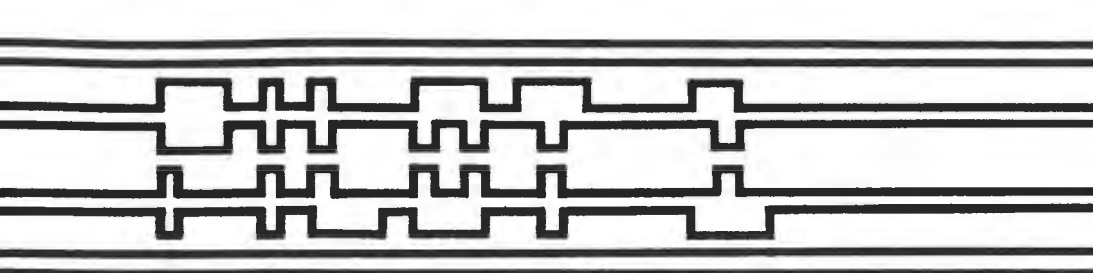



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PILOT ONE LTD. was established in 1984 to meet the demand for well-designed support materials for computer appreciation courses in education. We are a small company producing quality products to be used by students.

The company draws on a wide range of teaching expertise to provide the feedback necessary to design robust hardware and software. All materials are thoroughly tested by pupils of appropriate ages and a wide range of abilities.

In addition we offer a range of teacher support services including residential in-service training courses.

The control package is only part of a complete range of computer appreciation materials that will be available over the next two years.

If you would like to know more about our products, or have suggestions for new projects, then please contact us on 0234-327688.



STEPHEN PARTRIDGE
(Production manager)



NICK BENNETT
(Development manager)

PILOT IN CONTROL

CONTROL TECHNOLOGY COURSE

for 11 – 13 age group



The course is an ideal first step in the world of control technology. It contains text and software, enabling students to become quickly involved in stimulating activities.

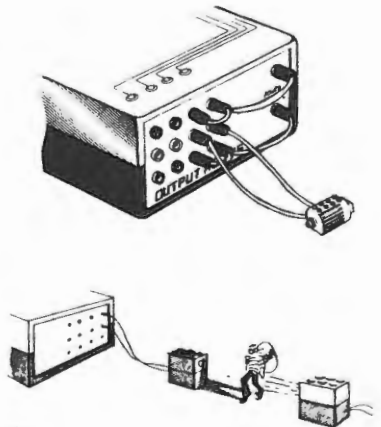
The main body of the text is a set of sixty pupils' worksheets. These pages contain both the necessary instructions to enable the students to proceed at their own individual rates, and also a wide range of questions.

It is assumed that pupils will have experience of loading and running programs on the micro. In addition pupils should be able to enter information using the keyboard. The text introduces a few elements of the BASIC language and a set of procedures for easy control of the interface. **Students should not require a vast amount of assistance to follow the course.** However, in many areas back-up teaching may be required to enable the pupils to grasp the full significance of the routines.

Part 1 Alarm Circuits – Introduction to the interface

Part 2 Driving Models – Connecting vehicles to the micro

Part 3 Feedback Routines – Steps towards precise control



PILOT IN CONTROL PIC/521/M

Teacher and pupil text. A suite of eighteen software routines and procedures to build into your own programs. A copy of the pupil's worksheets is provided for photocopying.

PUPIL WORKSHEETS PIC/521/P

12 copies of pupil's worksheets

EVALUATION KIT PIC/521/E

Full kit; manual, software, interface and models for project work and evaluation (1 item of each listed below).

CLASSROOM KIT PIC/521/C

The kit contains six digital interfaces and a collection of models to enable a full class of students to follow the course. In the first part of the course, six sets of apparatus are supplied but in parts 2 and 3 it is assumed that students can meet the various models at different stages.

- | | |
|-------------------------------|--------------------------------------|
| 6x Digital interface | 6x Alarm kit, all sensors and buzzer |
| 3x LEGO buggy kit L/1038 | 3x 2 motor connecting leads |
| 1x 3 motor connecting lead | 6x Slotted-opto sensor |
| 2x Reflective-opto sensor | 2x Microswitch |
| 2x Magnetic sensor | 2x Large yellow car |
| 2x Crane model | 1x Electric goods train |
| 1x Electric loco | 1x Motorised points, uncoupling rail |
| 1x Special train power supply | Supplementary LEGO spares |
| Connecting leads for above | |

Teacher's text, software and 12 copies of pupil's worksheets.

SAMPLE WORKSHEETS

Changing the Direction of the Motor

To change the direction of the drive on the motor to run in a different circuit to provide electricity to use a different motor in such directions.

Observe the following circuit on output lines to run a single motor in such directions.

Using two output lines four possible combined the output lines.

LINE 1	LINE 2	OUTPUT
OFF	OFF	STOP
ON	OFF	FORWARD
OFF	ON	REVERSE
ON	ON	STOP

Use the **REVERSE** button to obtain or change the direction of output lines shown above. The direction of rotation for each of the combinations.

If the state of the two output lines is the same there is no rotation of the motor. If the state of the two lines are different, then the motor will rotate in one direction.

If you wish, the two leads on the motor, can be swapped to change.

Adding the Sensors

Position the light sensors and sensors as shown in the diagram below.

Connect the light sensors to the ground pins on the COMB. BUS. If you wish connect the buzzer to the BUZZER PORT SUPPLY as you will hear the buzzer.

Now connect the light sensors to the output line, remember to make the correct sense the correct of the sensors on the output line.

Connect the BUZZER sensor to input line 4.
Connect the BUZZER sensor to input line 5.
Connect the BUZZER sensor to input line 6.

Check that all sensors are working by holding the light beams with your hand. The indicator for lines 4, 5 and 6 should normally show red and not when the corresponding light beam is interrupted.

If your sensors are not working, ask your teacher for help.

Designing an Alarm System

The burglar has set off the alarm. The alarm must record it and sound a bell or buzzer. The alarm can warn the police when should it sound the alarm?

Use the digital bus with just the pressure mat to input to input line 4.

Use the pressure mat on input 3 will send the buzzer to sound the alarm.

```

    10 RECORD: no_pins
    20 BUZZER
    30 BUZZER:BUZZER(4)
    40 BUZZER:BUZZER
  
```

The indicator on or OFF when someone is on the mat?

Use the BUZZER sensor to input line 4.
Use the BUZZER sensor to input line 5.
Use the BUZZER sensor to input line 6.

This is correct! If not, then you should sound the alarm.

