



# 9410 Selection and Application Guide

Power quality and analysis metering

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## Compact power, energy and power quality meters

The Siemens 9410 series power meter combines accurate, 3-phase energy and power measurement with data logging, power quality analysis, e-mail, alarming, Modbus Mastering, Waveform capture and extensive I/O capabilities not typically available in a compact meter.

Typical power and energy management applications using the 9410 Meter



Financial management including accounting and billing



Service entrances and onsite generation



Processes, lines, machines or equipment



Facility and energy management



Power mitigation and main power distribution equipment

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Supports operations management planning and procedures



PDUs and RPPs





Power generation transmission and distribution



Tenants, departments or subcontractors

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### **Features and benefits**



### 



#### Power quality main screen



#### Waveforms



The 9410 series meters are ideally suited to local and remote monitoring of low or high voltage electrical installations in industrial facilities, commercial buildings, utility networks or critical power environments. Facility and operations personnel will benefit in energy-related costs while avoiding power quality conditions that can reduce equipment life and productivity.

The 9410 series meter is easy to install and use, offering integrated or remote high-visibility displays. A range of expansion modules help match features to the application and support field-upgrading of meters as required. Serial and Ethernet communication enable the meter to be used within a WinPM.Net power management system or with third-party management systems.

### **Benefits**

- Maximize profits by providing high output with the least amount of risk to availability.
- Improve availability and reliability of electrical systems and equipment.
- Monitor power quality (PQ) for compliance and to prevent problems.
- Meters fully supported by WinPM.Net.
- Down to one millisecond digital Input event logging.

### Typical applications

### Industrial, commercial, and critical power

- Energy savings
  - Measure efficiency, reveal opportunities and verify savings
  - Sub-bill tenants for energy costs
  - Allocate energy costs to departments or processes
  - Reduce peak demand surcharges
  - Reduce power factor penalties
  - Leverage existing infrastructure capacity and avoid over-building
  - Support proactive maintenance to prolong asset life
- Energy availability and reliability
  - Validate that power quality complies with the energy contract
  - Verify the reliable operation of equipment
  - Improve response to power quality-related problems

### For electrical infrastructure

- Energy availability and reliability
  - Improve transmission and distribution network reliability
  - Enhance substation metering to reduce field service time
  - Maximize the use of existing infrastructure
- Power quality
  - Verify compliance with new power quality standards
  - Analyze and isolate the source of power quality problems

### 9410 Meter Features and benefits



Panel-mount meter with integrated display

DIN-rail mounted meter with remote display option, including adapter, cable and display

### Cost-effective, modular design

Standard features include a range of 3-phase power and energy measurements, total harmonic distortion (THD) metering, one RS-485 Modbus communication port, Dual- port Ethernet port, three digital inputs, one KY-type digital output, and alarming on critical conditions. The 9410 meter has custom logging and power quality analysis capabilities, while expansion modules offer additional I/O.

### **Easy installation**

Mounts into panel cutouts using two clips with no tools required. Directly connects to circuits up to 600V AC, eliminating the need for voltage (potential) transformers.

### High-Visibility COLOR display

Integrated or remote LCD offers multi-phase measurements, summary screens, bar charts, intuitive navigation and selectable languages.

### High accuracy measurements

IEC 62053-22 class 0.2S and ANSI C12.20 0.2S real energy accuracy for sub-billing and cost allocation. For reactive energy Class 0.5S (IEC62053-24)

### Power quality analysis

Reveal and understand power quality conditions with the 9410 meter capabilities:

- Dip and Swell detection
- Waveform capture 256 samples per cycle (Pre and Post)
- Disturbance direction and detection
- Trending and forecasting
- Compliant PQ standards
  - IEC6100-4-30 Class S
  - IEC 62586
  - EN50160

### Extensive data logging, trending and forecasting

Non-volatile on-board logging of min/max values, energy and demand, maintenance data, alarms, and any measured parameters. Trending and short-term forecasting of energy and demand.

### Custom alarming with time stamping

Triggers alarms on over 50 definable power or I/O conditions. Use boolean logic to combine up to four alarms.

