



Automation and Drive Systems for the Metals Industry

metals

cranes

mining

testing

oil & gas

renewable
energy

power
generation

cement

A Global Supplier of Automation & Drive Systems to the Metals Industry

TMEiC

Toshiba Mitsubishi-Electric Industrial Systems Corporation (TMEiC) was formed from the merger of the industrial systems departments of Toshiba Corporation and Mitsubishi-Electric. TMEiC manufactures and sells variable frequency drives, high-power electric motors, and advanced automation systems for the metals industry and a range of other industrial markets.



Drive Manufacturing Plant, Japan

TMEiC Corporation

TMEiC Corporation is the North American subsidiary of TMEiC, headquartered in Roanoke, Virginia. Prior to 2000, this group was the industrial drives division of the General Electric Company. Our engineers have global experience designing and building large control and automation systems for the metals industry.



U.S. Headquarters, Roanoke, Virginia

TMEiC Core Technologies

Control Systems

- System Engineering
- Network Technology
- Electromechanical Engineering
- Intelligent Sensor Systems
- Analysis and Synthesis
- Control Theory
- Modeling
- Simulation

Power Electronics Technologies

- Power Semiconductor Application
- Controls
- High Voltage/High Current Circuit Design
- Advanced Digital Circuits
- Software Development
- Assembly Processes
- 3D Design/Analysis Integration

- Over 35 years of Medium Voltage drive experience
- MV drives up to 120 MVA
- Voltages up to 11 kV



TMEiC
CORE TECHNOLOGIES

Rotating Machinery Technology

- Insulation Technology
- Cooling and Ventilation Technology
- Mechanical Structure Analysis
- Material Strength
- Vibration and Noise Reduction
- Electromagnetic Analysis
- Tribology

World Leading Motor Technology

- Very reliable motors for rough industrial applications
- Leader in high power, high performance motor technology



Total Solutions for Mill Automation

Hot Mills



TMEIC's control and automation systems have been applied to many of the world's hot strip mills. TMEIC firsts include the first use of all AC main drives, the first computer-based hot mill setup, and the first semi-continuous hot mill rolling. Our team has installed hundreds of major beam, plate and hot strip mills worldwide

Hot Mill Solutions:

- Caster and Furnace Control
- Slab Sizing Press
- Roughing Mill & Steckel Mill
- Finishing Mill
- Coiling Temperature Control
- Coiler Control

Cold Mills



TMEIC has provided drive solutions for over 100 cold mills worldwide. This vast experience supports our superior control systems, based on accurate process models and tightly integrated Level 1 control. Outstanding mill product quality has been achieved along with record breaking production.

Cold Mill Solutions:

- Tandem cold mills
- Single and Multistand Reversing mills
- Temper Mills
- Sendzimir Mills
- Coiler Control

Process Lines



TMEIC has developed strip transport controls based on power analysis of all the elements, allowing high line speeds while eliminating problems such as strip breaks and bridle slippage. These advanced controls have demonstrated benefits including reduced operator intervention, no product degradation, maximized line throughput and uptime, and seamless product transitions.

Process Line Solutions:

- Galvanizing Lines
- Pickle Lines
- Tinning Lines
- Coating Lines
- Paint lines

Long Products



TMEIC's looperless minimum tension control is obtained by measuring torque and controlling stand speed, with upstream stands under cascade control. The automation system tracks billets from the furnace, through the rolling stands, cooling bed, no-twist block and shears to the finished coils. Product data is sent to each stage controls and HMIs.

Long Products Solutions:

- Rod Mill Sizing Block control
- Rod Mill Laying Head control
- No Twist Mill control
- Section Mill Saw management
- Tube Mill control

Control Modernization



Many existing mills are operating with our old legacy DC and AC control systems, or other vendor control systems, and are due for replacement or modernization. TMEIC has the technology and project engineering team to ensure a smooth migration path and execution to our current platform.

Upgrading Old Control Systems:

- DC controls from the 1980s
- DC controls from the 1990s
- More recent AC control systems
- Other vendor's control systems

Mill Motors and Drives

TMEIC's family of high-power Motors and coordinated Variable Frequency Drives are designed for the special demands of rolling mills. Lower power coordinated drives are designed for process line applications such as galvanizing lines, pickle lines, and strip and bar conveyors.

High-Power Drives and Motors for Rolling Mills



Variable Frequency Drives TMdrive-70e2

Power levels: up to 36,000 kW
Voltage: 3,300 Vac
Frequency: up to 75 Hz



Main Drive Mill Motors

Synchronous & Induction motors supplying high torque and low speed for roughing and finishing mills, and reversing applications with impact.

Power levels: up to 16,000 hp
Voltages: up to 6,000 V
Shaft Speeds: up to 1,540 rpm



Special Motors

Large motors requiring high power for blowers and compressors. Power Levels: up to 107,000 hp
Voltages: up to 13.8 kV
Shaft Speeds: up to 3,600 rpm