Use line 4 as follow and add line 5:

```

    40 BUZZER:BUZZER(4)
    50 BUZZER:BUZZER:BUZZER
  
```

record at any time by switching line 4 and 5, record the direction of the motor to be driven.

```

    RECORD:BUZZER(4),BUZZER(5)
    RECORD:BUZZER(4),BUZZER(5)
  
```

Input: Use the function keys to edit for the following command:

```

    RECORD:BUZZER(4),BUZZER(5)
    RECORD:BUZZER(4),BUZZER(5)
  
```

In fact then the motor will stop in the on state and the up and down commands to be corrected by changing the motor.

***** CHECK ON THE BUZZER RES. ****

Use sensors, use fitted to each of the sensors above, determine the correct state of the digital bus. The indicator on the output line will show green through the hole the indicator.



DIGITAL INTERFACE

IN/521/E

- connects to the User Port of the BBC micro
- fully isolated to protect the micro
- built-in power supply to drive models (5V, 1A reg.)
- 4 output lines with changeover relays
- 4 sensitive input lines
- 4mm sockets to fit standard laboratory leads
- robust construction
- includes BASIC control procedures

Software Package



To enable the inexperienced programmer to utilise the PILOT ONE digital interface, a suite of procedures are provided which supplement the BBC Basic commands. The INTTEST package provides a teaching program to familiarise the student with the six control procedures. The procedures are called from a menu, and a screen display helps with the difficulties of syntax and gives an opportunity to try out each procedure in turn. The program can be used without an interface, to teach the ideas and build routines when a flow of data is not required. The syntax in each case has been designed to express in simple terms the action required. In addition, the procedures will trap errors; such as sending an output to an input line or the use of a non-standard string variable.

Once the actions of the procedures are understood, the teaching package offers a choice of deleting the teaching pages but leaving the procedures in memory at lines 10,000 onwards. The student is then free to write his own routine using any combination of BASIC commands and the procedures. To limit the amount of typing, the function keys are programmed to correspond to the procedures with the addition of auto line numbering and a listing on £9. When this key is used only the program lines to 9999 are listed (the student's routine). If the procedures are also required the usual LIST command will provide the student's routine and the INTTEST procedures listed as normal.

The INTTEST procedures are designed to enrich the commands already available in BASIC. The structure of these procedures is unimportant to the student, we hope he will learn to use them as he already uses the PRINT, REPEAT...UNTIL commands. They provide an easy way to control the interface and are perfectly adequate for most applications other than very fast sampling and control, when more sophisticated programming will be required.

PROCturn	This procedure will turn a stated output line ON or OFF.
PROCToggle	To turn an output line that is OFF to the ON state or to turn an output line that is ON to the OFF state.
FNtest	This command will test the value of an input line. The string "ON" or "OFF" is returned corresponding to the status of the indicator lamp on the interface unit.
PROCmultiturn	To simultaneously turn ON or OFF more than one output line.
PROCmultitoggle	To change the state of more than one output.
FNmultitest	To test the state of more than one line at a time.

basil IN CONTROL

- A control language for the PILOT ONE digital interface
- Designed for use by PRIMARY pupils
- User defined routines in LOGO like structure
- Clock module with full timing facilities
- Counter and store for counting operations
- PUPIL WORKSHEETS simple sample routines
- Comprehensive teacher utility package

BASIL is a control language that is simple to use yet powerful enough for complicated control applications. The screen editor indicates all options available to the user. Using only three keys all necessary information for the routines is prompted. The routines, with user defined names, have up to 16 steps and can be "nested" to any depth. The routines can be saved, loaded or dumped to a printer as required. Inputs can be read from the interface or keyboard, outputs can be sent to the interface or screen, operations can be performed on the counter and clock registers. The screen display also provides a monitor of output/input status; this allows the routines to be run without connection to the interface.

BIC/201/E BASIL software, worksheets, digital interface, alarm kit and manual
BIC/202/S BASIL software and manual
BIC/203/W 12 sets of BASIL worksheets

The whole BASIL, package is arranged in modules so that portions of the language can be introduced slowly without the distraction of a full range of options. Routines constructed with these modules can then be used at a later date with the full language.

The teacher utilities provide simple edit and file facilities for routine generation, module configuration and routine documentation.

Pupil worksheets

A3 folded, laminated worksheets with illustrations, sample programs and connection diagrams.

- | | |
|------------------------------------|--|
| 1. Sensors — The alarm system | 5. Output control — Switching motors |
| 2. Output control — The alarm bell | 6. Time Delays — Driving a buggy |
| 3. Counting — The production line | 7. Sequence — Buggy course plotting |
| 4. Timing Events — Race meeting | 8. Controlled motion — Counting Rotation |

Example BASIL routines

To time a vehicle passing through two separated light beams on inputs 5 and 6.

Counting people passing through a light beam on input 5 and sound buzzer when count reaches 100.

routine **TIME**

```
CLOCK RESET
WAIT for INPUT 5 is OFF
CLOCK START
WAIT for INPUT 6 is OFF
CLOCK STOP
```

routine **PASS**

```
COUNTER RESET
DO No. 3 IF INPUT 5 is off
DO No. 4 IF COUNTER ÷ 100
```

Driving a vehicle along a course called **PATH**.

PATH is constructed from routines called **TURN** and **MOVE**
(Drive motor on output 1, steering motor on output 2)

PATH

```
DO MOVE 3 TIMES
DO TURN 2 TIMES
DO MOVE 3 TIMES
```

MOVE

```
SWITCH OUTPUT 1 ON
CLOCK RESET
WAIT for CLOCK >100
SWITCH OUTPUT 1 OFF
```

TURN

```
SWITCH OUTPUT 2 ON
CLOCK RESET
WAIT for CLOCK >10
SWITCH OUTPUT 2 OFF
```



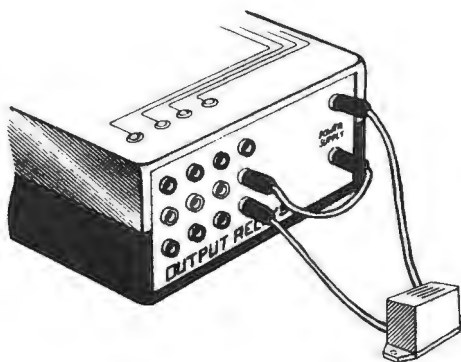
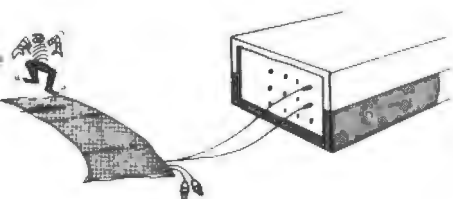
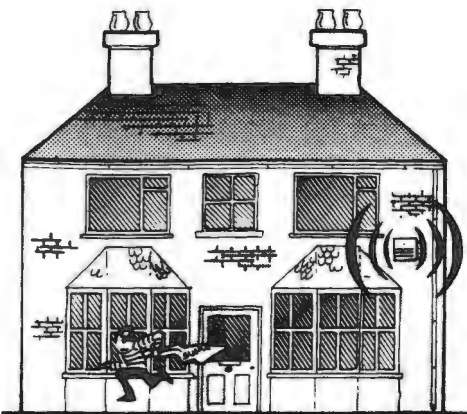
522/A

ALARM KIT

An ideal way of investigating the operation of the digital interface using either BASIL software or the BASIC procedures.

