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Equipment planning guide for vocational and technical training and education programmes



International Labour Office Geneva

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FOREWORD

1. This second (revised) edition of Equipment Planning Guide No. 10 aims at bringing up-to-date and improving the content of the first edition with regard to latest didactic and technological developments.

2. The purpose of equipment planning guides is to provide guidance and help to:

- government departments and national institutions in the developing countries, national project directors, teachers, instructors, chief technical advisers, experts, consultants, etc., so that they may plan their equipment requirements with accuracy and speed and produce precisely defined technical specifications for equipment requests and workshop layouts;
- purchasers in developing and industrialised countries, with a view to simplifying procedures for international competitive bidding and placing orders;
- firms in developing and industrialised countries, to enable them to understand exactly what is needed when they receive invitations to tender;
- teachers and instructors everywhere, so that they may provide learners with technical specifications and information on the characteristics of items of equipment in the guide lists.

3. The text of this guide is in English. An alphabetical index of item titles included in the equipment lists is attached in English; numerical indexes are attached in English, French and Spanish. A French version of this guide is also available.

4. This planning guide is the result of a collective effort. The authors are:

- S. Schoen, Chief of ILO's Technical Co-operation Equipment and Subcontracting Branch (EQUIPRO), who developed the conceptual and editorial framework;
- V. Remesh, Technical Standards Adviser (ILO/EQUIPRO), who prepared the technical content.
- Consultants, engaged by the Government of the Canada, who prepared the layouts, illustrations, and some item specifications.

5. The authors recognise that their attempt to define and compile comprehensive equipment planning guides cannot be inclusive of all possible needs. The Technical Co-operation Equipment and Subcontracting Branch (EQUIPRO) at ILO headquarters would be grateful to the users for any comments and suggestions on how this guide may be improved further. The guides will be revised at intervals of about five years or as the need arises. 6. While every care has been taken to ensure the accuracy of the technical data in this guide, the ILO and the authors cannot accept responsibility nor may they be held liable for :

- (a) any editorial or typographical errors which may have occured; and
- (b) any defaults arising from manufacture, method of selection, use, etc., of the equipment described in this guide.

Specifications which are subject to change should be confirmed when placing orders with suppliers.

7. Subject to mutual agreement, users of this planning guide may also avail themselves of the experience, expertise and services which the ILO can render in planning, purchasing and delivering technical co-operation equipment. Enquiries should be addressed to:

> Technical Co-operation Equipment and Subcontracting Branch (EQUIPRO) International Labour Office CH-1211 <u>Geneva 22</u> (Switzerland)

8. This guide has been prepared with financial assistance of the Government of Canada represented by the Canadian Commercial Corporation.

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HOW TO PLAN EQUIPMENT REQUIREMENTS

1. When planning equipment for vocational and technical training and education programmes, it is important to provide a clear idea of the equipment and layout features desired. Equipment lists for workshop layouts need not be as detailed as purchasing requests but they should give the architect all the information he needs to design an effective layout and to provide safe and adequate operating space.

2. The responsibility for recommending equipment should be given to experienced instructors/educators who are directly involved in the relevant programme.

3. Cost should not be the primary criterion for selection. Function, design and after-sales service are the three most important considerations; others are durability, accuracy, versatility and low operating costs.

4. Functional equipment must be well-designed, safe and easy to use. It must be selected for its compatibility with and contribution to the training/education programme to which it should form an essential complement, and it should have the capacity and degree of technical sophistication appropriate to the level of skills of those who will use it.

5. Incomplete or over-elaborate specifications in purchasing requests slow down the process and may result in late deliveries or the supply of inadequate, unnecessary or costly equipment. Requests should be carefully reviewed to ensure that equipment is in accordance with the needs of the particular programme.

6. To ensure fair competition, specifications should be so worded and detailed as to permit and encourage the widest possible market coverage. Specifications must be broad enough to allow several suppliers to submit bids whilst containing enough detail to indicate clearly the essential characteristics of each item. Such specifications enable the suppliers to understand particular requirements and to quote correctly.

7. Specifications should not list features which are not strictly necessary, otherwise certain suppliers might, quite wrongly, be discouraged from bidding or unnecessary expenditure might be incurred. It is, however, important to mention special requirements of local laws or conditions, such as tropicalisation and/or dust proofing, the system of weights and measures in use, etc. It is important that the electricity supply system should always be described in the equipment requests.

8. In exceptional cases the programme may require equipment which is not readily available and will have to be specially made. In such cases, detailed descriptions and drawings should be provided in enough copies, depending on the type of equipment and the number of firms to be consulted. When the use to which an item of equipment is to be put is not made sufficiently clear by the mention of its name alone, it should be described fully in the equipment request. 9. It is essential that there should be an efficient inventory system on the spot, in which the records are kept of all equipment purchased. As new equipment is received it should be recorded immediately on the inventory, which should contain such information as:

- (a) inventory number;
- (b) name or description;
- (c) serial number;
- (d) purchase order number;
- (e) cost;
- (f) supplier or manufacturer;
- (g) date of purchase;
- (h) location;
- (i) maintenance record.

The information in the inventory will be useful when ordering replacement items and for accounting for annual maintenance costs. It will also indicate when maintenance is required more frequently than is normal, in which case it may be time to consider the purchase of new equipment.

HOW TO USE THE EQUIPMENT GUIDE LIST

1. In general, a complete training package approach has been adopted in this guide to ensure delivery of both hardware and corresponding ready-to-use software. However, a variety of item specifications for separate testing and measuring instruments is also included in this guide to meet specific training and research requirements of particular projects. On the other hand, items for domestic and communication electronics were deleted from this issue because these items are included in full in the revised and renamed version of guide No. 11 "Communication Engineering".

Special attention has been given to microcomputer equipment, process control and printed circuits realisation systems.

2. This revised version of guide No. 10 contains main items related to Fundamentals of electronics (F), Industrial electronics (I), Electronic instrumentation (E) and Digital electronics (D). Corresponding abbreviations of these occupations (F, I, E and D) are given in the "USE" column of the guide list pages. Other items related to these occupations are listed in guides No. 9 (Electrical occupations) and 11 (Communication Engineering).

Ancillary items, which may be required for equipping an electronic laboratory or a workshop, such as metalworking machines, welding facilities, heavy handtools, sheetmetal machines, audiovisual, draughting, office and reproduction equipment can be found in guides Nos. 1, 2, 3, 6 and 15.

3. To facilitate the preparation of equipment lists, facilities, components and consumables closely related to the main items are listed in the same sections usually below the main item. However, general purpose machines, tools, components and consumables are included in separate sections.

4. The list of main equipment in this guide consists of "basic" and "optional" items commonly used in vocational and technical training and education programmes at different levels. The minimum essential items required to start a training programme for 16 learners in a particular occupation are marked with an asterisk and are regarded as "basic". To provide a maximum degree of flexibility, it is left to users of the lists to decide which of the "optional" items are necessary, taking account of local conditions, varying numbers of learners, different levels of training and the funds available.

5. The terminology in this guide relates to commonly used expressions although definitions may vary from country to country. Wherever possible internationally recognised standards were applied. Only SI Units have been used in this guide.

6. For the sake of clarity and to avoid duplication when ordering, a numerical code is used to identify each item, the first figure indicating the planning guide, the second the section and the third the individual item. For example, the code for the first item in section 1 (trainers and training kits) is 110.1.1, and for the second item 111.1.2. Based on project requirements a similar numerical code should be used whenever equipment requests are prepared (see also chapter "Equipment Request (Model)").

7. At the beginning of each section a short description of its content is provided as well as some ideas of how to use the items.

8. All items in the list have "neutral" technical specifications so that they may be used for international competitive bidding.

9. The illustrations represent equipment similar to the items described.

1

List number: 10 Technical field: Electronics

SECTION 1 TRAINERS AND TRAINING KITS

This section describes the selection of trainers for teaching basic and specific areas of electronics.

Each trainer has been categorised into an area of instruction.

The Basic Electricity and Electronics Trainer (110.1.1) is introductory in nature and offers the trainee a basic knowledge in electronics, upon which the trainee can then build. The next four trainers classified as fundamental are:

Power supplied and amplifiers trainer (110.1.2) Analog logic trainer (110.1.3) Digital logic trainer (110.1.4) Digital exercises kit (110.1.5)

The thyristor control trainer (110.1.6) deals with power control problems.

Industrial automatic regulation and control are represented by Instrumentation and process control trainer (110.1.14), Process control simulator (110.1.15), Programmable logic controller (110.1.16) and by Microprocessor trainer system (110.1.17).

Simultaneously, the microprocessor trainer system (110.1.17) along with the microcomputer hardware trainer is intended for hardware programming training, familiarisation and isolation of malfunctions as well as for software development.

Item 110.1.19 represents a microprocessor controlled robot arm trainer kit intended for training in its assembly, as well as in operation and programming of robots.

It should be noted that many instruments overlap in areas of use, so that a complete laboratory need not contain all of the instruments described.

