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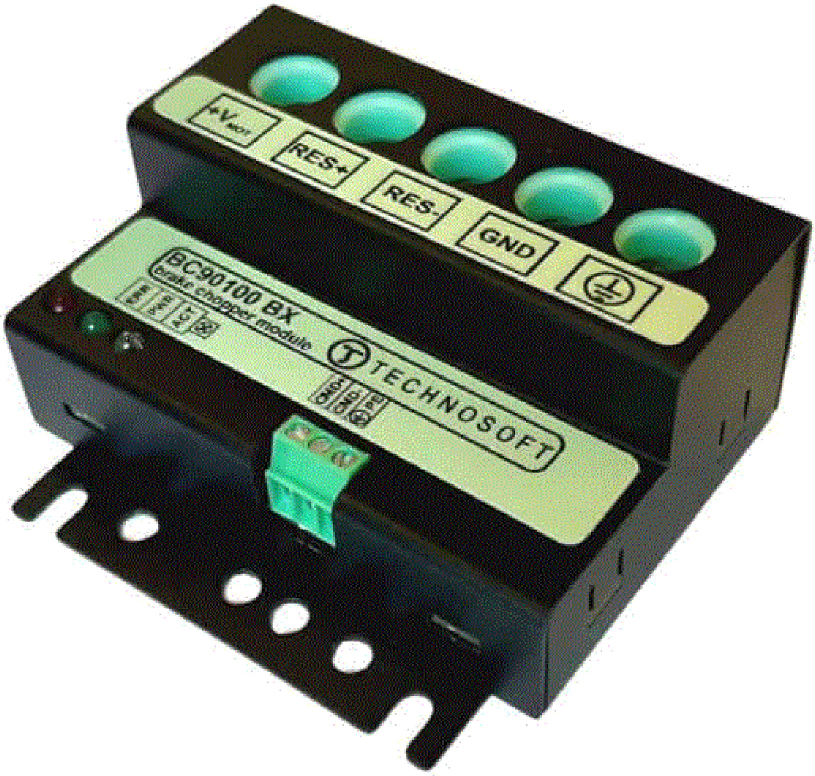
T E C H N O S O F T

TECHNOSOFT MOTION CONTROL BC90100 Intelligent Drives Module



Specifications

- Product: BC90100 Module
- Function: Heatsink and Chopping Resistor Sizing Guide
- Application: Braking module for thermal and electrical performance under braking scenarios
- Protection Mechanisms: Thermal and operating limits
- Thermal Protection: None built-in

Application description

This application note provides guidelines for selecting and dimensioning the chopping resistor and additional heatsink for the BC90100 BX braking module, ensuring reliable thermal and electrical performance under various braking scenarios.

About BC90100 BX

- The BC90100 BX unit does not apply PWM to the chopping resistor.
- When the DC bus voltage exceeds the overvoltage threshold, the drive sends an “ON” signal to the BC90100 B module. This connects the chopping resistor directly across the DC bus.

- Once the DC bus voltage drops below the overvoltage limit, the drive sends an “OFF” signal to disconnect the chopping resistor.

BC90100 BX – Protection Features and Thermal Guidelines

Current Protection Mechanisms:

- **Fast Short-Circuit Protection:**
  - Triggered when the chopping current exceeds 240 A.
  - **Response time:** 4 μs.
- **Slow Short-Circuit Protection:**
  - Activated when current is between 105 A and 240 A.
  - **Response time:** approximately 1 second.
- **Automatic Reset (Hiccup Mode):**
  - **The short-circuit protection resets after 2 seconds.**
  - If the fault persists, the unit re-enters protection mode cyclically.

Thermal and Operating Limits

- The BC90100 BX unit can sustain 35 A continuously at ambient temperatures up to 40°C, without additional heatsinking.
- For higher continuous currents, an external heatsink is required.
- During operation without external heatsink, keep the baseplate temperature below 75°C.
- The BC90100 BX has no built-in thermal protection.

