

Unified Controller nv Series

Product Application Guide



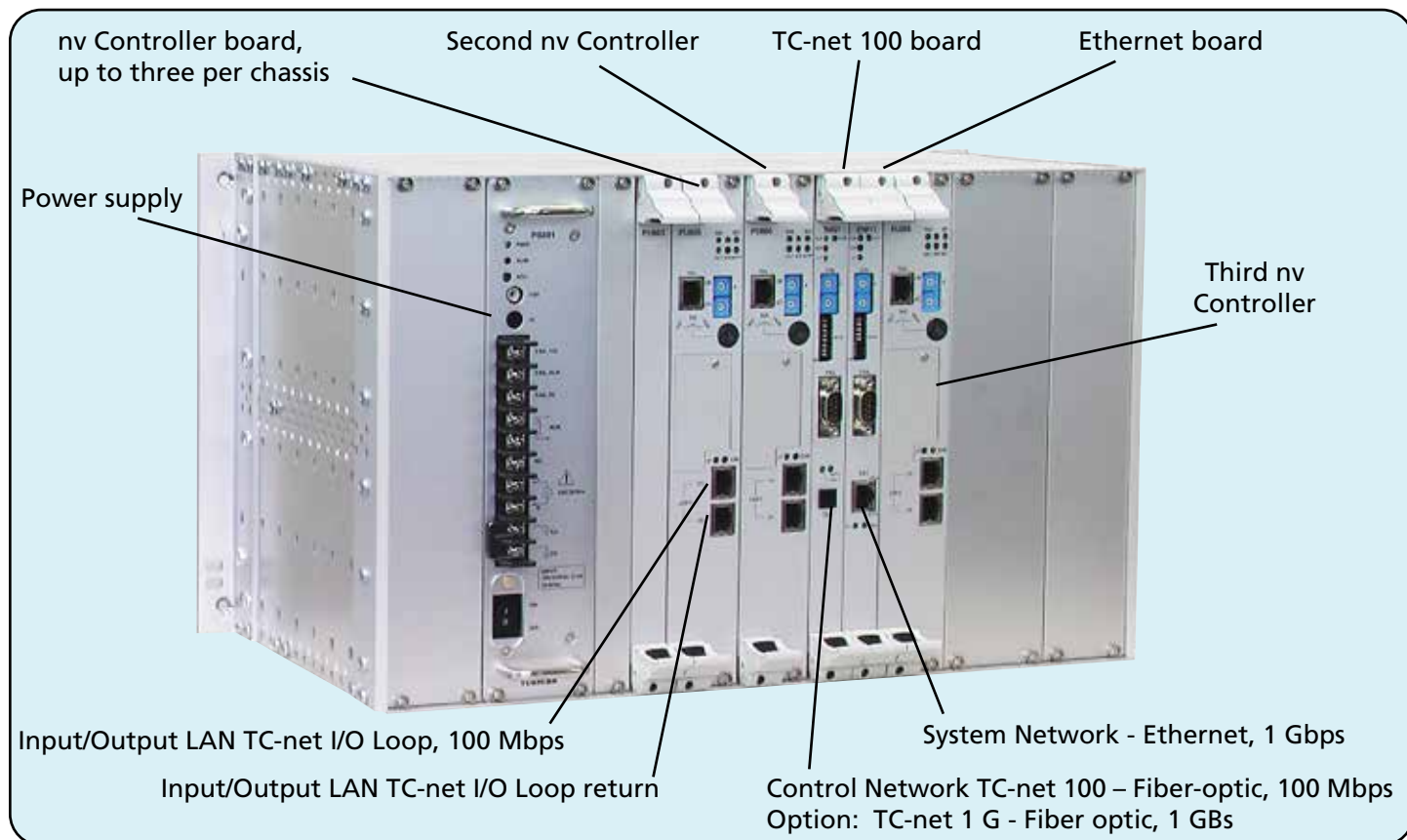
WWW.TMEIC.COM

Unified Controller nv Series

Toshiba's latest industrial controller, the Unified nv Series controller, is a big step beyond the existing V series used in industry around the world. The capabilities include high-speed logic, sequencing, motor speed control, and continuous control. High-speed I/O communication uses the industry's first 100 Mbps fault tolerant ring network "TC-net I/O", linking remote, field mounted I/O.