(the state	Equipment guide list				
	List number: 10				Date of issue
	Technical field: Electronics				November 1986
ltem	Description	Quant.	Use	Illustration	1
Item	<pre>Description BASIC ELECTRICITY & ELECTRONICS TRAINER for basic training and instruction in principles of electricity and electronic circuits, consisting, for example, of a panel to accommodate plug-in elements to permit different circuit configurations. Other arrangements may be considered. The trainer should cover the following subjects: principles of electrical engineering, (Ohn's law) DC/AC networks, RC/LC circuits principles of electronics (semiconductor characteristics, diode and transistor circuits, rectification, voltage multipli- cation, filtering, stabilisation, AC/DC voltage amplification, triacs, diacs, unjunction tran- sistors, FET's, VDR's, operatio- national amplifiers thyristor circuits, multivibrators, Schmitt triggers, principles of analog and digital circuits) Complete with: power supplies (DC, AC) function generator (s) set of necessary measuring instruments (oscilloscope(s), avometer(s) etc.) set of accessories and components for two years of maintenance in- cluding those which are subject to possible damage during experiments two sets of comprehensive manuals (handbooks) with laboratory exercises operation and service manuals. The trainer may include special furniture. </pre>	Quant	F *		
Note :	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental. Legend: F = Fundamen D = Digital ele I = Industrial e *Basic item	tals of el ctronics, lectronic	ectron E = E s	ics, A = Analog electronics Electronic instrumentation,	, Page б

Equipment guide list List number: 10 Technical field: Electronics Item Description Quant. Use Illustration

Date of issue November 1986

Item	Description		Quant.	Use		
110.1.2 Note	POWER SUPPLIES AND AMPLI TRAINER an experiment-based trai shall present the theory of various aspects of po and amplification. The shall contain all of the supplies and components explore the following to - transformers - rectifiers (half and f filters (pi, capacitan inductance) - voltage (dividing, mul regulating, stabilisin - constant current sourc general purpose amplif All experiments shall be capable. Minimum number of experi Complete with: - power supply, overload - set of plug-in compone connecting leads to pr basic exercices - set of corresponding m instruments with opera service manuals - set of recommended spa components for two yea operation, including t are subject to possibl during experiments - two sets of experiment - two sets of courseware principles of power su power delivery, contro modification. The trainer may includ furniture.	FIERS ner which and functions wer supplies trainer kit materials, necessary to opics: ull wave) de, tiplying g) e iers. breadboard ments: 10 protected ents and rovide all measuring tion and ares and ares of hose which e damage s manual describing pply, l and le special	8	F *	ics, A = Analog electronics,	Page
	scriptions and illustrations with specific makes or models is purely coincidental.	D = Digital elect ! = Industrial ele *Basic item	ronics, ctronic	E = E s	lectronic instrumentation,	7

	Equipment guide List number: 10 Technical field: Electronics	elist				Date of Novemb	issue Der 1986
ltem	Description		Quant.	Use	Illustration	L	
110.1.3 Note:	ANALOG LOGIC TRAINER for training in analo closed/open-loop cont industrial electronic instrumentation, consisting, for exam panel with sockets co with internaly fitted (symbolically represe front panel). Other may be considered. T shall permit differen configurations by mea connecting leads. Th should ensure large v experiments at least differential amplific non-inverting amplific converter, comparator multivibrator, integr and sawbooth generato differentiator, monos multivibrator, RC osc squarer, square-root pulse length discrimi to-frequency converte digital converter, div exponential function, the RMS value of a vo calculation circuits. Complete with: power supply all necessary funct set of necessary me instruments accessory kit for t operation with conn The kit should list quantity of compone subject to possible during experiments two sets of manual with laboratory exe operation and servi The trainer may inc special furniture.	<pre>gue computing, rol circuits, s and ple, of a nnected elements nted on the arrangements he trainer t circuit ns of external e trainer ariety of such as: rs, inverter, er, impedance , astable ator, delta r, table illator, extractor, nator analog-ro gital-to- ider, determining ltage, analog ional elements asuring wo years of ecting leads. recommended nts which are damage (handbooks) rcices ce manuals. lude</pre>	8 als of el	F *	ics, A = Analog electronics		Page
	specific makes or models is purely coincidental.	I = Industrial elec *Basic item	ectronics,	с — с S			8

Equipment guide list List number: 10 Date of issue November 1986 **Technical field: Electronics** Quant. Use Description Illustration Item 110.1.4 DIGITAL LOGIC TRAINER 8 D for training in operation and application of digital logic circuits extending to complex digital systems including circuits used in computer *

<pre>technology; consistin of a panel with outpu internally fitted ele (symbolically represe panel). Other arrange considered. The train different circuit con means of external con The trainer should en variety of experiment such as: basic logic circuit Boolean algebra coding, decoding, r arithmetic circuits comparator, thresho selection circuits memories A/D-D/A conversions digital switch basic flipflop circ shift registers synchronous counter asynchronous counter asynchronous counter asynchronous counter asynchronous counter demultipliers pulse edge delays, tion circuits, puls more complex exampl control, instrument technology. Complete with: all general purpose AND/NAND, OR/NOR ga J-K (master/slave), power inverters, re flops, indicator la pulse generators, m demultipliers shift BD4CD decimal decod memories, digital s power supply accessory kit with </pre>	g, for example, t sockets from ments nted on the front ments may be er shall permit figurations by necting leads. sure large s at least s ecoding ld value uits s rs and synchroniza- e gates es of digital ation and data logic elements tes, Schmitt, D triggers, lays, flip mps, clock onoflops, registers, er adders, witches, etc.) connecting		
 power supply accessory kit with leads set of necessary me instruments set of recommended components for two ration, including t subject to possible experiments 	connecting asuring spares and years of ope- hose which are damage during		
Note: Any similarity in above item de- scriptions and illustrations with specific makes or models is	Legend: F = Fundamentals of electron D = Digital electronics, E = E I = Industrial electronics	ics, A = Analog electronics, Pag Electronic instrumentation, 9	

purely coincidental.

Item Desc - t (d - t (d - 1 T s 110.1.5 DIG sel exp fro C-M The					1
Item Desc - t (d - 1 T s 110.1.5 DIG sel exp fro C-M	Equipment guide list				
Item Desc - t (- t (- t (- t (- t (- t () - t () - t () - t () - t () - t () - t () - t () - t () - 1 - T - t () - 1 - T - t () - 1 - T - T - T - T - T - T - T - T	List number: 10				Date of issue
Item Desc - t (d - 1 T s 110.1.5 DIG sel exp fro C-M	Technical field: Electronics				November 1986
- t (d - 1 T s 110.1.5 DIG sel exp fro C-M	Description	Quant.	Use	Illustration	
110.1.5 DIG sel exp fro C-M	 two sets of comprehensive manuals (handbooks) describing theory of digital logic circuits laboratory experiments manuals. The trainer may also include special furniture. 				
sel exp fro C-M	DIGITAL EXERCISES KIT	8	D		
	<pre>self-instructional, for practical experiments with integrated circuits from the two dominating types: TTL and C-MOS.</pre> The kit should comprise: breadboard unit two copies of exercice book containing approx. 30 to 40 exercises a set of electronic components with data sheets ensuring all exercises described in the book spare electronic components to cover their possible damage during experiments within two years of use.		*		
Note : Any si script specif	riptions and illustrations with ecific makes or models is I = Industrial electronic structures of the structure of the struct	als of electronics,	ectron E = E s	ics, A = Analog electronics lectronic instrumentation,	s, Page 10

(IIO)

List number: 10 Technical field: Electronics

Date of issue November 1986

<u> </u>			-		l	
ltem	Description		Quant.	Use	Illustration	
Item 110.1.6	Description THYRISTOR CONTROL TRAN for practical instruct conversion, instrument and open-loop control consisting, for examply with sockets (input, or connected with interna components (symbolical on the front panel). (arrangements may be con- trainer shall permit or configurations. The trainer should ens- such experiments as: - variable speed control DC motors - position control of - constant temperature phase angle control - lighting control Complete with: - power supply - internally installed thyristors and others - set of necessary mea- instruments - accessory kit with leads and components years of operation, those which are sub ble damage during er - set of units consist electrical machine or generator and tachon drive, temperature loop, lighting control The trainer may also the special furniture	INER tion in field of tation, closed technology; le, of a panel output, test) ally fitted lly represented Other onsidered. The different circuit sure at least rol of AC and an actuator e control e control with d groups of r circuits asuring connecting s for two including ject to possi- xperiments ting of: set (motor- meter), servo- controlled rol (handbooks) l technology rcices ce manuals. o include re.	Quant	I	Illustration	
Note	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundament D = Digital elec I = Industrial ele *Basic item	als of el tronics, ectronic	ectron E = E s	ics, A = Analog electronics, Electronic instrumentation,	Page

	Equipment guide List number: 10 Technical field: Electronics	e list			Da No	te of issue vember 1986
ltem	Description		Quant.	Use	Illustration	
110.1.7	TEMPERATURE CONTROL U self-contained, train The unit shall be equ transducers (thermoco thermoresistance, the regulate temperature, a simulated oven. Th consist of panel(s) w fitted internally and symbolically on panel may include special as trolley, support, Complete with: - control board - measuring instrumen - set of connecting c - power supply - set of recommended years of operation possible loss durin - two sets of experim - operation and servi	NIT ee-orientated. ipped with uple, rmistor) to for example, in e unit may ith components represented (s). The unit furniture such frame, etc. ts ables and leads spares for two to cover g exercises ents manuals ce manuals.	4	I		
110.1.8	LIGHTING CONTROL UNIT self-contained, train The unit may consist components fitted int represented symbollic The unit may include furniture such as tro frame, etc. Complete with: - control board - measuring intrument - set of connecting c - power supply - set of recommended years of operation possible loss durin - two sets of experim - operation and servi	ee-orientated. of panel(s) with ernally and ally on panel(s). special lley, support, s ables and leads spares for two to cover g exercises ents manuals ce manuals.	2	I		
Note	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundamenta D = Digital elec I = Industrial ele *Basic item	als of el tronics, ectronic	ectron E = E s	ics, $A = Analog electronics, electronic instrumentation,$	Page 12

