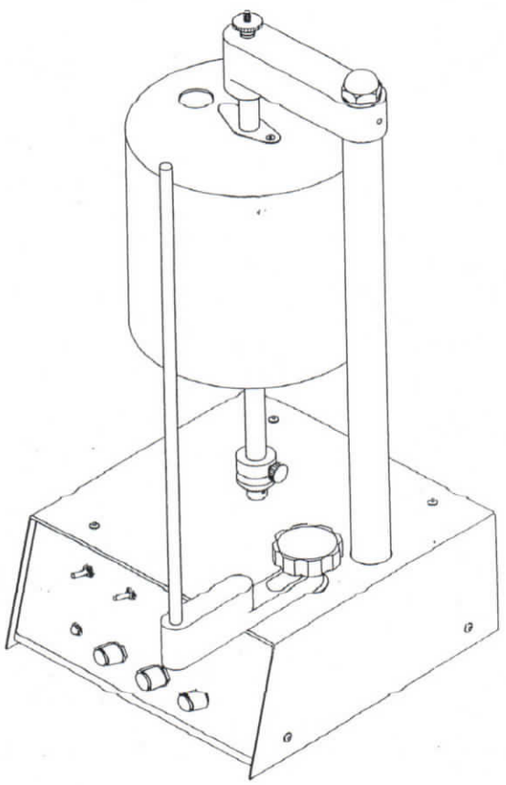
OPERATIONS MANUAL AND PARTS LIST

Kymo II

Catalog No.: 7006-501
Catalog No.: 7006-502



PHIPPS&BIRD
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(Local) 804/254-2737
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A STATEMENT ABOUT OUR LIMITED WARRANTY

PHIPPS & BIRD is proud of its reputation as a manufacturer of dependable products.

If you should experience any difficulty with our products, just telephone, fax or write. We'll make every reasonable effort to resolve the difficulty to your satisfaction within the terms of our WARRANTY. You may contact Phipps & Bird at:

Shipping Address:	1519 Summit Ave. Richmond, VA 23230-0475	Via Phone: Inside U.S. Toll Free: Outside U.S.:	 800/955-7621 804/254-2737
Mailing Address:	P. O. Box 7475 Richmond, VA 23221-0475	Via fax machine:	804/254-2955
E-mail address;	phippsbird@aol.com	Web site:	www.phippsbird.com

Please read the complete text of the LIMITED WARRANTY below. It is important that you complete and return the Warranty Card provided. This is the only way to validate your LIMITED WARRANTY coverage. The Warranty Card is self-addressed and requires no postage when mailed in the United States.

NOTICE:
WHEN AND WHEREVER THIS SYMBOL IS ATTACHED TO THE OUTSIDE OF THE EQUIPMENT, REFER TO THE INSTRUCTION MANUAL. PLEASE READ ALL APPLICABLE CAUTIONS, WARNINGS AND INSTRUCTIONS. IT IS THE RESPONSIBILITY OF THE OPERATOR TO REFER TO THE INSTRUCTION MANUAL TO PRESERVE THE PROTECTION AFFORDED BY THE EQUIPMENT.

LIMITED WARRANTY

Phipps & Bird, Inc. ("the Company") warrants that this equipment will be free from defects in material and workmanship under normal use and service for a period of one (1) year from the date of shipment. This warranty extends solely to the original purchaser of the equipment who uses same and may not be assigned or otherwise transferred to any other person. The Company's liability under this warranty is limited solely to replacing or repairing, at the discretion of the Company, the equipment that is defective; provided, however, that the Company shall not be liable under this warranty unless (a) the Company is notified promptly in writing, at the address printed on the warranty card, by the owner, upon the discovery of a defect, (b) if requested by the Company, defective equipment is promptly returned to the Company, and (c) the Company determines that the malfunction of the equipment was not caused by misuse, neglect, improper installation, repair, alteration or accident. IN NO EVENT SHALL THE COMPANY BE LIABLE TO THE OWNER OF THE EQUIPMENT FOR LOSS OF PROFITS, LOSS OF USE, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR DAMAGES OF ANY KIND BASED UPON A CLAIM FOR BREACH OF WARRANTY, OTHER THAN THE PURCHASE PRICE OF ANY DEFECTIVE EQUIPMENT COVERED HEREUNDER. This warranty shall not be enlarged, diminished or affected by, and no obligation or liability shall arise out of, the rendering of technical advice or service by the Company in connection with the equipment. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitations or exclusions may not apply to you. THE FOREGOING IS IN LIEU OF ANY OTHER WARRANTY, EXPRESSED OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY AND ANY WARRANTY OF FITNESS FOR ANY PARTICULAR PURPOSE. Some states do not allow limitations on how long an implied warranty lasts, so the above limitations may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

