

Mechanical Drives Learning System (SI units)

46100-00

FESTO

LabVolt Series

Datasheet



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Festo Didactic
en
05/2023

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General Description

Gain precious time with a turnkey solution for teaching the fundamentals of industrial mechanics

The Mechanical drives learning system exposes students to the hardware, tools, measuring apparatus, and methods used by industrial mechanics to keep plants running. It covers the identification, installation, and troubleshooting of common machine elements, and is suitable for beginners in vocational schools, as well as industrial mechanics who need to refresh their basic skills.

Hardware is of industrial-grade, yet small and light enough to be handled by one student. Most of the hands-on exercises take place inside an ergonomic and safe workstation which is the foundation of the system.

The Mechanical drives learning system is divided into a Workstation package (required for all topics) and four levels. Each level consists of separate models that include hardware, tools, measuring apparatus, and instructor manuals. Optional topics and hardware are also offered.

System of units (SI versions only)

The SI version of the system is designed with components and manuals that use the International System of Units, abbreviated SI (m, kg, etc.)

Electrical network (SI versions only)

The SI version of the system is available for 120 V, 60 Hz and 230 V, 50/60 Hz electrical networks. The 230 V, 50/60 Hz version of the workstation is CE compliant.

Languages for hardware and manuals (SI versions only)

The 120 V, 60 Hz system is available in English, Spanish and French. The 230 V, 50/60 Hz system is available in English, Spanish, French and German.

Features & Benefits

- Safe and ergonomic workstation
- Small footprint
- Hundreds of possible setups with movable T-slotted extrusions
- Turnkey solution with necessary fasteners and tools
- Optional work bench available to store components from all levels

List of Available Training Systems

Qty	Description	Model number
1	Mechanical Drives Training System, SI Units – Level 1 (add-on) _____	594777 (46100-10)
1	Mechanical Drives Training System, SI Units – Level 2 (add-on) _____	594778 (46100-20)
1	Mechanical Drives Training System, SI Units – Level 4 (add-on) _____	594781 (46100-40)

Available Training Systems

Mechanical Drives Training System, SI Units – Level 1 (add-on) 594777 (46100-10)



Properly aligned pulleys, sprockets, and gears as well as adjustment of belt tension, chain slack and gear backlash are essential in mechanical drives. The Level 1 package includes hardware and tools to master these skills.

Future industrial mechanics must be trained to master the fundamental skills related to the identification, installation, and maintenance of belt, chain, and gear drives to minimize vibration, maximize power transmission, and help ensure that components reach their expected service-life.

The manuals of the Level 1 package guide the students step-by-step during their learning process with several photos and illustrations. The pulleys, sprockets and gears are stored on a panel for quick identification and inventory control.

List of Equipment

Qty	Description	Model number
1	Belt drives 1 _____	593759 (46866-00)
1	Chain drives 1 _____	593763 (46867-00)
1	Gear drives 1 _____	593767 (46868-00)

List of Manuals

Description	Manual number
Belt Drives 1 (Workbook (Instructor)) _____	593952 (54332-3C)
Chain Drives 1 (Workbook (Instructor)) _____	593962 (54333-3C)
Gear Drives 1 (Workbook (Instructor)) _____	593972 (54334-3C)

Vibration Analysis

Qty	Description	Model number
1	Vibration Analysis (SI units) (add-on to Level 1) _____	593842 (46895-00)
1	Campus License - Vibration Metering and Analysis (English) _____	596185 (49358-0C) ¹

Vibration Metering

Qty	Description	Model number
1	Vibration Metering (SI units) (add-on to Level 1) _____	593838 (46894-00)

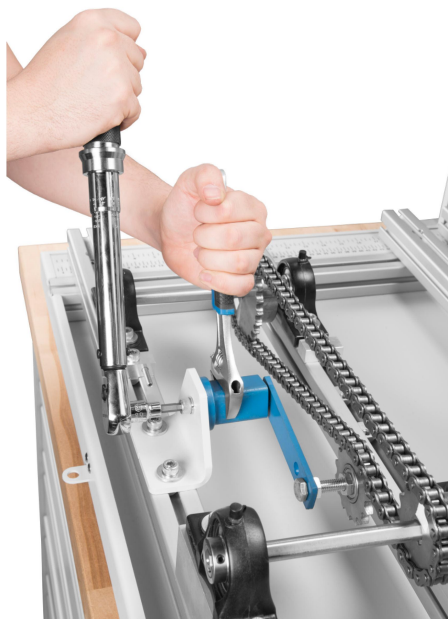
¹ Includes a paper copy of all the manuals from Vibration Metering and Vibration Analysis.

