Low Voltage
Motor Control Center Type-D
GLOBAL IMPACT OF MITSUBISHI ELECTRIC

Global Player

Changes for the Better

We bring together the best minds to create the best technologies. At Mitsubishi Electric, we understand that technology is the driving force of change in our lives. By bringing greater comfort to daily life, maximizing the efficiency of businesses and keeping things running across society, we integrate technology and innovation to bring changes for the better.

Mitsubishi Electric is involved in many areas including the following:

Energy and Electric Systems
A wide range of power and electrical products from generators to large-scale displays.

Electronic Devices
A wide portfolio of cutting-edge semiconductor devices for systems and products.

Home Appliance
Dependable consumer products like air conditioners and home entertainment systems.

Information and Communication Systems
Commercial and consumer-centric equipment, products and systems.

Industrial Automation Systems
Maximizing productivity and efficiency with cutting-edge automation technology.

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11 EMC-B: Electronic Multi-Function Motor Controller Type-B.
1 Outline of Low-Voltage Motor Control Center
Type-D (MCC-D)

IEC61439-1/2-compliant, space-saving and advanced utility and usability to meet the needs of the times.

With a solid reputation as a pioneer of motor switchgear, Mitsubishi Electric leverages its cutting-edge technology to propose a new concept.

![Image of MCC-D]

- **IEC-compliant**: Complies with the latest regulations, IEC61439-1/2
- **Space-saving**: Integrated cabinet platform enables installation in compact, space-restricted electrical rooms and package house-type electrical rooms
  - Rear dead space eliminated and busbar conversion panel removed.
- **High-capacity storage**: Capable of storing up to 40 units per panel thanks to newly developed compact units
- **Front operation**
  - Component layout and mounting method have been revised to enable operation from the front
  - Maintenance work also possible from the front via automatic connection of the main circuit and control circuit
- **Flexibility**: Changes in partition plates, etc. enable the flexibility to support onsite changing of unit ratings and types
- **Safety**: IEC TR61641 internal arcing fault-compliant (option)
- **Practical design**: Motor controller features:
  - Visually appealing design
  - MCCB operating handles and LED lamps for easy viewing of operating status
  - Attractive high-visibility LCDs

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■ Features of EMC Type-B (EMC-B)

IEC-compliant: Complies with the latest IEC61439-1

- **Easy Operation**
  - Simple to use
  - Quick learning process
- **Secure**
  - Equipped with the latest security mechanisms
- **Expanded User Support**
  - Provides 3-mode restart function after instantaneous voltage drops
  - Provides running time/count-based alarms
  - Permits setting of target current
  - Ample test functions
- **Energy-saving**
  - Features LCD “Normally OFF” mode
  - Measured electrical energy
  - Features 0-1mA DC current output
  - Uses a low-capacity regulating transformer

---

Japanese Patent No.4932009
Japanese Patent No.5008729
2.1 Applications

MCC-Ds are utilized for the power distribution equipment of various plants based on control technologies desired in various fields.

Video

We have supported one-sided installation for package house-type electrical rooms,†1 which are increasingly being used at overseas plants.

2.2 Part Names

### Field applications (examples)

- Chemical plants
- Steel plants
- Power plants
- Public plants

- Low-Voltage Switchgear
  - Front top and bottom covers
  - ACB cover
  - Side cover
  - Cable compartment
  - 1/4 Unit

- Controlgear
  - MCCB
  - 1/2 Unit
  - EMC-B
  - 1/1 Unit
  - Bottom Ventilation

---

†1 A container-shaped electrical room capable of being transported and installed with electrical devices mounted inside module type housing.
### 2.3 Specifications

<table>
<thead>
<tr>
<th>Items</th>
<th>Switchgear</th>
<th>Controlgear</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applied standard</td>
<td>IEC61439-1/2</td>
<td></td>
</tr>
<tr>
<td>Motor control center construction</td>
<td>Front access</td>
<td></td>
</tr>
<tr>
<td>Rated insulation voltage</td>
<td>1000 V</td>
<td></td>
</tr>
<tr>
<td>Rated busbar current (Horizontal)</td>
<td>1200A, 1400A, 2000A, 2500A, 3200A, 4000A</td>
<td></td>
</tr>
<tr>
<td>Rated voltage</td>
<td>Up to 690 V</td>
<td>Up to 480V</td>
</tr>
<tr>
<td>Bus System</td>
<td>3x60mm/3x4mm</td>
<td></td>
</tr>
<tr>
<td>Rated short-time withstand current</td>
<td>Up to 85 kA</td>
<td>Up to 85kA</td>
</tr>
<tr>
<td>Rated duration of short-time current</td>
<td>1 sec</td>
<td></td>
</tr>
<tr>
<td>Form of internal separation</td>
<td>Up to Form 4b</td>
<td></td>
</tr>
<tr>
<td>Rated frequency</td>
<td>50/60 Hz</td>
<td></td>
</tr>
<tr>
<td>Degree of protection</td>
<td>Up to IP43</td>
<td></td>
</tr>
<tr>
<td>Unit Connection method</td>
<td>Main circuit: Automatic. Control circuit: Automatic</td>
<td></td>
</tr>
<tr>
<td>Insulated busbar (†)</td>
<td>Option</td>
<td></td>
</tr>
<tr>
<td>Earth busbar</td>
<td>Horizontal</td>
<td>Horizontal/Vertical</td>
</tr>
<tr>
<td>Internal arcing fault (†)</td>
<td>Casings: 85kA/0.3sec at 480V</td>
<td>Unit: By the unit capacity of the following</td>
</tr>
<tr>
<td>Height</td>
<td>2370mm</td>
<td>2370mm</td>
</tr>
<tr>
<td>Depth</td>
<td>600mm</td>
<td>600mm</td>
</tr>
<tr>
<td>Width</td>
<td>800 to 1300mm</td>
<td>1000mm</td>
</tr>
</tbody>
</table>

### 2.4 Arrangement

#### Low-Voltage Switchgear and Controlgear Arrangement

#### Panel Layout (example)

#### Single-Line Diagram (example)

---

### 2.4.1 Unit Capacity

#### Short-circuit protection device

<table>
<thead>
<tr>
<th>Short-circuit protection device</th>
<th>ACB</th>
<th>MCCB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage</td>
<td>Up to 690 V</td>
<td>Up to 460V</td>
</tr>
<tr>
<td>Coordination for protective devices</td>
<td>Type 1</td>
<td>Type 1</td>
</tr>
<tr>
<td>Automatic connection unit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power feeder unit</td>
<td>630A to 4000A</td>
<td>Up to 400A/ 50kA</td>
</tr>
<tr>
<td>Starter unit</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(†1) Option  
(†2) Coming soon  
(Unit rating/Breaking current)
2 Features of MCC-D

2.5 Installation

(1) Space-saving Structure

- **Package House-Type Electrical Room Storage**: Enables installation in compact, space-restricted electrical rooms and package houses (located on panel rear wall).
  - Can be transported “as is” with electrical devices already mounted.
  - Electrical room with a container-shaped structure in which the electrical devices are mounted on a wall, realizing the use of a single surface (front).
  - All tasks, operations and maintenance can be performed from the front, simplifying operation and maintenance.

- **Package House-Type Electrical Room**:
  - Can be transported “as is” with electrical devices already mounted.
  - Electrical room with a container-shaped structure in which the electrical devices are mounted on a wall.
  - Can be easily maintained from the front.

- **MCC-D Installation Space (example)**:
  - 5-panel arrangement offers 45% reduction compared to a conventional model with the identical number of units and unit size.

- **Low-Voltage Switchgear Structure**:
  - For the MCC-D the rear dead space and busbar conversion panel size have been reduced through integration and making the depth dimension and busbar structure the same cabinet height as the conventional product. Effectively utilizing the space in the direction of depth reduces installation space requirements to 20% less than that required for conventional models.

- **Controlgear Structure**:
  - Efficient unit storage has been achieved through the development of compact controlgear (1/4 unit, 1/2 unit, 1 unit), and installation space has been reduced by 10% compared to conventional models.
  - (10% reduction of 5 panels -> 4 panels)
  - Maximum storage of the 1/4 unit (power feed) has been improved to 40 units per panel using the conventional cabinet width.

---

### MCC-D (5-panel arrangement) unit specifications

<table>
<thead>
<tr>
<th>Unit name</th>
<th>Q'ty</th>
<th>Type name</th>
<th>Rated value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACB</td>
<td>1</td>
<td></td>
<td>4000A</td>
</tr>
<tr>
<td>Starter unit</td>
<td>24</td>
<td>1/2 Unit</td>
<td>5.5kW</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>1/1 Unit</td>
<td>3.7kW</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>1/2 Unit</td>
<td>55kW</td>
</tr>
<tr>
<td>Power feeder unit</td>
<td>8</td>
<td>1/4 Unit</td>
<td>30AT</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>1/2 Unit</td>
<td>50AT</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>1/1 Unit</td>
<td>100AT</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>1/1 Unit</td>
<td>225AT</td>
</tr>
</tbody>
</table>

---

†1: 5-panel arrangement (table on right)
†2: 1/1 Unit is Full-width unit.

---

†1 5-panel arrangement (table on right)
- Low-Voltage Switchgear (1 panel)
- Control Gear (4 panels) (refer to unit specifications)

---

**Comparison of installation space with other Mitsubishi Electric products (45% reduction)** (JEM-standard LV MCC)

- 1,034mm
- 600mm
- 700mm
- 300mm
- 2,250mm
2.6 Structure

(1) Casing Construction

■ Thin, one-side structure (panel depth: 600mm)

The rear face is a panel-like structure with devices installed in the wall space, thereby saving space as maintenance space is not required on the backsides of the panel.

† Rear panel must be positioned at least 50mm from the wall to prevent condensation.