KYMO II - SPECIFICATIONS

This equipment is designed to be operated under the following conditions:

- Indoor use
- Altitude up to 2000 m
- 5 °C to 40 °C (41 °F to 104 °F)
- Relative humidity 50% - 80%

CAUTION:
IF THE EQUIPMENT IS USED IN A MANNER INCONSISTENT WITH THAT EXPRESSED BY PHIPPS & BIRD IN THIS INSTRUCTION MANUAL, THE PROTECTION PROVIDED BY THE EQUIPMENT AND THE FUNCTIONAL CAPABILITIES OF THE EQUIPMENT MAY BE IMPAIRED.

Electrical Requirements: Model 7006-501: 120 volt AC, 50/60 Hz, under 0.25 amperes
Model 7006-502: 220-240 volt AC, 50/60 Hz, under 0.25 amperes

Fuse: 1 ampere, type 3AG, internal on PC Board

Dimensions: 9"(W) x 8-3/4"(L) x 19-1/4"(H)
22.9cm. (W) x 22.2 cm. (L) x 48.9 cm. (H)

Weight: 13 lb. (5.9 kg.)

Drum Operating Speed (adjustable): 0.44 cm., 2.2 cm., 11 cm., 54 cm., and 270 cm. per minute

Signal Magnet Output: 12 VDC, at 16 ms. pulse width, Marker interval variable 0, 1, 5, 10, and 60 secs

Inductorium Output Voltage: 0-150 VDC, continuously variable

INTRODUCTION

For more than 150 years the Kymograph, A simple revolving drum, has been used to measure a large number of physiological parameters. While some advanced electronic recording devices are now used, the electrically driven Kymograph is still the old reliable workhorse of the life sciences laboratory.

This instrument also has applications in the areas of physiology experiments concerning animals and plants in addition to being widely used in psychology, physics and chemistry.

The kymograph is one of the oldest, and still the sturdiest, simplest and least expensive physiology recording device available for student use.

PREPARING THE KYMO II FOR USE

(Note: Items in all capital letters refer to items identified in Figure 1 on the following page.)
To remove the drum for attaching paper or smoking the attached paper lift the spring loaded DRUM CENTER SPINDLE, using the SPRING CENTER LOCKNUT, releasing the DRUM SHAFT. Tilt the DRUM and DRUM SHAFT to disengage the bottom of the DRUM SHAFT from the DRUM DRIVE SHAFT. To remove the DRUM from the DRUM SHAFT, depress the DRUM LATCH and slide the DRUM from the DRUM SHAFT. To replace, slide the DRUM onto the DRUM SHAFT and depress the DRUM LATCH to position were desired. Place the bottom end of the DRUM SHAFT onto the pointed end of the DRUM DRIVE SHAFT. Make sure the pointed end of the DRUM DRIVE SHAFT is inserted into the recessed hole on the end of the DRUM SHAFT. Engage the Pin with the slot in the DRIVING DOG and tilt the DRUM SHAFT to a near vertical position. Lift THE SPRING

CENTER LOCKNUT and engage the pointed end of the DRUM SPINDLE into the recessed hole at the end of the DRUM SHAFT to lock the shaft in place.

The spring force of the DRUM CENTER SPINDLE may be adjusted by loosening (or tightening) the SPRING CENTER KNOB. The SPRING CENTER LOCKNUT locks the knob in place. Adjust (if needed) the spring force so that the DRUM SHAFT is properly captured but not so tight to restrict rotation of the DRUM SHAFT.

Before starting the Kymo II, make sure the DRUM SPINDLE and DRUM SHAFT are engaged with the recessed holes in the ends of the DRUM SHAFT and the DRIVING DOG pin is inserted into the slot on the DRIVING DOG.

Load recording paper on the DRUM. Center the paper vertically on the DRUM. Tape the end of the paper to the DRUM and wrap the paper counterclockwise on the DRUM. Overlap and tape the second end of the paper onto the first end of the paper.