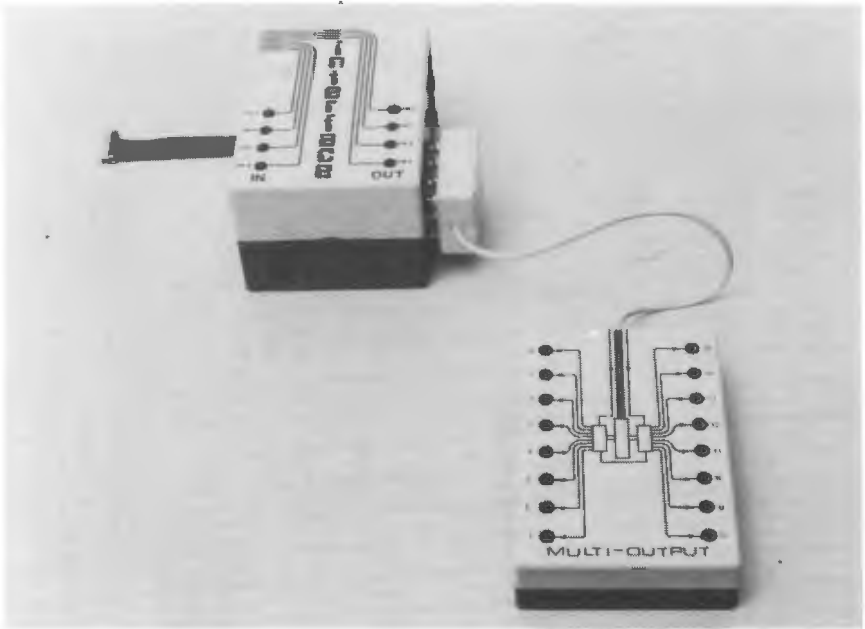
The five sensors are terminated with 4mm plugs for direct connection to the interface. These can be used for counting or timing exercises or used together to construct an alarm system for a house. The manual explains how the sensors operate and provides example routines to read the data from the sensors and switch the output lines.

- magnetic switch and magnet
- temperature switch 40°C
- tilt switch
- pressure mat
- light beam kit (sensor and light source)
- loud buzzer
- manual



Additional Sensors

SEN/1	Float switch	water level indicator
SEN/2	Microswitch	for car bumpers etc.
SEN/3	Light beam kit	sensor and light source
SEN/4/40	Temperature switch	40° C switch temp.
SEN/4/70	Temperature switch	70° C switch temp.
SEN/4/100	Temperature switch	100° C switch temp.
SEN/5/L	Pressure mat	730 mm x 380 mm
SEN/5/S	Pressure mat	580 mm x 175 mm
SEN/6	Magnetic switch with magnet	
SEN/7	Tilt switch (mercury bead)	
SEN/8	Slotted optical switch with disc.	
SEN/9	Reflective optical switch	
SEN/20	Buzzer	
SEN/21	2 x 4 mm leads 10 cm long	



534/MO

MULTIPLE OUTPUT UNIT

- 16 latched relay outputs
- changeover relay contacts rated at 1Amp
- connector sockets for plus or bare wire connection
- plugs directly into the PILOT ONE digital interface
- strobe software procedures supplied

The MULTIPLE OUTPUT UNIT allows up to 16 separate output lines to be connected to the PILOT ONE interface. The strobe software supplied sets the output latches in pairs, selected using a clock generated in the micro. All relays can be connected using 1mm pins or bare wire, singularly or in groups for bi-directional motor control. An indicator on each output line indicates the state of the relay latches. This unit is used for applications that require the operation of groups of motors on robot arms, multiple axial cranes or for operations on large railway layouts. External 5Volt power supply required.

This unit forms part of the sixth form course THE PILOT CONTROLLER, to be released in January 1986.