The main features of this powerful controller are:

- Fault tolerant ring 100 Mbps I/O communication
- Enhanced speed by direct execution of IEC standard control languages in ASIC hardware
- Higher reliability using redundant modules, and error checking and correcting ECC memory
- Gigabit supervisory control network



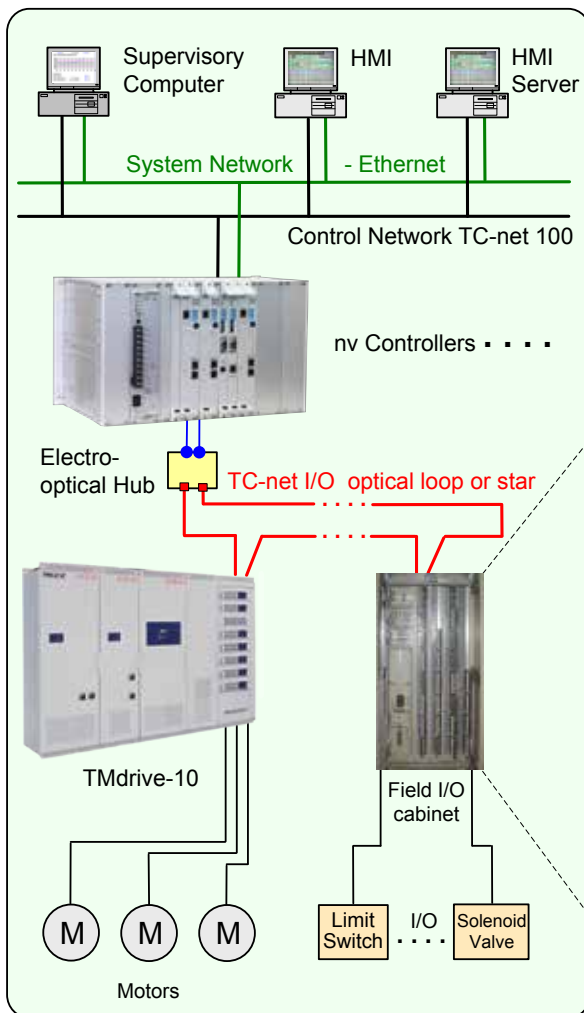
Feature	Details
High-speed processing	Bit and integer processing: 20 ns; floating point add/multiply: 120 ns
Short control cycle	Three separately scheduled periodic tasks: 0.5 ms to 1,000 ms
Large program capacity	Programs up to 256 kilo steps (instructions), up to 385 periodic programs
High data capacity	Local/global variables 256 K words; I/O variables 16,384 16-bit words
Interrupts	Total of 16 interrupt tasks
Multiple controllers	Up to three controllers per chassis; up to 4 communication modules; redundant controller and network configurations possible
Programming flexibility	Four IEC 61131-3 standard languages: LD, FBD, SFC, and ST
Memory reliability	An error-correcting ECC circuit in the internal memory of each module

Field Mounted I/O

To reduce hundreds of long wiring runs between the electrical room and the machinery, the nv controller features field mountable I/O modules communicating with the controller over an optical loop.

