LV Capacitor CLMD03 Power Module
Instruction manual
Table of Contents

1 Safety .............................................................................................................................................. 3
2 Upon reception .................................................................................................................................. 3
   2.1 Inspection on reception ........................................................................................................... 3
   2.2 Storage- transportation -handling .......................................................................................... 3
3 Hardware Description .................................................................................................................. 4
   3.1 CLMD03 Power module layout ................................................................................................. 4
   3.2 CLMD03 power module dimensions ......................................................................................... 5
4 Power module installation ............................................................................................................ 6
   4.1 Mechanical installation ........................................................................................................... 6
   4.2 Airflow and cooling requirement ............................................................................................ 7
   4.3 Electrical Installation ............................................................................................................. 9
      4.3.1 Electrical connection overview ......................................................................................... 9
      4.3.2 Cable sizing .................................................................................................................... 9
      4.3.3 Contactor for capacitor switching ...................................................................................... 10
      4.3.4 Earthing ...................................................................................................................... 10
      4.3.5 Fuses .......................................................................................................................... 10
5 Commissioning ........................................................................................................................... 11
6 Operation ....................................................................................................................................... 11
7 Maintenance .................................................................................................................................... 11
8 Detailed technical specification .................................................................................................. 12
Before installation, read this notice carefully and keep it at disposal of people in charge of installation, maintenance and operation.

1 Safety

For a safe use of CLMD capacitor units, please ensure:

- Installation and maintenance are undertaken only by authorized and qualified personnel, in accordance with current local regulations;
- Isolate the equipment from the supply before working

Wait 5 min. after isolating supply before handling.

After 5 min, short-circuit the capacitor terminals with a piece of insulated cable to confirm discharge.

Failure to respect the safety rules may lead to bodily injury, premature failure, or other material damage to installations.

2 Upon reception

2.1 Inspection on reception

Inspect the packing and immediately report any damages

Unpack the CLMD03 POWER MODULE and check that:

- data on the label correspond to those of your purchase order
- CLMD03 POWER MODULE is not damaged. Any loss or damage should be notified immediately to your closest ABB agent.

2.2 Storage- transportation - handling

Indoor, in dry, dust free and non-corrosive environments, protected from vibrations or shocks.

Storage in initial packing is recommended

Storage temperature:

- minimum: -40°C/-40°F.
- maximum: 75°C/167°F.
3 Hardware Description

3.1 CLMD03 Power module layout

Two types of CLMD03 POWER MODULES exist:

- CLMD03 POWER MODULE to be connected with a reactor.
- CLMD03 POWER MODULE to be connected without reactor.

CLMD03 Power Module to be connected with a reactor

1. Contactor
2. Cables from capacitor to contactor (provided)
3. Discharge resistor
4. Fuses & fuse holder
5. Capacitor

CLMD03 Power Module to be connected without reactor

1. Contactor
2. Cables from contactor to fuse (provided)
3. Cables from capacitor to contactor (provided)
4. Discharge Resistor
5. Fuses & fuse holder
6. Capacitor

Please refer to §4.3.1 for the electrical drawings that present the parts included or not for both versions of the product.
3.2 CLMD03 power module dimensions
## Power module installation

### 4.1 Mechanical installation

**CLMD03 Power Module must be fixed VERTICALLY so as to allow airflow circulation (see blue arrows in the figure below).**

CLMD03 POWER MODULE must be fixed on a rigid plate/frame with four M6 screws, nuts and washers (not provided).

Make sure that the rigidity of the support and the screws are sufficient to bear the weight (about 9 kg) of the CLMD03 POWER MODULE(s).

CLMD03 POWER MODULE can be mounted in 2 different positions: totally inside its enclosure or partly external to the enclosure as illustrated at the next page.

Clearances: 25 mm to walls and flange to flange between modules.
The capacitor of the power module must be located in a specific air duct (vertical row) with forced ventilation (refer to 4.2 Airflow and cooling requirement) with cylindrical links vertical.

The other components of the CLMD03 POWER MODULE (contactor, fuses, discharge resistor and cables) must be cooled with forced air cooling as well.

Rules of good practice:
When reactors are used they should be placed in such a way that they do not radiate heat directly on the capacitors. A thermal barrier is recommended.

In such mounting, Capacitor cylinders are located outside the enclosure.

Cylinders are naturally air cooled as they are oriented outside the enclosure.

Cylinders must not be heated by external source of heat.

A clearance distance of minimum 25 mm must be respected between the cylinders and the wall.