### Expandable I/O

A wide choice of standard or optional digital and analog inputs and outputs for pulse counting, demand metering for other utilities (pulse inputs from water, air, gas electricity or steam meters), equipment status/position monitoring, demand synchronization, triggering conditional energy metering, equipment control or interfacing.

### Serial and Ethernet Communications

Up to two simultaneous Modbus communications ports. Use the RS-485 port on the base meter unit or the Dual-Port Ethernet for daisy-chaining via Ethernet. The Ethernet port will allow up to 8 supervisory systems to link to the meter at the same time and provide email-alarms and Modbus master functionality.

### **Measurements**

### PQ compliance reporting and basic PQ analysis

- Monitors and logs parameters in support of international PQ standards,
- IEC 61000-4-30 Class S
- IEC 62586 PQI-S
- EN 50160
- Generates onboard PQ compliance reports accessible via onboard web pages:
  - Basic event summary and pass/fail reports, such as EN 50160 for power frequency, supply voltage magnitude, supply voltage dips, short and long interruptions, temporary over voltages, voltage unbalance and harmonic voltage.
  - ITIC (CBEMA) and SEMI curves, with alarm categorization to support further analyses.
  - NEMA Motor Derating curve.
  - Basic meter provides EN 50160 but can be configured to provide IEEE 519.
  - Harmonic analysis: THD on voltage and current, per phase, min/max, custom alarming.
  - Individual harmonic magnitudes and angles on voltage and current, up to the 63rd harmonic.
- Built-In web-enabled waveform viewer

- High resolution waveform capture: triggered manually or by alarm, captured waveforms available directly from the meter via FTP in a COMTRADE format.
- Disturbance detection and capture: sag/swell on any current and voltage channel, alarm on disturbance event, waveform capture with per-event information.
- Patented disturbance direction detection: provides indication of the captured disturbance occurring upstream or downstream of the meter; time stamped results provided in the event log, with degree of certainty of disturbance direction.

### Used with WinPM.Net , provides detailed PQ reporting across entire network:

- EN 50160 report.
- IEC 61000-4-30 report.
- PQ compliance summary.
- ISO 50001.
- Display of waveforms and PQ data from all connected meters.
- Onboard data and event logging.
- 512MB of standard non-volatile memory.350 MB of standard non-volatile memory dedicated to capture billing data, events, and waveforms.





Front panel display showing function selection buttons and 3-phase voltage, current and power summary display

### Front panel display

The unique, anti-glare backlit white LCD can be easily read in extreme lighting conditions or viewing angles. An intuitive navigation with self-guided menus make the meter easy to use. Multilingual operation can be user-configured for English, Spanish, French, Italian, German, Portuguese, Chinese, and Russian.

The large 6-line display offers summary screens that simultaneously presents up to 4 concurrent values, including power and energy values, I/O conditions or alarm status. For

example, all three voltage or current phases plus neutral can be quickly reviewed at one time. Bar chart displays graphically represent system loading and I/O conditions. Historical and active alarms are displayed with time stamping. Active alarms can be Color coded for quick indication of alarm severity.

The 9410 displays can also be customized to show any metering point or imported data point from Modbus RTU/TCP connected devices, making this a unique central display for critical information.

### Installation

### Installation – Mounting options

A meter with integrated display, or a remote display module, can be panel mounted through a square cutout (92 x 92 mm) or remote display retrofitted through an existing round meter hole using an adapter. A small panel footprint and shallow depth make the meters suitable for low voltage switchboards, shallow cable compartments or on standalone machines. The meter unit (without display) is DIN rail compatible.

Meters with the optional integrated display can be door panel mounted when voltage connections are within the local regulation limits. When voltage exceeds regulation limits, the meter unit can be mounted inside the electrical cabinet with an optional remote display connecting via a display adapter and cable. A single remote display can be transferred between any meter units.

#### Circuit and control power connections

Compatible with low and high voltage 4-wire wye and 3-wire delta systems. Direct connect inputs up to 690 V AC line-to-line or use voltage (potential) transformers for higher voltage systems. All models offer a universal AC or DC power supply.