Low Voltage Drives and Motors for Process Lines and other Mill Applications



Variable Frequency Drives TMdrive-10e2

Power levels: up to 1,949 kW
Voltage: 440 - 690 Vac
Frequency: up to 200 Hz



TM21-FII Induction Motors

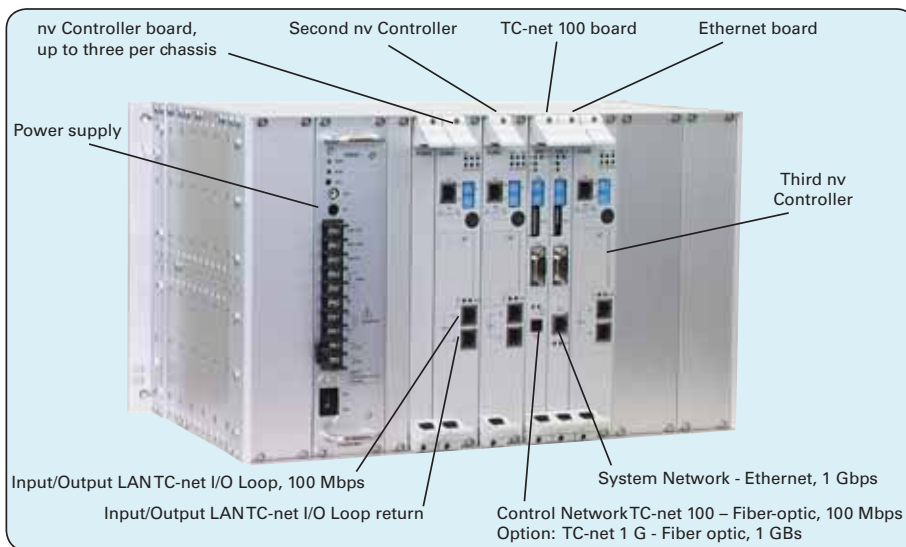
Low and Medium voltage motors
Power levels: 37 up to 1,390 kW
(50 up to 1,870 hp)
Voltages: up to 6.9 kV
Shaft Speeds: up to 3,600 rpm

DC drives & upgrades for Legacy Systems

DC drives & upgrades for Legacy Systems

Power levels: up to 1,900 kW
Voltages: 300 - 1200 Vdc output

Unified nV Series Controller



The latest nV series programmable logic controller features high-speed logic, sequence control, and drive speed control.

High-speed Communication

TC-net I/O is a fiber optic 100 Mbps fault tolerant ring network, linking drives and remote, field mounted I/O modules.

Controller to controller to computer communication uses *TC-net 100* at 100 Mbps, or *TC-net-1g* at 1 Gbps.

High-speed Control Processing

Bit and integer processing in 20 ns. Floating point add/multiply in 120 ns.

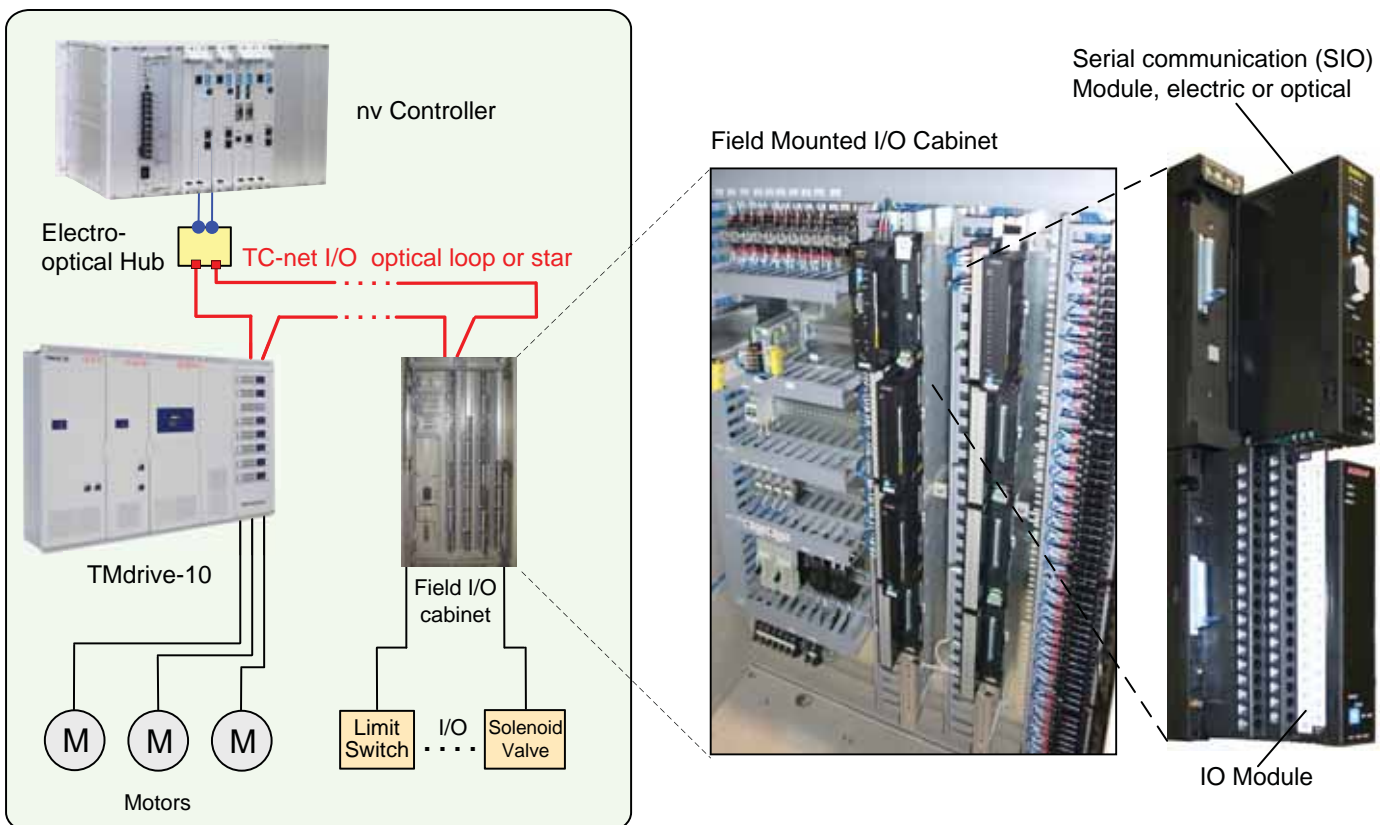
Large Program Capacity

Programs can contain up to 256 kilo steps (instructions), and up to 385 periodic programs.