Electrical Characteristics:

Internal Equivalent Resistance: 4.5 mΩ

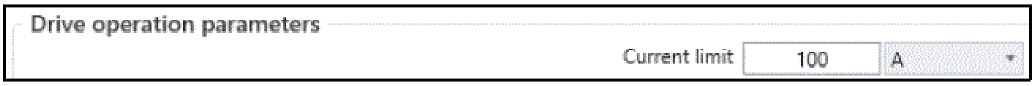
Chopping Resistor Dimensioning

Known values

- **VMOT** – Nominal voltage of the DC motor bus
- **IBR** – Maximum regenerative current that the drives can feed back into the system

during braking, under worst-case conditions.

Note: For a safe and conservative design, assume IBR equals the drive's declared current limit. In worst-case braking, the drive limits current to the value set as Current Limit in EasyMotion Studio (under Protection and Limits → Drive Operation Parameters).



- **ICR** – Desired current through the chopping resistor

Note: We recommend ICR = 1.1 × IBR to ensure proper energy dissipation

Calculating the Chopping Resistor Value (RCR)

Theoretical Calculation

Use Ohm's law to determine the ideal resistor value: RCR = VMOT / ICR

Example:

- VMOT = 48 V
- IBR = 10 A → ICR = 1.1 × 10 A = 11 A
- RCR = 48 V / 11 A = 4.36 Ω

Selecting a Realistic Resistor Value

Choose the nearest lower standard resistor value to the theoretical result.

Example:

- **Closest lower standard resistor:** RCR(real) = 3.9 Ω
- **Resulting current:** ICR(real) = VMOT / R CR(real) = 48 V / 3.9 Ω = 12.3 A

Determining Chopping Resistor Power Requirements

Braking behavior depends on the application type and load dynamics. Evaluate resistor power based on either continuous or intermittent braking:

Continuous Braking (e.g., Gravitational Loads)

- For long-duration braking, treat the resistor's power rating as its nominal power (PNOM):
- **Power dissipated:** PCR = $ICR(real)^2$ × RCR(real)

Example:

- PCR = 12.32 × 3.9 = 590.8 W
- Choose a resistor where PCR < PNOM
- **A suitable option:** 3.9 Ω rated at 800 W

Short-Duration Braking (Intermittent Use)

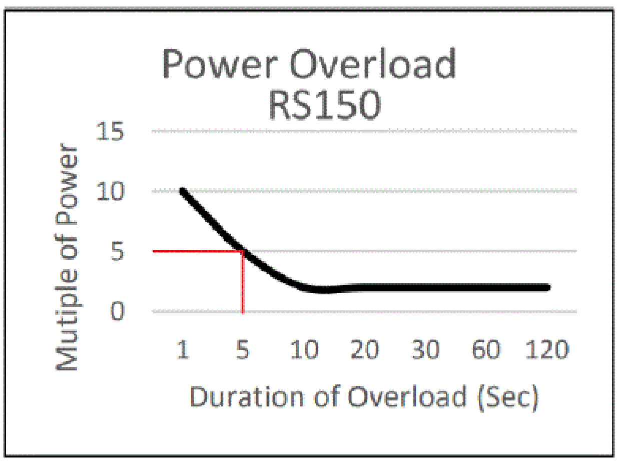
For short braking bursts, you can use a resistor's overload power (POL), as specified by the manufacturer:

- **POL** = k × PNOM
- **Ensure:** PCR < POL

You must also respect average power limits for repeated braking cycles:

- tBR = Braking time
- TBR = Minimum interval between braking events
- PCR(avg) = PCR × (tBR / TBR)
- **Final condition:** PCR(avg) < PNOM

Example:



- tBR = 5 s

- Resistor: RS150 (150 W nominal), with k = 5
- POL = 5 × 150 W = 750 W
- PCR = 590.8 W < 750 W ✅

Now calculate the minimum TBR:

- 150 W = (590.8 W × 5 s) / TBR → TBR ≥ 19.7 s
- This setup allows braking for 5 seconds every 20 seconds using a 150 W nominal chopping resistor.

