1. DESCRIPTION - USE

Multifunction Measuring Device.

Measures the main electrical quantities of a single-phase or three-phase network.
The insertion is done by measuring current transformers (CT).

2. RANGE

- Cat. N° 4 120 51: Multifunction measuring device, 4 DIN modules width (17.8 mm per pole). Modbus RS485 output and pulse output integrated. The device is also equipped with two digital inputs (3 terminals with common point).

Width:
- 4 modules (4 x 17.8 mm = 71.2 mm).

Auxiliary supply:
- 80 ~ 265 V~, 50 Hz or 400 Hz (automatic selection)
- 100 ~ 300 Vdc.
- Protected against reverse polarity

Rated current:
- Rated current, In: 1 A or 5 A (via external current transformer x/1 A or x/5 A)
- Max. current, Imax: 1.2 in
  - x/1 A: 1.2 A
  - x/5 A: 6 A

Insertion rated voltages:
- Un: 80~500 V~ (phase/phase)
- Un: 50~290 V~ (phase/neutral)

Rated frequency:
- fn: 50 Hz or 400 Hz (automatic selection)
- Admitted variation: 45 ~ 65 Hz (fn 50 Hz)
  - 360±440 Hz (fn 400 Hz)

3. OVERALL DIMENSIONS

4. PREPARATION - CONNECTION

Fixing:
- On symmetrical EN/IEC 60715 rail or DIN 35 rail.

Operating position:
- Vertical       Horizontal   Upside down   On the side

Screw terminals:
- Terminal depth: 8 mm.
- Stripping length: 8 mm

Screw head:
- Screw slotted.

Recommended tightening torque:
- CTs terminals (i, I, l): 1 Nm.
- Voltage measurement terminals (V, V, V, N). Inputs (1, C, 2).
- Output (3, 4), RS485 (+, -, SG), Auxiliary supply (Aux.): 0.6 Nm.
4. PREPARATION - CONNECTION (continued)

Tools required:
- CTs terminals: flat screwdriver 4 mm
- Other terminals: flat screwdriver 2.5 mm
- For fixing the device on the DIN rail: flat screwdriver 5.5 mm (from 4 to 6 mm).

Connectable section:
- Copper cables.
- CTs Terminals

<table>
<thead>
<tr>
<th></th>
<th>Without ferrule</th>
<th>With ferrule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rigid cable</td>
<td>0.05 to 6 mm²</td>
<td>-</td>
</tr>
<tr>
<td>Flexible cable</td>
<td>0.05 to 4 mm²</td>
<td>0.05 to 4 mm²</td>
</tr>
</tbody>
</table>

- Other terminals

<table>
<thead>
<tr>
<th></th>
<th>Without ferrule</th>
<th>With ferrule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rigid cable</td>
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</tr>
<tr>
<td>Flexible cable</td>
<td>0.05 to 2.5 mm²</td>
<td>0.05 to 2.5 mm²</td>
</tr>
</tbody>
</table>

Wiring diagrams:
- 4 wires three-phase network, 3 CT (3N-3E):

For all other wiring diagrams refer to the instruction sheet.

5. GENERAL CHARACTERISTICS

Case marking:
- By permanent ink pad printing.

Display
- Type: LCD back lit.
- Resolution: automatic adjustment of the display resolution for the decimal digits and for the engineering units as a function of the transformation ratio of the external current transformers (kTA¹) and, if any, if the external voltage transformers (kTV²)

```
¹kTA= external CTs ratio
(ex. 800A / 5A, kTA = 160).
²kTV = external VT ratio
(ex. 600V / 100V, kTV = 6). For direct connection kTV = 1.
In the example, kTA x kTV = 160 x 6 = 960.
```
- Refresh time: 1.1 sec.
- Automatic backlight reduction, after 20 sec. of keyboard inactivity

Measuring sensors operating range:
- Max. VTs primary voltage: 1200 V.
- Max CTs primary current: 50 kA (CT = x/5A), 10 kA (CT = x/1A)
- Max. product kTA x kTV = 99.990 (CT = x/5A and CT = x/1A)

Note: Changing one of the parameters kTA or kTV in the setup menu of the device, all the energy counters are reset.
5. GENERAL CHARACTERISTICS (continued)

Measured quantities and Accuracy class:

- Current (accuracy 0.5):
  - phase: $I_1$, $I_2$, $I_3$;
  - neutral: $I_0$.
- Voltage (accuracy 0.5):
  - phase/phase: $U_{12}$, $U_{23}$, $U_{31}$;
  - phase/neutral: $V_{1N}$, $V_{2N}$, $V_{3N}$.
- Frequency (accuracy ± 0.1 Hz)
- Power:
  - instantaneous active total power, phase, average value and max. average value (accuracy 0.5);
  - instantaneous reactive total power, phase, average value and max. average value (accuracy 1);
  - instantaneous apparent total power, phase, average value and max. average value (accuracy 1);
- Power factor a (accuracy 0.5).