■ Safe, compartment-like structure

• Gap size has been reduced by using metal to separate individual units from each other and the busbar chamber in each unit.

(Complies with IEC standard Form 4b)

• Unit chamber and wiring duct chamber are separated, therefore wiring tasks can be performed safely and easily.

■ Easy installation

• Cabinet panels can be transported one at a time.

• The horizontal busbars are arranged vertically, and cables can be run upwards or downwards.

• The horizontal busbar/earth busbar connection can be made from the front of the cable compartment.

(Conductor connection possible with busbar press nuts and bolts)

■ Simple planning

• Unit layout can be planned and changed freely in height increments of 100mm.

† See the Unit Selection tables (P49-50) for unit sizes.

(2) Busbar Construction

■ Horizontal busbars (copper/tin-plated)

• Busbar current rating: 1200A - 4000A

• Horizontal busbars can be arranged vertically

• The neutral phase of the 3-phase/4-wire horizontal busbar is identical to other phases in the standard product.

■ Vertical busbars (tin-plated, Z-shaped busbar)

• Busbar current rating: 1000A

• The vertical busbars have square slots with unit junctions located at 100mm intervals and metal plates covering unused slots.

■ Busbar support

Busbars are secured with unsaturated polyester resin molded supports having excellent arc-resistance and tracking resistance.

■ Horizontal busbar/Earth busbar connection

A crimp-type press nut is used for busbar attachment, enabling it can be tightened from the front of the panel. Conductor connection is possible simply by tightening bolts with the proper torque.

■ Earth busbar

The frame is earthed by screws in the horizontal earth busbar and vertical earth busbar (cross-section: 300mm²)

Option

(1) Insulated busbar

• Horizontal busbar: Epoxy resin coating (FBC) or PVC insulated tubing

• Vertical busbar: Resin-molded case

Unit Specifications (Controlgear)

<table>
<thead>
<tr>
<th>Unit size</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4 Unit</td>
<td>Power feeder unit Up to 35A</td>
</tr>
<tr>
<td>1/2 Unit</td>
<td>Power feeder unit Up to 63A, Starter unit Up to 22kW</td>
</tr>
<tr>
<td>1/1 Unit</td>
<td>Power feeder unit Up to 225A, Up to 400A, Starter unit Up to 55kW, Up to 90kW, Up to 132kW</td>
</tr>
</tbody>
</table>

Flexible unit arrangement

Arrangement of each rating unit can be changed without interrupting busbar power. (1/4, 1/2, 1/1 Unit)

Flexible unit capacity

Load capacity can be changed through junction connection of the distributor and busbar. (1/4, 1/2, 1/1 unit)
2 Features of MCC-D

2.7 Detailed Construction

(1) Unit Features

- A circuit-breaker (MCCB) and EMC-B operating device are equipped on the front of the unit.
- A main circuit junction and control circuit connector are equipped on the rear of the unit.
- An electromagnetic contactor, control transformer, ZCT, auxiliary relay, leakage relay, fuse, etc. are equipped inside the unit.

(2) Unit Size Changing System

- Connection between the power source side and load side.
  - The 1/1 Unit module is connected to the power source side in a different way than the 1/4 and 1/2 unit modules.
  - In the case of 1/4 and 1/2 units, the unit junctions connect with the vertical busbar through a distributor.
  - In the case of the 1/1 Unit module, the unit junctions connect directly on the vertical busbar. For all units, the load side (main circuit/control circuit) uses an external cable to the distributor terminal.

- Changing Unit Size
  - A different-sized unit can be used by replacing the distributor between the vertical busbar and unit.
  - Size changes: 1/4 unit → 1/2 unit → 1/1 Unit

Junctions are used to connect the distributor to the power source side, therefore no troublesome positioning adjustment is required upon replacement – simply connect.
2.7 Detailed Construction

(3) Unit Insert / Withdraw Mechanism
The unit main circuit junction and control connector automatically attaches and detaches when conducting unit attachment and detachment operations.

1. Connected position:
   This is when the main circuit and control circuit are electrically connected.

2. Test position:
   This is when only the control circuit is electrically connected.

3. Removed position:
   Both the main and control circuits are electrically disconnected and the unit can be removed from the cabinet.

(4) Insert / Withdraw Latch Operation
The unit has a latch mechanism with a connected position, test position and removed position.

Unit Specifications (Controlgear)

<table>
<thead>
<tr>
<th>Latch positions</th>
<th>Operation contents</th>
</tr>
</thead>
</table>
| LOCK            | • Locks in connected position  
                 • Locks in test position         |
| INSERTION       | • Test position  Connected position  
                 • Removed position  Connected position |
| PULL            | • Connected position  Test position  
                 • Moves between connected position and Removed position |
| WITHDRAW        |                                            |

(5) Unit Insert / Withdraw Operation

- Insert/Withdraw for 1/4 and 1/2 units
  These small units can be easily changed between connected position and test or removed positions by manual operation.

- Insert / Withdraw operation of 1/1 Unit
  A handle is used to release the unit from connected position, after which it can easily be changed to test or removed positions by manual operation.

- Operation handle for inserting/withdrawing unit
  Two types of operation handles for inserting/withdrawing the unit have been prepared to match the operating force. Handle operation is easy thanks to the inclusion of a horizontal shaft.
### 2 Features of MCC-D

#### 2.8 Protection System

**1. Controlgear Protection**

- IP2XXB level protection is possible against random contact with energized portions of the main circuit when the 1/4 and 1/2 units are extracted from the panel.
  - Vertical bus junction
  - Outgoing junction
  - Control connector

**2. Form of Internal Separation (Form (4b))**

Based on IEC 61439-2 Form (4b), the functional unit, busbar, and terminal for the external conductor of the MCC-D have been separated and are stored in a closed, protected space in compartments.

The diagrams below show the internal separation (Form (4b)) for the MCC-D.

**Option**
- 1/1 Unit module is equipped with an automatic shutter mechanism
- Provided by Customer
  - Padlock

**3. MCCB Locking System**

On the MCCB operating handle, a locking rod or padlock is attached for both ON and OFF positions. Up to three padlocks can be used.

**Fluorine grease (white)**

Mitsubishi Electric’s original fluorine grease is used at contact points for energizing the power-supply junction.

The oil content of the grease tends to resist evaporation, and the grease is characterized by its resistance to oxidation, sometimes retaining its initial state for 30 years or more, as verified by testing.

Unlike conventional grease, which tends to cake and necessitates a great deal of labor for removal and reaplication, the new grease remains highly lubricative, and its use significantly reduces the maintenance workload. (In practice, contamination by foreign matter/dust still requires routine maintenance.)

In general, the oxygen pressure tends to drop as grease bonds with oxygen and deterioration progresses as a result. Mitsubishi Electric’s fluorine grease is characterized by its resistance to oxidation and deterioration.

---

#### 2.9 Unit Easy Maintenance

**Use of Long-lasting Grease in the Power-supply Junction**

Mitsubishi Electric’s original fluorine grease is used at contact points for energizing the power-supply junction.

The oil content of the grease tends to resist evaporation, and the grease is characterized by its resistance to oxidation, sometimes retaining its initial state for 30 years or more, as verified by testing.

Unlike conventional grease, which tends to cake and necessitates a great deal of labor for removal and reaplication, the new grease remains highly lubricative, and its use significantly reduces the maintenance workload. (In practice, contamination by foreign matter/dust still requires routine maintenance.)

In general, the oxygen pressure tends to drop as grease bonds with oxygen and deterioration progresses as a result. Mitsubishi Electric’s fluorine grease is characterized by its resistance to oxidation and deterioration.
2 Features of MCC-D

2.10 Practical Design (Attractively designed indicators)

Based on a universal design, the MCC-D is now even easier to use owing to the adoption of characters that enable accurate identification by anyone and a high-contrast design.

1. Adoption of a display with varying color tones and character sizes has improved visibility, enabling specific pieces of equipment in an arrangement to be identified easily.
2. Two background colors are used for the MCCB operating handle, making the current operating state easily recognizable.
3. The EMC-B features a LED with a protruding lens, making it easy to confirm the operating state, and is equipped with an LCD display with excellent legibility.

MCC-D

Each panel has been given a red line on its front upper section and an indicator with a panel-specific symbol/name, making it easier to identify specific equipment for operation and maintenance purposes.

MCCB

The MCCB operating handle is fitted to a plate with a high-contrast two-segment design, making the current operating state easy to identify even when viewed at an angle.

3 Features of EMC Type-B (EMC-B)

3.1 Robust Environmental Resistance

Added resistance to the effects of corrosive gas, radio noise and static electricity

EMC-B Tough Motor Controller

<table>
<thead>
<tr>
<th>External factor</th>
<th>Ability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vibration/Impact-resistant</td>
<td>Remains problem-free even after the Control Center contactor has switched ON/OFF a million times.</td>
</tr>
<tr>
<td>Dust</td>
<td>Keeps out dust thanks to its hermetic construction and specially coated board elements (to IP53 [12] when mounted on the Control Center). (The Control Center has a semi-hermetic construction and may be optionally protected against dust to IP43 [12] max.)</td>
</tr>
<tr>
<td>Water</td>
<td>Hermetic construction guards against intrusion of water (to IP53 [12] when mounted to the Control Center). (The Control Center has a semi-hermetic construction and may be optionally waterproofed to a maximum of IP43 [12].)</td>
</tr>
<tr>
<td>Radio Noise</td>
<td>Highly resistant to interferences from cellular phones and transceivers. Cellular phones : may be used even at close proximity to the controller [13]. Transceivers : may be used at a distance of 40cm or more (154MHz, 5W; 460MHz, 5W)</td>
</tr>
<tr>
<td>Static Charge</td>
<td>Withstands the effects of static electricity at the highest level in its class (15kV). (Complies with international standard IEC61004-2 Class 4 requirements [static discharge immunity testing].)</td>
</tr>
</tbody>
</table>
| Corrosive Gas          | Can be used in an environment subjected up to 50ppb of H_{2}S gas (ISA S71.04 G3 [14]). [15]  
|                        | • Protected by a special high-performance coating for keeping out corrosive gas.  
|                        | • Housed in a semi-hermetic casing.  
|                        | • Fitted with gold-plated switches and connectors. |
| Surge/Noise            | Prevents malfunctions caused by propagation/radiation of surge/noise and noise from the power supply. Withstands an impulse noise level of 5kV. |

†2: Index of protective level against dust and liquids.
†3: According to the results of our studies of phones from multiple Japanese manufacturers (2010).
†4: ISA (Instrument Society of America) S71.04 (environmental conditions for process measurement and control systems) G3 (level of severity indicating an environment subject to a strong likelihood of corrosion).
†5: Here, the term “corrosive gas” refers to H_{2}S alone (50% RH or less). The concurrent presence of another gas can accelerate corrosion and thus shorten the expected service life. If the presence of a non- H_{2}S gas on its own is expected, contact us during the planning stage. If operation in an environment subjected to corrosive gas is expected (up to 50ppb), contact us for considerations pertaining to devices other than the EMC-B.