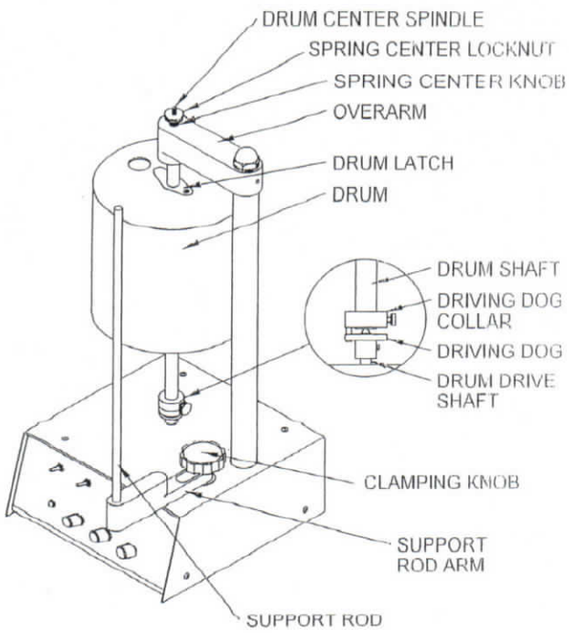


Figure 1 – Kymo II Major Components

OPERATING THE KYMO II

A stepper motor, precisely controlled by a programmed microchip, drives the Kymo II drum. Motor speeds are adjustable from a low of 0.44 cm., through 2.2 cm., 11 cm., 54 cm., to a high of 270 cm. per minute. With the proper AC-DC transformer supplied, the Kymo II can operate on nominal 110 to 220 VAC, 50-60 HZ.

To begin operation, plug the small DC Power plug on the AC-DC transformer into the Power Input Jack on the back of the Kymo II. Insert the AC Power Plug into an acceptable power source. Examples of the 110 and 220-volt plugs are shown below. Note: Your Kymo II may have a detachable AC Power cord. If so, plug the Detachable Power Cord Plug into the mating socket on the AC-DC Transformer (see Figure 2 below).