Qty	Description	Model number
1	Campus License - Vibration Metering and Analysis (English) _____	596185 (49358-0C) ²

Optional Manual(s)

Qty	Description	Model number
1	Vibration Analysis (Workbook) _____	596169 (49356-2C) ³
1	Vibration Metering (Workbook) _____	596161 (49352-2C) ⁴

Mechanical Drives Training System, SI Units – Level 2 (add-on) 594778 (46100-20)



Gain precious time with a turnkey solution for teaching the fundamentals of industrial mechanics

Building on the knowledge gained in Level 1, Level 2 provides students with more learning opportunities in installation procedures of hardware commonly used in a variety of belt drives, chain drives, and gear drives.

There are several types of belts, pulleys, chains, sprockets, and gears suited for specific applications. Industrial maintenance students need to be able to identify and install them according to specifications. A selection of the most common ones is included in Level 2, along with new hardware and tools to teach these skills.

The manuals of the Level 2 package guide the students step-by-step during their learning process with several photos and illustrations. The pulleys, sprockets and gears are stored on a panel for quick identification and inventory control.

List of Equipment

Qty	Description	Model number
1	Belt drives 2 _____	593778 (46873-00)
1	Chain drives 2 _____	593782 (46874-00)
1	Gear drives 2 _____	593786 (46875-00)
1	Level 2 Accessories (SI) _____	593790 (46876-00)

List of Manuals

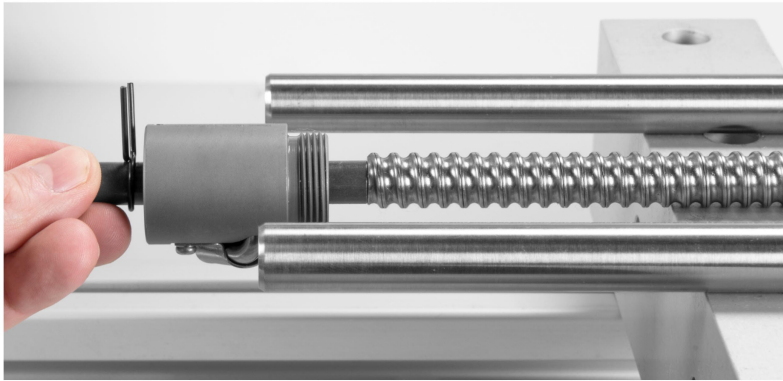
Description	Manual number
Belt Drives 2 (Workbook (Instructor)) _____	595217 (54977-3C)
Chain Drives 2 (Workbook (Instructor)) _____	595225 (54978-3C)
Gear Drives 2 (Workbook (Instructor)) _____	595233 (54979-3C)

² Includes a paper copy of all the manuals from Vibration Metering and Vibration Analysis.

³ A copy of the Student Manual is included in the optional Vibration Metering and Analysis Campus License but is not included with the system.

⁴ A copy of the Student Manual is included in the optional Vibration Metering and Analysis Campus License but is not included with the system.

Mechanical Drives Training System, SI Units – Level 4 (add-on) 594781 (46100-40)



This package introduces clutches for various operating conditions along with their proper installation procedures. And the topic ball screws and linear bearings introduces the main components and proper assembly steps of a linear slide.

Several industrial applications, such as some conveyors, may require a load to be engaged/disengaged or braked while the motor keeps running. Other applications require the torque to be

limited to protect mechanical equipment from overload caused by shock loads or machine jamming. The topic Clutches and brakes introduces those aspects and presents clutches for various operating conditions along with their proper installation procedures.

