function will be compatible with any brand and any type of protective device. * Provide a software correction of wiring errors, even off-load, by pressing the button on the front of the current measurement module.   + **DIRIS Digiware I-30: 3 current inputs**   The module shall measure the following real-time parameters:   * I1, I2, I3, IN, * Partial and total energies: ± kWh, ± kvarh (leading and lagging), kVAh * ∑P, ∑Q, ∑S, ∑PF   The module shall also include the following alerts:   * System alarms (sensor disconnected, wrong V/I association, wrong CT primary)   + **DIRIS Digiware I-60: 6 current inputs**   The module shall measure the following real-time parameters:   * I1, I2, I3, IN, * Partial and total energies: ± kWh, ± kvarh (leading and lagging), kVAh * ∑P, ∑Q, ∑S, ∑PF   The module shall also include the following alarms:   * System alarms (sensor disconnected, wrong V/I association, wrong CT primary) |

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| * **Metering and load curves** |
| * + **DIRIS Digiware I-31: 3 current inputs**   The module shall measure the following real-time parameters:   * I1, I2, I3, IN, * Partial and total energies: ± kWh, ± kvarh (leading and lagging), kVAh * Max. 8 configurable tariffs * ∑P, ∑Q, ∑S, ∑PF * P+/P-, Q+/Q-, S load curves (15-min demand power)   The module shall also include the following alarms:   * System alarms (sensor disconnected, wrong V/I association, wrong CT primary)   + **DIRIS Digiware I-61: 6 current inputs**   The module shall measure the following real-time parameters:   * I1, I2, I3, IN, * Partial and total energies: ± kWh, ± kvarh (leading and lagging), kVAh * Max. 8 configurable tariffs * ∑P, ∑Q, ∑S, ∑PF * P+/P-, Q+/Q-, S load curves (15-min demand power)   The module shall also include the following alarms:   * System alarms (sensor disconnected, wrong V/I association, wrong CT primary) |

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| * **Monitoring** |
| * + **DIRIS Digiware I-33: 3 current inputs**   The module shall measure the following real-time parameters:   * I1, I2, I3, IN (calculated) * Partial and total energies: ± kWh, ± kvarh (leading and lagging), kVAh * ∑P, ∑Q, ∑S, ∑PF * P, Q, S per phase * THD I1, I2, I3, IN   The module shall also include the following alarms:   * System alarms (sensor disconnected, wrong V/I association, wrong CT primary)   + **DIRIS Digiware I-43: 4 current inputs**   The module shall measure the following real-time parameters:   * I1, I2, I3, IN (measured) * Partial and total energies: ± kWh, ± kvarh (leading and lagging), kVAh * ∑P, ∑Q, ∑S, ∑PF * P, Q, S per phase * THD I1, I2, I3, IN   The module shall have an RJ9 output to connect to a single-point display.  The module shall have 2 digital inputs to retrieve logical states or data from multi-utility pulse-based meters.  The module shall have 2 relay outputs to remotely control devices in case of an alarm.  The module shall also include the following alarms:   * System alarms (sensor disconnected, wrong V/I association, wrong CT primary) |

