

Foundations of Manufacturing

metric dimensions, wear limits and assembly

LUBRICATION FOR MAINTENANCE TECHNICIANS 77-BA03-0001

77-BA04-0001

77-BA05-0001

77-BA06-0001

ading footing, foundation, and floor plans

entify welding symbols

ntifying Lubricating Oils

pplying Lubricating Oils

Bearing Packers Brease Lubricators

olt Extractor

HAND TOOLS

Hook and Loop Fasteners

llers and Tape Measures

uares and Levels

cribes and Punches

Nork Holding Devices

Sutters Files & Deburring Tools

Power Tools

Rotary Tools

andsaws

Reciprocating Saws

actions, Decimals, and Rounding

rnier, Dial, and Digital Calipers

eight Gauges and Dial Indicators

minal Dimensions and Tolerance

arts Inspection and Inspection Reports onclusion - Quality Control in Industry

erstanding the History of Manufacturing

nning and Staffing a Manufacturing Company derstanding Product and Strategy Selection

reparing a Resume/Writing a Cover Letter

ntifying Manufacturing Processes derstanding CAD, CAE, CAM, CNC

derstanding the Role of Quality Control

ixed Gauges ransfer Measurement Tools

tatistical Analysis tatistical Process Control

MECHANICAL MEASUREMENT AND QUALITY CONTROL 77-8014-0001

INTRODUCTION TO ADVANCED MANUFACTURING 77-3096-0000

rstanding Forecasting Software and Computer Simulation Mo

derstanding the Role of Automation in Manufacturing

derstanding Computer Integrated Manufacturing

MECHANICAL FASTENERS

eaded Fastener Selection

eating and Repairing Threads

plying Lubricating Greases

electing Synthetic Lubricants Grease Guns

tting Up a Lubrication Schedule

entifying General Purpose Grease

itifying Special Purpose Greases

INDUSTRY 4.0 CAREER SKILLS TRAINING

MACHINING

unting the Workpiece

ring the Workpiece

nning a Program ndamentals of NC Programming

oject #1 - Programming the House

oject #2 - Programming the Star

iing a Program amentals of NC Programming

gramming a Taper Machining ject #1 - Machining

COMPUTER-AIDED MANUFACTURING

uring and NC File Generation

ced Operations Setup

equential Control with a Timed Delay

lding a Basic Electrical Circuit

olementing the Logic Function AND

lementing the Logic Function NOT

lding a Fully Automatic Circuit

dding a Delay Using an Electric Timer

latching a Fully Automatic Circuit

FUNDAMENTALS OF LADDER LOGIC

atching and Unlatching Outputs

ject: Implementing CTU and CTD

oject; Applying Equal and Not Equal

e Greater Than (GRT) Instruction

ject: Implementing GRT and LES

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proving Elevator Control

ADVANCED LADDER LOGIC

ne Equal (EQU) Instruction

he Move (MOV) Instruction

ne Add (ADD) Instruction

ne Subtract (SUB) Instruction

e Not Equal (NEQ) Instruction

unter Up and Reset

ne Shot Risina

riting and Simulating a Basic Ladder Diagram

ct: Controlling a Sorting System

e 5/2 Solenoid-Spring Valve

e 5/2 Solenoid-Solenoid Valve

sing A Single Pilot Valve in a Pneumatic Circui

osing Control Signals

ming Diagrams

ELECTRO-PNEUMATICS

WITH SPECTRACAM - MILLING

ifying a Program

Guide to Skills Coverage

