TOSHIBA

TYPE TE MOTOR CONTROL CENTER

# M series and G series

## Advancing Motor Control Technology

# TOSHIBA Type TE Motor Control Center

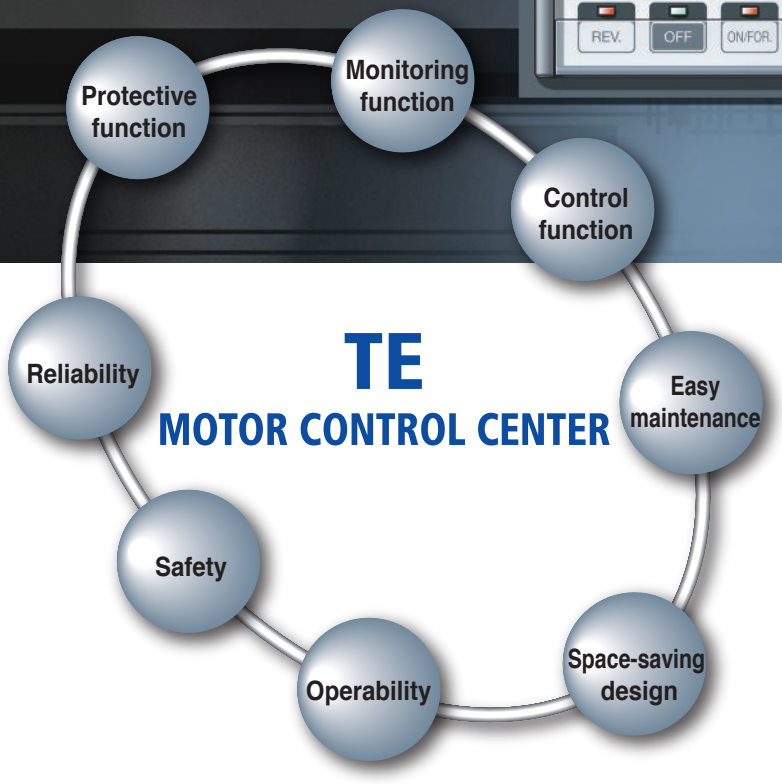
Toshiba began the production of Motor control centers in 1954, and has been improving the technology for more than 60 years.

The Type TE motor control center is used in many industrial plants.

For example: Steelworks and Oil refinery plants, Paper mills plants, Cement plants, Food industry plants, Water treatment infrastructures, Power plants, Garbage disposal facilities, Road and traffic systems etc.

The type TE motor control center is enjoying a high reputation all over the world.

The motor multi-relay CCR22, a further advanced model of the multi-function protecting relay, has been developed.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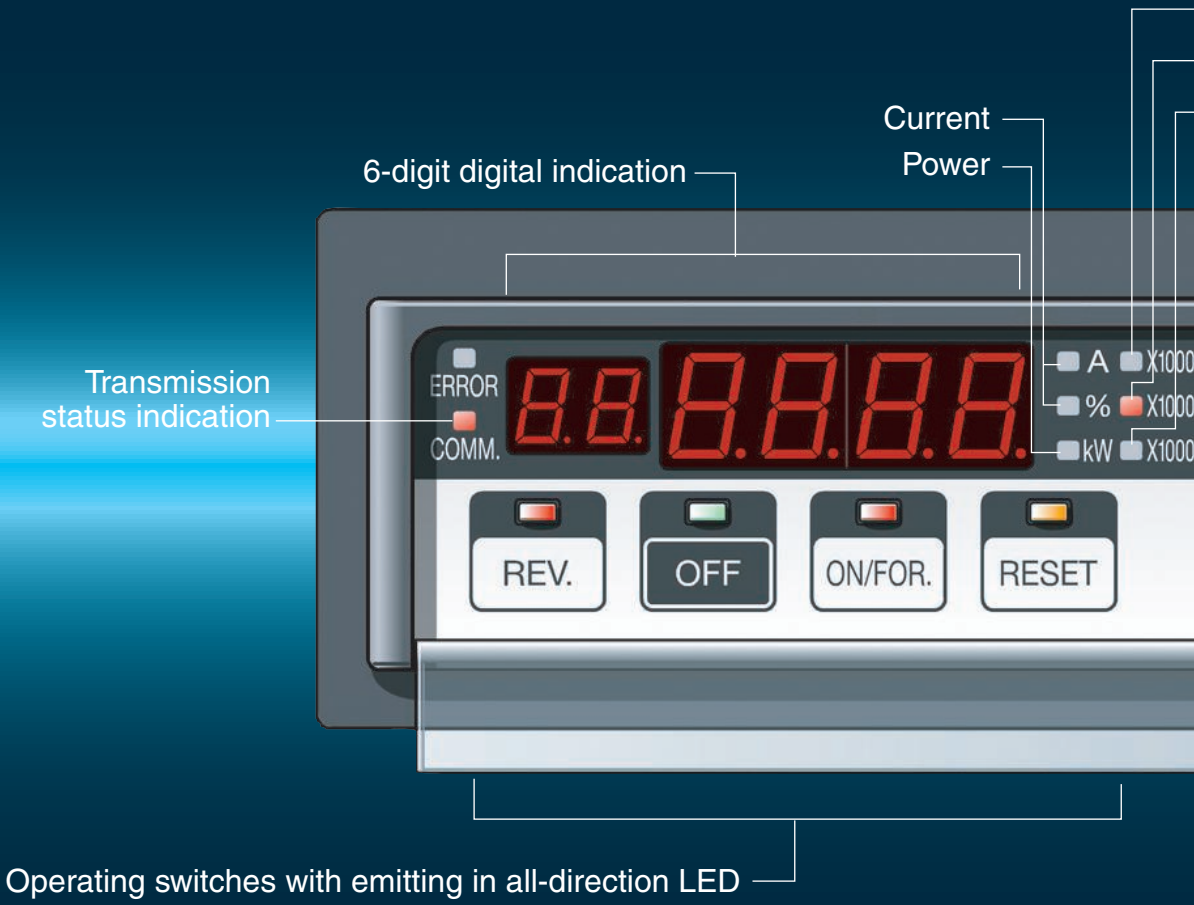
### Long-life, bright, and large 7-segment LED indicator

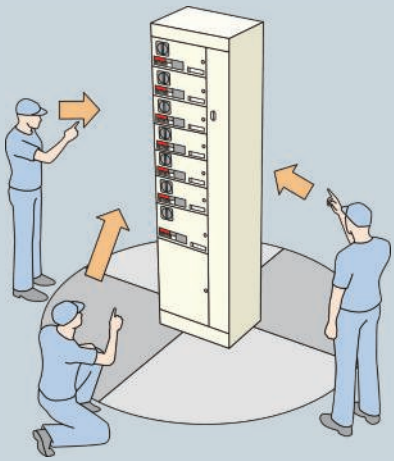
This LED indicator has longer service life compared to LCD, and indicated values can be read clearly both in bright and dark places.
The 6-digit-display helps you recognize at a glance which item is being set.

# MOTOR MULTI-RELAY MODEL CCR22




### Lenses which enable clear and easy view from any direction were adopted.

Operation indicator lamps can be seen from above, below, left and right.



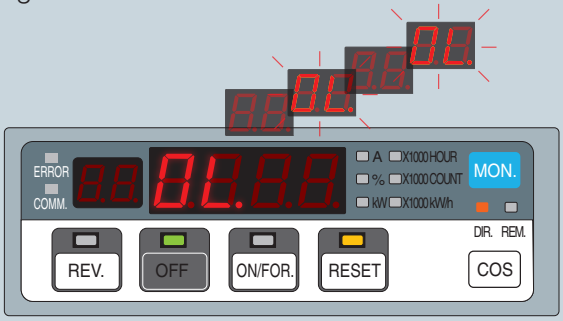
### Compatible with old-type models

As this model is compatible with old-type motor multi-relays, it is possible to renew them and enhance their monitoring functions.

### Protection, control and monitoring of motors are managed by a PC. Also energy-saving and failure analysis are supported.

## Easily understandable trip indicator

When a trip occurs, the orange lamp will light. The 7-segment LED will indicate the cause of the failure and blink.



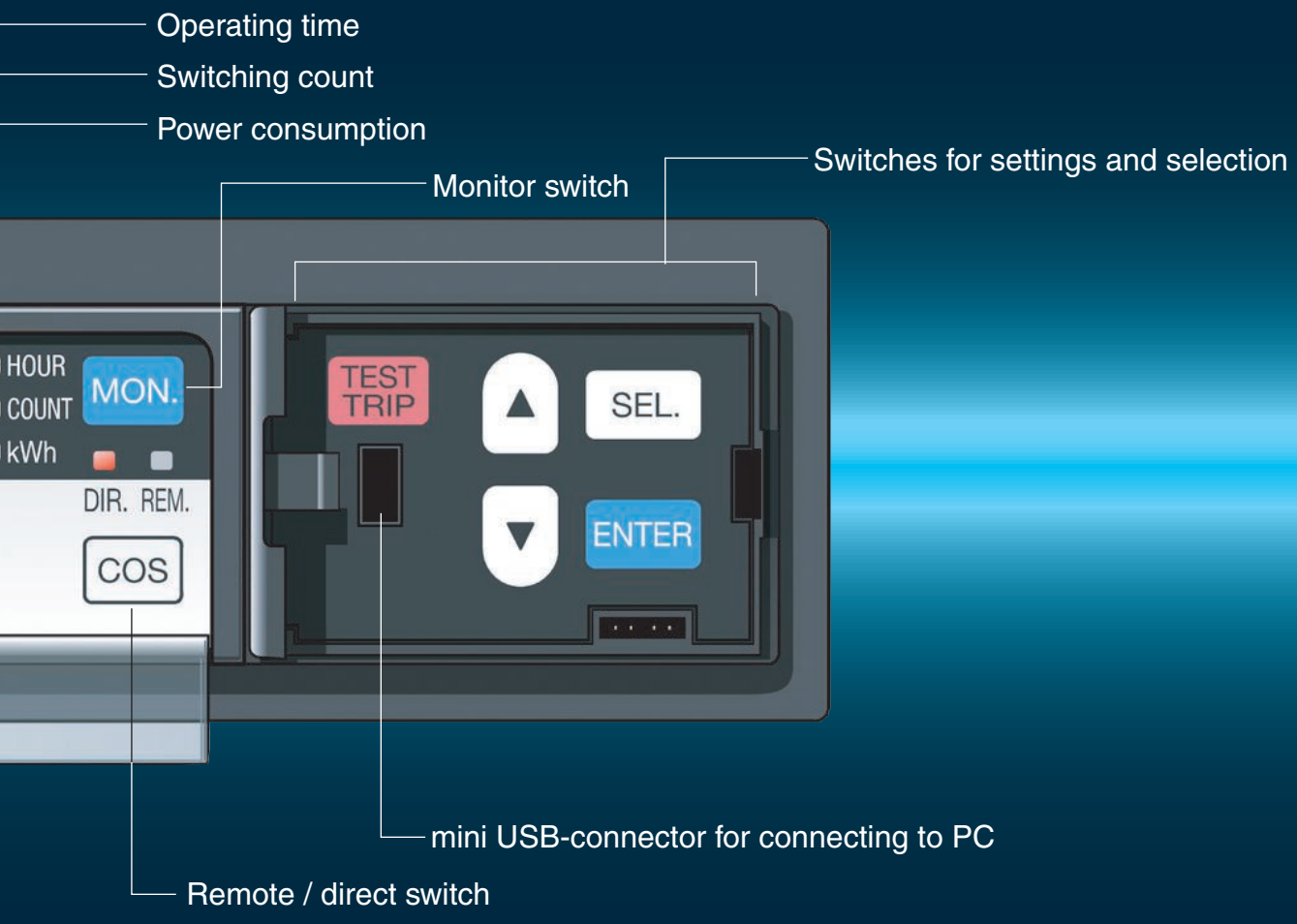

## In addition to power and power consumption, power factor is also measured.

It is possible to measure power, power consumption and power factor. These measurements serve for energy-saving.

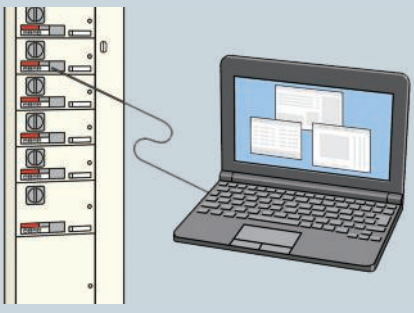
*Pulse output (insulated) for power consumption can be output as standard.

## Improvement of electrical contact reliability

Switch contacts and connector contacts on the circuit board are gold-plated and thus improve electrical contact reliability.



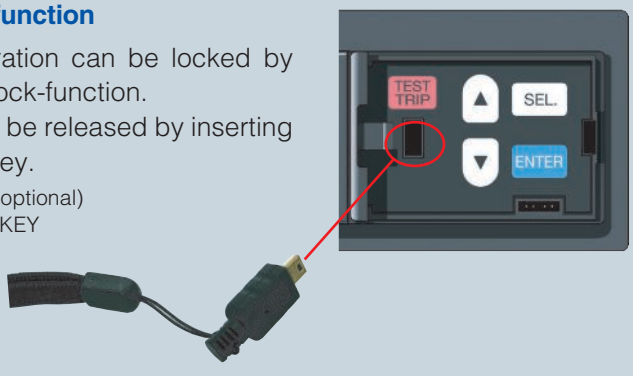

## The unit can be connected to a PC using a commercially available USB-cable.



## Security function

Switch operation can be locked by setting the lock-function.
The lock will be released by inserting the unlock key.

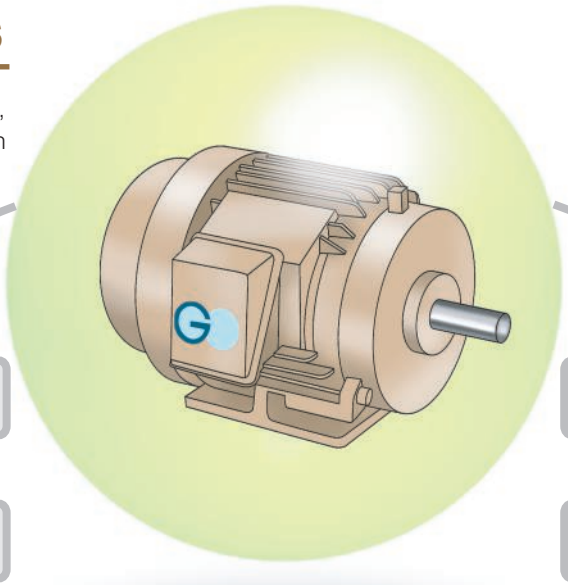
*Unlock key (optional)
Type CCR-RKEY



## Protective functions

According to the properties of the load, various protective functions can be chosen to protect the valuable equipment.

