Power Transducer Series

MULTI POWER MONITOR
(4 digital displays)

Functions & Features
- Measures simultaneously several variables of a heavy-current power system: current, voltage, active, reactive and apparent power, active and reactive energy, power factor, frequency, etc.
- All measured values, counter values, display mode, setting data are stored in the non-volatile memory at the power off
- Conversion factors, system configuration, interval times are programmable using the front buttons
- Open collector output for alarm or energy count

Typical Applications
- Multi-functional power monitor incorporated in an electric device: saves space, wiring works, and cost

MODEL: 53U-1[1][2][3]-[4][5]

ORDERING INFORMATION
- Code number: 53U-1[1][2][3]-[4][5]
  Specify a code from below for each of [1] through [5]. (e.g. 53U-1211-M2/H/UL/Q)
- Specify the specification for option code /Q (e.g. /C01/SET)

CONFIGURATION
1: Single-phase / 2-wire and 3-wire,
   3-phase / 3-wire and 4-wire

[1] INPUT
1: 480 V / 1 A AC
2: 480 V / 5 A AC

[2] CONTACT INPUT
0: None
  ('External Interface' codes 1, 4 and 5 Not selectable.)
1: 24 V DC
  ('External Interface' codes 2, 3, 6, 7, 8 and 9 Not selectable.)
2: 110 V DC
  ('External Interface' codes 2, 3, 6, 7, 8 and 9 Not selectable.)

[3] EXTERNAL INTERFACE
1: Modbus, Do × 1, Di × 1
2: 4 – 20 mA DC × 4
3: 1 – 5 V DC × 4
4: 4 – 20 mA DC × 2, Do × 1, Di × 1
5: 1 – 5 V DC × 2, Do × 1, Di × 1
6: 4 – 20 mA DC × 2, Do × 2
7: 1 – 5 V DC × 2, Do × 2
8: Modbus, Do × 3
9: Do × 4

[4] AUXILIARY POWER SUPPLY
AD4: universal (Option /UL not selectable.)
100 – 240 V AC (Operational range 85 – 264 V, 47 – 66 Hz) / 110 – 240 V DC (Operational range 99 – 264 V, ripple 10 %p-p max)
M2: 100 – 240 V AC (Operational voltage range 85 – 264 V, 47 – 66 Hz)

[5] OPTIONS (multiple selections)
Performance
blank: Standard
/H: High accuracy (voltage/current: ±0.2 %, energy: ±0.5 %)
Standards & Approvals
blank: CE marking
/UL: UL approval, CE marking
Other Options
blank: none
/Q: Option other than the above (specify the specification)

SPECIFICATIONS OF OPTION: Q (multiple selections)
COATING (For the detail, refer to M-System’s web site.)
Moving parts and indicators are not coated.
/C01: Silicone coating (UL not available)
/C02: Polyurethane coating (UL not available)
/C03: Rubber coating (UL not available)
EX-FACTORY SETTING
/SET: Preset according to the Ordering Information Sheet (No. ESU-6485)
RELATED PRODUCTS

• PC configurator software (model: PMCFG)
• PC Recorder Light software for the 53U (model: MSR128LUx) Software downloadable at M-System’s web. Software downloadable at M-System’s web site.

A dedicated cable is required to connect the module to the PC. Please refer to the internet software download site or the users manual for the PC configurator for applicable cable types.

GENERAL SPECIFICATIONS

Construction: 96-mm square (1/4 DIN size) panel flush mounted

Degree of protection
Front panel: IP 50
Terminal block, housing: IP 30

Connection
Voltage input: Connector type terminal block (applicable wire size ≤ 2.5 dia, 0.5 – 3.5 mm², stripped length 7 - 8 mm)
Current input: Screw terminal block (applicable wire size ≤ 2.4 dia, 0.5 – 3.5 mm², stripped length 13 - 15 mm)

Contact input, contact output, analog output, Modbus, auxiliary power supply: Connector type terminal block (applicable wire size ≤ 2.4 dia, 0.5 – 2.5 mm², stripped length 7 - 8 mm)

Configuration: Single phase/2-wire and 3-wire, 3-phase/3-wire balanced/unbalanced load, 3-phase/4-wire balanced/unbalanced load

Housing material: Flame-resistant resin (gray)

Isolation: Voltage input to current input to contact input to Modbus or configurator jack or analog output to contact output (between each contact output except for External Interface code 8) to power

■ Measured variables
Voltage: 1 – N, 2 – N, 3 – N, 1 – 2, 2 – 3, 3 – 1
Current: 1, 2, 3, N
Average current: 1, 2, 3
Active / reactive / apparent power: 1, 2, 3, Σ
Power factor: 1, 2, 3, Σ
Frequency
Phase angle between voltages: 1 - 2, 2 - 3, 3 - 1
Active energy incoming / outgoing: Σ
Reactive energy Inductive / capacitive: Σ
Apparent energy: Σ
Active / reactive / apparent power intervals (demand)

