

HOT ROLLING MILL FACTORY

AUTOMATION

with

PROGRAMMABLE LOGIC CONTROLLERS
(PLC)

and

SCADA

GENERAL

Contemporary hot rolling mill factory automation is a PLC based, computerised, fast acting and reliable system.

This easy-to-use, user friendly, intelligent and fail safe automation system together with the years of experience on the hot rolling process, yields increased quality and production rate, reduced scrap material amounts and a more effective rolling process.

MAIN FEATURES

Main features of a digital hot rolling mill automation system :

Typical hot rolling mill automation system is composed of : Digital DC motor drives, Programmable Logic Controllers (PLC), Control desks equipped with touchscreen LCD operator interfaces, remote I/O units, digital communication infrastructure and SCADA computer(s).

All components of the system is connected to a digital communications network, to provide a fast and safe data exchange. This network may be built on fiber optic basis if required.

DC drives residing on this network are fully under the control of PLC for a safe start and rolling operation. All necessary checks and warnings are managed by the PLC software.

Automation system have the required hardware and software to provide remote diagnostics and servicing facilities.

Automation System provides an accurate and precise speed reference entrance by means of LCD touch screen or control desk buttons.

Rolling Schedules, which are created with a specific name, edited, deleted and recorded by the operator, provides a fast and easy start-up of a rolling.

Duty Watch records are triggered by the operator using LCD panel. These records are kept on scada computer's database.

Remote I/O topology provides a considerable amount of cable reduction laid between automation system units.

COVERAGE OF THE AUTOMATION SYSTEM

Hot rolling mill automation basically covers the following control points :

- Fully digital control of DC drives
- Intermediate shears
- Saws
- DC start-stop shear
- Cooling bed, transfer groups
- Taker arms
- Pinch Rolls
- Roller tables
- Packing machine

CONTROL UNITS OF THE PLC BASED AUTOMATION SYSTEM

PLC based Hot Rolling mill process consists of the following main units :

- 1- Mikrotek-Sprint digital DC motor drive panels made in Türkiye
- 2- High End Control products : Telemecanique Quantum PLC range
- 3- Operators interface : Control desks and LCD touch panels
- 4- Supervisory control : SCADA
- 5- Transparent factory : Remote servicing and monitoring.

1- MİKROTEK DIGITAL DC MOTOR DRIVE PANELS

Mikrotek A.S. produces digital DC motor drive panels, using Sprint stack driver units. These panels are produced considering the tough physical and functional hot rolling plant conditions.

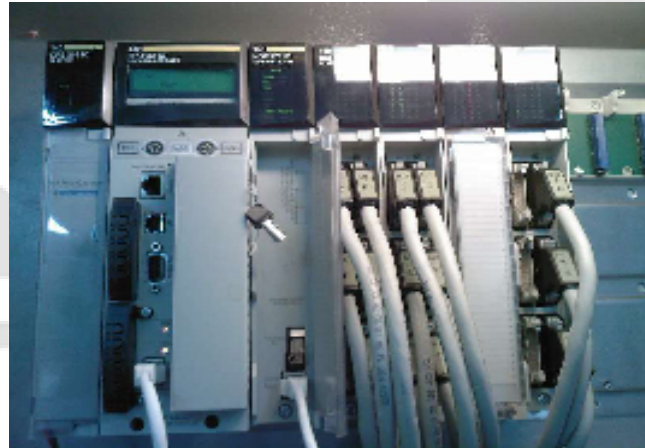


Mikrotek Digital DC drive panel

2- PLC

PLC, being the heart of the automation system, mainly performs the following :