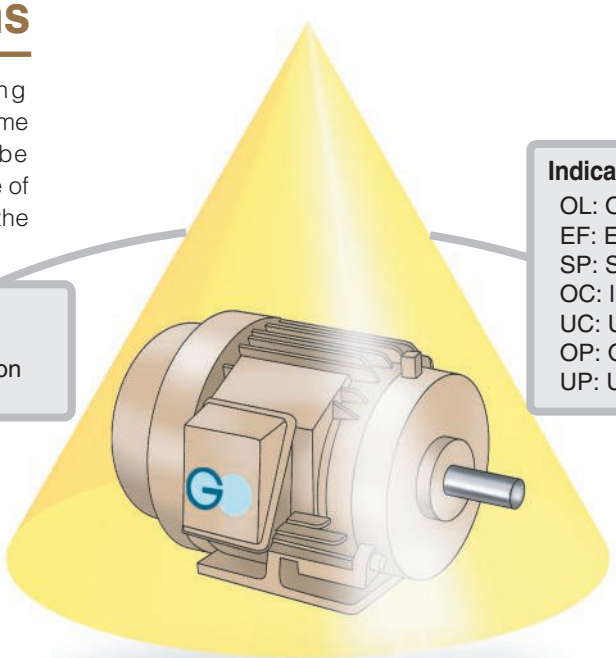
**Setting range of overload protective funcion (0.11A–630A)**



- Overload protection
- Power overload protection
- Single phase protection
- Under power protection
- Grounding fault protection
- Undercurrent protection
- Instantaneous overcurrent protection

## Monitoring functions

Thanks to the enhanced monitoring functions, energy-saving and updating time management for the equipment can be realized. Furthermore, as cause of failure of the load can be identified, functions of the equipment can recover quickly.



**Power Monitoring**
- Power
- Power consumption
- Power factor

**Indication of failure causes**
- OL: Overload
- EF: Earth fault
- SP: Single phasing
- OC: Instantaneous Overcurrent
- UC: Undercurrent
- OP: Over power
- UP: Under power

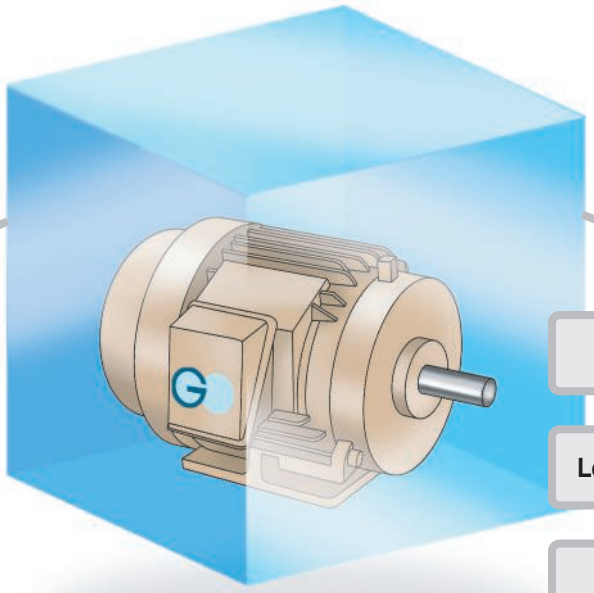
**Time Monitoring**
- Accumulated operation time
- Accumulated switching frequency (contactor switching frequency)
- Starting time
- Time elapsed since the occurrence of a failure

**Contactor Monitoring**
- Contactor malfunction
- Chattering

**Current Monitoring**
- Operating current
- Leak Current
- Fault Current (The past 8 fault currents)

# Control functions

According to the usage, various control systems can be selected.



- Input operation condition selection
- Starting method
- Operation
  Stop
  Reset after failure
- Output condition selection
- Load applied selection
- Remote and direct switching selection
- **Instantaneous stop and restart selection**
  Instantaneous compensation time:
  None, 0.5, 1, 2, 3, 4, 5, 10, 15–60sec (unit: 5sec)
  Instantaneous compensation time for immediate restart:
  0.1sec (standard)
  0.2sec (optional)
  Restarting delay time:
  1–180sec (unit: 1sec)


# Transmitting functions (optional)

By using transmission equipment, wiring can be reduced.

- High speed multi-station transmission equipment
  - ***TOSLINE-F10M***
- Open field network
  - CC-Link
  - PROFIBUS®

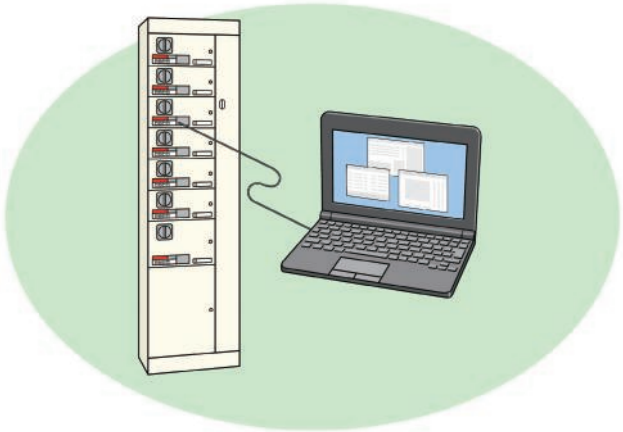
## Motor multi-relay setting tool for function and failure analysis (optional)

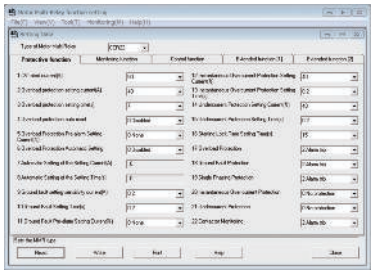
The motor multi-relay CCR22 can be connected to a PC using the commercially available USB-cable (Type A – mini B).
Setting data values, current/voltage waveform, protection coordination can be displayed on the PC's screen.

Other features:

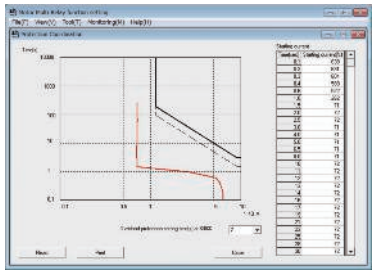
Fault and Leakage current values
-Past 8 times (in % of the load current).
-Past 20 seconds before failure to 5 seconds after failure.

Data can be saved either in TXT or CSV format.

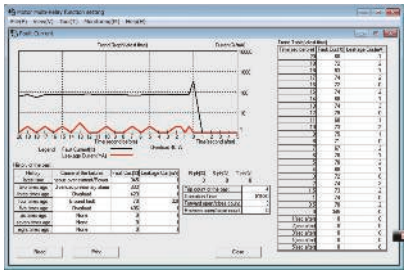




Motor multi-relay-setting



Protection coordination screen



Fault current

## Output Function

0–1mA (not-insulated) or 4–20mA (not insulated) output for the control panel on site is provided as standard. 4–20mA (insulated) output can be provided by an optional circuit board.

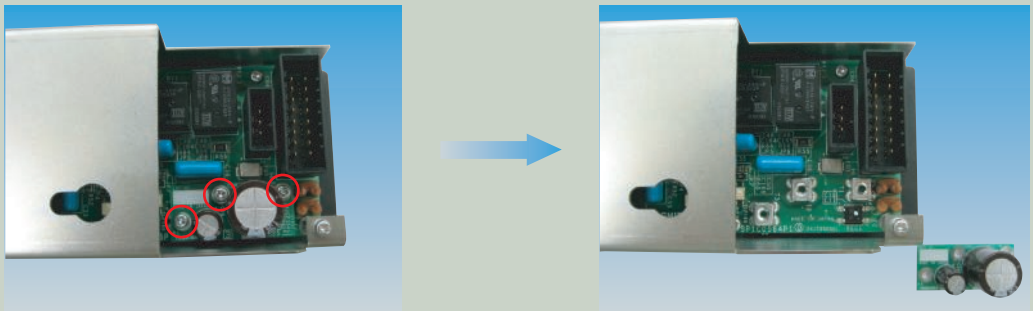
*It is not possible to use the 4-20mA output and the transmission function simultaneously.

It is possible to output pulse of power cosumption (insulated) as standard. (1 pulse is output for 10Wh, 100Wh and 1kWh.)

*Support for windows 7.


## Maintenance

Since the electrolytic capacitor has a relatively short life among the other electronic components, the motor multi-relay CCR22 has a circuit board structure in which the electrolytic capacitors can be changed easily. When changing a capacitor, it can be detached easily by removing 3 screws combining the main circuit board of CCR22 and the capacitor circuit board.



## ■ Restarting after voltage dip function

In the event of an instantaneous voltage dip, if the contactor was operating before the instantaneous voltage dip, the contactor will be switched on as soon as the voltage recovers, or after a certain time period has elapsed, and the motor will be restarted.

In the CCR22, 3 setting modes are provided to match the action during the instantaneous voltage dip and after recovery of voltage.

### ■ Setting instantaneous compensation time 0.5, 1, 2, 3, 4, 5, 10, 15–60 sec (unit: 5 sec)

- When an instantaneous voltage dip occurs and the voltage does not recover within a preset time period, the motor is stopped.
- When an instantaneous voltage dip occurs and the voltage recovers within a preset time period, the motor continues to operate.

### ■ Setting restarting delay time 1–180 sec (unit: 1 sec)

- When an instantaneous voltage dip occurs and the voltage recovers within a preset time period, motors restart according to the preset order (When an instantaneous voltage dip is detected the motor will stop).

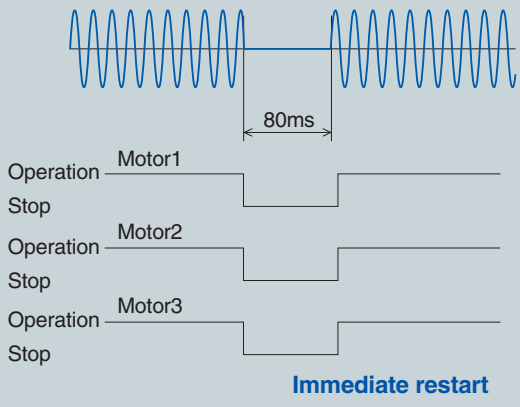
### ■ Setting instantaneous compensation time for immediate restart 0.1 sec (optionally 0.2 sec)

**In case the instantaneous compensation time as well as the restarting delay time are set**

- In the event of an instantaneous voltage dip, in case the voltage recovers within the preset time period (0.1sec), motors will continue to operate because the in-rush current is small.
- In the event of an instantaneous voltage dip, in case the voltage does not recover within the preset time period (0.1sec), but it recovers within the instantaneous compensation time, motors will restart. However, if a number of motors would start simultaneously, the in-rush current would become very large. For this reason, the motors will restart in the order that was set when setting the restarting delay time.

### Instantaneous compensation time for immediate restart

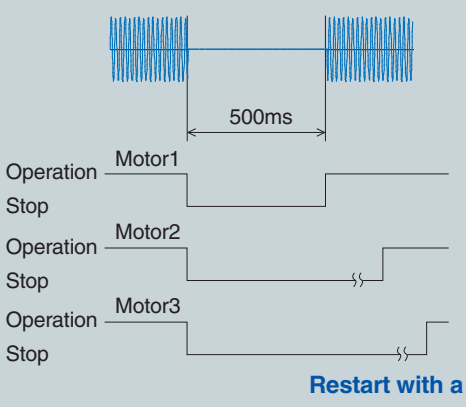
Duration of power failure<100ms




Immediate restart

Motors are restarted immediately because the in-rush current is small.

Duration of power failure >100ms



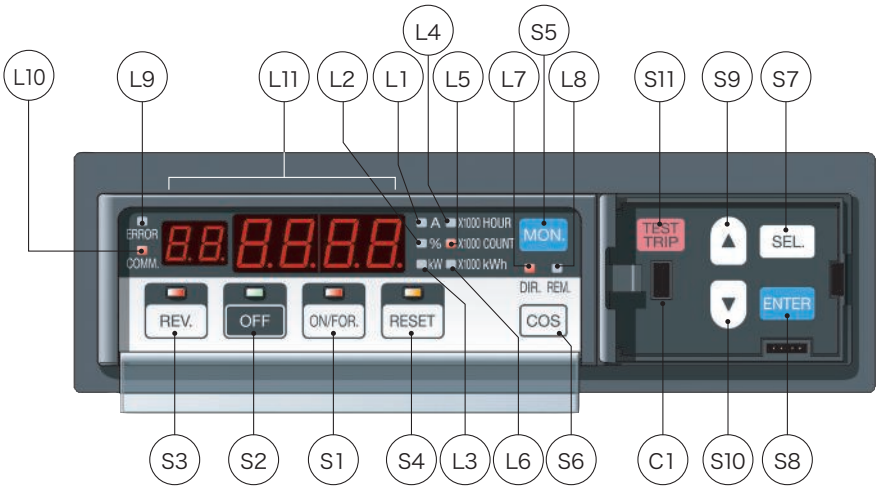

Restart with a time delay

If the motors would restart immediately, the in-rush current would become very large. For this reason, motors restart successively.

# Specifications of CCR22

CCR22 consists of circuit boards (incorporated into the operation panel) and a case. Dependent on the used load and the purpose of control, main circuit board, expansion circuit board and transmission circuit board are combined.

Front panel




| Kind | No. | Name | Function |
|---|---|---|---|
| Switches and indicators | S1 | ON/FOR. | To start the motor (in the forward direction). Lit in red while the motor is running. |
| | S2 | OFF | To stop the motor. Lit in green when motor is idle. |
| | S3 | REV. | To start the motor (in the reverse direction). Lit in red while the motor is running. |
| | S4 | RESET | To reset the protective function. Lit in orange during failure (while the protective function is operating). |
| Switches | S5 | MON. | To select the display on the monitor. |
| | S6 | COS | To select the operating location (remote or local). |
| | S7 | SEL. | Selects a fault display and a function setting display and to change setting. |
| | S8 | ENTER | To enter setting values. |
| | S9 | △ | To select functions and to change values (increasing the values) |
| | S10 | ▽ | To select functions and to change values (reducing the values) |
| | S11 | TEST TRIP | To cause a test trip during test |
| LED | L1 | A | For digital display of current |
| | L2 | % | For % display of current |
| | L3 | kW | For indication of electric power *1, *2 |
| | L4 | x1000 HOUR | For displaying hours (In the case of 1 hour, the display is 0.001.) |
| | L5 | x1000 COUNT | For displaying the count (In the case of 1 time, the display is 0.001.) |
| | L6 | x1000 kWh | For indication of wattage per hour *1, *2 |
| | L7 | DIR. | This indicates the location of the operation and is lit when the local operation can be made. |
| | L8 | REM. | This indicates the location of the operation and is lit when the remote operation can be made. |
| | L9 | ERROR | This is lit when the CPU fails. |
| | L10 | COMM. | This is lit when transmission is normal. |
| | L11 | Digital indicator | This digitally indicates a current value and a setting value. |
| Connector | C1 | Communication connector | Connectors for function setting and for reading of maintenance data (For PC connection) |

*1 Power indication is only possible when the type of the connected current sensor is CV3-□□□.
*2 Electric power and wattage per hour at the secondary side of the inverter cannot be measured.