Dimensions:

- A. Meter with integrated display panel mount into a square cutout
- B. Meter with integrated display with up to (4) I/O module

C. Din Rail mounted meter with up to (4) I/O modules

D. Din Rail Mounted meter with remote display

### **Electrical Characteristics**

Type of measurement		True rms to 256 samples per cycle
Measurement	Current and voltage	Class 0.2 as per IEC 61557-12
	Active power	Class 0.2 as per IEC 61557-12
accuracy	Power factor	Class 0.5 as per IEC 61557-12
	Frequency	Class 0.2 as per IEC 61557-12
	Active energy	Class 0.2S IEC 62053-22 (In=5A) Class 0.2 IEC 61557-12, ANSI C12.20 Class 0.2
	Reactive energy	Class 0.5S IEC 62053-24
Data update rate		1/2 cycle or 1 second
	Specified accuracy voltage	57 VLN/100 VLL TO 400 VLN/690 VLL
	Impedance	5MΩ per phase
Input-voltage	Specified accuracy	42 to 69Hz
characteristics	frequency	(50/60Hz nominal)
	Limit range of operation -frequency	20 to 450Hz
	Rated nominal current	1A (0.55), 5A (0.25), 10A (0.2ANSI)
Input-current	Specified accuracy current range	Starting Current: 5mA Accurate Range: 50mA-10A
characteristics	Permissible overload	200A rms for 0.5 <sup>8</sup> , non-recurring
	Impedance	0.0003Ω per phase
	Burden	0.024 VA at 10A
	AC	90-415V AC ±10% (50/60Hz ± 10%)
	DC	120-300V DC ±10%
Power supply	Ride-through time	100 ms (6 cycles at 60Hz) min., any condition 200 ms (12 cycles at 60Hz) typ., 120V AC 500 ms (30 cycles at 60Hz) typ., 415V AC
	Burden	Meter Only: 18 VA max at 415V AC, 6W at 300V DC Fully optioned meter: 36 VA max at 415V AC, 17W at 300 V DC
Input/outputs	Meter Base Only	3 form A digital inputs (30V AC/60V DC) 1 form A (KY) solid state digital output (30V AC/60V, 75mA)
	Optional	Digital - 6 form A digital inputs (30V AC/60V DC) 8 A at 250V AC or 5A at 24V DC)
		Analog - 4 analog inputs (4-20mA, 0-30V DC) + 2 analog outputs (4-20mA 0-10V DC)

### **Mechanical Characteristics**

Weight		DIN rail mounted Model 0.528 kg IO modules 0.140 kg Remote display 0.300 kg	
IP degree of protection		IP 54, UL type 12: Panel mount and Remote display, front. IP 30: Panel mount rear, DIN rail mount, I/O modules.	
Dimensions	Panel mount model	96 x 96 x 77.5 mm	
	DIN model	96.6 x 90.5 x 90.8 mm	
	IO modules	90.5 x 90.5 x 22 mm	
Environmental conditions			
Operating temperature		-25°С то + 70°С	
Remote Display Unit		-25°C то + 60°C	
Storage temperature		-40°C to + 85°C)	
Humidity rating		5% to 95% non-condensing	
Installation category		III	
Operating altitude (maximun)		3000m above sea level	

Integrated display module 9.58 1 kg

### Alarm and control functions

Over 50 definable alarm conditions with 1 second response time can be used to log critical events or to perform control functions. Trigger on over or under conditions on any measured parameters, phase unbalance, digital input changes and more.

Multiple alarms can be defined, with each alarm individually configured with pickup setpoint, dropout setpoint and delay. Each alarm can be assigned one of four priority classes. Assign multiple alarms to a single quantity to create alarm levels. Assign different actions based on the severity level of the alarm. Use alarms to trigger waveform recording, data logging or to control digital outputs.

Customizable Programmable logic with the 9410 meter increases flexibility by allowing the combination of up to four other alarms using NAND, AND, OR, NOR and XOR functions.

