TMdrive®-MVe2 Product Application Guide

Medium Voltage Multilevel IGBT Drive
Up to 5,500 HP (5,000 kVA), 3.3 kV to 11 kV
The TMdrive®-MVe2 is an enhancement to the family of TMEIC medium voltage general purpose drives offering:

- Regeneration
- Smaller footprint
- Unity line-side power factor
- Reduced part-count
- High availability

### Design Feature | Customer Benefit
---|---
Active line side converter | - Unity (1.0) power factor across entire speed range  
- Line side harmonics much lower than IEEE 519-2014  
- Standard regenerative braking

Conservative electronic design & dry film-type capacitors | - Highly reliable operation, expected 16-year MTBF  
- No need for periodic capacitor replacement

Multilevel drive output voltage waveform | - No derating of motor for voltage insulation or heating required  
- Applies easily to existing motors without the need for an expensive output filter  
- Eliminates the need for special VFD rated cables  
- No Neutral Shift

Input isolation transformer with static shield included in drive package | - Simplifies design and installation  
- Less total space required, plus easy integration in MCC building  
- Better motor protection than transformerless design  
- High frequency transients are attenuated

Power conversion module in a single drawer type package | - Reduction in spare parts  
- Minimal personnel training for maintenance  
- 30 minutes Mean Time to Repair (MTTR)

Synchronous bumpless transfer of the motor to the utility line | - Allows control of multiple motors with one drive  
- No motor current or torque transients when the motor transitions to the AC line

Covering a broad range of medium voltage drive applications:

- **11,000 Series**  
  Motor Voltage (V): 11,000  
  Motor Power: 700 - 5,200 HP [500 - 3,860 kW]

- **6,000 Series**  
  Motor Voltage (V): 6,000  
  Motor Power: 400 - 3,350 HP [315 - 2,500 kW]

- **4,000 Series**  
  Motor Voltage (V): 4,000  
  Motor Power: 550 - 2,200 HP [400 - 1,600 kW]

- **3,000 Series**  
  Motor Voltage (V): 3,000  
  Motor Power: 200 - 1,700 HP [160 - 1,250 kW]
Oil & Gas
For Oil and Gas applications, the MVe2 family of variable frequency drives seamlessly integrates with the rest balance of process with a choice of 3/3.3 kV, 4.16 kV, 6/6.6 kV, 10kV or 11 kV options. The MVe2 can be applied to existing motors and cabling, making them an excellent option in modernization/retrofit applications, including:

- Oil pumps
- Expanders
- Gas compressors
- Extruders
- Fans
- Mixers

Power Generation
Traditional mechanical methods of controlling flow are inefficient and require considerable maintenance. In the Power Generation/Utilities industry, the MVe2 provides more reliable, accurate and energy-efficient control of flow while eliminating the maintenance associated with dampers, vanes or valves for:

- Induced and forced draft fans
- Primary and secondary air fans
- Boiler feed water pumps
- Condensate extraction pumps

Mining
Accurate torque control is a key in controlling large conveyors. The MVe2’s flux vector algorithm provides the accuracy and response for constant torque applications. Mining applications include:

- Raw material conveyor
- Grinding mills
- Pumps
- Crushers
- Shredders
- Hoists

Industrial
Regardless of the torque profile, MVe2 drives are designed to meet motor control needs in a variety of industries:

- Steel
- Water & wastewater treatment
- Rubber & plastics
- Test stands
- Agriculture
- Paper & pulp
- Recreational/Entertainment
A Look Inside

Differentiating Features
- Compact design saves valuable floor space making retrofits of old equipment easier
- Compartmentalized panels provide voltage class segregation and top or bottom cable feeds
- Integral isolation transformer provides reliable operation and simplifies installation.
- Significant reduction in parts, reducing spare parts requirements

Input Power Disconnect Option
- A visible, bolted pressure, isolation switch offers mechanical interlocking to allow for maintenance personnel to service the drive.
- The fused (Class E rated) vacuum contactor provides critical fault current protection to the drive.

Main Power Input
Four voltage levels are available:
- 3-3.3 kV, 3-phase, 50/60 Hz
- 4-4.16 kV, 3-phase, 50/60 Hz
- 6-6.6 kV, 3-phase, 50/60 Hz
- 10-11 kV, 3-phase, 50/60 Hz

Internal Pre-Charge AC Reactor*
An ac reactor and medium voltage contactor mitigate the transformer magnetizing inrush current, minimizing stress on the fusing and power components.