## Type (CCR22)

CCR22– * * * * * * *

| | | |
|---|---|---|
| 1st digit | Control voltage | 0:100Vac/110Vac without expansion board<br>1:100Vac/110Vac with expansion board<br>2:200Vac/220Vac without expansion board<br>3:200Vac/220Vac with expansion board |
| 2nd digit | Optional board | 0: None<br>1: TL-F10M(T-US005)<br>2: CC-Link(C-US002)<br>3: Transducer (CCR22-AN)<br>6: PROFIBUS-DP (P-US000) |
| 3rd digit | Case | 0: Standard<br>1: Old type, MMR compatible |
| 4th digit | CV·ZCT | 0:CV3 (standard)ZCT Hikari Trading (standard)<br>1:CV3 (standard)ZCT Seiko Electric<br>2 CV2 ZCT Hikari Trading (standard)<br>3 CV2 ZCT Seiko Electric |
| 5th digit | Optional function | 0: None<br>1: Voltage dip compensation time 0.2sec. compensation (optional) |
| 6th digit | User sequence | 0: Standard<br>1: Variable sequence used |
| 7th digit | For future use | 0: Standard |

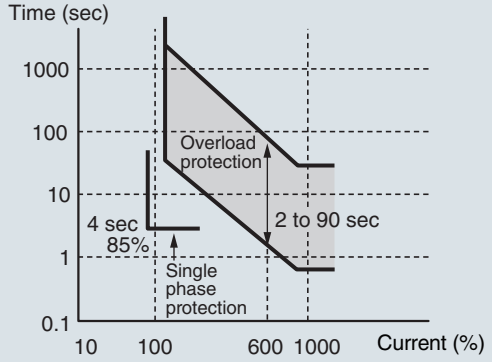
## General Specifications

| | |
|---|---|
| Power supply voltage: | 20 Vac: 50/60 Hz |
| Allowable voltage variation: | 85 to 110% |
| Operating voltage: | 100/110Vac 50/60Hz<br>200/220Vac 50/60Hz |
| Noise resistance: | 2000 V for 1μs (by noise simulator) |
| Service temperature: | –10 to +60 ℃ |
| Storage temperature: | –20 to +60 ℃ |
| Service humidity: | 10 to 85% RH (no dew condensation can result) |
| Atmosphere: | There should be no dust nor corrosive gas. |
| Insulation resistance: | 100M Ω (500V megger) (between terminals tied together and ground) |

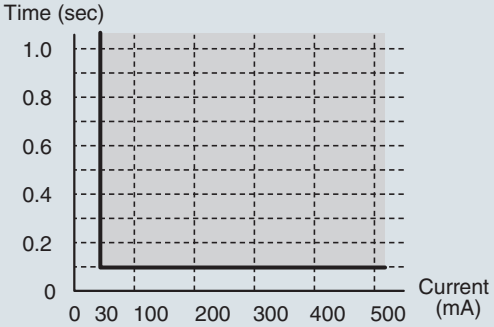
# Functions of CCR22

| | Items | | Description |
|---|---|---|---|
| Protective functions | Protection against overload | Setting current | 35 to 105% (unit: 1%) |
| | | Minimum operating value | 115% of the set-up current |
| | | Converter's (CV) rated current | 0.11 to 630 A |
| | | Pre-alarm operating current | None, 50 to 100% (unit: 1%) of the set-up current |
| | | Operating time characteristics | 2 to 90 sec (unit: 1 sec) |
| | | Thermal storage characteristics | With hot characteristics |
| | | Reset | Auto and Manual |
| | Single phase protection | Single phase operation imbalance percentage | None, 30%, 60% |
| | Grounding protection | Sensitivity current | None, 30, 100 to 500 mA |
| | | Operating time | 0.1 to 1 sec (unit: 0.1 sec) |
| | | Pre-alarm operating current | None, 30 to 95% of the sensitivity current (unit: 1%) |
| | Instantaneous overcurrent protection | Operating current | None, 40 to 600% of the set-up current (unit: 5%) |
| | | Operating time | 0.1 to 9 sec (unit: 0.1 sec) |
| | | Starting operation lock time | 1 to 180 sec (unit: 1 sec) |
| | Undercurrent protection | Operating current | None, 15 to 100% of the set-up current (unit: 1%) |
| | | Operating time | 0.2 to 9 sec (unit: 0.1 sec) |
| | Power overload protection | Set-up power | 1 to 200 kW |
| | | Operating time | 0.1 to 10 sec |
| | Under power protection | Set-up power | 1 to 200 kW |
| | | Operating time | 0.2 to 10 sec |
| Monitoring functions | Operating current monitoring | | Digital (A) or percentage (%) switchable |
| | Leakage current monitoring | | Digital (A) |
| | Power monitoring | | Indicated in kW |
| | Power consumption monitoring | | Indicated in kWh |
| | Power factor monitoring | | Percentage (%) |
| | Control voltage monitoring(insufficient voltage) | | 80% or less of the relay rated voltage |
| | Contactor monitoring | | Non-operation monitoring 1 sec after switching operation |
| | Chattering monitoring | | Switching (twice or more) within 0.15 sec monitoring |
| | Accumulated operation time monitoring | | Operation time accumulation monitoring |
| | Accumulated switching count monitoring | | Accumulated switching count of the contactor |
| | Failure factor indication | | Overload, overload pre-alarm, grounding, pre-alarm for grounding, single phasing, instantaneous overcurrent, undercurrent, power overload, under power, starting jam, contactor trouble, and contactor chattering |
| | Starting time | | Time from the start of the operation until the current becomes 110% or less |
| | Elapsed time indication | | Indication of time elapsed following the trip |
| | Faulty current indication | | Past 8 faulty current values (in % of the load current), leakage current values, and current values of the R, S, and T phases (in A) |
| Control functions | Input operation condition selection | | Conditions can be selected from 15 types of functions via the universal input terminals. |
| | Output condition selection | | Output conditions can be selected from 35 types via 2 standard relays and 3 optional relays. |
| | Starting method | | Non-reversible, reversible, 人-△, closed 人-△, pole change, reactor, Korndorfer, inverter non-reversible, inverter reversible |
| | Load applied | | Single-phase load, three-phase load |
| | Operation stop | | Operation, Stop, and Trouble Reset by illuminated (LED) push-button switch |
| | Remote and direct switching selection | | With Remote (REM) or Direct (DIR) switching. 5 types of circuit conditions can be selected. |
| | Restarting after voltage dip | Instantaneous compensation time | None, 0.5, 1, 2, 3, 4, 5 sec, 10 to 60 sec (unit: 5 sec.) |
| | | Instantaneous compensation time for immediate restart | 0.1, 0.2 sec (optional) |
| | | Restarting delay time | 1 to 180 sec (unit: 1 sec) |
| | Operation in stop | | Stop or continue operation is selected in the case of CPU problem. |
| Other | Transducer output | | 0 to 1 mA (not insulated) or 4 to 20 mA (not insulated) |
| | Test trip | | For problem simulation at a sequence test |
| | Interface | | USB |

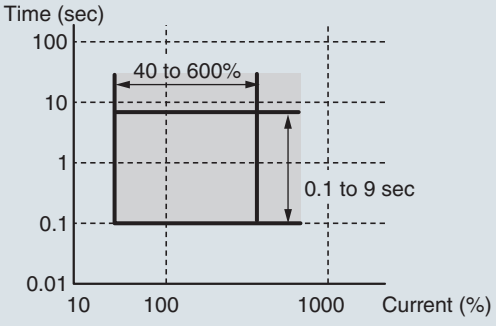
## Overload Protection Characteristics and Single Phase Protection Characteristics



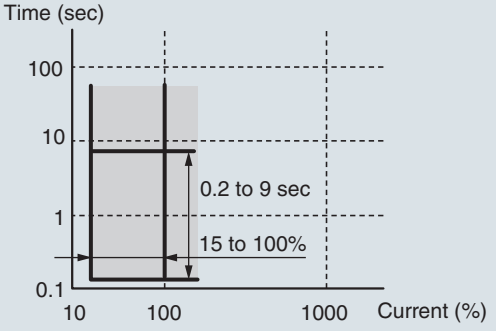

## Grounding Protection Characteristics




## Instantaneous Overcurrent Protection Characteristics



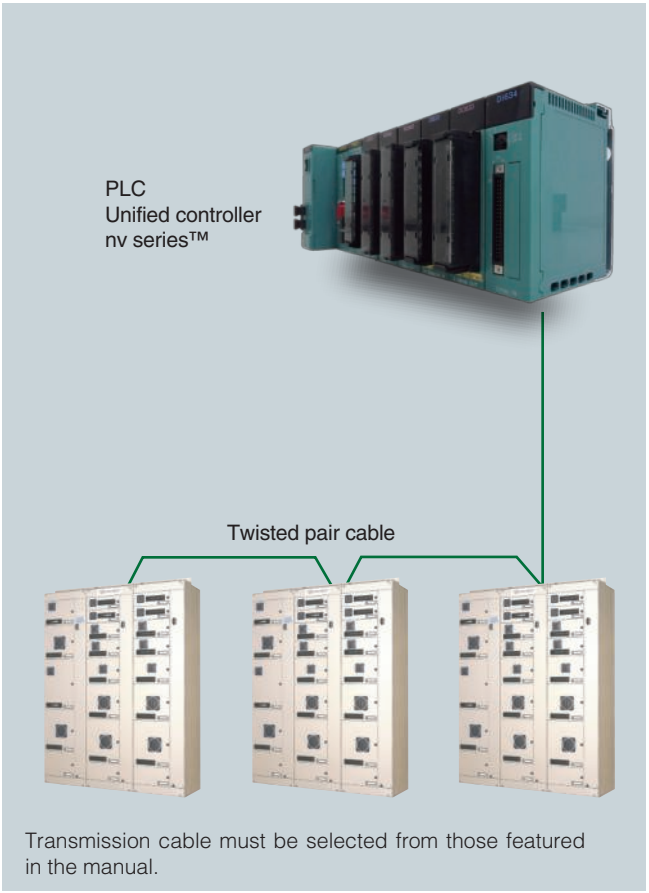

## Undercurrent Protection Characteristics



# High speed, multi-station transmission equipment TOSLINE-F10M

**High speed, multi-station transmission equipment (TOSLINE-F10M) is used for the motor control center for more efficient operation of plant and reduction of total equipment costs.**
**It can be supplied to M series as an option.**

- The TOSLINE-F10M is high speed (750 kbps), multi-station transmission equipment with multi-drop configuration using twisted pair. Relay control is performed by cyclic scan transmission and maintenance support system is realized by message transmission.
- Up to 128 stations (2 words per station) can be connected to a main station, with execution speed 100m/sec or less. The main station can be expanded to 4 main stations and thus up to 512 stations can be connected.
- Transmission distance is 500m between stations and a repeater (RP) is installed every 32 stations. Total extension can be 2 km.
- When distance between stations exceeds 500 m, electro-opto converter (EO) is used for opto-transmission for up to 1 km.
- A unit station can be put in the moter multi-relay, therefore installation space is not necessary.
- For redundancy of transmission route, the main station can be duplexed and transmission route can also be duplexed.




Transmission cable must be selected from those featured in the manual.

### General specifications

| Specification | Description |
|---|---|
| Transmission cable | Twisted paircable (special cable) |
| Communication distance | 2 km at maximum |
| Transmission speed | 750kbps |
| Scan time | 100ms |
| Number of units connected | 128/main station |
| Transmission functions | Cyclic scan transmission, Message transmission |
| Check method | CRC check |
| Insulation method | Photo coupler |

### Example of transmit data set up

| | Sending data of PLC (PLC to motor control center) | Receiving data of PLC (Motor control center to PLC) |
|---|---|---|
| Scan transmission | Forward operation command<br>Stop command<br>Reverse operation command<br>Alarm reset | Forward operation status<br>Reverse operation status<br>General purpose relay output status<br>Input status of general input<br>Forward interlock input status<br>Reverse interlock input status<br>Operating current |
| Message transmission | ——— | Operation time<br>ON/OFF count<br>Trip count<br>Cause of problem in the past<br>Load current in problem<br>Power, power consumption |

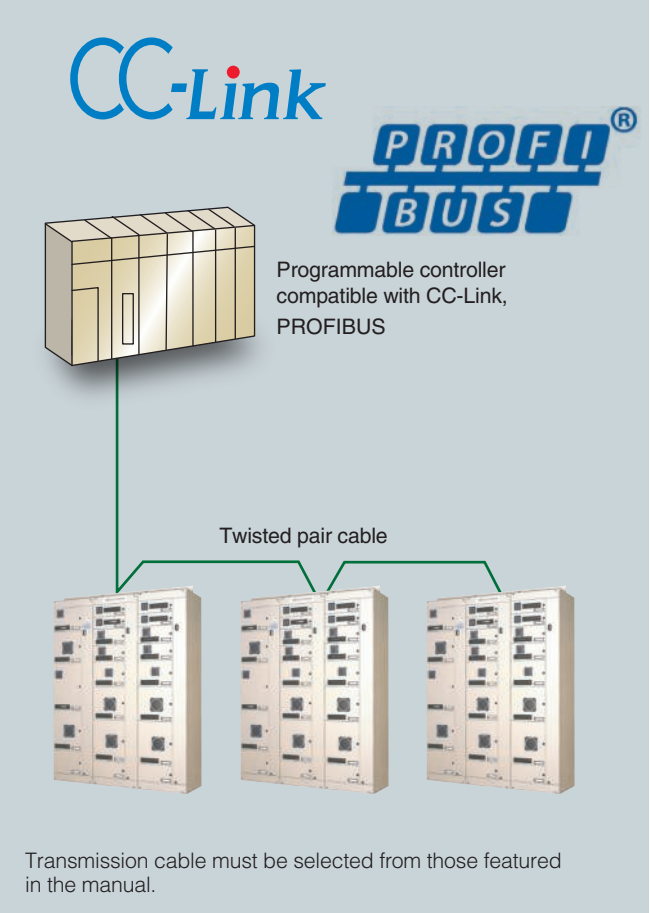
Note: The general purpose relay can, with no restriction, set up the causes of problem such as overload plus single phasing, grounding, pre-alarm, etc.

# Open field network

## An open field network — CC-Link and PROFIBUS — is used to meet different needs.

***Supplied for M series (optional).**

- Can be connected to many items of field equipment compatible with CC-Link and PROFIBUS thanks to open transmission equipment.
- Full fledged and highly reliable functions
  -A standby master is set up. Therefore, data link is active if an error has occurred in the master station.
  -When an error has occurred in a slave station while data link is being activated and it is made inactive, the slave station is disconnected and data link is activated between normal stations only.
- Thanks to PROFIBUS whose specification has been made public throughout the world, our motor control centers can be connected to any PLC(programmable controllers) of other manufacturers even if the superordinate system is of another manufacturer.
- Data transmission is performed by high speed transmission (CC-Link:625 kbps, PROFIBUS:500 kbps).
- Transmission cable is a special cable and transmission distance is up to 900m for CC-Link, and up to 4km (include 9 repeaters) for PROFIBUS.
- The number of unit stations connected can be, in the case of CC-Link, up to 42 for a master station when one station is occupied, and, in the case of PROFIBUS, up to 122 for a master station.




Transmission cable must be selected from those featured in the manual.