In modern industry, ball screws and linear bearings are commonly used to transform rotational movement into linear movement, and vice versa. Typical applications include many types of machine tools, such as CNC mills and drills. The topic Ball screws and linear bearings introduces the main components and proper assembly steps of a linear slide. Essential concepts of maintenance and lubrication of linear bearings, ball screws, and ball nuts are also covered.

The manuals of the Level 4 package guide the students step-by-step during their learning process with several photos and illustrations. The main hardware is stored on panels for quick identification and inventory control.

List of Equipment

Qty	Description	Model number
1	Clutches and Brakes _____	593820 (46888-00)
1	Ball screw drives and linear bearings _____	593824 (46889-00)
1	Electromagnetic Clutch-Brake Unit (SI) _____	593834 (46893-00)

List of Manuals

Description	Manual number
Clutches and brakes (Workbook (Instructor)) _____	596149 (49349-3C)
Ball Screws and Linear Bearings (Workbook (Instructor)) _____	596157 (49350-3C)
Ball Screws and Linear Bearings (Workbook (Instructor)) _____	8121664 (49350-30)

Equipment Description

Belt drives 1
593759 (46866-00)



Aligned pulleys, properly tensioned belts, and careful handling and inspection of belts and pulleys are essential to minimize vibration, maximize power transmission, and meet the expected service-life of belt drives. Industrial mechanics must be trained to master the fundamental skills related to the installation and maintenance of belt drives.

The Belt drives 1 package includes all the hardware and tools to teach these skills. Pulleys with different pitch diameters, a pulley gauge, a belt, and a belt tension tester are available for students to experiment with proper installation and maintenance procedures. Pulleys are stored on a panel for identification and inventory control. The panel has handles for moving and positioning.

Manual

Description

Manual
number

Belt Drives 1 (Workbook (Instructor)) _____ 593952 (54332-3C)

Specifications

Parameter	Value
Pulleys	
Pitch diameter	80 mm (3.15 in), 100 mm (3.94 in), 125 mm (4.92 in)
For Belt Type	A and B
V-Belt	
Designation	A38
V-Belt and Pulley Gauges	
Includes	8 gauges for grooves and 2 for belts
Pen Belt Tension Tester	
Maximum Tension	15.9 kg (35 lb)
Panel	
Quantity	1
Dimensions (H x W x D)	TBE
Physical Characteristics	
Total Net Weight	TBE

Chain drives 1 593763 (46867-00)



Aligned sprockets, proper adjustment of chain slack, lubrication, and careful handling and inspection of chains and sprockets are essential to minimize vibration, maximize power transmission and meet the expected service-life of chain drives. Industrial mechanics must be trained to master the fundamental skills related to the installation and maintenance of chain drives.

The Chain Drives 1 package includes all the hardware and tools to teach these skills. Sprockets with varying numbers of teeth, chains, connecting links, a chain puller, and a chain breaker are available for students to experiment with proper installation and maintenance procedures. Sprockets are stored on a panel for identification and inventory control. The panel has handles for moving and positioning.



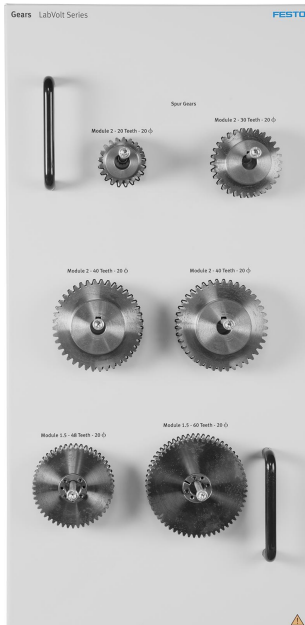
Manual

Description

Manual number

Chain Drives 1 (Workbook (Instructor)) _____ 593962 (54333-3C)

Gear drives 1 593767 (46868-00)



Aligned gears, proper adjustment of backlash, lubrication, and careful handling and inspection of gears are essential to minimize vibration, maximize power transmission, and meet the expected service life of gear drives. Industrial mechanics must be trained to master the fundamental skills related to the installation and maintenance of gear drives.