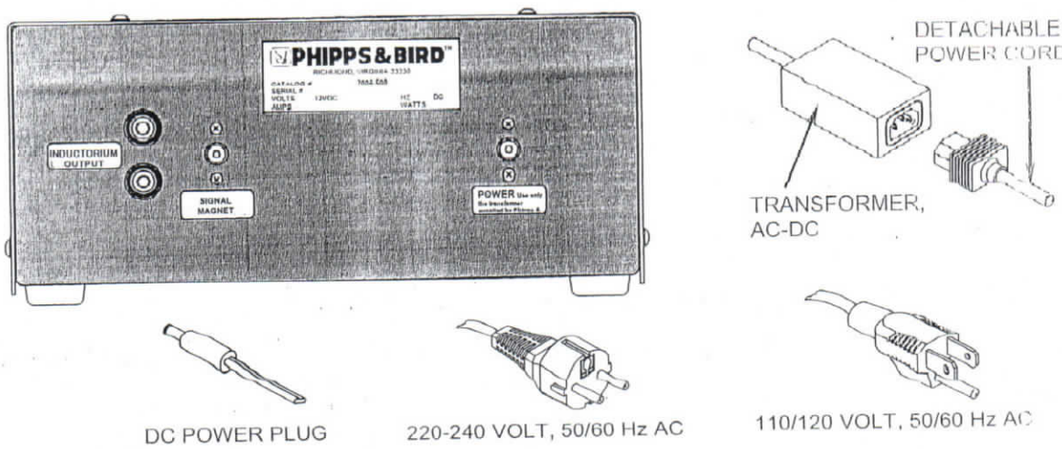


Figure 2 – Kymo II Rear Panel, Cable and Power Cord Connectors

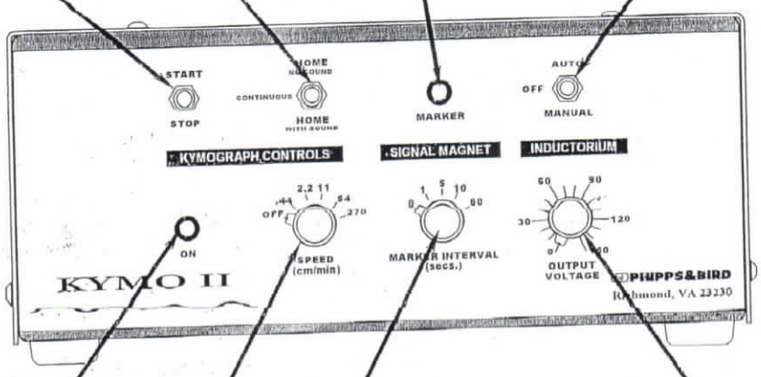
FRONT PANEL CONTROLS OVERVIEW

CONTINUOUS OR SINGLE REVOLUTION SELECTION SWITCH
Toggle switch to either: (1) CONTINUOUS uninterrupted rotation, (2) single rotation from the initial "HOME" position WITH SOUND simultaneous with the Signal Magnet Marker, or (3) single rotation from the "HOME" position NO SOUND.

INDUCTORIUM PULSE SELECTION SWITCH
Toggle switch to either: (1) OFF or no Inductorium pulse generation, (2) AUTO synchronous pulse generation with Signal Magnet Marker, or (3) MANUAL hand generation of Inductorium pulses.

START/STOP SWITCH
Depress or lift momentary toggle switch to STOP or START drum rotation.

SIGNAL MAGNET MARKER LED INDICATOR
LED will blink when Signal Magnet sends a pulse at the set Marker Interval.



"ON" LED INDICATOR
LED will light when power is supplied to the KYMO II and SPEED Control Switch is set at a position other than "OFF"

MARKER INTERVAL
Turn adjustment knob to desired Signal Magnet Marker interval

DRUM SPEED
Turn adjustment knob to desired drum speed in cm/min.

INDUCTORIUM OUTPUT VOLTAGE ADJUSTMENT
Adjust knob to desired Inductorium Output Voltage. Adjustment is not linear below 50 volts and scale is meant as an approximation

Figure 3 – Kymo II Front Panel Controls Overview

KYMOGRAPH

To begin using the kymograph, make sure that recording paper is taped to the drum, the drum and drum shaft is properly installed, and power is supplied to the Kymo II (see OPERATING THE KYMO II). Turn the SPEED control to the desired drum speed (the ON LED indicator will light). The SPEED is in linear travel (cm.) per minute of the outer surface of the DRUM or recording paper. Use the table on the following page as a reference of drum SPEED to rotational speed of the drum.

LINEAR DRUM SPEED (cm/min)	ROTATIONAL DRUM SPEED (rpm)	TIME FOR 1 REVOLUTION
0.44	5.4138	11.08 sec.
2.2	1.0827	55.42 sec.
11	0.2206	4 min, 31.98 sec.
54	0.0441	22 min, 40.54 sec.
270	0.0088	1 hr, 53 min, 38.18 sec.

Select CONTINUOUS, HOME NO SOUND, or HOME WITH SOUND. With CONTINUOUS operation, the drum will rotate until the STOP switch is depressed. With the HOME options, the drum will rotate one complete revolution from its initial position. With SOUND, an audible "beep" will sound simultaneous with the Signal Magnet Marker Interval setting (see SIGNAL MAGNET below).

Toggle the START/STOP switch "up" to begin drum rotation. Depress the START/STOP switch to stop drum rotation. The ON LED will blink or flicker to indicate the drum is rotating. This is especially helpful at the lowest speeds.

SIGNAL MAGNET

The Signal Magnet output produces a pulse of 12 VDC at a set MARKER INTERVAL. Set intervals are 0, 1, 5, 10, and 60 seconds. The Signal Magnet (Phipps & Bird Cat. No. 7081-001/Kit) is a separate writing device, when used in conjunction with the Kymo II, that is used to record an event such as the application of a stimulus, or to calibrate an experimental recording with respect to time. The Signal Magnet output generates a pulse that energizes the Signal Magnet, producing a "twitch" of the Signal Magnet tip. In turn the ink-writing pen or smoke-writing stylus "twitches" producing a mark on the recording paper on the drum.