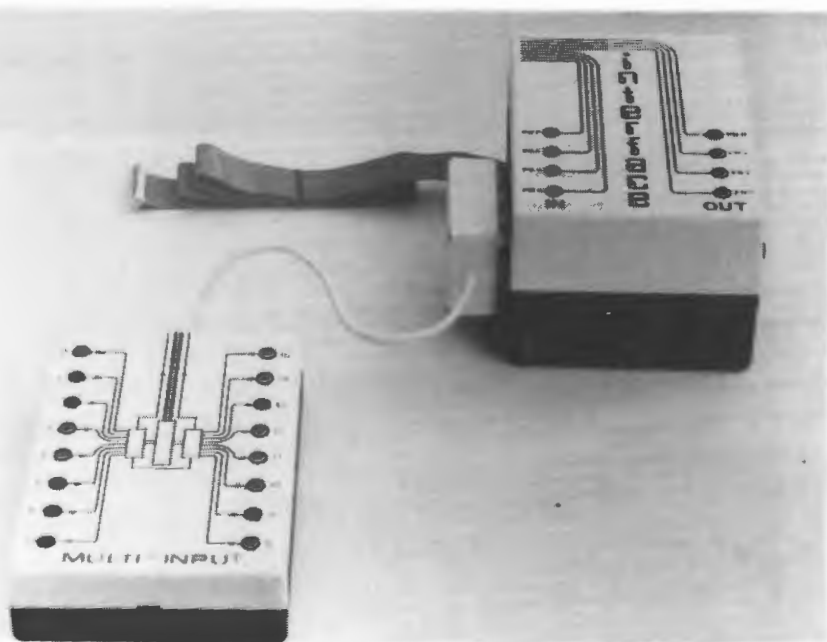
535/MI

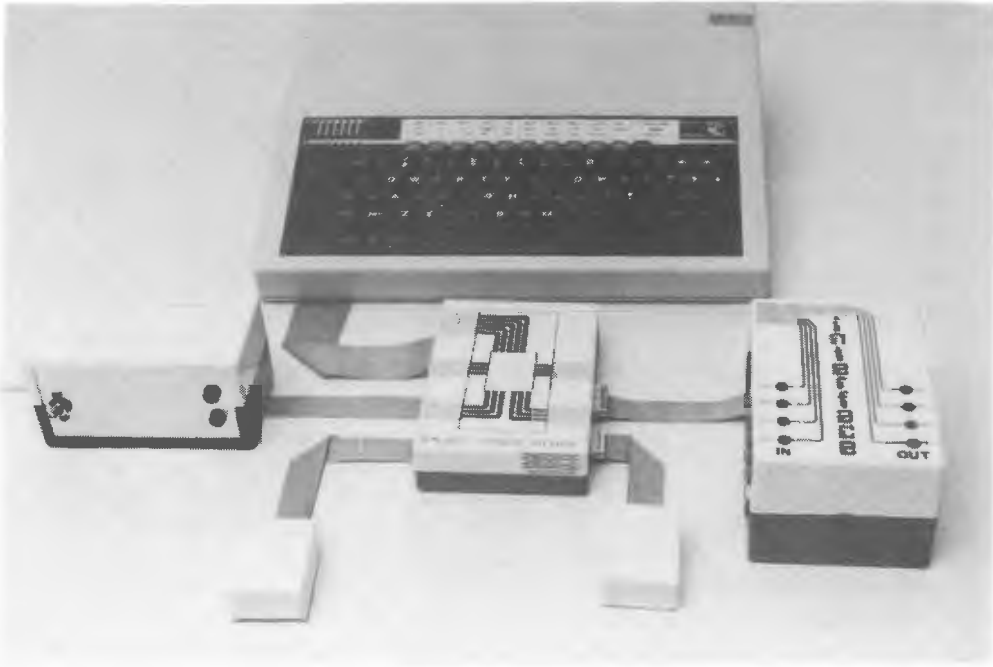
MULTIPLE INPUT UNIT

- 16 sensitive input lines
- 1mm connector for sensors with power lines
- LED indicators on all lines
- plugs directly into the PILOT ONE digital interface
- strobe software procedures supplied

The multiple input unit allows up to 16 separate input sensors to be connected to the PILOT ONE digital interface. The strobe software supplied reads the input lines in pairs selected using the internal clock in the unit. ALL the sensor range with polarised four pin terminations can be connected to the unit, with indicators displaying the status of each line. This unit is ideal for a large number of positional indicators in a maze or for a large railway layout.

This unit forms part of the Sixth form course THE PILOT CONTROLLER, to be released in January 1986.





601/MUP

MULTIPLE USER PORT DRIVER

The **MULTIPLE USER PORT DRIVER** connects to the 1MHz bus of the BBC micro and provides an additional four user-port sockets. Therefore up to five user-port devices can be connected to the micro at one time. The **PORT SUPERVISOR** software controls which user port is addressed so that the data entering the micro is correctly interpreted and data leaving the interface appears at the correct port.

Any user port device can be connected to the unit including digital interfaces, analogue to digital converters, digital to analogue converters or multiple keypads.

This unit will be utilised in the sixth form course **THE PILOT CONTROLLER**, and in the **DATA GATHERING PACKAGE FOR SCIENTISTS**, both to be released in January 1986.

801/AP

ANALOGUE PORT

- Simple -1V to $+1\text{V}$ analogue converter. 8-bit resolution
- ANALOGUE software procedures to use in BASIC programs

A simple analogue to digital converter for interfacing standard analogue temperature, pressure, light sensors. The software supplied contains a set of BASIC procedures for data gathering from the analogue port.

A set of compatible sensors.

- 802/P Analogue pressure sensor
- 803/T Analogue temperature sensor
- 804/L Analogue light sensor

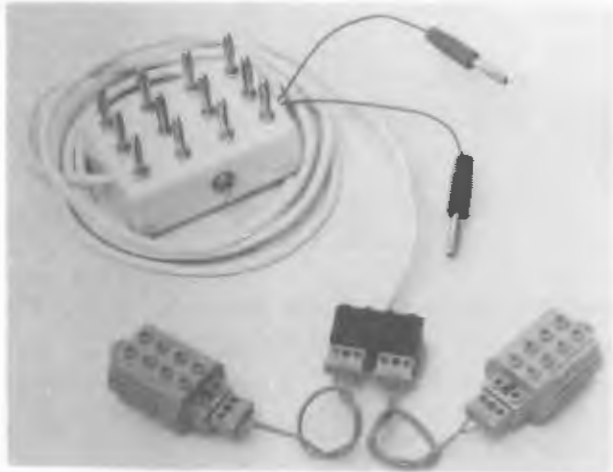
This unit will be utilised in the sixth form course THE PILOT CONTROLLER, and in the DATA GATHERING PACKAGE FOR SCIENTISTS, both to be released in January 1986.



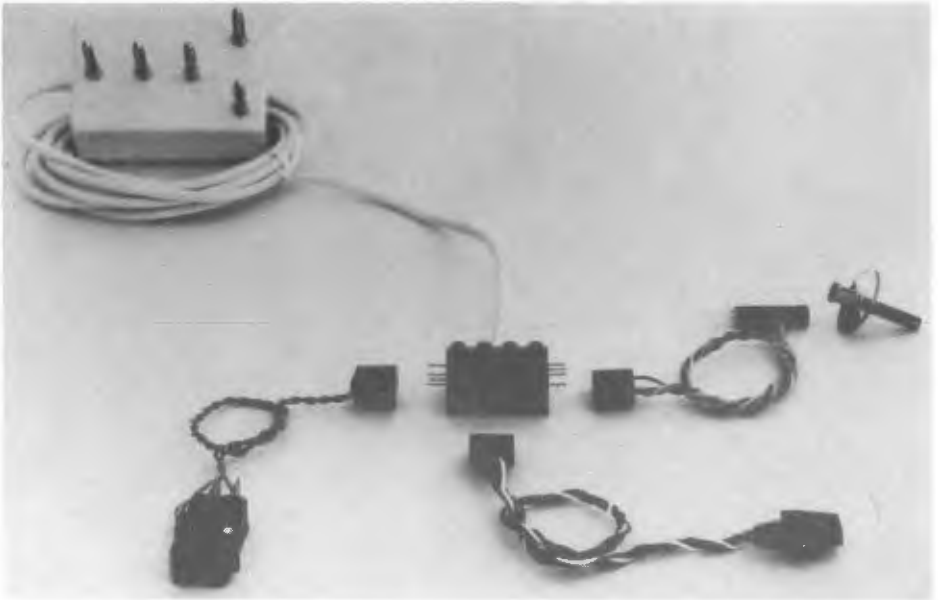
MODEL DRIVE LEADS

Connect your LEGO® or fischer technic® model to the digital interface using the PILOT ONE drive leads.