sonal Protective Equipment (PPE) Identifying Wastes in a Workplace Designing the Manufacturing Workplace afety Procedures designing a Workstation oduct Development & Customer Service undamental Concepts in Lean SAFETY: LOCKOUT / TAGOUT Applying Lean to a Household Task Task Analysis and Design mpleting and Attaching Tagout Devices 77-BA01A-0001 MATH FOR TECHNICIANS I BASIC POWER ELECTRICITY orking with Whole Numbers ELECTRICAL CIRCUITS orking with Systems of Measuremen nnecting a Momentary Switch ntifying Sources of Electricity easuring DC Voltage 77-BA01B-0001 MATH FOR TECHNICIANS II structing a Parallel Circuit lying Mechanical Principles sing Ohm's Law in Series and Parallel Circuits verting Binary, Binary Coded Decimal (BCD), Hexadecimal an JM-BASE-EA01B RESISTORS & CONDUCTORS alculating Pressure, Force, Head and Flow alculating Shim Requirements electing Pipe Size 77-3097-0000 EMPLOYABILITY lating Wire Size rsonal Qualities Desirable for the Workplace rnersonal Communication JM-BASE-EA01C ging a Capacitor & Testing a Capacito oblem-Solving Techniques siness and Personal Ethics siness Etiquette and Ethical Computer Behavior sembling an Electromagnet per Communication with Diverse Populations olying Electromagnetic Principles ob Applications sembling & Operating Transformers tential Employer Interviews 77-BA02-0001 MECHANICAL BLUEPRINT READING JM-BASE-EA01D MOTORS & GENERATORS ngle, multiple, and auxiliary views ding and locating blue print dimensions ating a Series Motor entify tapers and machined surface symbols tting planes and sections

INTRODUCTION TO LEAN MANUFACTURING

	ELECTRICAL CONTROL SYSTEMS
Ov	VERLOAD/OVERCURRENT PROTECTION & MONITORING JM-CTRL-EA02
	rawing and Reading Circuit Protection Symbols

JM-CTRL-EA03

cesses and Machine Definition

ning Part Production in the Lathe

COMPUTER INTEGRATED MANUFACTURING 2

w Production Details in the Device View and Storage View

ducing a New Part

grated Production

cking Integrated Production

ding an Assembly Station

rchase Orders and MRP

embled Part Production

embled Product Characteristics

assemblies and Multi-Level Assembly

anding Assembly Capabilities

ti-Level Assembly Production

ve Maintenance and Troubleshooting Fuse Blocks ing Circuit Breakers ing and Resetting a Circuit Breaker usting and Testing the Overload Relay

ating Three-Phase Power

TRANSFORMERS aw and Read Transformer Symbols

nect Transformer as Auto Transformer for Buck and Boost Operat nect Transformers in Delta and Wye spect and Service a Transformer

ng and Operating a Split-Phase Motor ecting and Operating a Space Finance Motor ecting and Operating a Shaded-Pole Motor ng DMM and Motor Meager Tests oleshooting a Split-Phase Motor bleshooting a DC Motor ubleshooting a Three-Phase Motor

ELECTRO-MAGNETIC MOTOR STARTERS JM-CTRL-EA07 ting, Adjusting and Operating a Single Magnetic Starter ect, Adjust, and Operate a Three-phase Reversing Starter nect and Operate a Magnetic Starter for Jogging

publeshoot a Three-phase Motor Control Circui RELAYS, TIMERS AND TIME DELAY RELAYS JM-CTRL-EA08 Programming, Operating Analog On-Delay and

ecting, Programming, and Operating Digital Interval, Repeat ng Digital Relays and Motors necting and Operating Electric Timers

JM-CTRL-EA09 ting and Operating a Photoelectric Sensor with Fiber Opti nd Operating a Capacitive Proximity Switch necting and Operating a Limit Switch

SOLID-STATE REDUCED VOLTAGE STARTERS JM-CTRL-EA11 t and Operate a Solid State Starter

VARIABLE FREQUENCY DRIVES - VFD JM-CTRL-EA12

JM-CTRL-EA16

ding Voltage and Current on the VFD

DC MOTOR CONTROL nect, Set Up, and Operate DC Drive ect and Operate Braking Controls ubleshoot DC Drive