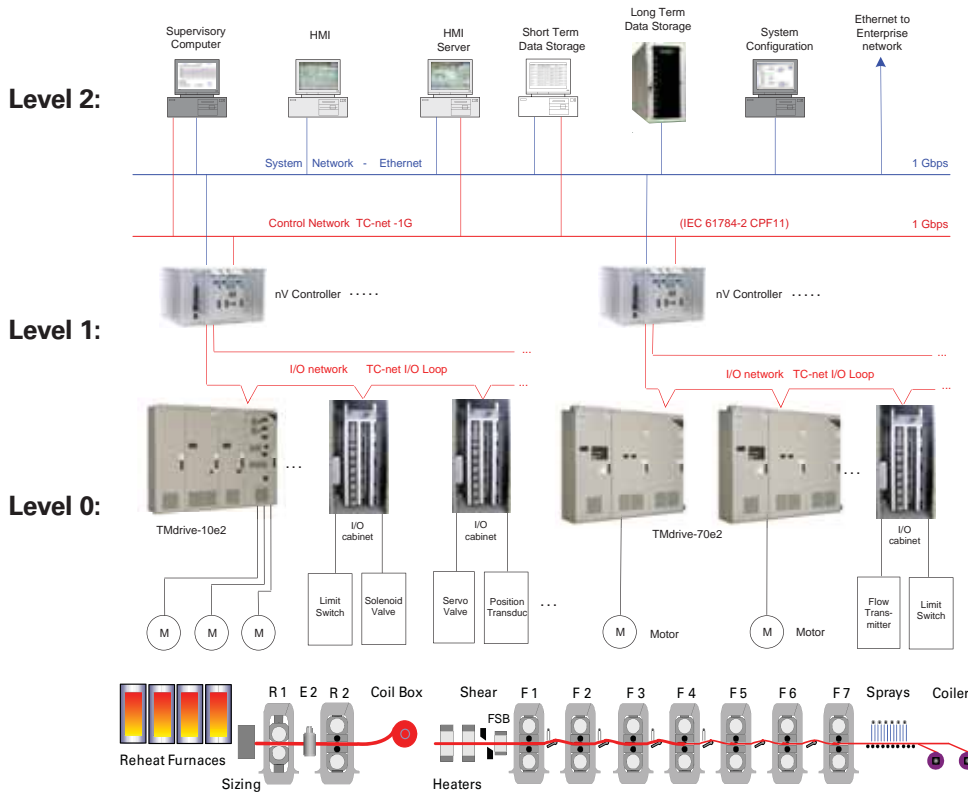
Selection of four standard programming languages.

The controller provides four standard IEC 61131-3 languages: Ladder Diagrams, Function Block Diagrams, Sequential Function Charts, and StructuredText. Direct language execution in ASIC hardware provides enhanced speed. Machine Diagnostics are available using permissive logic blocks in the ladder logic, indicating a machinery fault and providing the cause, such as a broken limit switch.

Controller Local and Remote I/O System



TMACS – TMEiC Advanced Control Solutions



The TM Advanced Control Solutions industrial control system is designed to handle the high-speed processing and data transmission required to provide real-time mill control. Based on the advanced nV Series industrial controller, the hierarchical system employs 100 Mbps fiber optic networks to bring data from the Level 0 input/output devices to the controller, and up to the operator interfaces.

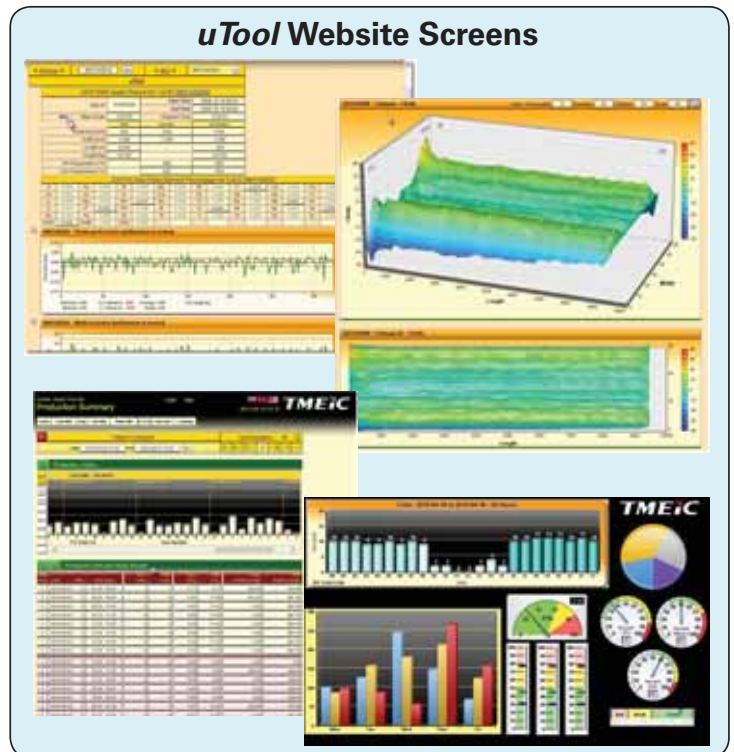
At Level 2, supervisory control computers run software models to provide optimum setpoints to the controllers to achieve superior product quality and increased mill speed.

