**SECTION 26 09 13**

**ELECTRICAL POWER MONITORING**

**PART 1 – GENERAL**

* 1. **SUMMARY**
1. This specification describes a multi-function meter associated to current sensors designed for measuring, monitoring and managing energy within an electrical installation.
2. The technical benchmark is SOCOMEC DIRIS A-40 or equal and approved.
	1. **SUBMITTALS**
3. Product data: Include rated capacities, weights, operating characteristics, furnished specialties and accessories.
4. Shop drawings: Dimensioned plans, elevations, sections, conductor entry provisions, installed features and devices and material lists for each switch specified.
5. Field quality control test reports.
6. Operation and maintenance data specified by the manufacturer.
7. Product certificates: Signed by manufacturer certifying that products comply with requirements mentioned.
	1. **RELATED STANDARDS**
8. **IEC 61557-12***: Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c. - Equipment for testing, measuring or monitoring of protective measures - Part 12: Performance measuring and monitoring devices (PMD)*
9. **UL 61010-1:** *Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use*
	1. **QUALITY ASSURANCE**
10. The components of the measuring system shall be of the same manufacturer.
11. Comply with requirements of latest revisions of applicable industry standards.

**PART 2 – PRODUCTS**

1. **MANUFACTURERS**
2. Subject to compliance with requirements, provide products by one of the following  :
3. Multi-circuit measuring and monitoring system:
4. SOCOMEC DIRIS A-40 along with SOCOMEC DIRIS G gateway
5. …
6. **Power and performance Monitoring Device REQUIREMENTS**
7. **GENERAL:**

The multi-function measuring system should be a compact PMD\* type with a modular format, compliant with IEC standard 61557-12.

*\*PMD: Performance Measuring and monitoring Device in accordance with IEC standard 61557-12.*

1. It should provide all voltage, current, output, energy and quality measurement functions and enable a joint analysis of the single-phase and three-phase loads.
2. The measuring system comprises:
* The control and power supply interface (110-230 VAC +/- 15%)
* The remote display: visualization the load
* The voltage inputs : 50-520 Vac ph/ph for all 3 phases + neutral + earth
* The current inputs : 3 RJ12 current inputs
* The current sensors:
* The accuracy of the measurement will be ensured by the system (measurement units and sensors), in accordance with IEC 61557-12 standards: class 0.5 from 2 to 120% of the nominal current (In) with a TE/TF current sensor.
* The current sensors form an integral part of the measuring system and therefore must come from the same manufacturer as the measuring units. They enable a risk-free connection and disconnection of the current sensor.

To prevent any risks of error during installation, they will be automatically identified (type, rating, current direction) by the measuring device.

1. The measuring system should be able to adapt to any type of new or existing installation using TE solid sensors from 5A to 2000A, TR split-core sensors from 25A to 600A and TF flexible sensors from 150A to 6000A.

To facilitate their integration, the solid current sensors can be directly fitted on all types of conductors (cable, flexible or rigid busbar) or on a DIN rail or back-plate support. These sensors may be fitted aligned or staggered to match the pitch of the corresponding protective device.

1. If an installation error is detected during set-up, an alarm will be automatically generated.
2. **STANDARD FUNCTIONALITIES**

In terms of functions, the measuring system must respect the following requirements:

1. **General measurements:**
* Current, frequency, voltage electrical values
* Active, reactive and apparent power, power factor, cos phi and tan phi
* Operation across 4 quadrants
* Predictive power
* The measurements will be available with the following values:
* Instantaneous
* max instantaneous (timestamped)
* min instantaneous (timestamped)
* average
* max average (timestamped)
* min average (timestamped)
1. **Specific measurement**

In the associated measurement unit:

Different measurements are performed, depending on the type of measuring unit :

* Type 1:
* U12, U23, U31, V1, V2, V3, VN, F
* THD U, THD V
* I1, I2, I3, IN, ∑P, ∑Q, ∑S, ∑PF
* Metering : ± kWh, ± kvarh (lagging and leading), kVAh
* P, Q, S, PF per phase
* THDI
* Type 2:
* U12, U23, U31, V1, V2, V3, VN, F
* U system, V system
* Ph/N unbalance (direct, inverse and homopolar components and unbalance)
* Ph/Ph unbalance (direct and inverse components and unbalance)
* THD U, THD V
* Crest factor ph-ph and ph-n voltages
* Individual harmonics U & V (up to order 63)
* Voltage dips, swells and interruptions (according to EN 50160)
* I1, I2, I3, IN, ∑P, ∑Q, ∑S, ∑PF
* P, Q, S, PF per phase
* Predictive power (∑P, ∑Q, ∑S)
* Metering : ± kWh, ± kvarh (lagging and leading), kVAh
* Load curves (11 days with 10-min values)
* I System
* Current unbalance (direct, inverse and homopolar components and unbalance)
* Phi, cos Phi, tan Phi
* THDI
* Individual harmonics (up to rank 63)
* Overcurrent
* Alarms on thresholds and inputs
* inputs/2 outputs
* Crest factor I

