TMdrive®-MVe2 Series Product Application Guide

Energy Saving Medium Voltage Inverter
Energy Saving Medium Voltage Inverter

Improved Productivity
- Regenerative Braking is standard.
- Fast acceleration/deceleration operations are available.
- High response and stable operations are available under sensorless vector control.

Energy Savings
- Application of an inverter saves energy by enabling improved process control. Wasted energy can be reduced, resulting in a more efficient process.

Installation & Maintenance Cost Savings
- Small footprint and height allows for economical transportation and installation.
- Reliability, life cycle cost and maintenance time minimized by using film capacitors and extended life fans.

Power Supply Friendly
- The TMdrive-MVe2 has very low harmonic levels and low inrush currents.
- Unity (1.0) input power factor contributes to an electricity cost reduction and a smaller power supply requirement for on-site power capacity.

Simple Commissioning, Operation & Troubleshooting
- The Auto-tune function assists with commissioning, allowing for a shorter startup time and lower commissioning costs. TMEIC’s Drive Navigator software make troubleshooting simple and can help reduce downtime.
Improved Productivity

Rapid acceleration/deceleration

The standard regenerative braking function provides for rapid acceleration/deceleration operation with quick speed response.

Stable speed control without a speed sensor

• A speed sensor is not required, improving reliability
• Sensorless vector control using a theory of vector operations achieves stable speed control
• For applications requiring a large starting torque, vector control using a speed sensor is available
• An auto-tuning function is standard

Robust protection against power supply fluctuations

• Wide operating range in the event of a voltage drop. The rated voltage output is available when the power supply voltage drops. (Only limited by the overload capacity.)
• Ride-through control during an instantaneous power failure is available for a duration as high as 2 seconds. When a power failure for 2 seconds or shorter occurs, torque output is reduced to zero without tripping, and then returns after power returns.
• Automatic restart can be performed after power failure for 2 seconds or longer. (Automatic re-acceleration of the load is possible.)

Enhanced applications

• Since the TMdrive-MVe2 output current contains extremely low harmonic content, torque ripples are negligible. By suppressing the torsional vibration torque caused by resonance of mechanical systems, stable control of the machine is assured.

• TMdrive-MVe2 supports constant-torque loads, such as extruders or mixers (which require high starting torque), or conveyors and reciprocating compressors, etc., (which may require regenerative function).
• TMdrive-MVe2 can be used as a motor soft starter in an application with a large inertia, which may be susceptible to problems with voltage drop, starting frequency, etc. when the motor is started by commercial power supply. Multiple motors can be started independently with the appropriate switchgear lineup.
• TMdrive-MVe2 can control induction or synchronous motors.

Short MTTR

Drawer type cell inverters shorten MTTR to 30 minutes.
Power Supply Friendly

### Input harmonic mitigation

The PWM converter arrangement of the TMdrive-MVe2 performs better than IEEE-519 requirements, without the use of harmonic filters.

In fact, the TMdrive-MVe2 outperforms a 36 pulse system, with only 2% current distortion!

Lower order harmonics (like the fifth and seventh) are reduced as compared to diode converters.

#### TMdrive-MVe2 relative harmonic content on the input side (actual load test measurements of the 1600 kVA frame)

<table>
<thead>
<tr>
<th>Order</th>
<th>5th</th>
<th>7th</th>
<th>11th</th>
<th>13th</th>
<th>17th</th>
<th>19th</th>
<th>23rd</th>
<th>25th</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative harmonic content (%)</td>
<td>1.0</td>
<td>0.45</td>
<td>0.16</td>
<td>.08</td>
<td>0.08</td>
<td>0.06</td>
<td>0.04</td>
<td>0.08</td>
</tr>
<tr>
<td>IEEE-519 (1992) (%)</td>
<td>4.0</td>
<td>4.0</td>
<td>2.0</td>
<td>2.0</td>
<td>1.5</td>
<td>1.5</td>
<td>0.6</td>
<td>0.6</td>
</tr>
</tbody>
</table>

### High input power factor

The PWM converter enables operations with unity (1.0) power factor across the entire speed range.

Utility charges will be reduced as compared with drives operating at a lagging power factor. For example, a diode converter operating with a 95% power factor will require almost 5% more current than a comparable drive operating at 1.0 power factor.

Since power factor correction equipment is not required, capital investment costs can be saved. Even when the load fluctuates, stable input power factor is assured.