Inside the enclosure, the other components of the CLMD03 POWER MODULE (contactor, fuse, discharge resistor and cables) must also be cooled with forced air cooling (refer to 4.2 Airflow and cooling requirement).

4.2 Airflow and cooling requirement

The service conditions specified in the IEC 60831-1 §4 are applicable.

As per IEC 60831-1 §3.21, the ambient temperature for capacitors is the temperature around the capacitors itself and not around the cubicle.
The cross-section of air inlet and outlet must be adapted to the air flow. Air should flow from the bottom to the top of the cubicle as illustrated on the opposite picture. One fan per 6 PMOD03 columns blowing a minimum air flow of 420 m³/h is requested.

Design guideline:
Difference between ambient temperature outside the cubicle and measured temperature must be lower than 22.5°C. To meet that requirement, the temperature probe must be located at about 2/3 of the air duct, attached to the central cylinder of the CLMD03 POWER MODULE, as per (1) of present drawing.

CLMD03 capacitor cylinders are natural air cooled. Air must circulate freely around the cylinders at least one meter below and above them without any other source of heat around them. Inside the cubicle, an air forced ventilation has to be ensured by a fan of 170 m³/h.

**Note:** The use of an over temperature protection can be performed by the RVT temperature probe in order to switch the bank off in case of fan failure or over temperature due to other causes.
4.3 Electrical Installation

4.3.1 Electrical connection overview

<table>
<thead>
<tr>
<th>CLMD03 Power Module to be connected without reactor</th>
<th>CLMD03 Power Module to be connected without reactor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Capacitor</td>
<td>1. Capacitor</td>
</tr>
<tr>
<td>2. Cable from capacitor to contactor (provided)</td>
<td>2. Cable from capacitor to contactor (provided)</td>
</tr>
<tr>
<td>3. Contactor</td>
<td>3. Contactor</td>
</tr>
<tr>
<td>4. Cable from contactor to fuse (provided)</td>
<td>4. Cable from contactor to reactor (not provided)</td>
</tr>
<tr>
<td>5. Fuse</td>
<td>5. Reactor (not provided)</td>
</tr>
<tr>
<td></td>
<td>6. Cable from reactor to fuse (not provided)</td>
</tr>
<tr>
<td></td>
<td>7. Fuse</td>
</tr>
</tbody>
</table>

4.3.2 Cable sizing

The cables must be sized for a current of 1.5 times nominal current \( (I_n) \) minimum.

The nominal current can be calculated with the following formula:

\[
I_n = \frac{Q_n}{V_n \cdot \sqrt{3}}
\]

Where:

- \( Q_n \) is the capacitor rated reactive power
- \( V_n \) is the capacitor rated voltage

The temperature around the cables must also be considered according to cable manufacturer.

**Note:** In case of CLMD03 POWER MODULE connected without reactor, it is necessary to add additional inductance to attenuate the inrush peak current. A practical method for making additional inductance is simply made by winding the cables designed to connect...
the Power Module onto a cylinder. For more details please refer to the “Attenuation of the Inrush Peak” chapter of the ABB UA contactor manual.

4.3.3  **Contactor for capacitor switching**

Capacitor switching leads to transient operating conditions. Therefore, the use of standard contactors is not acceptable and can be dangerous for the safety of people as well as the installations.

The ABB UA50 and UA75 contactors are specially designed to control capacitors whose inrush current peaks are less than or equal to 100 times nominal rms current.

![Contactor for capacitor switching](image)

Please refer to the ABB contactors for capacitor switching application guide for the conductor's dimensions as well as the additional inductance in case of inrush current peak.

4.3.4  **Earthing**

Earthing is achieved through fixation points of the CLMD03 POWER MODULE.

An extra cable between the CLMD03 POWER MODULE enclosure and the earthing contact of the installation is therefore required in case the CLMD03 POWER MODULE unit is fixed to an isolating material.

4.3.5  **Fuses**

The fuses are made with non-isolated gripping lugs, double indicator and contact blades compliant to DIN VDE 0636 Part 201 and IEC 60269-2-1. The NH system is classed among plug-in fuse systems

![Fuses](image)

M8 cable shoes are fixed with M8 screw and nuts (both not provided) on the fuse terminal.