### Communications

Multiple simultaneously operating communication ports allow the meters to be used as part of a power and energy management system and interface with other automation systems. Captured waveforms, alarms, billing data, and more can be uploaded to WinPM.Net 6.0 or later for viewing and analysis. Option modules offer a choice of communications standards.

- Standard RS-485 port (on meter unit): 2-wire connection, up to 38.4 kbaud, Modbus (ASCII and RTU) or JBUS protocol.
- Support of IPv6
- Dynamic Host Configuration Protocol (DHCP) IPv4 & IPv6 DHCP is a network protocol that enables a server to automatically provide an IP address and other related information for a device.
- A dual port 10/100 Base-T UTP port supporting Modbus TCP/IP, DNP3 and IEC 61850 communications. Full-function embedded web server provides standard web browser access to meter data, and the ability to email on an alarm from the host meter. RS-485/232 port, 2- or 4-wire, Modbus (ASCII and RTU) master port providing Ethernet-to-serial line gateway or Modbus master functionality.

### Software integration

Integration with the WinPM.Net system software allows for automatic retrieval of the meters real-time and on-board data logs. Modbus compatibility and register-based logged data supports integration and data access by building automation, SCADA and other third-party systems.

### **Special features**

Hour counter: load running time in days, hours and minutes.

Upgradeable Firmware – Your meters can be upgraded with the latest firmware. Contact your local Siemens representative for details.

Measurement Features Guide 9410				
	Use on LV and MV systems	$\checkmark$		
	Current accuracy (5A Nominal)	0.1 % reading		
	Voltage accuracy (57 V LN/100 V LL			
General	to 400 V LN/690 V LL)	0.1 % reading		
	Active energy accuracy	0.20%		
	Number of samples/cycle or	256		
	sample frequency	230		
	Current, voltage, frequency	$\checkmark$		
	Active, reactive, apparent power	$\checkmark$		
Instantaneous PMS Values	Person forster Tatal and non phase	1		
NIVIS Values	Power factor fotal and per phase	v		
	(autoranging)	0.05 - 10A		
	Active, reactive, apparent energy	$\checkmark$		
Energy Values	Settable accumulation modes	✓		
	Current - Present and max. values			
	Active, reactive, apparent power –	,		
	Present and max. values	$\checkmark$		
Demand	Predicted active, reactive,	1		
Values	apparent power			
	Synchronization of the measurement	$\checkmark$		
	Sotting of calculation mode. Plack cliding	1		
	Setting of calculation mode - Block, sliding	•		
	Individual harmonics	v 62		
		05		
Dower Quality	Detection of voltage swells and cags	•		
Measurements	East acquisition 1/2 such data	•		
Wiedsdreinents	Fast acquisition - 1/2 cycle data	•		
	EN 50160 compliance checking	v		
	logic and math functions)	$\checkmark$		
	Min/max of instantaneous values	$\checkmark$		
	Data logs	✓		
	Event logs	$\checkmark$		
Data	Trending/forecasting	✓		
Recording	SER (Sequence of event recording)	$\checkmark$		
-	Time stamping	✓		
	GPS synchronization (+/- 1 ms)	$\checkmark$		
	Memory (in Mbytes)	512		
	Front panel display	$\checkmark$		
	Wiring self-test	$\checkmark$		
Display and I/O	Pulse output	$\checkmark$		
	Digital or analog inputs(max)	27 DI/16 AI		
	Digital or analog outputs (max,	1 DO/8 RLY/8		
	including pulse output)	AO		
	RS 485 port	1		
	Ethernet port	2		
	Serial port (Modbus, ION, DNP3)	$\checkmark$		
	Ethernet port (Modbus/TCP, ION TCP, DNP3 TCP, IEC 61850)	$\checkmark$		
	Concurrent Connections over Ethernet	8		
Communication	Ethernet gateway	$\checkmark$		
communication	Alarm notification via email	$\checkmark$		
	HTTP web server	$\checkmark$		
	SNMP with custom MIB and traps	$\checkmark$		
	IUI aldIIIIS			
	NTP time synchronization	·		
	ETP file transfer	√		

### 9410 Built-In Web Pages





Realtime web page



Harmonics web page

Power Quality web page



Phasor web page



Example screen from WinPM.Net software showing electrical system diagram with multiple real-time metering points.

