

## EM720 expertmeter™

### Power Quality Revenue Meter

The EM720 series is a group of state-of-art multi-microprocessor digital instruments that incorporate the capabilities of a power quality analyzer, revenue energy meter, fault and data recorder and programmable controller, oriented for AMR, substation, industrial and commercial areas. These instruments provide three-phase measurements of electrical quantities in power distribution systems, monitoring external events, operating external equipment via relay contacts, fast and long-term on-board recording of measured quantities, transient voltages measurements up to 2KV , fault recording of currents up to 10x nominal current (50A), harmonic analysis and disturbance recording.

A high-contrast graphical LCD display with backlight allows easy local meter readings and servicing. Two serial communication ports (infrared and RS-232/RS-485), a USB port, Ethernet and a wireless GSM/GPRS modem allow local and remote automatic meter readings and setup though the supplemental communication software or user data acquisition software.

The EM720 is especially designed for utility, industrial and commercial billing metering with high requirements to reliability of power quality monitoring and availability of the device.



## Highlights

### High Accuracy Revenue Meter

IEC 62053-22 Accuracy Class 0.2S active and reactive energy polyphase static meter, with comprehensive TOU (Time-of-Use) to fit any utility tariff

### EN 50160 Power Quality Recorder

A full-featured programmable power quality recorder provides EN 50160 compliance statistics and reports with IEC 61000-4-30 Class A accuracy

### Fast Transient Recorder

An optional high-voltage fast transient recorder (EM720T) detects impulsive and low frequency oscillatory transient overvoltages with peaks up to 2kV and durations from 16/20 microseconds.

### Digital Fault Recorder

An embedded fault recorder is capable of recording current faults up to 50 amps.

## Models

The unit is available in two models:

**EM720** High accuracy revenue energy meter class 0.2S with Power Quality Analyzer according to EN50160 Standard, all the basic metering, control, and fault and event recording capabilities

**EM720T** All the EM720 functionality plus transient recording capabilities

## Features

### Billing/TOU

- IEC 62053-22 Accuracy Class 0.2S active and reactive energy polyphase static meter
- Time-of-Use, 10 billing energy and maximum demand registers, 8 tariff rates, 4 seasons x 4 types of days, 8 tariff changes per day
- One-time easy programmable tariff calendar schedule, one-time programmable or calendar scheduled daylight savings switch dates
- Configurable triggering an end of billing period: automatic monthly, local from the front display (password protected) or via communications
- Automatic recording billing energy, maximum demand and cumulative maximum demand registers for last 24 billing periods
- Automatic 120-day daily energy and maximum demand profile
- Automatic 120-day/15-minute or 240-day/30-minute energy load profile
- Easy access to the three previous billing period data via the front display
- Transformer/Line loss compensation
- PT/CT corrections, up to 8 points

### Multi-functional Power Meter

- Enhanced 3-phase Power meter: true RMS volts and amps, powers, power factors, unbalance, neutral current, frequency
- Demand Meter: amps, volts, harmonic demands, block and sliding power demands
- Harmonic Analyzer: up to 50th harmonic volts and amps; fundamental volts, amps, power and power factor, phasor, symmetrical components

### Power Quality

- EN 50160 Power Quality (PQ) recorder: onboard power quality analyzer; programmable limits; EN 50160 power quality event log, EN 50160 compliance statistics; EN 50160 harmonics survey statistics

- Power frequency, voltage variations, rapid voltage changes, IEC 61000-4-15 flicker, voltage dips, interruptions, temporary overvoltages, transient overvoltages, voltage unbalance, IEC 61000-4-7 harmonic and interharmonic voltage, mains signaling voltage
- High-voltage fast transient recorder (EM720T); impulsive and low frequency oscillatory transient overvoltages with peaks up to 2kV and durations from 20 microseconds
- Ready-for-use compliance statistics reports

### Fault Recorder

- Fast digital Fault recorder: up to 8 external digital triggers from protection relays; onboard voltage and current fault detector; zero-sequence currents and volts, current and voltage unbalance; programmable fault thresholds and hysteresis
- 10x nominal current (50A) fault currents
- Ready-for-use fault reports - fault current magnitudes and duration, coincident volt magnitude, fault waveforms and fast RMS trace