Input Isolation Transformer Standard.
The input transformer has multiple secondary windings to feed IGBT inverters (cell inverters). This design provides galvanic isolation between the power system and the motor-inverter system. Electrostatic shield is standard.

Kirk Key Interlocks†
For additional safety, Kirk key locks are provided standard on all drives.

Filtered Air Intake
Washable input air filters have front access for periodic maintenance.

* Available in select frame sizes
†For 4 kV drive, CSA listed in U.S. and Canada only.
Inverter/Converter Phase-Leg Assemblies
Each modular phase leg assembly includes:
- Robust IGBTs
- Gate driver circuit board
- DC bus capacitors, dry-film type for long life
- Fiber optic link interface circuit board

A phase leg assembly can be easily racked out and replaced in 30 minutes in case of failure.

Blower Assemblies
Quiet (<80 dB(A) at 1m), fans circulate air throughout enclosures pulling air from the front filter assemblies and venting it out the top of the cabinets. Redundant fan assemblies can be provided as an option.

Control
Single 32-bit microprocessor-based control board combines several key drive functions:
- Power semiconductor gating
- Speed and torque regulation
- Motor and drive protection
- I/O mapping
- Diagnostic functions
- High speed data capture buffering
- Hosting of optional LAN interface
- Drive is configured from the TMdrive-Navigator

Lightning Arrestors†
Incoming power is protected by distribution class lightning arrestors for suppression of transient surges.

Power & Motor Cabling Terminations
Conveniently located power cable terminations can be accessed from the front or rear. A metal cover prevents exposure to live parts when drive is running.

Application Specific Controls
Each drive is matched to project requirements with custom control components.

Remote Connectivity Module Standard.
On-board Windows® based computer provides access to live variables, parameters & historical fault data.

Communications
An optional communications card can be provided to connect the VFD to the DCS/SCADA system.

RCM

Control & Power Cables
Gland plates are provided to enable cable entry. Top and bottom entry options are selectable onsite.

Remote Connectivity Module
Standard.

Communications
An optional communications card can be provided to connect the VFD to the DCS/SCADA system.
Utility & Motor

**High Input Power Factor. Reduced Electricity Charges.**
The PWM converter maintains a unity power factor across the entire speed range eliminating the need for correction equipment and utility penalties.

**Extremely Low Harmonics. No line-side filter required.**
The MVe2 line side harmonics are much lower than IEEE 519-2014 requirements. Less than 2% current distortion is seen by utility.

**Utility Interruption Protection.**
Momentary power loss & voltage unbalances can cause harmful effects to a motor. The MVe2 VFD control remains active during instantaneous power loss for up to 2 seconds. For power outages longer than 2 seconds, the VFD can regain motor control of a spinning load.

**Utility Energy Return**
The power regeneration function enables stopping of large inertia loads in a short time. During deceleration the rotational energy is returned to the power supply. This reduces energy consumption and electricity costs versus conventional models that can only provide for a coasting stop.
**Engineered Motor-Drive Packages. Single point of contact.**

Through TMEIC’s extensive application expertise, we deliver motor-drive solutions that support your technical and commercial needs from concept to decommissioning.

**Apply to Existing Motors**
The multilevel PWM output waveform approximates a sine wave, reducing dv/dt. Less than 2% I_{THD} and V_{THD}.

- 3-4.16 kV: 9 levels (0 to peak) / 17 levels (peak to peak)
- 6-6.6 kV: 13 levels (0 to peak) / 25 levels (peak to peak)
- 10-11 kV: 21 levels (0 to peak) / 41 levels (peak to peak)

**Rapid Acceleration / Deceleration**
The standard regenerative braking function provides for rapid acceleration and deceleration with quick speed response.
Field Installation

...Made Easy.