11 The Good Design Award is presented by the Japan Institute of Design Promotion and is awarded for comprehensive design incentive systems.
3.2 Easy Operation

(1) Additional Button (DISP)
One press of the DISP (display) button turns on the LCD without needing to open the cover.†1

(2) EMC-B Operation Buttons
The arrangement and design of the operation buttons have been fully reconfigured to improve ease of operation. The darker shade of the STOP button makes it easier to spot.

1 Control Buttons
The EMC-B provides a way to directly control a single motor. Pressing the buttons will cause the motor to operate normally, in reverse, or stop. Setting the EMC-B to REMOTE enables external control.

2 Display Selection/Settings Buttons
These buttons are used to switch between LCD modes and to change settings. Pressing the RESET button resets the controller in the event of fault-triggered tripping.

3 LCD
The display provides a wide range of information, including readings for the main circuit current, leakage current, and other parameters.

4 LED Lamps
These lamps indicate the state of the motor (e.g., in operation, at rest, tripped).

3 Features of EMC Type-B (EMC-B)

(3) Easy-to-Learn Button Operation

- **Mode Sequence of the EMC-B**
  - Shifting through modes is as easy as pressing the MODE button.

- **Simplified EMC-B Settings**
  - **Item serial number**
    - Each item that can be set has a corresponding number. To represent the hundreds column, an “a” is displayed at the top right of the number. In the example on the left, the display indicates the number “180”.
  - **Item setting guidance**
    - Codes are displayed corresponding to the item to be set. In the example on the left, “BL” is displayed, which stands for backlight control.
  - **Setting contents**
    - When the target item is displayed, the setting can be changed. The targeted item setting will flash and can be changed using the ↑ and ↓ buttons. When the desired value is reached, press the SET button.

(4) Ample Test Functions †2

- **Abnormal CPU operation mode**
  - At the same time, when the CPU is operating abnormally transmission data is sent automatically, which means that generation of the transmission signals sent in the case of an actual system error can be simulated (with CDL transmission specifications).

  - **Transmission output mode**
    - Using EMC-B, the level can be changed and output enabled without having to perform actual input!

- **Transmission output mode (when off)**
- **Transmission output mode (at 0% output)**
- **Transmission output mode (at 50% output)**
- **Transmission output mode (at 100% output)**
- **Transmission output mode (at 150% output)**

†1: Only valid in LCD Normally OFF mode (see page 35).

†2: Other possible tests not listed here include the overcurrent/ground fault trip test and external current output test.

†3: When “SET” is pushed, in the case of abnormal CPU operation, transmission notification is sent for CDL transmission.
3 Features of EMC Type-B (EMC-B)

3.3 Other Benefits

1. **Extensive Motor Protective Mechanisms**
   
   EMC-Bs meet a wide range of needs for motor protection. There is no need to provide separate relays to protect motors against overcurrent (OC), unbalance (UB), leakage current (ground fault, GF), instantaneous overcurrent (IOC), or undercurrent (IU) or power shortage. The wide selection and range of settings eliminates the need to consider equipment replacement when planning or changing configurations. The controllers can also be used in combination with harmonic circuits (inverter loads).

2. **Various Indicators/Readings**
   
   The state of the motor is indicated by LED lamps (e.g., operational, at rest, fault, error (including system error)). The EMC-B provides current meter, leakage current meter, and voltage meter functions, eliminating the need for separate meters and reducing cost and space requirements. The readings are indicated on a LCD. The standard power status/elec- trical energy meters are simplified. (The meters require advance settings of rated voltage, voltage used, and power factor.) A current output function can also be incorporated (optional: 0–1mA DC, 4–20mA DC).

3. **Programmable Sequence**
   
   Using a MELSEC programmable controller and equivalent ladder software, it’s possible to freely program the internal ladder program. Installing the ladder program internally reduces internal wiring in the unit, allowing cost to be reduced. Ladder programs can be changed using the software (max. stops: 350). There are five input points (alarm: 1a, reverse: 1b, stop: 1c, forward: 1d, general-use: 3), and 10 output points (trip/ alarm: 1a 1b x 1, stop: 1b x 1, forward: 1c x 1, reverse: 1a x 1, general-use: 6 [1a x 3, 1b x 2, 1c x 1]), which can be applied to various circuits. As optional items, seven input points (eight output points), and 10 input points (five output points) are also available. In addition, an instantaneous voltage drop restart function is included, enabling continuous operation.

4. **Compact Design**
   
   A compact design has enabled application from the 1/2 unit. This helps to increase unit storage number and reduce the number of panels.

5. **Multiplexing Compliant**
   
   A range of communication options are provided for CDL / Modbus®-RTU. Transmission. In the case of CDL transmission, when the CDL MASTER maintenance support system is connected, a dedicated maintenance monitoring system can be set up, decreasing the workload of daily maintenance tasks. Structuring transmission to include the distributed control system enables constant monitoring of operation and control.

6. **Simple Panel Planning and Alteration**
   
   Compact dimensions make unit size less of a consideration, simplifying panel planning. Its compatibility for a wide range of applications make it possible to address changes with great flexibility, from planning to delivery.

7. **Simplified Post-delivery Modification/Customization**
   
   Before EMCs were used in control centers, when currents reached unexpected levels due to motor capacity, there were many cases in which modifications such as the replacement of thermal relays or the addition of a reactor were carried out. However, since the introduction of EMCs, the adjustment range is large and most problems can be resolved by changing internal settings. In contrast to the adjustment scales of thermal relays, which are imprecise and produce large error, accurate settings are possible using EMCs. EMCs are also convenient for adjustment because of the many functions incorporated, such as functions to automatically inspect the protective properties, fast overcurrent/leakage current and fast test system error and transmission data output (see page 24 for more information regarding fast output functions). The reduced time required for making adjustments also increases efficient use of time.

8. **Preventing Accidents**
   
   The EMC-B constantly monitors the system for load/leakage currents and retains histories of various operations to help predict and prevent accidents by indicating the hours of motor operation/number of contactor activations (open/close), and the nature and number of motor tripping events based on causative factors. Other preventive functions include self-diagnostics, auxiliary power supply (optional), and various fail-safe mechanisms.

---

†1: Please confirm the delivery schedule, including that for standard products, separately.
3 Features of EMC Type-B (EMC-B)

3.4 Names and Functions

- **LCD**: Displays various information such as measurement results, alarms, and settings.
- **LED Indicating Lamps**: Show operational and fault statuses.
- **Operation Buttons**: Direct operation, remote operation, stop, reverse rotation, normal rotation.
- **Indication Selection/Settings Button**: Mode, set, keep target current value, start/stop counting of zone alarms.
- **[com.] Connector**: For connecting a PC or mounting a security key.
- **Operation Button Cover**: Protects the operation buttons.
- **Ratings Plate (Operator's Guide)**: Provides important specifications and warnings.

### LCD Indications
- **DIR (ON)**: Direct operation (SW1)
- **REM (ON)**: Remote operation (SW2)
- **FWD (ON)**: Normal rotation (SW5)
- **REV (ON)**: Reverse rotation (SW4)
- **LOCK (ON)**: Operation button lock state
- **STOP (stop)**: Stop (SW3)
- **TRIP (flashing)**: Fault tripping
- **PICKUP (flashing)**: Pickup indication
- **ALARM (flashing)**: Alarm indication
- **SD (ON)**: CDL transmission indication
- **com. (ON)**: Indicated during communication with PC
- **RECORD (ON)**: Running history mode
- **SET (ON)**: Setting mode
- **TEST (ON)**: TEST mode
- **LOCK (ON)**: Operation button lock state
- **TRIP (flashing)**: Fault tripping
- **PICKUP (flashing)**: Pickup indication
- **ALARM (flashing)**: Alarm indication

### Indication Selection/Settings Button
- **MODE**: Switches through various modes.
- **SET**: Stores setting in memory.
- **Retains target current value.
- **Starts/ Stops counting of zone alarms.
- **CLEAR/BACK**: Increases/Decreases indicated values.
- **CLEAR/BACK**: Clears running history values.
- **RESET**: Resets after fault tripping.
- **RESET**: Resets indication of running time/count alarms.

### [com.] Connector
- Used to connect a PC using a special cable for communication.
- Used to mount a security key to set up security parameters.

### Operation Button Cover
The following operations are possible when the operation button cover is closed:
- **DISP**: With the cover closed, the CLEAR/BACK button serves as the DISP button. One press of the button turns on the LCD.
- **RESET**: With the cover closed, the RESET button provides the same function as the Indication selection/settings RESET button (4 above).