**3. Inputs/Outputs**

The product will provide 3 digital inputs/ 2 digital output.

In addition to the standard functions of the PMD, and depending on which units are used, the following features shall be provided:

1. **ALARMS:**
* Timestamped alarms for the instantaneous or average values for an electrical measurement
* Possibility of Boolean combinations of alarms
* Predictive load-shedding smart alarm
1. **ADVANCED FUNCTIONALITIES**
* Monitoring the status of the upstream protective devices (open/closed position, Trip status, trip and operation counters) without the use of auxiliary contacts
* Software correction of wiring errors, even in off-load conditions by pressing a front button on the module
* The above functionalities shall be available when the device is positioned downstream any protective device
1. **DATA LOGGING**
* Recording of average electrical values (configurable: U, F, I, P, Q, S, PF, THD) over 7 days with 10-min values
* Recording and timestamping of min/max electrical values
* Archiving of events:
* Recording of voltage power quality events and current overloads
* Recording of measurement alarms
* Recording of system alarms
1. **ACCURACY**

The combination of the measuring devices and sensors allows the following overall accuracy of the measurement chain to be ensured for power and energy (kWh):

* **Class 0.2 in accordance with IEC 61557-12 standards:** accuracy of 0.2% for the measuring unit alone
* **Class 0.5 in accordance with IEC 61557-12 standards:** from 2 to 120% of the nominal current for the entire measurement chain (measurement unit + TE/TF current sensors)
1. **OPTIONAL DISPLAY**
* A control interface screen:
* High-resolution graphic screen
* 24VDC or self-supply - power supply to prevent dangerous voltage on the door
* 10 direct access keys to the measuring information, selection of outputs and configuration of the equipment
* RS485/Ethernet for making available all the metering, measurement and alarm data from the meters and the measuring devices
* Embedded webserver
1. **CONFIGURATION**

The measuring system should be configured automatically:

* Wizard:

The product shall be able to be configured thanks to a assistant to allow an easy, quick and reliable commissioning.

* Type of loads:

The measuring device is able to identify single phase, two phase and three phase type loads with or without neutral. 1 to 3 sensors may be used to measure balanced or unbalanced loads.

1. **GENERAL CHARACTERISTICS**

The modular communication gateway will act as an interface and data-logger from the measuring devices (PMD measuring devices, meters, etc.) equipped with an RS485 communication bus using the Modbus RTU protocol.

The data collected will be transmitted via the Ethernet network. On the Ethernet network, the gateways will use the Modbus TCP protocol to enable the exchange and storage of the measuring device data.

A web server embedded in this PMD allows the real-time display of measurement data, alarms, archived data and consumption of the measuring points

1. **FUNCTIONS AND PERFORMANCE**
2. **Memory**

The gateway may act as an extended memory for PMDs with the following characteristics:

* Records of the energy consumption over 1 year, for all products combined
* Archiving of the average electrical values: 2 months with a 10-minute integration period.
* Storage of 1000 timestamped alarms (exceeded thresholds, events and changes to the state of an input)
* Storage of 1000 network voltage quality events
1. **Inputs/Outputs**
* Module with 3 digital inputs/2 digital outputs
1. **Communication port**
* RS485 - Modbus RTU protocol
* Ethernet Modbus TCP protocol or BacNet IP
* USB for configuration of the gateway and the connected PMDs
1. **Embedded web server**
* Real-time measurement
* Alarms
* Archiving of measurements and consumption management
	1. **SOFTWARE REQUIREMENTS**

This specification describes the software solution integrated into the communication gateway. It is designed for monitoring measurements and alarms and archiving measurements and consumption.

The technical benchmark is SOCOMEC VERTELIS WEBVIEW Power & Energy Monitoring or equal and approved.