While tightening the bolt, a dedicated torque must be applied for proper electrical connection according to the applicable standards.
5 Commissioning

With the equipment isolated from the supply, check:

- Cabling is properly connected (including earth)
- Ambient ventilation is adequate
- Correct tightness of the connections

6 Operation

The CLMD03 POWER MODULE capacitor unit is delivered with factory-installed discharge resistors to comply with IEC 60831 and allow a decrease of the residual voltage to less than 50V after 1 min. disconnection from supply.

During operation, make sure the delay before the CLMD03 is re-energized is not shorter than 40 sec. Failure to follow this rule may cause damage and reduce the lifetime of the capacitor.

Like other standard capacitor units, CLMD03 POWER MODULE discharge devices are not suitable for use with rapid switching rates like thyristor switched banks (minimum off time: 40 sec).

Additional external resistors are not a solution for such cases. Only specially designed capacitors must be used in such applications. Please contact ABB.

Harmonics

Installation of capacitors on networks disturbed by harmonics may require special precautions especially when there is a risk of resonance phenomena. Please ensure that your installation is as per the over current rating as per IEC 60831 Standard. Please contact ABB for technical support.

7 Maintenance

Ensure safety procedures are completed (see paragraph “Safety”)

Maintenance frequency depends on working conditions.

At least a yearly maintenance should include:

- Removal of dust deposits, cleaning of all parts;
- Check of tightness of all electrical connections;
- Check of ambient temperature;
- Check condition of discharge resistors.
## Detailed technical specification

| **Voltage range** | 400V and 415V at 50Hz  
380V and 480V at 60Hz  
For other values, please consult us |
| **Connection** | Three-phase |
| **Net output power** $Q_N$ | 25 or 50 kvar |
| **Discharge resistors** | Included  
Discharge: less than 50V in 1 minute |
| **Terminals** | Fuse: M8 threaded terminals  
Contactor: UA50 and UA75 |
| **Earth** | Earth connection on the enclosure flange  
M6 |
| **Case material** | Aluminum |
| **Color** | Raw aluminum |
| **Fixing** | Four slots for M6 screws (12x7mm) on the upper flange |
| **Execution** | Indoor |
| **Protection degree (according to IEC 60529)** | IP00 |
| **Weight** | Approx. 9 kg |
| **Maximum ambient temperature** | Class D according to IEC 60831:  
Maximum average over 1 year: 35°C  
Maximum average over 24h: 45°C  
Maximum: 55°C |
| **Minimum ambient temperature** | -25°C |
| **Fuse** | ABB gG or gL 50, 63, 100 and 125 A |
| **Contactor** | ABB UA50 for 25kvar  
ABB UA75 for 50 kvar  
Control voltage:  
230V at 50Hz  
120V at 60Hz |
| **Clearance** | 25 mm minimum to walls  
Flange to flange between power modules |
| **Capacitor losses** | Less than 0.5 W/kvar (discharge resistor losses included) |
| **Contactor and fuses losses** | With UA50 contactor: 0.53 W/kvar  
With UA75 contactor: 0.82 W/kvar |
| **Tolerance on capacitance** | 0% +10% |
| **Capacitor voltage test** | Between terminals:  
2.15xUn for 10 seconds  
Between terminals and earth:  
3kV for 10 sec: $Un \leq 450V$  
4kV for 10 sec: $Un > 450V$  
Lightning impulse voltage:  
8 kV: $Un \leq 690V$  

Overload capability (according to IEC 60831)

Overvoltage tolerance: 10% for maximum 8h in every 24h and 30% for maximum 1min

Maximum permissible current: 1.3x In.

Altitude

Up to 1000m

Compliance

IEC 60831 part 1 & 2
CE marked

Dimensions

Cooling

- If the capacitors are placed externally: natural cooling for capacitors and forced air cooling for internal parts
- If the capacitors are placed internally: forced air cooling

Label

<table>
<thead>
<tr>
<th>Un (V)</th>
<th>In (Hz)</th>
<th>Qn (kvar)</th>
<th>L (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>400</td>
<td>50</td>
<td>25</td>
<td>7</td>
</tr>
</tbody>
</table>

Connection D

Warning:
After disconnecting from supply, wait 2 min. and check the absence of residual voltage before handling the parts

Made in Belgium 12-03-07

Type: PMOD F5 V400 Q25 N3 L7 APCR03 S1 OEM
Contact us

ABB n.v.
Power Quality Products
Avenue Centrale 10
Zoning Industriel de Jumet
B-6040 Charleroi (Jumet), Belgium
Phone: +32(0) 71 250 811
Fax: +32 (0) 71 344 007
E-Mail: Power.Quality@be.abb.com

www.abb.com/lowvoltage