**SECTION 26 09 13**

**ELECTRICAL POWER MONITORING**

**PART 1 – GENERAL**

* 1. **SUMMARY**
1. This specification describes a multi-function, multi-circuit measuring system with associated current sensors designed for measuring, monitoring and managing electrical installation.
2. The technical benchmark is SOCOMEC DIRIS Digiware 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. **ANSI C12.20:** *Electricity Meters – 0.2 and 0.5 Accuracy Classes*
9. **IEC 61557-12***: Electrical safety in low voltage distribution systems up to 1000 V a.c. and 1500 V d.c. - Equipment for testing, measuring or monitoring of protective measures - Part 12: Power Metering and monitoring devices (PMD)*
10. **UL 61010-1:** *Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use*
	1. **QUALITY ASSURANCE**
11. The components of the measuring system shall be of the same manufacturer.
12. 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 Digiware along with SOCOMEC DIRIS G gateway
5. …
6. **Power Metering and Monitoring Device REQUIREMENTS**
7. **GENERAL:**

The measuring system shall be CE marked, cULus listed and shall be a multi-circuit, modular PMD\* compliant with IEC 61557-12 and ANSI C12.20 standards.

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

1. It shall provide voltage, current, output, energy and power quality measurements and enable a joint analysis of the single-phase and multi-phase loads simultaneously.
2. The Plug & Play system will be based on modules that can be interconnected (without tools) and will provide automatic detection and configuration of the network type, current sensor rating, verification of the current flow direction, and auto-addressing of the devices connected to the Digiware bus.
3. The power monitoring system comprises:
* One 24VDC Power supply for the whole system
* One system interface centralizing the 24VDC power supply and communication inputs for the entire system and allowing the visualization of all the products connected downstream directly on the display, remotely on its webserver or via multiple communication protocols (Modbus, BACnet, SNMP v1, v2, v3)
* One dedicated voltage measurement module
* Multiple current measurement modules. The current modules shall have integrated sensors for the measurement up to 63A or use external current sensors with an RJ type connection to the current measurement module allowing the measurement of higher currents.
* The current measurement modules shall have up to six independent current inputs which can be used to monitor several load types (three-phase, single-phase…). The system shall allow up to 32 current modules to be added, for the monitoring of up to 192 loads.
* Optional Input/Output modules
* The modules will be interconnected by a bus with a RJ45 link. This bus will distribute the power supply & communication to all the modules and will synchronize the single voltage measurement with the current measurements for all the loads with the same voltage reference, to avoid repeating the voltage connection for each load. All modules can be fitted on a DIN rail or on a back-plate.
* Current sensors:
* The current sensors form an integral part of the measuring system and therefore must come from the same manufacturer as the measuring modules. They enable a risk-free connection and disconnection of the current sensor.
* The system shall be suited for any type of new or existing installations using TE solid-core sensors from 5A to 2000A, TR/iTR split-core sensors from 25A to 600A and TF flexible sensors from 150A to 6000A.
* The accuracy of the measurement will be ensured by the system (measurement modules and sensors), in accordance with the ANSI C12.20 and IEC 61557-12 standards: class 0.5 from 2 to 120% of the nominal current (In) including sensors

No calibration of the system with current sensors needs to be done to guarantee the proper functioning.

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

The measuring system shall meet the following requirements:

The measurements shall be available with the following values:

* Instantaneous
* max instantaneous (timestamped)
* min instantaneous (timestamped)
* average
* max average (timestamped)
* min average (timestamped)
1. **General measurements:**
* Current, frequency, voltage
* Active (kW), reactive (kVAR) and apparent power (kVA), power factor, cos phi and tan phi
* Operation across 4 quadrants (import/export powers)
* Predictive power
1. **Metering**
* Active, reactive (lagging and leading), apparent partial and total energies (+/- kWh, +/- kVarh and kVAh)
* Demand profiles
* Multi-tariff (8 tariffs maximum)
1. **Power Quality analysis**
* Total Harmonic Distortion for voltage and current (THD V,U,I)
* Individual Harmonics analysis (up to 63rd) for voltage and current
* Unbalance for voltage and current, symmetrical components (direct, inverse and homopolar)
* Crest factor for voltage and current
* K-factor
* Events in accordance with EN 50160 (voltage sags, voltage swells and voltage interruptions) based on a half-cycle sampling rate
* Overcurrents based on a half-cycle sampling rate
1. **INPUT/OUTPUT**

Digital input/output modules can be added to the system. Each module should have at least 4 inputs and 2 outputs enabling the following:

* Pulse centralization from multi-fluid meters with a pulse output
* Status identification of 3rd party device (breaker position, trip status etc.)
* Manual command of 3rd party equipment

Analog input modules can be added to the system. Each module should have at least 2 inputs, 0/4 – 20mA type, enabling the following:

* Data collection from analogue sensors (pressure, humidity sensors)
* Monitoring of levels by setting up alarms on chosen thresholds
1. **ALARMS:**
* Timestamped alarms for the instantaneous or average values for an electrical measurement
* Alarms when a digital input changes status
* Boolean combinations of alarms
* Predictive load-shedding smart alarm
1. **ADVANCED FUNCTIONALITIES**

Intelligent current sensors may be used, providing:

* Monitoring the status of the upstream protective devices (open/closed position, Trip status, trip and operation counters) without the use of auxiliary contacts. This functionality shall be compatible with all brands and types of protective devices.
* Software correction of wiring errors, even in off-load conditions by pressing a front button on the module
1. **DATA LOGGING**
* Recording of average electrical values (configurable: U, F, I, P, Q, S, PF, THD, Crest factor, K-Factor) with a variable integration period
* Recording and time-stamping of min/max electrical values
* Recording of measurement alarms
* Recording of EN 50160 events and current overloads.
* Recording of Voltage/current phase association 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 ANSI C12.20:** accuracy of 0.2% for the module 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 module + TE/TF current sensors)
1. **OPTIONAL DISPLAY**

The remote display shall have the following characteristics:

* 24VDC power supply to prevent dangerous voltage on the door
* High-resolution & graphical views
* 10 direct access keys to the configuration and measuring information
* IP65 degree of protection for the front panel
* Embedded web server for remote visualization of measurements on a web browser
* Multiple protocols (Modbus TCP; Modbus RTU; BACnet IP; SNMP v1, v2 & v3)
* SNTP synchronization of downstream products
* SMTP e-mail transmission in case of alarms
1. **WEBSERVER**

All measurements from the system shall be visualized in a web interface embedded either in a dedicated Ethernet gateway or in the remote Display. This webserver shall allow:

* Display of real-time and historical measurements
* Display of on-going alarms and a log of finished alarms
* Manual or automatic FTPS data export in .CSV format
1. **INTEGRATION / COMMUNICATION PROTOCOLS**

The measuring system must allow integration with any external software through the following communication protocols:

* Modbus TCP over Ethernet
* Modbus RTU over RS485
* BACnet IP over Ethernet
* SNMP v1, v2 & v3 over Ethernet
1. **CONFIGURATION**

The measuring system can be configured from the remote display or using a free dedicated configuration software installed on a PC connected to the measuring system via a USB connection or via the communication network (RS485/Ethernet).

In addition, the system shall allow:

* **Automatic detection and addressing**

An auto-addressing function automatically allocates Modbus addresses to the modules connected to the optional display or Ethernet gateway (see separate technical specification document).

**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**