## ■ CC-Link

### General specifications

| Specification | Description |
|---|---|
| Transmission cable | Twisted pair cable (special cable) |
| Communication distance | 900m at maximum |
| Transmission speed | 625kbps |
| Scan time | 85ms (one station occupied, 42units) |
| Number of units connected | 42/master station |
| Communication method | Polling |
| Check method | CRC check |
| Insulation method | Photo coupler |

### Example of transmit data set up

| | Sending data of PLC (PLC to motor control center) | Receiving data of PLC (Motor control center to PLC) |
|---|---|---|
| Bit information | Forward operation command<br>Stop command<br>Reverse operation command<br>Alarm reset | Forward operation status<br>Reverse operation status<br>General purpose relay output status<br>Input status of general input<br>Forward interlock input status<br>Reverse interlock input status |
| Word information | ——— | Operating current<br>Leak current<br>Power |

## ■ PROFIBUS

### General specifications

| Specification | Description |
|---|---|
| Transmission cable | Twisted pair cable (special cable) |
| Communication distance | 4km at maximum (include 9 repeaters) |
| Transmission speed | 500kbps |
| Number of units connected | 122/master station |
| Communication method | Polling |
| Insulation method | Photo coupler(insulation inside of the unit) |
| External power source | Network power source |

### Example of transmit data set up

| Sending data of PLC (PLC to motor control center) | Receiving data of PLC (Motor control center to PLC) |
|---|---|
| Forward operation command<br>Stop command<br>Reverse operation command<br>Alarm reset | Forward operation status<br>Reverse operation status<br>General purpose relay output status<br>Input status of general input<br>Forward interlock input status<br>Reverse interlock input status<br>Operating current<br>Leak current<br>Power |

# Features of the Type TE Motor Control Center

## Wide variation allowing choice of functions, installation conditions

| Series | Breaking capacity at 480V | Installation condition | Height | Width | Depth |
|---|---|---|---|---|---|
| M series with motor multi relay | 30kA | Basic type | 2300 | 600 | 550 |
| G series with thermal relay | 50kA | Wide type | 2300 | 700 | 550 |
| | 70kA | Thin type | 2300 | 600 | 350 |
| | | Low type | 1900 | 600 | 550 |

In addition, the following panels can be supplied.
D series DC motor control center for emergency use.
B series power distribution panel for lighting and miscellaneous power circuits.


### ■Space saving by piling-up

- Space-saving can be realized thanks to the possibility of piling up maximum 10 units.
  Smallest unit: 2 size unit (to 37kW/400V)

- Reduction of the number of cabinets thanks to expansion of unit accommodation space
  Accommodation space: 2100mm

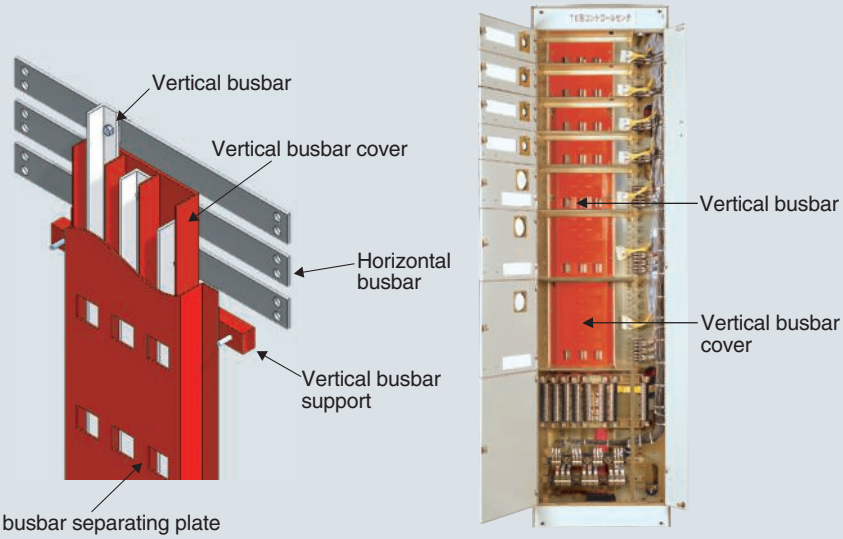
## Design pursuing reliability, safety and easy operability

### ■Construction that can avoid insulation deterioration, Construction that prevents spread of accidents

- Since the vertical busbar supports are placed outside of the vertical busbar covers, accumulation of dust particles in the spaces between phases and on the grounded side can be avoided. Insulation of the busbars will not be deteriorated for a longer period of time and maintenance of the construction is easy.
- Three phases of the vertical busbar are separated by barriers and a separating plate so that short-circuit between the phases can be avoided. Even if a short-circuit occurs elsewhere, no short-circuit will occur between the phases of the vertical busbars.

Vertical busbar construction viewed from above

Entirely insulated vertical busbar equipment



## ■Special of Toshiba MCC which uses current-limiting wires

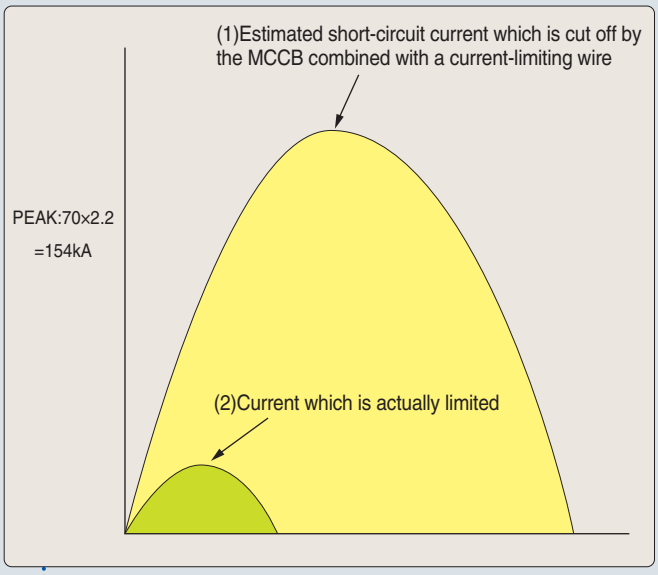
Fault current is limited by means of current-limiting wires so that the MCCB with a cut-off capacity of 7500A(440V) can be used as if it were an MCCB with a cut-off capacity of 70kA. (Breaking duty: Once)

*Space requirement will not increase by incorporating a current-limiting wire.

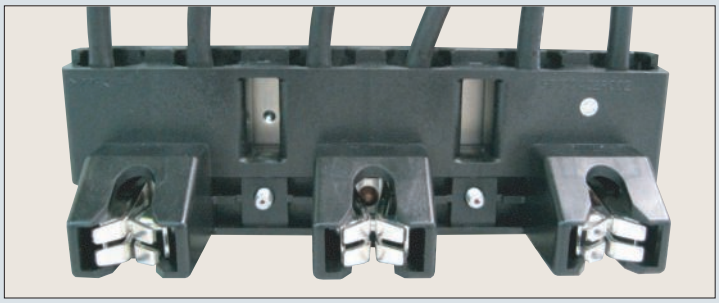
**Example of Application**

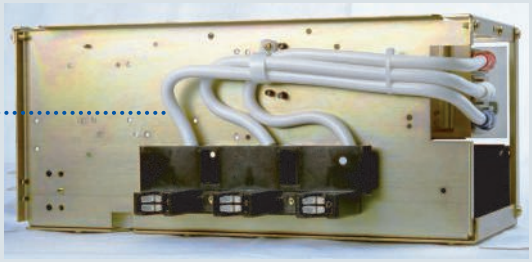
In the diagram on the right, (1) is short-circuit current. When the circuit breaker of 50AF (switch-off capacity 7500A) is combined with current-limiting wires, the current can be cut off like (2) because the current-limiting wires limit current to the cut-off range of the circuit breaker of 50AF.

Thus, the electromagnetic force acting on the equipment and the heat shock can be reduced, and at the same time, occurrence of arc at cutting off can be minimized so that overvoltage can be prohibited.




## ■Disconnector equipped with W-M grips





Rear View of Unit

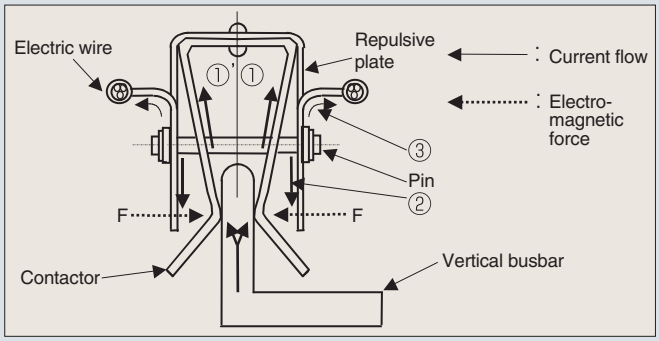
## ■Principle concerning large current

The disconnector for the main circuit of the type TE motor control center consists of a spring contactor and a repulsive conducting plate. Fault current flows through the route ①,② and ③ indicated by arrows.

Mechanism:

- The spring force of the contactor itself will keep the contactor tight together.
- The electromagnetic force “F” arising at ① - ①’ increases the contact pressure of the contactor.
- The electromagnetic repulsion arising at ① - ② will be counteracted by means of a pin, thus maintaining contact pressure of the contactor.

This way, the contact of the vertical busbar and the disconnector will not easily be separated.



# Construction of vertical busbar

- The vertical busbar is front side, back side independent type compatible with the unit.
- The vertical box is manufactured by high strength molding technology with at least 1.6t steel plate in compliance with UL845. It must be chosen from protective structure by JIS C 0920.

## Protective structure

| | |
|---|---|
| General | IP20, IP40 |
| Water protection | IPX1 |
| Outdoor type | IP33W(walk-in, non-walk-in) |

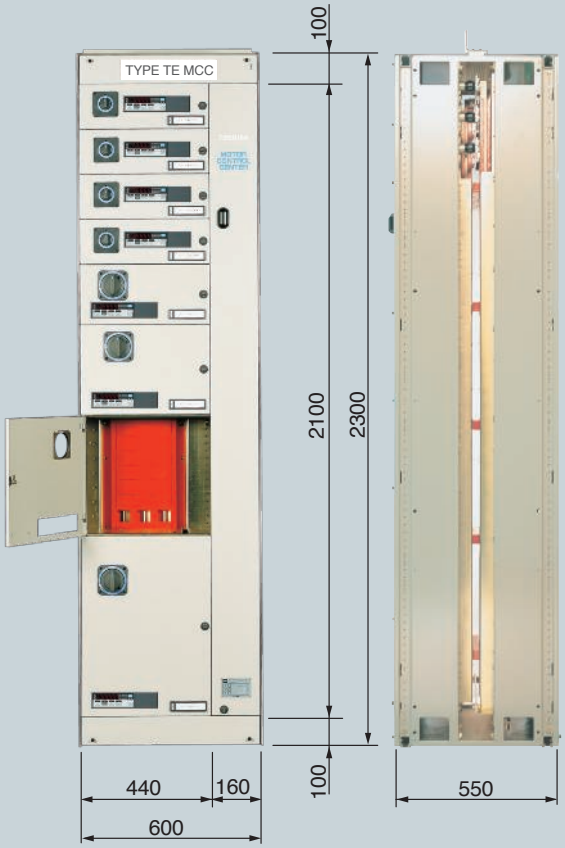
- In addition to the basic cabinet style, the following cabinets can be supplied at customer request.

## Other cabinet styles

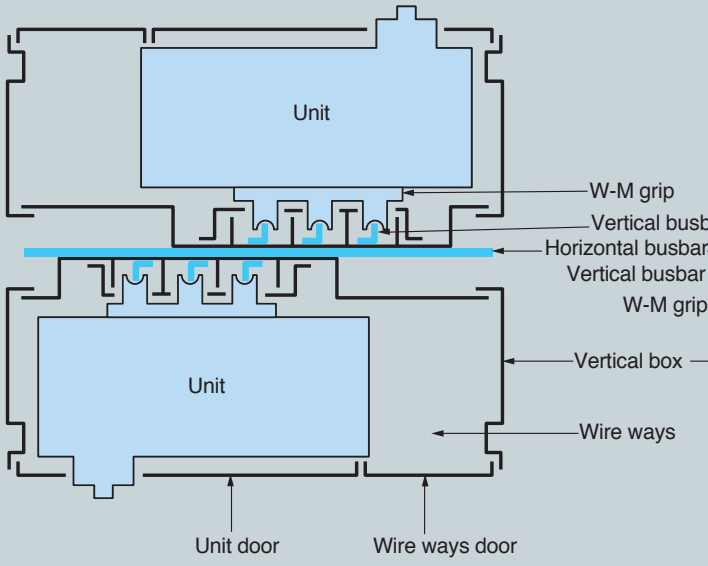
| | |
|---|---|
| Wide type | 70mm wide cabinet with 260mm wire ways<br>Can be used for drawing armored cables. |
| Thin type | 350mm deep cabinet (one side only) |
| Low type | 1900mm high cabinet<br>Can be used when there is a limit in height. |

- Divided into 3 portions as standard for shipment.
  See the outline drawing for the division points.

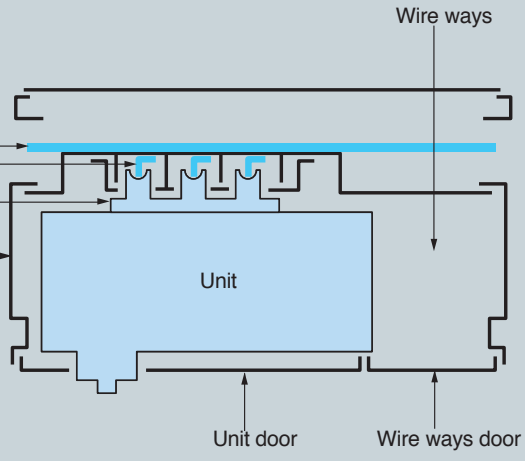
## Vertical box (basic type)




## Vertical cross-sectional view of basic type (back to back)




## Vertical cross sectional view of thin type

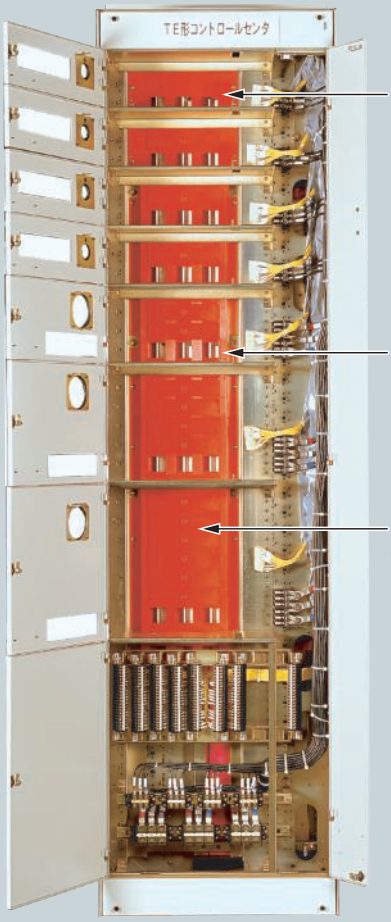



*In the case of the back to back type, vertical busbars are for R phase, S phase, and T phase from the left on the front side and back side, and the units can be mounted on the front side and back side.

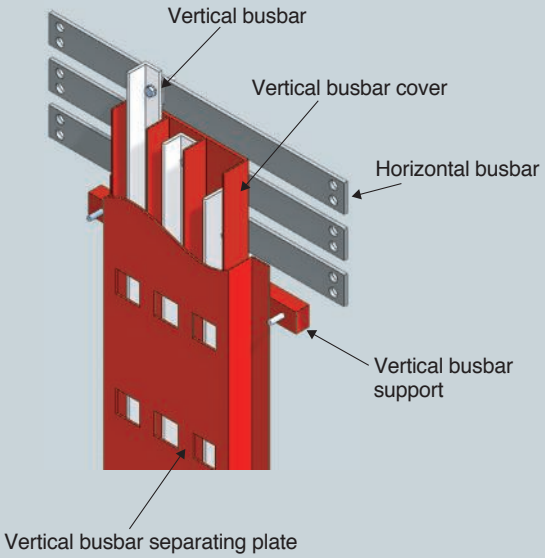
# Construction of horizontal busbar

- The horizontal busbar is longitudinally arranged on the top of cabinet on which cable can be drawn on up side and down side safely (I-line busbar).
- The vertical busbar is entirely-insulated having a barrier between phases to prevent erroneous contact and propagation of arc discharge. Two-sides type is of a busbar structure with independent front side and back side.
  3 phase, 4 wire type can also be selected.
- The size of neutral phase of 3 phase, 4-wire type horizontal busbar is one-half that of positive phase as standard.
- The horizontal and vertical busbars are made of copper.
  The horizontal busbar is tin-plated for resistance against corrosion and the vertical busbar, having a sliding portion, is silver-plated against abrasion.
- The unit opening of vertical busbar has an insulation plate for shielding. Unit mounting and dismantling can be done without exerting influence on the operations of up side unit and down side unit.
- A shutter can also be supplied as an option according to customers' specifications.
- The live part section of main circuits in the wire room is isolated to secure the safety of adjacent unit's modification and wiring works.
- The horizontal busbars are positioned in the same manner as for the existing panels of TM type. Note, however, units are not compatible.