	Equipment guide list				
VIII UIV	List number: 10				Date of issue
	Technical field : Electronics				November 1986
Item	Description	Quant.	Use	Illustration	
110.1.9	DC MOTOR SPEED CONTROL UNIT self-contained, trainee-oriented. The unit may consist of DC motor generator set with tachometer or DC motor with tachometric unit both with electronic speed control circuitry. The unit may include panel(s0 with components fitted internally and represented symbolically on panel(s). It may also include special furniture such as trolley, support, frame etc. Complete with: - control board - two sets of educational handbooks covering DC motor speed control subject - measuring instruments - set of connecting cables and leads - power supply - recommended accessories and spares for two years of operation including those which are subject to possible damage during exerci- ses - two sets of experiments manuals - operation and service manuals.	2	I		

Item	Equipment guide List number: 10 Technical field: Electronics Description	list	Quant.	Use	Illustration	Date of Novemb	issue ber 1986
110.1.10	AC MOTOR SPEED CONTRO self-contained, train The operation of the on sumultaneous frequ vary principles to af maintain power or to them in a desired ran consit of a motor, ta electronic control ci may include panel(s) fitted internally and symbolically on panel It may also include s ture such as troll frame, etc. Complete with: - control board - two sets of educati covering AC motor s subject - measuring instrumen - set of connecting c - power supply - recommended accesso spares for two year including those whi to possible damage ments - two sets of experim - operation and maint	L UNIT ee-orientated. unit may be based ency and voltage fect speed and change both of ge. The unit may chometer and rcuits. The unit with components represented (s). pecial furni- ey, support, onal handbooks peed control ts ables and leads ries and s of operation ch are subject during experi- ents manuals enance manuals.		I			
Note	: Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundamenta D = Digital elec I = Industrial ele *Basic item	ais of ele tronics, ectronic	ectron E = E s	Ics, A = Analog electronics, lectronic instrumentation,	,	Page 14

Equipment guide list List number: 10 Date of issue November 1986 Technical field: Electronics Description Quant. Use Illustration Item 110.1.11 ANGULAR POSITION UNIT 2 Ι self-contained, trainee-orientated. The operation of the unit may be based on the servocontrol principle involving, for example, servo amplifier, error position detector, open loop position controller. The unit may include panel(s) with components fitted internally and represented symbolically on panel(s). It may also include a special furniture such as trolley, support, frame, etc. Complete with: • control board - two sets of educational handbooks covering in detail angular position control subjects - set of connecting cables and leads power supply recommended accessories and components for two years of operation including those which are subject to possible damage during experiments two sets of experiments manuals - operation and service manuals. 110.1.12 X-Y POSITION UNIT 2 Τ self-contained, trainee-orientated. The unit may represent a numerically controlled position device with a marking pen, similar to the plotter. It may include autonomous control panel. Complete with: - control board - two sets of educational handbooks covering in detail two position control subject - set of connecting cables - recommended accessories and components for two years of operation, including those which are subject to possible damage during experiments - two sets of experiments manuals - operation and service manuals. Note: Any similarity in above item de-Legend: F = Fundamentals of electronics, A = Analog electronics, Page D = Digital electronics, E = Electronic instrumentation, scriptions and illustrations with I = Industrial electronics specific makes or models is 15 *Basic item purely coincidental.

See and	Equipment guide	list				
VIION	List number: 10					Data of issue
	Technical field: Electronics					November 1986
ltem	Description		Quant.	Use	Illustration	
110.1.13 Note	STEPPING MOTOR CONTRO self-contained, train electronically contro electromechanical dev represent principles in robotic equipment, plotters. The traine designed to study a s operation, step incre variable speed rotati of rotation, incremen incoding. The unit ma special furniture. Complete with: - control board - two sets of educati stepping motor cont - measuring instrumen indicating devices - set of connecting c leads - power supply - recommended accesso for two years of op including those whi to possible damage ses - two sets of experim - operation and servi	L UNIT ee-orientated, lled ice should of driving units printers, r should be tepping motor ment control, on and inversion tal position y include onal books on rols ts and/or ables and pries and spares peration ch are subject during exerci- ments manuals ce manuals.	2 als of e		ics, A = Analog electronic	s, Page
	specific makes or models is purely coincidental.	I = Industrial elec Basic item	ectronic	, <u> </u>		16

purely coincidental.

Equipment guide list

List number: 10

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Technical field: Electronics

Item	Description	Quant.	Use	Illustration	
Item 110.1.14	Description INSTRUMENTATION AND PROCESS CONTROL TRAINER a self-contained laboratory-centered trainer designed to explain the design and control of instrument systems and process control. The trainer shall be fully programmable with the potential to input malfunctions. The following topics shall be covered as minimums: - transducers - encoders/decoders - programming control systems - programming process systems Complete with: - supply unit - supply unit - supplies and components necessary for all the experiments - recommended consumables and/or spares for two years of operation including those which are subject to possible damage during experi- ments - two sets of handbooks on instru- mentation and process control engineering - two sets of laboratory experiments manuals - operation and maintenance manuals.	Quant.	E I *	Illustration	
Note	: Any similarity in above item de- scriptions and illustrations with specific, makes or models is Legend: F = Fundament D = Digital elec	L als of el stronics, ectronic	lectror E = l	L nics, A = Analog electronics, Electronic instrumentation,	Page

*Basic item

Equipment guide list List number: 10

Technical field: Electronics

	/ rechnical held. Electronics					Novemi	Der 1980
Item	Description		Quant.	Use	Illustration		
110.1.15	PROCESS CONTROL SIMUL	ATOR	1	E			
	for teaching automati engineering.	c control		I			
	Approximate specifica	tions:		*			
	The simulator should types of controllers (P), Integral (I), De and their behavior.	represent all Proportional crivative (D)					
	<pre>It should be possible the following phenome - step and sine funct of linear and non-1 functions - control performance systems and the inf P, PI, PD and PID c - automatic control s as: fixed value co ratio control system - special features su non-linear control points controllers, systems of higher o The simulator should with disturbance sour include, for example, sockets (input, output connected internally as well as to suit ex units or plugs. Approx. range of funce - proportional amplif (P)5 to 200% steple - integral action (with reduction poss - derivative action (with reduction poss - two sets of coursew engineering related simulator - two sets of experim - operation and servi</pre>	d represent all s Proportional Derivative (D) ele to examine mena: action responses -linear transfer acc of controlled influence of controllers systems such control systems, tems, cascade such as: ol loops, two s, control order. d be equipped urce and may e, a panel with put, test) y with components external plug-in mentions: .ifying action plessly adjusted. (I) 0.1s to 10s pssibility by 0.01 (D) 0 to 0.5 s pssibility by 0.01 ess and components is and accessories operation, thich subject to huring experi- seware in control red to the ciments manuals vvice manuals.					
Note	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundamenta D = Digital elect I = Industrial elec *Basic item	als of electronics,	ectron E = E s	ics, A = Analog electronics lectronic instrumentation,	i,	Page 18



List number: 10

Date of issue November 1986

Technical field: Electronics

Item	Description		Quant.	Use	Illustration	
110.1.16	PROGRAMMABLE LOGIC CON for training in an eff to any industrial prod tasks. Consisting of base unit (CPU and pro and a programming pane Approximately 300 step memory (C-MOS, RAM) wi battery back-up. Mini input/output lines. (supply units operation manuals.	NTROLLER fective solution cess control a programmable ogramme memory) el. p programme ith five year imum six Complete with n and service	2	I *		
110.1.17	MICROPROCESSOR TRAINED	R SYSTEM	8	D		
	<pre>MICROPROCESSOR TRAINER SYSTEM of a modular development type with provisions for inputing malfunctions to enable direct experimentation on common type(s) of microprocessor(s) and trouble shooting, as well as: - to study the operation of the microprocessor (programming I/O process, branching, procedural instructions, monitor interface DAC/ACD, RAM, ROM) - to write programs and to check their execution - to develop experimental prototypes of systems - to program and erase EPROM'S - to produce documentation - to store results The trainer shall consist of: main unit to accept common type(s) of microprocessor(s) - emulating unit - additional memory - video terminal - keyboard - floppy disk drive - data cassette recorder with automatic start/stop facility - printer - EPROM reader/programmer - UV EPROM eraser - Basic - Pascal Complete with: - supply unit(s) - set of connecting cables and wires</pre>			*		
Note	: Any similarity in above item de-	Legend: F = Fundament D = Digital elec	als of e	lectror E = I	nics, A = Analog electronics, Electronic instrumentation.	Page
	specific makes or models is purely coincidental.	I ≃ Industrial el *Basic item	ectronic	s		19

