Thank you for purchasing an Itoh Denki CB-016 series motor driver. Please read this manual before operating the product, and keep this manual readily accessible for reference.

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**Standard Accessories**
- Power connector (CN 1) ........................................ 1pc
- Control connector (CN 2) ........................................ 1pc
- Mounting screws and nuts ........................................
  - Screw M4 x 15 ....................................................... 2pcs
  - Nut M4 ................................................................. 2pcs
- UL: UL recognized
- LT: Low Temp
- S: For standard motor, NPN signal input and output
- P: For standard motor, PNP signal input and output
- BS: For built-in brake motor, NPN signal input and output
- BP: For built-in brake motor, PNP signal input and output

**WARNING & CAUTION**

**Warning**
Incorrect handling may lead to death or serious injury, indicating potential danger.

**Caution**
Possible danger of light or medium injury, or only a material damage.

**1 Safety Instructions**

- **Maximum Surrounding Air Temperature 40°C**
- Switch off the power, when removing from conveyor, wiring or maintenance is done, otherwise you have a risk of electrical shock or injury.
- Respect the electrical regulations of the site or the equipment, where the product in installed. (Labor safety and sanitary regulations, electrical equipment technical standard, etc)
- Operate the motor driver within its intended design and specifications to avoid electrical shock, injury, fire, or damage to the equipment.
- Do not disassemble, repair or modify the product (for which we do not warrant) It might cause electrical shock, injury or fire.
- Separately set the circuitry to monitor the important input and/or output signal status, which might cause accident, because the signal may stay ON or OFF in case of the CB-016 driver card failure.
- Be sure to shut off the power before inserting or removing any connector. Do not wire connector left in the CB-016 driver card.
- Do not drop, give external impact nor pressure to the CB-016 driver card. If that happens, do not reuse it.
- Make sure all the connectors are properly engaged with wiring cables.
- Make sure the conveyor frame and control box where the CB-016 driver card is mounted are grounded.
- Do not switch on or off the relay or contactor in close proximity to power or signal lines, or the CB-016 driver card as the generated noise could cause malfunction.
- Be sure to inject power or input signal for 15 milli-seconds or over to ensure the proper reaction.
- Use the MDR with built-in brake option (BR) along with CB-016 driver card (BS7? BP7?) if holding effect is needed.
- Do not pull by force during operation. It causes the CB-016 driver card to malfunction.
- Do not force the MDR to turn. It may cause of damage to the driver card or shorten its life cycle.
- If condensation is
2 Power

24VDC battery or switching power (24VDC 5A) or smoothed and rectified power (≤10% ripple)
* Use stable power supply with 5A or over. The Power supply should not be affected by peak current 20A for 1ms.

In case of using UL recognized product.
* Battery shall not be used for power supply.

Accommodated DC power
DC power source supplied to the product need to be accommodated to the following conditions.
1) Recommended specification of power supply
   * Stabilized power supply that isolates between output and input, (24 V DC / 5A)
   * Conforming to safety standards as below.
   US: UL60950-1, IEC60950-1
   Canada: CSA C22.2 No.60950-1
2) Power supply specification for the product.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage range</td>
<td>100 to 230 V AC (± 15%)</td>
</tr>
<tr>
<td>Input frequency range</td>
<td>50 to 60 Hz (± 5%)</td>
</tr>
<tr>
<td>Output voltage range</td>
<td>24 V DC (± 5%)</td>
</tr>
<tr>
<td>Rated output current</td>
<td>5A or over</td>
</tr>
<tr>
<td>Operating ambient temperature</td>
<td>0 to 40 deg. C</td>
</tr>
<tr>
<td>Humidity</td>
<td>90% RH or less (No condensation)</td>
</tr>
<tr>
<td>Safety standard</td>
<td>Conforming to UL60950-1 in the US.</td>
</tr>
<tr>
<td></td>
<td>CSA C22.2 No.60950-1 in Canada.</td>
</tr>
</tbody>
</table>

* The installation of specific over current protection device in power source might be requested by specification DC power source that would requests safety standard (UL60950-1, etc.). In this case, install specified over current protection device.
* Overcurrent protective device must be provided in 24VDC power input circuit, when using a power supply other than Limited Power Source (LPS).

3 Before Operating the Product

3-1 Mounting

The product is defined as "Open Type" complying with UL508C standard. Therefore, in order to conform to UL on the installation, the device must be installed in the proper enclosure.
1) Drill mounting holes in the conveyor frame to fit the fixing holes in the product (see Dimensions).
   * The product's back place should be affixed to metallic plate face to ensure the heat dissipation. Care must be paid to prevent the metallic dust entry to the product.
   * Make sure the conveyor is adequately grounded.