Using this approach, wiring material and labor costs can be

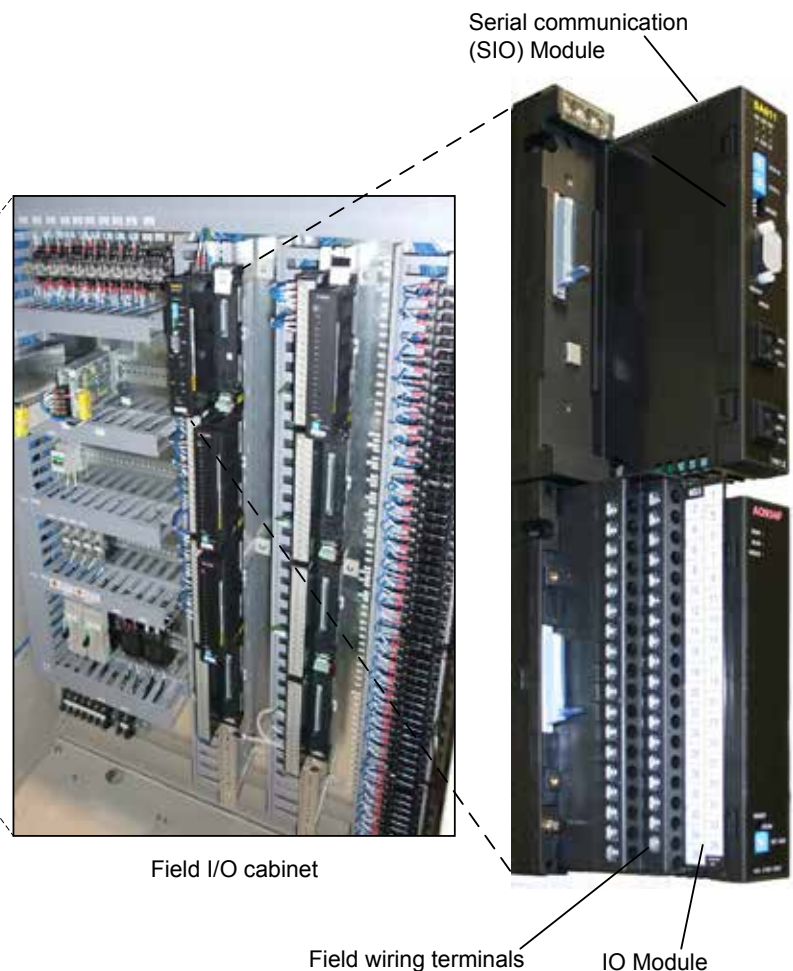
greatly reduced. To protect the modules against conditions close to the machinery, the enclosure is rated IP54, which gives protection against dust, vibration, water splash and drips. Field I/O is housed in cabinets like the one shown below.



Control system topology

Two networks link the controller with the input/output modules:

- The Electrical ring (blue) services I/O local to the controller
- The Optical ring (red) services field distributed I/O local to the machinery. Field I/O is housed in the cabinet shown below.



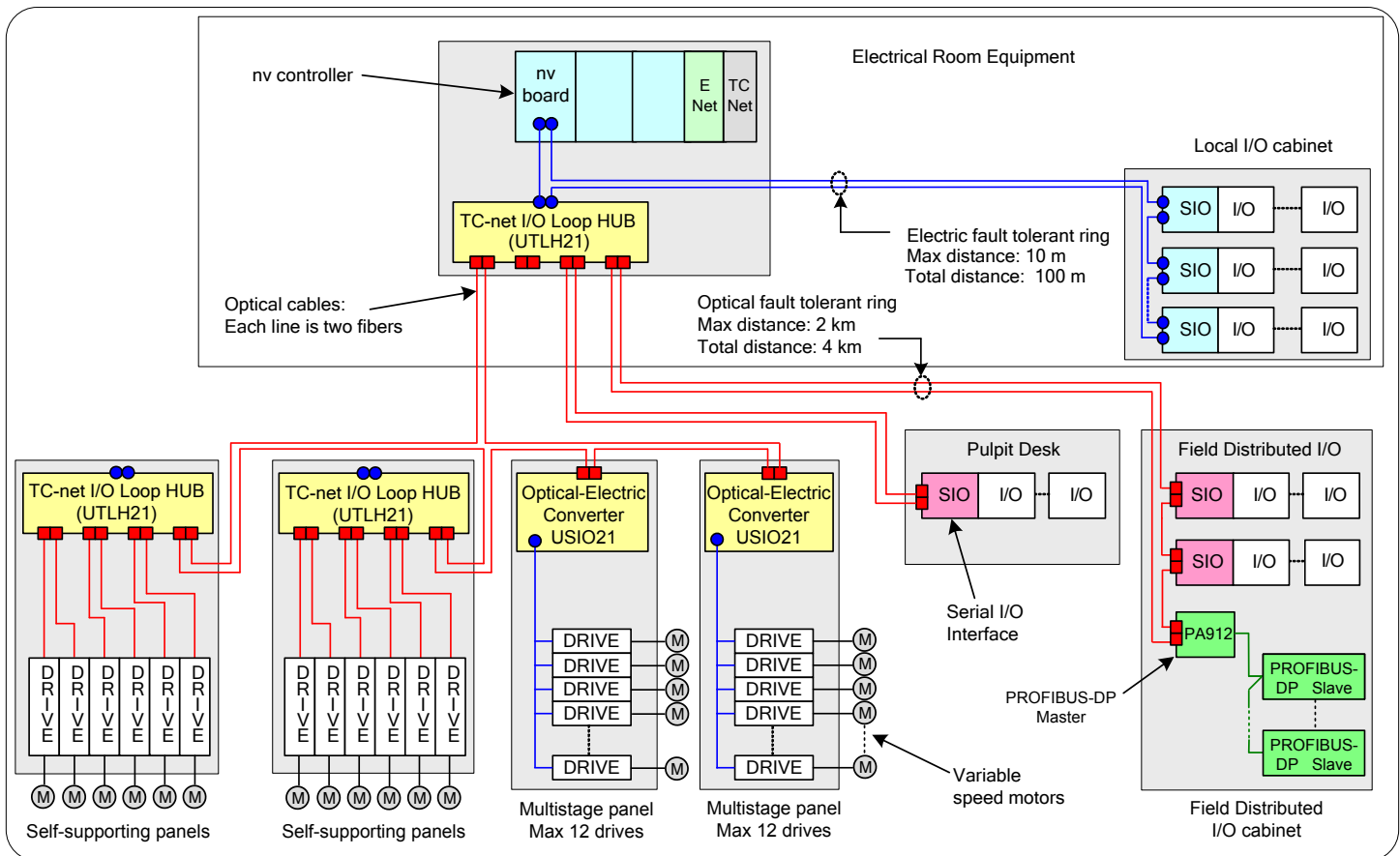
Field Enclosure. The typical field enclosure is 1200 mm wide, 2100 mm high, and 600 mm deep. The enclosure contains the circuit breakers, power supplies and other components on the left hand side, and the DIN-rail mounted I/O modules on the right. The enclosure is rated IP54. Other sizes are available to suit the application, such as pedestal or wall mount.