(Internet	Equipment guide	list				
	List number: 10 Technical field: Electronics					Date of issue November 1986
Item	Description		Quant.	Use	Illustration	!
	 two sets of educati describing micropro two sets of experim manual initial supply of 2 initial supply of 5 set of recommended years of operation possible loss durin operation and servi 	onal handbooks decessor(s) lentation 0 datacassettes 0 floppy disks spares for two to cover g exercices ce manuals.				
110.1.17A	<pre>INTERFACE WITH ANALOG should match the micr trainer, preferably o to control a wide ra units - application m Complete with: set of application power supply set of connecting c set of recommended years of operation possible loss durin operation and servi NOTE: 110.1.17A is no item and may be the request alo processor train upon project sp a list of neces tion modules sh tioned in the r</pre>	UNITS oprocessor f universal type nge of analog odules. modules ables and leads spares for two to cover g exercices ce manuals. t a stand-alone included in ng with micro- er. Depending ecialisation sary applica- ould be men- equest.	8	Α		
Note:	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundament D = Digital elec I = Industrial ele *Basic item	als of el tronics, ectronic	ectron E = { s	ics, A = Analog electronics Electronic instrumentation,	s, Page 20

(1 m)	Equipment guide	list		•			
WIDE	List number: 10						!
	Technical field: Electronics					Date of i Novemb	issue ber 1986
ltern	Description		IQuant.	Use	Illustration		
110.1.18	MICROCOMPUTER HARDWAR	F TRAINER	8	ם			
	designed to introduce control and potential	subsystems, use of a					
	microcomputer system. shall include hardwar and isolation of malf Experiments shall cov	Activities e familiarisation unctions. er the following			Constantine and a set of the set		
	- central processing	unit					
	 introduction to pro languages peripheral control 	gramming					
	 memory circuits networking system troubleshoot 	ing.				0.30	
	The trainer shall inc main unit, video disp impact printer, flopp and software.	lude: lay terminal, y disk system			e tert and the second sec	9.08 8 9 9.08 8 9	
	<pre>Complete with: peripheral cabling two sets of introdu computer systems co two sets of laborat ments manuals initial supply of 5</pre>	ction to urseware ory experi- 0 floppy disks					
	 storage unit(s) for recommended spares accessories for two operation, includin are subject to poss during experiments operation and servi 	floppy disks and years of g those which ible damage ce manuals.					
Note:	Any similarity in above item de-	Legend: F = Fundament	als of el	ectron	ics, A = Analog electronics,		Page
	scriptions and illustrations with specific makes or models is purely coincidental.	D = Digital elec I = Industrial elec *Basic item	tronics, ectronic	E = E s	Electronic instrumentation,		21

(Fr. ND	Equipment guide	e list					
VIIIOR	List number: 10					Data of	issue
	Technical field: Electronics					Novem	ber 1986
ltem	Description		Quant.	Use	Illustration	•	
		·····	<u> </u>	·			<u> </u>
			1				
110.1.19	ROBOT ARM TRAINER KIT		2	I			
	<pre>microprocessor contro type assembly robot a training in its own a as on assembly operat programming of robots Approx. specification - the trainer may be powered type in fou rotational movement one rotational and movement of a gripp - gripper, pneumatica from internally fit compressor, opening - 16 independent nume (0-5V) and 16 outpu 25 V) - command entry from teach pendant; prov control from an ext via parallel interf be incorporated - approx. size of ope envelope of a parti external radius 250 internal radius abo depth about 50 mm; axes 270 degrees - programming capabil programmable sequen steps - resolution on rotat not less than 5 min - resolution on verti better than 0.2 mm - continuous position on all four numeric axes by means of op for example. Complete with: - power unit - control unit - teach pendant - two sets of teachwa - two assembly means</pre>	<pre>lled educational rm designed for ssembly as well ion and s: of DC servo r axis (2 s of an arm, one vertical er) lly operated ted mini- is-25 mm rical inputs ts (max. 30 mA, hand held ision to ernal computer, ace may also rating al toroid form: -300 mm; ut 100 mm, rotational ities: 2-3 cies of 32 ional axes utes of arc cal axis al feedback ally controlled tical encoders,</pre>					
	trainer kit - two programming man - two exercise manual - set of accessories	uals s and components					
	for two years of op including those whi to damage during ex	eration ch are subject periments					
Note	L : Any similarity in above item de-	Legend: F = Fundament	als of el	ectron	ics, A = Analog electronics	;,	Page
	scriptions and illustrations with specific makes or models is	D = Digital elec I = Industrial elec	tronics, ectronic	E≃E s	Electronic instrumentation,		22
	purely coincidental. *Basic item						

	Equipment guide	e list				
VIION	List number: 10	Dissifiance				
	Technical field: Electronics					November 1986
Item	Description		Quant.	Use	Illustration	
110 1 20	 operation and servi The trainer kit may special furniture. NOTE: In view of the technology dev this field, ot and configurat trainers may b 	ce manuals include the rapid elopment in her systems ions of robot e considered.	0			
110111.00	heavy duty. laminated	surface, for	Ū			
	experiments and test	equipment.		D		
	Approx. size of worki 75	ng area: cm x 200 cm		E		
	Approx. height	70 - 80 cm		F		
				Ι		
110.1.21	TRAINEE STOOL		16	A		Ш
	stool of heavy steel adjustable height, sw	construction, ivel chair, with		D		
	castors.			Ε		
				F		R
				I		
Note	L : Any similarity in above item de-	Legend: F = Fundamenta	als of el	 ectron	ics, A = Analog electror	ics, Page
	scriptions and illustrations with specific makes or models is	D = Digital elec I = Industrial ele	tronics, ectronic:	E = E s	lectronic instrumentation	ı, 23
	purely coincidental.	*Basic item				-,

List number: 10 Technical field: Electronics

SECTION 2 MICROCOMPUTER SYSTEM

This section is intended as a guidance in designing a project microcomputer system for training in programmes development and in computer application for administration, design, engineering, statistics, analysis and manufacturing.

The section includes main hardware and software as well as main consumables and supporting facilities including special furniture and maintenance items.

No parameters of the microcomputer system are given due to the rapid development of microcomputer technology, both in hardware and software. This is also due to the large variety of models and systems available, as well as the local regulations, requirements and service possibilities. Therefore, the exact design of the system, determination of a microcomputer model, etc., is subject to additional study at the time of the preparation of the equipment request.

If the project site suffers from low quality of electricity supply (voltage fluctuations and spikes) it is recommended to order a suitable line voltage conditioner (110.2.38 or 110.2.39) to protect the microprocessor based equipment from damages.

If frequent power failures have been observed, the uninterruptible power supplies (110.2.40 of 110.2.41) will be a solution to save programme or data.

Equipment guide list List number: 10 Date of issue **Technical field: Electronics** November 1986 Quant. Use Item Description Illustration MICROCOMPUTER SYSTEM D 110.2.1 1 NOTE: due to the rapid development * of technology, hardware and software, as well as the large variety of existing systems and models, and taking account of local regulations, availability of service facilities and real needs, the project must specify the following: - central processing unit architecture or its type - size of RAM - graphic possibility, colour - national language character set and language of a keyboard - quantity and type of disk drives - if hard disk is needed and its capacity - if a streamer is needed and its parameters if an optical disk drive with interface is required - type and quantity of input /output interfaces - type (colour, monochrome) and size of a monitor - format size, resolution and typing speed of printer, if critical - need and size of plotter - list of the required software - need of a power backup - special furniture. 110.2.2 INTEGRATED SOFTWARE 1 D containing spreadsheet, graphics and * database. Note: Any similarity in above item de-Legend: F = Fundamentals of electronics, A = Analog electronics, Page scriptions and illustrations with D = Digital electronics, E = Electronic instrumentation, I = Industrial electronics specific makes or models is 26

*Basic item

purely coincidental.



List number: 10

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Technical field: Electronics

Item	Description		Quant.	Use	Illustration		
110.2.3	TEXT PROCESSING SOFTWA NOTE: the project sho package or describe ro including language of processing package. I technical data must bo	ARE ould specify the equirements the text Microcomputer e also given.	1	D *			
110.2.4	DATABASE SOFTWARE NOTE: the project she package or describe re Microcomputer technica also given.	ould specify the equirements. al data must be	1	D *			
110.2.5	SPREADSHEET SOFTWARE NOTE: the project she package or describe re Microcomputer technica also given.	ould specífy the equirements. al data must be	1	D *			
110.2.6	PROGRAMMING LANGUAGE SOFTWARE-BASIC NOTE: the project sho technical data of the	ould specify the microcomputer.	1	D *			
110.2.7	PROGRAMMING LANGUAGE SOFTWARE-FORTRAN NOTE: the project sh technical data of the	ould specify the microcomputer.	1	D			
Note: Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental. Legend: F = Fundamentals of electronics, A = Analog electronics, D = Digital electronics, E = Electronic instrumentation, I = Industrial electronics						Page 27	

List number: 10

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Technical field: Electronics

\square	I echnical field: Electronics						er 1900
Item	Description		Quant.	Use	Illustration		
110.2.8	PROGRAMMING LANGUAGE SOFTWARE-COBOL NOTE: the project sho technical data of the	ould specify the microcomputer.	1	D *			
110.2.9	PROGRAMMING LANGUAGE SOFTWARE-PASCAL NOTE: the project sho technical data of the	ould specify the microcomputer.	1	D *			
110.2.10	EMULATION PROGRAMME NOTE: the project sho microcomputer technica	ould specify the al data.	1	D *			
110.2.11	COMPUTER AIDED DESIGN NOTE: the project sho package and describe p technical data, model microcomputer must als	SOFTWARE ould specify the ourpose(s). The of a so be given.	1	D *			
Note :	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundamenta D = Digital elec I = Industrial ele *Basic item	als of el tronics, ectronic	ectron E = E S	ics, A = Analog electronics, lectronic instrumentation,	,	Page 28

Equipment guide list List number: 10 Date of issue Technical field: Electronics November 1986 Description Quant. Use Illustration Item 110.2.12 ELECTRONICS/ELECTRICAL SOFTWARE 1 D PACK 20 general purpose, for calculation and solving common electrical engineering problems. The pack should include such examples of calculating programs as: class A transistor amplifier design, Schmitt trigger circuit design, bridge-rectified power supply, dual-output regulated power supply, Gaussion pulse bandwith calculation, microstrip design, strip-line design, lossless transmission lines, single and two-wire transmission line, RF air-core inductor design, voltage standing wave ratio calculation and decibel conversion. There should be a possibility for modifications or additions. The pack should comprise a comprehensive user's manual.