2) Fix the product tightly to the conveyor frame with the supplied mounting screws and nuts with the recommended fastening torque between 1.5Nm ± 20%.

3-2 Wiring

The product discharges an abnormal status data, when abnormal circumstances such as overload or high temperature rising condition, but does not block out the power. Therefore, if the power needs to be blocked out, add a external device that detects abnormal circumstances and block out the motor power or add a circuit breaker on motor power line that is controlled by upper layer device (PLC etc.).

Motor overload and over-temperature sensing is not provided by the driver.

Wiring should be made while the product is not powered.
* Switch for Run/stop or CW/CCW is an option and is not supplied.
* Relay contact or PLC output can be used instead of the above switch.
* Wiring to the supplied connectors should be made before inserting into the driver card.

Dip switch 1-3 is to select the motor turning direction viewed from the MDR card (motor connector to CN 3) while the power is shut off.

3-3 Direction setting

Dip Switch 1-3 setting

| Model               | PM486FE-60-400-D-024 |

4 Functions

1) Dip Switch (SW1)

<table>
<thead>
<tr>
<th>No</th>
<th>Function</th>
<th>ON</th>
<th>OFF</th>
<th>Default</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>SW1-1</td>
<td>Thermostat/Under voltage reset</td>
<td>Manual</td>
<td>Automatic</td>
<td>ON</td>
<td>See section 5</td>
</tr>
<tr>
<td>SW1-2</td>
<td>Speed variation</td>
<td>External</td>
<td>Internal</td>
<td>OFF</td>
<td>See section 5-1</td>
</tr>
<tr>
<td>SW1-3</td>
<td>Turning direction</td>
<td>See 5-2</td>
<td></td>
<td>OFF</td>
<td>See section 5-2</td>
</tr>
<tr>
<td>SW1-4</td>
<td>Error signal</td>
<td>Discharges in normal status</td>
<td>Discharges when error arises</td>
<td>ON</td>
<td>See section 6</td>
</tr>
<tr>
<td>SW1-5</td>
<td>Speed range</td>
<td>High range</td>
<td>Low range</td>
<td>ON</td>
<td>See section 5-1</td>
</tr>
</tbody>
</table>

2) Potentiometer (VR)

<table>
<thead>
<tr>
<th>Min</th>
<th>Max</th>
<th>Default</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 sec</td>
<td>2.5 sec</td>
<td>Min</td>
<td>See section 5-3</td>
</tr>
</tbody>
</table>

Example

PM486FE-60-400-D-024
5 Operation Instructions

- MDR is adequately installed in compliance with the manual.
- MDR shafts are adequately secured with the supplied brackets or accessories.
- Each connector on the driver card is adequately wired and inserted.
- Operating and environmental conditions are respected.
- Power supply has sufficient capacity (stable 24VDC, 5A or over) so as not to be affected by varying load.
- The protector for the power supply should not react with peak current 20A be affected by varying load.
- The power supply should not exceed 10V. Its 0V should be common to the Power voltage.

5-1 Speed Variation

Speed of the MDR can be varied either internally by integral dip switch or externally by analog voltage input.

Example

| PM486FE-60-400-D-024 Model | Nominal Speed |

[5-1-1] Internal Speed Variation

- Set the SW1-5 OFF to effect the internal speed variation.
- With the combination of SW1-5 and Rotary Switch SW5, speed can be varied in 20 steps.

[5-1-2] External Speed Variation

- Set the SW1-2 ON to effect the external speed variation.
- Inject and vary the analog voltage between 0 and 10V to CN2-3 to vary the motor speed in 20 steps.

- Max 2mA current is consumed at CN2-3.
- The analog voltage input should not exceed 10V. Its 0V should be common to the Power voltage.
**5-2 Direction Setting**

Reverse direction by external DIR signal can be permitted even while motor is running. MDR turning direction can be set or changed either internally by integral dip switch or externally by optional switch.

**Setting for Turning Direction**

<table>
<thead>
<tr>
<th>MDR Type</th>
<th>CW</th>
<th>CCW</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM500FP</td>
<td><img src="https://via.placeholder.com/150" alt="Diagram" /></td>
<td><img src="https://via.placeholder.com/150" alt="Diagram" /></td>
</tr>
<tr>
<td>PM570FE</td>
<td><img src="https://via.placeholder.com/150" alt="Diagram" /></td>
<td><img src="https://via.placeholder.com/150" alt="Diagram" /></td>
</tr>
<tr>
<td>PM605FE</td>
<td><img src="https://via.placeholder.com/150" alt="Diagram" /></td>
<td><img src="https://via.placeholder.com/150" alt="Diagram" /></td>
</tr>
</tbody>
</table>

Reverse direction by dip switch is prohibited while motor is running. Motor must be stopped first, and then reverse a direction by dip switch.