Electric Room Enclosure. This is the same size enclosure used for the field I/O, but with electric TC-net I/O cabling to the SIO modules. An optical interface is used if cabling distance requires one. Controller arrangements can be made for up to three CPUs. This enclosure rating is IP20.

I/O Communications over TC-net I/O

The nv series I/O modules can be mounted in the electrical room or remotely, adjacent to the machinery or process. TC-net I/O communication with the local I/O is over an electrical Cat5e fault tolerant ring (shown in blue), which connects to electrical serial I/O modules (SIO). Field mounted I/O is connected using fault tolerant optical rings (shown in red), which connect to optical SIOs, while the drives typically use an optical converter or hub, (shown in yellow).

Large drives such as the cabinet-mounted TMdrive-10e2, 30, 50, and 70 are connected in star configuration to a hub device. Smaller TMdrive-10e2 family drives mounted in multistage panels share an electrical multidrop cable using an optical-electrical converter mounted in the drive panel. Other communication networks such as Modbus and Profibus (shown in green) can communicate over TC-net I/O using special modules.



TC-net I/O Features	Details
Topology	Fault tolerant rings, each cable has a transmit and receive wire or fiber. Any loop connection can be severed without loss of communication
Data rate	Transmission and reception at 100 Mbps
Number of interfaces	32 SIO interfaces per loop plus up to 200 drives per controller
Serial interfaces, SIO	Electrical SA911; Optical SA912; Profibus DP Master PA912 (optical); Modbus RTU MD911-M
Number of modules	16 I/O modules per SIO interface
Scan cycle	High-speed scan: 100µsec or more; medium speed scan: 1 ms or more
Cable length	Electrical distance between nodes 10 m (32 ft.); optical distance 2 km (6,550 ft)
Cable type	Electrical cable is category 5 shielded twisted pair; optical cable is GI 50/125

Input/Output I/O Module Family

The the table below shows a partial list of I/O modules with brief specifications. Rack mount versions are also available.