Page

	Equipment guide	list			_	
MION	List number: 10 Technical field: Electronics					Date of issue November 1986
Item	Description		Quant.	Use	Illustration	L
Item 110.2.13	Description GENERAL ELECTRONICS C PACK for designing schemat electronic and electr a microcomputer monit for performing their transient analysis/te should include the li drawings of usual ele electronic components such as: batteries, r capacitors, inductors diodes, bipolar trans transformers, MOS dev sinusoidal voltage so programmable voltage polynomial sources. There should be a pos the user to create an the library a certain specific circuits for The microcomputer sof should comprise a com user's manual.	AD/ANALYSING ic diagrams of ical circuits on or screen and AC, DC and st. The pack brary of ctrical and and facilities esistors, istors, ices, opamps, urces, sources and sibility for d to add to number of later use. tware pack prehensive	Quant.	Use D *	Illustration	
Note	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundamenta D = Digital elec I = Industrial ele *Basic item	als of el tronics, ectronic	ectron E = E s	ics, A = Analog electronics lectronic instrumentation,	s, Page 30
List number: 10

specific makes or models is purely coincidental.

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ltem	Description	Quant.	Use	Illustration	
Item	Description LOGIC DESIGN AND SIMULATION PACKAGE for designing and performing simulation run of schematic diagrams of micro electronic logic facilities on a microcomputer screen. The package should include the library of logic circuits like gates, latches, flip-flops inverters addees atc	Quant.	Use D	Illustration	
	There should be a possibility for the user to modify and to add to the existing library a specific number of new or modified circuits for a later use. The microcomputer software package should comprise a comprehensive user's manual. NOTE: when ordering electrical/ electronic CAD software, the project should specify all microcomputer parameters including availability of graphic cards (mono and/or colour) etc.				
Note:	Any similarity in above item de- scriptions and illustrations with D = Digital elec	als of electronics.	ectron E = E	ics, A = Analog electronics lectronic instrumentation.	, Page

I = Industrial electronics

*Basic item

States	Equipment guide	e list					
	List number: 10 Technical field: Electronics					Date of is Novembe	sue er 1986
Item	Description		Quant.	Use	Illustration		
110.2.15	DOT MATRIX PRINTER, A with draft, near lett	4 er quality (NLQ)	1	D *			
	and graphics modes of size A4, parallel/ser pin paper feed; frict programmable line spa size in a draft mode x 9 matrix and in NLQ than 18 x 18 matrix. Complete with: - printer cable	ial interface; ion feed; cing; character not less than 9 mode not less					
	 detachable tractor continuous perforat detachable sheet pa attachment ten ribbons 2000 sheets A4 of p folded paper operation and servi 	unit for ed paper feed per feed erforated ce manuals.					
	NOTE: Project should microcomputer its technical ordering dot m	specify model and data when atrix printers.					
110.2.16	PRINTER RIBBON FOR A4	PRINTER	1	D *		J	
110.2.17	PRINTER PAPER, PERFOR folded, perforated wh the printer, size A4, single sheets.	ATED, A4 lite paper for about 2000					
Note	: Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundament D = Digital elec I = Industrial el *Basic item	tals of el ctronics, ectronic	ectron E = E s	ics, A = Analog electronics lectronic instrumentation,	5,	Page 32



List number: 10

Technical field: Electronics

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Item	Description	<u></u>	Quant.	Use	Illustration	
110.2.18	DOT MATRIX PRINTER, A with draft, near lett and graphics modes of	3 er quality (NLQ) printing; paper	1	D		
	pin paper feed; frict programmable line spa size in a draft mode x 9 matrix and in NLQ than 18 x 18 matrix.	ion feed; cing; character not less than 9 mode not less				
	 Complete with: printer cable detachable tractor continuous perforat detachable sheet parattachment ten ribbons 2000 sheets A4 of p folded paper operation and servite 	unit for ed paper feed per feed erforated ce manuals.				
	NOTE: Project should microcomputer its technical ordering dot m	specify model and data when atrix printers.				
110.2.19	RIBBON FOR A3 PRINTER		1	D *		
110.2.20	PRINTER PAPER, PERFOR	ATED, A3				
	folded, perforated wh the printer, size A3, single sheets.	ite paper for about 2000				
Note:	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundamenta D = Digital elec I = Industrial ele *Basic item	als of el tronics, ectronic	ectron E = E s	ics, A = Analog electronics, lectronic instrumentation,	Page 33

	Equipment guide list	_			
	Technical field: Electronics				Date of issue November 1986
Item	Description	Quant.	Use	Illustration	I
110.2.21	PLOTTER, A4	1	D		
	six colours, long-life ball point, fibre-tip and ceramic pens; serial/parallel interface; support for Hewlett-Packard graphics language; for plotting on plain paper and on overhead transparen- cies.				
	 software package including high quality character sets five sets of colour markers operation and service manuals. 				
	NOTE: project should specify microcomputer model and its technical data when ordering plotters.				
110.2.22	PLOTTER, A3	1	D		
	six colours, long life ball point, fiber-tip and ceramic pens; serial/ parallel interface, support for Hewlett-Packard Graphics language; for plotting on plain paper and on overhead transparencies.		*		
	 Complete with: software package including high quality character sets five sets of colour markers operation and service manuals. 				
	NOTE: project should specify microcomputer model and its technical data when ordering plotters.				
110.2.22A	COLOUR MARKERS SET	1	D		
	for plotters, set of different colours.		*		
Note	Any similarity in above item de- scriptions and illustrations with second in maken or models is	tals of el ctronics,	ectron E = E	nics, A = Analog electronics Electronic instrumentation,	s, Page
	purely coincidental.	nectronic	5		24

(Er th	Equipment guide list				
Sullons	List number: 10				Date of issue
	Technical field: Electronics				November 1986
ltem	Description	Quant.	Use	Illustration	
110.2.23	SINGLE FLOPPY DISK DRIVE, 5.25 INCH	1	D		
	<pre>external, complete with: disk controller operation and service manuals. NOTE: project should specify microcomputer model and its technical data when ordering floppy disk drives.</pre>				
110.2.24	DOUBLE FLOPPY DISK DRIVE, 5.25 INCH external, complete with: - disk controller - operation and service manuals. NOTE: project should specify microcomputer model and its technical data when ordering floppy disk drives.	1	D *		
110.2.25	FLOPPY DISKS, 5.25 INCH for microcomputers; double sided, double density, certified and tested; 40 tracks per side; pack of 10.	16	D *		
110.2.26	FLOPPY DISKS, 5.25 INCH double-sided, ultra high density for AT microcomputers, certified and tested, pack of 10.	16	D *		
Note : Any similarity in above item de- scriptions and illustrations with specific makes or models is Legend: F = Fundamentals of electronics, A = Analog electronics, D = Digital electronics, E = Electronic instrumentation, I = Industrial electronics					

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I = Industrial electronics *Basic item

purely coincidental.

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(Equipment guide	e list				
VIION	List number: 10					Data af isaua
	Technical field: Electronics		November 1986			
ltem	Description		Quant.	Use	Illustration	
110.2.27	STORAGE BOX FOR 5.25	INCH DISKS	16	D		
	storage capacity 10 d	isks.		*		
110.2.28	DISKS, 3.5 INCH		16	D		89-
	for microcomputers, d double density, doubl certified and tested,	ouble-sided, e track 135 TPI, pack of 10.		*		
110.2.29	STORAGE BOX FOR 3.5 I	NCH DISKS	16	D	Æ	I
	storage capacity 10-2	0 disks.		*		
110.2.30	HARD DISK, EXTERNAL		1	D		
	complete with: - controller - expansion unit - operation and servi	ce manuals.		*		
110.2.31	TAPE STREAMER		1	D		
	a hard disk back up f	acility		*		
	Complete with: - power supply - software - operation and servi	ce manuals.				
Note	: Any similarity in above item de-	Legend: F = Fundamen	tals of el	ectron	ics, A = Analog electronics	, Page
	scriptions and illustrations with specific makes or models is purely coincidental.	D = Digital elec I = Industrial e *Basic item	ctronics, lectronic	E = E s	lectronic instrumentation,	36