### Ratings Plate (Operator's Guide)
- **Character**: a, A, %
- **Location on LCD**: Upper right, middle right, middle right, bottom right
- **Notation used herein**: a, A, % UP, % DOWN

A few characters appearing on the display are assigned different meanings. For the sake of convenience, they are identified as follows:

- **a (ON)**: In setting mode, indicates settings No. 100 through 199 when ON; indicates settings No. 0 through 99 when OFF.
- **A (ON)**: Indicates unit of main circuit current (Ai), unit of leakage current (mA)
- **% UP (ON)**: Indicates unit for numerical input in percentage (%) in setting mode (setting value appearing in Indicator A).
- **% DOWN (ON)**: Indicates unit for relative value and deviation range appearing in Indicator C

1: Flashes in response to a specific fault, pickup, or alarm.
2: The above are sample indications, modifiable using a ladder program.
3: It's possible to change ON to green and OFF to red.
4: Switches 1~5 can be enabled/disabled.
5: The layout of the operating switches can be changed.
3.5 Specifications

(1) General Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply voltage</td>
<td>Main circuit voltage: 200/230VAC, 50/60Hz with secondary transformer; Tertiary power supply voltage: 18/13.2VAC</td>
</tr>
<tr>
<td>Consumption (VA)</td>
<td>Control power capacity: Normal: Approx. 4.0VA, approx. 6.0VA with 8% current output in use; Input: 1, output: 1, backlight: normally off</td>
</tr>
<tr>
<td>Input current</td>
<td>Max. Approx. 2.75A (input: 5, output: 3, backlight normally off, normally AC)</td>
</tr>
<tr>
<td>Current rating</td>
<td>Hdd, clr</td>
</tr>
<tr>
<td>Static protective relay for electric motor</td>
<td>Contact current: Approx. 4.0A, approx. 6.0A</td>
</tr>
<tr>
<td>Weight</td>
<td>Hdd, clr</td>
</tr>
<tr>
<td>Ambient temperature for service</td>
<td>−15℃ – 60℃</td>
</tr>
<tr>
<td>Ambient humidity (without condensation)</td>
<td>40% to 90% RH</td>
</tr>
<tr>
<td>Ambient temperature for storage</td>
<td>−20℃ – 70℃</td>
</tr>
<tr>
<td>Ambient humidity for storage</td>
<td>5% to 90% RH (without condensation)</td>
</tr>
<tr>
<td>System dimensions</td>
<td>270 x 280 x 140mm</td>
</tr>
</tbody>
</table>

(2) Functions

- **Applicable area**: Low-voltage 3-phase (including morning load)
- **Specifications**
  - Standard (low-voltage (L), high-voltage (H), high-resistance grounding (G)), micro-leakage current measurement (M), low-sensitivity (L), high-sensitivity (H)
- **Protection**
  - Main circuit current (including 5% to 970% of rated current value, leakage current up to 1x 0.099VA), trip current name as main circuit 
    (leakage current)/leakage current power (0.5x 0.099VA), electrical energy (0.5x 0.099VA), automatic power level/electric energy level
- **Indications**
  - LCD: Run, stop, fault, transmission error, system error (LCD: manual, direct, reverse rotation, trip: alarm, trip cause, alarm, settings (settings guidance + settings selection), running, normal, system error)
- **Function**
  - Indicators: System display, fault alarm output, contact output at system error, fault reset, programmable sequence
- **Control**
  - Normal rotation, reverse rotation, stop
- **Analog input**
  - MCT current sensor (main circuit current, 2CT zero phase transformer (leakage current))
- **Digital input**
  - DI points: 1 x point for normal rotation, 1 x point for reverse rotation for general use if in non-reverse sequence, 2 points for general use (2 points for Input 1 point input specifications)
- **Analog output (optional)**
  - External current output: DC 0-10V (1, triple/partial extension scale), external current output: DC 4-20mA (1), with zero/ linear automatic adjustment function
- **Digital output**
  - 16 points: 1 x point for trip/alarms, 1 x point for stop, 1 x point for normal rotation, 1 x point for reverse rotation for general use if in non-reverse sequence, 2 points for general use if in non-reverse sequence, 4 points for general use if in non-reverse sequence, 8 points for general use if in non-reverse sequence (4 points if at time of 7-step input specifications)

(3) Names and Functions of Parts

<table>
<thead>
<tr>
<th>Setting name</th>
<th>Setting range</th>
</tr>
</thead>
<tbody>
<tr>
<td>[03] Key lock selection</td>
<td>OFF / ON</td>
</tr>
<tr>
<td>[02] Specifications</td>
<td>Low-voltage: 3-phase, high-voltage: 2-stage (excluding S specifications)</td>
</tr>
<tr>
<td>[01] Power factor</td>
<td>0 – 100%</td>
</tr>
<tr>
<td>[00] Overcurrent operating level</td>
<td>100 – 120%</td>
</tr>
<tr>
<td>[01] Overcurrent operating time</td>
<td>5 – 300s</td>
</tr>
<tr>
<td>[01] Undercurrent operating level</td>
<td>0 – 100%</td>
</tr>
<tr>
<td>[01] Undercurrent operating time</td>
<td>5 – 300s</td>
</tr>
<tr>
<td>[01] Leakage operating level</td>
<td>0.1 – 30mA</td>
</tr>
<tr>
<td>[01] Leakage operating time</td>
<td>5 – 120s</td>
</tr>
<tr>
<td>[01] Voltage setting</td>
<td>Low-voltage: 30 – 1000mA, high-voltage: 200 – 8000mA</td>
</tr>
</tbody>
</table>

- **Setting name**
  - CDL transmission function
  - CDL transmission address
  - CDL transmission station number
  - CDL transmission station number
  - CDL transmission station number
  - CDL transmission station number
  - CDL transmission station number
  - CDL transmission station number
  - CDL transmission station number
  - CDL transmission station number
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  - CDL transmission station number
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  - CDL transmission station number
  - CDL transmission station number
  - CDL transmission station number
  - CDL transmission station number

- **Setting range**
  - OFF / ON |
  - OFF / ON |
  - OFF / ON |
  - OFF / ON |
  - OFF / ON |
  - OFF / ON |
  - OFF / ON |
  - OFF / ON |
  - OFF / ON |
  - OFF / ON |
  - OFF / ON |
  - OFF / ON |
  - OFF / ON |
  - OFF / ON |
  - OFF / ON |
  - OFF / ON |
  - OFF / ON |

†1: Does not apply to models with no external current output function
†2: Does not apply to S specifications.
3 Features of EMC Type-B (EMC-B)

3.5 Specifications

(4) Protective Characteristics

- Overcurrent Operating Characteristics
- Hot-start Characteristics
- Unbalance Characteristics
- Ground Fault Operating Characteristics
- Overcurrent Instantaneous Characteristics
- Undercurrent Characteristics

(5) Sample Wiring

Standard EMC-B for a non-reversible sequence (CDL transmission, 5-point input)

(6) Product Configuration

EMC-B standard specifications

EMC-B Modbus®-RTU transmission specifications (Option) [See P37 to P41]

EMC-B CDL transmission specifications (Option) [See P42 to P44]

(7) Internal Circuit Diagram

- DL Interface line
- MCT current sensor
- External current supply transformer

(8) Associated Equipment

The following equipment must connected when using the EMC-B.

- Special Transformer
- Special Current Sensor (MCT)
- Special Zero-phase Current Transformer (ZCT)
- Special DC power-supply input specifications
- Special Zero-power supply input specifications

†1: For DC power-supply input specifications, the input voltage is DC and there is no auxiliary power-supply function.
†2: Please confirm the delivery schedule separately.
3 Features of EMC Type-B (EMC-B)

3.6 Extended Maintenance Support
The support function is comprised of (1) operation monitoring function, (2) operational availability monitoring function, and (3) maintenance monitoring function.

(1) Operation Monitoring Function
(3-mode Restart Function after Instantaneous Voltage Drop)
Supports the load option upon restart after an instantaneous voltage drop.

- In the case of short instantaneous voltage drops
  Short instantaneous voltage drops are characterized by relatively small differences in phase between supply voltage and motor residual voltage when voltage returns.
  ⇒ The startup (rush current) is relatively low.
  < Setting procedure >
  Even if all loads are allowed to start up at the same time following recovery from an instantaneous voltage drop, the power system is minimally affected. Loads are initiated by Immediate restart, for sustained operations.

- In the case of long instantaneous voltage drops
  Relatively long instantaneous voltage drops are characterized by larger differences in phase between the supply voltage and motor residual voltage when voltage returns.
  ⇒ High startup rush current.
  < Setting procedure >
  Since starting all loads at the same time is likely to impose a burden that outstrips the supply power, they are started one after another in accordance with Delay restart setup.

Short instantaneous voltage drop detection

- In the case of an instantaneous voltage drop that recovers within the immediate restart time
  Detects a power outage when the voltage has dropped below the instantaneous voltage drop detection level and ignores the restart time limit to initiate load if the voltage recovers to the recovery level or higher within the instantaneous voltage drop immediate restart time (0.2s).

- In the case of instantaneous voltage drops requiring longer time to recover than immediate restart time
  Detects a power outage when the voltage has dropped below the instantaneous voltage drop detection level and initiates load after the restart time limit if voltage recovers to the recovery level or higher within the instantaneous voltage drop compensation time (0.5 to 65.0s).

- In the case of relatively long instantaneous voltage drops
  Relatively long instantaneous voltage drops are characterized by larger differences in phase between the supply voltage and motor residual voltage when voltage returns.
  ⇒ High startup rush current.
  < Setting procedure >
  Since starting all loads at the same time is likely to impose a burden that outstrips the supply power, they are started one after another in accordance with Delay restart setup.

(2) Operational Availability Monitoring Function
(Target Current Setup)
The EMC-B monitors the readings for you!