I/O Module dimensions:

W 35 mm (1.377 in)
H 185 mm (7.28 in)
D 95 mm (3.74 in)

Module and Base dimensions:

W 92 mm (3.62 in)
H 200 mm (7.87 in)
D 115 mm (4.53 in)

External Power Supply:

24 Vdc



Serial I/O Communication Module

Communicates with up to 16 I/O modules

Optical SA912 and electrical SA911 versions available

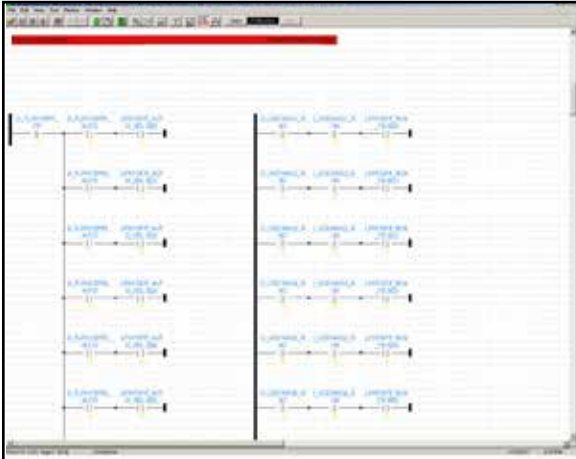
Redundant serial I/O interfaces are on option

Module	Name	Channels	Input-Output	Description	Accuracy	Speed
Discrete Input	DI934T	32	24 Vdc	8 ma	—	—
	DI943S	32	24 Vdc	5.2 ma with strobe	—	< 1ms
	DI944	32	48 Vdc	2.5 ma	—	—
	DI936	16	12/24 Vdc	9.6 ma, independent pts	—	< 1ms
	DI937	16	24 Vdc	9.6 ma, contact input	—	< 1ms
	IN954	32	AC/DC 100/120V	10.2 mA (100 Vac-50Hz)/13.6 mA(110Vac-60Hz)	—	—
	IN956	16	AC/DC 100/120V	15 mA (100 Vac)/2.3 mA (110 Vac)	—	—
	IN966	16	200/240 Vac	10 ma (at 200 Vac-50 Hz)	—	15 ms
Discrete Out	DO934	32	12-24 Vdc	100 ma sink output	—	< 1ms
	DO934P	32	12-24 Vdc	100 ma source output	—	< 1ms
	DO936	16	24 Vdc	2.0 A sink out, isolation	—	< 1ms
	DO933P	16	24 Vdc	2A protected source	—	—
Analog Input	AI929D	16	0-20 mA	Non isolated	14 bits, 0.1%	50ms/16 ch.
	AI938	8	±10 V	Transformer isolation	5+13 bits, 0.2%	0.5ms
	AI928	8	0-20 ma	Transformer isolation	14 bits, 0.2%	0.5ms/8 ch.
Thermocouple Resistance TD	TC919	16	Thermocouples	Type B, R, S, J, K, T, E	0.1%	0.8s/16 ch.
	RT918C	8	Pt100; JPt100	Platinum RTD	±0.1%CJC ±1%	0.8s/8 ch.
	RT918	8	Pt100; JPt100	Platinum RTD, isolated	±0.1%	0.8s/8 ch.
Analog Output	AO928F	8	0-20 ma	Insulated channels	16 bits, 0.1%	1 ms/8 ch.
	AO938		-10 to 10 V	Non-insulated	13 bits, 0.1%	5 ms/8 ch.
	AO934F	4	-10 to 10 V	Insulated channels	15 bits, 0.1%	0.175ms/4 ch.
	AO954F	4	-10ma to 10ma	Insulated channels	15 bits, 0.1%	0.175ms/4 ch.
Pulse Output	PI918	8	12/24 V	Gated inputs 50 kHz	—	—
	PI924	4	12/24 V	Bipulse input, up-down, 50 kHz	—	—
	PI934	4	RS485 input	Up/Dn:2.6 MHz, A-Quad-B:650kHz	—	—
	PI964	4	12/24 V	Versatile A-Quad-B, 50 kHz	—	—
Resolver Input	AB932J	2	Poscoder	Single-turn encoder	—	—
	AB933J	2	Poscoder	Multi-turn encoder	—	—
	AB934J	2	Linear sensor	Resolver type linear encoder	—	—
	AB932N	2	NSD Abscoder	Single turn encoder	—	—
	AB933N	2	NSD Abscoder	Multi-turn encoder	—	—
	AB934N		NSD Linear Abs	Linear encoder	—	—
	AB935N	2	JCC Line resolv	Linear encoder, High resolution	—	—
	AB936N	2	JCC Line resolv	Linear encoder, Medium resolution	—	—
Linear Sensor	TP912M	2	MTS Tempsonics sensor	Up to 25-bit data	—	—
Modbus	MD911-M		Modbus-RTU	Master module	—	—
	MD911-S		Modbus-RTU	Slave module	—	—
Profibus	PA912		Profibus-DP	Master module	—	—