Energy:

- total and partial active energy, positive and negative (accuracy 0.5);
- total and partial reactive energy, positive and negative (accuracy 1).
- THD (accuracy 1):
  - voltages THD: $V_1$, $V_2$, $V_3$ o $U_{12}$, $U_{23}$, $U_{31}$;
  - currents THD: $I_1$, $I_2$, $I_3$.
- Harmonic analysis:
  - Voltages: odd harmonics up to 9th (in display); odd and even harmonics up to 25th (via communication RS485);
  - Currents: odd harmonics up to 9th (in display); odd and even harmonics up to 25th (via communication RS485);

Measurements update period
- 0.2 s

Energy count mode
- 4 selectable modes:
  - Asyn: Partial Energy count always active
  - Syn: Partial Energy count activated by digital inputs
  - Trfs: Energy count on 4 tariffs; switching via the digital inputs
  - Cntr: Partial Energy count always active + status of inputs and input pulses counter.

Digital inputs
- 2 active digital inputs, with different use:
  - activation of partial energy count
  - switching of energy count on 4 tariffs
  - input pulse counting
- 3 input terminals with a common point (1 - C - 2)
- Max. voltage: 27 Vd.c.
- Max input pulse frequency: 15 Hz
- Inputs wiring:

RS485 communication port's characteristics:

- Programmable addresses: from 1 to 247
- Baud rate: 4,8 - 9,6 - 19,2 - 38,4 kbps
- Parity bit: none, even, odd
- Stop bit: 1
- Galvanically isolated respect to measuring inputs and auxiliary supply
- Standard RS485 3 wires, half-duplex
- Protocol Modbus® RTU
- Response time (time out question/answer): ≤ 200 ms

Pulse output's characteristics:

- Optorelays with potential-free SPST-NO contact
- Type S0 (IEC/EN62053-31)
- Voltage $U_{imp}$: max. 27 Va.c/d.c.
- Current $I_{imp}$: max. 50 mA
- Programmable pulse weight, possible values: 10 – 100 - 1k - 10k - 100k - 1M - 10M Wh/imp or varh/imp
- Programmable pulse duration, possible values: 50 - 100 - 200 - 300 ms.

Note: "V" max. 27 Vd.c. (ex. Cat. N°. E49 or 346020)

Technical data sheet: F02167EN/00 Updated: - Created: 18/09/2015
5. GENERAL CHARACTERISTICS (continued)

Alarms output characteristics:
- Optorelays with potential-free SPST-NO contact
- Voltage: max. 27 Va.c./d.c.
- Current: max. 50 mA
- Control type:
  - bistable (rMh)
  - temporized (rMt)
- Relay run mode: normally open (NO) / normally closed (NC)
- Relay run mode: temporized (rMtt)
- Relay run mode: bistable (rMtB)
- Relay run mode: temporized (rMtb)
- Recovery delay: 0÷99 sec.
- Intervention delay: 0÷99 sec.
- Programmable intervention threshold

Output characteristics - Remote control via RS485:
- Optorelays with potential-free SPST-NO contact
- Voltage: max. 27 Va.c./d.c.
- Current: max. 50 mA
- Control type:
  - bistable (rMh)
  - temporized (rMt)
- Relay run mode: normally open (NO) / normally closed (NC)
- Relay run mode: temporized (rMtt)
- Relay run mode: bistable (rMtB)
- Relay run mode: temporized (rMtb)
- Recovery delay: 0÷99 sec.

Plastic material:
- Self-extinguishing polycarbonate.

Ambient operating temperature:
- Min. = -5 °C Max. = +55 °C.

Ambient storage temperature:
- Min. = -25 °C Max. = +70 °C.

Device protection:
- Recommended fuse 0.5 A type gG

Protection index:
- Protection index of terminals against solid and liquid bodies (wired device): IP 20 (IEC/EN 60529).
- Protection index of the front face against solid and liquid bodies: IP 54 (IEC/EN 60529).

Impulse withstand voltage:
- Supply / Measuring inputs:
  - wave 1.2 / 50 μs 0.5 J: 6kV
  - alternate current 50 Hz / 1 m.s.: 3 kV
- Supply / RS485 port:
  - wave 1.2 / 50 μs 0.5 J: 6kV
  - alternate current 50 Hz / 1 m.s.: 3 kV
- Measuring inputs / Pulse output:
  - wave 1.2 / 50 μs 0.5 J: 6kV
  - alternate current 50 Hz / 1 m.s.: 3 kV
- All circuits / earth:
  - alternate current 50 Hz / 1 m.s.: 4 kV

pollution degree:
- 2

Installation category:
- III

Average weight per device:
- 0.250 kg.

Volyme when packed:
- 0.70 dm³.

Consumption:
- ≤ 2.5 VA (a.c. supply)
- ≤ 3.5 W (d.c. supply)

Thermal power dissipated:
- ≤ 5 W.

