

ODS-1500

1200...1500 VA DC/AC INVERTER

GENERAL FEATURES:

- Sine wave output voltage
- Selectable output frequency: 50/60Hz
- Adjustable output voltage
- High input-output isolation 3000Vrms
- Remote inhibit
- Remote control via RS232
- Alarm by isolated relay contacts
- Remote off opto-coupled
- Optional railway version EN50155
- Fire and smoke: EN45545-2 approved
- Efficiency up to 91%



| | 12Vdc 10 ... 15V | 24Vdc 16.8 ... 30V | 36Vdc 25.2 ... 45V | 48Vdc 33.6 ... 60V | 72Vdc 50.4 ... 90V | 110Vdc 77 ... 138V |
|--------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| 120Vac | ODS-1500-7121 1200 W | ODS-1500-7123 1500 W | ODS-1500-7124 1500 W | ODS-1500-7125 1500 W | ODS-1500-7126 1500 W | ODS-1500-7127 1500 W |
| 230Vac | ODS-1500-7111 1200 W | ODS-1500-7113 1500 W | ODS-1500-7114 1500 W | ODS-1500-7115 1500 W | ODS-1500-7116 1500 W | ODS-1500-7117 1500 W |



INPUT

| | |
|----------------------|------------------------------------|
| Input voltage range | -30, +25% Vin nom, (10 ... 15Vdc)* |
| Maximum input ripple | 5% Vin nom (Vrms, 100Hz) |

OUTPUT

| | |
|----------------------------|--|
| Output voltage | 120 / 230Vac sinusoidal |
| Output frequency | 50 / 60Hz ± 0.25Hz |
| Load regulation | < 4% |
| Line regulation | < 2 % Vin -25% ... +25%, < 10% Vin -30% ... +30% |
| Output wave distortion THD | < 2% (average of 16 samples) |
| Output HF ripple | < 2.5% |

ENVIRONMENTAL

| | |
|--|---------------------------|
| Storage temperature | -25 ... 80°C |
| Operatingtemperature full load | -25 ... 55°C(EN50155 OT1) |
| Operatingtemperature 50% load | -25 ... 70°C(EN50155 OT3) |
| Relative humidity without condensation | 5 ... 95% |
| Cooling | Controlledinternal fan |
| MTBF (MIL-HDBK-217-E; Gb, 25°C) | 130.000 h |

EMC

| | |
|---------------------|---------------------------|
| Immunity according | EN61000-6-2 (EN50121-3-2) |
| Emissions according | EN61000-6-4 (EN50121-3-2) |

SAFETY

| | |
|--------------------------------------|-------------------------|
| Dielectric strength: Input /output | 3000 Vrms / 50Hz / 1min |
| Dielectric strength: Output / ground | 1500 Vrms / 50Hz / 1min |
| Dielectric strength: Input / ground | 500 Vrms / 50Hz / 1min |
| Safety according to | EN60950-1, EN62368-1 |
| Fire and smoke | EN45545-2 approved |

MECHANICAL

| | |
|--------|--------|
| Weight | 3800 g |
|--------|--------|

PROTECTIONS

| | |
|--------------------------|---|
| Against overloads | Current andI ² T limited (see overload protection) |
| Against over-temperature | Shutdown with auto-recovery |

CONTROL

| | |
|------------------------|--|
| Output OK LED | Green |
| Alarm LED | Red |
| Output failure alarm | Isolated contact relay open when alarm (<0.3A at 150Vcc) |
| Remote OFF | Off applying 4...24 Vdc, Impedance > 3k3Ω |
| Status and programming | RS232 port |