### Excitation inrush current reduction

A pre-charge reactor circuit is utilized for larger frames to limit the excitation inrush current for the input transformer and reduce the voltage drop in the system.
Installation and Maintenance Cost Savings

**Compact Footprint**

- The compact design contributes to significant construction cost reduction (the enclosure height is 2100 mm up to 6.6 kV-3000 kVA class)\(^2\)
- Units up to 6.6 kV-1600 kVA\(^2\) can be transported as a single enclosure, simplifying transport, unloading and installation.
- Single enclosure makes Installation safe and straightforward
- For export to overseas destinations, the low-height enclosure allows transportation in general-purpose containers, making transportation easy and lowering costs.
- The TMdrive-MVe2 is designed for front maintenance, resulting in a smaller footprint and saving floor space.\(^3\)
- Transformer can be mounted remotely from the power electronics when space is limited.

**Reduced load on air conditioning systems**

- When there is limited space in the switchroom, the input transformer can be installed externally (optional). The switchroom heating load can be reduced (by 50%), which reduces the load to the air conditioning system.
- Operating costs of the air conditioning system are reduced significantly

**Lower Maintenance Costs**

- Maintenance-free film capacitors used for DC bus energy storage do not need replacement, significantly reducing the operating cost compared to electrolytic capacitors.
- Extended life ventilation fans are used, reducing maintenance costs and down time.
  - Conventional Fans: 3 year life
  - TMdrive-MVe2 Fans: 7 year life

**Can be used with existing motors**

- The multilevel PWM output waveform approximates a sine wave, reducing voltage steps and peaks.
- By utilizing a proprietary switching shift control, an output filter is not required. Motors do not require surge protection.

**Easy wiring of control circuit**

- Insertion type spring terminals are used for the control circuit. The terminals are highly reliable and facilitate easy wiring. Terminals to suit ring-type crimp lugs are also available (option).
Energy Savings

Energy savings with speed control

- In variable torque load applications such as fans, pumps or blowers, variable speed operation of inverters achieves significant energy saving effect as compared to the constant speed operation using a commercial power supply (50 Hz or 60 Hz).
- When motor speed control is used in applications such as fans, pumps or blowers:
  - Air volume (flow) is proportional to Speed
  - Required power is proportional to (Speed)³. For example, when 80% air volume (flow) is required, significant power saving can be achieved by performing the speed control: Required power = (80%)³ ≈ 50%

Pump Application

Boiler Application

Conveyor Application

Regenerative power feedback to the power supply

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, which contributes to a reduction in energy consumption and a reduction in electricity costs.

Calculation examples

A machine which decelerates with 1500 kW power in 15 minutes, with a 25% torque
→ Each time it is stopped, power equivalent to 50 kWh is generated.*1

*1 Mechanical losses and losses in the motor and the inverter are not included.

High Efficiency

The TMdrive-MVe2 has low switching losses of the main circuit elements. Low input side harmonic currents not only result in low losses, but also contributes to improvement of the efficiency of the equipment as a whole by eliminating harmonic filters or power factor improving capacitors.*
TMdrive-MVe2 variable speed drive system has conversion efficiency of 97%.
* At rated speed and full load.

Regenerative Braking of a conveyor application allows saving of energy during each conveyor stop. Regenerative operation of downhill conveyors allows long term energy savings.
Energy Savings Payback Analysis

Replacing a mechanical speed control device with an adjustable speed drive usually produces large energy savings, plus a reduction in maintenance costs. This appendix outlines how the energy savings can be calculated as follows:

1. Calculate the cost of energy used by the electric drive speed control system, outlined on this page.
2. Calculate the cost of energy used by the mechanical speed control system, as outlined on this page.

The difference is the energy cost savings. Typical power consumption curves for pumps and fans are shown below.

Below is an example of the energy cost calculation for a pump driven by a motor and electric drive. Since energy consumption varies with speed and flow, you need the load profile table which shows the number of hours running at the various flows. Refer to the example below.