## Vertical busbar




## Drawing of horizontal and vertical busbar connections




## Insulation plate for vertical busbar

# Construction of unit

- M series accommodating the motor multi-relay and G series having a thermal relay can be supplied. These types can be combined when necessary and can be mounted on the same vertical box.
  *See Unit Selection Table (on pages 24 and 25) for unit size.
- The unit can be placed at the following positions by the use of racking screw. For a large unit which can't be drawn out, only the circuit breaker unit can be drawn out.

| Unit position | Main circuit | Auxiliary circuit |
|---|---|---|
| Connection position | Connection | Connection |
| Test position (Disconnection position) | Disconnection | Overall test: connection |
| | | Unit test: disconnection |

*At the test position (disconnection position) the unit door is closed.

- The circuit breaker operation handle (multiple handle) has the following functions.
- Regarding unit connection, main circuit is automatic connection, and auxiliary circuit is mannual connection.

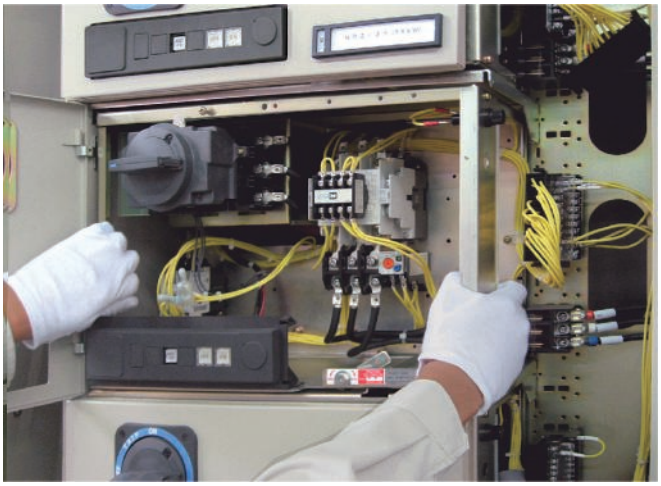
## Functions of circuit breaker operation handle (multiple handle)

| Function name | Function | Remarks |
|---|---|---|
| Door interlock | The door cannot be opened when MCCB is ON. When the door is open, MCCB cannot be ON. | Standard |
| Handle lock (ON/OFF position) | Handle operation cannot be performed when MCCB is ON or OFF. | Standard (Padlock is optional.) |
| Forced release | Even when MCCB is ON, the door can be opened (in emergencies). | Standard |
| Trip indication | When MCCB trips, the operation handle interlocks with it and trip is shown. | Standard |

### Unit (M series)

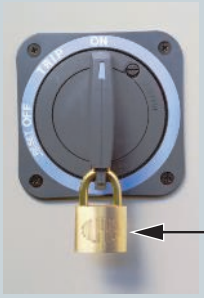
### Unit (G series)

### Unit draw out



### Forced release of door interlock


### Handle lock



# Ratings/Types

## Ratings and applicable standards

| | | |
|---|---|---|
| Applicable standards | | JEM1195 |
| Maximum rated insulation voltage | | AC600V |
| Rated operating voltages | Main circuits | AC200, 220, 400, 440V |
| | Auxiliary circuits | AC100, 110, 200, 220V |
| Rated frequency | | 50, 60Hz |
| Rated busbar current | Horizontal busbar | 800, 1200, 1600, 2000, 3150A |
| | Vertical busbar | 400, 600A |
| Rated short time withstand current | | 30, 50, 70kA-0.5sec<br>30, 50kA-1sec |
| Rated breaking capacity | | 30, 50, 70kA (at 440V) |
| Dielectric voltage at commercial frequency | Main circuits | 2200V / 1min |
| | Auxiliary circuits | 1500V / 1min |

## Types

### Bank type

**TE-50G**

- **Type**
- **Rated breaking capacity**
  - 30:30kA
  - 50:50kA
  - 70:70kA
- **Series symbol**
  - G : thermal relay incorporated
  - M: motor multi-relay incorporated

### Unit type

**NR2-20M**

- **Unit styles**

| Without ground fault protection | With ground fault protection | Applied unit |
|---|---|---|
| NR (S) | ML (S) | Non reversible |
| HR (S) | HL (S) | Non reversible (SSC) |
| RG (S) | RL (S) | Reversible (general) |
| RM (S) | KL (S) | Reversible (with mechanical) |
| VR (S) | VL (S) | Reversible (SSC) |
| PD (S) | DL (S) | Pole change (2xMC) |
| PT (S) | PL (S) | Pole change(3xMC) |
| YD (S) | YL (S) | Star delta |
| XS (S) | XL (S) | Reactor start |
| IN (S) | IL (S) | Inverter |
| NF | NL | MCCB, FU-SW feeder |
| ND | BL | 2 circuits incorporated by MCCB feeder |
| CF | CL | MCCB having MC, FU-SW feeder |
| GR | GL | Group starter |
| ST | SL | 1φTR (MCCB with FU-SW) |
| TT | TL | 3φTR (MCCB with FU-SW) |
| ES | | Empty unit |
| DS | | Space not usable for unit |
| AU | | Others |

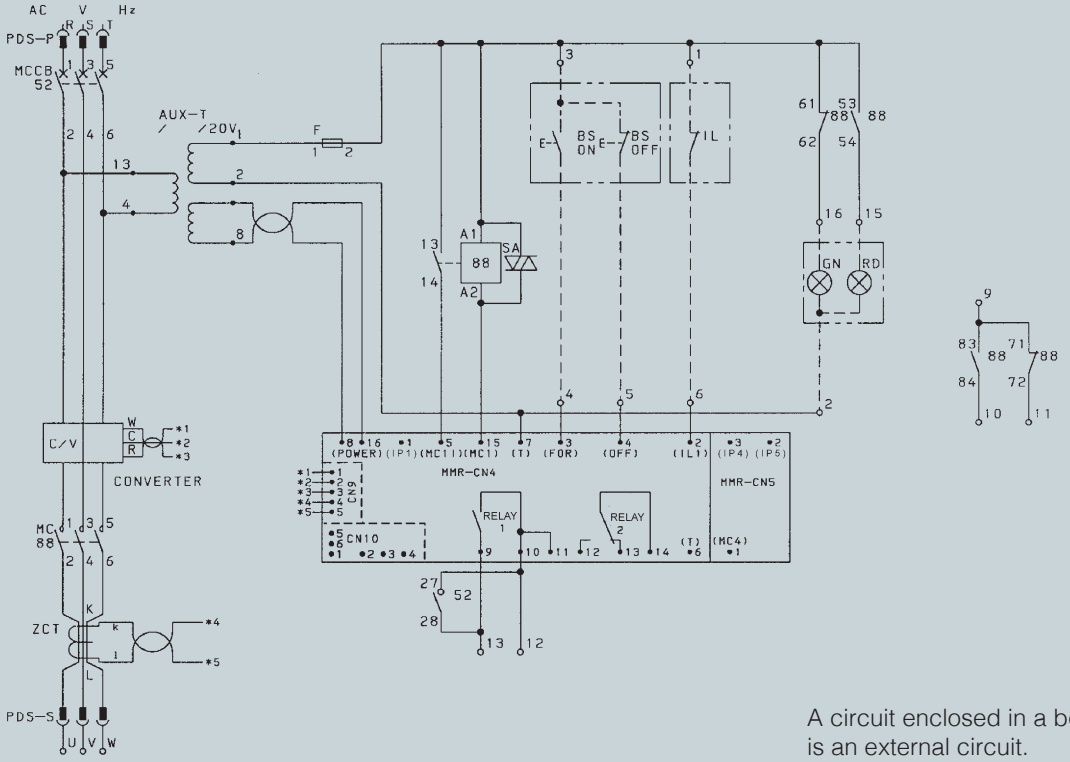
Note: "S" in parentheses is for the case in which a compact circuit breaker is used. It is described as "NRS" for example.

- **Unit heights**
  - 2 : 200mm
  - 3 : 300mm
  - ⟨
- **Unit rated current**
  - · Indicates the rated current of electromagnetic contactor for the starter unit.
  - · Indicates the frame current of circuit breaker for the feeder unit.
  - · Indicates the capacity (kVA) of inverter for the inverter unit.
- **Protection method**
  - M : motor multi-relay incorporated (M series)
  - T : motor multi-relay(with transmission equipment) incorporated (M series)
  - ⬚ : thermal relay incorporated (G series)

Note: "E" is attached to a unit for the future (wired in the cabinet).

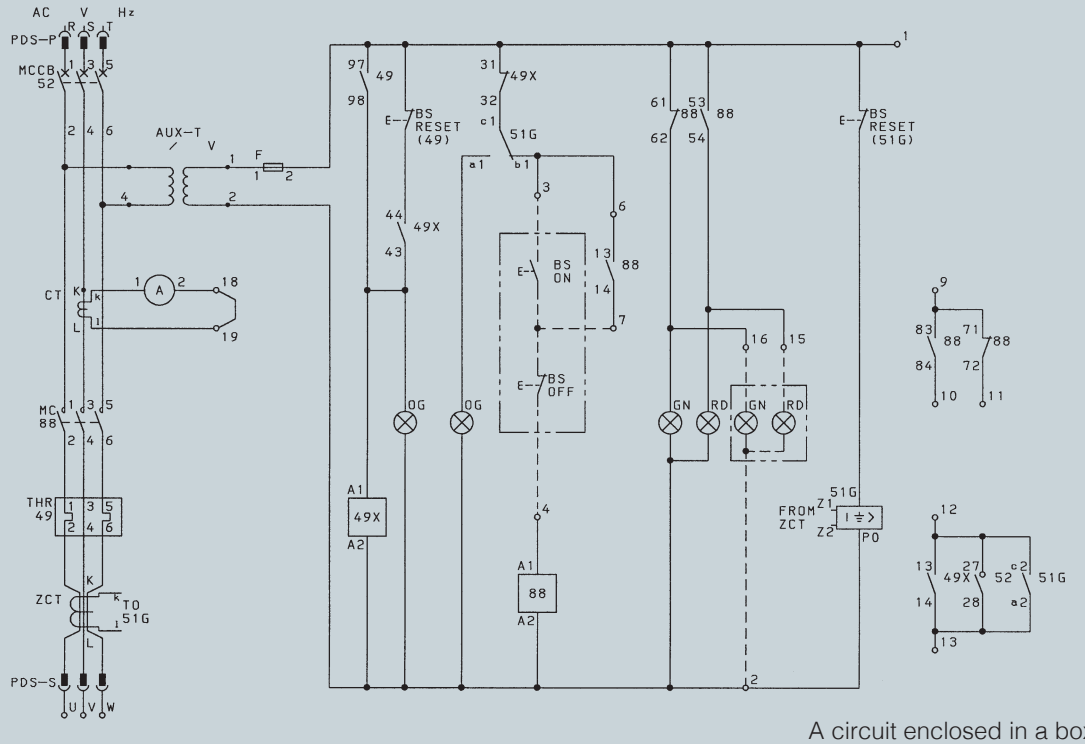
# Unit circuit diagrams

## Non reversible unit of M series (with ground fault protection)




A circuit enclosed in a box is an external circuit.

## Non reversible unit of G series (with ground fault protection)




A circuit enclosed in a box is an external circuit.

# Type TE Motor Control Center is equipped with high-performance inverter VF-AS1.

## Features

- The inverter units are piled up. Maximum number of units piled-up: 8 (two-side type, 3.7kW or less).
- The unit is drawable type (~75kW/440V, ~45kW/220V) provided with interlocks for circuit breaker operation and protection against erroneous contact with the busbars.

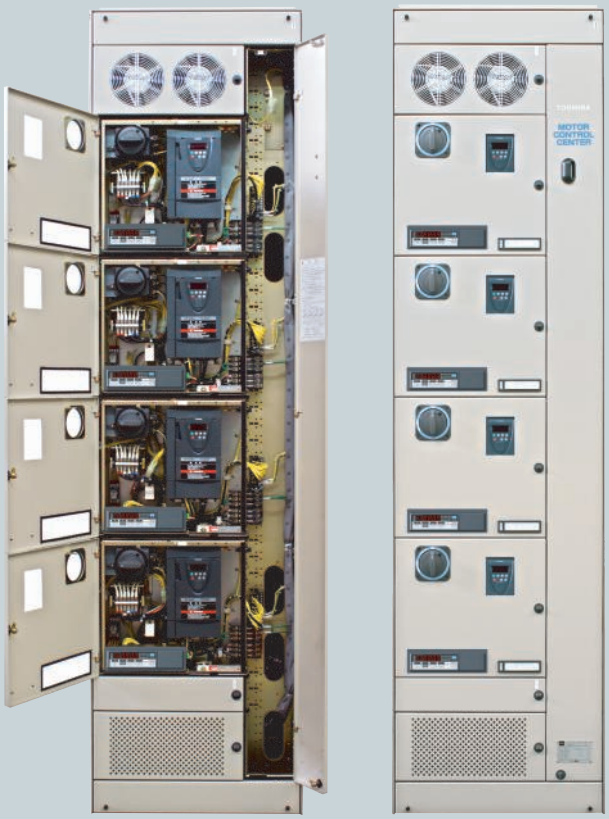
  Note) In case of larger units (11~75kW/440V, 7.5~45kW/220V) only the circuit breaker unit is drawable type.

**Features of inverter VF-AS1**

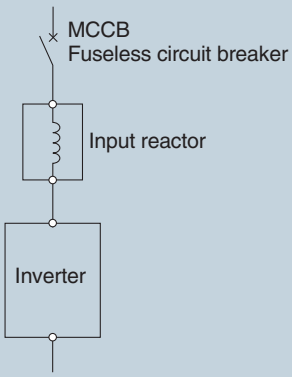
- Incorporated noise filter
  200V: 0.4-7.5kW
  400V: 0.75-75kW
- Excellent motor control performance
  Stable control for both drive and regeneration is realized.
  Setting can be easily done by auto-tuning.
- Incorporated d.c.reactor
  200V: 11-45kW
  400V: 18.5-75kW

- The inverter unit has the same size as the Type TE motor control center M- and G-series so that the cabinets can be lined up easily and a good ventilation effectiveness can be achieved.
- Networks with monitoring and controlling devices can be built up by means of the transmission devices (CC-Link, PROFIBUS).