**5-3 Acceleration and Deceleration**

1. Integral potentiometer VR 1 allows the acceleration adjustment from 0 to 2.5 seconds.
2. Integral potentiometer VR 2 allows the deceleration adjustment from 0 to 2.5 seconds.

- The adjustable range of time is on the control basis, thus may differs on actual transfer speed.

**6 Error Signal Output**

- To monitor the error signal, a protective resistor should be mounted to suppress 24VDC to 25mA or less.
- The driver card has 100Ω protective resistor.

Error signal is discharged from CN2-4

1. SW1-4 allows the selection of the error signal discharge timing: discharge on normal status or discharge when error arises. Error signal is PNP open collector.
2. See section 8 for error status, reset and history.
7 Motor Pulse Signal Output

Caution

- Protective resistor should be mounted to suppress the output to be 25mA or less, otherwise the driver card's integral transistor may be damaged.
- 100Ω resistor is built-in the driver card's output section for motor pulse signal.
- MDR's motor pulse signal is discharged from CN2-5.
- 2 pulses/motor rotation, NPN open collector output.

<table>
<thead>
<tr>
<th>Internal speed variation</th>
<th>Motor speed (rpm)</th>
<th>Analog voltage input</th>
</tr>
</thead>
<tbody>
<tr>
<td>SW1-5</td>
<td>SW5</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>155</td>
<td>4638</td>
</tr>
<tr>
<td>8</td>
<td>152</td>
<td>4556</td>
</tr>
<tr>
<td>7</td>
<td>145</td>
<td>4349</td>
</tr>
<tr>
<td>6</td>
<td>138</td>
<td>4141</td>
</tr>
<tr>
<td>5</td>
<td>131</td>
<td>3934</td>
</tr>
<tr>
<td>4</td>
<td>124</td>
<td>3727</td>
</tr>
<tr>
<td>3</td>
<td>110</td>
<td>3313</td>
</tr>
<tr>
<td>2</td>
<td>104</td>
<td>3106</td>
</tr>
<tr>
<td>1</td>
<td>97</td>
<td>2899</td>
</tr>
<tr>
<td>0</td>
<td>90</td>
<td>2692</td>
</tr>
<tr>
<td>8</td>
<td>83</td>
<td>2485</td>
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<tr>
<td>7</td>
<td>76</td>
<td>2278</td>
</tr>
<tr>
<td>6</td>
<td>69</td>
<td>2071</td>
</tr>
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<td>5</td>
<td>62</td>
<td>1864</td>
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<td>55</td>
<td>1657</td>
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<td>48</td>
<td>1450</td>
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<tr>
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<td>41</td>
<td>1242</td>
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<tr>
<td>1</td>
<td>35</td>
<td>1035</td>
</tr>
<tr>
<td>0</td>
<td>28</td>
<td>828</td>
</tr>
<tr>
<td>0</td>
<td>21</td>
<td>621</td>
</tr>
</tbody>
</table>

Speed deviation +/-3%.

8 Error Status, Reset and History

- When error arises, the error can be identified either by LED 1 (green) and LED 2 (red), or by the error signal discharged from CN2-4.

- To reset the error status, first remove the cause of error, and then switch the direction signal at CN2-2.
- To restart the MDR, first remove the cause of error, and then re-inject run signal at CN2-1.
- Please have 100ms or more intervals between each switch for ON--OFF--ON / OFF--ON--OFF / RUN--STOP--RUN to release error signal or restart MDR.

### LED indication

- ![LED1 (green) in Normal operation](image)
- ![LED2 in Normal operation](image)
- ![LED3 in Normal operation](image)

### LED visibility

- ![LED1 (green) in Normal operation](image)
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- ![LED3 in Normal operation](image)

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- ![LED2 in Normal operation](image)
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# 8-2 Indication of Error Occurrence Frequency

Shows the occurrence frequency of thermister error, motor stall error or under voltage error.