<table>
<thead>
<tr>
<th>Client Input Interface</th>
<th>TMdrive-MVe2</th>
<th>Client Motor Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Power</td>
<td>Transformer panel</td>
<td>Control/output panel</td>
</tr>
<tr>
<td>Fan Power</td>
<td>Inverter panel (Example: 4 kV class)</td>
<td></td>
</tr>
<tr>
<td>Control Input (Digital/Analog)</td>
<td>Power supply unit</td>
<td></td>
</tr>
<tr>
<td>LAN Communications (Optional)</td>
<td>+5 V, +15 V, +24 V, -15 V</td>
<td>To control circuit</td>
</tr>
</tbody>
</table>

- **Main Power**
  - Main circuit power supply: 3.3 kV, 4.6 kV, 6.6 kV, 10 kV, 11 kV
  - Other voltage inputs available.
- **Fan Power**
  - 460 V (Other options available)
- **Control Input (Digital/Analog)**
  - Start/Stop Sign
  - Emergency stop signal
  - Speed reference: 0-10 V or 4-20 mA
- **LAN Communications (Optional)**
  - 0-10 V or 4-20 mA

**Control Inputs and Outputs**

- **Input frequency**
- **Output current**

**Motor Outputs**

- **Programmable outputs**
  - 4-20 mA
  - Output current 4-20 mA

**Control Outputs**

- **Incoming circuit breaker (CBS) “Closed”**
  - Input shut-off device trip signal
  - To the trip circuit of incoming circuit breaker

**Field Installation**

- **Client Input Interface**
  - Client Motor Interface
  - Main Power
  - Fan Power
  - Control Input (Digital/Analog)
  - LAN Communications (Optional)

**Control I/O terminals**

- **Door-mounted HMI**
- **Low voltage fan input terminals**

**Motor Output terminals**

- **Incoming power terminals**
- **Motor lead terminals**
An optional lifter cart enables the operator to quickly rack-in/out the power modules.

A convenient isolation switch kills the main power to the VFD to allow for safe servicing.

Drawing type cell inverters shorten MTTR to 30 minutes.

Aluminum mesh air filters can be removed and cleaned while the VFD is running.

**System configurations**

<table>
<thead>
<tr>
<th>Running duty</th>
<th>When appropriately rated, the MVe2 can be applied for continuous duty applications providing:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Running and/or starting duty</td>
<td>TMEIC provides integrated packing of:</td>
</tr>
<tr>
<td>Running and/or starting duty</td>
<td>The MVe2 can be rated either for starting duty and/or running duty. With the appropriate switchgear lineup, the MVe2 control can automatically accelerate the connected motor to match the incoming utility voltage, frequency and phase. The load can then be bumplessly transferred to power source with no surges in torque or current. This allows for sequential starting of multiple motors with a single VFD. In a redundant arrangement, any motor can be started with either VFD, or can be configured as a hot-standby. Alternatively, the VFD can also capture the motor from the utility line and regain speed control.</td>
</tr>
</tbody>
</table>
TMdrive-MVe2 Architecture

Simplified.

Switching Devices
Insulated gate bipolar transistors (IGBT)

DC Link Long Life Capacitors
Dry film type capacitors eliminate replacement (no electrolytic capacitors)

Easy Rack-Out
Convenient handles enable easy removal of power modules

Cooling Heat Sink
Heat transferred from the switching device to the heat sink

Input Fuse
Fused inputs to converter

Control Board
- Board passes pulse width modulated control signal to gate drivers
- Gate driver circuit boards connect directly to IGBTs

Rack In-Rack Out...in 30 minutes.

3-Level (0-peak) Cell inverter module is a patented technology of TMEIC.

Series connected identical inverter cells

Power supply three-phase 50/60 Hz

3.4.10 kV class

M

IGBT Front End Converter
DC Bus Film-Type Capacitors (for extended life)
IGBT Neutral Point Clamped (NPC) Inverter

Film capacitor

M

M

Film capacitor
## Frame Sizes to Fit Your Application

### 4-4.16 kV

<table>
<thead>
<tr>
<th>VFD Outline</th>
<th>Maximum Weight (lbs. (kg))</th>
<th>Approximate Motor Shaft HP (kW) at 4.16 kV</th>
<th>Rated Output Current (A)</th>
<th>Inverter kVA output at 4.16 kV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame 100</td>
<td>9,300 (4,218)</td>
<td>536 (400)</td>
<td>69</td>
<td>500</td>
</tr>
<tr>
<td>Frame 200</td>
<td>9,300 (4,218)</td>
<td>1,085 (810)</td>
<td>138</td>
<td>1,000</td>
</tr>
<tr>
<td>Frame 300</td>
<td>14,285 (6,480)</td>
<td>1,500 (1,120)</td>
<td>191</td>
<td>1,380</td>
</tr>
<tr>
<td>Frame 400</td>
<td>14,285 (6,480)</td>
<td>2,145 (1,600)</td>
<td>262</td>
<td>1,890</td>
</tr>
</tbody>
</table>