Mounting and Connecting the Signal Magnet

The Signal Magnet is mounted on the vertical Support Rod with a Double Right Angle Clamp (Phipps & Bird Cat. No. 7026-000) oriented as shown below. A cable is provided for connecting the Signal Magnet to the Kymo II. Loosen the two terminal Thumbnuts at the end of the Signal Magnet. Insert one of the spade terminals of the Signal Magnet Output Cable to each of the Signal Magnet terminals and tighten thumbnuts. Plug the opposite end of the cable into the Signal Magnet output jack on the back of the KYMO II. Adjust the position of the double-right angle clamp so that the pen (or stylus) rests against the recording paper on the drum. The double-right angle clamp can be adjusted vertically for desired placement of a "record" on the recording paper or for multiple "stacked" recording of experiments on the paper.

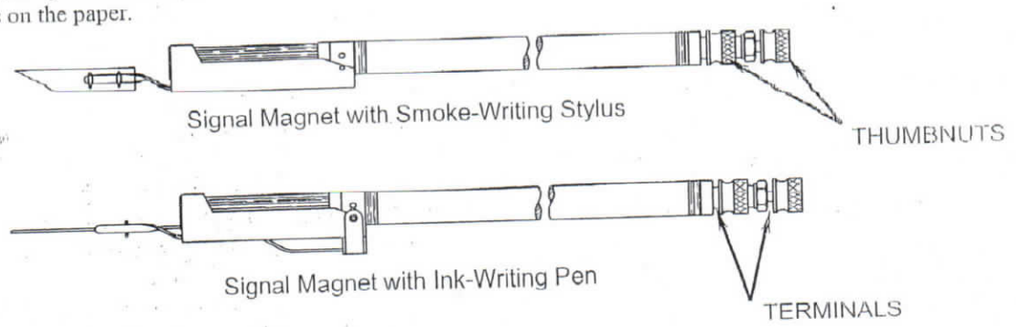


Figure 4 – Signal Magnets

Marker Interval

Adjust the control knob to the desired marker interval (in seconds). The initial and each subsequent fifth marker will be a double mark. The double mark assists when counting time markers on the recording paper. The Marker LED will blink simultaneous with the Marker Interval pulse.

INDUCTORIUM

There are four general ways a tissue, organ, or intact animal may be artificially stimulated.

1. Mechanically – by pinching or pulling the tissue (compressing or stretching).
2. Thermally – by applying a warm or cold object to the tissue.
3. Chemically – through the use of drugs or chemicals (e.g., acids or bases), or changes in the osmotic properties of tissues.
4. Electrically – applying current to the tissues.

All of the above forms alter the environment of the cells or tissues; however, the electrical method of stimulation, with its speed of action, reproducibility and ease of administration is most frequently the method of choice

A stimulus, regardless of its type, must be of certain threshold strength to elicit a response, and maintained at or above that threshold level for a certain time interval. An electrical stimulus of less than 0.01 milliseconds duration is inadequate regardless of its strength.

The purpose of the inductorium is to provide a high voltage stimulus to enable the experimenter to apply a threshold stimulus to living tissue while controlling both the intensity (OUTPUT VOLTAGE control) and frequency (AUTO/OFF/MANUAL toggle switch) of the stimuli. The AUTO/OFF/MANUAL toggle switch provides for several ways to apply stimulus..

Connecting the Inductorium Output to an Electrode

Using the two 22 Ga. wires (1 black, 1 red) provided, connect an appropriate electrode (Stainless Steel Electrode, P&B Cat. No. 7115-204 or Platinum Electrode, P&B Cat. No. 7115-200) to the Inductorium Output terminals on the back of the Kymo II.

Regulating the Output Voltage

Output voltage is adjustable from 0 to 150 VDC. Output is linear above 50 volts. Output below 50 volts is non-linear. The scale on the front panel, below 50 volts is for reference purposes only.

Pulsating Output in a Continuous AUTO Mode

Toggle the inductorium output selection switch to AUTO. Select the desired OUTPUT VOLTAGE. Turn the Kymograph Controls to the desired SPEED. Select the desired pulse interval (frequency) by adjusting the Signal Magnet Marker Interval. Note: The AUTO selection provides a stimulus simultaneous with the Signal Marker interval (adjustable to 1, 5, 10, and 60 sec). Start the KYMO II by flipping up the START/STOP toggle switch. The Kymo II drum will immediately begin to rotate and provide a stimulus via the inductorium output.