## Inverter-incorporated motor control center



## Single-line wiring diagram

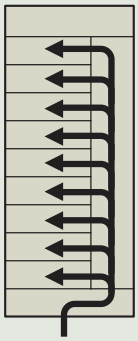
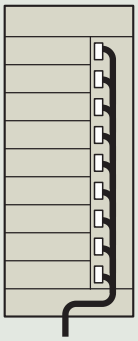
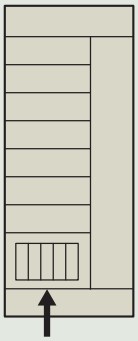



In the inverter units 18.5-75kW/440V, 11-45kW/220V, a d.c.-reactor is incorporated as standard.

# External connection method

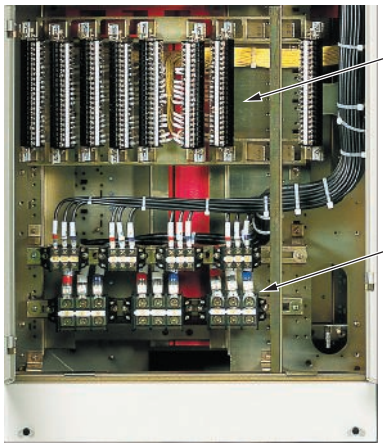
- The types of motor control center and external connection methods are specified by the standards (JEM1195) as shown in the figure. It must be specified when ordering.
- The following external connection methods are provided as maker's standard. The most suitable one can be chosen according to unit piling-up and operability.
- A screw-up terminal board is adopted for the control circuit terminal board to reduce auxiliary cable connection work. (Up to 2mm$^2$ is good for the auxiliary cable. 5.5mm$^2$ is optional.)

## External connection method

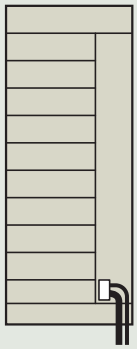
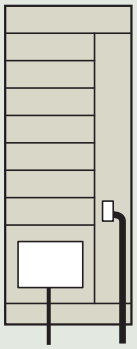
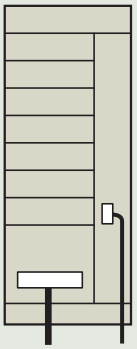
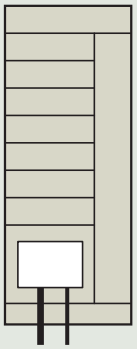
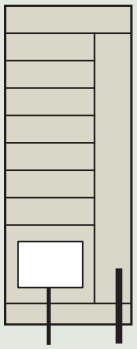
| External connection method | A | B | C |
|---|---|---|---|
| Features | No terminal board for load is provided. It is directly connected to the terminals of equipment in the unit. | Connected to the terminal board near each unit. | Overall terminal board is provided. |
| Figures |  |  |  |

## Terminal room of CC method

(Different in case of IEC standard panel.)

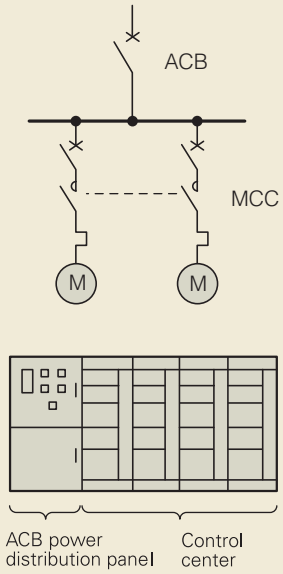
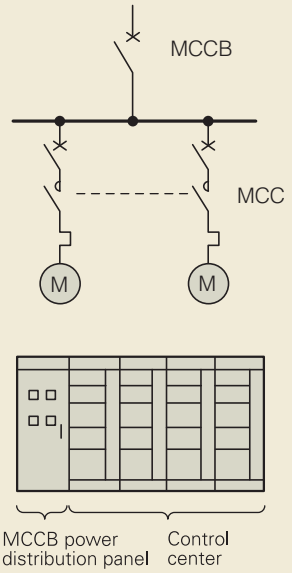
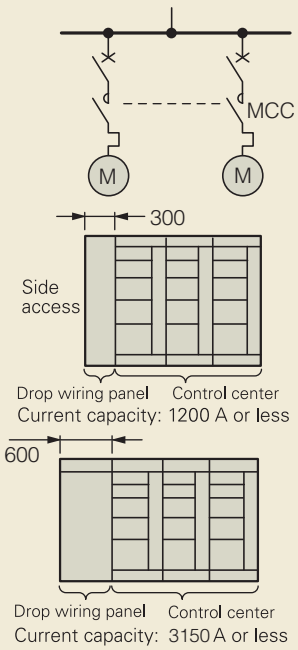
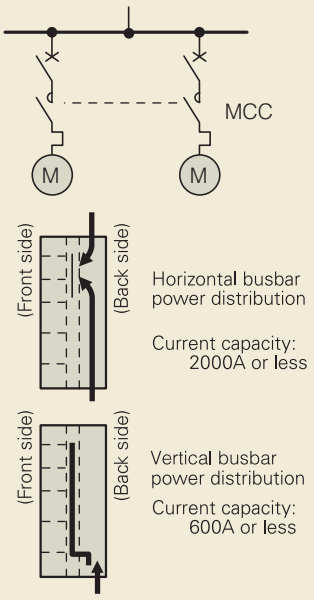



## Methods of external connection (maker's standard)

| Manufacturer code | | BB | BC | CB | CC | RC |
|---|---|---|---|---|---|---|
| JEM1195 nomenclature | Main circuit | Method B | Method B | Method C | Method C | Method C (back side) |
| | Auxiliary circuit | Method B | Method C | Method B | Method C | Method C |
| Maximum number of units piled-up | Unit height: 200mm | 10 | 7 | 7 | 7 | 7 |
| Features | | * Units can be piled-up and most economical.<br>* Good for one-side type and two-side type. | * Second only to BB method in economicalness.<br>* Applicable when there are many auxiliary cables. | * Second only to BB method in economicalness.<br>* Applicable when main circuit cables are thick. | * Applicable when method C is adopted both for main and auxiliary circuits. | * One-side type only<br>* Applicable when there are many auxiliary cables. |
| Terminal layout figures | |  |  |  |  |  |

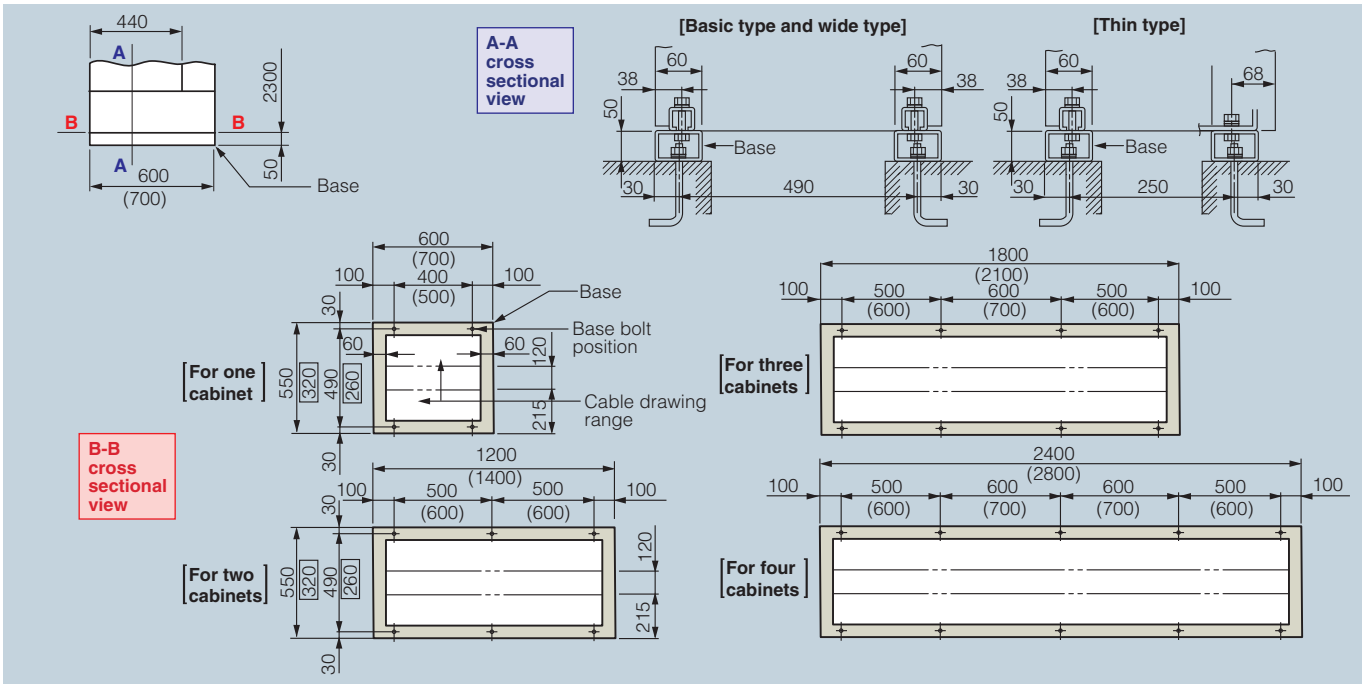
## Power distribution method

There are the following power distribution methods. The most suitable one must be selected according to the network, capacity, and installation space. Consult us for details.

| | Power distribution with air circuit breaker (ACB power distribution) | Power distribution with wiring circuit breaker (MCCB power distribution) | Power distribution with drop wiring panel | Direct power distribution on back side |
|---|---|---|---|---|
| Figures |  |  |  |  |
| Descriptions | A power distribution panel for which air circuit breaker is used. Available for one line and two lines. Current capacity is 4000A or less. | A power distribution panel for which a wiring circuit breaker is used. Current capacity is 2000A or less. | A method in which a drop wiring panel is provided. Current capacity is 3150A or less. | A method in which the back side of motor control center is used. Horizontal busbars or vertical busbars are used for power distribution. |

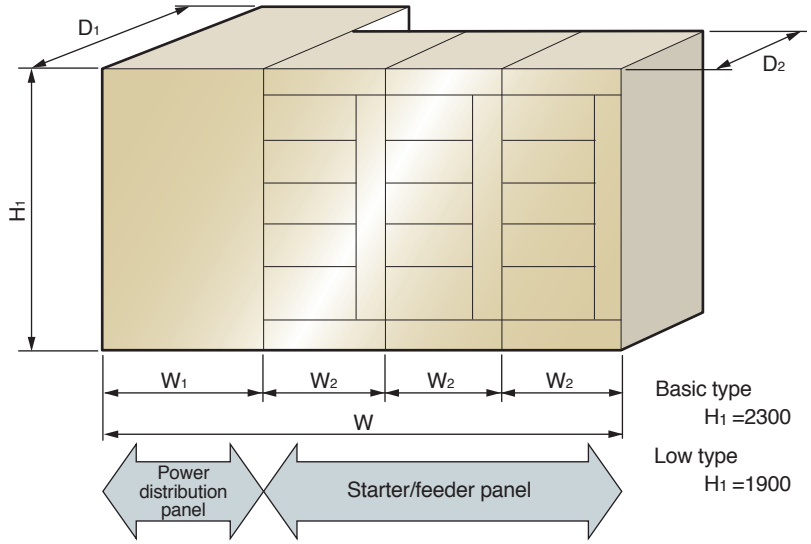
## Installation

The dimensions in parentheses ( ) are for wide type. The dimensions in boxes ☐ are for thin type.
When the number of cabinets is more than 4, a combination of 1 - 4 will be adopted.



# Dimensions and mass

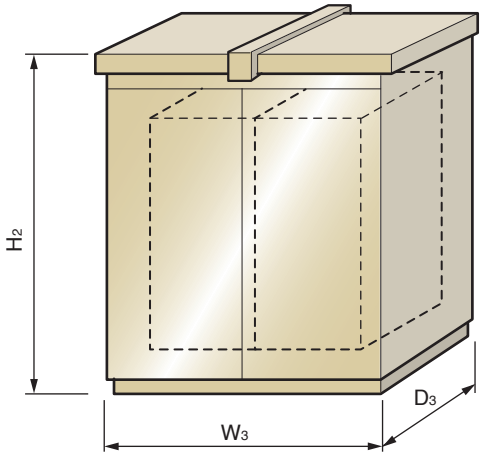
## Indoor type




Basic type
$H_1$ =2300

Low type
$H_1$ =1900

## Outdoor type




Basic type $H_2$ =2675

Low type $H_2$ =2275

## Dimensions and mass

| Type | | Specification | | Breaker current (A) | External dimension / Mass | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Indoor type | | | | | Outdoor type | |
| | | | | | Dimension | | | | Mass(kg) | $W_3$ | $D_3$ |
| Power distribution panel | ACB accommodated | Power distribution for 1 line | 3Φ 3W | 800 | $W_1$ | 700 | $D_1$ | 1400 | 550 | $W_1$+400 | $D_1$+500 |
| | | | | 1250 | | | | | 600 | | |
| | | | | 2000 | | | | | 650 | | |
| | | | | 2500 | | 800 | | | 700 | | |
| | | | | 3150 | | 1000 | | 1500 | 1000 | | |
| | | | 3Φ 4W | 800 | | 800 | | 1400 | 650 | | |
| | | | | 1250 | | | | | 700 | | |
| | | | | 2000 | | | | | 800 | | |
| | | | | 2500 | | 900 | | | 850 | | |
| | | | | 3150 | | 1200 | | 1500 | 1150 | | |
| | | Power distribution for 2 lines | 3Φ 3W | 800 | | 1600 | | 1400 | 1400 | | |
| | | | | 1250 | | | | | 1500 | | |
| | | | | 2000 | | | | | 1600 | | |
| | | | | 2500 | | | | | 1750 | | |
| | | | | 3150 | | 2000 | | 1500 | 2400 | | |
| | | | 3Φ 4W | 800 | | 1600 | | 1400 | 1500 | | |
| | | | | 1250 | | | | | 1600 | | |
| | | | | 2000 | | | | | 1700 | | |
| | | | | 2500 | | 1800 | | | 1900 | | |
| | | | | 3150 | | 2400 | | 1500 | 2800 | | |
| | MCCB accommodated | Power distribution capacity: 1200A or less | | | | 600 | | 550 | 250 | $W_2$+300 | $D_2$+500 |
| | | Power distribution capacity: 2000A or less | | | | 800 | | 800 | 350 | | |
| | Side panel | Power distribution capacity: 4000A or less | | | | 600 | | 550 | 300 | | |
| Starter/feeder panel | Basic type | | | | $W_2$ | 600 | $D_2$ | 550 | 350 | | |
| | Wide type | | | | | 700 | | 550 | 400 | | |
| | Thin type | | | | | 600 | | 350 | 300 | | |

Note: The dimensions and mass of ACB power distribution panel are for SSTD method. The mass for the starter/feeder panel is for one-cabinet type.
The dimensions of outdoor type are for non-walk type.