Phase sequence correction diagnostic:
- In the software of the device there is a specific functionality to detect and correct problems concerning voltage and / or current connections.
  The “Testing connections” functions can be activated with a specific password for connections 3-2E, 3-3E or 3N-3E.
  Conditions for the execution of the function:
  - multifunction device 4 120 51 must have current and voltage on each phase and the neutral, if present, must be connected to the corresponding terminal “N”.
  In addition, the test function requires:
    - an electrical 120° three-phase system.
    - a value of the power factor PF > 0.5 for 3N-3E and 3-3E or PF > 0.71 for 3-2E.
    - the power factor of the system is not included in these ranges, the function cannot be used.
    - no crossings between cables connected to secondary of CTs (ex. TA phase 1 → terminals S1 and S2 of I1 and so on).

Procedure’s access codes:
- 3333: Start of diagnostic procedure
- 4444: Display of the current configuration
- 5555: Restore the default configuration (factory configuration)
6. COMPLIANCE AND APPROVALS

Compliance to standards:
- Compliance with Directive on electromagnetic compatibility (EMC) n° 2004/108/EC
- Compliance with low voltage directive no. 73/23/CEE dated 19 February 1973, modified by directive no. 93/68/CEE dated 22 July 1993, modified by directive n° 2006/95/CE.
- Electromagnetic Compatibility:
  - emission according IEC/EN 61326-1, class B
  - immunity according IEC/EN 61326-1.
- Active energy accuracy class: 0,5 (E<sub>a</sub>, IEC/EN 61557-12).
- Reactive energy accuracy class: 1 (E<sub>r</sub>, IEC/EN 61557-12).

Conformity table to IEC 61557-12 Edition 1 (08/2007)

<table>
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<tr>
<th>Type of characteristic</th>
<th>Specification values</th>
<th>Other complementary characteristics</th>
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<tbody>
<tr>
<td>Power quality assessment function</td>
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<td>Classification of PMD</td>
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<td>Temperature</td>
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<td>Humidity + Altitude</td>
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<td>Active power and Active energy function performance class</td>
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<tr>
<td>Function symbols</td>
<td>Function performance class according to IEC 61557-12</td>
<td>Measuring range</td>
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<td>------------------------------------------------------</td>
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<td>P</td>
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<tr>
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<td>0.01 + 1.2 A (x/1 A) 0.05 + 6 A (x/5 A)</td>
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<tr>
<td>Ss, Sv</td>
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<td>0 = 9999999.9 MWh</td>
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<tr>
<td>Esa, Esv</td>
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<td>0 = 9999999.9 Mvarh</td>
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<td>f</td>
<td>± 0.1 Hz</td>
<td>45 + 65 Hz</td>
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<tr>
<td>l</td>
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<td>ln, lnc</td>
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<td>0.5 ind + 0.8 cap</td>
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<td>-</td>
</tr>
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<td>U     U     U     U</td>
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<td>-</td>
</tr>
<tr>
<td>THD     THD     THD     THD</td>
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<td>30 - 300 V (Ph/N) 50 - 500 V (Ph/Ph)</td>
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<td>THD-Rn</td>
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<tr>
<td>ln     ln     ln     ln</td>
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<td>0.1 + 1.2 A (x/1 A) 0.1 + 6 A (x/5 A)</td>
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<tr>
<td>THD     THD     THD     THD</td>
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<td>0.1 + 1.2 A (x/1 A) 0.1 + 6 A (x/5 A)</td>
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<tr>
<td>THD-Rn</td>
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<tr>
<td>M-var</td>
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</table>
### 6. COMPLIANCE AND APPROVALS (continued)

Conformity table to IEC 61557-12 Edition 1 (08/2007) (continued)

<table>
<thead>
<tr>
<th>Function symbols</th>
<th>Function performance class according to IEC 61557-12</th>
<th>Measuring range</th>
<th>Other complementary characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>( f )</td>
<td>( \pm 0.1) Hz</td>
<td>( 45 \div 65) Hz</td>
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<tr>
<td>( I )</td>
<td>0.5</td>
<td>( 0.01 \div 1.2) A (x/1 A) ( 0.05 \div 6) A (x/5 A)</td>
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</tr>
<tr>
<td>( I_n, I_{nc} )</td>
<td>2</td>
<td>( 0.1 \div 1.2) A (x/1 A) ( 0.1 \div 6) A (x/5 A)</td>
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<tr>
<td>( U )</td>
<td>0.5</td>
<td>( 30 \div 300) V (Ph/N) ( 50 \div 500) V (Ph/Ph)</td>
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</tr>
<tr>
<td>( U_{ph} )</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>( U_{pm} )</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>( U_b )</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>( U_{ab} )</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>( U_{ab} )</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>( U_i )</td>
<td>1</td>
<td>( 30 \div 300) V (Ph/N) ( 50 \div 500) V (Ph/Ph)</td>
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<tr>
<td>( I_i )</td>
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<td>( 0.1 \div 1.2) A (x/1 A) ( 0.1 \div 6) A (x/5 A)</td>
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<tr>
<td>( M_{av} )</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
7. Communication

RS485 Wiring diagram:

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RS485: Prescribed use of Cable Belden 9842, Belden 3106A (or equivalent) for a maximum length of 1000 m, or Category 6 cable (FTP or UTP) for a maximum length of 50 m.

*Resistance not furnished

Modbus communication tables

Modbus communication tables are available at www.e-catalogue.legrandgroup.com, typing “412051” in the search field.