- plugs into the output side of the digital interface
- terminal block accepts LEGO or fischer technic plugs
- power supply leads to interface or separate power supply
- PANIC switch to cut power to the model



- 527/L20 Two-motor drive lead. Provides independent control of two motors in both directions
- 528/L30 Three-motor drive lead. Allows bi-directional control of three motors, one motor active at a time



MOTOR SENSOR LEAD

Sensors on a model are easily connected to the digital interface using the model sensor lead (521/L3I).

- three sensor lines provided
- power supply line for optical sensors
- polarised 4-pin termination on building block



539/L3I – Model Sensor Lead.

Any combination of the following sensors can be used on the lead:

- SEN/2L microswitch for buggy bumper
- SEN/8L slotted optical sensor with disc for sensing axis rotation
- SEN/9L reflective optical switch for position
- SEN/6L magnetic switch for position sensing



523/C CAR

The first step in computer controlled motion, using a large robust model car which is simple and fun to use.

No external power supply is required for the car as the neat plug-in module allows power to be drawn from the interface power supply. Commands from the micro control both steering and forwards/reverse motion.

The "INMOTO" software is a menu-driven control package. A route of up to 20 steps can be planned, stored and executed in a user-friendly fashion.

524/N CRANE

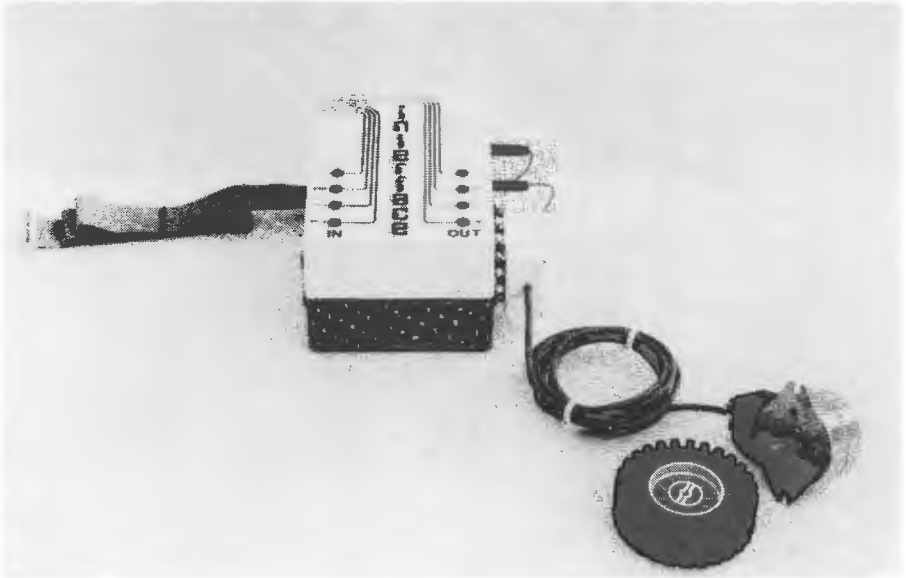
This model introduces the idea of providing the precise motion, utilising optical positional feedback on each of the three motors.

The crane is simple and fun to use. It can be commanded to rotate, the jib can be extended, and the hook can be raised or lowered.

The software provided allows a sequence of movements to be constructed on the screen, stored and executed.



STEPPER MOTORS



- Stepper motor with connection to the PILOT ONE digital interface
- 7.5 degree per step, step rate 100 per second at $\approx 2\text{Ncm}$ torque
- STEPPER software procedures in BASIC to control the motor
- Teaching package on the operation of the stepper motor

The stepper motor is controlled by pulse trains sent from the output lines of the digital interface. The direction and speed control is achieved using BASIC procedures, utilising an internal clock or initiated from pulses fed into the input line of the digital interface. The procedures are provided with a teaching package on the operation of the stepper motor with full screen graphic displays running in unison with the motor.

A second stepper motor can be added to make a turtle-like vehicle. The second motor is supplied with a connection block that "piggy backs" onto the output side of the interface. A pair of wheels are supplied with instructions for building a turtle.

- 543/S Stepper motor (connection for digital interface) STEPPER software
- 544/S2 Second stepper motor for connection to digital interface, 2 wheels
- 545/ID35 7.5 degree stepper motor (spare motor, no connectors)



LEGO® TECHNIC Sets

LEGO TECHNIC is an ideal building material for younger pupils. The sets are carefully designed to provide the maximum flexibility and the activity cards enable pupils to quickly grasp the technical principles.

The models driven with motors from the TECHNIC kit can then be easily interfaced to the micro using the PILOT ONE drive leads.

Sensors placed on the models can provide feedback to the micro utilising the PILOT ONE sensor lead.

L/1030 LEGO TECHNIC I

179 elements in a sturdy storage box. 20 activity cards.

L/1031 Extra Activity Cards for TECHNIC I.

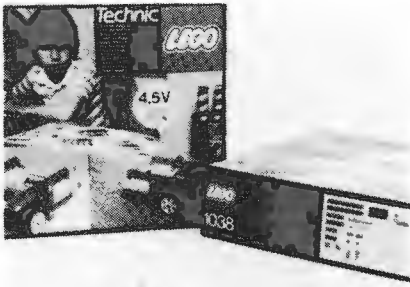
L/1032 LEGO TECHNIC II

278 elements including a 4.5V motor. 20 activity cards.

L/1033 Extra Activity Cards for TECHNIC II.

L/1034 LEGO Teacher's Set to TECHNIC I and II.

1516 replacement pieces including two motors. Teacher's guide to activity cards.



LEGO BUGGY



LEGO buggy with drive lead

L/1038 LEGO BUGGY

A super two motor buggy with worm drive to wheels. Easy to build, yet precise control can be achieved by using the gears provided. Easily connected to the micro using the PILOT ONE drive lead and sensor lead.

551/LB MICRO BUGGY KIT

A LEGO buggy (L/1038) with drive lead and sensor lead. Two optical sensors and discs provide feedback to the micro. A third sensor can be connected to the lead for white line following, bumper switching, or position switching.