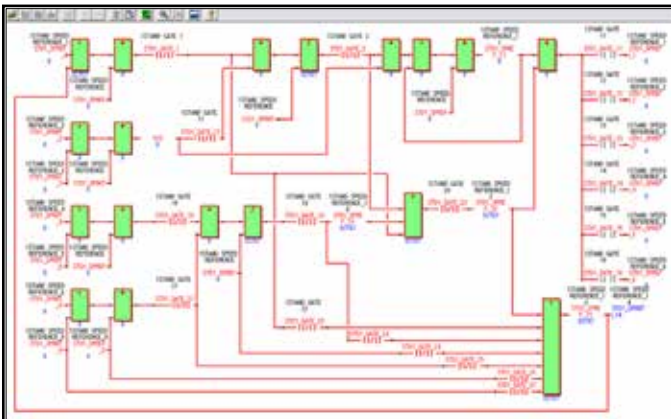
Controller Programming

Engineering Tool - choose from four International Standard Programming Languages

The Engineering Tool software for the nv Series controller provides four IEC-61131-3 standard programming languages: Ladder Diagrams (LD), Function Block Diagrams (FBD), Sequential Function Charts (SFC), and Structured Text (ST). The first three can be mixed in the same program and displayed on the same screen.

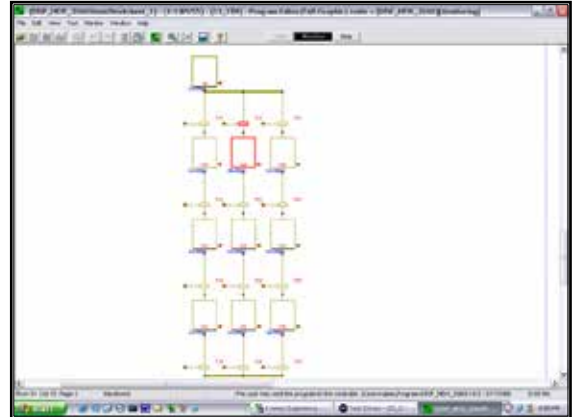


Ladder Diagrams LD is the preferred programming language for logic control and sequencing. It shows relay circuit contacts and coils, and indicates power flow using color to allow easy test and debug of logic circuits before actual use.

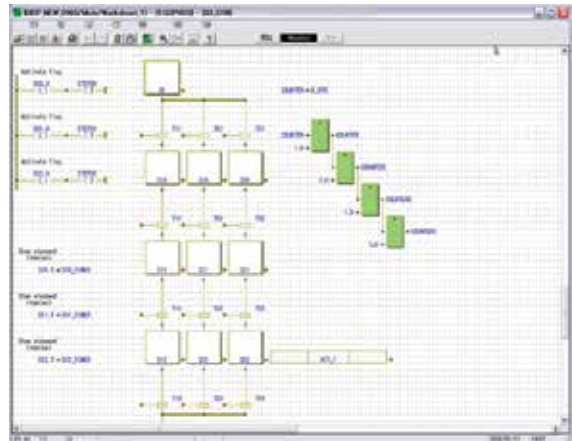


Function Block Diagrams - FBDs are a familiar graphical control representation using function blocks containing sections of logic or analog control for easy manipulation and connection. Custom control blocks can be kept for re-use. Features include high density notations, line crossing and skip, and return lines.

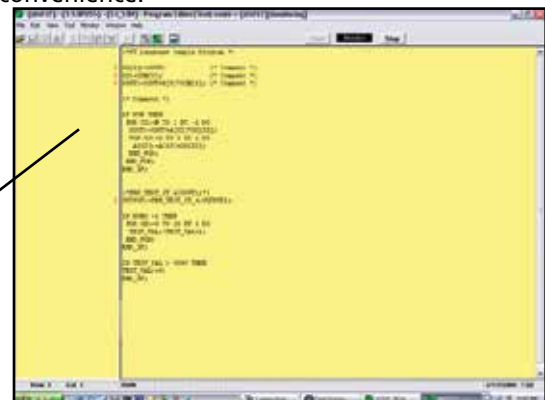
Structured Text Language - ST allows difficult applications not easily programmed with LDs, SFCs, or FBDs to be handled with languages such as Visual Basic or C. Note that Structured Text cannot be mixed with the other three languages.