nect and Operate SCR Speed Control

ct and Operate TRIAC Speed Contro

st Solid State Starters

MECHANICAL SYSTEMS BASIC MACHINES JM-MBLM-ME01 MACHINE SHAFT COUPLINGS JM-MBLM-ME07 Aligning Rims & Faces GEAR DRIVES JM-MBLM-ME08 Mass and Inertia Installing a Worm Gear Drive Measuring Backlash JM-MBLM-ME09 MACHINE SPEED REDUCERS MACHINE STATICS AND DYNAMICS ELECTRIC BRAKES JM-MBLM-ME10 ifv Material Fatique & Fatique Stress Points Installing Electric Brakes easuring & Verifying Shafts emonstrating Shaft Expansion Principles easuring Eccentricity & Shaft Runout JM-MBLM-ME11 LASER ALIGNMENT onstrating Shaft Key Principles VIBRATION ANALYSIS Measuring the Vibration of a Motor Measuring Shaft Misalignment ting Belt Drive Ratio Principle: roubleshooting Bent Shaft Vibration Froubleshooting Resonant Vibration ing Adjustable Speed Sheaves BEARING MAINTENANCE JM-MBLM-ME13 Using an Arbor Press Using a Bearing Puller Installing and Removing Bushings Roller Chain & Sprocket F alling & Aligning Sprockets Using a Cone Heater Loading a Grease Gun ubleshooting & Maintenance

INDUSTRIAL POWER ELECTRONICS HAND HELD DIGITAL OSCILLOSCOPE JM-POWR-EB01C OSCILLOSCOPE Identifying and Using Oscilloscope Controls ting Up and Operating the Oscilloscope forming AC Voltage Calculations Measuring AC Voltage and Frequency DIGITAL MULTIMETER DC POWER SUPPLIES JM-POWR-EB02A ding the Liquid Crystal Display Locating Diodes and Symbols ng Up the DMM for Reading AC Voltage

Hand Packing a Bearing

Using a Bearing Packer

Ilculating & Converting AC Voltage Connecting and Operating a Half-Wave DC PS Confirming Full-Wave DC Power Supply Operation
Connecting and Operating a Full-Wave DC PS charging a Capacitor Confirming Single-Phase Bridge Rectifier Operation SINGLE-PHASE AND suring DC Millivolt THREE-PHASE POWER SUPPLIES ting Grounds and Bonds ecting and Operating a Zener Diode Voltage Regulator ng and Operating a DC Power Supply with an IC Voltage CIM/FMS ooting a DC Power Supply FLEXIBLE MANUFACTURING SYSTEM 77-3022-0000

ning Three-Phase Bridge Rectifier Operation a Three-Phase Bridge Rectifier ting and Operating a Three-Phase Bridge Rectifier igning an FMS Workcell ling the Workcell THYRISTOR ELECTRIC MOTOR DRIVES JM-POWR-EB03 ing and Operating an SCR ng Finished Parts iple Part Programming ng and Operating a Full-Wave SCR DC Motor Drive oting a Full-Wave SCR DC Motor Drive tiple Part Lathe Operations ing the TRIAC and drawing the TRIAC Symbo signing and Running the Final Project nstrating TRIAC Control Principles nating a DIAC and Drawing the Schematic Symbol necting and Operating a DIAC-Controlled TRIAC AC Motor Driv COMPUTER INTEGRATED MANUFACTURING 1 77-3015-0000 ecting and Operating a Schmitt Trigger-Controlled TRIAC AC oducing OpenCIM Software shooting a TRIAC Motor Drive arts and Production Flow rage Setup

onstrating PWM Principles **E**LECTRONIC TIMERS ng and Operating a 555 Timer in Monostable Mode ng and Operating a 555 Timer in Astable Mode fying a Pulse Train Circuit STEPPER MOTOR DRIVES

> rating Stepper Motor Principles ing Stator Winding Connections trating Unipolar Stepper Motor Drive lling, Connecting and Monitoring a Stepper Motor Drive Servo Motor Drives trate Servo System Feedback Device Principles

> > g and Troubleshooting a Basic Servo Motor Drive

ate Analog and Digital Servo Motor Drive Principles nnect and Monitor a Basic Servo Motor Drive