ORDERING CODES

| Model | Input voltage DC [V] | Input voltage range [V] | Output voltage AC [V] | Output current [V] | Active output power [W] | Appar. output power [VA] | Output peak current | | Efficien. [%] | No load input current [A] |
|---------------|----------------------|-------------------------|-----------------------|--------------------|-------------------------|--------------------------|---------------------|-------------------|---------------|---------------------------|
| | | | | | | | 5s [Arms] | (Iopk) 10ms [Apk] | | |
| ODS-1500-7111 | 12 | 10.0 - 15 | 230 | 5.2 | 1200 | 1200 | 6.8 | 16 | 87 | < 0.8 |
| ODS-1500-7113 | 24 | 16.8 - 30 | 230 | 6.5 | 1500 | 1500 | 10 | 16 | 88 | < 0.4 |
| ODS-1500-7114 | 36 | 25.2 - 45 | 230 | 6.5 | 1500 | 1500 | 10 | 16 | 89 | < 0.3 |
| ODS-1500-7115 | 48 | 33.6 - 60 | 230 | 6.5 | 1500 | 1500 | 10 | 16 | 90 | < 0.2 |
| ODS-1500-7116 | 72 | 50.4 - 90 | 230 | 6.5 | 1500 | 1500 | 10 | 16 | 90 | < 0.15 |
| ODS-1500-7117 | 110 | 77 - 138 | 230 | 6.5 | 1500 | 1500 | 10 | 16 | 91 | < 0.1 |
| ODS-1500-7121 | 12 | 10.0 - 15 | 120 | 10.0 | 1200 | 1200 | 13 | 30 | 86 | < 0.8 |
| ODS-1500-7123 | 24 | 16.8 - 30 | 120 | 12.5 | 1500 | 1500 | 20 | 30 | 88 | < 0.4 |
| ODS-1500-7124 | 36 | 25.2 - 45 | 120 | 12.5 | 1500 | 1500 | 20 | 30 | 88 | < 0.3 |
| ODS-1500-7125 | 48 | 33.6 - 60 | 120 | 12.5 | 1500 | 1500 | 20 | 30 | 89 | < 0.2 |
| ODS-1500-7126 | 72 | 50.4 - 90 | 120 | 12.5 | 1500 | 1500 | 20 | 30 | 89 | < 0.15 |
| ODS-1500-7127 | 110 | 77 - 138 | 120 | 12.5 | 1500 | 1500 | 20 | 30 | 90 | < 0.1 |

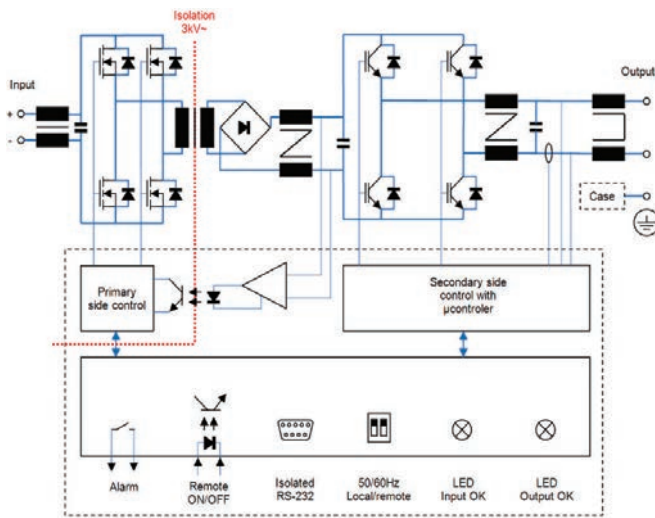
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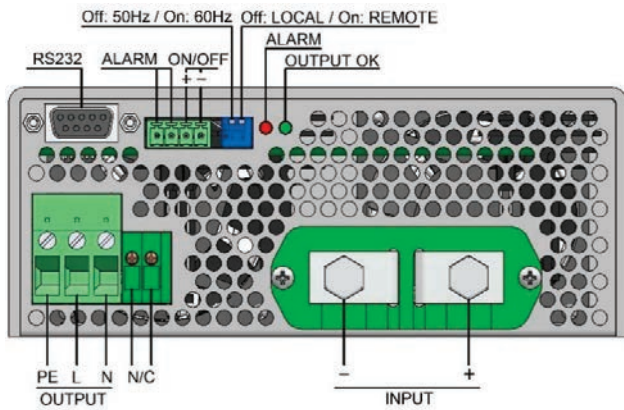
Accessories must be ordered in a separated order line



BLOCKS DIAGRAM

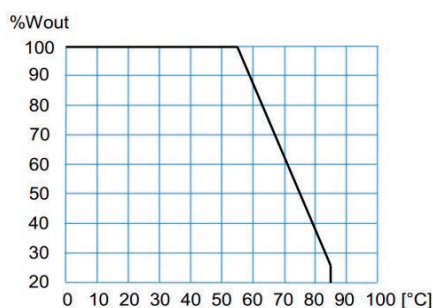


CONNECTIONS



| RS232 functions | |
|-----------------|-----------------------------|
| Monitoring | Input voltage |
| | Output voltage |
| | Output current |
| | Internal temperature |
| | Output frequency |
| | Output power |
| Settings | Input under-voltage lockout |
| | Input under-voltage alarm |
| | On / Off |
| | Output frequency |
| | Maximum output current |
| | Output voltage |