### Energy Cost for Electric Drive Speed Control

<table>
<thead>
<tr>
<th>Step</th>
<th>Calculation details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>Select the desired pump output flow, for example, 90%, and number of hours/day at this flow, for example, 12.</td>
</tr>
<tr>
<td>Step 2</td>
<td>Obtain the variable speed pump performance chart and the load pressure-flow curve, which is the flow resistance of the process being fed.</td>
</tr>
<tr>
<td>Step 3</td>
<td>Find the pump input power</td>
</tr>
<tr>
<td>Step 4</td>
<td>Convert the input shaft hp to shaft kW Conversion: Horsepower x 0.746 = kW</td>
</tr>
<tr>
<td>Step 5</td>
<td>Obtain the electric motor efficiency Example: Induction motor efficiency 95.7% from manufacturer’s data sheets (find each at RPM)</td>
</tr>
<tr>
<td>Step 6</td>
<td>Obtain the adjustable speed drive efficiency Example: Drive efficiency 95.5% from manufacturer’s data sheets (find each at RPM)</td>
</tr>
<tr>
<td>Step 7</td>
<td>Obtain the electric power cost Example: Energy cost - $0.07/kWh. Calculate cost for the hours at this flow from load profile; in this example it is 12 hours/day.</td>
</tr>
</tbody>
</table>

Overlay the load pressure-flow curve on the pump chart and find the pump input shaft horsepower at the 90% flow (point B). You need the load profile. See example below.

Pump input power at N2 rpm = 1,500 hp at point B, 90% flow.

### Daily Load Profile (example)

<table>
<thead>
<tr>
<th>Operation Hours/Day</th>
<th>5</th>
<th>12</th>
<th>5</th>
<th>1</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent Flow</td>
<td>100%</td>
<td>90%</td>
<td>80%</td>
<td>70%</td>
<td>60%</td>
</tr>
</tbody>
</table>

Energy cost = $1,212 kW x 0.075 kWh x 12 hrs/day x 365 days/year = $371,500 per year. (Repeat calculation for other flows in load profile and total).
Simple Commissioning, Operation & Troubleshooting

An LCD keypad is included for operator interface. The inverter status can be monitored on the easy-to-view display screen. Parameter setting and troubleshooting can be also performed easily.

LCD Graphic Keypad Display
<240X64 dots, monochrome>
- Operating status display
- Fault information display
- Parameter display

Operation panel indicators:
- Main functions
  - Parameter input/change
  - Display mode switching
  - Location/remote switching
- Discharge check LED
- Fault reset switch
- Interlock switch
- Analog output check pins
  - Current feedback output - 2 channels
  - Analog output for measurement/monitoring - 5 channels

Multilingual Touch Display (option)
An optional touch screen display is available with 9 languages built in. The graphic display is easy to read and understand. It contains all of the same functions as the standard keypad.

Drive Troubleshooting
This screen displays a drive first fault and shows selected trend displays to assist in determining the cause. The fastest trend displays four variables sampled at a rate of 333 microseconds. The other two slower trends are sampled at 1 millisecond and 100 milliseconds.

Available Troubleshooting Functions:
- First fault display
- Operation preparation display
- Fault trace back
- Trouble records
- Fault history display
- Online manual

Control of multiple motors with a single drive
With the appropriate switchgear lineup, the TM-MVe2 control can automatically accelerate the connected motor to match the incoming utility voltage, frequency and phase. The load can then be connected to the power source with no surges in torque or current. This allows for sequential starting of multiple motors with any of the motors operating under variable speed control.
The TMdrive-MVe2 consists of a dedicated input transformer and a single phase IGBT inverters (cell inverters). Six cell inverters are connected for 3 kV/4 kV class, nine inverters for 6 kV class, and fifteen inverters for 11 kV class, which allows three-phase high voltage AC output of 3 kV, 4 kV, 6 kV, and 11 kV respectively.

**Control Block Diagram**

The sensorless vector control offers strong and smooth operations.

The 32 bit microcomputer is specially designed for power electronics and allows for extremely reliable operation. (Vector control with a speed sensor is also available depending on accuracy or high starting torque requirements. An open loop type V/f control is also available.)
Standard connection diagram

![Diagram showing connection between transformer panel, inverter panel, and control/output panel.]

**Customer ➔ Inverter**

<table>
<thead>
<tr>
<th>Connection</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main circuit power supply</td>
<td>Main circuit power supply</td>
<td>400V-50 Hz/440 V-60 Hz/Other options</td>
</tr>
<tr>
<td>Control/fan power supply*</td>
<td>Control/fan power supply</td>
<td>Dry contact: 24 VDC-12 mA</td>
</tr>
<tr>
<td>Start/stop signal</td>
<td>“Closed” to operate, “opened” to stop</td>
<td>Dry contact: 24 VDC-12 mA</td>
</tr>
<tr>
<td>Emergency stop signal</td>
<td>“Closed” during normal operation, “opened to initiate an emergency stop (coast-to-stop)</td>
<td>Dry contact: 24 VDC-12 mA</td>
</tr>
<tr>
<td>Incoming contactor status signal</td>
<td>“Closed” when the circuit breaker is closed</td>
<td>Dry contact: 24 VDC-12 mA (if an output contactor is installed)</td>
</tr>
<tr>
<td>Output circuit breaker status signal</td>
<td>“Closed” when the circuit breaker is closed</td>
<td>Input impedance 1M (0-10 V)</td>
</tr>
<tr>
<td>Speed reference signal</td>
<td>0-10 V = 0-100% or 4-20 mA = 0-100%</td>
<td>Input impedance 10 (4-20 mA)</td>
</tr>
</tbody>
</table>