LEGO buggy with optical sensors fitted to sensor lead





RAILWAYS



525/LR Computer controlled electric railway kit

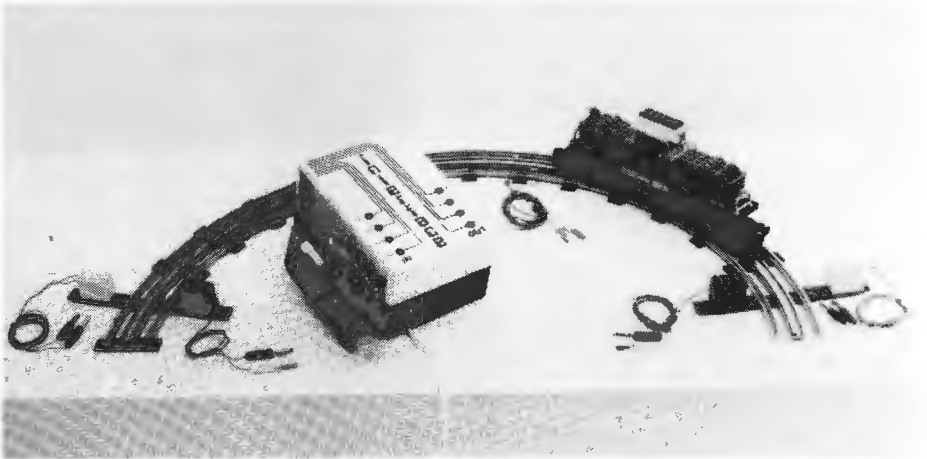
- for use with the digital interface IN/521/E
- an oval of track with siding
- motorised point and decoupling unit
- 12Volt train power supply
- 3 light beam kits for positional feedback
- railway drive connector for interface
- railway software to perform shunting operations

The LEGO railway kit provides a simple way of illustrating positional feedback. Optical sensors arranged around the track provide the micro with data about the position of the train. By controlling the motorised points and decoupling rails the train can be set to perform a whole range of shunting operations.

NOTE: A separate 12Volt power supply is required to drive the point motors. They will not operate on the power supply in the digital interface.

526/LRS LEGO railway shuttle kit

LEGO railway loco and two light beam kits to illustrate positional feedback



L/7730	Electric Goods Train Set
L/7740	Electric Inter-City Train Set
L/7755	Electric Diesel Locomotive
L/7850/4	Straight Rails
L/7851/5	Curved Rails
L/7856	Manually Operated Points (one left & one right)
L/7857	Electric Crossing
L/7858	Remote Controlled Points (right)
L/7859	Remote Controlled Points (left)
L/7860	Remote Control Signal
L/7861	Train Lighting Set
L/7862	Remote Decoupling rail
L/7863	Remote Points Motor (for L/7856)
L/7864	12Volt Transformer/Controller
L/7866	Remote Level Crossing gates
L/7867	Track Lamps

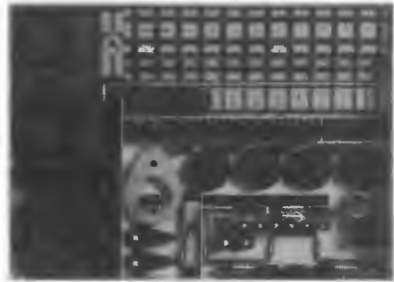
The fischertechnik range of building materials are ideal for older pupils where more advanced models are required. The extensive range of gears and electrical elements can be used to build anything from a model factory production line to a robot arm. The motors can be controlled using the PILOT ONE digital interface, plugging directly into the model output leads. Sensors from the model sensor range can be added to provide feedback to the micro.

The basic sets ut-1, ut-2, provide blocks and gears for simple motor-driven models.

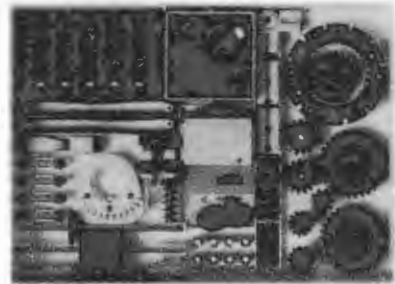
Cranes, bridges and curved structures can be created using ut-S statics kit.

A range of switches and lamp units are provided in the electrical kits ut-3 and ut-3/1.

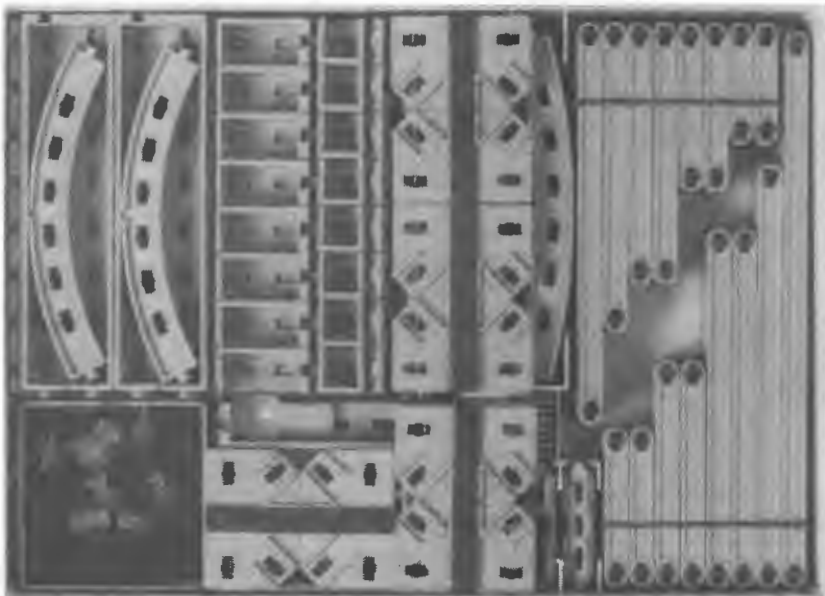
A full range of sensors and control electronics is supplied in ut-4 and ut-4/1.