POWER DERATING vs AMBIENT TEMPERATURE



DESCRIPTION

The ODS-1500 consists of single phase sine-wave DC/AC inverters with galvanic isolation between input and output

The unit allows:

- Select 50 / 60Hz by means of DIP-switch.
- Select local / remote (RS-232) by means of DIP-switch
- Shutdown applying voltage on pins 3 and 4 of signal connector
- Local signalization of Output OK by means of green LED
- Local alarm. Red LED ON when:
 - Output voltage is not OK
 - Output current > OUTPUT CURRENT ALARM
 - Input voltage out of margins
 - Unit shutdowns by over-current or remote OFF
- Remote alarm. Open contacts when output voltage is not OK
- Set and monitor parameters via RS-232.

The ODS-1500 are equipped with a maximum average power protection as well as maximum output peak current protection. This protects the unit even when an output short-circuit occurs. It also features a disable function for input under-voltage, which allows protecting the batteries from harmful discharges.

INSTALLATION

- The unit has 6 threaded holes for the fixation on a mounting surface.
- The unit has internal fans. For an appropriate cooling, the air input and output should be free of elements that cause an air flow reduction (minimum recommended distance to other objects 50mm).
- Make connections as shown in the figure.
- The default output frequency is 50Hz. For 60Hz simply actuate the dip-switch as indicated in the figure.

For safety reasons, the following requirements must be met:

- Provide the equipment with some kind of protective enclosure that complies with the electrical safety directives in effect within the country where the equipment is installed.
- Include an input fuse with a rating immediately higher than the maximum input current.
- Use cables of adequate cross-section to connect inputs and outputs. The following table lists the maximum currents and the minimum cross-sections for the cables used for each power connection.

| | Input 12V | Input 24V | Input 36V | Input 48V | Input 72V | Input 110V | Output 120V | Output 230V |
|---------------------|--------------------|--------------------|--------------------|--------------------|-------------------|---------------------|---------------------|---------------------|
| Max. current | 140 A | 100 A | 75A | 50 A | 33 A | 22 A | 13 A | 6.7 A |
| Cable cross-section | 35 mm ² | 16 mm ² | 16 mm ² | 10 mm ² | 6 mm ² | 2.5 mm ² | 1.5 mm ² | 1.0 mm ² |



RS232 communication port

It is possible to control and monitor the unit via RS232 by means of an application tool named PAM. This application is free and can be downloaded from the Premium web site

Also it is possible to control and monitor the unit directly using the protocol showed in table:

Protocol configuration: ASCII code, 19200 bauds, parity none, 8 bits, 1bit stop

| Header | Function | Parameter | Returns | Explanation | |
|--------|----------|----------------|--|--|--|
| P | L | V | PTV####. | Input voltage in Volts | |
| | | U | PTU####. | Output voltage in Volts RMS | |
| | | I | PTI####. | Output current in Amps RMS | |
| | | T | PTT####. | Internal temperature in °C | |
| | | F | PTF####. | Output frequency in Hz | |
| | | W | PTW#### | Output power in W | |
| | | S | PTS####. | Inverter state 999.9→ Inverter enabled 000.0→ Inverter disabled 222.2→ Inverter blocked by overload 111.1→ Inverter blocked by overload or short-circuit | |
| | | M | PTM#### | Model number | |
| | | R | PTR#### | Firmware version | |
| | | Othercharacter | PTE | Command not supported | |
| | G | 1 | ####. | OK | Set the minimum input working voltage in Volts |
| | | | | ERR | Value NO VALID for this parameter |
| | | 2 | ####. | OK | Set the minimum alarm input voltage in Volts |
| | | | | ERR | Value NO VALID for this parameter |
| | | 3 | ####. | OK | Changes the status bit (after start up enabled with SW3 =LOCAL and disabled with SW3 =REMOTE) 999.9→ Inverter enabled 000.0→ Inverter disabled |
| | | | | ERR | Value NO VALID for this parameter |
| | | 4 | ####. | OK | Set the output voltage in Volts RMS $80\% V_{nom} \leq \text{####.} \leq 105\% V_{nom}$ |
| | | | | ERR | Value NO VALID for this parameter |
| | | 5 | ####. | OK | Set the maximum output current in Amps $20\% I_{nom} \leq \text{####.} \leq 100\% I_{nom}$ |
| | | | | ERR | Value NO VALID for this parameter |
| 6 | ####. | OK | Changes the output frequency (it's not stored for the next start-up) 050.0→ 50Hz 060.0→ 60Hz | | |
| | | ERR | Value NO VALID for this parameter | | |
| 7 | ####. | OK | Set the OUTPUT CURRENT ALARM $0 \leq \text{####.} \leq 100\% I_{max_warning}$ | | |
| | | ERR | Value NO VALID for this parameter | | |
| 8 | ####. | OK | 111.1→ Reset the inverter | | |
| | | ERR | Value NO VALID for this parameter | | |