* Separate step-down transformer for the control power supply (from 440 V to 120 V) (option)

**Inverter ➔ Customer**

<table>
<thead>
<tr>
<th>Connection</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation ready signal</td>
<td>“Closed” when inverter is ready for operation</td>
<td>Dry contact (max. 220 VAC-0.8 A, 110 VDC-0.2 A, 24 VDC-1.5 A)</td>
</tr>
<tr>
<td>Running signal</td>
<td>“Closed” when the inverter is running</td>
<td>Dry contact (max. 220 VAC-0.8 A, 110 VDC-0.2 A, 24 VDC-1.5 A)</td>
</tr>
<tr>
<td>Fault signal</td>
<td>“Closed” when an inverter fault occurs</td>
<td>Dry contact (max. 220 VAC-0.8 A, 110 VDC-0.2 A, 24 VDC-1.5 A)</td>
</tr>
<tr>
<td>Emergency stop signal</td>
<td>“Closed” when an inverter fault occurs (for tripping incoming circuit breaker)</td>
<td>Dry contact (max. 220 VAC-0.8 A, 110 VDC-0.2 A, 24 VDC-1.5 A)</td>
</tr>
<tr>
<td>Incoming circuit breaker trip signal</td>
<td>4-20 mA = 0-125% current</td>
<td>Dry contact: 24 VDC-12 mA (if an output contactor is installed)</td>
</tr>
<tr>
<td>Output current</td>
<td>“Closed” when the circuit breaker is closed</td>
<td>Resistive load 500 Ω or lower</td>
</tr>
<tr>
<td>Motor speed</td>
<td>4-20 mA = 0 to 125% speed</td>
<td>Resistive load 500 Ω or lower</td>
</tr>
</tbody>
</table>
## Standard Specifications

### Standard Rating

<table>
<thead>
<tr>
<th>Item</th>
<th>3.3/3.0 kV</th>
<th>4.16 kV</th>
<th>6.6/6.0 kV</th>
<th>11 kV</th>
</tr>
</thead>
<tbody>
<tr>
<td>At 3.3 kV output (kVA)</td>
<td>200 300 400 600 800 950 1100 1300 1500</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cell frame (frame)</td>
<td></td>
<td>100 200 300 400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overload (60 sec.)</td>
<td></td>
<td></td>
<td>110%</td>
<td></td>
</tr>
<tr>
<td>Rated current (A)</td>
<td></td>
<td></td>
<td>35 53 70 105 140 166 192 227 263</td>
<td></td>
</tr>
<tr>
<td>Applicable motor output (kW)*1</td>
<td></td>
<td></td>
<td>160 250 320 450 650 750 900 1000 1250</td>
<td></td>
</tr>
<tr>
<td>At 4.16 kV output (kVA)</td>
<td>500 1000 1380 1890</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cell frame (frame)</td>
<td></td>
<td>100 200 300 400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overload (60 sec.)</td>
<td></td>
<td></td>
<td>110%</td>
<td></td>
</tr>
<tr>
<td>Rated Current (A)</td>
<td></td>
<td></td>
<td>69 138 191 262</td>
<td></td>
</tr>
<tr>
<td>Applicable motor output (kW*1)</td>
<td></td>
<td></td>
<td>400 810 1120 1600</td>
<td></td>
</tr>
<tr>
<td>At 6.6 kV output (kVA)</td>
<td>400 600 800 1000 1200 1400 1600 1900 2200 2600 3000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cell frame (frame)</td>
<td></td>
<td>100 200 300 400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overload (60 sec.)</td>
<td></td>
<td></td>
<td>110%</td>
<td></td>
</tr>
<tr>
<td>Rated Current (A)</td>
<td></td>
<td></td>
<td>35 53 70 87 105 122 140 166 192 227 262</td>
<td></td>
</tr>
<tr>
<td>Applicable motor output (kW*1)</td>
<td></td>
<td></td>
<td>315 450 650 810 1000 1130 1250 1600 1800 2250 2500</td>
<td></td>
</tr>
<tr>
<td>At 11 kV output (kVA)</td>
<td>660 990 1320 2000 2640 3080 3630 4290 5000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cell frame (frame)</td>
<td></td>
<td>100 200 300 400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overload (60 sec.)</td>
<td></td>
<td></td>
<td>110%</td>
<td></td>
</tr>
<tr>
<td>Rated Current (A)</td>
<td></td>
<td></td>
<td>35 53 70 105 139 162 191 226 263</td>
<td></td>
</tr>
<tr>
<td>Applicable motor output (kW*1)</td>
<td></td>
<td></td>
<td>500 800 1000 1600 2040 2500 2800 3500 3860</td>
<td></td>
</tr>
</tbody>
</table>