- To provide accurate speed references for the drives. Speed references are programmed and changed by control desks.
- To provide industrial digital fieldbus communication with all slave equipment.
- To select and apply prerecorded rolling schedules to the system for easy start-up.
- Hot Metal Tracking.
- LOOP control.
- TENSION control.
- Single(independent) and/or cascaded operation of DC motors.
- "Impact Speed Compensation" control at selected drives.
- Control of shears and saws.
- Start-stop organisation logic of each drive for a safe start action.
- Organisation of the DC motor and DC drive panel head lamp signaling.
- Keeping the records of billets processed.
- Organising digital communications with control desk(s).
- Controlling Pinch Rolls and provide speed references for pinch roll drivers.
- Providing digital speed references for roller group frequency convertors.
- Evaluation of the "Ready" and "Alarm delaying" signals for each drive and check it before start operation.
- Organising DC drive panel fan and motor fan operations according to motor start-stop logic.
- Control of lubrication systems.
- Issue alarms and warnings.
- Besides above listed operations, PLC organises the operations of cooling bed, chain transfer platform, rollers, saws, taker arms, packing units and other control points if exists.



Control system platform is Modicon TSX Quantum High performance architecture.

The Quantum PLC, CPU Specifications used for hot rolling mill applications :

Processor / clock speed	586 / 166 MHz
Memory flash / SRAM	2M
Discretes (in / out)	65,535 any mix
Maximum IEC 61131-3 program	512Kb / 7.2Mb with PCMCIA
Modbus ports	1
Ethernet ports	1
USB ports	1
Option modules supported	6

Number of K instructions executed by Kins/ms:

100% boolean	10.28
65% boolean and 35% numerical	9.91

3- CONTROL DESKS AND LCD TOUCH PANEL

Control desk(s) are used for operator interface at command towers and control desks are equipped with LCD touchscreens to provide safe and easy operator interface.

Number of control desks may vary according to the need.

Following operations are covered by the control desk :

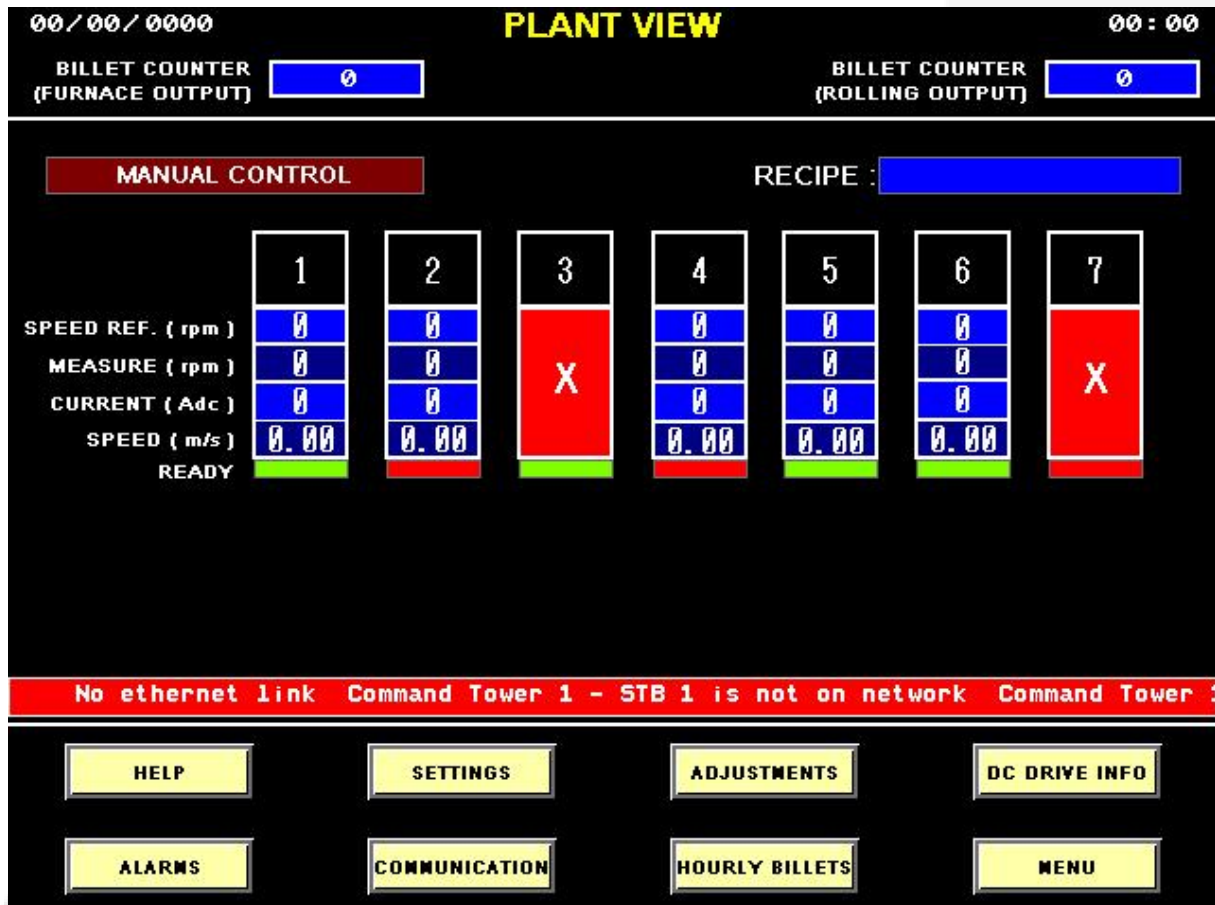
- Parameter entrance for the rolling operation.
- Operation mode selection, process and alarm monitoring and manual operations.
- Remote IO circuitry located in these desks provides a safe transfer of desk signals to main PLC to be evaluated in PLC logic.
- Rolling Schedules are created with a specific name, edited, deleted and recorded by LCD panel. Operator may select and apply one of these records to process.
- Duty Watch records are done by the operator, using LCD panel, on scada computers database.
- Listing of all alarms and warnings.
- Monitoring of total and hourly counted billet numbers.
- Monitoring of all instantaneous operating values and fault signalling of each DC drive separately.
- To monitor the operation by control desk signalling.
- To monitor the communications diagnostics between control desk and PLC.