### 3-3.3 kV

<table>
<thead>
<tr>
<th>VFD Outline</th>
<th>Maximum Weight (lbs. (kg))</th>
<th>Approximate Motor Shaft HP (kW) at 3.3 kV</th>
<th>Rated Output Current (A) I phase AC*</th>
<th>Inverter kVA output at 3.3 kV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame 100</td>
<td>8,400 (3,800)</td>
<td>220 (164)</td>
<td>35</td>
<td>200</td>
</tr>
<tr>
<td>Frame 200</td>
<td>8,800 (4,000)</td>
<td>330 (246)</td>
<td>53</td>
<td>300</td>
</tr>
<tr>
<td>Frame 300</td>
<td>11,700 (5,300)</td>
<td>440 (328)</td>
<td>70</td>
<td>400</td>
</tr>
<tr>
<td>Frame 400</td>
<td>12,350 (5,600)</td>
<td>1,040 (776)</td>
<td>166</td>
<td>950</td>
</tr>
</tbody>
</table>

* 1: 110% OL for 60 sec. Panel heights include cooling fans. VFD capable of 80% regeneration at nominal voltage at unity power factor.

† Applicable for CSA listed VFD in U.S. and Canada. Frame designation indicates power cell rating for replacement parts and other purposes.
# Frame Sizes to Fit Your Application

## 6-6.6 kV

<table>
<thead>
<tr>
<th>VFD Outline</th>
<th>Maximum Weight lbs. (kg)</th>
<th>Approximate Motor Shaft hp (kW) at 6.6 kV</th>
<th>Rated Output Current (A) I phase AC*</th>
<th>Inverter kVA output at 6.6 kV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame 100</td>
<td>8,400 (3,800)</td>
<td>440 (328)</td>
<td>35</td>
<td>400</td>
</tr>
<tr>
<td></td>
<td></td>
<td>660 (490)</td>
<td>53</td>
<td>600</td>
</tr>
<tr>
<td></td>
<td></td>
<td>880 (656)</td>
<td>70</td>
<td>800</td>
</tr>
<tr>
<td>Frame 200</td>
<td>10,360 (4,700)</td>
<td>1,320 (985)</td>
<td>105</td>
<td>1,200</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1,760 (1,312)</td>
<td>140</td>
<td>1,600</td>
</tr>
<tr>
<td>Frame 300</td>
<td>15,000-15,800 (6,750-7,150)</td>
<td>2,085 (1,555)</td>
<td>166</td>
<td>1,900</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2,400 (1,790)</td>
<td>192</td>
<td>2,200</td>
</tr>
<tr>
<td>Frame 400</td>
<td>15,000-15,800 (6,750-7,150)</td>
<td>2,850 (2,126)</td>
<td>227</td>
<td>2,600</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3,300 (2,460)</td>
<td>263</td>
<td>3,000</td>
</tr>
</tbody>
</table>

*1: 110% OL for 60 sec. Panel heights include cooling fans. VFD capable of 80% regeneration at nominal voltage at unity power factor. Frame designation indicates power cell rating for replacement parts and other purposes.

## 10-11 kV

<table>
<thead>
<tr>
<th>VFD Outline</th>
<th>Maximum Weight lbs. (kg)</th>
<th>Approximate Motor Shaft HP (kW) at 11 kV</th>
<th>Rated Output Current (A) I phase AC*</th>
<th>Inverter kVA output at 11 kV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame 100</td>
<td>16,500 - 17,600 (7,800 - 8,000)</td>
<td>700 (522)</td>
<td>35</td>
<td>660</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1,100 (820)</td>
<td>53</td>
<td>990</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1,400 (1,044)</td>
<td>70</td>
<td>1,320</td>
</tr>
<tr>
<td>Frame 200</td>
<td>16,500 - 17,600 (7,800 - 8,000)</td>
<td>2,200 (1,640)</td>
<td>105</td>
<td>2,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2,900 (2,160)</td>
<td>139</td>
<td>2,640</td>
</tr>
<tr>
<td>Frame 300</td>
<td>29,500 - 29,800 (13,350 - 13,500)</td>
<td>3,400 (2,536)</td>
<td>162</td>
<td>3,080</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4,000 (2,984)</td>
<td>191</td>
<td>3,630</td>
</tr>
<tr>
<td>Frame 400</td>
<td>29,500 - 29,800 (13,350 - 13,500)</td>
<td>4,700 (3,500)</td>
<td>226</td>
<td>4,290</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5,500 (4,100)</td>
<td>263</td>
<td>5,000</td>
</tr>
</tbody>
</table>