*1 Approximate value for the standard 4-pole motor

### Standard Specifications List

<table>
<thead>
<tr>
<th>Item</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>Output frequency (Hz)</td>
</tr>
<tr>
<td>Overload capacity</td>
<td>110 % - 60 seconds</td>
</tr>
<tr>
<td>Main circuit</td>
<td>Three-phase 3000, 3300, 4160, 6000, 6600, 11000 V - 50/60 Hz</td>
</tr>
<tr>
<td>Control/fan circuit</td>
<td>400 - 50 Hz/440 V-60 Hz/Other options available</td>
</tr>
<tr>
<td>Permissible function</td>
<td>Voltage: ±10%, frequency: ±5 %</td>
</tr>
<tr>
<td>Input power factor/regenerative capacity</td>
<td>Fundamental wave power factor of approximately pf=1.0, regenerative capacity of 80%</td>
</tr>
<tr>
<td>Control method</td>
<td>Sensorless vector control, vector control with sensor, or V/f control + Multi level PWM (Pulse Width Modulation)</td>
</tr>
<tr>
<td>Frequency accuracy</td>
<td>±0.5% for maximum output frequency (for the analog frequency reference input)</td>
</tr>
<tr>
<td>Load torque characteristic</td>
<td>Variable torque load, constant-torque load</td>
</tr>
<tr>
<td>Acceleration/deceleration time</td>
<td>0.1 to 3270 seconds, individual setting possible (Setting depends on the load GD2)</td>
</tr>
<tr>
<td>Primary control functions</td>
<td>Soft stall (Programmable speed reduction for fans and pumps during periods of overload), Ride-through control during instantaneous power failures, break point acceleration/deceleration function, specific frequency evasion function, continuous operation function during speed reference loss, total run time display function</td>
</tr>
<tr>
<td>Primary protective functions</td>
<td>Current limit, overcurrent, overvoltage, overload, load side ground fault, undervoltage, CPU error, cooling fan fault, etc.</td>
</tr>
<tr>
<td>Display Functions</td>
<td>Input Transformer</td>
</tr>
<tr>
<td>-------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Display</td>
<td>Class H, dry type, TMdrive-MVe2 dedicated specifications (External options available)</td>
</tr>
<tr>
<td>Push buttons</td>
<td>NAVIGATION key, CONTROL key, Operation, stop, fault reset, interlock (drive run inhibit)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Electrical standards: JEC, IEC Component and others: JIS, JEC, JEM
The TMdrive-Navigator tool helps you maintain TMEIC drives yourself. Engineers and technicians are empowered to understand how the drive works and what the drive is doing. Any user can easily access current drive expertise and know-how.

Desktop-like search technology links topical signal lists, block diagrams, help files, product documentation, change history, and user notes. Windows techniques facilitate navigation within a drive and across the system. The status of all drives is always in view.

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

Fault data can be automatically “pushed” to key users. The client-server architecture allows access to high performance data from remote locations – with the same resolution as if you were in the plant.

Wizards support tuning of drive functions.

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 right into the tool. Users can even capture their own notes to benefit future troubleshooting.

Compatible with:
• OS Windows 7
• Professional 32 bit
At TMEIC, we provide highly-reliable automation systems. Sometimes even the best systems can experience faults. For events we can’t foresee, TMEIC offers remote connectivity with RCM® - protection for your investment, by reducing downtime, lowering repair costs and providing peace of mind.