Other demands
Harmonic contents: 2nd to 31st
Max. and min. values

■ DISPLAY: LCD with LED backlight

(LEDF OFF timer available)
Signed: 4 digits, 3 lines
Energy: 9 digits, 1 line
Bargraph: 3 points

INPUT SPECIFICATIONS

Frequency: 50 / 60 Hz (45 – 65 Hz)

• Voltage Input
Rated voltage
Line-to-line (delta voltage): 480 V
Line-neutral (phase voltage): 277 V (single-phase / 2-wire and 3-wire)

Consumption VA: ≤ Uᵢ² / 300 kΩ / phase
Overload capacity: 200 % of rating for 10 sec., 120% continuous

Selectable primary voltage range: 50 - 400 000 V

• Current Input
Rated current: 1 A or 5 A
Consumption VA: ≤ Iᵢ² / 0.01 Ω / phase
Overload capacity: 4000 % of rating for 1 sec., 2000% for 4 sec., 120% continuous

Selectable primary current range: 1 – 20 000 A

Operational range
Voltage, current, apparent power: ≤ 120 % of the rating
Active/reactive power: ≤ ±120 % of the rating
Frequency: 45 - 65 Hz
Power factor: ≤ ±1

■ Contact Input: 24 V DC or 110 V DC (input resistance 6 kΩ)
Detecting voltage: External 24 V DC ±10 % or 110 V DC ±10 %
ON current: ≥ 1 mA (≤ 24 kΩ @ 24 V, ≤ 110 kΩ @110 V)
OFF current: ≤ 0.1 mA (≥ 240 kΩ @ 24 V, ≥ 1.1 MΩ @ 110 V)
Detecting time: 10 – 1000 msec.
The status can be monitored on the Modbus; usable to reset energy count or to update average (demand) value.

OUTPUT SPECIFICATIONS

■ Modbus
Communication: Half-duplex, asynchronous, no procedure
Interface: Conforms to TIA/EIA-485-A
Max. transmission distance: 500 meters
Baud rate: 1.2 – 38.4 kbps
Max. number of nodes: 31 (except the master)
Protocol: Modbus RTU
Node address: 1 – 247 (factory default setting: 1)
Parity: none, even or odd (factory default setting: odd)
Stop bit: 1 or 2 (factory default setting: 1)
Media: Shielded twisted-pair cable (CPEV-S 0.9 dia.)
■ DC Current: 4 – 20 mA DC
Load resistance: ≤ 270 Ω

Measurands converted into analog output: Voltage, Current, Active / reactive / apparent power, Power factor, Frequency, Harmonic contents

- DC Voltage: 1 – 5 V DC
- Load resistance: ≥ 5000 Ω

Measurands converted into analog output: Voltage, Current, Active / reactive / apparent power, Power factor, Frequency, Harmonic contents

- Open Collector
  Programmable for either alarm or energy count.

  Max. rated load: 130 V DC @50 mA
  Continuous rated load: 130 V DC @30 mA
  Saturation voltage: 1.5 V DC

Measurands applicable to alarm: Voltage, current, current intervals, neutral current, frequency, energy, energy intervals
  (ON delay, deadband and other parameters are selectable)

Measurands applicable to count: Energy; Pulse rate selectable within
  0.1 – 10 000.0 kWh/p, kvarh/p, kVAh/p

**INSTALLATION**

Power consumption

- AC: < 8 VA
- DC: < 4 W

Operating temperature: -10 to +55°C (14 to 131°F)
Storage temperature: -20 to +80°C (-4 to +176°F)
Operating humidity: 90 % RH max. (non-condensing)
Mounting: Panel flush mounting
Weight: 300 g (0.66 lb)

**PERFORMANCE**

Accuracy (at 23°C ±10°C or 73.4°F ±18°F, 45 – 65 Hz)

- Voltage: ±0.3 % (±0.2 % for Option /H)*1
- Current: ±0.3 % (±0.2 % for Option /H)*1
- Power: ±0.5 %*1
- Power factor: ±0.5 %
- Frequency: ±0.1 %*1
- Energy: ±1 % (±0.5 % for Option /H)*2
- Harmonic contents: ±1 %*1

Analog output: Accuracy of assigned measurand or ±0.2 %, whichever is greater.

*1. Percentage of the spans:
  480 V for voltage;
  1 A or 5 A for current; and
  4155 W (5 A) or 831 W (1 A) for active power

The described accuracy levels are ensured at the input 1 % or more for phase 2 current with 3-phase/3-wire unbalanced load, for neutral current with 3-phase/4-wire unbalanced load, and neutral current with 1-phase/3-wire.