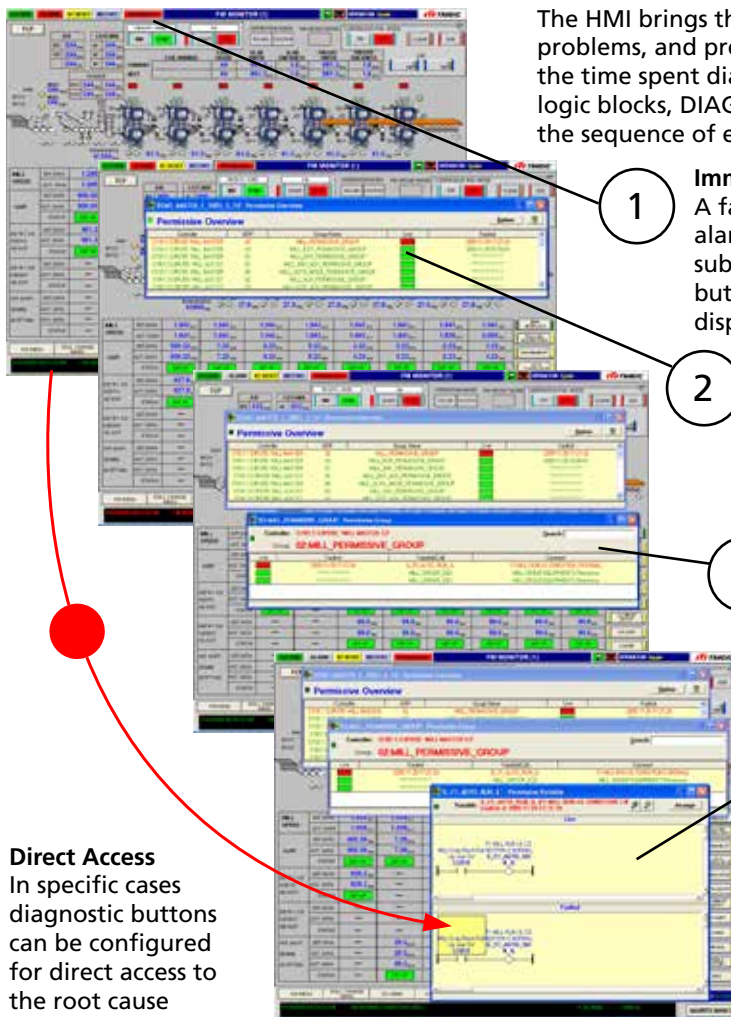
Sequential Function Charts - SFC charts show the control flow and the action unit, which shows the action performed at each step, and the transition condition unit, which shows the conditions for advancing to the next step.



Mix all three programs on one screen. Using all the graphical programs offers the best programming convenience.



Operator Accessible Machine Diagnostic Displays



TMEIC's Library of Control Modules

Engineering Tool contains project-specific control modules developed over 50 years of mill experience. A few are listed here.

Hot Mill and Cold Mill Function Blocks

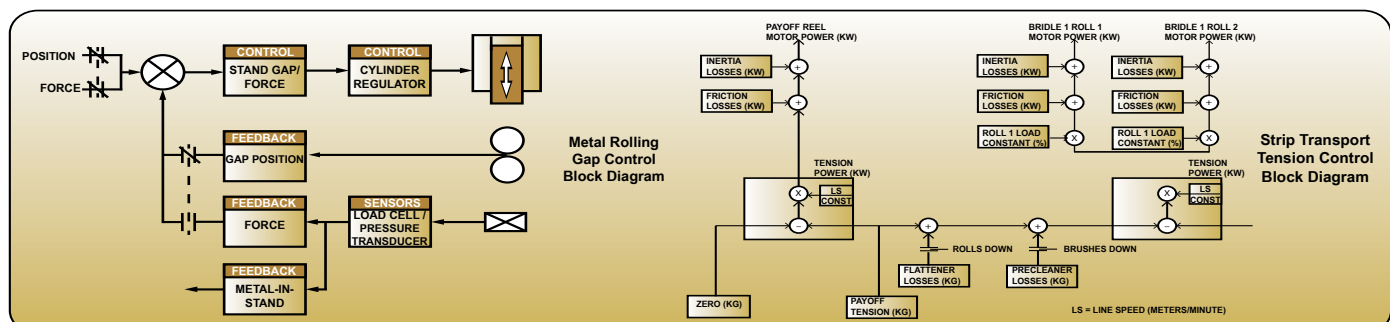
- Hydraulic Gap Control
- Gauge Control
- Coiler Automatic Jump Control
- Hydraulic/Electric Interstand Looper Control
- Cold Mill Interstand Tension Control