*1: 110% OL for 60 sec. Panel heights include cooling fans VFD capable of 80% regeneration at nominal voltage at unity power factor. Frame designation indicates power cell rating for replacement parts and other purposes.
### Cabinet Minimum Clearance Space

<table>
<thead>
<tr>
<th>Drive Class</th>
<th>Frame</th>
<th>Front Side Space</th>
<th>Rear Side Space</th>
<th>Upper Space</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-3.3 kV</td>
<td>1, 2</td>
<td>1,700 mm (5.6 ft / 67 in)</td>
<td>–</td>
<td>300 mm (1 ft / 11.8 in)</td>
</tr>
<tr>
<td></td>
<td>3, 4</td>
<td>1,700 mm (5.6 ft / 67 in)</td>
<td>–</td>
<td>210 mm (0.68 ft / 8.3 in)</td>
</tr>
<tr>
<td>4-4.16 kV</td>
<td>1, 2, 3, 4</td>
<td>1,700 mm (5.6 ft / 67 in)</td>
<td>–</td>
<td>220 mm (0.72 ft / 8.7 in)</td>
</tr>
<tr>
<td>6-6.6 kV</td>
<td>1, 2</td>
<td>1,700 mm (5.6 ft / 67 in)</td>
<td>–</td>
<td>300 mm (1 ft / 11.8 in)</td>
</tr>
<tr>
<td></td>
<td>3, 4</td>
<td>1,700 mm (5.6 ft / 67 in)</td>
<td>–</td>
<td>210 mm (0.68 ft / 8.3 in)</td>
</tr>
<tr>
<td>10-11 kV</td>
<td>1, 2</td>
<td>1,900 mm (6.2 ft / 75 in)</td>
<td>1,000 mm (3.3 ft / 40 in)</td>
<td>300 mm (1 ft / 11.8 in)</td>
</tr>
<tr>
<td></td>
<td>3, 4</td>
<td>1,900 mm (6.2 ft / 75 in)</td>
<td>1,000 mm (3.3 ft / 40 in)</td>
<td>210 mm (0.68 ft / 8.3 in)</td>
</tr>
</tbody>
</table>

### Application Notes

1. Inverter Power (kVA) = \( \frac{\text{Motor Shaft Power (kW)}}{\text{Motor pf x Motor Eff}} \)
   
   Rated Output Current = \( \frac{\text{Inverter Power (kVA)}}{1.732 \times \text{Motor Voltage (L–L)}} \)

   • Ratings based on motor pf = 0.87, Motor Eff = 0.94, ambient temperature is 32°F–104°F (0°C–40°C)
   • Ratings based on a variable torque load (fans, pumps, centrifugal compressors)
   • For constant to secure load consult TMEIC.
   • Altitude above sea level is 0-3300 ft (1-1000 m).
2. Optional bypass circuit can be separately mounted.
3. Redundant cooling fans available as an option.
4. No rear access required except for 10-11 kV VFDs or 13.8 kV VFDs.
5. Incoming power cabling and motor cabling are bottom entry, top entry is standard for CSA design, option for IEC
6. Air is pulled through the filters in the cabinet doors and vented out top.
7. Available options include motor cooling fan control, cabinet space heater, sync motor control, smooth transfer to and from utility, motor space heater control, RTD, monitor redundant fans, output sine wave filters, and others.
8. For conservative sizing of HVAC equipment, use 3kW of heat rejection per 100 hp of motor power.
9. The panels include channel bases attached to the cabinets before shipment.
10. This table presents only a sample of voltages and horsepower ratings. Other options such as 13.8 kV input are available.
Specifications

**VFD Power Input**
- Mains input voltage: Up to 13.8 kV, 3-phase, ±10%
- Complete power loss ride-thru of 300 ms.
- Input frequency: 50/60 Hz, ±5%
- Power factor: Unity at all loads and speed
- Harmonics: Lower than IEEE 519-2014 standard, No line-side filters required, <2% I_{1h}
- Converter type: AC fed active front end
- Power semiconductor technology: Low loss IGBT
- Transformer: Dry type, aluminum wound, H-type
- Auxiliary power: Control power (internal), Fan power: 380V-690V (external)