List number: 10 Technical field: Electronics

	recifical field. Electronics					Novemb	
Item	Description		Quant.	Use	Illustration		
110.2.31A	STORAGE CASSETTE		1	D			
	for storage of stream	er tape.		*			
	NOTE: In a request for disk drive for and tape stream needed and all computer techn should be given the required comp	or hard disk, optical disk mer, the model micro- ical data n along with apacity.					
110.2.32	DISK DRIVE FOR COMPAC DISK	T OPTICAL	1	D *			
	complete with: - power supply - interface - operation and servi	ce manuals.					
110.2.33	COMPACT OPTICAL DISK		1	D			
	write once, read most capacity approx. 100 permanent data storag	ly (worm); MB; for e and reading.		*			
110.2.34	VIDEO DISPLAY, MONOCH	ROME	1	D			
	approximate resolutio	n 720 x 340.		*			
	complete with:						
	- connecting cable - operation and servi	ce manuals.				5	
Note	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundament D = Digital elec I = Industrial el *Basic item	als of el tronics, ectronic	lectror E = I s	nics, A = Analog electronics Electronic instrumentation,	5,	Page 37

	Equipment guide list					
	List number: 10					Date of issue
	Technical field: Electronics					November 1986
ltem	Description	(Quant.	Use	Illustration	··· · · · · · · · · · ·
						<u> </u>
110 2 25			1	n		
110.2.35	VIDEO DISPLAY, COLOOR, RGB		1	ע		
	complete with:			*		
	- connecting cable	ls.				
	NOTE: when endering wides die				A annual and a category	
	the project should spec	ify				5
	and technical data of	del				
	microcomputer(s).					
· .						
						•
				i		
Note	Any similarity in above item de- scriptions and illustrations with	F = Fundamentals D = Digital electro	s of ele onics.	ectroni E = E	cs, A = Analog electronics, lectronic instrumentation.	Page
	specific makes or models is purely coincidental	I = Industrial elec *Basic item	tronics	5		38

List number: 10

purely coincidental.

Technical field: Electronics

	rechined held, Electronics					1.000
Item	Description	Quant.	Use	Illustration		
Item 110.2.36	<pre>Description Description COMPUTER AIDED PCB DESIGN AND MANUFACTURING SYSTEM for training in preparation of drawings, schematic and circuit diagrams and manufacturing experimental or master printed circuit boards. Complete with: - microcomputer (if not already available at the project) with common application software packages (Word Processing, Electronic Spreadsheet, Database, Basic) - printer - plotter - microprocessor controlled interface for engraving device - special engraving device (similar to plotter principle of operation) with set of cutters for engraving the circuit diagrams on copper clad boards; working space approximately 350 mm x 350 mm - two sets of cutters for engraving device - set of a special Computer Aided Design, Engineering and Manufacturing software to include circuit design, verification and realisation - two sets of a comprehensive courseware - operation and service documenta- tion. The system may also include a special furniture. NOTE: If a microcomputer is available, the project re- quest must contain precise technical data of the system in order to decide about the possibility of its use in the computer aided PCB design and manufacturing system. </pre>	Quant.	Use D ★			
Note:	Any similarity in above item de- scriptions and illustrations with Legend: F = Fundament	tals of el ctronics,	ectron E = E	lics, A = Analog electronics Electronic instrumentation,	s,	Page
	specific makes or models is I = Industrial el	ectronic	s			39

*Basic item

	List number: 10 Technical field: Electronics	list				Date of Novem	issue ber 1986
ltem	Description		Quant.	Use	Illustration		
110.2.37	CNC MACHINE SYSTEM, 3 computer numerically desktop machine for p in programming and i The system should pr milling and drilling materials. Three axis control system; stand format; linear and ci interpolation; automa datum point. Approx. data: - x-y table movement: - z(axis) spindle mov - approx. spindle mov - approx. spindle mot - max. drill size: - table and spindle m three stepping moto each axis) - accuracy: not less Complete with: - microcomputer (if n availale at the pro with common applica packages (Word Proc Electronic spreadsh Basic) - printer - plotter - interface - CNC software - power supplies - two sets of a compr courseware - set of drills and e - set of recommended and spares to cover loss during two yea - programming, operat service manuals. The system may also a special furniture NOTE: If a microcomp available, the p must contain its technical data n determine the in the software.	D controlled ractical study n an operation. ovide programmed in lightweight (x, y, z) ard ISO software rcular tic return to 100 mm ement: 20-25 mm or power: 80-100 W 3 mm ovement by rs (one on than 0.25 mm ot already ject) tion software essing, eet, Database, ehensive ndmills accessories possible rs of operation ion and include a uter is roject request precise ecessary to terface and	Quant.	D *			
Note	e: Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundamenta D = Digital elect I = Industrial ele *Basic item	Is of el ronics, ctronic	ectron E = E s	ics, A = Analog electroni lectronic instrumentation	CS,	Page 40

	Equipment guide	list				
	List number: 10 Technical field: Electronics					Date of issue November 1986
Item	Description		Quant.	Use	Illustration	<u>. </u>
110.2.38	LINE VOLTAGE CONDITION for microprocessor bases other sensitive to spectrum The conditioner show spikes free AC stabil supply and also contar protect the equipment conducted radio frequent interference. Input voltage instable + or - 10 %, output wariation + or - 2% Approximate maximum Complete with operates service manuals.	ONER, 400 VA ased systems and bikes equipment. ald provide lized voltage ain a filter to t against hency allity voltage load 400 VA ion and	1	A D F I		
110.2.39	LINE VOLTAGE CONDITION for microprocessor bac other sensitive to sp The conditioner show spikes free AC stabil supply and also conta protect the equipment conducted radio frequ interference. Input voltage instable + or - 10%, output vo variation + or - 2% Approximate maximum Complete with operation	ONER, 800 VA ased systems and bikes equipment. and provide lised voltage ain a filter to t against hency ility bltage load 800 VA ion and service	1	A D F I		
110.2.40	UNINTERRUPTIBLE POWER VA power backup system of maintenance free batt microcomputers and po- ensure continuity of about 20 minutes after failure; to provide of data saving, etc., or of local emergency po- Battery life about fr AC power output 250 V Complete with operate instructions and serve	A SUPPLY, 250 with set of ceries for eripherals; to AC supply for er power enough time for for initiation ower system. ive years, VA, ion vice manual.	1	A D F I		
Note	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundamen D = Digital ele I = Industrial e *Basic item	tals of el ctronics, lectronic	ectron E = E s	hics, A = Analog electronic Electronic instrumentation,	cs, Page 41

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Technical field: Electronics						
ltem	Description	Quant.	Use	Illustration		
110.2.41	UNINTERRUPTIBLE POWER SUPPLY, 500 VA power backup system with set of maintenance free batteries for microcomputers and peripherals; to ensure continuity of AC supply for about 20 minutes after power failure; to provide enough time for data saving, etc., or for initiation of local emergency power system. Battery life about five years, AC power output 500 VA. Complete with operation instructions and service manual.	1	A D F I ∗			
110.2.42	COMPUTER DESK to accommodate a microcomputer and a VDU. The desk should consist of two independent areas. One intended for a microcomputer and a VDU (approx. size D.500 mm x W.700 mm) and the second for a keyboard (approx. size D.350 x W.700). There should be a possibility for adjusting heights of both areas for optimum visibility and ease of use. The desk top areas must be either of plastic or of wood. The desk should be on castors.	1	D *			
110.2.43	<pre>PRINTER TABLE to accommodate a large variety of printers. Complete with a paper storage shelf and a paper collection basket. The work surface should be adjustable. Work area about 600 x 800 mm Shelf about 500 x 700 mm Paper collection basket about</pre>	1	D			
Note:	Any similarity in above item de- scriptions and illustrations with specific makes or models is ourely coincidental.	tals of e ctronics lectroni	lectro , E = cs	I nics, A = Analog electronic Electronic instrumentation,	s, Page 42	

	Equipment guide	list					
	List number: 10 Technical field: Electronics					Date of is Novembe	isue er 1986
ltem	Description		Quant.	Use	Illustration		-
110.2.44	PERSONAL COMPUTER CA mobile, lockable, wi screws, ventilated a with, at least, four with power cable of metres long to enabl the microcomputer sy from the cabinet as storage at least of processing unit, VDU and/or plotter, syst documentation and so Approx. specificatio - minimum overall di 75 x 50 x 160 cm - minimum four shelv two of which must type; the shelves fixed and should p rearrangements in - curtain sliding an door - document holder, t clamping fixtures, approx. size 30 x	BINET th levelling nd equipped power sockets about three e operation of stem directly well as for central , printer em ftware. ns: mensions: es/platforms be of telescopic should not be ermit height about 40mm steps d lockable iltable with line indicator, 40 cm.	1	D *			
110.2.45	FLOPPY DISK DRIVE CL for use with 5 1/4 i double sided disk dr COMPUTER CLEANING SO for cleaning all del mechanisms. It shoul computer heads magne floppy disks, tape m springs, heads and r harmless to plastics non-flammable, safe terminals, in aeroso 300 to 400 ml.	EANING KIT nch, single and ives. LVENT icate computer d be safe on tic tapes, echanisms, eaders, , on line l cans of about.	1	D * D			
Note :	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundament D = Digital elec I = Industrial ele *Basic item	als of el tronics, ectronic	ectron E = E s	L ics, A = Analog electronics Electronic instrumentation,	,	Page 43

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SECTION 3 TEST AND MEASUREMENT INSTRUMENTS

This section describes the specifications for test and measurement instruments used in fundamental electronics, analog and digital electronics, industrial electronics and electronic instrumentation.

These test and measuring instruments may also be used in communication circuity but the section does not specifically include communication measuring techniques. Specifications of various accurate power supplies associated with electronics and communications are available in this section.