Control desk remote IO units



Control desk with LCD touchscreen



Plant View page on LCD touch screen.

Other pages that can be reached are shown at the bottom of the page.

4- SCADA

Scada is for the purpose of animation, parameter monitoring, historical trend recording, alarm monitoring and database recording. For these purposes, system may include one or more than one computers.

A scada system has following properties :

- Scada computer runs an application software. A database is in the computer.
- Scada computer is for the purpose of animation, parameter monitoring, historical trend recording, alarm monitoring and database recording.
- Motor operation time accumulators are used to warn operators for maintenance times.
- Monitoring of total and hourly counted billet numbers.
- Production records are listed and printed out.
- History trends keep records of operation variables of each drive in graphics mode. These records are kept for past 2 years.
- At “plant view” page, animation and instantaneous operation values are monitored.

Short keys are present near DC motor icons, to reach easily to trend and information pages for each motor.

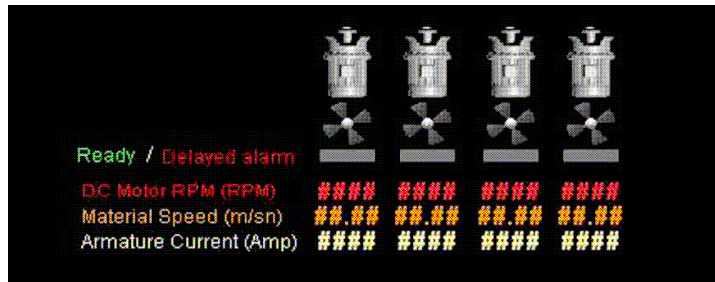
- Alarm lists are monitored.
- DC motor information pages have the instantaneous operation values and the cause of faults.