Unified Tool – *uTool*

Web-based Access to Everything. TMEiC's *uTool* simplifies the gathering and access to manufacturing data needed to monitor and improve mill performance. *uTool* offers connectivity to key mill information and diagnostic power through easy to use Web-based technology. The integrated view of product, process, and system information delivers the right information at the right time to the right persons – the maintenance, supervisory, and executive staff.

uTool System Features:

- | | |
|------------------|---|
| Reports | Quality and production reports, engineering logs, equipment status, production dashboards |
| Web-based | Internet Explorer browser over the plant network |
| Deep access | Drill down to low level, detailed information throughout the automation system |
| Document Linkage | Fast access to documents such as manuals, company standards, FAQs |
| Configurable | Common Web programming language (PHP) used to meet new demand |



Upgrading Legacy Control Systems to TMEIC's latest System

AC Control Systems

TMEIC legacy control systems dating back to the 1980s can be easily upgraded to TMACS, the latest control system. Simple revamps consisting of installing new HMIs and PCs are often first steps in complete mill modernizations that may include replacement of existing controllers, I/O, and full repowering of the mill. Other manufacturer's systems can also be upgraded. Most projects can be phased in during regular outages without shutting down production, as described below.

The diagram below illustrates a typical legacy control system modernization. The gray shaded equipment is the original control system shown part way through the upgrade. The blue shaded equipment is the new TMACS control system, which is being added. The blue block containing network interface cards is the bridge to the TC-net 100 Mbps system network.

The original drives can be kept or replaced with new ones connected to the new controller. I/O can be moved over to the new controller when convenient. The gray dotted items are the computers and controllers which will eventually be removed when all control has been moved to the TMACS system.