**VFD Power Output**
- Output Voltage: 3/3.3 kV, 4.16 kV, 6/6.6 kV, 10/11 kV
- Output Frequency: 0-120 Hz for 3/3.3 kV, 4.16 kV, 6/6.6 kV, 0-72 Hz for 10/11 kV inverters
- Output Voltage Levels: 9/17-levels for 3/3.3 kV, 4.16 kV, 13/25 levels for 6/6.6 kV, 21/41 levels for 10/11 kV
- Number of cell modules in series per phase: 2 for 3/3,3 kV and 4.16 kV, 3 for 6/6.6 kV, 5 for 10/11 kV
- Overall Efficiency: >98.5 %, Including auxiliaries & isolation transformer
- Power Semiconductor Technology: Low loss IGBT

**Digital I/O**
- Digital Input: Qty. (5)
- Dedicated Function Input: Qty. (1)
- Configurable (programmable) Function Input: Qty. (4)
- Digital Relay Output: Qty. (8)
- Digital 24V Outputs: Qty. (4)

**Control**
- Speed feedback encoder input: High resolution tach, 10 kHz, 5 or 15 V DC diff. input, A quad B, with marker
- Motor temperature sensor option: High resolution temperature protection relay: 100 Ohm platinum RTD, 14 channels

**Environmental**
- Operating Temperature: 0 to 40°C (32° to 104°F) at rated load
- Storage Temperature: -25° to +70°C, indoor storage only
- Relative Humidity: Up to 95%, non-condensing
- Altitude: Up to 1000m (3300 ft), Higher altitude available with derating
- Vibration: 0.3G max, 2Hz< f<9Hz: Half amplitude sine wave is within 0.9m, 9Hz< f<100Hz: Vibration acceleration is <3m/s²
- Cooling: Air-cooled with fans on top and air intake on front
  - For 10/11kV inverter, air intake in rear also

**Mechanical**
- Enclosure: NEMA 1, Gasketed
- Cable Entrance: Top or bottom, Selectable on-site
- Noise: ~76-80 dBA at 3.1 ft from enclosure
- Mean Time To Repair (MTTR): 30 minutes to replace power module
- Mean Time Between Failure (MTBF): 16 years
- Code conformance: Applicable IEC, JIS, JEM, UL, CSA and NEMA standards
- Equipment marking: 4.16 kV variant only

**Motor Control and Protection**
- Vector Control Accuracy:
  - Speed response: 20 rad/sec
  - Speed regulation without speed sensor ± 0.5%
  - Speed Control Range: 5 - 100%

**Control**
- Non-volatile memory for parameters and fault data
- Vector control with/without speed feedback, or Volts/Hz
- Designed to keep running after utility supply transient voltage drop outs of 300 ms
- Synchronous transfer to line (option)
- Synchronous motor control (option)

**Major Protective Functions**
- Inverter overcurrent, overvoltage
- Cooling fan abnormal
- Motor ground fault
- Low or loss of system voltage
- Over-temperature
- DC bus voltage
- Voltage/current unbalance
- 5/20 min. overload
- Loss of speed reference
- Input Voltage phase loss
- VFD output open
- Transformer overheat

For specifications not mentioned here, contact TMEIC.
Empower Your Crew: Local and Remote Control

The MVe2 keypad, coupled with the Windows® based TMdrive Navigator brings productivity to your commissioning and maintenance activities.

The Navigator tool helps maintain TMEIC drives in the field. Any user can easily access current drive expertise & know-how.

Compatible with OS Windows 7 and Professional 32-bit

High speed data is automatically captured and saved in the event of a drive fault. Users can capture high speed data based on their own trigger conditions or perform high resolution real-time trending.

Live block diagrams provide a real-time graphical view of drive functions. Functions can be configured directly from the graphical view.

Product documentation is integrated into tool. Users can capture their own notes to benefit future troubleshooting.

Operator Keypad (Standard)

High Function Display
- LCD backlight gives great visibility & long life
- Bar graphs, icons, menus, and digital values combine to provide concise status information, often eliminating the need for traditional analog meters

RJ-45 Ethernet port is used for the TMdrive Navigator

Instrumentation Interface
- Two analog outputs are dedicated to motor current feedback
- Five analog outputs are mapped to variables for external data logging and analysis

Easy to understand navigation buttons allow quick access to information without resorting to a PC based tool

Switch to local mode to operate the equipment from the keypad

Interlock button disables the drive

Multilingual Keypad (Optional)

An optional touch screen display is available with 9 languages built in. The graphic display is easy to read and understand and contains all of the same functions as the standard keypad.
At TMEIC, we provide highly reliable automation systems, additionally TMEIC offers remote connectivity with RCM®. Protection for your investment, by reducing downtime and lowering repair costs.