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	Technical field: Electronics					November 1986
ltem	Description		Quant.	Use	Illustration	······
110.3.1	ANALOG GENERAL PURPOS for tests in electron Approx. specification - DC ranges: 100 mV t 50 m - DC sensitivity: no - DC accuracy: not 1 - AC ranges: 3 V to - AC accuracy: not - resistance ranges: - Accuracy: not less Complete with: - two sets of batteri - carrying case	E AVOMETER ic circuits. s: o at least 300V bicro A to 10 A t less than 20 k Ohm/Volt ess than 1 % at least 300 V 10 mA to 10 A less than 2 % 2 k Ohm to 20 M Ohm than 3 %	16	E *		
110.3.2	 operation and servi ANALOG ELECTRONIC AC/ for measurements in e circuits. Frequency r 200 kHz. Approx. specification DC voltage measuremen - 10 mV to at least 3 sensitivity 100 mic input resistance 10 accuracy 1 % DC current measuremen - 1 mA to at least 10 sensitivity 10 micr voltage drop 100 mV accuracy 1.5 % AC voltage measuremen - 10 mV to at least 3 sensitivity 100 micr input impedance 10 accuracy 1.5% f.s.d frequency range 20 corresponding dB sc AC current measuremen 1 mA to at least 10 sensitivity 10 micr voltage drop 100 mV 	DC MULTIMETER lectronic ange DC, 20 Hz to s: ts: 00 V ro V M Ohm ts: 00 V ro V M Ohm ts: 00 V ro V M Ohm/120 pF at 50 Hz Hz - 200 kHz ale ts: A o A to 300 mV Hz - 1k Hz	16	E *		
Note	Any similarity in above item de-	Legend: F = Fundament	als of ele	ectron	ics, A = Analog electronic	s, Page
	scriptions and illustrations with specific makes or models is purely coincidental.	D = Digital elec I = Industrial ele *Basic item	tronics, ectronics	с = E ;	ectronic instrumentation,	46

the age	Equipment guide	list				
KIION	List number: 10 Technical field: Electronics					Date of issue November 1986
Item	Description		Quant.	Use	Illustration	L
110.3.3 Note	Resistance measuremen - 10 Ohm to 100 M Ohm - sensitivity 0.1 Ohm - Accuracy 1.5 % to 5 depending on the ra The multimeter should down or fuse protecti Power source: standar Complete with: - measuring leads - set of spare fuses - set of batteries - operation and servi ANALOG AC MILLIVOLTME for measurements in e circuits. Approx. specification - frequency range: n - measuring range: n 0 - 1 m - dB scale: - 8 - input impedance: - accuracy: 1% f.s.d - AC and DC outputs - overload protected. Complete with: - measuring cable - set of batteries (i operated) - power cable (if mai - operation and servi	<pre>ts: % f.s.d nge have shut on. d batteries ce manuals TER, 12 MHZ lectronic s: ot less than 2 Hz to 12 MHz ot less than 2 Hz to 12 MHz ot less than V to 0 - 300 V 0 dB to + 52 dB 1 M Ohm/40 pF + 1% of reading f battery ns operated) ce manuals.</pre>	2 tals of el	E	tics, A = Analog electronics	s, Page
	specific makes or models is purely coincidental.	I = Industrial efe Basic item	lectronics,	ב ∸ t :S	ມອອດເອກາບ ກາຣເກຍເກາຍແຜດເອດ,	47

	Equipment guide List number: 10	e list				Date of	issue
Item	Description		Quant.	Use	Illustration	Novemi	
Item 110.3.4	ANALOG DC MICROVOLTME for measuring in elect Approx. specification - measuring ranges: 0 - sensitivity: - Accuracy: 1 % f.s.d - input resistance: to 30 mV range to 100 M Ohm on 1 V ra higher DC output - overload protected Complete with: - measuring cable - high tension probe - set of batteries (operated) - power cable (if mai - operation and servi DIGITAL RMS MULTIMETE for measurements in e circuits. Approx. specification - 4 1/2 digits displa - autoranging - measuring functions - AC frequency range: - AC voltage range: 1 - accuracy: 0.1 - resolution: - polarity display fo - input impedance: Complete with: - measuring cables - power cable - operation and servi	TER tronic circuits. AS: -10 micro Volt to 0 - 300 V 1 micro Volt 1. + 1 % of reading from 1 MOhm up not less than inge and if battery ns operated) ce manuals. R, DC-20 MHZ electronic AC,DC, AC+DC 10 Hz to 20 MHz 50 micro Volt to 300 Volt % +/- 1 digit 1 micro Volt % +/- 1 digit 1 micro Volt r DC 10 M Ohm/40 pF ce manuals.	Quant. 2 2	E)
Note	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundamenta D = Digital elec I = Industrial ele *Basic item	als of el tronics, ectronic	ectron E = E s	ics, A = Analog electronics lectronic instrumentation,	,	Page 48

Equipment guide list List number: 10 Date of issue November 1986 **Technical field: Electronics** Quant. Use Item Description Illustration Ε 110.3.6 DIGITAL RMS AND PEAK MULTIMETER 2 for measurements in electronic circuits. Approx. specifications: - 5 1/2 digit display, autoranging automatic polarity display measuring functions: AC (RMS) AC (peak); DC, AC + DC and resistance measurements - frequency range: not less than 100 KHz - AC/DC voltage ranges: 0-200 mV to not less than 0-600 V - resolution at the lowest range: 1 micro Volt - peak voltage range: not less than 1000 V - accuracy in AC and DC voltage measurements: 0.01 % +/- 1 digit AC, DC and AC + DC current ranges: 2 micro Ampere to 2 A - resistance measurements by 2 and four-wire methods resolution with 4 wire method: 1 milli Ohm - resistance measuring ranges: 0-200 Ohm to approx. 0-2 GOhm - all ranges should be overload protected Complete with: - mains cable set of test leads shielded measuring cable four-wire measuring cable operation and service manuals. Note: Any similarity in above item de-Legend: F = Fundamentals of electronics, A = Analog electronics, Page scriptions and illustrations with D = Digital electronics, E = Electronic instrumentation, specific makes or models is I = Industrial electronics 49

*Basic item

purely coincidental.

	Equipment guide	list				
North Real Provide State	List number: 10 Technical field: Electronics					Date of issue November 1986
Item	Description		Quant.	Use	Illustration	L
Item 110.3.7	Description HIGH VOLTAGE METER, 4 a self-contained high with an integral indi measurement of positi to 40 kV in video dis tension low power cir Approx. specification - voltage range 0 to - scale graduation:at st - sensitivity: - accuracy: + Complete with: - earth connection cl - instruction manual.	0 kV voltage probe cating meter for ve DC voltage up play monitor high cuits. s: 40kV graduation least in 2 kV eps 20 kOhm/V /- 3 % f.s.d. ip	Quant.	E	Illustration	
Note:	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundament D = Digital elec I = Industrial el *Basic item	als of el tronics, ectronic	ectron E = E s	nics, A = Analog electronics Electronic instrumentation,	s, Page 50



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Item	Description		Quant.	Use	Illustration	
110.3.8	DUAL TRACE OSCILLOSCO for general purpose 1 and experiments with circuits. Approx. (minimum) spe - screen area: 8 cm - accuracy: +/- 3 % o - availability of the calibrating voltage	PE, 15 MHz aboratory work electronic cifications: x 10 cm r better internal	8	E		
	 AC or AC and DC bat operation Vertical axis (Y): bandwidth: 0 - 15 M sensitivity: 2 mV/d in calibrated steps sequence input impedance: trigger sources: in external, trigger slope: + display modes: CHA, alternate, Chopped, input coupling: AC Horizontal axis (X): bandwith: 0 - 1 MH time base modes: au triggered display modes: time operation with X de input deflection coeffici to 10 V/div in cali in 1-2-5 sequence time coefficients: accuracy: +/- 3 % Complete with: contrast filter graticule set of recommended probes BNC to banana plug viewing hood operating and servi 	Hz iv to 10 V/div , in 1-2-5 1 MOhm/30 pF ternal and or - CHB, Added , DC, O Z to, free-run base, X-Y flection via YB ents: 2 mV/div brated steps 0.25/div to 0.5 micros/div or better measuring adapter ce manuals.				
Note	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundament D = Digital elec I = Industrial el *Basic item	als of el tronics, ectronic	lectror E = E s	nics, A = Analog electronics, Electronic instrumentation,	Page 51

Equipment guide list List number: 10 Date of issue Technical field: Electronics November 1986 Quant. Use Item Description Illustration 110.3.9 DUAL TRACE OSCILLOSCOPE, 50-75 MHz 2 Ε compact field and laboratory oscilloscope. Approx. (minimum) specifications: 8 cm x 10 cm screen area: - accuracy: not less than 3 % - main and delayed time base, external signal triggering trigger view facility - availability of an internal calibrating voltage - Z-modulation - AC and DC battery pack operation. Vertical axis (Y): - band width: 0 - 50 - 75 MHz - sensitivity: 2 mV/div to 10 V/div in 1-2-5 calibrated sequence with continuous control between steps - input impedance: 1 MOhm/20-30 pF - display modes: CHA, CHB, CHA and CHB chopped, CHA and CHB alterna-te, CHA and CHB added, trigger view only, trigger view with CHA and CHB alternate, trigger view with CHA and CHB chopped, CHA and CHB inverted. Horizontal axis (X): - horizontal deflection from main time base, delayed time base or from an external signal main time base coefficients: 0.5 s/div to 50 ns/div in 1-2-5 sequence; continuous control between steps - horizontal amplifier response: $0 - 1\overline{0}0 \text{ kHz}$ - delayed time base coefficients: 1 ms/div - 50 ns/div in calibrated steps, 1-2-5 sequence; uncalibrated continuous control between steps - sweep delay: continuously calibrated between 0 and 10 x main time base setting. Complete with: two battery packs contrast filter - set of recommended measuring probes - BNC to banana adapter - operating and service manuals. Note: Any similarity in above item de-Legend: F = Fundamentals of electronics, A = Analog electronics, Page

scriptions and illustrations with specific makes or models is purely coincidental.