The Gear Drives 1 package includes hardware to teach the fundamentals of gear drives. Spur gears with varying modules and numbers of teeth are available for students to experiment with proper installation and maintenance procedures. Gears are stored on a panel for identification and inventory control. The panel has handles for moving and positioning.

Manual

Description

Manual number

Gear Drives 1 (Workbook (Instructor)) _____ 593972 (54334-3C)

Belt drives 2 593778 (46873-00)



This package includes all the hardware to teach additional belt drives skills. Various types of common pulleys and belts shall be included for students to experiment with proper installation and maintenance procedures. Pulleys are stored on panels for identification and inventory control. Each panel has two handles for moving and positioning.



Manual

Description

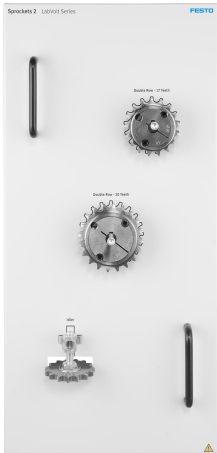
Manual number

Belt Drives 2 (Workbook (Instructor)) _____ 595217 (54977-3C)

Topic Coverage

- Wedge and cogged belts
- Multiple-belt drives
- Multiple-speed belt drives
- Variable-speed belt drives
- Synchronous belt drives
- High torque synchronous belt drives
- Pulley idlers

Chain drives 2 593782 (46874-00)



This package includes all the hardware to teach additional chain drives skills. Double sprockets with varying number of teeth, a double chain, a chain tensioner, and double connecting links are available for students to experiment with proper installation and maintenance procedures. Sprockets are stored on a panel for identification and inventory control. The panel has two handles for moving and positioning.



Manual

Description

Manual number

Chain Drives 2 (Workbook (Instructor)) _____ 595225 (54978-3C)

Topic Coverage

- Multiple-Chain Drives
- Chain tensioners

Clutches and Brakes 593820 (46888-00)



This package includes hardware and tools to teach clutches and torque limiter installation and maintenance skills.

Manual

Description

Manual number

Clutches and brakes (Workbook (Instructor)) _____ 596149 (49349-3C)

Topic Coverage

- Freewheel clutches
- Torque limiters
- Electromagnetic clutches and brakes

Ball screw drives and linear bearings
593824 (46889-00)



This package includes hardware and tools to teach ball screws and linear bearings installation and maintenance skills.



List of Manuals

Description	Manual number
Ball Screws and Linear Bearings (Workbook (Instructor))	596157 (49350-3C)
Ball Screws and Linear Bearings (Workbook (Instructor))	8121664 (49350-30)

Topic Coverage

- Linear bearings
- Ball nuts and ball screws
- Backlash
- Pitch, lead, start, and speed

Electromagnetic Clutch-Brake Unit (SI)
593834 (46893-00)

This package consists of an electromagnetic clutch/brake unit which is required for some suggested experiments included in the Clutches and Brakes package manuals.

Optional Equipment Description

Vibration Metering (SI units) (add-on to Level 1) (Optional) 593838 (46894-00)



Vibration occurs in all rotating machines as a response to internal and external forces. The intensity of vibration depends on a large variety of factors and even new machines vibrate to some extent. However, as the equipment is used and subjected to wear, the intensity of vibration tends to increase. Excessive vibration in a system can cause various types of damage and faults and ultimately cause the system to fail. It is therefore important to detect and correct the causes of excessive vibration before failure occurs. The goal of the Vibration metering package is to locate and understand the causes of vibration and be able

to determine how to mitigate or eliminate these causes.

Manual

Description

Manual number

Vibration Metering (Workbook (Instructor)) _____ 596165 (49352-3C)

Topic Coverage

- Perform vibration measurements using a vibration meter
- Analyze the effects of an unbalance condition on the vibration measurements
- Analyze the effects of a coupling misalignment condition on the vibration measurements
- Analyze the effects of a bearing defect condition on the vibration measurements
- Briefly explain vibrations and their main causes

Features & Benefits

- Safe and ergonomic workstation
- Small footprint
- Hundreds of possible setups with movable T-slotted extrusions
- Turnkey solution with necessary fasteners and tools
- Optional work bench available to store components from all levels

Vibration Analysis (SI units) (add-on to Level 1) (Optional) 593842 (46895-00)



Vibration occurs in all rotating machines as a response to internal and external forces. The intensity of vibration depends on a large variety of factors and even new machines vibrate to some extent. However, as the equipment is used and subjected to wear, the intensity of vibration tends to increase. Excessive vibration in a system can cause various types of damage and faults and ultimately cause the system to fail. It is therefore important to detect and correct the causes of excessive vibration before failure occurs.