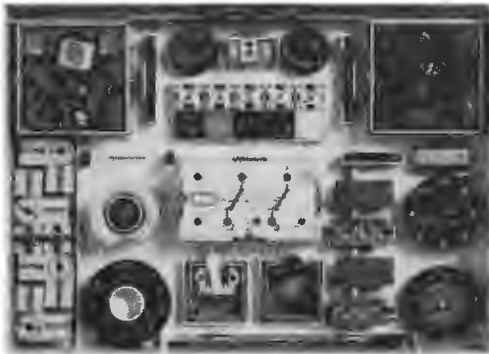
FT701/u-t 1 Basic set



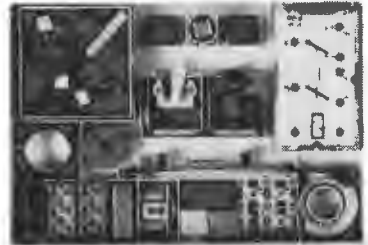
FT702/u-t 2 Motor and gears



FT703/ u-t S Statics

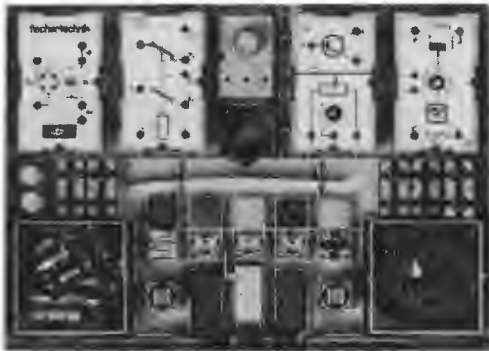


FT710/u—t3

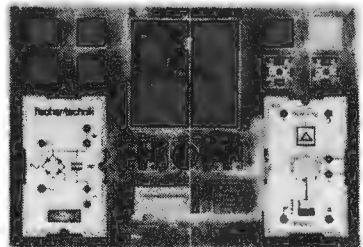


FT711/u—t3/1

2 instructional building kits on the subject "Switching and Controlling"



FT712/u—t4



FT713/u—t4/1

2 instructional building kits on the subject "Control and Regulate" (Electronics)

MODEL KITS

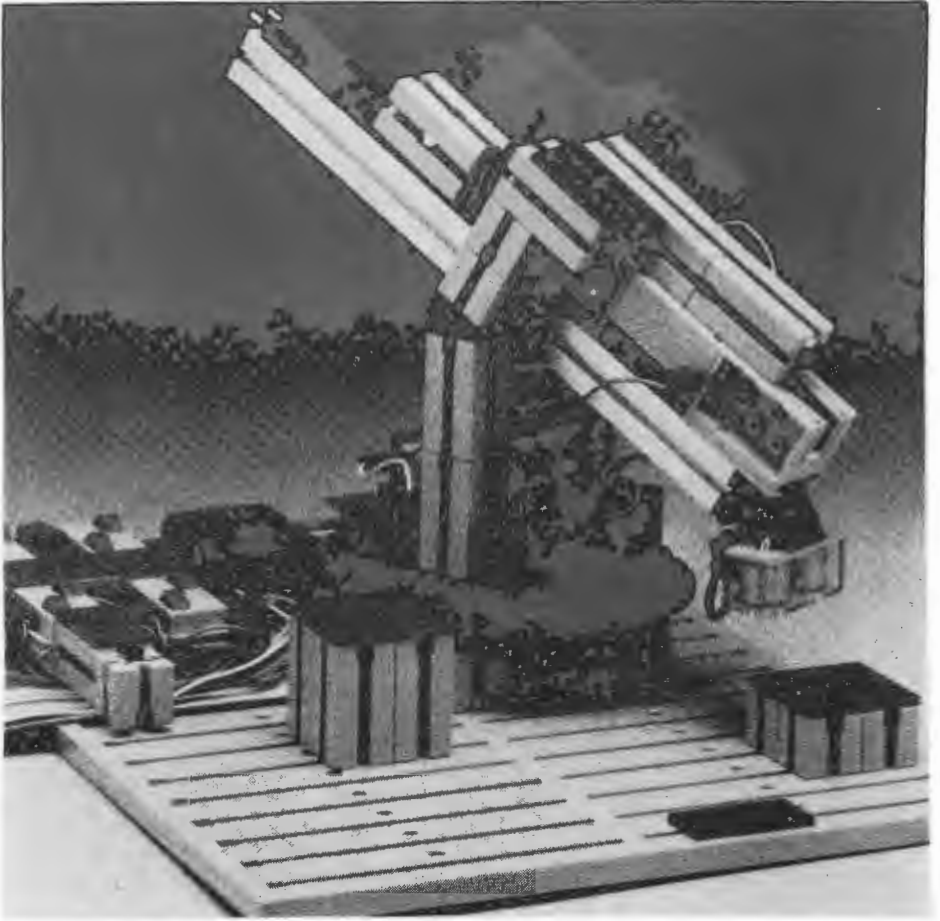
The following model kits do not contain motors. Motors are available as separate items (see the fischertechnik spares list on last page).

FT/706/30480 Turret crane with three axes of movement.

FT/707/30481 Multipurpose vehicle with steering.

FT/708/30474 Crane with telescopic arm, 3 axes of movement.

FT/709/30479 Gantry crane.



Fischertechnik Computing Kit **FT/710/COM**

The versatile computing kit can be used to construct several different models utilising the 2 d.c. motors, 2 potentiometers, switches and the magnet supplied in the kit. Motors and switches can be connected to the micro via the PILOT ONE digital interface. Feedback potentiometers can be interfaced using the joystick port or the PILOT ONE analogue to digital converter.

Typical models include:—

- | | |
|--------------|----------------|
| Plotter | Sorting system |
| Aerial rotor | Lift mechanism |
| Simple robot | Machine tool |

530/R1

SINGLE MAINS RELAY UNIT



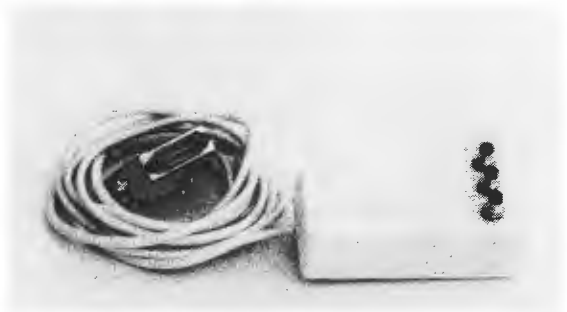
This unit contains a relay suitable for switching mains current up to 5Amps. The relay is activated by a 5V power supply optically isolated from the unit. The device can be driven directly from the PILOT ONE digital interface. The unit is supplied with a Euro socket outlet and lead.