Remote drive connectivity requires an internet connection between your facility and TMEIC for retrieval of fault logs and files for diagnosing drive upsets. The RCM® enables seamless integration between drives and support engineers.

### TMEIC Remote Connectivity Philosophy

- **Cost Analysis**
  - **With RCM®**: Realized Savings
  - **Without RCM®**: Field engineer expenses

### Features

<table>
<thead>
<tr>
<th>Features</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduced downtime &amp; mean-time-to-repair</td>
<td>Quick support saves thousands in lost production. TMEIC engineers can quickly connect to the drive and diagnose many issues in minutes.</td>
</tr>
<tr>
<td>Secured connection</td>
<td>Customer-controlled access. All remote activity is conducted with permission of the customer. Drive start/stop is not permitted remotely.</td>
</tr>
<tr>
<td>Fault upload utility</td>
<td>Proprietary fault upload software. RCM® can monitor key real-time parameters. Historical drive faults are pushed automatically to the computer. This enables TMEIC engineers to analyze the issue resulting in the fault and provide a more coherent solution.</td>
</tr>
<tr>
<td>Industrial computer</td>
<td>Rugged computer for the most demanding applications. Fanless computer withstands high vibration and temperature ranges in a small DIN-rail mounted footprint</td>
</tr>
<tr>
<td>Multiple ethernet/serial ports</td>
<td>Flexible connectivity. The module can be connected to two separate LANs along with a host of serial talking USB devices.</td>
</tr>
</tbody>
</table>
North American Sales and Service Network

Whether the equipment is up and running or experiencing downtime, live help from TMEIC is a phone call away. With bases in North America and around the world, regional TMEIC companies and TMEIC motor service shops provide reliable support whenever needed.

- 77 TMEIC VFD Service Engineers
- 43 Motor service locations
- Authorized VFD service providers
- Authorized MV Motor Repair Technicians

Service 24/7 – Talk to a service engineer, we’re available when you need us
### Quote Contact Information

- **Customer Reference:**
- **Quote Due Date:**
- **Project Name:**
- **Equipment Delivery Date:**
- **Contact Name:**
- **# of Units Required:**
- **Contact Number:**
- **TMEIC Representative:**

*Please complete one request for each unique motor rating*

### Driven Equipment & Motor Details

- **Type of load:**
  - Fan
  - Pump
  - Compressor
  - Other (specify): ____________

- **Torque profile:**
  - Variable
  - Constant
  - Other (specify): ____________

- **Gear box ratio:** ____________ to ____________

- **Speed range:** ____________ Hz to ____________ Hz

- **Load torque/speed curve provided:**
  - Yes
  - No

- **Regeneration:**
  - Yes
  - No

- **Breakaway torque:**
  - 0% - 100%
  - 101% - 150%
  - >150%

- **Overload Rating for 1 minute:** ____________

- **Motor power (HP):** ____________

- **Motor voltage (V):** ____________

- **Motor full load (A):** ____________

- **Motor Speed (RPM):** ____________

- **New Motor**
- **Existing Motor**

- **Service factor:** ____________

- **Motor space heater (Control):**
  - By ASD
  - By Others

- **Motor RTD: Qty.** ____________

- **Type:** ____________

- **To others (specify):** ____________

- **Encoder:**
  - Yes
  - No

- **Cable distance from motor to ASD:** ____________ ft

- **Inverter duty motor:**
  - Yes
  - No

- **Motor rated to start direct-on-line:**
  - Yes
  - No

### Utility Supply & Environment

#### *System Voltage:*
- 2400V
- 3300V
- 4160V
- 6900V
- 13800V
- Other: ____________ V ± ____________ %

#### Power System One-line Diagram Provided:
- Yes
- No

#### *Line frequency:*
- 60 Hz
- 50 Hz

#### ASD auxiliary three-phase power:
- End user supplied
- Internal to ASD

#### Control power:
- End user supplied
- Internal to ASD

#### *Site location:*
- ASD cabinet space heater? *Yes* *No*

- **Elevation:** ____________ meters above sea level

- **ASD enclosure:**
  - NEMA 1
  - NEMA 3R

- **Electrical room provided by:**
  - TMEIC
  - Others

- **Elec. room max. ambient:** ____________ °C

- **Humidity:** ____________ % (non-cond.)