The 9410 comes with many standard HTML web pages showing the meters data, but additional custom web pages can be designed to display other Modbus serial or Modbus TCP connected devices like power meters, trip units, flow meter information, and more!



Built-In web-enabled Waveform viewer

### **Applications and benefits**

- Maximize profits by providing high output with the least amount of risk to availability.
- Improve availability and reliability of electrical systems and equipment.
- Monitor power quality (PQ) for compliance and to prevent problems.
- Meters fully supported by WinPM.Net Power Monitoring Software.

### Main characteristics

- Precision metering:
- IEC 61557-12 PMD Sx K70 3000m 0.2 (performance measuring and monitoring functions).
- Class 0.2S accuracy IEC 62053-22, ANSI C12.20 Class 0.2 (active energy).
- Industry leading Class 0.5S\* accuracy for reactive energy (IEC 62053-24).
- Cycle-by-cycle RMS measurements updated every 1/2 cycle.
- Full 'multi-utility' WAGES metering support.
- Net metering.
- Anti-tamper protection seals.
- PQ compliance reporting and basic PQ analysis.
- Monitors and logs parameters in support of international PQ standards
  - IEC 61000-4-30 Class S
  - -IEC 62586 PQI-S

### Digital and analog inputs and outputs

The 9410 meter provides a three digital status/counter input and digital (KY type) output. A wide range of optional field-installable expansion modules will add more digital and analog I/O as required. Up to four expansion modules can be installed per meter (including logging or communication modules).

Digital output relays can act in response to internal alarms, external digital input status changes, or commands over communications. Digital inputs can be used to trigger alarms, trigger logging, and synchronize to a demand pulse or control conditional energy accumulation. Both models offer five channels for metering of water, air, gas, electricity or steam utilities through the digital input pulse counting and consumption/ demand calculation capabilities of the meter. Pulses from multiple inputs can be summed through a single channel communications. Up to 27 total digital inputs can be logged in the 9410 with millisecond time stamping for critical information like detailed sequence of event recording.

Туре	Input/ Output	Specifications
Standard (Meter Unit)	1 digital KY	6 to 220V AC $\pm 10$ % or 3 to 250V DC $\pm 10\%100$ mA maximum at 25 °C, 1350 V rms isolation
	3 digital input	20 to 150V AC/DC ±10 %, <5 mA maximum burden
9410 (US2:94 8M2D O6DI)	2 digital relay outputs	6 to 240V AC or 6 to 30V DC, 2 A rms, 5 A maximum for 10 second/hour
	6 digital inputs	20 to 150V AC/DC, 2 mA max., 24V internal supply: 20 to 34V DC, 10 mA maximum (feeds 6 inputs)
9410 US2:94 8M2AO 4AI)	Analog I/O module (4 analog inputs & 2 analog outputs)	
	4 analog inputs (4-20mA; 0-30 V). 2 analog outputs (4-20mA; 0-10 V) for interfacing with building management sensors and systems.	



Attachment of logging, I/O, or Ethernet expansion modules to meter unit



Bottom view of 9410 meter unit, showing dual Ethernet port and RS-485 communication port connectors, configuration switches and 4x expansion I/O modules.

Visit www.usa.siemens.com/pds for more information on

other PDS products, applications and system solutions.

### **Ordering information**

Please contact your local sales representative for ordering information.