**LED indication**
- ☑: Illuminates
- [ ]: Blinks at 1Hz
- [ ]: Blinks at 6Hz
- [ ]: Off

<table>
<thead>
<tr>
<th>LED2(red)</th>
<th>LED3(orange)</th>
<th>Occurrence</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>first time</td>
<td>stall error</td>
</tr>
<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>second time</td>
<td>stall error</td>
</tr>
<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>≥ 3 times</td>
<td>stall error</td>
</tr>
<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>first time</td>
<td>stall error</td>
</tr>
<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>second time</td>
<td>stall error</td>
</tr>
<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>≥ 3 times</td>
<td>thermister error</td>
</tr>
<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>first time</td>
<td>stall error</td>
</tr>
<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>second time</td>
<td>thermister error</td>
</tr>
<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>≥ 3 times</td>
<td>thermister error</td>
</tr>
<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>first time</td>
<td>stall error</td>
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<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>second time</td>
<td>stall error</td>
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<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>≥ 3 times</td>
<td>thermister error</td>
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<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>first time</td>
<td>stall error</td>
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<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>second time</td>
<td>thermister error</td>
</tr>
<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>≥ 3 times</td>
<td>thermister error</td>
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<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>first time</td>
<td>stall error</td>
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<td>[ ]</td>
<td>[ ]</td>
<td>second time</td>
<td>stall error</td>
</tr>
<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>≥ 3 times</td>
<td>thermister error</td>
</tr>
<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>first time</td>
<td>stall error</td>
</tr>
<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>second time</td>
<td>stall error</td>
</tr>
<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>≥ 3 times</td>
<td>under voltage error</td>
</tr>
<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>first time</td>
<td>stall error</td>
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<td>[ ]</td>
<td>[ ]</td>
<td>second time</td>
<td>under voltage error</td>
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<tr>
<td>[ ]</td>
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<td>[ ]</td>
<td>second time</td>
<td>under voltage error</td>
</tr>
<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>≥ 3 times</td>
<td>under voltage error</td>
</tr>
</tbody>
</table>

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(10)
9 Troubleshooting

Symptom 1: MDR does not run

- Power:
  - Check if only LED 1 (green) illuminates.
  - Check if 24VDC stable voltage is adequately supplied from the power supply.
  - Check if the wiring to CN1 connector is made correctly.
  - Check if 24VDC cable is adequately wired to the CN 1 connector.

- RUN signal:
  - Check if 0V is injected to CN2-1.
  - Check if the 0V injected to CN2-1 is common to 0V injected to CN1-2.
  - Check if the wiring is adequately made to CN2-1 connector.
  - Check if the SW2 is set to NPN.

- Error:
  - Check if LED 2 is illuminating or blinking. 
    * If this is the case, see section 8 and remove the cause of error.

- MDR:
  - Check if the MDR is adequately installed and its shafts are adequately fixed with the supplied mounting brackets or accessories.
  - Check if the MDR end housing is NOT contacting conveyor frame.
  - Check if the MDR’s connector is properly inserted to the driver card.
  - Check if the o-ring or belt tension is not too strong.
  - Check if the number of slaved idler rollers is adequate.

Symptom 2: Speed variation is not achieved, or speed is slower than expected

- MDR:
  - Check if the nominal speed of the MDR to see if the right model is used to achieve the speed variation or to reach expected speed.

- SW1-2 setting:
  - Check if the SW1-2 is set properly: ON for external speed variation and OFF for internal speed variation.

- Power:
  - In case of external speed variation, check if the 0V is common to the 0V input to CN1-2.
  - Check if the stable 24VDC is supplied.

- CN2-3:
  - Check if the wiring is adequately made to CN2-3 connector.
  - Check if the analog voltage input is made between 0 and 10V.

Symptom 3 Reversing is not achieved

- CW/CCW:
  - Check if 0V is injected to CN2-2, and it is common to the 0V input to CN1-2.
  - Check if the wiring is adequately made to CN2-1.

Symptom 4: Error Signal Not Discharged

- SW1-4:
  - Check if the external voltage is 24VDC or less and its 0V is common to the 0V input to CN1-2.
  - Check if the resistor larger than 1kΩ is mounted.

- Voltage:
  - Check if 0V is injected to CN2-4.

Symptom 5: Error Signal is often Discharged

- LED 2 (red):
  - Check if the LED 2 is blinking.
    * If this is the case, see page 7 and remove the cause of error.
  - Check if the wire diameter of the power supply is appropriate (0.5 to 1.5mm²).
  - Also, check if there is no failure in wiring or no looseness at connectors.
  - Check if the wire diameter and wirings.
  - Check if CB-016 is too far from the power supply.
  - Check if the voltage is dropped.

- Environment:
  - Check if the product is used in the ambient temperature range between 0 and 40°C. 
    * If the driver card back plate is affixed to the metallic plate face for better heat dissipation.
  - Check if the MDR is stalled in the conveyor line.

- MDR:
  - Check if the MDR end housing is contacting the conveyor frame.
  - Check if the MDR’s connector is properly inserted to the driver card.
  - Check if the MDR’s connector is disconnected, or about to disconnect.

*1 CB-016 driver card having LT option is used in the ambient temperature range between -30 and 10 °C. (no condensation)