DC motor information pages :



Production pes and reports :

Visual DC motor status information :



System parameters :

PARAMETERS										
MOTORS	Start current rate	Start rate delay	Reverse factor	Min start at 100%	Reverse factor at 100%	Max start at 100%	Reverse factor at 100%	Forward speed rpm	Reverse speed rpm	Active brake
DC MOTOR 1	#####	#####	#####	#####	#####	#####	#####	#####	#####	<input type="checkbox"/>
DC MOTOR 2	#####	#####	#####	#####	#####	#####	#####	#####	#####	<input type="checkbox"/>
DC MOTOR 3	#####	#####	#####	#####	#####	#####	#####	#####	#####	<input type="checkbox"/>
DC MOTOR 4	#####	#####	#####	#####	#####	#####	#####	#####	#####	<input type="checkbox"/>
DC MOTOR 5	#####	#####	#####	#####	#####	#####	#####	#####	#####	<input type="checkbox"/>
DC MOTOR 6	#####	#####	#####	#####	#####	#####	#####	#####	#####	<input type="checkbox"/>
DC MOTOR 7	#####	#####	#####	#####	#####	#####	#####	#####	#####	<input type="checkbox"/>

Motor maintenance warnings :

MOTOR MAINTENANCE TIME		#####	Hour
(!) MOTOR WORKING TIME			
DC MOTOR 2 WORKING TIME	#####	Hour	##### Min.
DC MOTOR 3 WORKING TIME	#####	Hour	##### Min.
DC MOTOR 4 WORKING TIME	#####	Hour	##### Min.

Hourly billet counts :

(!) HOURLY BILLET COUNT			
00 - 01	###	12 - 13	###
01 - 02	###	13 - 14	###
02 - 03	###	14 - 15	###

Trends for motor parameters :



5- REMOTE SERVICING AND MONITORING

Automation system will have the required hardware and software to provide remote diagnostics and servicing facilities.

For this purpose the factory must provide an ADSL internet connection with a static IP. With this facility activated, in case of a demand, a safe and secure connection is provided between the factory automation network and the authorised servicing point.

Over this connection followings can be done remotely :

- System diagnostics can be performed remotely by Mikrotek. This is a fast and secure operation.
- Software modifications can be done by Mikrotek, without stopping the system.
- SCADA Software modifications can be done by Mikrotek, without stopping the system.
- Authorised corporate people may reach the process data, production data and alarms with a password over internet.

6- COMMUNICATION ARCHITECTURE

Automation system is connected together by an industrial fieldbus communication network.

PLC, SCADA computers, Operator panels are connected to this industrial network.

Copper or Fiber networks are chosen according to the needs of the project.

Harsh environmental conditions may require the usage of fiber networks as well as the usage of separate networks are needed for more reliable operation.

PLC panel(s) have the necessary communications devices such as : Switches, Fiber optic patch panels, communications module(s) and service modems.

MİKROTEK HOT ROLLING MILL APPLICATION REFERENCES

Some projects include only DC drive panel productions.

In production or waiting for commissioning :

FNT / TABRİZ - IRAN

ROYAL / IRAN

STEEL TECH. / DAMASCUS - SYRIA

Completed projects :