<During Alarm Condition>
LCD turns orange to indicate that an alarm has been issued. Press the RESET button to reset the alarm condition.

(3) Maintenance Monitoring Function
(Running Time/Count-based Alarms)
The EMC-B notifies what needs to be replaced, and when.

\[1\] 72.5V = Instantaneous voltage drop detection voltage level (when main circuit supply voltage is 100/110VAC)
\[2\] In the case Y12 (Y13) is used for an instantaneous voltage drop
3.7 Easy Maintenance

(1) Replacement of Parts
When a replacement part reaches the end of its life, it can now be replaced by the user without detaching the EMC-B unit (i.e., without disconnecting all connectors). The EMC-B allows replacement of the aluminum electrolytic capacitor PCB and display PCB (i.e., LCD, LED).

- Replacing the Aluminum Electrolytic Capacitor PCB
  - When the aluminum electrolytic capacitor reaches the end of its life, the power supply may fail, preventing normal startup.

- Replacing the Display PCB (LCD, LED)
  - When the LCD reaches the end of its life, the text may become too light, certain segments may not illuminate, or the visibility may deteriorate altogether.

(2) Adding/Changing Specifications
It’s no longer necessary to replace the EMC-B main unit. Specifications can be changed simply by making additions/changes to the options board.

- Procedure for Checking Specifications
  The present specifications and specifications after making changes can be easily checked in test mode.

### EMC-B hardware-based specifications list
- Micro-leakage current measurement specification
  - Micro-leakage current measurement data
  - (0: None, 1: Yes)
- Auxiliary power supply
  - Auxiliary power supply data
  - (0: None, 1: Yes)
- No external current output
  - External current output data (T/O, Transducer)
  - (0: None, 2: 0-1mA + 4-20mA)
- 5-point input
  - Input/Output data
  - (0: None, 1: 5-point input + 10-point output, 2: 7-point input + 8-point output)
- CDL transmission
  - Transmission data
  - (0: None, 1: CDL, 2: CC-Link, 3: Modbus®-RTU)
- No system error contact output function
  - System error contact output function
  - (0: None, 1: Yes)
- No low-sensitivity ground overcurrent specification
  - Low-sensitivity ground overcurrent specification
  - (0: None, 1: Yes)

CAUTION
Capacitors tend to deteriorate over time while in storage. Contact us if capacitors kept in reserve need to be replaced. Be sure to take every precaution to protect against static electricity to avoid physical and subsequent functional damage to the product.

1. Aluminum electrolytic capacitor, LCD, LED.
2. Replacement parts are sold separately. Contact us to place your orders.
3. A long service life aluminum electrolytic capacitor rated at 125°C and 5,000hr is adopted.
4. We designate replacement time of the aluminum electrolyte capacitor as 10 years.
5. The liquid crystal display (LCD) is likely to require replacement after 10 years or so of use.
6. Changes are not possible for some product versions. Please check with a Mitsubishi Electric representative.
3 Features of EMC Type-B (EMC-B)

3.8 Energy Savings

- **LCD Normally Off Mode**
  The EMC-B LCD can be set to normally on or normally off.
  - **LCD Normally Off mode**
    In this mode, the LCD is normally off, prioritizing energy savings. The LCD turns on (high brightness) during key operation and turns off two minutes after key operation stops. Please note that use of the Normally Off mode shortens the service life of the LCD. Therefore, we recommend operation in Normally Off mode.

- **Settings can be used to prioritize saving energy or visibility.**
  The backlight on/off status changes depending on the LCD mode and key operation. The table below summarizes these changes:

<table>
<thead>
<tr>
<th>LCD mode</th>
<th>Key operation</th>
<th>Normal (2min after key operated)</th>
<th>Key operation again</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCD Normally Off mode</td>
<td>High brightness</td>
<td>Off</td>
<td>High brightness</td>
</tr>
<tr>
<td>LCD Normally On mode (low brightness)</td>
<td>High brightness</td>
<td>Low brightness</td>
<td>High brightness</td>
</tr>
<tr>
<td>LCD Normally On mode (high brightness)</td>
<td>High brightness</td>
<td>High brightness</td>
<td>High brightness</td>
</tr>
</tbody>
</table>

- **Power/Electrical Energy**
  The EMC-B comes with a simplified power/electrical energy measurement function as standard, providing measurements of power and electrical energy according to a preset input voltage/power factor. Measurement of power/electrical energy is provided to improve energy-savings.

- **0-1mA DC Current Output**
  The existing main circuit current (running current) may be output in the form of a 0-1mA DC current (optional). After doing so, there is no longer any need to add CT for an external meter, and the output current may be reduced from 1 (or 5) A to 1mA, further contributing to various energy-saving schemes.

- **Small-capacity Control Transformer**
  In addition to the existing 75-VA and 150-VA control transformers, a 50-VA small-capacity control transformer has been added to the line-up to accommodate wide-ranging energy-saving schemes.

3.9 Security

The EMC-B now makes it possible to deploy a soft padlock (security function 11) designed to lock data electronically via special software. Previously, the cover had to be equipped with a physical padlock to ensure data protection.

11: The security function requires a special security key (EMC-B-SKEY, available separately).
4 Transmission System

4.1 Modbus®-RTU Transmission System

(1) What is Modbus®-RTU Transmission?

Modbus® Transmission is a de facto standard bus equipped with the Modbus® protocol. Modbus® transmission is used widely throughout industries based on the fact that the protocol has been released for public use, and also because of its simple configuration. As a multi-tenant network, Modbus® transmission-compliant devices are provided from manufacturers worldwide, so system configuration and expansion capabilities are advantageous. Additionally, RS485 and other standards can be used as the physical layer.

Feature 1: Realizes Fast Response Time Under 1s (control x 2, monitoring x 1) When 25 EMC-B units are Connected

- Based on our unique technologies, the EMC-B internal processing time per unit has been reduced to less than 4ms.
- Based on the above, transmission of monitoring/control data at the maximum transmission speed setting (115.2kbitps) when 25 EMC-B units are connected is under 1s, realizing smooth, stress-free responsiveness (calculations based on three communication exchanges [control x 2; monitoring x 1]).
- Even when the maximum of units (64) is connected, response time is still an impressive 2.5s (under the same conditions as those described above).

![Modbus®-RTU Response Time Chart](image)

Details at 115,200bps

<table>
<thead>
<tr>
<th>Response time (ms)</th>
<th>Units connected (≤64)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,400bps</td>
<td>10,000</td>
</tr>
<tr>
<td>4,800bps</td>
<td>15,000</td>
</tr>
<tr>
<td>9,600bps</td>
<td>20,000</td>
</tr>
<tr>
<td>19,200bps</td>
<td>25,000</td>
</tr>
<tr>
<td>38,400bps</td>
<td>30,000</td>
</tr>
<tr>
<td>57,600bps</td>
<td>64</td>
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![Modbus®-RTU Response Time Chart](image)

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<td>25,000</td>
</tr>
<tr>
<td>38,400bps</td>
<td>30,000</td>
</tr>
<tr>
<td>57,600bps</td>
<td>64</td>
</tr>
</tbody>
</table>

(2) Example Modbus®-RTU Transmission System Configuration

Examples of single and redundant configurations are shown below for the case of the EMC-B with Modbus®-RTU transmission system. The EMC-B can be connected to any machinery or system that conforms to the Modbus®-RTU transmission protocol.

![Modbus®-RTU Configuration Diagram](image)

System configuration example

- Distribution Control System
- Low-Voltage Motor Control Center Type-D

- High-order communication (Ethernet, etc.)
- Modbus-RTU (CDL)
- Easy system expansion, reduced wiring cost

1. As a form of serial communication, Modbus® transmission has a remote terminal unit (RTU) mode and an American Standard Code for Information Interchange (ASCII) mode. In general, the RTU mode (known as Modbus®-RTU), which allows one byte of data to be sent without changes, is used (including for our EMC-B).
2. Modbus® is a registered trademark of Schneider Electric SA.
3. The worldwide standard transmission bus for all practical purposes irrespective of whether or not there are established standards or norms.
4. A communications protocol developed by Modicon Inc. (AEG Schneider Automation International S.A.S.) for programmable logic controllers (PLCs).
5. A transmission system component that enables overall communications through mutual conversion of data differing in terms of medium or protocol.
4 Transmission System

4.1 Modbus®-RTU Transmission System

(3) Redundant Modbus®-RTU Transmission Control System: A Choice of Two Types to Suit Customer Operations

<table>
<thead>
<tr>
<th>Control system</th>
<th>Double-master system</th>
<th>Standby master system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Features</td>
<td>Consists of two operating lines (A and B), and the same commands (control, monitoring) are sent simultaneously for both lines. Useful for equipment where a power outage is not acceptable.</td>
<td>Control is via the operating line (line A) only. The standby line (line B) is only used to check system soundness (monitoring). The system that is in general use.</td>
</tr>
<tr>
<td>Muits</td>
<td>No need to consider the switching time regardless of which line the error occurs in.</td>
<td>No need to set timing for either line (operating, standby). Can be applied to single transmission routes.</td>
</tr>
<tr>
<td>Dements</td>
<td>Care is needed to ensure that the difference in control timing between the two lines does become too large to make sure that subsequently received control signals can be accepted. Cannot be applied to single transmission routes.</td>
<td>Need to consider switching time (dead time: dependant on system) when an error occurs in the operating line.</td>
</tr>
<tr>
<td>Applicable (recommended) systems</td>
<td>Systems that require 24-hour operation or where it is difficult to secure time for switching (i.e., systems where a power outage is not acceptable).</td>
<td>Standard systems or systems with single transmission routes (e.g., systems where only the master is redundant).</td>
</tr>
</tbody>
</table>

Fig. 3 Double-master system (standard)  
Fig. 4 Standby master system (option)

Feature 2 More Compact EMC-B Realized Even with Redundant Transmission Specifications

The EMC-B has an industry-leading compact size thanks to use of the same external dimensions (length, width) for both redundant and single transmission specifications. In addition, MCC units with a height equivalent to the 1/2 unit can be stored with an increase in the depth dimension of only approximately 10mm.