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| * **Analysis module** |
| * + **DIRIS Digiware S-135: all-in-one with 3 built-in sensors up to 63 A**   The module shall measure the following parameters as real-time values, average values,  min/max timestamped real-time values, min/max timestamped average real-time values:   * I1, I2, I3, IN, * Partial and total energies: ± kWh, ± kvarh (leading and lagging), kVAh * Max. 8 configurable tariffs * ∑P, ∑Q, ∑S, ∑PF * P, Q, S, PF per phase * Predictive power * P+/P-, Q+/Q-, S load curves (15-min demand power) * Phi, Cos Phi, Tan Phi * THD I1, I2, I3, IN * Individual harmonics I up 63rd * Current unbalance and direct, inverse and zero-sequence symmetrical components * K factor * Crest Factor * Overloads based on a half-cycle sampling rate (10 ms at 50 Hz)   The module shall also include the following alarms:   * System alarms for incorrect voltage/current association indicating a possible wiring error * Timestamped alarms for real-time or average values on the above electrical parameters * Boolean combination of alarms * Smart alarm in case of an opening or a trip of the protective device * Predictive load-shedding alarm   The module shall also offer advanced technologies based on a voltage detection of conductors, enabling to:   * Monitor the upstream protective device (ON/OFF position, tripping, operation and trip counters) without the use of auxiliary contacts. This function will be compatible with any brand and any type of protective device. * Provide a software correction of wiring errors, even off-load, by pressing the button on the front of the current measurement module.   + **DIRIS Digiware I-35: 3 current inputs**   The module shall measure the following parameters as real-time values, average values,  min/max timestamped real-time values, min/max timestamped averages:   * I1, I2, I3, IN (calculated), Isystem * Partial and total energies: ± kWh, ± kvarh (leading and lagging), kVAh * Max. 8 configurable tariffs * ∑P, ∑Q, ∑S, ∑PF * P, Q, S, PF per phase * Predictive power * P+/P-, Q+/Q-, S load curves (15-min demand power) * Phi, Cos Phi, Tan Phi * THD I1, I2, I3, IN, system * Individual harmonics I up 63rd * Current unbalance and direct, inverse and zero-sequence symmetrical components * K factor * Crest Factor * Overloads based on a half-cycle sampling rate (10 ms at 50 Hz)   The module shall also include the following alarms:   * System alarms (sensor disconnected, wrong V/I association, wrong CT primary) * Timestamped alarms for real-time or average values on the above electrical parameters * Boolean combination of alarms * Smart alarm in case of an opening or a trip of the protective device * Predictive load-shedding alarm   + **DIRIS Digiware I-45: 4 current inputs**   The module shall measure the following parameters as real-time values, average values,  min/max timestamped real-time values, min/max timestamped averages:   * I1, I2, I3, IN (measured), Isystem * Partial and total energies: ± kWh, ± kvarh (leading and lagging), kVAh * Max. 8 configurable tariffs * ∑P, ∑Q, ∑S, ∑PF * P, Q, S, PF per phase * Predictive power * P+/P-, Q+/Q-, S load curves (15-min demand power) * Phi, Cos Phi, Tan Phi * THD I1, I2, I3, IN, system * Individual harmonics I up to 63rd * Current unbalance and direct, inverse and zero-sequence symmetrical components * K factor * Crest Factor * Overcurrents with a half-cycle sampling rate (10 ms at 50 Hz)   The module shall have an RJ9 output to connect to a single-point display.  The module shall have 2 digital inputs to retrieve logical states or data from multi-utility pulse-based meters.  The module shall have 2 relay outputs to remotely control devices in case of an alarm.  The module shall also include the following alarms:   * System alarms (sensor disconnected, wrong V/I association, wrong CT primary) * Timestamped alarms for real-time or average values on the above electrical parameters * Alarm on the status change of a Digital Input * Boolean combination of alarms * Predictive load-shedding alarm |

* 1. **DIRIS Digiware R-60 Residual Current Monitoring (RCM) module**

The RCM module shall have the following characteristics:

* Minimum Type A according to IEC 62020
* Have independent alarm LEDs for each circuit measured
* Combine residual current and power monitoring.

The module shall measure the following parameters as real-time values, average values, timestamped min/max instantaneous values, timestamped min/max average values:

* IΔ and IPE residual currents
* I1, I2, I3, IN
* Partial and total energies: ± kWh, ± kvarh (leading and lagging), kVAh
* Max. 8 configurable tariffs
* ∑P, ∑Q, ∑S, ∑PF
* P, Q, S, PF per phase
* P+/P-, Q+/Q-, S load curves (15-min demand power)
* Phase angles Phi

The module shall also include the following alarms.

* System alarms (sensor disconnected, wrong V/I association, wrong sensor primary)
* RCM alarms (high and low thresholds on IΔ and IPE)
* Alarm on overloaded neutral
* Protection alarms in case of :
  + Manual operations
  + Trip
  + Defective RCD

All alarms shall be timestamped.