1. **GENERAL CHARACTERISTICS**

This web server will be embedded into the communication gateway which consolidates the data from several devices. It can be used to monitor all of the measurements from up to 32 devices connected via a RS485 Modbus RTU bus. It will also display the archived data and the distribution of energy consumption across the installation. Predefined alarms will be timestamped and listed in a table with their status and origin.

The web server will be easily accessible from a web browser on a PC or tablet.

The web server, depending on the version, can be used to perform 3 main functions:

* Real-time monitoring of the installation's multi-fluid parameters (electricity, water, gas, etc.)
* Centralization of alarms relating to the installation
* Display of measurement archives and consumption distribution
* These functions may be used independently of one another.
1. **FUNCTIONS AND PERFORMANCES**
2. **Real-time monitoring**

A sequence of screens is used to monitor the electrical network and the loads:

* Analysis of the electrical network:

The web server, depending on the characteristics of the measuring device or meter connected, will be able to display all of the parameters, according to the capabilities of the device connected:

* Representation of the electrical network as a Fresnel diagram
* U and V measurements with graphic representation or table and display of the average/instantaneous values with min/max
* Quality of the network with dips, interruptions and swells
* Harmonic distortion rate for U and V with a table
* Harmonics for U and V up to rank 63 with graphic representation and analysis of each harmonic rank
* Crest factor U/V
* Status of the protective devices connected to the inputs
* Analysis of loads:

The web server, depending on the capabilities of the measuring device or meter connected, should be able to display all of the following parameters:

* Representation of the loads connected, via a Fresnel diagram, indicating the phase shift between the currents and voltages
* Summary of outputs P, Q and S with a representation of 4 quadrants indicating the sign for the outputs and the type of load (lagging/leading)
* I measurements per phase and sum with graphic representation or table and display of the average/instantaneous values with min/max
* P, Q, S and PF measurements per phase and sum with graphic representation or table and display of the average/instantaneous values with min/max
* Harmonic distortion rate for I with a table
* Crest factor I
* Harmonics for I up to rank 63 with graphic representation and analysis of each harmonic rank.
* Inputs/outputs
* Input/output state
* Analysis of the energies
* Display of the multi-fluid energy consumption (electricity, water, gas, etc.)
1. **Monitoring of alarms**

The web server will be able to centralize the timestamped alarms originating from the meters.
The types of alarm will be as follows:

* Threshold exceeded alarm
* Event alarm
* Change of input status alarm

It will also be possible to access the following functions to interpret the alarms:

* Display of alarm archive
* Timestamping of alarms
* Multi-criteria filtering to simplify analysis by type, nature, criticality or state
* Details on each alarm (type, nature, criticality, state, timestamp)
* Signaling the presence of an alarm when browsing
* Sending of e-mails for alarms (SMTP) with indication of the type of alarm
1. **Display of measurements and consumption archive**
* Display of measurements archive
* Display of stored measurement parameters with graph or table representation
* Export of archived data in CSV format
* Display of the installation's consumption data
* Display of consumption with the option of analyzing 1 year of data
* Creation of a hierarchy of measurement points within the installation
* Distribution of consumption by usage type (heating, lighting, etc.)
* Distribution by fluid type (electricity, water, gas, etc.)
* Export of consumption data in CSV format

**PART 3 – EXECUTION**

**3.01 INSTALLATION**

1. Preparation shall be in accordance with reviewed product data, final shop drawing and manufacturer’s recommendations.
2. Installation shall be in accordance with manufacturer’s instructions.
3. Identify components according to Division 26 section “Identification for Electrical Systems”.

**3.02 CONNECTION**

1. Wiring connection shall be in accordance with manufacturer’s instructions.
2. Wiring connection shall be according to Division 26 section “Low-Voltage Electrical Power Conductors and cables”.

**3.03 MAINTENANCE & TRAINING**

1. Operation and Maintenance Instruction: Personnel shall also be formally trained by the manufacturer’s authorized representative as to the proper operation and maintenance of the PMD.
2. The PMD shall not require a new calibration for a period of 10 years minimum if the environment and installation conditions are conform to manufacturer’s instructions.

**3.04 TESTING**

1. The PMD shall be declared conform to the IEC and UL standards by a testing laboratory having the CBTL (Certification Body Testing Laboratory) qualification delivered by a National Certification Body under the IEC Electrotechnical Equipment (IECEE) certification body scheme and/or the NRTL (National Recognized Testing Laboratory) qualification.
2. After installing equipment, execute test reports in accordance with manufacturer’s instructions.

**END OF SECTION 26 09 13**