(4) Functions Provided by Modbus®-RTU Transmission

<table>
<thead>
<tr>
<th>Transmission function</th>
<th>Modbus®-RTU support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status monitoring</td>
<td>○</td>
</tr>
<tr>
<td>Current monitoring</td>
<td>○</td>
</tr>
<tr>
<td>Operation log monitoring</td>
<td>○</td>
</tr>
<tr>
<td>Error monitoring</td>
<td>○</td>
</tr>
<tr>
<td>Polling transmission</td>
<td>△</td>
</tr>
<tr>
<td>Control command</td>
<td>○</td>
</tr>
<tr>
<td>Automatic inspection execution command</td>
<td>○</td>
</tr>
</tbody>
</table>

†1 There is no polling function in Modbus®-RTU transmission, but polling can be achieved via a master-side application.
†2 There is no notification function in Modbus®-RTU transmission; the EMC-B only replies to queries from the master station.
†3 Only supported in Modbus®-RTU transmission.
†4 Circles (○) indicate total support; triangles (△) indicate partial support.

(5) Modbus® Function Code

For EMC-B, the following items are supported within the function code defined in the Modbus® protocol.

<table>
<thead>
<tr>
<th>Function</th>
<th>Code</th>
<th>Sub Code</th>
<th>EMC-B support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical discrete inputs</td>
<td>Read discrete inputs</td>
<td>02</td>
<td>○</td>
</tr>
<tr>
<td>Physical input registers</td>
<td>Read input registers</td>
<td>04</td>
<td>○</td>
</tr>
<tr>
<td>Internal bits or physical coils</td>
<td>Read coils</td>
<td>01</td>
<td>○</td>
</tr>
<tr>
<td>Write single coil</td>
<td>05</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Write multiple coils</td>
<td>15</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Internal registers or physical output registers</td>
<td>Read holding registers</td>
<td>03</td>
<td>○</td>
</tr>
<tr>
<td>Write single register</td>
<td>06</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Diagnostics</td>
<td>Diagnostics</td>
<td>08</td>
<td>Only 00 supported</td>
</tr>
</tbody>
</table>

Line A Line B

Fig. 3 Double-master system (standard)  
Fig. 4 Standby master system (option)
4 Transmission System

4.1 Modbus®-RTU Transmission System

(6) Advantages of EMC-B Modbus® Transmission

- Excellent responsiveness ⇒ Equal to or under 10ms, excluding transmission route (fixed regardless of transmission speed)
- Faster transmission speed than the standard Modbus® transmission ⇒ Set speed up to 1.24kbaud
- Increased No. of connected terminals ⇒ Up to 64 units can be connected (standard: 32 units)

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical conditions</td>
<td></td>
</tr>
<tr>
<td>Transmission medium</td>
<td>Three-line twisted shielded cable [1.0,0.5]</td>
</tr>
<tr>
<td>Transmission distance</td>
<td>1.20m (at 10.24kbaud) (changes depending on transmission speed)</td>
</tr>
<tr>
<td>Topology</td>
<td>Bus method</td>
</tr>
<tr>
<td>Connected terminals</td>
<td>Max. 64 units</td>
</tr>
<tr>
<td>Settable addresses</td>
<td>1 ~ 257 (amount for 64 units)</td>
</tr>
<tr>
<td>Transmission line</td>
<td>Five in total: DARX+ (transmission line), DBRX- (transmission line), DG (GND), FG and SLD</td>
</tr>
<tr>
<td>Terminal resistance</td>
<td>120Ω</td>
</tr>
<tr>
<td>Physical layer</td>
<td>RS485 [1]</td>
</tr>
<tr>
<td>Electrical conditions</td>
<td></td>
</tr>
<tr>
<td>Bus connection method</td>
<td>Photo coupler</td>
</tr>
<tr>
<td>Transmission power source</td>
<td>Not required (supplied from EMC-B)</td>
</tr>
<tr>
<td>Logic system</td>
<td></td>
</tr>
<tr>
<td>Synchronizing method</td>
<td>Asynchronous (data: 8-bit, parity: 1-bit)</td>
</tr>
<tr>
<td>General frame configuration</td>
<td>AF: Address field (1 byte) FF: Function field (1 byte) DATA: Data field (max. 253 bytes) CRC: Cyclic redundancy check (error check field 2 bytes)</td>
</tr>
<tr>
<td>Parity bit</td>
<td>Non, odd, even [7]</td>
</tr>
<tr>
<td>Stop bit</td>
<td>1 or 2 [7]</td>
</tr>
<tr>
<td>Error detection</td>
<td>Parity, CRC [11]</td>
</tr>
<tr>
<td>Other functions</td>
<td></td>
</tr>
<tr>
<td>Broadcast</td>
<td>Broadcast query [8]</td>
</tr>
<tr>
<td>Redundancy specifications</td>
<td>Double-master system/Standby-master system (for both systems, consult a Mitsubishi Electric representative regarding the delivery schedule)</td>
</tr>
</tbody>
</table>

†1 RS485 are standards relating to the level of the communications-protocol physical layer, which consists of two lines: the communications line and grounding line.
†2 In Modbus® transmission, only the master station can issue a query (start transmission). The slave stations see the query, perform the specified function and send a response message.
†3 In Modbus® transmission, a code known as the function code is prepared. This code defines the transmission function and allows support functions to be adopted or rejected for each device (the supporting function codes for the EMC-B are shown below).
†4 Parity-bit and stop-bit settings are correlated as follows.
†5 Cyclic redundancy check (CRC) is an error-detection technique that uses a prepared, standardised generator polynomial, and considers the data frame that transmits the CRC to be a high-degree polynomial.
†6 Special queries transmitted as a batch from a master station to all slave stations. The receiving slave stations execute functions as directed by the query, but cannot send an answer.

4.2 CDL Transmission System

(1) What is a CDL Transmission System?

Control center data link systems (CDLs) were developed to establish a control/information network connecting various devices and equipment in a power distribution system. They are primarily used as part of a configuration for monitoring power distribution systems managed from control centers. Connecting devices and equipment with a flexible, branching digital network reduces wiring costs, facilitates distributed control/collective supervision/maintenance, and results in reliable systems.

Sample Configuration for a CDL Transmission System

(2) Calculating Transmission Distance:

A CDL transmission system uses electric current to transmit signals. Feasible transmission distances depend on transmission line impedance and the number of connected terminals. The specific transmission type affects the propagation time of the entire transmission system. This makes it important to determine transmission distances in ways that satisfy both of the following requirements:

- The transmission system is divided into independent systems (nodes) separated by relays (RPQ) or optical converters (CEQ) with the maximum length of each node assigned the value in Table 1.
- The overall transmission system consists of nodes. The maximum distance between the two terminals that are farthest apart is the figure given in Table 2.

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission line type</td>
<td>Single 0.75mm (AWG 18, φ1.3mm) Max. length 64 max. 760m 100m</td>
</tr>
<tr>
<td></td>
<td>1.25mm (AWG 16, φ1.3mm) 1200m 100m</td>
</tr>
<tr>
<td></td>
<td>20mm (AWG 14, φ1.5mm) 2000m 100m</td>
</tr>
</tbody>
</table>

Table 1

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Maximum transmission length system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic system (not using relays or optical converters)</td>
<td>2,000m  (if CDL-Z and -V used in combination, 1,500m)</td>
</tr>
<tr>
<td>Transmission system using a repeater</td>
<td>4,000m (if CDL-Z and -V used in combination, 3,000m)</td>
</tr>
<tr>
<td>System with “n” repeaters (n = 1, 2, 3, 4)</td>
<td>2,000 × (n+1) m</td>
</tr>
<tr>
<td>System with an optical converter (n = 1, 2, 3, 4)</td>
<td>2,000 × (n+1) m</td>
</tr>
</tbody>
</table>

Table 2

Example using 1.25mm² transmission line (AWG 16, φ1.3mm, single line)

<table>
<thead>
<tr>
<th>PW</th>
<th>MS-QZ</th>
<th>PW</th>
<th>MS-QZ</th>
<th>PW</th>
<th>MS-QZ</th>
</tr>
</thead>
<tbody>
<tr>
<td>LS</td>
<td>LS</td>
<td>LS</td>
<td>LS</td>
<td>LS</td>
<td>LS</td>
</tr>
</tbody>
</table>

17: Distributed Control System.
19: For the maximum number of MS-QZs that can be accommodated by a PLC, see the catalog for the Network System CDL for Mitsubishi Electric Power Distribution Systems (Japanese only) (JNEE-SL-0123).
11: RS485 are standards relating to the level of the communications-protocol physical layer, which consists of two lines: the communications line and grounding line.
12: In Modbus® transmission, a code known as the function code is prepared. This code defines the transmission function and allows support functions to be adopted or rejected for each device (the supporting function codes for the EMC-B are shown below).
13: In Modbus® transmission, a code known as the function code is prepared. This code defines the transmission function and allows support functions to be adopted or rejected for each device (the supporting function codes for the EMC-B are shown below).
14: Parity-bit and stop-bit settings are correlated as follows.
15: Cyclic redundancy check (CRC) is an error-detection technique that uses a prepared, standardised generator polynomial, and considers the data frame that transmits the CRC to be a high-degree polynomial.
16: Special queries transmitted as a batch from a master station to all slave stations. The receiving slave stations execute functions as directed by the query, but cannot send an answer.
4 Transmission System