When used with iTR current sensors, the RCM module shall also offer advanced technologies based on a voltage detection of conductors, enabling to:

* Monitor the upstream protective device (ON/OFF position, trip, counters) without the use of auxiliary contacts. This function will be compatible with any brand and any type of protective device.
* Determine the origin of the Trip (overload or a high residual current)
* Provide a software correction of wiring errors, even off-load
  1. **Current sensors**

The current sensors shall:

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|  | * Be an integral part of the power monitoring system and shall come from the same supplier as the measurement modules. * Have an mV output and an RJ type connection to the current module. * Allow a risk-free connection and disconnection under load * Eliminate the risk of error during installation, thanks to an automatic detection of the circuit type, the rating of the current sensor and the direction of the current flow.   If an installation error is detected during commissioning, an alarm will be automatically generated. |

The power monitoring system shall adapt to any type of new or existing electrical installation by choosing from the following current sensors:

* **Solid-core TE, 5 A to 2000 A**
  + The solid-core current sensors shall be mountable in line or staggered to always match the pitch of the protective device
  + The power monitoring system and current sensors do not need to be calibrated.
* **Split-core TR, 25 A to 600 A**
  + The split-core current sensors shall be mountable in line or staggered to always match the pitch of the protective device
  + The measurement system and current sensors do not need to be calibrated.
* **Split-core iTR, 25 A to 600 A** embed a feature to detect voltage in conductors
  + The split-core current sensors shall be mountable in line or staggered to always match the pitch of the protective device
  + The current sensors shall also offer advanced technologies based on a voltage detection of conductors enabling to:
* Monitor the upstream protective device (ON/OFF position, tripping, operation and trip counters) without the use of auxiliary contacts. This function will be compatible with any brand and any type of protective device.
* Provide a software correction of wiring errors, even off-load
  + The power monitoring system and current sensors do not need to be calibrated.
* **Flexible TF, 150 A to 6000 A.**
  + The power monitoring system and current sensors do not need to be calibrated.
  + The flexible sensor must have a locking system that prevents the loop from opening inadvertently.
  1. **Residual Current Transformers**

Residual CTs shall:

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|  | * Be an integral part of the monitoring system and shall come from the same supplier * Be minimum Type A according to IEC 62020 * Have an RJ type connection to the current module. * Include an alarm indication LED to easily locate alarms inside electrical panels * Allow a risk-free connection and disconnection under load |

The measurement system shall adapt to any type of new or existing electrical installation by choosing from the following residual CTs:

* **Solid-core ΔIC residual CTs**
  + Apertures from ø 8mm up to ø 300m
  + Centering accessory to ensure accurate measurement and enhanced immunity to network interferences.
  + Multiple mounting options: DIN rail, back plate, direct mounting onto the cable
* **Split-core ΔIP-R residual CTs**
  + Apertures of ø 80mm and ø 120mm
  + Centering accessory to ensure accurate measurement and enhanced immunity to network interferences.
  + Multiple mounting options: DIN rail, back plate, direct mounting onto the cable
  1. **DIRIS Digiware IO: input/output modules**
* **DIRIS Digiware IO-10: digital input/output module**

The digital input/output modules shall have at least 4 inputs and 2 outputs, to:

* Count pulses from multi-utility pulse based meters (water, gas, etc.)
* Monitor protective devices (ON/OFF position, tripping, trip counter) or the status of third-party devices.
* Control third-party equipment
* Trigger load shedding commands in case of an alarm on another DIRIS Digiware module
* **DIRIS Digiware IO-20: analogue input modules**

The analogue input modules will have at least 2 x 0/4-20mA inputs, to:

* Collect data from analogue sensors, such as pressure, humidity, temperature, levels (fuel, etc.)
* Monitor levels by setting up threshold alarms

1. **Configuration**

The measurement system can be configured from the remote display or from a free dedicated configuration software downloaded on a PC with a USB, RS485 or Ethernet connection.

The measurement system shall also enable:

* **Automatic detection and addressing**

An auto-discovery and auto-addressing function can be launched from displays and gateways to automatically detect connected slave devices and assign them with a unique Modbus address.

* **Software correction (with iTR sensors)**

iTR current sensors shall embed a wiring error correction technology, based on a voltage detection of conductors. This technology shall also work off-load.

1. **Commissioning**

The manufacture shall propose commissioning services for the power monitoring system and visualisation software.