DIMENSION

Dimensioning the Thermal Resistivity of the Heatsink for BC90100 BX (if required)

Known Values

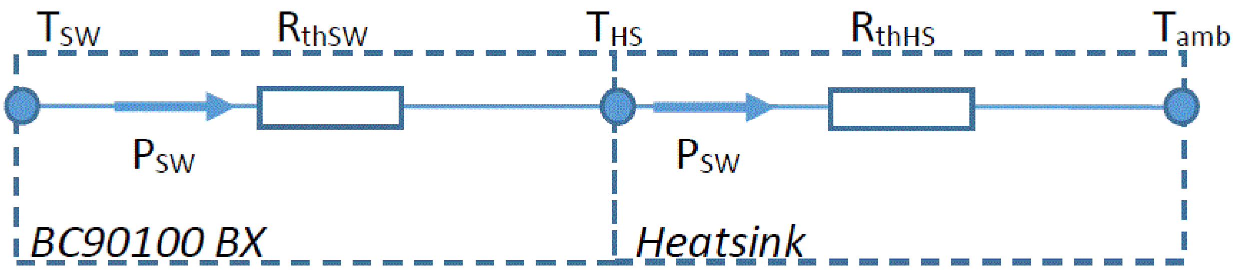
- RSW – Equivalent resistance of the internal chopping switch in the BC90100 BX: RSW = 4.5 mΩ
- TSW – Maximum allowable temperature of the switch case:
- TSW = 100°C

Calculating the Required Thermal Resistivity for an Additional Heatsink

Theoretical Cooling Model

The heat transfer model is analogous to Ohm's Law:

- Voltage → Temperature difference
- Current → Thermal power
- Resistance → Thermal resistivity



Term definitions in the model:

- **TSW** – Temperature of the BC90100 BX switch (must remain below 100°C)
- **THS** – Temperature at the baseplate of the BC90100 BX
- **Tamb** – Ambient temperature
- **PSW** – Power dissipated in the internal switch
- **RthSW** – Internal thermal resistance between the switch and baseplate:
- **RthSW** = 0.8°C/W
- **RthHS** – Thermal resistivity of the additional heatsink (this is the value to be determined)

Calculating Power Dissipated by the Switch

Formula:
PSW = ICR(real) × ICR(real) × RSW

Example:

- For ICR(real) = 100 A:
- PSW = 100 A × 100 A × 4.5 mΩ = 45 W

Calculating Required Thermal Resistivity of the Additional Heatsink

Formula:

- RthHS = (TSW – Tamb) / PSW – RthSW
- This gives the maximum allowed thermal resistivity of the additional heatsink.

Example:

- ICR(real) = 100 A
- Tamb = 40°C
- PSW = 45 W
- TSW = 100°C
- RthSW = 0.8°C/W
    - RthHS = (100°C – 40°C) / 45 W – 0.8°C/W

- RthHS = 60°C / 45 W – 0.8°C/W = 1.33 – 0.8 = 0.53°C/W

In this example, the additional heatsink must have a thermal resistivity of 0.53°C/W or lower.

FAQ

Is thermal protection built-in for the BC90100 BX?

No, the BC90100 BX does not have built-in thermal protection.

How to select a realistic resistor value for chopping?

Choose the nearest lower standard resistor value to the theoretical result obtained using Ohm's law.

Documents / Resources

	TECHNOSOFT MOTION CONTROL BC90100 Intelligent Drives Module [pdf] User Guide BC90100 Intelligent Drives Module, BC90100, Intelligent Drives Module, Drives Module, Module

References

- User Manual

TECHNOSOFT MOTION CONTROL

BC90100, BC90100 Intelligent Drives Module, Drives Module, Intelligent Drives Module, Module, TECHNOSOFT MOTION CONTROL

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