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

### TMEIC Remote Connectivity Philosophy

- **Plant Operations**
- **Internet**
- **Plant Router**
- **Firewall**
- **TMEIC Drives**
- **RCM®**
- **TMEIC Support**
- **Firewall**

* Connectivity subject to customer IT department’s permission

### Features

<table>
<thead>
<tr>
<th>Features</th>
<th>Benefits</th>
</tr>
</thead>
</table>
| **Reduced downtime & Mean-Time-to-Repair** | **Quick support saves thousands of $ in lost production**  
TMEIC engineers can quickly connect* to the drive and diagnose many issues in a matter of minutes. |
| **Secured connection**           | **Customer-controlled access**  
All remote activity is conducted with permission of the customer. Drive start/stop is not permitted remotely. |
| **Fault Upload Utility**         | **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. |
| **Industrial computer**          | **Ruggedized computer for the most demanding applications**  
Fan-less computer withstands high vibration and temperature ranges in a small DIN-rail mounted footprint |
| **Multiple ethernet/serial ports** | **Flexible connectivity**  
The module can be connected to two separate LAN’s along with a host of serial-talking/USB devices. |
TMEIC AC Drives Offer Complete Coverage

Global Office Locations:

**TMEIC Corporation**
Office: 1325 Electric Road, Suite 200  
Roanoke, VA, United States 24018  
Mailing: 2060 Cook Drive  
Salem, VA, United States 24153  
Tel.: +1-540-283-2000; Fax: +1-540-283-2001  
Web: www.tmeic.com  
Email: info@tmeic.com

**TOSHIBA MITSUBISHI-ELECTRIC INDUSTRIAL SYSTEMS CORPORATION**
Tokyo Square Garden, 3-1-1 Kyobashi  
Chuo-ku, Tokyo, 104-0031 Japan  
Tel: +81-(0)3-3277-551 1  
Web: www.tmeic.co.jp

**TMEIC Europe Limited**
6-9 The Square, Stockley Park  
Uxbridge, Middlesex, United Kingdom, UB11 1FW  
Tel.: +44 870 950 7220; Fax: +44 870 950 7221  
Email: info@tmeic.eu  
Web: www.tmeic.com/europe

**TMEIC Industrial Systems India Private Limited**
Unit # 03-01, Third Floor, Block 2, Cyber Pearl, HITEC City, Madhapur,  
Hyderabad, 500081, Andhra Pradesh, India  
Tel.: +91-40-4434-0000; Fax: +91-40-4434-0034  
Web: www.tmeic.com/india  
Email: inquiry_india@tmeic.in

**TMEIC–Sistemas Industriais da América do Sul Ltda.**
Av.Paulista, 1439 Sala 72  
Bela Vista, 01311-200  
São Paulo/SP, Brazil  
Tel: +55-11-3266-6161; Fax: +55-11-3253-0697

**TOSHIBA MITSUBISHI-ELECTRIC INDUSTRIAL SYSTEMS (BEIJING) CORP.**
21/F., Building B, In.do Mansion  
48 Zhichunlu A, Haidian District,  
Beijing 100098, PRC  
Tel.: +86 10 5873-2277; Fax: +86 10 5873-2208  
Email: sales@tmeic-cn.com

TMdrive and MELPLAC are registered trademarks of TOSHIBA MITSUBISHI-ELECTRIC INDUSTRIAL SYSTEMS CORPORATION.  
TC-net and TOSLINE are trademarks of Toshiba Corporation.  
Ethernet is a trademark of Fuji Xerox Co., Ltd. in Japan.  
Profibus-DP is a trademark of Profibus International.  
Modbus is a trademark of Schneider Automation Inc.  
ControlNet is a trademark of ControlNet International, Ltd.  
DeviceNet is a trademark of Open DeviceNet Vendors Association, Inc.  
ISBus is a trademark of General Electric Company U.S.A.  
Anybus is a registered trademark of HMS international networks.  
CompactCom is a trademark HMS international networks.  
Microsoft and Windows are registered trademarks of Microsoft Corporation in USA and other countries.  
All other products mentioned are registered trademarks and/or trademarks of their respective companies.

All specifications in this document are subject to change without notice. The above brochure is provided free of charge and without obligation to the reader or to TMEIC Corporation. TMEIC Corporation does not accept, nor imply, the acceptance of any liability with regard to the use of the information provided. TMEIC Corporation provides the information included herein as is and without warranty of any kind, express or implied, including but not limited to any implied statutory warranty of merchantability or fitness for particular purposes. The information is provided solely as a general reference to the potential benefits that may be attributable to the technology discussed. Individual results may vary. Independent analysis and testing of each application is required to determine the results and benefits to be achieved from the technology discussed.  

If you have any questions regarding your project requirements, please contact TMEIC Corporation at 540-283-2000.