4.2 CDL Transmission System

(3) CDL Transmission-based Functions

<table>
<thead>
<tr>
<th>Transmission function</th>
<th>CDL support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status monitoring</td>
<td>☑</td>
</tr>
<tr>
<td>Current monitoring</td>
<td>☑</td>
</tr>
<tr>
<td>Operation log monitoring</td>
<td>☑</td>
</tr>
<tr>
<td>Error monitoring</td>
<td>☑</td>
</tr>
<tr>
<td>Polling transmission</td>
<td>☑, ✗</td>
</tr>
<tr>
<td>Control command</td>
<td>☑</td>
</tr>
<tr>
<td>Automatic inspection command</td>
<td>☑</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Transmission function</th>
<th>CDL support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear operation log command</td>
<td>☑</td>
</tr>
<tr>
<td>Status change notification</td>
<td>☑</td>
</tr>
<tr>
<td>Setting change notification</td>
<td>☑</td>
</tr>
<tr>
<td>Read settings</td>
<td>☑</td>
</tr>
<tr>
<td>Write settings</td>
<td>✓</td>
</tr>
<tr>
<td>Loopback test</td>
<td>✓</td>
</tr>
<tr>
<td>Broadcast transmission</td>
<td>☑</td>
</tr>
</tbody>
</table>

(4) CDL Transmission System Specifications

<table>
<thead>
<tr>
<th>Physical conditions</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission medium</td>
<td>Electricity</td>
</tr>
<tr>
<td></td>
<td>Light: Silica glass 0.5×0.125 optical fiber</td>
</tr>
<tr>
<td></td>
<td>Dark: Powder glass 0.5×0.125 optical fiber</td>
</tr>
<tr>
<td>Transmission distance</td>
<td>By electricity: 2,000m (depending on cable size and number of terminals)</td>
</tr>
<tr>
<td></td>
<td>By light: Silica glass 0.5×0.125 optical fiber</td>
</tr>
<tr>
<td>Topology</td>
<td>Bus type (loop connection also possible)</td>
</tr>
<tr>
<td>Connected terminals</td>
<td>64 terminals max. (depending on type)</td>
</tr>
<tr>
<td>Transmission line</td>
<td>4 in total, i.e., P (power): 1; N (GND): 2; S (signal): 1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Electrical conditions</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission speed</td>
<td>9.6kbps (bit/s)</td>
</tr>
<tr>
<td>Signal Type</td>
<td>Time-division multiplex digital transmission, Baseline, Current bus</td>
</tr>
<tr>
<td>Bus connection</td>
<td>By photocoupler</td>
</tr>
<tr>
<td>Transmission power supply</td>
<td>24VDC (signal line) / 12VDC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Logic</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>CDMA/NBA, CSMA/NBA, Current bus, bus type</td>
</tr>
<tr>
<td>Synchronization</td>
<td>Asynchronous (1-bit data, 1-bit parity)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Basic frame construction</th>
<th>SA</th>
<th>DA</th>
<th>CW</th>
<th>BC</th>
<th>DATA</th>
<th>FCC</th>
</tr>
</thead>
<tbody>
<tr>
<td>SA: Self address (1 byte)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DA: Destination address (1 byte)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CW: Control code (1 byte)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Error detection | Combined parity/FCC |

Self-diagnosis

Bus low-level detection/s split

The duration for which the level of the signal line (S) remains low is monitored. If it remains low for more than a specific period (200 to 500ms), an error condition is assumed, resulting in cutting off the terminal signal line in question from the CDL transmission bus.

Double-address detection

The use of the same address by different slave terminals results in a double-address error.

1. Standard function for CDL transmission.
2. For CDL transmission, it is not possible to write settings.
3. Only Modbus-RTU transmission is supported.
4. May be increased to 10km max. using repeaters.
5. Refers to a transmission system in which a single transmission channel is used by multiple terminals through a time-share scheme.
6. Refers to a transmission system in which digital signals are sent to a transmission channel without modulation.
7. Refers to a transmission system using electric current.
8. Refers to a transmission system often used in field networks intended primarily to connect field equipment and subassemblies or to connect controllers to other controllers. Individual terminals and nodes (master terminals) monitor the common bus, initiating transmission when it becomes available. Transmission collisions are obviated by applying a set of rules that grant varying precedence to individual nodes. Since any of the terminals is likely to be using the bus at any given time, the system is highly efficient. The abbreviation stands for Carrier Sense Multiple Access with Non-destructive Bitwise Arbitration.

(5) High Reliability (noise resistance)

CDL Transmission and Noise Resistance

In CDL transmission, the level of the signal line at High is 12VDC. This is sufficiently high relative to noise waveforms (approximately several V). At transmission speeds of 9.6kbps, the per-bit time length (104µs) is also sufficient for noise waveforms (several µs or less). These factors make the line highly resistant to external noise. Combined with the signal level check (bit checks) executed as often as five times per bit, they make CDL a remarkably reliable transmission system.

Current Loop Scheme

CDL transmission applies a current loop scheme whereby signals are sent using changes in electric current. As a transmission system that takes advantage of an appreciable amount of current (i.e., 12mA per terminal), it is relatively unaffected by transmission cable resistance and offers high S/N ratios and high noise resistance.

Improved Response

In CDL transmissions, slave terminals normally respond in sequence. (1) (e.g., 2 → 3 → 4 → 5) to polling (periodical queries) from the master terminal based on assigned addresses. In this method, it takes 12.8s for the master terminal to call on a specific slave terminal (polling) regardless of the number of connected terminals. (In the diagram to the right, each of the terminals 1 through 6 are called once every 12.8s.) Thanks to a CSMA/NBA system, a change in the state of a slave terminal (e.g., its output contact or presence of a fault) is immediately reported before polling by the master terminal occurs. Likewise, data initiating a command for operations written to the master terminal will be executed immediately on the slave terminal in question. Signal transmission (change-of-state notice, operating commands) between master and slave terminals occurs based on the priority specific to a CDL transmission.

Exogenous noise: 1µs or less, approx. several V

Time-division multiplex digital transmission

CDL transmission

Current Loop Scheme

Improved Response

No effects attributable to noise

Current of 12mA per terminal

Exogenous noise: 1µs or less, approx. several V
4 Transmission System

4.3 CDL MASTER Maintenance Support/Operation Status Monitoring System (optional)

This system provides efficient maintenance support and monitoring of control center status by making it possible to view EMC-B data on a personal computer. ①

Sample system configuration

Data such as present load conditions and measurement values are displayed on the screen for simple monitoring of load operation status.

② EMC-B registration data, status, measurement values, operation log, settings, failure log and other items can be saved as text or CSV files.

③ The monitoring system has a simple structure; for example, monitoring of device settings can be performed via simple data entry.

④ Easy to change settings such as load name or unit position.

Advantages Demonstrated in Four Situations

1. Supports plant startup work
Quickly test operations at time of plant startup

The number of motor operations and failures can be checked easily. It took less time to test operations when installing equipment for production line A.

2. Simple data editing
Easily complete settings using data-editing software

Setting the EMC-B for expanding conveyor belt of production line B was easy. All that was required was carrying over the data for existing EMC-B settings.

3. Computer-based centralized management
Carry-over sequence circuits too...

It’s now easier to put all the EMC’s under the same sequence circuit at the time of plant startup too.

4. Simple to change EMC-B internal sequence circuits
Integrate EMC-B status displays

When starting up production line C, all of the measurements could be checked on a single screen without having to use the control panel of the EMC-B main unit. The data log function is also very convenient for maintenance.

It’s recommended that this software be purchased preinstalled as a set with a computer specified by Mitsubishi Electric. The software can be supplied separately, but the user will be required to personally check operations after installation. The operations guarantee only applies when used with a computer specified by Mitsubishi Electric.

4.4 EMCSET Plant Startup/Maintenance Support Software (Computer Version) (Optional)

This software makes it easy to efficiently read/write internal sequence data and edit setting data/display operation logs of the EMC-B using a computer.

Advantages Demonstrated in Four Situations

1. Supports plant startup work
Quickly test operations at time of plant startup

2. Simple data editing
Easily complete settings using data-editing software

3. Computer-based centralized management
Carry-over sequence circuits too...

4. Simple to change EMC-B internal sequence circuits
Integrate EMC-B status displays

It’s recommended that this software be purchased preinstalled as a set with a computer specified by Mitsubishi Electric. The software can be supplied separately, but the user will be required to personally check operations after installation. The operations guarantee only applies when used with a computer specified by Mitsubishi Electric.
5 Dimensions and Installation of MCC-D

5.1 External Dimensions

- LV Switchgear
- Controlgear

<table>
<thead>
<tr>
<th>Unit: mm</th>
<th>Side</th>
<th>Front</th>
<th>Rear</th>
</tr>
</thead>
<tbody>
<tr>
<td>LV Switchgear</td>
<td>800</td>
<td>1200</td>
<td>50</td>
</tr>
<tr>
<td>Controlgear</td>
<td>800</td>
<td>1200</td>
<td>50</td>
</tr>
</tbody>
</table>

5.2 Installation

5.3 Maintenance Space

(Note)
1. Channel base is per panel only.
2. Channel base height is 50mm.
3. Packaging is at per panel.
4. Only the necessary number of foundation bolts (above) are supplied upon request.
5. After removing the shipping brackets, attach the decorative plate included to the side of the channel base using the M5 tapping screws.