- 530/R1 Single mains relay unit (5 Amp contacts), input and output lead
- 531/R4 Four individual mains relay units (total rating 5Amps), input and 4 output leads

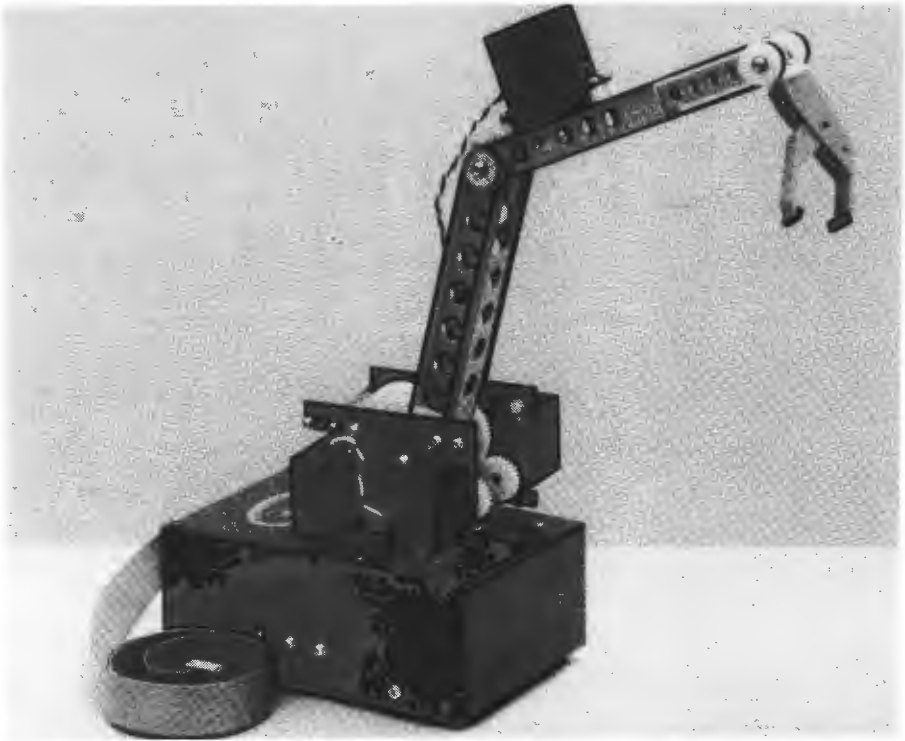
533/L

REMOTE 3 KEY PAD

This 3 key unit plugs into the joystick port and can be used to activate the menu driven programs. The unit has a 5 metre lead and allows demonstrations remote from the keyboard or class participation during demonstrations. The JOYKEYS software allows simple adaptation of all software operated on a limited keyboard.



ALFRED *from* ROBOT CITY TECHNOLOGY



ALFRED is a 6-axis robot arm driven by servo motors. The arm will rotate and lift on both sections. The gripper can rotate on the wrist in two dimensions, open and close. The feedback on each axis allows for 256 positions to be set for each of the six movements. The arm has its own interface that plugs directly into the user port. The unit comes complete with PILOT ONE menu-driven software that allows:-

- real time micro keyboard drive
- sequence drive to fixed points
- emulator drive and sequence construction

Emulator and remote keypad available as extras.

- | | |
|-------|---|
| 401/A | ALFRED robot kit and PILOT ONE software package |
| 402/S | PILOT ONE software package for ALFRED |
| 403/E | Emulator for ALFRED |
| 404/K | 12 keypad for remote ALFRED control |

Alternatively the servo drive board can be used to interface up to 8 servos. The drive board and servo units are available as spare items.

- | | |
|--------|--|
| 410/I | 8-servo-drive interface board for user port |
| 411/PS | Power supply for above |
| 412/S | Servo with termination for servo interface board |

TEACH ROBOT *from* REMCON

- D.C. motor drive and optical feedback
- BASIC procedures available
- BASIL routines available
- Individual piston activators available

This 6-axis robot arm uses d.c. motors driving piston actuators with digital feedback provided by optical sensors. The arm is very robust and can be controlled from the special interface supplied or the PILOT ONE digital interface (IN/521/E) and the multiple input and output units. The arm is available with software in BASIC as a supplement to the PILOT IN CONTROL course. Alternatively, the arm can be operated using BASIL routines.



- | | |
|--------|---|
| 301/TR | Teach Robot Kit with PILOT ONE interface and BASIC software |
| 302/BS | BASIL routines for the Teach Robot |
| 310/A | D.C. motor driven piston actuator with optical feedback. |

LEGO[®] TECHNIC SPARES

L/1100 2 Connector Leads, 750 and 100mm
L/1122 1 Large and 2 Small Hinges
L/1123 3 Ball and Socket Couplings, 1 Articulated Joint
L/1120 Digger Bucket Assembly
L/1125 Crane Grab Assembly
L/1132 4 Tilting Bearings
L/1133 4 Hinges
L/1175 Technic 4.5Volt Motor
L/1217 20 Technic Beams and Plates – Yellow
L/1218 20 Technic Beams and Plates – Blue
L/1219 20 Technic Beams and Plates – Red
L/1220 20 Technic Beams and Plates – Black
L/1221 8 Technic Beams 12 & 16 Stud – Yellow
L/1222 8 Technic Beams 12 & 16 Stud – Blue
L/1223 8 Technic Beams 12 & 16 Stud – Black
L/1224 8 Technic Beams 12 & 16 Stud – Red
L/1226 6 Technic Wheels
L/1229 70 Technic Chain Links
L/1230 54 Technic Chain Tracks
L/1231 2 Technic Wheels & Tyres (large 82mm dia)
L/1232 Technic Bushes, Piston Rods, Toggle Joints
L/1234 34 Technic Axles
L/1235 Gear Wheels, Steering, Crown and Drive Wheel
L/1236 2 Technic Wheels and Tyres (medium 62mm dia)

fischertechnik. SPARES

FT/711/ 30185 6V motor
FT/712/ 30187 6V mini motor
FT/713/ 30280 Grey building blocks
FT/714/ 30282 Red building blocks
FT/715/ 30283 Base plates and driver's cab
FT/716/ 30284 Chains
FT/717/ 30285 Wheels and Springs
FT/718/ 30287 Statics parts
FT/719/ 30288 Lamps and cables
FT/720/ 30289 Winch
FT/721/ 30290 Revolving mount
FT/722/ 30291 Hydraulic cylinder
FT/723/ 30292 Figures and Seats
FT/724/ 30384 Base plate 500-0
FT/725/ 30381 Base plate 1000-0

PILOT ONE LIMITED reserves the right to change any product description and accepts no responsibility for any errors or omissions in this manual.

Pilot One Ltd.

22 Campbell Road

Bedford

MK40 3DD

Tel.: (0234) 327688