AL WAHİB / TARTOUS - SYRIA

AK DEMİR / İZMİR - TÜRKİYE

HARTOUM - SUDAN

TUFENGJI GROUP INDUSTRIES / ALEPPO - SYRIA

TİSAN A.Ş. / İZMİR - TÜRKİYE

ÇELMER A.Ş. / KOCAELİ - TÜRKİYE

KAR-DEMİR LTD / İZMİR - TÜRKİYE

SİDER DIŞ TİCARET (EREĞE) / İZMİR - TÜRKİYE

TOSYALI DEMİR ÇELİK 1. SECTION MILL - İSKENDERUN - TÜRKİYE

TOSYALI DEMİR ÇELİK 2. SECTION MILL - İSKENDERUN - TÜRKİYE

KOCAER HADDECİLİK ALİAĞA / İZMİR - TÜRKİYE

SÖZER DEMİR ÇELİK / İZMİR - TÜRKİYE

İMSAN / İZMİR - TÜRKİYE

ÖZKAN DEMİR / ÇELİK İZMİR - TÜRKİYE

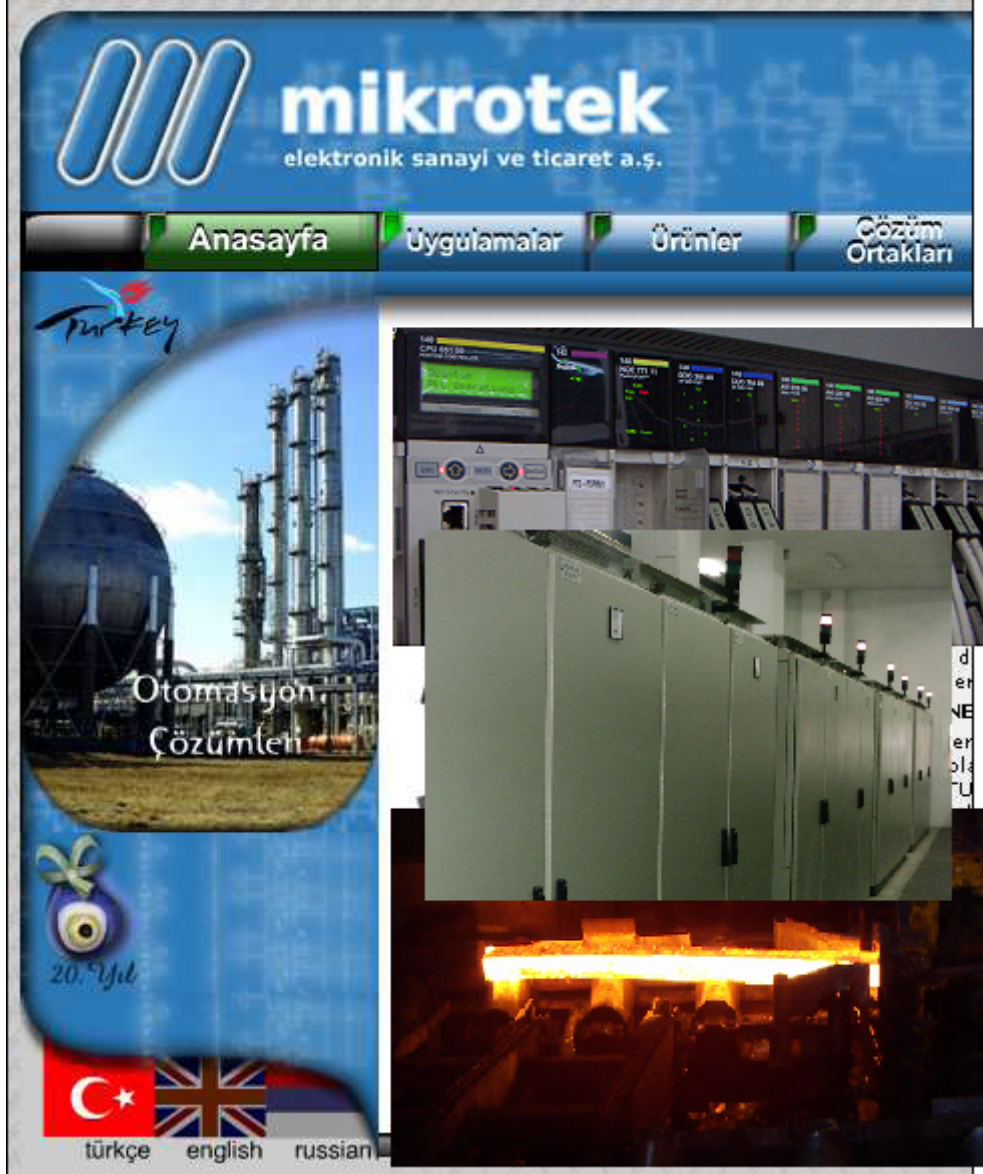
NURMET / İSKENDERUN - TÜRKİYE

BAŞTUĞ ÇELİK SANAYİ / İSKENDERUN - TÜRKİYE

DHT METAL/ BAKU - AZERBEIJAN

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Mikrotek A.Ş. , working in industrial automation business for 23 years, designs and produces complete automation solutions for hot rolling mill industry.

Mikrotek-Sprint Digital DC motor drives and Schneider Electric automation equipment are integrated with Computer based industrial hot rolling mill automation solutions and automation software.