**Catalog Numbers** Electromagnetic compatibility 9410 Series Meter Description Product standards IEC 62052-11 and IEC 61326-1 US2:9410DC DIN96 Panel mount meter (Integrated color display, Immunity to electrostatic discharge IEC 61000-4-2 1 DO, 3 DI, dual port Ethernet) Immunity to rediated fields IEC 61000-4-3 US2:9410TC DIN rail mount meter without display Immunity to fast transients IEC 61000-4-4 (1 DO, 3 DI, dual port Ethernet) Immunity to surges IEC 61000-4-5 US2:9410RC DIN rail mount meter packaged with remote Immunity to conducted disturbances IEC 61000-4-6 display (Includes 3 meter cable) IEC 61000-4-8 Immunity to power frequency Accessories Description magnetic fields US2:948DISP96 Remote display, 3 meter cable, mounting hardware Immunity to conducted disturbances, CLC/TR 50579 for 30mm hole (nut and centering pin), mounting 2-150kHz hardware for DIN96 cutout (92x92mm) adapter plate Immunity to voltage dips and interruptions IEC 61000-411 US2:948M2D06DI Digital I/O Module (2 relay outputs & 6 digital inputs - wetted) Immunity to ring waves IEC 61000-412 US2:948M2AO4AI Digital I/O Module (2 analog outputs (4 - 20 mA, EN 55022, EN 55011, FCC Conducted and radiated emissions 0-10V DC) and 4 analog inputs (4 - 20 mA, 0 - 30V DC) part 15, ICES-003 US2:948DCAB10 Remote display cable, 10 meters Surge withstand Capability (SWC) IEEE C37.90.1 Safety IEC/EN 61010-1 ed.3, CAT III, 400 VLN / 690 V LL UL 61010-1 ed.3 and CSA-C22.2 No. 61010-1 ed.3, CAT III, 347 V LN / Safety Construction 600 V LL IEC/EN 62052-11, protective class II Communication Ethernet to serial line gateway Communicates directly with up to 32 unit load ION slave devices. Web server Customisable pages, new page creation capabilities, HTML/XML compatible. Serial port RS485 Baud rates of 2400 to 115200, pluggable screw terminal connector. Ethernet port(s) 2x 10/100Base-TX, RJ45 connector (UTP). Up to 8 concurrent connections over Ethernet. Modbus, ION, DNP3, IEC 61850, HTTP, FTP, SNMP, SMTP, DPWS, RSTP, NTP, SNTP, GPS protocols Protocol Many industrial and utility customers are demanding a higher level of cyber security and encryption method hardening for Cyber Security their power monitoring systems. Meets NERC/CIP and IEC 62443 Standards. **Firmware Characteristics** Down to 1/2 cycle interval burst recording, stores detailed characteristics of disturbances or outages. Trigger recording High-speed data recording by a user-defined setpoint, or from external equipment. Harmonic distortion Up to 63rd harmonic (127th via StruxureWare software) for all voltage and current inputs. Analyze severity/potential impact of sags and swells: magnitude and duration data suitable for plotting on voltage Sag/swell detection tolerance curves per phase triggers for waveform recording, control. Determine the location of a disturbance more quickly and accurately by determining the direction of the disturbance Disturbance direction relative to the meter. Analysis results are captured in the event log, along with a timestamp and confidence level indicating detection level of certainty. High accuracy of standard speed (1s) and high-speed (1/2 cycle) measurements, including true rms per phase Instantaneous and total for: voltage, current, active power (kW), reactive power (kvar), apparent power (kVA), power factor, frequency, voltage and current unbalance, phase reversal. Channel assignments (800 channels via 50 data recorders) configurable for any measurable parameter, including historical Load profiling trend recording of energy, demand, voltage, current, power quality, or any measured parameter. Trigger recorders based on time interval, calendar schedule, alarm/event condition, or manually. Historical trends and future forecasts to better manage demand, circuit loading, and other parameters. Provides average, Trend curves min, max and standard deviation every hour for last 24 hours, every day for last month, every week for last 8 weeks and every month for last 12 months. Simultaneous capture of all voltage and current channels sub-cycle disturbance capture, maximum cycles is 100,000 (16 Waveform captures samples/ cycle x 96 cycles, 10MBytes memory), max 256 samples/cycle. Threshold alarms: adjustable pickup and dropout setpoints and time delays, numerous activation levels possible for a Alarms given type of alarm, user-defined or automatic alarm threshold settings, user-defined priority levels (optional automatic alarm setting).

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