### Event Recorder

- Event recorder for logging internal diagnostics events, setpoint and I/O operations

### Waveform Recorders

- Seven channel simultaneous recording of three voltage and four current channels
- Selectable sampling rate of 32/64/128/256 samples per cycle (s/c); 20 pre-fault cycles, up to 3 min of continuous recording (at 32 s/c)
- Optional 4-channel transient voltage recording at 1024 samples per cycle (EM720T)
- Synchronized waveforms from multiple devices in a single plot
- Exporting waveforms in COMTRADE and PQDIF file formats

## Data Recorders

- Sixteen fast Data recorders
- Programmable data logs on a periodic basis and on any internal and external trigger; triggering from the Fault recorder, PQ recorder or control setpoints; exporting data trends in PQDIF file format
- Fast fault and PQ data profiling (trending) triggered from the Fault and PQ recorders: ½ cycle to 10-min RMS envelopes; up to 20 pre-fault and post-fault cycles

## Programmable Logical Controller

- Embedded Programmable Controller: 16 control setpoints
- OR/AND logic, extensive triggers, programmable thresholds and delays, relay control, event-driven data recording
- 8 digital counters for counting pulses from external sources and internal events
- 4 programmable timers from 1 cycle to 24 hours for periodic recording and triggering operations on a time basis.

## Time and Clock

- High-accuracy real-time clock with a lithium backup battery
- 1-ms digital input synchronization
- satellite-synchronized clock option (IRIG-B time-code input)
- SNTP clock synchronization option
- One-time programmable or calendar scheduled daylight saving time (DST) switch dates; configurable DST start and end time

## Extended Security

- 3-level password security for protecting meter setups and accumulated data from unauthorized changes

## Display

- Easy to read high contrast graphical 128x32 pixel LCD display with backlight
- Multi-page data display with auto-scroll; time, billing, instrumentation and service data
- Menu-driven setups

## Digital I/O

- Four embedded digital inputs with 1 ms scan time
- Replaceable 2DI/2DO expansion I/O modules with 1/2 cycle scan/update time

## Memory

- 8/16 MB flash memory for long-term billing, event, waveform and data recording

## Communications

- Front Infrared IEC 62056-21 serial communication port (IEC 62056-21, MODBUS RTU/ASCII and DNP3 protocols)
- Plug-in serial RS-232/RS-485 communication port (MODBUS RTU/ASCII and DNP3 protocols)
- Plug-in full speed USB 1.1 port (MODBUS RTU protocol)
- Plug-in Ethernet port (MODBUS/TCP and DNP3/TCP protocols, IEC 61850), up to 5 simultaneous connections
- Plug-in wireless GSM/GPRS modem (MODBUS/TCP and DNP3/TCP protocols)

## Expansion I/O & Comm. slots

- 3 expansion hot-swap slots for plug-in I/O and communication modules

## Backup Power Supplies

- Heavy-duty lithium backup battery for RTC, setup and data logging information
- Optional high-capacity rechargeable Li-ion battery for up to 6 hours full operation
- Auxiliary 24VDC backup power supply module

## Upgradeable Firmware

- New features can be easily added to your meter by simply updating the firmware through any communication port.

## Software Support

- PAS – free software for meter configuration, control and data acquisition
- eXpertpower – SATEC proprietary Internet services

## Technical Specifications

The EM720x is offered in two versions:

- 120V for connection via PTs
- 480V for direct connection

ENVIRONMENTAL CONDITIONS	
Operational temperature	-40°C to + 70°C
Full accuracy operational temperature	-25°C to + 60°C
Storage temperature	-45°C to + 85°C
Humidity	0 to 95% RH non-condensing
CONSTRUCTION	
Enclosure with sealing cover	
Reinforced Plastic material and corrosion resistant	Flammability UL94V0
Size (HxWxD)	303 x 177 x 144mm
Weight (including battery)	3.95 kg
Mounting	DIN43857

## INPUT RATINGS

AC VOLTAGE INPUTS	
V1, V2, V3, VN and VG	50/60 Hz
Voltage rating	120V version: 3 x 57.73/100 V 3 x 63/110 V 3 x 69/120 V 3 x 57.73 V 3 x 63 V 3 x 69 V
	480V version: 3 x 120/207 V 3 x 220/380 V 3 x 230/400 V 3 x 277/480 V 3 x 220 V 3 x 230 V 3 x 277 V
Voltage range, Crest factor	120V version: 0 up to 144 V ≥2 (voltage peak up to 300V) 480V version: 0 up to 320 V RMS, ≥2 (voltage peak up to 700 V)