Single Stimulus in the MANUAL Mode

The MANUAL selection can be used both momentary or continuously. The Signal Magnet Marker Interval must be turned off (set to 0 seconds) when used in the MANUAL mode. Select the desired OUTPUT VOLTAGE. Start the KYMO II by flipping up the START/STOP toggle switch. The Kymo II drum will immediately begin to rotate. A momentary depression of the toggle switch will produce a single stimulus. Note: do not continue to depress the MANUAL switch if a single stimulus is desired; continuous depression of the switch will yield a continuous output until the switch is released (see below).

Continuous Stimulus in the MANUAL Mode

For a continuous stimulus in the MANUAL mode, the Signal Magnet Marker Interval must be turned off (set to 0 seconds). Select the desired OUTPUT VOLTAGE. Start the KYMO II by flipping up the START/STOP toggle switch. The Kymo II drum will immediately begin to rotate. Depress the MANUAL switch. The inductorium will provide a continuous stimulus (as a frequency of 87 Hz) as long the manual switch is depressed.

REPLACEMENT PARTS LIST

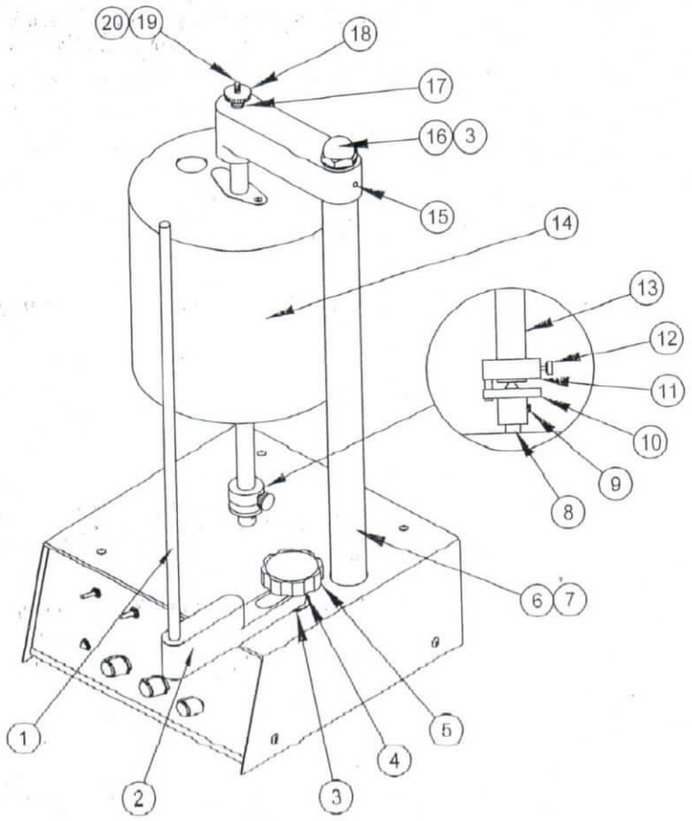


Figure 5 – Kymo II Replacement Parts

	DESCRIPTION	PART NO.
1	Support Rod	970065014
2	Support Rod Arm	970065010
3	Flat Washer, 1/2", MS15795-819	803050010
4	Flat Washer, 1/2"	803050001
5	Clamping Knob	100430300
6	Overarm Rod	970065015
7	Overarm Support Tube	970065002
8	Drum Drive Shaft	970065008
9	Screw, Hex Socket, #8-32 x 1/2"	801608125
10	Driving Dog	970065013

	DESCRIPTION	PART NO.
11	Driving Dog Collar	100130610
12	Thumbscrew, #8-32 x 3/8	450000041
13	Drum Spindle	970065016
14	Drum w/ Latch	970060001
15	Screw, Hex Socket, #10-32 x 1/4	801610250
16	Acorn Cap Nut, 1/2-20	383050020
17	Spring Center Knob	100131400
18	Spring Center Locknut	100131300
19	Compression Spring	100131500
20	Spindle, Overarm-Drum Center	970065012

ACCESSORIES FOR KYMO II

CATALOG NO.	DESCRIPTION
7013-701	Smoking Stand & Burner
7013-702	Smoking Burner Only
7019-600	Paper, Kymo, 6" x 20.125", 100/Pk, 2-Sided Litho, 1mm Grad 1-Side
7021-000	Ink, Blue, 4 oz.
7026-000	Double Right Angle Clamp
7081-001/KIT	Signal Magnet, Ink & Smoke Writing
7106-000	Tuning Fork
7107-000	Tuning Fork Starter

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