- **Elec. room min. ambient:** ____________ °C

- **Humidity:** ____________ % (non-cond.)

- **Outdoor contamination (eg: corrosive gases):** ____________

- **Download more copies**
  (http://tinyurl.com/ASDchecklistTMEIC)
### ASD Design/Requirements Performance

<table>
<thead>
<tr>
<th><strong>ASD Design Standards</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>□ UL347A or □ IEC61800-5-1</td>
<td></td>
</tr>
<tr>
<td>□ Other/National/Local: ___________________________</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>ASD Cooling Method</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Air-cooled □ Water cooled</td>
<td></td>
</tr>
<tr>
<td>Site cooling water for ASD use: □ Yes □ No</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Input ASD Switchgear</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>□ TMEIC or □ Others</td>
<td></td>
</tr>
<tr>
<td>If other, provide detail: ___________________________</td>
<td></td>
</tr>
</tbody>
</table>

| **Cable entry** | □ Top □ Bottom |  |

| **ASD Duty Cycle** | □ Continuous duty □ Starting only |  |

<table>
<thead>
<tr>
<th><strong>Bypass operation</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Direct-on-line starter</td>
<td></td>
</tr>
<tr>
<td>□ Solid state starter</td>
<td></td>
</tr>
<tr>
<td>□ Synchronous transfer by ASD</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Synchronous transfer by ASD</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of motors: _________</td>
<td></td>
</tr>
<tr>
<td>Bypass gear □ By TMEIC □ By Others</td>
<td></td>
</tr>
<tr>
<td>If others, provide gear details: ___________________________</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Testing</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>□ ASD standard client witness test</td>
<td></td>
</tr>
<tr>
<td>□ ASD witness client test with dynamometer</td>
<td></td>
</tr>
<tr>
<td>□ ASD/Motor combined test at external test facility</td>
<td></td>
</tr>
<tr>
<td>Other tests: ___________________________</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Motor Protection</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(Not necessary for continuous ASD operation)</td>
<td></td>
</tr>
<tr>
<td>□ 6 channel RTD RELAY</td>
<td></td>
</tr>
<tr>
<td>□ MULTILIN 369</td>
<td></td>
</tr>
<tr>
<td>□ MULTILIN 469</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Spares</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Spare parts kit: □ Yes □ No</td>
<td></td>
</tr>
<tr>
<td>Spare Power Module: □ Yes □ No</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>ASD Controls and Indications</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Volts/Hz speed control</td>
<td>□ Master-follower</td>
</tr>
<tr>
<td>□ Sensorless vector</td>
<td>□ 0.5% without tachometer</td>
</tr>
<tr>
<td>□ Closed loop vector control</td>
<td>□ 0.01% with tachometer</td>
</tr>
<tr>
<td>□ Other</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Communication Options</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>□ EGD</td>
<td>□ DEVICENET</td>
</tr>
<tr>
<td>□ PROFIBUS</td>
<td>□ ACU Cond.</td>
</tr>
<tr>
<td>□ MODBUS RTU/PLUS</td>
<td>OTHER ________________</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Indications</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>□ ASD fault indication</td>
<td>□ Local/remote selector switch</td>
</tr>
<tr>
<td>□ ASD alarm indication</td>
<td>□ ASD run indication</td>
</tr>
<tr>
<td>□ Start</td>
<td>□ ASD ready indication</td>
</tr>
<tr>
<td>□ Emergency stop button</td>
<td>□ Stop push button</td>
</tr>
<tr>
<td>□ Fault clear button</td>
<td>□ Other</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Options</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Kirk key interlocks: □ Yes □ No</td>
<td></td>
</tr>
<tr>
<td>4 20mA Isolated Analog Outputs □ Yes □ No</td>
<td></td>
</tr>
<tr>
<td>□ Speed □ Current □ Voltage</td>
<td></td>
</tr>
<tr>
<td>□ Load □ Other ________________</td>
<td></td>
</tr>
<tr>
<td>Redundant fan □ Yes □ No</td>
<td></td>
</tr>
<tr>
<td>Additional controls □ Yes □ No (attach control schematic)</td>
<td></td>
</tr>
<tr>
<td>Additional notes: ___________________________</td>
<td></td>
</tr>
</tbody>
</table>

Note: All TMEIC ASDs are manufactured with standard digital I/Os, Analog I/Os, push buttons, and indications as specified in the Application Guide.
TMEIC AC Drives Offer Complete Coverage

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