WORKING PARAMETERS

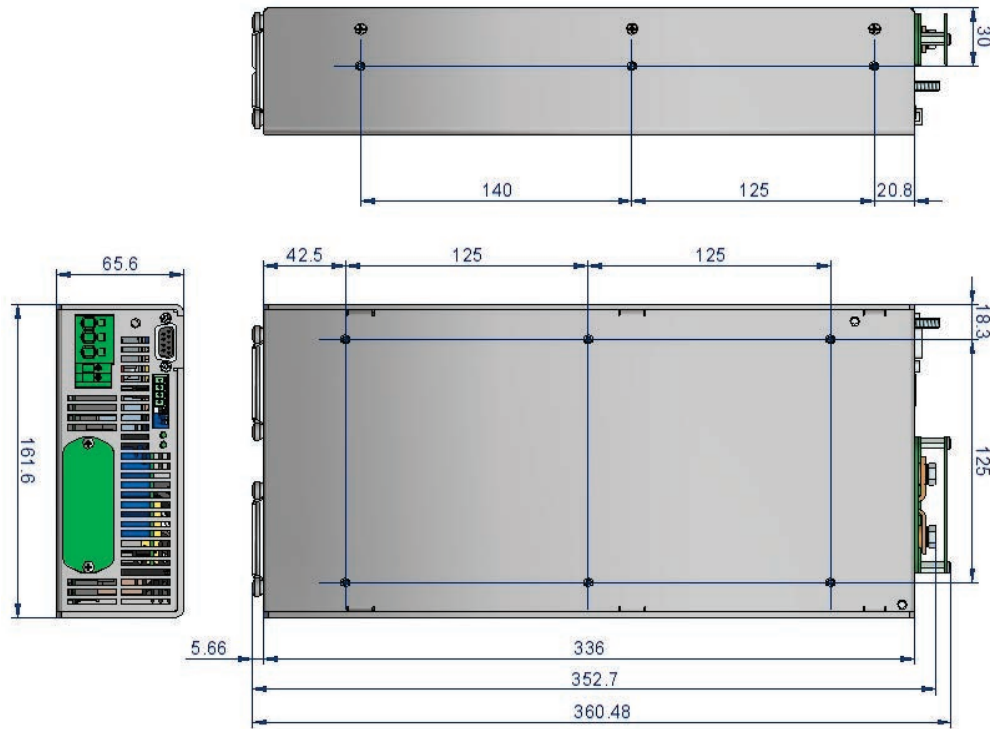
| Thermal protection | 71XX | | | | | | |
|---|------------------|--------------|------|------|--------------|-------|-----|
| Internal warning temperature | 88 | | | | | | °C |
| Internal shutdown temperature | 92 | | | | | | °C |
| Internal restart temperature after over-temperature shutdown | 75 | | | | | | °C |
| Input voltage parameters | 71X1 | 71X3 | 71X4 | 71X5 | 71X6 | 71X7 | |
| Max. input voltage shutdown instantaneous | 16.8 | 33.7 | 50.6 | 67.3 | 100.9 | 154.1 | Vdc |
| Max. input voltage shutdown timed 0.1s | 15.1 | 30.1 | 45.2 | 60.1 | 90.1 | 138.6 | Vdc |
| Maximum star-up voltage | 14.9 | 29.9 | 44.9 | 59.8 | 89.7 | 137.4 | Vdc |
| Minimum star-up voltage | 10.6 | 17.9 | 26.9 | 35.9 | 53.9 | 82.4 | Vdc |
| Min. input voltage shutdown timed 0.1s | 10.0 | 16.7 | 25.1 | 33.5 | 50.3 | 76.9 | Vdc |
| Min. input voltage shutdown instantaneous | 9.6 | 14.4 | 21.6 | 28.7 | 43.1 | 65.9 | Vdc |
| Output voltage parameters | 711X | | | 712X | | | |
| Output voltage of short circuit or deep overload | < 164 | | | < 86 | | | Vac |
| Time of short-circuit | 1000 | | | | | | ms |
| Time of start-up after shutdown by short-circuit | 2000 | | | | | | ms |
| Number of start-up attempts after short circuit | 3 | | | | | | |
| Output current parameters | 7111 | 7113/4/5/6/7 | | 7121 | 7123/4/5/6/7 | | |
| Maximum continuous output current | 5.3 | 6.6 | | 10.1 | 12.7 | | A |
| Warning current | 5.2 | 6.5 | | 10 | 12.5 | | A |
| Start-up time after shutdown by overload | 1000 | 1500 | | 1000 | 2000 | | ms |
| Maximum overload I ^{2t} | See figure below | | | | | | |
| Number of attempts of consecutive overload | 3 | | | | | | |
| Start-up and working errors | 71XX | | | | | | |
| Maximum time for overload or internal failure | unlimited | | | | | | |
| Minimum time required between disconnection and next connection | 2 | | | | | | min |