Temporary over voltage between live conductors and earth	240 V RMS (120V version) 1000 V RMS (480V version)
Transient over voltage between live conductors and earth (from 15 μs up to milliseconds)	2 kV peak
Starting voltage	0.5%U <sub>n</sub>
Burden per phase	< 0.2 VA (120V ver.) < 0.5 VA (480V ver.)
Overload withstand for 1 minute phase-to-ground (IEC 62053-22, protective class II)	4000V RMS
Rated impulse voltage (IEC 62052-11, protective class II)	6000V
Terminals for wires size	2.5 up to 6 mm <sup>2</sup>

AC CURRENT INPUTS	
4 Galvanic isolated Inputs	
REFERENCE CURRENT (I <sub>n</sub> = 5A, I <sub>n</sub> = 1A)	
Overload current (continuously) I <sub>max</sub>	2 x I <sub>n</sub>
Maximum measurable short circuit current (I <sub>sc</sub> )	10 x I <sub>n</sub>
Burden per phase (I <sub>n</sub> = 5 A)	< 0.2 VA
Burden per phase (I <sub>n</sub> = 1 A)	< 0.05 VA
Starting current (I <sub>1</sub> , I <sub>2</sub> , I <sub>3</sub> )	0.1% I <sub>n</sub>
Starting current (I <sub>4</sub> )	0.5% I <sub>n</sub>
Over current withstand for 1 second non-recurring	50 x I <sub>n</sub>
Voltage galvanic isolation rating	4000V RMS
Terminals for wires size	2.5 to 6 mm <sup>2</sup>

## POWER SUPPLY

3P POWER SUPPLY (MPS)	
Power supply Inputs from measured AC Voltage inputs	
207-480V AC 50/60 Hz	96- 575V AC

High range power supply (480V version)	
100-120 V AC 50/60 Hz	45 - 250 V AC
Low range power supply (120V version)	
Burden as per IEC 62053-61 multi-function meter requirements	3 W and <15VA/phase
<b>BATTERY BACKUP POWER SUPPLY (BPS)</b>	
Build-in rechargeable Li-ion battery, Redundant MPS	Up to 6 hours backup
<b>AUX. POWER SUPPLY (APS)</b>	
Low DC Power Supply, Redundant MPS	
DC PS module - Optional DC input	24V DC $\pm$ 15%
Power Consumption	6W maximum
Dielectric insulation withstand	4 KV AC @ 1mn
Terminals for wires size	2 x 4 mm <sup>2</sup>
<b>REAL TIME CLOCK BATTERY BACKUP</b>	
According to IEC 61038 Field replaceable Lithium battery	> 3 consecutive years. More than 10 years service battery life

## INPUT/OUTPUT PORTS

<b>DIGITAL INPUT – BASIC</b>	
Dry contact - Optically isolated	4 inputs
Wetting (internally) input contact	24 VDC internal power supply (5mA wetting current per contact)
Open contact impedance	> 1M $\Omega$
Close contact impedance	< 100 $\Omega$
Sampling rate cycle	1ms
Dielectric insulation withstand	4 KV AC @ 1mn
Terminals for wires size	8 x 2.5 mm <sup>2</sup>
<b>DIGITAL INPUT 2DI/2DO MODULE - OPTIONAL</b>	
Dry contact - Optically isolated	2 inputs
Wetting (internally) input contact	24 VDC internal power supply (5mA wetting current per contact)
Open contact impedance	> 1M $\Omega$