*2. Accuracy level:
  Active energy class 0.5S according to IEC 62053-22
  (Reactive energy class 2 according to IEC 62053-23)

Sampling rate: 64 samples per cycle
Data update period:
  Harmonic contents and frequency: ≤ 1.1 sec.
  Other: ≤ 600 msec.
Response time: ≤ 2 sec. (0 – 99 %), ≤ 3 sec. for frequency and harmonic contents
Insulation resistance: ≥ 100 MΩ with 500 V DC
Dielectric strength:
  4000 V AC @1 minute
  2500 V AC @1 minute
  2000 V AC @1 minute
  (voltage input or current input or contact input or contact output or Modbus or configurator jack or analog output to power)
  2000 V AC @1 minute
  (voltage input to contact input to contact output to Modbus or configurator jack or analog output)
  2000 V AC @1 minute
  (between each contact output except for External Interface code 8)
  2000 V AC @1 minute (circuits to housing)

**STANDARDS & APPROVALS**

EU conformity:
  EMC Directive
  EMI EN 61000-6-4
  EMS EN 61000-6-2
  Low Voltage Directive
  EN 61010-1
  Measurement Category III (input)
  Installation Category II (power)
  Pollution Degree 2

Input to auxiliary power: Reinforced insulation (550 V)
Output to auxiliary power: Reinforced insulation (300 V)
Input to output: Basic insulation (550 V)
RoHS Directive
  EN 50581

Approval:
  UL/C-UL general safety requirements
  (UL 61010-1, CAN/CSA-C22.2 No.61010-1)
MOUNTING REQUIREMENTS

■ PANEL CUTOUT unit: mm (inch)

Panel thickness: 2 to 15 mm (0.08 to 0.59 inch)

EXTERNAL VIEW

■ FRONT VIEW

■ REAR VIEW

Data Displays
Control Buttons
Current Input Terminals
Configurator Jack
Auxiliary Power Supply Terminals
Ext. Interface Terminals
Voltage Input Terminals
Current Input Terminals
Configurator Jack
**TERMINAL CONNECTIONS**

For UL approved model, L and N are marked, instead of U(+) and V(-).

### System / Application

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Three phase / 3-wire, balanced load</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><img src="image1" alt="Diagram" /></td>
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</table>

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Three phase / 4-wire, balanced load</th>
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</thead>
<tbody>
<tr>
<td></td>
<td><img src="image2" alt="Diagram" /></td>
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</table>

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Single phase / 3-wire</th>
</tr>
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<tbody>
<tr>
<td></td>
<td><img src="image3" alt="Diagram" /></td>
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### Note:

For low voltage circuit, grounding is not required.
- Contact Input Connection E.g.

- Contact Output Connection E.g.

1. When the device is located at the end of a transmission line via twisted-pair cable, (when there is no cross-wiring), close across the terminal T2 – T3 with a leadwire.

2. Analog output may momentarily fluctuate while the configurator cable is left connected.

3. For UL approved model, L and N are marked, instead of U(+) and V(–).
MODBUS WIRING CONNECTION

*1. Internal terminating resistor is used when the device is at the end of a transmission line.
*2. Install shield cables to all sections and ground them at a single point.

EXTERNAL DIMENSIONS unit: mm (inch)

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>96 (3.78)</td>
<td>Height</td>
</tr>
<tr>
<td>80 (3.15)</td>
<td>Width</td>
</tr>
<tr>
<td>23.91</td>
<td>Front panel width</td>
</tr>
<tr>
<td>[12.47]</td>
<td>Front panel depth</td>
</tr>
<tr>
<td>102.34</td>
<td>Side panel width</td>
</tr>
<tr>
<td>92 (3.62)</td>
<td>Side panel depth</td>
</tr>
<tr>
<td>3.12</td>
<td>Mounting bracket</td>
</tr>
<tr>
<td>2 (0.08)</td>
<td>Gasket</td>
</tr>
</tbody>
</table>

*1. Internal terminating resistor is used when the device is at the end of a transmission line.
*2. Install shield cables to all sections and ground them at a single point.
SYSTEM CONFIGURATION EXAMPLES

**RS-485 / RS-232-C**

- RS-232-C
- RS-232-C/RS-485 Converter (model: R2K-1 or LK1)
- Lightning Surge Protector for RS-485/422 (model: MD74R or MDP-4R) *1
- RS-485 (Modbus RTU)

**RS-485 / ETHERNET**

- Ethernet
- Communication Adaptor (model: 72EM-M4 or 72EM2-M4)
- Lightning Surge Protector for RS-485/422 (model: MD74R or MDP-4R) *1
- RS-485 (Modbus RTU)

Multi Power Monitor (model: 53U)

*1. Insert lightning surge protectors recommended in this example if necessary.
⚠ Specifications are subject to change without notice.