6 Selection Table of MCC-D

6.1 Low-Voltage Switchgear Ratings

<table>
<thead>
<tr>
<th>Frame size</th>
<th>Rated voltage</th>
<th>Rated short-time withstand current, Rated duration of short-time current</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incomer</td>
<td></td>
<td>Up to 690V</td>
</tr>
<tr>
<td>Bus-tie</td>
<td></td>
<td>65kA / 85kA, 1Sec</td>
</tr>
<tr>
<td>Outgoing feeder</td>
<td></td>
<td>65kA, 1Sec</td>
</tr>
</tbody>
</table>

6.2 Controlgear Ratings

<table>
<thead>
<tr>
<th>Frame size</th>
<th>Rated voltage</th>
<th>Rated short-time withstand current, Rated duration of short-time current</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Up to 480V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>65kA, 1Sec</td>
</tr>
</tbody>
</table>

†1: Space to prevent condensation
†2: The 50mm height of the channel base is not included in the height dimension.
# Controlgear Unit Selection Table

## 7.1 Unit Ratings

### Coordination for Protective Devices: Type 1

<table>
<thead>
<tr>
<th>Frame size</th>
<th>Rated voltage</th>
<th>Rated conditional short-circuit current</th>
<th>Rated capacity</th>
<th>NOS pole</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4 unit</td>
<td>Up to 460V</td>
<td>50kA</td>
<td>≥30A</td>
<td>3P</td>
<td>7</td>
</tr>
<tr>
<td>Type D2Q</td>
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<td></td>
<td></td>
<td>4P</td>
<td></td>
</tr>
<tr>
<td>1/2 unit</td>
<td>Up to 460V</td>
<td>50kA</td>
<td>≥50A</td>
<td>3P</td>
<td>11</td>
</tr>
<tr>
<td>Type D2H</td>
<td></td>
<td></td>
<td></td>
<td>4P</td>
<td>12</td>
</tr>
<tr>
<td>1/1 Unit</td>
<td>Up to 460V</td>
<td>65kA</td>
<td>≥65A</td>
<td>3P</td>
<td>11</td>
</tr>
<tr>
<td>Type D2</td>
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<td></td>
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<td>4P</td>
<td>12</td>
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<tr>
<td>Type D3</td>
<td></td>
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</tr>
<tr>
<td>1/1 Unit</td>
<td>Up to 460V</td>
<td>660mm</td>
<td>225kW</td>
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<td>Type D3</td>
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<tr>
<td>Type D6</td>
<td></td>
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</table>

### Skelton diagram

- **Power feeder unit**
  - Type D2Q: 50kA, 30A
  - Type D2H: 65kA, 63A
  - Type D2: 65kA, 63A
  - Type D3: 65kA, 63A
  - Type D6: 400A, 125A

- **Starter unit**
  - Type D2H: 22kW, 3P
  - Type D2: 22kW, 3P
  - Type D3: 90kW, 3P
  - Type D6: 132kW, 3P

---

## 7.2 Unit Selection Table

### Coordination for Protective Devices: Type 1

<table>
<thead>
<tr>
<th>Skelton diagram</th>
<th>Rated current (A)</th>
<th>460V</th>
<th>480V</th>
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</thead>
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<tr>
<td>MCCB</td>
<td>50kA</td>
<td>30</td>
<td></td>
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<tr>
<td>ZCT</td>
<td>65kA</td>
<td>63</td>
<td></td>
</tr>
<tr>
<td>MCT</td>
<td>65kA</td>
<td>63</td>
<td></td>
</tr>
<tr>
<td>MC</td>
<td>5.5</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Type D2H</td>
<td></td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>Type D2</td>
<td></td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>Type D2H</td>
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<td>30</td>
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<tr>
<td>Type D2</td>
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<td>Type D3</td>
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</tr>
<tr>
<td>Type D6</td>
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<td>132</td>
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</tbody>
</table>

### Skelton diagram

- **Power feeder unit**
  - Type D2Q: 50kA, 30A
  - Type D2H: 65kA, 63A
  - Type D2: 65kA, 63A
  - Type D3: 65kA, 63A
  - Type D6: 400A, 125A

- **Starter unit**
  - Type D2H: 22kW, 3P
  - Type D2: 22kW, 3P
  - Type D3: 90kW, 3P
  - Type D6: 132kW, 3P

---

## 7.3 Distributor Ratings

### Coordination for Protective Devices: Type 1

<table>
<thead>
<tr>
<th>Frame size</th>
<th>Rated conditional short-circuit current</th>
<th>Rated capacity</th>
<th>NOS pole</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4 Distributor</td>
<td>50kA, ≥10A</td>
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<td>21</td>
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<td></td>
<td>4P</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>1/2 Distributor</td>
<td>65kA, ≥63A</td>
<td>3P</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4P</td>
<td>21</td>
<td></td>
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</tbody>
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---

*Unit Sizes and Types*:

<table>
<thead>
<tr>
<th>Frame size</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type D2Q</td>
<td>1/4 unit</td>
</tr>
<tr>
<td>Type D2H</td>
<td>1/2 unit</td>
</tr>
</tbody>
</table>
### 9 Use and Ordering

#### 9.1 Points to Note When Placing an Order

Thank you for your continued patronage of Mitsubishi Electric products. Before ordering the Mitsubishi Electric product described in this catalog (hereinafter, the Product), please carefully read the following conditions (assuming there are no requirements for special conditions relating to matters such as estimates, contracts, specifications or catalogs other than this one). When placing an order, you (the customer) agree to the stipulations stated hereinafter.

1. **Warranty Period**
   - The free service warranty period for the Product is one (1) year from the date of delivery, provided that no separate agreement has been made between Mitsubishi Electric and the customer.

2. **Scope of Warranty**
   - If the Product is found to have a fault or defect attributable to Mitsubishi Electric during the warranty period, Mitsubishi Electric shall provide the necessary replacement parts and/or exchange/repair the faulty part at no cost to the customer. However, if it becomes necessary to dispatch a technician to the site to conduct repairs either domestically or internationally, the customer shall be liable for the expenses incurred to dispatch said technician. In addition, Mitsubishi Electric shall not be liable for: a. faults or defects attributable to the customer; b. faults or defects attributable to the use of the Product; c. damage to products of other companies; d. compensation for replacement work, on-site recalibrations of machinery/equipment, trial start-up operation or other work performed by the customer.

3. **Exclusion of Warranty Obligations for Opportunity/Secondary Loss**
   - Regardless of whether or not the warranty is valid, Mitsubishi Electric shall not be liable for: a. any damage found not to be attributable to the Product; b. the loss of opportunity or profits for the customer or user caused by any fault in the Product; c. damage, secondary damage or accident compensation resulting from special factors regardless of whether or not such factors could be predicted by Mitsubishi Electric; d. damage to products of other companies; e. compensation for replacement work, onsite recalibrations of machinery/equipment, trial start-up operation or other work performed by the customer.

4. **Changes to Specifications**
   - Please be aware that the specifications described in the catalog, manual or technical documents are subject to change without prior notice.

5. **Scope of Services**
   - The price of the Product does not include service costs such as the dispatch of technical personnel. Customers are requested to contact Mitsubishi Electric if such services are required.

#### 9.2 Improving Reliability and Recommended Renewal Period

1. **1. Improving Reliability of Safeguards**
   - The parts equipped in protective relays have a limited service life; the rate of deterioration varies according to the application, number of years in service, usage environment and individual performance of parts. Mitsubishi Electric generally designs its products to have a recommended renewal period of 15 years when components, etc. require replacement prior to the end of the 15-year period. To avoid situations where relays do not operate properly/fail to operate as a result of unintended circumstances/conditions, depending on the importance of the equipment, the customer is advised to take appropriate measures; for example, use a redundant system for safeguards, and monitor relay status using products equipped with alarm output contacts that enable constant self-monitoring.

2. **Recommended Renewal Period**
   - Mitsubishi Electric recommends a scheduled renewal approximately 15 years after manufacture. This is based on the recommended renewal period described in “JEM TR-156: Guidelines for Maintenance/Inspections of Protective Relays” issued by the Japan Electrical Manufacturers’ Association (in Japanese). This renewal period does not reflect the manufacturer’s guaranteed values for functions and performance, but rather the period generally considered beneficial, including economically, to replace the Product with a new product considering the deterioration of machinery structural materials in a standard usage environment where standard maintenance/inspections are conducted. Unexpected malfunctions or operational failures may occur if the Product is used beyond the recommended renewal period. Furthermore, Mitsubishi Electric recommends that peripheral devices such as transmitters be included in the renewal process. As described in 1. above, Mitsubishi Electric generally designs its products to have a recommended renewal period of 15 years.

#### 9.3 Maintenance/Inspections

1. **1. For the Product to provide satisfactory performance, appropriate regular inspections and maintenance are essential. Please perform an initial inspection before turning the power on for the first time and then at least once every one to three years after that.**

2. **2. Please check that all the terminal connections are securely tightened, as loosening of connections could cause electrical failure.**

3. **3. The LCD parts, including the LEDs used in the LCD, have a limited service life and will gradually decrease in brightness (this varies depending on the usage environment). Please replace the LCD if the lamps or LCD screen become dark or the character’s become unclear for details, please contact a Mitsubishi Electric representative.**

---

### 8 Specifications Sheet (for planning by customer)

#### 8.1 General conditions

<table>
<thead>
<tr>
<th>Item</th>
<th>Standard specification</th>
<th>Optional specification</th>
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<td>Applied standard</td>
<td>IEC</td>
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<tr>
<td>General conditions</td>
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<tr>
<td>Seismic resistance</td>
<td>IEC</td>
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<tr>
<td>Humidity proof spec.</td>
<td>IEC</td>
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<tr>
<td>Water proof spec.</td>
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<tr>
<td>Outer surface color</td>
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<tr>
<td>(unless interior frame and unit case are manufacturer’s standards)</td>
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<tr>
<td>Whipping/Braiding</td>
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<td>Membrane thickness specified</td>
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<tr>
<td>Panel</td>
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<tr>
<td>Outer surface color</td>
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<td>(unless interior frame and unit case are manufacturer’s standards)</td>
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</table>
Safety Precautions

Please read the instruction manual before using the device.