Importing Pictures
Importing a Drawing DXF/DWG/SVG
3D Dinosaur Project HYDRAULICS PNEUMATICS FUNDAMENTALS OF HYDRAULICS 77-8068-0000 FUNDAMENTALS OF PNEUMATICS spheric Pressure and Vacuum essure and Force spheric Pressure, Vacuum and Mechanical Work e Double-Acting Cylinder lydraulic Power Transmission trolling a Piston with PBs termining Component Characteristics ow Control Valves 2 Air-Operated, Spring-Returned Valve /3 Closed-Center Valve - Characteristics wer Transformation Using a Double-Acting Cylinde ot Welding System oading a Piston e Punch - A Semi-Automatic System ask: Building a Circuit 77-8069-0000 ADVANCED PNEUMATICS **ADVANCED HYDRAULICS** lementing AND in a Pneumatic Circuit trolling a Hydraulic Press trolling a Barricade sing AND to Build a Fully Automatic System ain Gate Valves lementing OR in a Pneumatic Circuit ntrolling a Cargo Airplane Door cuit with Two Double-Acting Cylinders creasing System Efficiency quential Cycle

77-3140-0001

COMPUTER-AIDED MANUFACTURING

Finish Tool Path and NC File Generation

COMPUTER-AIDED DESIGN WITH SPECTRACAD 77-3004-0001

77-8160-0001

77-3026-0000

WITH SPECTRACAM - TURNING

Creating the Part Drawing

Drawing the M

Speaker Design Project Creating the Speaker Cone

SpectraCAD Engraver

Generating an NC File

Securing the Work Piece

NC Files and Coding

CNC ROUTING

Axis of Travel

Installing a Tool

Jogging the Router Setting Part Zero G-Code Editing

Cutting a Sample Part Introduction to Vectric VCarve Pro

Making a Gear Clock Drawing

Completing the Speaker Project

Drawing the C

Creating the Lighter Geometry

Final Geometry and Tool Paths Final Tool Paths and NC Code

atching a Relay emi-Automatic Press System ing a Single Pilot Valve to Prevent Opposing Control Signals nproving Control in a Circuit with Sequential Operation ELECTRO-HYDRAULICS

lydraulic Systems Usage and Control ntrolling Piston Speed i-Directional Motor essure Relief Valve /3 Closed-Center Valve vs. 4/3 Tandem-Center Valve nultaneous Operation of Two Componen ntrolling Two Actuators Using Two Valves imit Switch Sequential Operation atching a Relay PLC-Controlled Pneumatic Systems 77-3034-0000

77- 3032-0000 Manual Control of a Pneumatic Piston Semi-Automatic Control Systems Semi-Automatic Action Using a 5/2 Spring-Return Valve Fully Automatic Operation with Spring Return Valve Sequential Operation with Two Double- Acting Cylinders

Sequential Operation with Three Double- Acting Cylinders Solving Opposing Control Signals Solving Opposing Control Signals in a Three Cylinder System Controlling a System with a Variable Timer PLC CONTROLLED HYDRAULIC SYSTEMS 77-3035-0000

Using a 4/2 Sol-Spring Valve to Control Double-Acting Cylinder Using a 4/3 Sol-Sol Valve to Control a Double-Acting Cylinder Using a Fully Automatic Hydraulic Circuit Using a Fully Automatic Hydraulic Circuit with a Timer Using a 4/3 Sol-Sol Valve with a Counter Using a Fully Automatic Hydraulic Circuit with an OSR Instruction Sequential Operation with Two Double-Acting Cylinders Sequential Operation with Three Double-Acting Cylinders Sequential Operation with Two Double-Acting Cylinders and a Delay Sequential Operation with Three Double-Acting Cylinders & a Delay Project: Port Soil Removal System

INDUSTRY 4.0 LEVEL 1

FUNDAMENTALS OF ROBOTICS w Robots Work ing Robotic Control Software ording Robot Positions ogramming a Simple Pick and Place Task osolute and Relative Positions Basic Robotic Programming Tools Block Alignment Project eders and Templates eripheral Devices ear Slidebase Project

ROBOTICS

ogramming with Subroutines

oll and Pitch gramming the Robot to Execute Linear and Circular Movemen nal Project: Drawing a House ADVANCED ROBOTICS

ject #1 - Delivering Materials with a Conveyor onditional Branching roject #2 - Programming with Conditional Branching log Inputs and Outputs ntact and Non-Contact Sensor ogramming a Sorting System Projec ROBOTICS & MATERIALS HANDLING 1 ording Robot Positions iting and Running a Robot Program

puts and Program Jumps oint and XYZ Coordinate Systems ops, Polling, and Counters ntact and Non-Contact Sensors vo Control of the Conveyo