The goal of the Vibration analysis package is to locate and understand the causes of vibration and be able to get information as to the current state of the vibrating components, and indicate whether these components should be serviced, corrected, or replaced soon.

Manual

Description

Manual number

Vibration Analysis (Workbook (Instructor)) _____ 596173 (49356-3C)

Topic Coverage

- Perform vibration measurements on a mechanical drive system using a vibration meter
- Observe vibration measurements using a time waveform representation
- Observe vibration measurements using a spectrum representation
- Perform a bump test to determine a system's natural frequencies
- Analyze the effects of an unbalance condition, a coupling misalignment and a bearing defect

Features & Benefits

- Safe and ergonomic workstation
- Small footprint
- Hundreds of possible setups with movable T-slotted extrusions
- Turnkey solution with necessary fasteners and tools
- Optional work bench available to store components from all levels

Campus License - Vibration Metering and Analysis (English) (Optional) **596185 (49358-0C)**

The Campus License contains PDF versions of the student and instructor manuals for the topics from Mechanical Drives Learning System – Vibration Metering and Analysis, as well as one printed copy of each of the instructor and student manuals.

Includes all instructor and student worksheets for the Mechanical Drives Learning System – Vibration Metering and Analysis.

Topics:

- Introduction to Vibration
- Vibration Measurements – Unbalance
- Vibration Measurements – Coupling
- Vibration Measurements – Bearing
- Time Waveform Representation
- Spectrum Representation
- Spectrum Analysis – Unbalance
- Spectrum Analysis – Coupling Misalignment
- Spectrum Analysis – Bearing Defect
- Spectrum Analysis – Gear Drive

List of Manuals

Description	Manual number
Vibration Metering (Workbook) _____	596161 (49352-2C)
Vibration Metering (Workbook (Instructor)) _____	596165 (49352-3C)
Vibration Analysis (Workbook) _____	596169 (49356-2C)
Vibration Analysis (Workbook (Instructor)) _____	596173 (49356-3C)
(Workbook) _____	603851 (49352-AC)
Vibration Metering (Workbook) _____	603937 (49352-2C)
Vibration Metering (Workbook (Instructor)) _____	603941 (49352-3C)
Vibration Analysis (Workbook) _____	603945 (49356-2C)
Vibration Analysis (Workbook (Instructor)) _____	603949 (49356-3C)

Table of Contents of the Manual(s)

Vibration Metering (Workbook) (596161 (49352-2C))

- 1 Introduction to Vibration
- 2 Vibration Measurements – Unbalance
- 3 Vibration Measurements – Coupling Misalignment
- 4 Vibration Measurements Bearing Defect

Vibration Analysis (Workbook) (596169 (49356-2C))

- 1 Time Waveform Representation
- 2 Spectrum Representation
- 3 Spectrum Analysis – Unbalance
- 4 Spectrum Analysis – Coupling Misalignment
- 5 Spectrum Analysis – Bearing Defect
- 6 Spectrum Analysis – Gear Drive

Reflecting the commitment of Festo Didactic to high quality standards in product, design, development, production, installation, and service, our manufacturing and distribution facility has received the ISO 9001 certification.

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Festo Didactic SE

Rechbergstrasse 3
73770 Denkendorf
Germany

P. +49(0)711/3467-0
F. +49(0)711/347-54-88500

Festo Didactic Inc.

607 Industrial Way West
Eatontown, NJ 07724
United States

P. +1-732-938-2000
F. +1-732-774-8573

Festo Didactic Ltée/Ltd

675 rue du Carbone
Québec QC G2N 2K7
Canada

P. +1-418-849-1000
F. +1-418-849-1666

www.labvolt.com

www.festo-didactic.com