# Unit selection table

## M series starter unit type

| Applied motor (kW) | | Non reversible unit | | Reversible unit | | Star delta | | Maximum applicable cable size | |
|---|---|---|---|---|---|---|---|---|---|
| 400V class | 200V class | General | With ground fault protection | General | With ground fault protection | General | With ground fault protection | B method | C method |
| 3.7 | 1.5 | NR 2 - 20M | ML 2 - 20M | RM 2 - 20M | KL 2 - 20M | YD 3 - 20M | YL 3 - 20M | 14mm² | 14mm² |
| 7.5 | 3.7 | NR 2 - 20M | ML 2 - 20M | RM 2 - 20M | KL 2 - 20M | YD 3 - 20M | YL 3 - 20M | | |
| 11 | 5.5 | NR 2 - 35M | ML 2 - 35M | RM 3 - 35M | KL 3 - 35M | YD 3 - 35M | YL 3 - 35M | | |
| 15 | 7.5 | NR 2 - 35M | ML 2 - 35M | RM 3 - 35M | KL 3 - 35M | YD 3 - 35M | YL 3 - 35M | | |
| 22 | 11 | NRS 2 - 50M | MLS 2 - 50M | RMS 4 - 50M | KLS 4 - 50M | YDS 4 - 35M | YLS 4 - 35M | | 22mm² |
| 37 | 18.5 | NRS 2 - 80M | MLS 2 - 80M | RMS 5 - 80M | KLS 5 - 80M | YDS 5 - 50M | YLS 5 - 50M | 38mm² | 38mm² |
| 45 | 22 | NR 4 - 95M | ML 4 - 95M | RM 5 - 95M | KL 5 - 95M | YD 6 - 80M | YL 6 - 80M | | |
| 55 | 30 | NR 6 - 180M | ML 6 - 180M | RM 9 - 180M | KL 9 - 180M | YD 6 - 80M | YL 6 - 80M | 80mm² | 100mm² |
| 75 | 37 | NR 6 - 180M | ML 6 - 180M | RM 9 - 180M | KL 9 - 180M | YD 10 - 95M | YL 10 - 95M | | |
| 90 | 45 | NR 6 - 180M | ML 6 - 180M | RM 9 - 180M | KL 9 - 180M | YD 11 - 180M | YL 11 - 180M | | |
| 110 | 55 | NR 9 - 220M | ML 9 - 220M | RM 10 - 220M | KL 10 - 220M | YD 12 - 180M | YL 12 - 180M | | 200mm² |
| 150 | 75 | NR 9 - 400M | ML 9 - 400M | RM 12 - 400M | KL 12 - 400M | YD 15 - 220M | YL 15 - 220M | | |
| 200 | 100 | NR 11 - 400M | ML 11 - 400M | RM 13 - 400M | KL 13 - 400M | YD 21 - 400M | YL 21 - 400M | | |

Note: The size is different when the external ammeter has a CT.

## G series starter unit type

| Applied motor (kW) | | Non reversible unit | | Reversible unit | | Star delta | | Maximum applicable cable size | |
|---|---|---|---|---|---|---|---|---|---|
| 400V class | 200V class | General | With ground fault protection | General | With ground fault protection | General | With ground fault protection | B method | C method |
| 3.7 | 1.5 | NR 2 - 20 | ML 2 - 20 | *RM 2 - 20 | *KL 2 - 20 | YD 4 - 20 | YL 4 - 20 | 14mm² | 14mm² |
| 7.5 | 3.7 | NR 2 - 20 | ML 2 - 20 | *RM 2 - 20 | *KL 2 - 20 | YD 4 - 20 | YL 4 - 20 | | |
| 11 | 5.5 | NR 2 - 35 | ML 2 - 35 | RM 3 - 35 | KL 3 - 35 | YD 4 - 35 | YL 4 - 35 | | |
| 15 | 7.5 | NR 2 - 35 | ML 2 - 35 | RM 3 - 35 | KL 3 - 35 | YD 4 - 35 | YL 4 - 35 | | |
| 22 | 11 | NRS 3 - 50 | MLS 3 - 50 | RMS 4 - 50 | KLS 4 - 50 | YDS 5 - 35 | YLS 5 - 35 | | 22mm² |
| 37 | 18.5 | NRS 3 - 80 | MLS 3 - 80 | RMS 5 - 80 | KLS 5 - 80 | YDS 6 - 50 | YLS 6 - 50 | 38mm² | 38mm² |
| 45 | 22 | NR 5 - 95 | ML 5 - 95 | RM 6 - 95 | KL 6 - 95 | YD 9 - 80 | YL 9 - 80 | | |
| 55 | 30 | NR 6 - 180 | ML 6 - 180 | RM 10 - 180 | KL 10 - 180 | YD 9 - 80 | YL 9 - 80 | 80mm² | 100mm² |
| 75 | 37 | NR 6 - 180 | ML 6 - 180 | RM 10 - 180 | KL 10 - 180 | YD 11 - 95 | YL 11 - 95 | | |
| 90 | 45 | NR 6 - 180 | ML 6 - 180 | RM 10 - 180 | KL 10 - 180 | YD 12 - 180 | YL 12 - 180 | | |
| 110 | 55 | NR 9 - 220 | ML 9 - 220 | RM 12 - 220 | KL 12 - 220 | YD 13 - 180 | YL 13 - 180 | | 200mm² |
| 150 | 75 | NR 9 - 400 | ML 9 - 400 | RM 13 - 400 | KL 13 - 400 | YD 15 - 220 | YL 15 - 220 | | |
| 200 | 100 | NR 11 - 400 | ML 11 - 400 | RM 14 - 400 | KL 14 - 400 | YD 21 - 400 | YL 21 - 400 | | |

Note: The size is different at some portions when it has an instantaneous restart timer. The size is different when the external ammeter has a CT.
(*) indicates an auxiliary relay is accommodated.

## Feeder unit and feeder unit with contactor types

| Load current (A) | Feeder unit | | Feeder unit with contactor | | Maximum applicable cable size | |
|---|---|---|---|---|---|---|
| | General | With ground fault protection | General | With ground fault protection | B method | C method |
| 15 | NF 2 - 50 | NL 2 - 50 | CF 2 - 20 | CL 2 - 20 | 14mm² | 14mm² |
| 25 | | | CF 2 - 35 | CL 2 - 35 | | |
| 40 | NFS 2 - 100 | NLS 2 - 100 | CFS 2 - 50 | CLS 3 - 50 | 38mm² | 38mm² |
| 50 | | | CFS 2 - 80 | CLS 3 - 80 | | |
| 75 | | | | | | |
| 100 | NF 3 - 225 | NL 4 - 225 | CF 5 - 95 | CL 5 - 95 | 80mm² | |
| 125 | | | CF 6 - 180 | CL 6 - 180 | | 100mm² |
| 150 | | | | | | |
| 175 | | | | | | |
| 200 | NF 4 - 400 | NL 7 - 400 | CF 9 - 180 | CL 9 - 180 | | 200mm² |
| 250 | | | CF 9 - 400 | CL 9 - 400 | | |
| 300 | | | | | | |
| 400 | * NF 5 - 600 | * NL 9 - 600 | * CF21 - 600 | * CL21 - 600 | | |

Note: The size of unit depends on the circuits and devices accommodated. Please consult with us.
The size is different when the external ammeter has a CT or unit is equipped with auxiliary relay.
*Entirely fixed type

# Unit selection table

## M series inverter unit type (with incorporated motor multi-relay)

| 400V class | | | | 200V class | | | | Maximum applicable cable size | |
|---|---|---|---|---|---|---|---|---|---|
| Applied motor capacity (kW) | General | With ground fault protection | Unit size | Applied motor capacity (kW) | General | With ground fault protection | Unit size | B method | C method |
| 0.75 | IN 4- 18M | IL 4- 18M | 600W×550D | 0.4 | IN 4- 11M | IL 4- 11M | 600W×550D | 14mm² | 14mm² |
| 1.1/1.5 | IN 4- 31M | IL 4- 31M | | 0.75 | IN 4- 18M | IL 4- 18M | | | |
| 2.2 | IN 4- 44M | IL 4- 44M | | 1.1/1.5 | IN 4- 30M | IL 4- 30M | | | |
| 3.7 | IN 4- 80M | IL 4- 80M | | 2.2 | IN 4- 42M | IL 4- 42M | | | |
| 5.5 | IN 6- 110M | IL 6- 110M | | — | — | — | | | |
| 7.5 | IN 6- 130M | IL 6- 130M | | 3.7 | IN 4- 67M | IL 4- 67M | | | |
| 11 | IN 11- 210M | IL 11- 210M | | 5.5 | IN 6- 100M | IL 6- 100M | | | |
| 15 | IN 11- 250M | IL 11- 250M | | 7.5 | IN 8- 130M | IL 8- 130M | | | |
| 18.5 | INS 11- 310M | ILS 11- 310M | | — | — | — | | | 22mm² |
| 22 | INS 11- 370M | ILS 11- 370M | | 11 | INS 11- 210M | ILS 11- 210M | | | |
| 30 | INS 16- 500M | ILS 16- 500M | | 15 | INS 12- 250M | ILS 12- 250M | | 38mm² | 38mm² |
| 37 | INS 19- 600M | ILS 19- 600M | 600W×550D | 18.5 | INS 12- 290M | ILS 12- 290M | | | |
| 45 | IN 19- 720M | IL 19- 720M | | 22 | IN 13- 340M | IL 13- 340M | | | |
| 55 | IN 19- 880M | IL 19- 880M | | 30 | IN 19- 460M | IL 19- 460M | | 80mm² | 100mm² |
| 75 | IN 19- 1220M | IL 19- 1220M | | 37 | IN 19- 550M | IL 19- 550M | 600W×550D | | |
| 90 | IN 21- 1360M | IL 21- 1360M | 800W×800D | 45 | IN 21- 670M | IL 21- 670M | | | |
| 110 | IN 21- 1640M | IL 21- 1640M | | 55 | IN 21- 840M | IL 21- 840M | 800W×800D | | 200mm² |
| 132 | IN 21- 1970M | IL 21- 1970M | 1400W×800D | 75 | IN 21- 1090M | IL 21- 1090M | | | |
| 160 | IN 21- 2390M | IL 21- 2390M | | — | — | — | | | |
| 200 | IN 21- 2950M | IL 21- 2950M | 1800W×800D | 90 | IN 21- 1330M | IL 21- 1330M | 1600W×800D | | |

Note: A different unit size is used when an option other than a reactor for coordination with the power supply is accommodated.

## G series inverter unit type (with incorporated thermal-relay)

| 400V class | | | | 200V class | | | | Maximum applicable cable size | |
|---|---|---|---|---|---|---|---|---|---|
| Applied motor capacity (kW) | General | With ground fault protection | Unit size | Applied motor capacity (kW) | General | With ground fault protection | Unit size | B method | C method |
| 0.75 | IN 4- 18 | IL 6- 18 | 600W×550D | 0.4 | IN 4- 11 | IL 6- 11 | 600W×550D | 14mm² | 14mm² |
| 1.1/1.5 | IN 4- 31 | IL 6- 31 | | — | — | — | | | |
| 2.2 | IN 4- 44 | IL 6- 44 | | 0.75 | IN 4- 18 | IL 6- 18 | | | |
| 3.7 | IN 4- 80 | IL 6- 80 | | 1.1/1.5 | IN 4- 30 | IL 6- 30 | | | |
| 5.5 | IN 6- 110 | IL 6- 110 | | 2.2 | IN 4- 42 | IL 6- 42 | | | |
| 7.5 | IN 6- 130 | IL 6- 130 | | 3.7 | IN 4- 67 | IL 6- 67 | | | |
| 11 | IN 10- 210 | IL 10- 210 | | 5.5 | IN 6- 100 | IL 6- 100 | | | |
| 15 | IN 10- 250 | IL 10- 250 | | 7.5 | IN 8- 130 | IL 8- 130 | | | |
| 18.5 | INS 11- 310 | ILS 11- 310 | | — | — | — | | | 22mm² |
| 22 | INS 11- 370 | ILS 11- 370 | | 11 | INS 11- 210 | ILS 11- 210 | | | |
| 30 | INS 15- 500 | ILS 15- 500 | | 15 | INS 12- 250 | ILS 12- 250 | | 38mm² | 38mm² |
| 37 | INS 19- 600 | ILS 19- 600 | 600W×550D | 18.5 | INS 12- 290 | ILS 12- 290 | | | |
| 45 | IN 19- 720 | IL 19- 720 | | 22 | IN 13- 340 | IL 13- 340 | | | |
| 55 | IN 19- 880 | IL 19- 880 | | 30 | IN 19- 460 | IL 19- 460 | | 80mm² | 100mm² |
| 75 | IN 19- 1220 | IL 19- 1220 | | 37 | IN 19- 550 | IL 19- 550 | 600W×550D | | |
| 90 | IN 21- 1360 | IL 21- 1360 | 800W×800D | 45 | IN 21- 670 | IL 21- 670 | | | |
| 110 | IN 21- 1640 | IL 21- 1640 | | 55 | IN 21- 840 | IL 21- 840 | 800W×800D | | 200mm² |
| 132 | IN 21- 1970 | IL 21- 1970 | 1400W×800D | 75 | IN 21-1090 | IL 21- 1090 | | | |
| 160 | IN 21- 2390 | IL 21- 2390 | | — | — | — | | | |
| 200 | IN 21- 2950 | IL 21- 2950 | 1800W×800D | 90 | IN 21- 1330 | IL 21- 1330 | 1600W×800D | | |

Note: A different unit size is used when an option other than a reactor for coordination with the power supply is accommodated.

## Single phase transformer unit (circuit breaker for wiring, accommodating a transformer)

| Transformer capacity (VA) | Primary voltage 400V class | | | | Primary voltage 200V class | | | |
|---|---|---|---|---|---|---|---|---|
| | General | With ground fault protection | Maximum applicable cable size | | General | With ground fault protection | Maximum applicable cable size | |
| | | | Secondary voltage 100V class | Secondary voltage 200V class | | | Secondary voltage 100V class | Secondary voltage 200V class |
| 0.5 | ST 2 - 5 | SL 4 - 5 | 14mm² | 14mm² | ST 2 - 5 | SL 4 - 5 | 14mm² | 14mm² |
| 1 | ST 6 - 10 | SL 6 - 10 | | | ST 6 - 10 | SL 6 - 10 | | |
| 1.5 | ST 6 - 15 | SL 6 - 15 | | | ST 6 - 15 | SL 6 - 15 | | |
| 2 | ST 6 - 20 | SL 6 - 20 | | | ST 6 - 20 | SL 6 - 20 | | |
| 3 | ST 7 - 30 | SL 7 - 30 | | | ST 7 - 30 | SL 7 - 30 | | |
| 5 | STS 9 - 50 | SLS 9 - 50 | 38mm² | 38mm² | STS 9 - 50 | SLS 9 - 50 | 38mm² | 38mm² |
| 7.5 | STS 9 - 75 | SLS 9 - 75 | | | STS 9 - 75 | SLS 9 - 75 | | |
| 10 | STS 9 - 100 | SLS 9 - 100 | | | STS 9 - 100 | SLS 9 - 100 | | |
| 15 | STS12 - 150 | SLS12 - 150 | 100mm² | 38mm² | ST 12 - 150 | SL 12 - 150 | 100mm² | |
| 20 | STS13 - 200 | SLS13 - 200 | | | ST 13 - 200 | SL 13 - 200 | | 100mm² |
| 30 | ST 13 - 300 | SL 15 - 300 | 200mm² | 100mm² | ST 13 - 300 | SL 15 - 300 | 200mm² | |

Note: A unit with 7.5 kVA or more is only for one-side type.