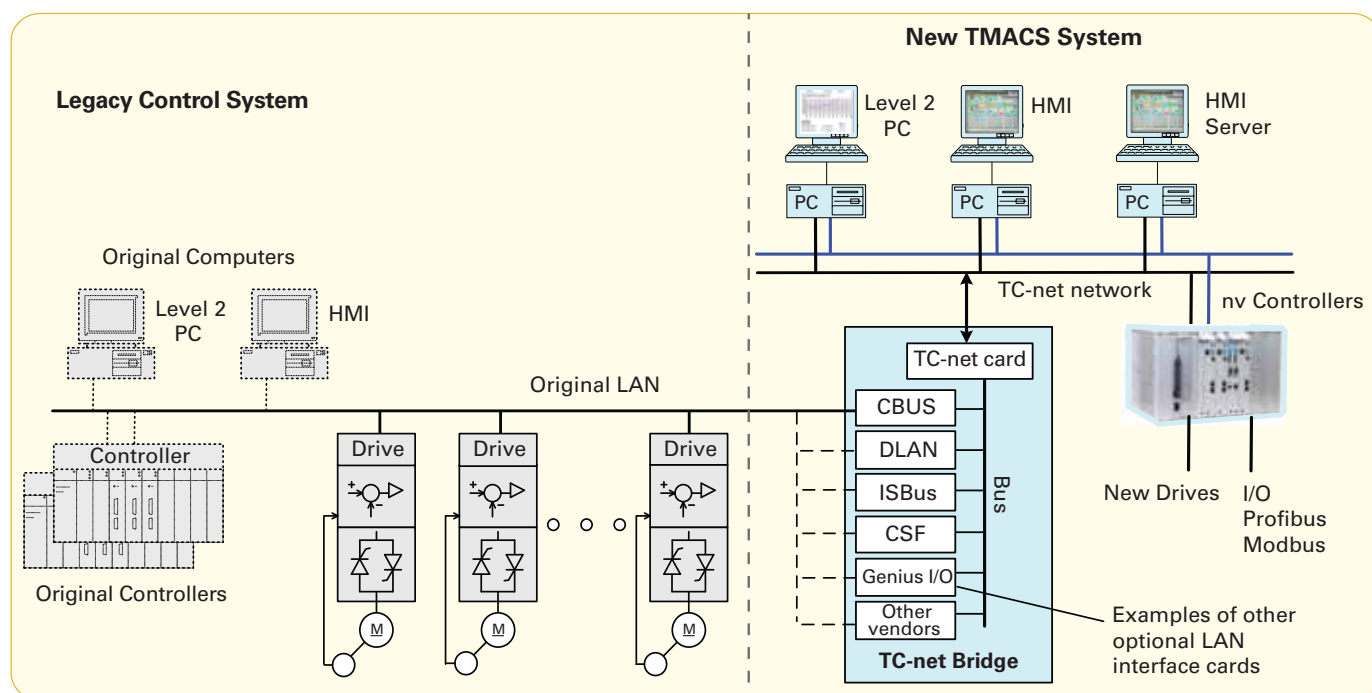
DC Control Systems

Original drive and power SCRs

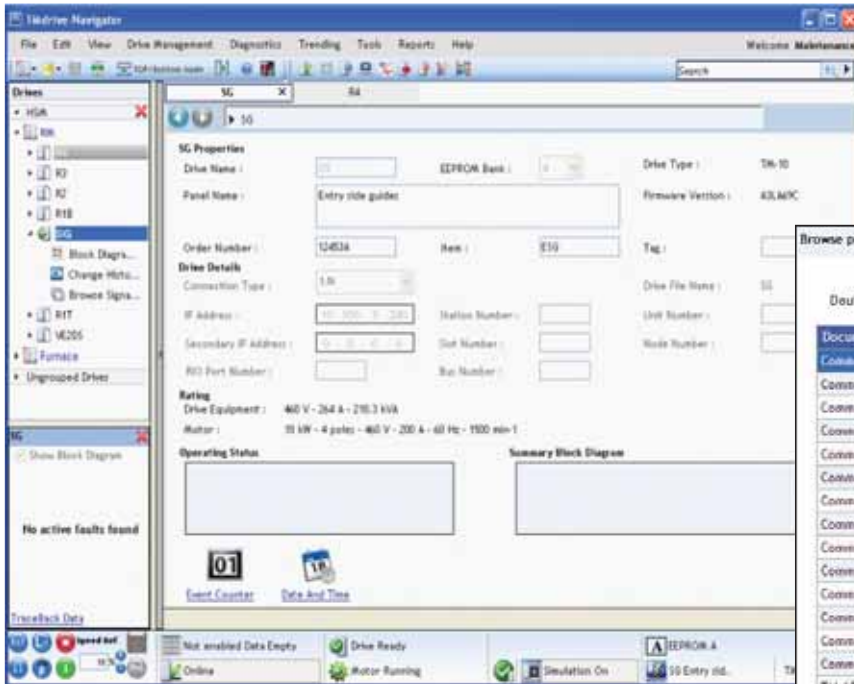


Added Digital Front End

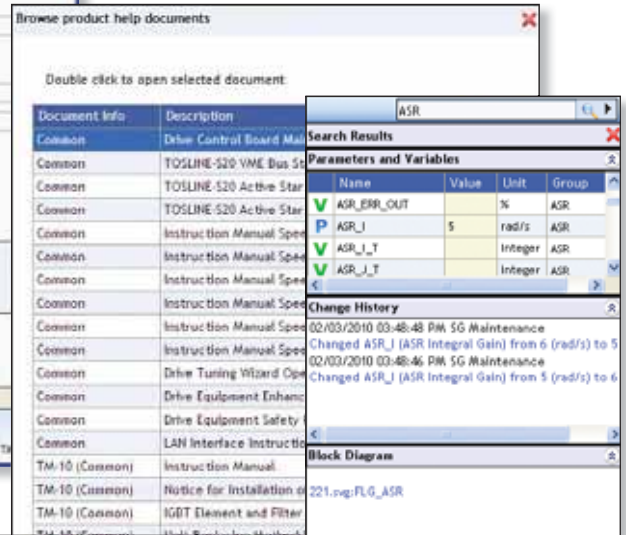
Legacy DC drives can be fitted with TMEIC's Digital Front End (DFE) which provides the latest high-speed communications, control boards, and I/O boards, while continuing to employ the original power SCRs, wiring, and motor. Since the original DC motors are used, this allows a low cost upgrade with minimum down time.



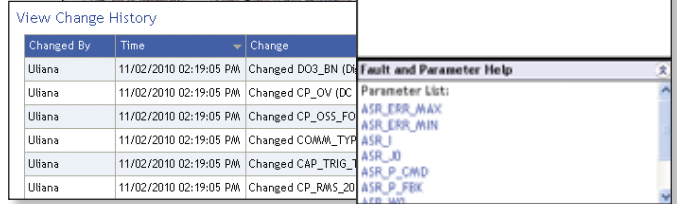
TMdrive-Navigator – Simple Drive Configuration and Maintenance



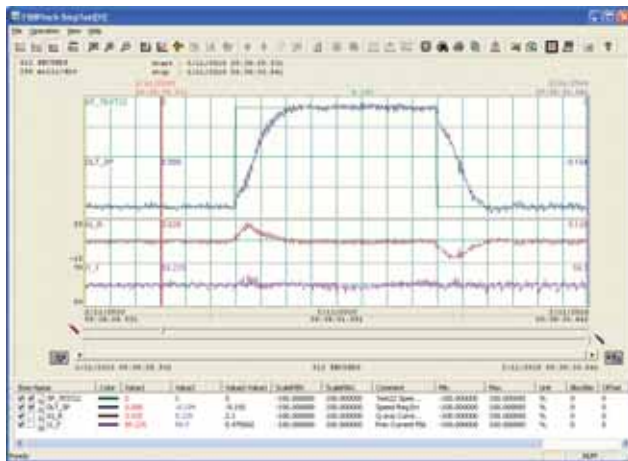
The TMdrive-Navigator tool helps mill engineers and technicians configure and maintain TMEIC drives themselves. Any user can easily access current drive performance data, see below.



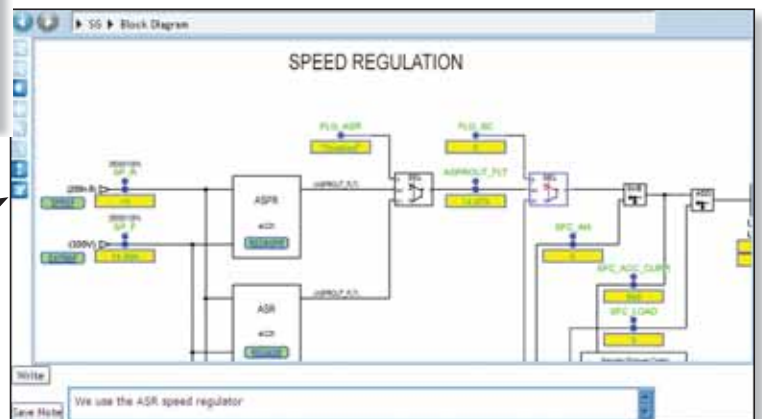
Desktop-like search technology links topical signal lists, block diagrams, help files, product documentation, change history, and user notes. The status of all drives is always in view.



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 published to key users.



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.



Process Models Ensure Production of Quality Product

TMEIC's automation system provides superior mill control based on accurate Level 2 process models and integrated Level 1 controls for hot mills. Some cold mill process models are listed below along with the shape control block diagram.

Force and Power Models

Force, torque, and power models with the effects of tension and friction.

Flow Stress Models

Flow stress models with the material chemistry and work hardening effects on elongation.

Friction Models

Compensation for coefficient of friction variations.

Strain Model

In-coil strain distribution.

Roll Wear Model

Thermal and wear effects on roll diameter profile.