Control of the Conveyor 77-8083-0000 ROBOTICS & MATERIALS HANDLING 2 anipulating Blocks Project ogramming the Robot to Execute Circular Movement Block Alignment Projec eeders and Templates eripheral Devices near Slidebase Project ogramming Using Encoder Values nditional Branching

ogramming with Conditional Branching nalog Inputs and Outputs rogramming a Sorting System Project ogramming Gravity Feeder Operations gramming Jig and Gun Operations

asic Robotic Programming Tools Ivanced Robotic Programming Tools gramming Welding Operations gramming a Fully Automated Welding Cycle forming a T-joint Weld and Fine-Tuning gramming and performing a Butt Joint Weld enting Thermal Deformation Changing Parameters: Inert Gas Shield anging Parameters: Robot Speed and Feed Rate

oject: Welding Your Name Machine Vision & Quality Control WITH COGNEX LAB 1

ntro to In-Siaht Explor Analytical Tools Optics and Lighting Image Setup, Lighting, and Calibration ilters and Noise Elimination

Machine Vision & Quality Control 77-8089-0000

e Color Tool etting Up an Emulator sion Tools and the Emulator Spreadsheet Logic Image Analysis with the Emulator mage Enhancements with the Emulator

77-8401-0001 MANUFACTURING PROCESS Manufacturing Process – Overview RobotExpert Software Layout nownload and install the software CAD Import - Basic Environmer Modeling & Layout

MANUFACTURING PROCESS WITH ROBOTEXPERT 2 DLP- Off Line Programming ublishing

ADVANCED INDUSTRY 4.0 CONCEPTS INTRO TO INDUSTRY 4.0 Advanced course covering the Architecture and Protocols of Introductory course providing an overview of Industry 4.0 concepts and technologies Industry 4.0 systems Prerequisite: Intro to Industry 4.0 (lvl 1) - What is Industry 4.0? Why Now? ndustry 4.0 - The Architecture Key Technologies that drive Industry 4.0 - Components and architecture of Industry 4.0 systems The Journey to Industry 4.0 Integrated systems approach

Horizontal Integration & Vertical Integration (Mixing IT with OT, intro to MES) ne 4 industrial revolutions - background Diversified Manufacturing (Subtractive, additive, rapid ndustry 3.0 to Industry 4.0 - the gaps prototyping, flexible mass production, automation,.... Key elements of Industry 4.0 CyberPhysical Systems (Cloud, Simulation, Twinning atroduction to maintenance / 0 Digital Twinning) ntroduction to flexible (customized) mass production Jse cases of Industry 4.0 - Digitization (Smart sensors, IoT, Asset/Inventory

SCADA

Machine to machine connectivity

- Reference architecture

- Real-time access to data

ADVANCED CYBER SECURITY

threats in industry 4.0 systems

Recognize Cybersecurity Breach

Basic Firewall Protection Settings

Basic Switch protection settings

Virus and Malware

on the manufacturing floor.

- Real- time views of production

- Real-time insights

FOR INDUSTRY 4.0

Protocols (OPC-UA, MQTT)

- Standards : IEC62541, DIN spec1592

Materials identification (RFID/barcode/etc)

Prerequisite: Intro to Cybersecurity (lvl 1)

Curriculum with Hands-on lab for Cybersecruity with Lab

Skills of Identify, Protect, Detect, Respond, & Recover cybe

Lab will implement exercises relevant to the awareness and

implementation of cyber-security practices and protocols

- Antivirus software - installation and configuration

INDUSTRY 4.0 LEVEL 2

tracking) INTRODUCTION TO HOT AND CONNECTIVITY ADVANCED HOT AND CONNECTIVITY

Overview of smart connectivity. Introduction to smart FOR INDUSTRY 4.0 sensors, IoT, Connectivity, Identification techniques in Advanced course covering sensors and connectivity within the integrated smart factory. The course will delve into sensors, machine to machine communications, protocols and components for industry 4.0. The course is accompanied undamentals of networking (all the types of comms and

by labwork for hands-on learning of sensors and IoT omparison) Prerequisite: Intro to IoT/Connectivity (lvl 1) IoT Communications and Architecture - Types of sensors Design Modularity How they work Smart Sensors How they communicate - What data they collect