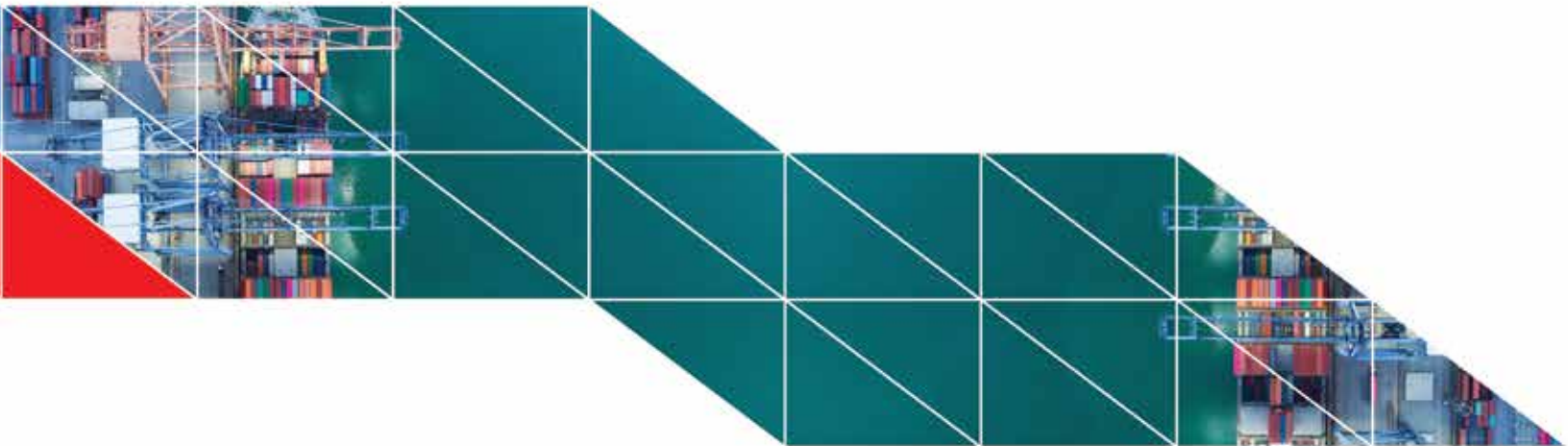
Process Lines Function Blocks

- Zone Tension control
- Loop Car/Tower control
- Coiler Sequencing control

All-Purpose Function Blocks

- Position Regulator
- Special PID
- Coiler Sequencing Control





About TMEIC

A Global Network

TMEIC is built on the combined and proud heritage of Toshiba and Mitsubishi-Electric in the industrial automation, control and drive systems business. TMEIC's global business employs more than 2,200 employees, with sales exceeding U.S. \$2.4 billion, and specializes in Metals, Oil & Gas, Material Handling, Utilities, Cement, Mining, Paper and other industrial markets.

TMEIC Corporation, headquartered in Roanoke, Virginia, designs, develops and engineers advanced automation and variable frequency drive systems, and is home to our Global Center of Excellence for Crane Systems

TMEIC delivers high quality advanced systems and products to factories worldwide, while serving as a global solutions partner to contribute to the growth of our customers.



TMEIC Corporation Americas | Roanoke, Virginia | Houston, Texas | WWW.TMEIC.COM

All specifications in this document are subject to change without notice. This brochure is provided free of charge and without obligation to the reader or to TMEIC. TMEIC does not accept, nor imply, the acceptance of any liability with regard to the use of the information provided. TMEIC 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.

TMdrive is a trademark of TMEIC Corporation Americas.
© 2021 TMEIC Corporation Americas. All Rights Reserved.

D-0026
Revised June 2021