Interactions

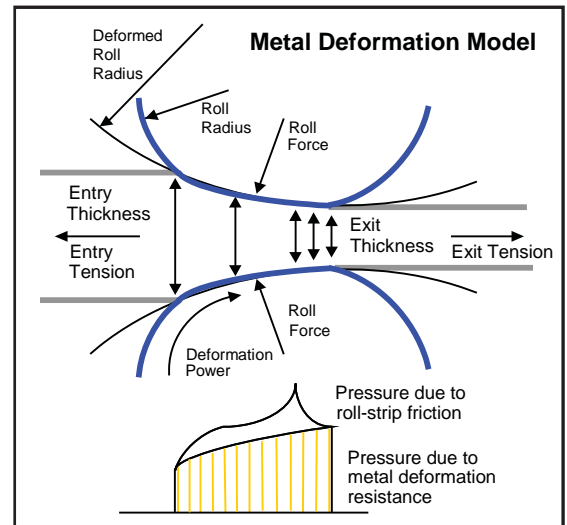
Interactions between tension, forward slip, friction, and speed.

Textured Rolls

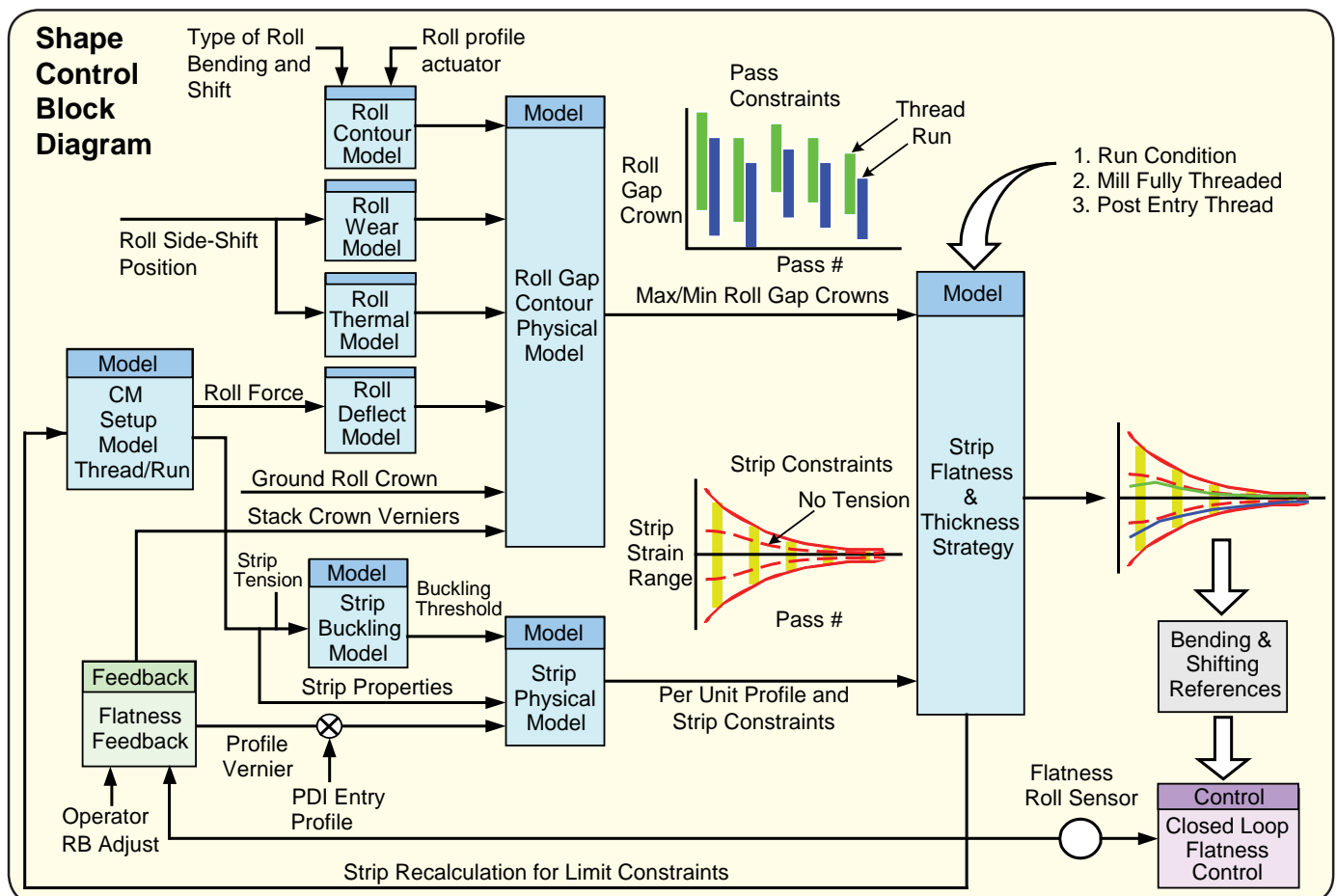
The coefficient of friction effect of textured rolls.

Product Variations

Product dependent transfer functions for level 1 control.



References from the model provide the setup for level 1 controls, as shown in the diagram below.