OVERLOAD PROTECTION

| | | |
|---|---|--|
| Protection against overloads and short-circuits | By current limiting at I _{opk} By I^{2t} . The unit shutdowns when the current-time is over the continuous operation curve | |
| Overload protection recovery | Every 2 seconds after shutdown, the unit tries to restart up to 3 times. If the overload persists, the unit reminds shutdown until an input reconnection . | |



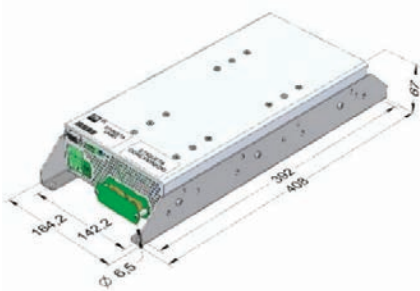
DIMENSIONS



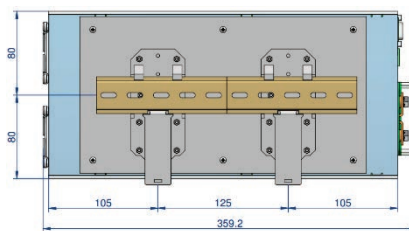
ACCESSORIES

| DESCRIPTION | NOTES | CODE |
|-------------------------------|---------------------------------------|----------|
| Mounting brackets kit | Contains two brackets and screws | NP-9282 |
| DIN rail assembly kit | Screws included | NP-9339 |
| 2U 19" rack mounting tray kit | It allows to install one or two units | NP-9353 |
| Signals female connector | | 2601-409 |

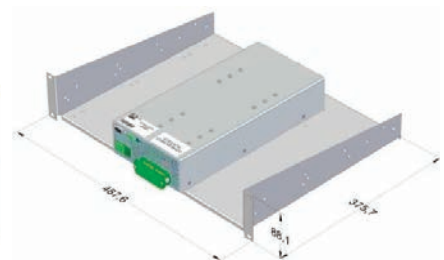
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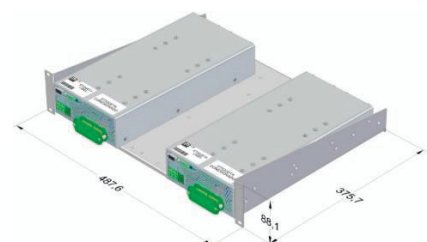
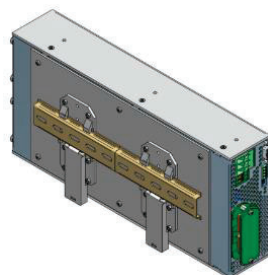
NP-9339



NP-9353



2601-409





CE EU DECLARATION OF CONFORMITY

The undersigned, representing the following:

Manufacturer: PREMIUM, S. A.,
Address: C/ Dolors Aleu 19-21, 08908 L'Hospitalet de Llobregat, SPAIN

herewith declares that the product:

Type: DC/DC converter
Models: **ODS-1500-7111 ... 7127**

is in conformity with the provisions of the following EU directive(s):

| | |
|------------|--|
| 2014/35/EU | Low voltage |
| 2014/30/EU | Electromagnetic compatibility |
| 2011/65/EU | Restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS) |

and that standards and/or technical specifications referenced overleaf have been applied:

| | |
|---------------------|---|
| EN 60950-1: 2005 | Safety. Information technology equipment |
| EN 62368-1: 2014 | Safety. Audio/video, information and communication technology equipment |
| EN 61000-6-3: 2007 | Generic emission standard |
| EN 61000-6-2: 2005 | Generic immunity standard |
| EN 50155: 2017* | Railway applications. Electronic equipment used on rolling stock material |
| EN 50121-3-2: 2016* | Railway applications. EMC Rolling stock equipment |

* Optional, See annexe

CE marking year: **2010**

Notes:

For the fulfilment of this declaration the product must be used only for the aim that has been conceived, considering the limitations established in the instructions manual or datasheet.

L'Hospitalet de Llobregat, 04-10-2019

Jordi Gazo
Chief Executive Officer

PREMIUM S.A. is an ISO9001 and ISO14001
certified company by **Bureau Veritas**



ANNEXE

Applicable values for the different sections of the norm EN50155: 2017

| 4.3.1 | Working altitude | Up to 2000m | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|---|---------------------|---------------------------|--------------------|----------------------------|---------------------|--------------------|-------------------------|--------------|--------------------------------|-----------------------|---------------------------------|-----------------------|-----------------|----------------------------|-------------------------|--------------|------------------|----------|--|---------------------|-------------|--------------------------|-------------------------------|--------------------------|------------------------------------|------------------------------------|-------------------------------------|------|------------------------|--|-----------------|--------------|-------|------|----------------|---|--------|------|--------|------|--|--|----|------|--|--|-------|--------------|--------------|------|-----------------|---|---------------|------|--------------|--------------|-------|-----|--------------------------|---|--------|-----|--------|-----|----|-----|----------------|--------------|------------|--------|----------------------|---|
| 4.3.2 | Ambient temperature | Class OT1 (-25 to 55°C): load < 100% Class OT2 (-40 to 55°C): load < 100% (Without connectors handling) Class OT3 (-25 to 70°C): load < 75% Class OT4 (-40 to 70°C): load < 75% (Without Connectors handling) Class OT5 (-25 to 85°C): load < 37.5% Class OT6 (-40 to 85°C): load < 37.5% (Without Connectors handling) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4.3.3 | Switch-on extended operating temp. | ST1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4.3.4 | Rapid temperature variations | H1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4.3.5 | Shocks and vibrations | According EN61373:2010 Category 1 class B | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4.3.6 | EMC Electromagnetic Compatibility EN50121-3-2:2016 | <table border="1"> <thead> <tr> <th>Test</th> <th>Norm</th> <th>Port</th> <th>Frequency</th> <th>Limits</th> </tr> </thead> <tbody> <tr> <td rowspan="3">Radiated emissions</td> <td rowspan="3">IEC55016</td> <td rowspan="3">Case</td> <td>30MHz...230MHz</td> <td>40dB(µV/m) Qpk at 10m</td> </tr> <tr> <td>230MHz...1GHz</td> <td>47dB(µV/m) Qpk at 10m</td> </tr> <tr> <td>1...3GHz</td> <td>Do not apply</td> </tr> <tr> <td></td> <td></td> <td></td> <td>3...6GHz</td> <td>Internal freq. < 108MHz</td> </tr> <tr> <td rowspan="2">Conducted emissions</td> <td rowspan="2">IEC55016</td> <td rowspan="2">Input</td> <td>150kHz...500kHz</td> <td>99dB(µV) Qpk</td> </tr> <tr> <td>500kHz...30MHz</td> <td>93dB(µV) Qpk</td> </tr> </tbody> </table> | Test | Norm | Port | Frequency | Limits | Radiated emissions | IEC55016 | Case | 30MHz...230MHz | 40dB(µV/m) Qpk at 10m | 230MHz...1GHz | 47dB(µV/m) Qpk at 10m | 1...3GHz | Do not apply | | | | 3...6GHz | Internal freq. < 108MHz | Conducted emissions | IEC55016 | Input | 150kHz...500kHz | 99dB(µV) Qpk | 500kHz...30MHz | 93dB(µV) Qpk | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Test | Norm | Port | Frequency | Limits | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Radiated emissions | IEC55016 | Case | 30MHz...230MHz | 40dB(µV/m) Qpk at 10m | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | 230MHz...1GHz | 47dB(µV/m) Qpk at 10m | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | 1...3GHz | Do not apply | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | 3...6GHz | Internal freq. < 108MHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Conducted emissions | IEC55016 | Input | 150kHz...500kHz | 99dB(µV) Qpk | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | 500kHz...30MHz | 93dB(µV) Qpk | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | <table border="1"> <thead> <tr> <th>Test</th> <th>Norm</th> <th>Port</th> <th>Severity</th> <th>Conditions</th> <th>P</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Electrostatic discharge</td> <td rowspan="2">IEC61000-4-2</td> <td rowspan="2">Case</td> <td>±8kV</td> <td>Air (isolated parts)</td> <td rowspan="2">B</td> </tr> <tr> <td>±8kV</td> <td>Contact (conductive parts)</td> </tr> <tr> <td rowspan="3">Radiated high-frequency</td> <td rowspan="3">IEC61000-4-3</td> <td rowspan="3">X/Y/Z Axis</td> <td>20V/m</td> <td>0.08...1.0GHz M. 80% 1kHz</td> <td rowspan="3">A</td> </tr> <tr> <td>10V/m</td> <td>1.4...2.1GHz M. 80% 1kHz</td> </tr> <tr> <td>5V/m</td> <td>2.1...2.5GHz M. 80% 1kHz</td> </tr> <tr> <td></td> <td></td> <td></td> <td>3V/m</td> <td>5.1...6GHz M. 80% 1kHz</td> <td></td> </tr> <tr> <td rowspan="3">Fast transients</td> <td rowspan="3">IEC61000-4-4</td> <td>Input</td> <td>±2kV</td> <td rowspan="3">Tr/Th: 5/50 ns</td> <td rowspan="3">A</td> </tr> <tr> <td>Output</td> <td>±2kV</td> </tr> <tr> <td>Signal</td> <td>±2kV</td> </tr> <tr> <td></td> <td></td> <td>PE</td> <td>±1kV</td> <td></td> <td></td> </tr> <tr> <td rowspan="2">Surge</td> <td rowspan="2">IEC61000-4-5</td> <td>Input L to L</td> <td>±1kV</td> <td rowspan="2">Tr/Th: 1.2/50µs</td> <td rowspan="2">B</td> </tr> <tr> <td>Input L to PE</td> <td>±2kV</td> </tr> <tr> <td rowspan="4">Conducted RF</td> <td rowspan="4">IEC61000-4-6</td> <td>Input</td> <td>10V</td> <td rowspan="4">0.15...80MHz M. 80% 1kHz</td> <td rowspan="4">A</td> </tr> <tr> <td>Output</td> <td>10V</td> </tr> <tr> <td>Signal</td> <td>10V</td> </tr> <tr> <td>PE</td> <td>10V</td> </tr> <tr> <td>Magnetic field</td> <td>IEC61000-4-8</td> <td>X/Y/Z Axis</td> <td>300A/m</td> <td>0Hz, 16.7Hz, 50/60Hz</td> <td>A</td> </tr> </tbody> </table> | Test | Norm | Port | Severity | Conditions | P | Electrostatic discharge | IEC61000-4-2 | Case | ±8kV | Air (isolated parts) | B | ±8kV | Contact (conductive parts) | Radiated high-frequency | IEC61000-4-3 | X/Y/Z Axis | 20V/m | 0.08...1.0GHz M. 80% 1kHz | A | 10V/m | 1.4...2.1GHz M. 80% 1kHz | 5V/m | 2.1...2.5GHz M. 80% 1kHz | | | | 3V/m | 5.1...6GHz M. 80% 1kHz | | Fast transients | IEC61000-4-4 | Input | ±2kV | Tr/Th: 5/50 ns | A | Output | ±2kV | Signal | ±2kV | | | PE | ±1kV | | | Surge | IEC61000-4-5 | Input L to L | ±1kV | Tr/Th: 1.2/50µs | B | Input L to PE | ±2kV | Conducted RF | IEC61000-4-6 | Input | 10V | 0.15...80MHz M. 80% 1kHz | A | Output | 10V | Signal | 10V | PE | 10V | Magnetic field | IEC61000-4-8 | X/Y/Z Axis | 300A/m | 0Hz, 16.7Hz, 50/60Hz | A |
| | | Test | Norm | Port | Severity | Conditions | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Electrostatic discharge | IEC61000-4-2 | Case | ±8kV | Air (isolated parts) | B | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | ±8kV | Contact (conductive parts) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Radiated high-frequency | IEC61000-4-3 | X/Y/Z Axis | 20V/m | 0.08...1.0GHz M. 80% 1kHz | A | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | 10V/m | 1.4...2.1GHz M. 80% 1kHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | 5V/m | 2.1...2.5GHz M. 80% 1kHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | 3V/m | 5.1...6GHz M. 80% 1kHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fast transients | IEC61000-4-4 | Input | ±2kV | Tr/Th: 5/50 ns | A | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Output | ±2kV | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Signal | ±2kV | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | PE | ±1kV | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Surge | IEC61000-4-5 | Input L to L | ±1kV | Tr/Th: 1.2/50µs | B | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Input L to PE | ±2kV | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Conducted RF | IEC61000-4-6 | Input | 10V | 0.15...80MHz M. 80% 1kHz | A | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Output | 10V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Signal | 10V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | PE | 10V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Magnetic field | IEC61000-4-8 | X/Y/Z Axis | 300A/m | 0Hz, 16.7Hz, 50/60Hz | A | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| P= Performance criteria, L= Line, PE= Protective Earth | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4.3.7 | Relative humidity | Up to 95% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5.1.1.2 | DC power supply range | From 0.70 to 1.25 Un continuous | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5.1.1.3 | Temporary DC power supply fluctuation | From 0.60 to 1.40 Un 0.1s From 1.25 to 1.40 Un 1s without damage | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5.1.1.4 | Interruptions of voltage supply | Class S1 (without interruptions) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5.1.1.6 | Input ripple factor | 10% peak to peak with a DC Ripple Factor of 5 % | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5.1.3 | Supply change-over | 0.6 Un duration 100 ms (without interruptions). Performance criterion A | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7.2.7 | Input reverse polarity protection | By external fuse | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10.7 | Protective coating for PCB assemblies | Class PC2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13.3 | Tests list | <table border="0"> <tr> <td>1 Visual Inspection</td> <td>Routine</td> </tr> <tr> <td>2 Performance test</td> <td>Routine</td> </tr> <tr> <td>3 Power supply test</td> <td>Routine</td> </tr> <tr> <td>4 Insulation test</td> <td>Routine</td> </tr> <tr> <td>5 Low temperature storage test</td> <td>-</td> </tr> <tr> <td>6 Low temperature start-up test</td> <td>Type</td> </tr> <tr> <td>7 Dry heat test</td> <td>Type</td> </tr> <tr> <td>8 Cyclic damp heat test</td> <td>Type</td> </tr> <tr> <td>9 Salt mist test</td> <td>-</td> </tr> <tr> <td>10 Enclosure protection test (IP code)</td> <td>-</td> </tr> <tr> <td>11 EMC test</td> <td>Type</td> </tr> <tr> <td>12 Shocks and vibrations test</td> <td>Type</td> </tr> <tr> <td>13 Equipment stress screening test</td> <td>Routine: 24h at 40°C and load 100%</td> </tr> <tr> <td>14 Rapid Temperature variation test</td> <td>Type</td> </tr> </table> | 1 Visual Inspection | Routine | 2 Performance test | Routine | 3 Power supply test | Routine | 4 Insulation test | Routine | 5 Low temperature storage test | - | 6 Low temperature start-up test | Type | 7 Dry heat test | Type | 8 Cyclic damp heat test | Type | 9 Salt mist test | - | 10 Enclosure protection test (IP code) | - | 11 EMC test | Type | 12 Shocks and vibrations test | Type | 13 Equipment stress screening test | Routine: 24h at 40°C and load 100% | 14 Rapid Temperature variation test | Type | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 Visual Inspection | Routine | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 Performance test | Routine | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 Power supply test | Routine | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 Insulation test | Routine | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 Low temperature storage test | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 Low temperature start-up test | Type | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 Dry heat test | Type | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 Cyclic damp heat test | Type | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 Salt mist test | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 Enclosure protection test (IP code) | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 EMC test | Type | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 Shocks and vibrations test | Type | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13 Equipment stress screening test | Routine: 24h at 40°C and load 100% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14 Rapid Temperature variation test | Type | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