# Guidance of the plan

| ITEM | | | Standard specification | Optional specification |
|---|---|---|---|---|
| General | Unit | | SI unit | —— |
| | Screw bolt | | ISO standard | —— |
| | Language | Drawings | Japanese, English | As specified by the customer |
| | | Nameplate & label | Japanese, English | As specified by the customer |
| | Electrical symbol | | JIS, IEC | FormerJIS, NEMA |
| | Site condition | Location | Indoor | Outdoor |
| | | Ambient Temp. | -5℃ up to +40℃ | –5℃ and under |
| | | | | +40℃ or more |
| | | Altitude | Not to exceed 2000m above sea level | —— |
| | Limit of transportation | | No (3 Panels at the maximum) | As specified by the customer |
| Finish and color | External and internal surface | | 5Y7/1 | As specified by the customer |
| | Components on the door | | N1.5 | —— |
| | Material | | Powder coating | Melamine enamel<br>Polyurethane enamel |
| | Gloss | | Semi-gloss (40) | High-gloss (70) |
| | | | | Low-gloss (10) |
| | Thickness | | External (40μm), Internal (30μm) | 100μm at the maximum |
| Main circuit | Arrangement of main circuit | AC | 1st, 2nd, 3rd, and neutral phase from front, top, or left-hand side | As specified by the customer |
| | | DC | P. -pole, and N. -pole from front, top, or right-hand side | As specified by the customer |
| | Identification of main circuit | Three phase circuit | 1st phase Red(R)<br>2nd phase White(S)<br>3rd phase Blue (T)<br>Neutral phase Black(N) | Color: Red, White, Blue, Black, Yellow, Green<br>Wire mark: as specified by the customer |
| | | Single phase circuit | 1st phase Red(R)<br>Neutral phase Black(N)<br>2nd phase Blue(T) | |
| | | DC circuit | Positive pole Red(P)<br>Negative pole Blue(N) | |
| | Wires | | 600V polyethylene insulated wires | |
| | Inside terminal lug | | Crimp type terminal (Ring tongue, Non-insulated)<br>(Crimp type terminals (Fork tongue, Non-insulated) are used for some points) | Crimp type terminals (Ring tongue, Non-insulated) are used for all points. |
| | Outside terminal lug | Provided | None | Provided |
| | | Type of terminal lug | Crimp type for 325mm² or less<br>Compression type for over 325mm² | Clamp type |
| | | | | Compression type |
| Auxiliary circuit | Identification of phase code | | None | Vinyl tube |
| | | | | Plastic ring |
| | Wire mark | | Vinyl tube<br>(Not for the inside of the unit) | Vinyl tube<br>(Include with the inside of the unit) |
| | Color of wire | | Yellow: AC and DC, Ct 2ry, Vt 2ry<br>Black: Shielding | As specified by the customer |
| | Size of wires | Inside the unit | 1.25mm² | 2.0mm² |
| | | Outside the unit AC/DC | 1.25mm² | 2.0mm² |
| | | Outside the unit Vt/Ct 2ry | | 3.5mm² |
| | | | | 5.5mm² |
| | | Outside the unit Shielding | 0.5mm² | 1.25mm² |
| | Type of wires | | 600V polyethylene insulated Wires | 600V Polyvinyl chloride insulated wires<br>600V Non–corrosive wires<br>600V wires (UL44 type SIS) |
| | Inside terminal lug | for the inside of the unit | Crimp type terminal (Fork tongue, Non-Insulated) | Crimp type terminal (Ring tongue, Non-insulated) |
| | | | | Crimp type terminal (Ring tongue, Insulated) |
| | | for the outside of the unit | Crimp type terminal (Fork tongue, Non-Insulated) | Crimp type terminal (Fork tongue, Insulated) |
| | Outside terminal lug | Provided | None | Provided |
| | | Type of cable terminal | Crimp type terminal | As specified by the customer |
| | | Size | 2.0mm² at the maximum | As specified by the customer |

# Guidance of the plan

| ITEM | | | Standard specification | Optional specification |
|---|---|---|---|---|
| Grounding | Color of wires | | Green | Yellow/Green |
| | Size of wires | | 2.0mm² | 3.5 up to 5.5mm² |
| | Type of wires | | Same as auxiliary circuit | Same as auxiliary circuit |
| | Outside cable terminal lug | Provided | Provided | —— |
| | | | Connecting point is shown in the outline drawing. | Connecting point as specified by the customer |
| | | Type | Crimp type terminal (Ring tongue, Non-Insulated) | As specified by the customer |
| | | Size | 38mm² | As specified by the customer |
| | Phase | | 3φ 3W | 3φ 4W |
| Ratings | Rated insulation voltage | Main circuit | 600V | —— |
| | | Auxiliary circuit | 250V | 300V |
| | Rated voltage | | AC 440V and below | —— |
| | Rated frequency | | 50, 60Hz | DC |
| | Rated bus current | Horizontal bus | 800A | 1200 up to 3150A |
| | | Vertical bus | 400A | 600A |
| | Rated short-time withstand current: | | 30, 50, 70kA-0.5sec | 30kA-1sec, 50kA-1sec |
| | Rated breaking capacity | | 30, 50, 70kA<br>Sym. Rms (at 440V) | —— |
| | Dielectric test voltage | Main circuit | 2200V/1min | 2500V/1min |
| | | Auxiliary circuit | 1500V/1min | 2000V/1min |
| | Rated voltage (Auxiliary circuit) | Operation circuit | AC100V/50Hz<br>AC110V/60Hz | Without the specification shown in the left column<br>Not exceeding 250V |
| | | Alarm circuit | | |
| Applicable standards | MCC | | JEM 1195 | NEMA |
| | Components | | Japanese standard | —— |
| Type specifications | Type | | S=one side only D=double front | None |
| | Panel size | | 600W x 2300H x 550D | 700W x 2300H x 550D<br>600W x 2300H x 350D<br>600W x 1900H x 550D |
| | Class (NEMA standard) | | 2 (electrical interlock with external) | 1(without electrical interlock) |
| | External connection method | Main circuit | B (directly connected to the unit) | C |
| | | Auxiliary circuit | B (directly connected to the unit) | C |
| | Protection unit of main circuit | | B (MCCB) | —— |
| | Unit mounting arrangement | | W (draw-out) | X (fixed) |
| | Operation configuration | | d (Interlock between door and MCCB, panel indication, and panel operation systems) | —— |
| | Separated with a split plate | | 3 | —— |
| | Monitoring control components | | C (TR and Indication for each unit) | —— |
| Construction | Termination for ent. Cable (position) | Incoming | Bottom (cable pit) | Top |
| | | Load cable | Bottom (cable pit) | Top |
| | | Auxiliary cable | Bottom (cable pit) | Top |
| | Protective structure | | General (IP20) | Drip proof (IPX1)<br>Dust proof<br>Outdoor type (IP33W) |
| | Thickness of door | | 1.6mm<br>(Door for panel: 2.3mm) | 2.3mm |
| | Rear door | | 2-split hinge type | 2-split hook type |
| | Foundation base | Type | 60W x 50H | 50W x 100H |
| | | | | 100W x 50H |
| | | Installation | Floor mount with anchor | Flush |
| | | | | Semi-flush |
| | | | | As specified by the customer |
| | Material of busbar | Horizontal busbar | Copper (Tin coating) | —— |
| | | Vertical busbar | Copper (Silver coating) | —— |
| | | Grounding busbar | Copper (Tin coating) | —— |

| ITEM | | | | Standard spesification | Optional specification |
|---|---|---|---|---|---|
| Construction | Nameplate | Material | | Acrylic resin<br>Black letters on white | Acrylic resin plate.<br>Color specified by the customer |
| | | | | | Aluminum |
| | | | | | Laminated |
| | | Mounting method | Panel name | Bolted | —— |
| | | | Load name | Card holder | Bolted |
| | | Position | Panel name | Top of the center in the group | Position specified by the customer |
| | | | Load name | Unit door | Mounted also on the back door |
| | Bottom plate | | | None | Steel |
| | | | | | Polyvinyl chloride |
| | | | | | Fireproof plate |
| Incoming | Method | | | Direct | With MCCB |
| | | | | | Incoming panel |
| | | | | | With ACB |
| | | | | | V-bus |
| | Apparatus | | | None | As specified by the customer |
| Schematic diagram | Control power supply system | | | Unit transformer | Group transformer |
| | | | | | External power supply |
| | Operating method | | | Remote | Direct |
| | | | | | Remote and direct switching selection |
| | | | | | Auto and manual switching |
| | External contact for operation | | | None | As specified by the customer |
| | External contact warning | | | 49x, 52 (a contact) | As specified by the customer |
| | Alarm | | | 49 | As specified by the customer |
| Main components specifications | Circuit breaker | Accessories | | With alarm contact | ON/OFF monitoring |
| | | | | | Draw-out to outside |
| | | Interlock with door | | Impossible to open the door with ON.<br>Possible to open the door with OFF.<br>Impossible to ON with door-open. | —— |
| | | Interlock with unit draw-out mechanism | | None | Impossible to draw-out or push-in with ON. |
| | Electromagnetic contactor Auxiliary relay | Excitation system | | Regular excitation system | Regular no-excitation system<br>Mechanical latch |
| | | Return system | | Instantaneous return system | Delayed return system<br>Mechanical latch |
| | | Coil voltage | | AC100V/50Hz<br>AC110V/60Hz | Without the specification shown in the left column. |
| | | Rated contact (Open/ Closed) capacity | | Class-AC3 | Class-AC4 |
| | | | | | As specified by the customer |
| | | Auxiliary contact | | 2a2b | Depending on circuit condition |
| | G Series | Protection against overload | Protection | 2-element thermal | Missing phase type |
| | | | Reset system | Electrical reset | Mechanical reset |
| | | Grounding protection | Rated sensitivity current | 0.2A | 0.03～0.5A |
| | | | Operating time | 0.2sec | As specified by the customer |
| | | | Reset | Manual | Auto |
| | | Instantaneous stop and restart | Coil voltage | AC100V | AC200V |
| | | | Setting time | 0.5sec | 0.05～6sec |
| | | Ammeter | | 3 times extended scale | With red pointer |
| | | Signal lamp | | LED AC100V | AC200V |
| | M Series | Motor multi relay | Grounding protection | 30～500mA | —— |
| | | | Restarting after voltage dip | 0.5, 1, 2, 3, 4, 5sec<br>10～60sec (unit: 5sec) | —— |
| | | | Instantaneous compensation time for immediate restart | 0.1sec | 0.2sec |
| | | | Restarting delay time | 1～180sec (unit: 1sec) | —— |
| | | | Output current | 0-1mA (not insulated)<br>4-20mA (not insulated) | 4-20mA (insulated) |
| | | | Power consumption Pulse output | Pulse output: 1 point (insulated) | —— |
| | | | Transmission | None | Yes |

# Guidance of the plan

| ITEM | | | | Standard spesification | Optional spesification |
|---|---|---|---|---|---|
| Main components specifications | Operating transformer | Capacity | | 50, 150, 500VA | ——— |
| | | Rated voltage | 50Hz | 400/100V, 200/100V | Without the specification shown in the left column |
| | | | 60Hz | 440/110V, 220/110V | Without the specification shown in the left column |
| | Current transformer | Rated load | | 15VA, 1st class | 40VA, 1st class |
| | | Secondary current | | 5A | 1A |
| Acceptance test | | | | Construction, Electrical operation, Withstand voltage | As specified by the customer |
| Accessories | | | | Yes | As specified by the customer |
| Spare parts | | | | None | As specified by the customer |

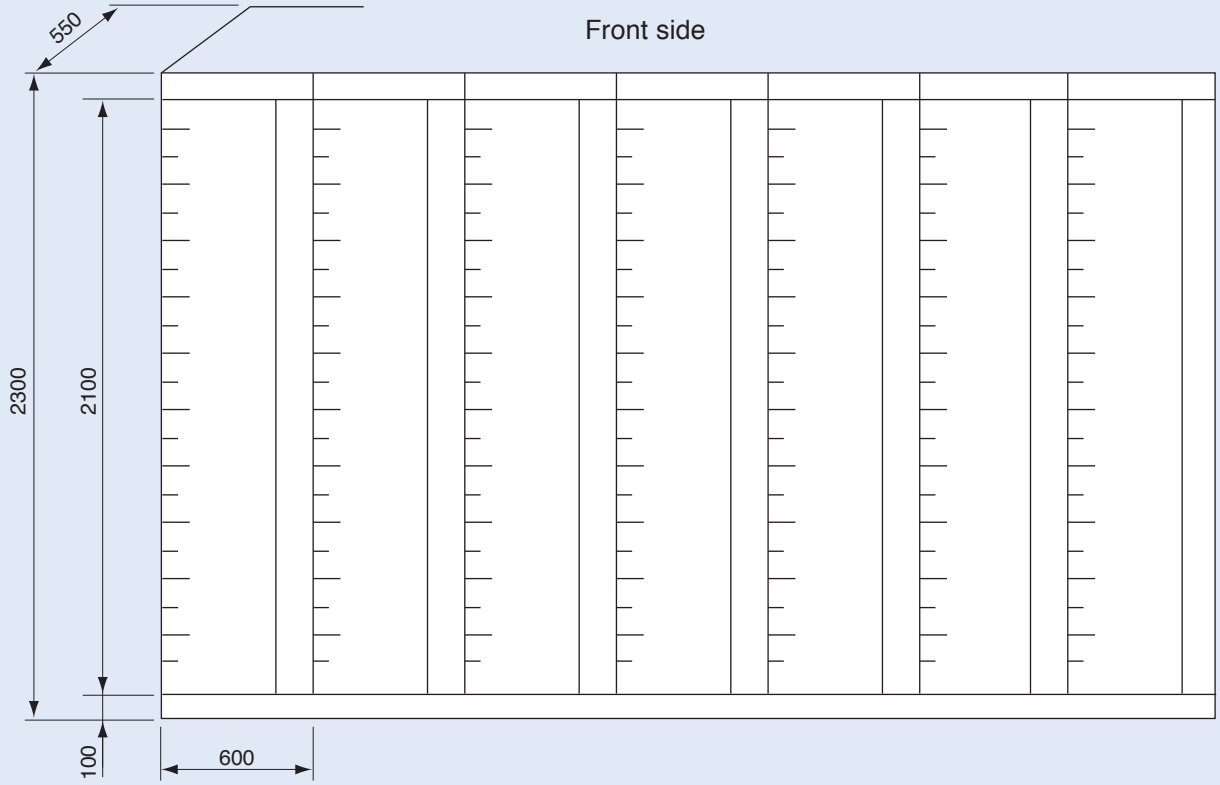
**⚠ Caution**

- Before using the Type TE Motor control center, read the operating manual with a great care to ensure completely familiar with it.
- For safety of operation, never modify the Type TE Motor control center or add extra functions which are not described in the manual. When modification or addition is to be done, contact Toshiba.
- Observe the following operating conditions to fully utilize the performance capability of the Type TE Motor control center. In the case that different operating conditions are inevitable, specify them at the time of placing your order.

1) Ambient temperature: -5 to 40˚C (daily average of 35˚C or below)
2) Relative humidity: 45 to 85% with no condensation
3) Free of excessive water vapor, oil mist, smoke, dust, salt, and corrosive and inflammable hazardous gases.
4) Free from abnormal vibration and shock.

# Motor Control Center unit layout (for planning by the customer)

Front side




Back side

*Besides the space for the units, space for power supply lines is needed.
*In case of wiring BC, CB, CC and RC, space of approxmately 600mm is needed for installing terminal blocks.

## Notes on safety

- Before installation, connection, operation, or maintenance, the catalog, manual, and documents attached to the products must be read with great care.
- The customer must be acquainted with the performance and principle of equipment and laws relevant to electrical equipment and work.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