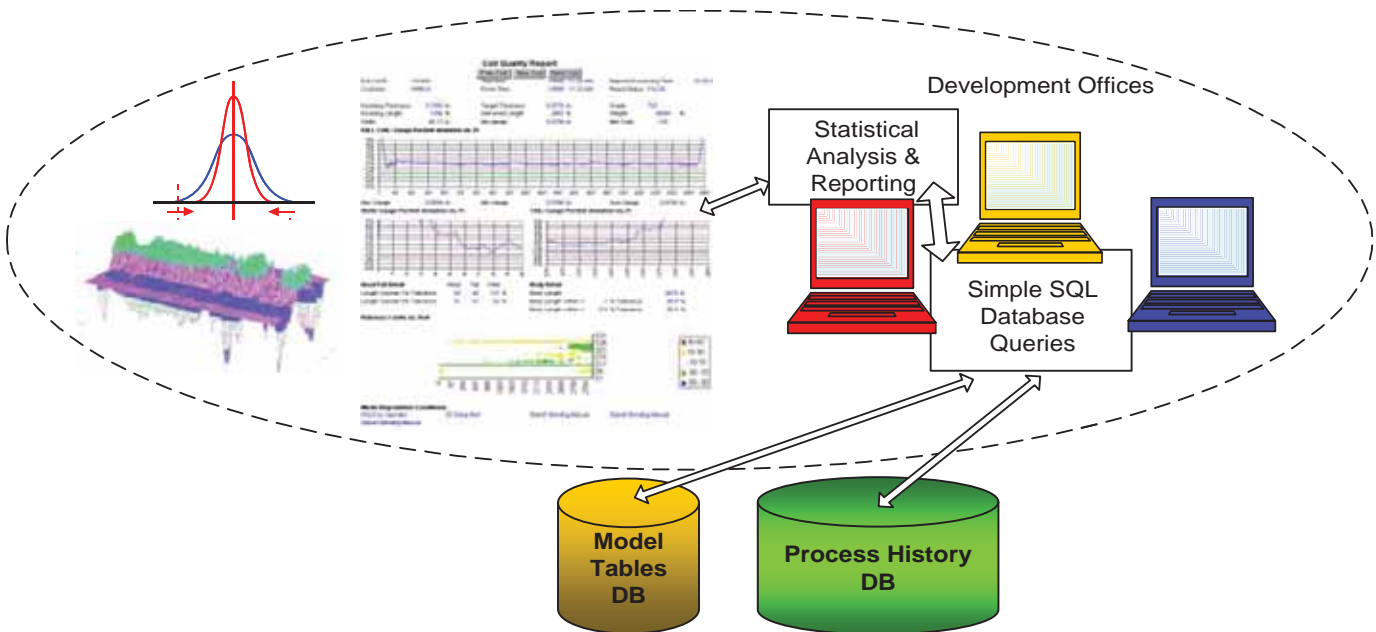


Mill Level 2 Software and Models

Level 2 provides mathematical process models and the required software infrastructure for them to function. Level 2 distributes references to the level 1 controllers in a timely manner, and receives process feedbacks for model updates and data collection. Typical level 2 functions include:

- Material tracking through process zones
- Distribution of references
- Process feedback scans and process setups
- Production logging
- Engineering logging
- Performance classification and reports

Software and hardware (if necessary) is split into two basic parts: process control (executables) and data storage (databases).



Features

Open Architecture

The hardware platform is based on industrial standards (PC servers), software platform C++, open communication links via Ethernet, and database (MS SQL or Oracle) accessed via ODBC.

Structured Software Products

Based on OOD and OOP concepts, the suite of software products is fully configurable. The functions are configured for various applications, NO CODE CHANGES are required.

Platform Independence and Distributed Computing

The same source of software products is used for various OS platforms: Windows, OVMS, or Linux. The same applications can run on the centralized computer or can be distributed onto various units as required.

Customer Benefits of Level 2 Software and Models

- High product quality
- Low cost of system ownership
- Simple maintenance and troubleshooting

Benefits

Scalability

The software products can be simply "instanced" and added to the application software for easy expansion.

Cohesion of all Control Layers

The concept of global signals (Signal Data Base) and central data structure definition (data Dictionary DB) simplifies the system design and maintenance.

Comprehensive Analysis Tools and Reporting

System diagnosis utilities allow monitoring of process execution and detailed communication diagnostics. Process data can be accessed via ODBC, analyzed, and reported using standard applications such as: Excel, Access, MathCAD, and Statistica.

- Minimum downtime
- Short system startup and tune-up
- Comprehensive reporting & record keeping system

Customer Training



Classroom in Virginia

Training at our Virginia Facility

Our first-class customer training facility in Roanoke, Virginia features large classrooms and fully-equipped training labs. Training is usually 50% class time and 50% hands-on lab time. TMEIC's drive products, control systems, and programming tools are covered.

Customized Training at your Plant

TMEIC can offer a course tailored to your project or specific needs and held at your location. In this case, a project engineer and local service engineer train your operators, maintenance technicians, and engineers in your facility.

System Commissioning

Commissioning is a team effort. Prior to shipping, the control system is staged in our test lab and thoroughly tested by experienced metals industry engineers. At the mill site, the commissioning team supervises the system installation and wiring, and carries out the initial testing of the drives, motors, and control. After the first coils/slabs are run, the mill is tested to see if the customer's contractual requirements are met, including the desired production rates, material properties, product dimensions, and flatness goals.



Rolling Mill Commissioning

Global Customer Support Network

TMEIC Corporation supports customers globally with trained and experienced service engineers. We have service engineers located in North America, South America, Europe, Japan, China, India, and the Pacific.