Close contact impedance	< 100 $\Omega$
Sampling rate cycle	½ cycle (50/60 Hz)
Dielectric insulation withstand	4 KV AC @ 1mn
Terminals for wires size	4 x 2.5 mm <sup>2</sup>
<b>SOLID STATE OUTPUTS 2DI/2DO MODULE - OPTIONAL</b>	
SSR FORM C	2 relays
Maximum switching voltage	250VAC/VDC
Make and carry capacity	0.12A max
Maximum operate time	1 ms
Maximum release time	1 ms
Dielectric insulation withstand	4 KV AC @ 1mn
Terminals for wires size	6 x 2.5 mm <sup>2</sup>
<b>RELAY OUTPUTS - 2DI/2DO MODULE - OPTIONAL</b>	
Electromechanic FORM C	2 relays
Maximum switching voltage	250VAC/110VDC
Make and carry capacity	10A max
Maximum operate time	7 ms
Maximum release time	5 ms
Dielectric insulation withstand	4 KV AC @ 1mn
Terminals for wires size	6 x 2.5 mm <sup>2</sup>

## COMMUNICATION PORTS

<b>COM1: IR</b>	
Front panel	
Optical Communication port	IEC 62056-21
Max. Baud rate	19.200 kb/s
Protocols	MODBUS RTU/ASCII and DNP3.0
<b>COM2: GSM/GPRS MODULE (Optional)</b>	
Plug-in modules isolated communication port	Field installable
GSM/GPRS module	Quad Band GPRS class10
Max. Baud rate	115.2 kb/s
Protocols	MODBUS RTU/TCP and DNP3.0/TCP
Isolation	4 KV AC @ 1mn
GSM/GPRS module antenna connector	SMA
<b>COM3: IRIG-B</b>	
Plug-in modules isolated	Field installable

communication port	
Versatile RS-232/485	
Max. Baud rate	115.2 kb/s
Isolation	4 kV AC @ 1mn
Protocols	MODBUS RTU/ASCII and DNP3.0
Terminals for wires size	5 x 2.5 mm <sup>2</sup>
<b>IRIG-B MODULE</b>	
Isolation	4 kV AC @ 1mn
Time code signal	Unmodulated (pulse-width coded)
Signal Level	Unbalanced 5V
Connector Type	BNC
Recommended cable	51Ω low loss - RG58A/U (Belden 8219 or equivalent), BNC connector
Recommended GPS time code generator	Masterclock GPS-200A
<b>10/100 BASE T (Optional)</b>	
Plug-in modules network communication port	Field installable
Wired LAN communication port	IEEE 802.3
Ethernet port Baud rate	10/100 Mb/s, auto-negotiation
Protocols	MODBUS/TCP or DNP3.0/TCP protocols, up to five non-intrusive simultaneous connections, Telnet service port
ETH port Isolation	3 kV AC @ 1mn
ETH connector	Standard RJ-45

<b>USB (Optional)</b>	
Plug-in modules network communication port	Field installable
USB communication port	Full speed Device
USB port Baud rate	12 Mb/s
USB port Isolation	1.5 kV AC @ 1mn
Protocols	MODBUS RTU/ASCII and DNP3.0
USB connector	Mini-USB type B
<b>CONSOLE DISPLAY UNIT</b>	
Display	LCD graphic bright display: Multiple screens display Resolution 128 x 32 dots Viewing area 99.0 x 24.0 mm Operational temperature - 20°C to + 70°C Backlit LCD display screen Timeout operation
LEDs	2 Active and reactive energy led pulse
SCROLL SELECT/ENTER buttons	2 Monitoring and configuring sealed buttons
<b>REAL TIME CLOCK</b>	
5 ppm Accuracy @ 25°C	2.7 minute / year
RTC backup data retention	5 years
<b>LOG MEMORY</b>	
Non Volatile Memory (20 years Data retention)	
Standard Log Memory	8 MB
Expanded Log Memory	16 MB

## Standards Compliance

### EMC

- IEC standards IEC 61000-2

### Immunity

- ESD - IEC61000-4-2/IEC 62052-11: 15KV /- air/contact
- Electromagnetic RF Fields - IEC61000-4-3/IEC 62052-11: 30V/m @ 80MHz–1000MHz
- FTB - IEC61000-4-4/IEC 62052-11: 4KV on current and voltage circuits and 2 KV for auxiliary circuits
- SURGE - IEC61000-4-5/IEC 62052-11: 4KV on current and voltage circuits and 1 KV for auxiliary circuits
- Conducted Radio-frequency–IEC61000-4-6/IEC 62052-11: 10V @ 0.15Mhz – 80MHz
- Power Frequency Magnetic Fields–IEC61000-4-8
- Damped oscillatory waves–IEC61000-4-12/IEC 62052-11: CMM 2.5KV and DFM 1KV @ 100KHz and 1MHz