- What is InT Protocols - Standards Materials identification - Vision systems - RFID/Barcode/other

How this can be used

communications architecture

FOR INDUSTRY 4.0

Industry 4.0

INTRO TO NETWORKING & CYBER SECURITY FOR INDUSTRY 4.0 Overview of networking and cyber-security in IT/OT systems, including networking fundamentals, identification

of cyber threats and means of protection. asics of Data Networking - IP networking Basics Cloud Computing Basics Components of the mfa network

Guidance on Securing Digital Manufacturing Opera-- What are cyber threats Basic cybersecurity practices Key Technologies in Cyber systems

FOR INDUSTRY 4.0

Data mining

atabase fundamentals

ig Data: Why and Where

ata Warehousing

The Importance of Cybersecurity Protecting Against Cyber Attacks Common Virus Types, Malware, Worms and Protectio

Overview of the concepts of Data Science and the role of data

collection, analysis and use of data in developing operational

- Characteristics of Big Data and Dimensions of Scal-

efficiency, predicitive maintenance and business flexibility

troduction to Big Data/Data Science

Getting Value out of Big Data

Intelligent decision making

Principles of cloud & hig data

Data driven innovation (DDI)

science in the Smart Factory. The course will explain data

Secure provisioning of operating systems, software, and - Cyber Breach Response T Cybersecurity Basics

- Manage Services and Ports Securely in OT devices Lab includes: loud Security Basics

- Configuration and test of firewall, switch, etc. - Installation of software including security software - Perform a DoS Attack Against a Specified Target - Hack a Specified file (flag) in a Remote Network - Perform Steps to Establish Persistence in

Compromised network or Device

INTRO TO INDUSTRY 4.0 SOFTWARE TECHNOLOGIES Overview of all the Software technologies and applications that transform traditional production lines into Smart

Industry 4.0 Software Tools and Digital technologies Digital information management System Management - ERP - Enterprise Resource Planning systems

- MES - Mnufacturing Execution Systems - APS - Advanced supply chain & planning systems stem visualization tools - Virtual reality Augmented Reality

- Digital Twinning/Simulation apps - Artificial Intelligence and Machine Learning

INDUSTRY 4.0 LEVEL 3

· Getting Value out of Big Data examples

troduction to Machine Learning with Big Data

ADVANCED ADVANCED DATA SCIENCE FOR INDUSTRY 4.0 Advanced course covering the Data Science terms and concepts and ways to benefit form the information that is collected from a Smart factory system. Data warehousing

Data mining Data driven innovation (DDI) One Matrices That Matter (OMTM) KPIs of Big Data Deep Learning & Machine Learning, Al Working with Analytics Kit - lab A.I. - Deep learning tools - Lab

INDUSTRY 4.0 - THE ECOSYSTEM High level look at the Industry 4.0 Smart manufacturing in industry and the trends and use cases for technology Industry 4.0 - The super infrastructure for the future of manufacturing (market trends)

Requirements for a factory to be Industry 4.0 (technology ndustry 4.0 and Business processes (Flexible Mass

- Enhanced customer experience - Competitive industrial production Customized mass production - Maintaining production (improved reliability/quality)

INDUSTRY 4.0 FOR BUSINESS A look at industry 4.0 from the business perspective. The course will look at the benefits and justifications for smart manufacturing.

utcomes of Industry 4.0 - Customer satisfaction - Information transparency - Customized mass production - Intelligent decision making - Asset management Use cases examples (Case Studies) usiness with industry 4.0 - Business 4.0 (business efficiency)

- Supply chain 4.0

- Maintenance 4.0

- Quality 4.0

- Real time business processes

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