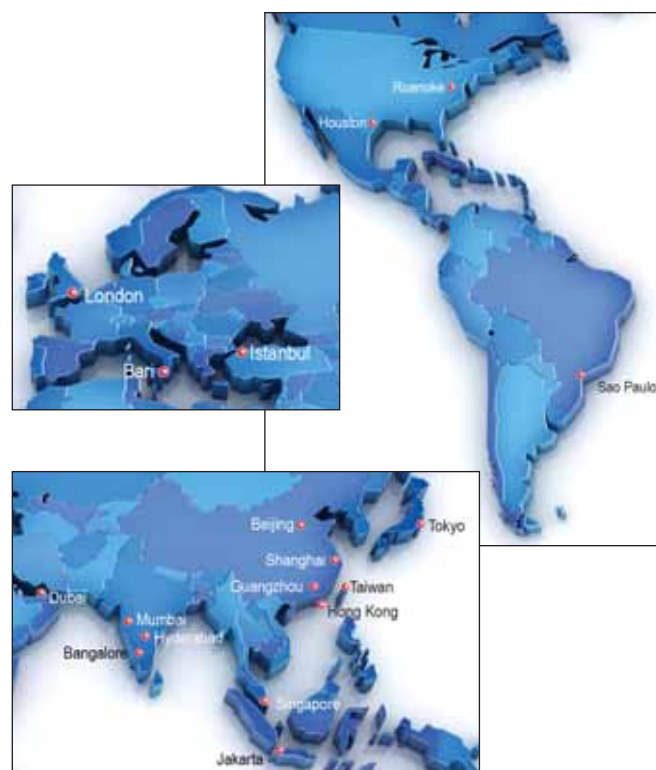
For technical service and parts, our phone number is available 24/7:

- U.S. Toll Free 1-877-280-1835
- International +1-540-283-2010

Remote Connectivity Module (RCM) is a remote diagnostic service link with TMEIC design and service engineers in Roanoke, enabling seamless integration between your drives and our engineers. This remote access allows TMEIC engineers in Roanoke to quickly analyze data and provide a drive problem resolution.

System Diagnostics

TMEIC's diagnostic tool is included in the controller programming package, and allows the operator to quickly diagnose system problems which can stop the mill. This tool is available to on-site engineers, and also to service engineers in Roanoke through the RCM.



Head Office

Toshiba Mitsubishi-Electric Industrial Systems Corporation
Tokyo Square Garden
3-1-1 Kyobashi, Chuo-kyo, Tokyo, 104-0031, Japan
Tel.: +81-3-3277-4491; Fax: +81-3-3277-5533
Email: info-pv@tmeic.co.jp; Web: www.tmeic.co.jp

Overseas Affiliates

NORTH AMERICA

TMEIC Corporation

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

TMEIC Corporation - Houston Branch

2901 Wilcrest Dr., Houston, TX 77042, USA
Tel.: +1-713-784-2163; Fax: +1-713-784-2842
Email: OilGas@tmeic.com; Web: www.tmeic.com

TMEIC Power Electronic Products Corporation

13131 W. Little York Road, Houston, Texas 77041, USA

SOUTH AMERICA

TMEIC – Sistemas Industriais da América do Sul Ltda.

Av. Paulista, 1439 cj72, Bela Vista, CEP:01311-200
São Paulo/SP, Brasil
Tel: +55-11-3266-6161; Fax: +55-11-3253-0697

EUROPE

TMEIC Europe Limited

6-9 The Square, Stockley Park, Uxbridge, Middlesex,
United Kingdom, UB7 7LT
Tel.: +44-870-950-7220; Fax: +44-870-950-7221
Email: info@tmeic.eu; Web: www.tmeic.com/Europe

Italy Branch Office

Via Pappacena, 22-70124
Bari, Italy
Tel.: +39-080-504-6190; Fax: +39-080-504-2876
Email: info@tmeic.eu; Web: www.tmeic.com/Europe

ASIA

Toshiba Mitsubishi-Electric Industrial Systems Corp (Beijing)

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

Shanghai Branch Office

2603 Shanghaimart, 2299 Yan An Road (W)
Shanghai, 200336, China
Tel.: +86-21-6236-0588; Fax: +86-21-6236-0599
(Shanghai Plant)

Shanghai TMEIC Power Electronics Corporation

B1-101 No. 1355 Chengbei Road
Jiading District, Shanghai 201800, R.R. China
Tel.: +86-21-6992-5007; Fax: +86-21-6992-5065

Yancheng TMEIC Power Electronics Corporation

#2 Optoelectronics Industrial Park, 66 Liajiang Road
Economic & Technological Development Zone
Yancheng, Jiangxi, China

TMEIC Asia Company Limited

1006 Nan Fung Commercial Centre, 19 Lam Lok St.,
Kowloon Bay, Hong Kong, China
Tel.: +852-2243-3221; Fax: +852-2795-2250

Singapore Branch Office

150 Beach Rd, #15-08 Gateway West
Singapore, 189720
Tel.: +65-6292-7226; Fax: +65-6292-0817

PT. TMEIC Asia Indonesia

Unit-E, 23rd Floor Alamanda Tower, Jl. TB Simatupang
Kav 23-24
Cirandak Barat, Jakarta 12430
Tel.: +62-21-2966-1699; Fax: +62-21-2966-1689

TMEIC Industrial Systems India Private Limited

Unit # 03-04, Third Floor,
Block 2, Cyber Pearl, HITEC City, Madhapur,
Hyderabad, 500081, Andhra Pradesh, India
Tel.: +91-40-44434-0000; Fax: +91-40-4434-0034
Email: inquiry_india@tmeic.com; Web: www.tmeic.in

Mumbai Branch

901/D Filix, L.B.S. Road, Opp Asian Paints, Bhandup
West Mumbai, Maharashtra India 400 078
Tel.: +91-22-6155-5444; Fax: +91-22-6155-5400

TMEIC Power Electronics Systems India Private Limited

#85 Kaniminiki Village, Kengri Hobli, Bangalore South Taluk
Bangalore, India 560 074
Hyderabad, 500081, Andhra Pradesh, India
Tel.: +91-80-6746-6000; Fax: +91-80-6746-6100

Overseas Office

MIDDLE EAST

Middle East Branch

Office No. 5EB-533, 5th Floor, 5EB, Dubai Airport Freezone,
P.O. Box 54512, Dubai, United Arab Emirates
Tel.: +971-4-6091-434; Fax: +971-4-6091-439

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