### Emission

- Radiated / Conducted
- CISPER 22 Class A

### Safety

- IEC 61010

### Insulation

- Impulse, protective class II - IEC 62052-11: 6KV /500Ω @ 1.2/50 μs
- Dielectric withstand, protective class II–IEC 62053-22: 4 KV RMS. @ 1mn

### Measurements and Accuracy

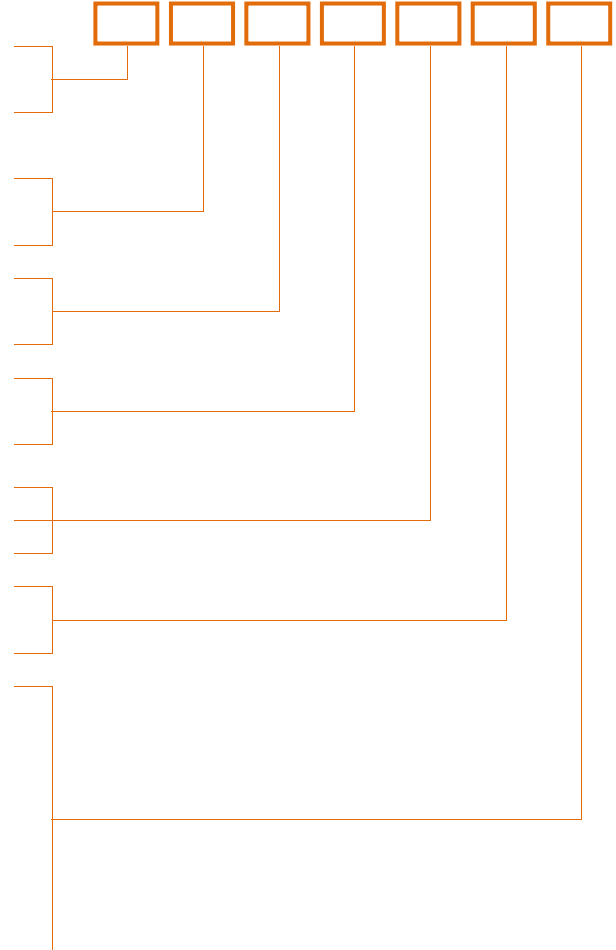
- IEC 62052-11
- IEC 62053-22–Active Energy measurement: Class 0.2S
- IEC 62053-23–Reactive Energy measurement: Class 0.5S

### Power Quality

- PQ methods–IEC 61000-4-30: Class A
- Harmonics & Interharmonics measurements: IEC 61000-4-7: Class I
- Flicker measurements–IEC 61000-4-15: Class I
- Report–EN50160

## Order String

MODEL	
Basic model	EM720
Transient Power Master	EM720T
OPTIONS	
Voltage Inputs	
480V AC (L-L)	480V
120V AC (L-L)	120V
Calibration at Frequency	
50 Hz	50HZ
60 Hz	60HZ
Current Inputs	
5 Ampere	5
1 Ampere	1
Rechargeable Battery	
Without Battery	-
With Battery	B
Memory	
Standard Memory - 8MB	-
Expanded Memory - 16MB	XM
OPTIONAL MODULES (see notes)	
[1] Ethernet, USB and 2nd RS-232/485	COM-ETH
[1] Ethernet with IEC 61850 support, USB and 2nd RS-232/485	COM-IEC
[1] Exchanging the IRIG-B with Ethernet and USB	COM-UPG
[2] GPRS (GSM)	COM-GSM
[3] 2 DI/2 Relay Output (Form C) 250VAC/5A	DIO-R
[3] 2 DI/2 Solid State Relay Output (Form A) 250VAC/0.1A	DIO-S
[4] Aux. PS: 88-265V AC and 90-290V DC	AUX-ACDC
[4] Aux. PS: 24 VDC	AUX-24



### Notes:

Maximum 2 modules per device, with the following limitations:

- [1] Maximum 1 module with Ethernet per device
- [2] Maximum 1 GSM module per device
- [3] Maximum 2 I/O modules per device
- [4] Maximum 1 Aux. Power Supply module per device