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ltem	Description	<u> </u>	Quant.	Use	Illustration	
Item 110.3.10	Description DIGITAL STORAGE OSCIL MHz for advanced experime circuits. The instru as a conventional two oscilloscope or in a mode and replay. Approx. (minimum) spe - screen area: 8 cm - bandwidth: direct d in digital storage than 10 MHz - accuracy: +/- 3 % - availability of int calibrating voltage - possibility to comp with a signal previ in the memory - analog and digital - time windows (appro 50 s) for single ev - peak value detectio Vertical axis: - two identical chann - sensitivity: 1-2 mV	LOSCOPE, 25 nts in electronic ment may be used channel digital storage cifications: x 10 cm isplay mode mode not less or better ernal are live signal ously stored outputs x. 2 ms to ents n els /div to mV/div	Quant.	E	Illustration	
 sensitivity: 1-2 mV 5-10 accuracy: +/- 3% or calibrated position input impedance: 1 maximum input volta 400 V peak AC display modes: CHA, te, Added, Inverted Triggering: trigger sources: in external, manual trigger slope: + o adjustable manual c Horizontal axis: frequency response: time coefficients: 100 ns/div in 1-2-5 uncalibrated contin between steps Accuracy: +/- 3 % o Digital facilities: 		<pre>/div to mV/div better in s MOhm/30pF ge: 400 VDC or CHB, Alterna- ternal, r - ontrol range 0 to 1 MHz 0.5 s/div to sequence; uous control r better</pre>				
	- memory size: 4096 - timebase: 0.1 micro	x 8 bits s/div to 5 s/div				
Note:	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundament D = Digital elec I = Industrial el *Basic item	als of el tronics, ectronic	lectror E = { s	nics, A = Analog electronics, Electronic instrumentation,	Page 53

Item Description Quent Use Histration Complete with: - contrast filter - recommended set of measuring probes - recommended set of measuring probes - - - 1 recommended set of accessories - viewing hood - - - - 110.3.104 OSCILLOSCOPE CAMERA to suit digital storage oscilloscope, 25 MMz with accessories and operation manual. 1 E - - Not: Any similarity in above item de- sorptions and instantow with propres congedness Lagend: F = Fundamentals of electronics, A = Analog electronics, D = Digital electronics, E = Electrone instrumentation = Biglicit electronics, E = Electrone instrumentation F4		Equipment guide List number: 10 Technical field: Electronics	e list				Date of issue November 1986
Note: Any similarity in above iteractions of contained and of accessories 1 E 110.3.104 OSCILLOSCOPE CAMERA 1 E 12.3.105 OSCILLOSCOPE CAMERA 1 E 110.3.106 OSCILLOSCOPE CAMERA 1 E 110.3.107 OSCILLOSCOPE CAMERA 1 E 110.3.108 OSCILLOSCOPE CAMERA 1 E 110.3.109 OSCILLOSCOPE CAMERA 1 E 1110.3.109 OSCILLOSCOPE CAMERA 1<	Item	Description		Quant.	Use	Illustration	
110.3.10A OSCILLOSCOPE CAMERA 1 E to suit digital storage oscilloscope, 25 MHz with accessories and operation manual. 1 E Note: Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental electronics. A = Analog electronics. A = Analog electronics. T = Foundamentals of electronics. A = Analog electronics. S = Electronic instrumentation. 1 = Industrial electronics. 5 = Electronic instrumentation. 5 = Societal electronics. 5 = Societal e		Complete with: - contrast filter - recommended set of probes - recommended set of - viewing hood - BNC to banana plug - operating and servi	measuring accessories adaptor .ce manuals.				
Note: Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental. Legend: F = Fundamentals of electronics, A = Analog electronics, D = Digital electronics, E = Electronic instrumentation, I = Industrial electronics Page 54	110.3.10A	OSCILLOSCOPE CAMERA to suit digital stora 25 MHz with accessori manual.	ge oscilloscope, es and operation	1	Ε		
	Note	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundament D = Digital elec I = Industrial ele *Basic item	als of el tronics, ectronic	ectron E = E s	ics, A = Analog electronics, Electronic instrumentation,	Page

Equipment guide list List number 10 Date of issue November 1986 Technical field: Electronics Item Description Quant. Use Illustration FOUR-CHANNEL MULTIDISPLAY 110.3.11 Е 1 OSCILLOSCOPE for solving timing problems in digital electronics. Simultaneous display of signals should ensure realtime analysis both on component and system level. Approx. specifications: - screen area: 8 cm x 10 cm internal graticule - four channels to show signal relationships in time - multi-source triggering - two timebases (main and delayed) - alternative timebase mode (simultaneous run of both timebases) - accuracy: 3% or better - availability of calibrating facilities 'Z' modulation. Vertical axis (Y): DC to 35 -- frequency response: 100 MHz - deflection coefficients: 2 mV/div to 5 V/div in calibrated steps 1-2-5 sequence; uncalibrated continuous control between steps - input impedance: 1 MOhm/20 pF- display modes: CHA, CHB, CHC or CHD, CHA + CHB, CHC + CHD, trigger view, multiple display chopped or alternate; CHA, CHB, CHC and CHD may be inverted maximum input voltage 400 VDC or peak AC - signal visible delay 15 ns. Horizontal axis (X) - frequency response: DC - 2 MHz - display modes: main.timebase, delayed timebase, main timebase intensified by delayed timebase, alternate (simultaneous display) - measuring accuracy: +/- 3 % main timebase modes: auto, triggered and single shot main timebase coefficients 1 s/div to 50 ns/div approx.: in calibrated steps, in 1-2-5 sequence; uncalibrated continuous control between steps. Note: Any similarity in above item de-Legend: F = Fundamentals of electronics, A = Analog electronics, Page D = Digital electronics, E = Electronic instrumentation, scriptions and illustrations with I = Industrial electronics specific makes or models is 55 *Basic item purely coincidental.

(Stand	Equipment guide	list				
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Item	Description		Quant.	Use	Illustration	
	 main timebase trigg internal A, B, C, D time, external slope: + or - maximum input volta peak AC delayed timebase mo after the delay tim delay time by the f pulse. delayed timebase tr sources: internal a delayed timebase co approx. 0.5 s/div in calibrated steps sequence, uncalibra between 0 and 10x m setting. Complete with: contrast filter recommended set of probes recommended set of viewing hood BNC to banana plug operating and servi 	er sources: composite, ge: 400 VDC or des: start e or after irst trigger iggering nd external efficients to 50 ns/div , in 1-2-5 ted continuous ps ed sweep delay ain timebase measuring accessories adapter ce manuals.				
110.3.11A 110.3.12	OSCILLOSCOPE CAMERA to suit four-channel oscilloscope with acc operation manual. OSCILLOSCOPE TROLLEY	multidisplay essories and	1	E		
Note	: Any similarity in above item de-	Legend : F = Fundament	als of el	ectron	ics, A = Analog electronic	s, Page
	scriptions and illustrations with specific makes or models is purely coincidental.	D = Digital elec I = Industrial elec *Basic item	tronics, ectronic	E = E s	Electronic instrumentation,	56



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				-		
Item	Description		Quant.	Use	Illustration	
Item 110.3.13	Description COUNTER, 40 MHz for measurements of f width, period and per Approx. (minimum) spe - frequency range: 10 - period: 0.5 micr - minimum input volta 50 mV to 20 MHz and 40 MHz (sine), 200 - display: 8 digits - frequency standard: oscillator 10 MHz - input impedance: - accuracy: +/- 1 dig frequency standard Complete with: - BNC to banana adapt - recommended set of probes - recommended set of - operation and servi	requency, pulse iod average. cifications: Hz to 40 MHz o s to 100 ms ge: 100 mV to mV (pulse) cristal 1 MOhm/60 pF jt +/- error. er measuring accessories ce manuals.	Quant.	E	Illustration	
Note	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundament D = Digital elec I = Industrial el *Basic item	als of el tronics, ectronic	ectron E = E s	nics, A = Analog electronics, Electronic instrumentation,	Page 57

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	Technical field: Electronics					Date of issue November 1986
ltem	Description	······	Quant.	Use	Illustration	£
Item 110.3.14 110.3.14A	Description SPECTRUM ANALYSER, 10 for measuring amplitu of sinusoidal compone electric signal of an Approx. specification - frequency range: 30 - frequency measuring graticule scale - sweep modes: automa - sweep speed: 100 ms 1-2-5 sequence - filter bandwith: na 50 Hz), normal (5 5000 Hz) and wide (- digital storage sys spectral informatio - build-in frequency 10 - build-in or seperat - display range: - input impedance: 600 Ohm, 50 Oh Complete with: - set of recommended cables, measuring p attenuator(s)' - viewing hood - set of recommended (BNC to banana plug plugs - operation and servi CAMERA FOR SPECTRUM A complete with mountin operation manual.	0 MHz de and frequency nts of the y shape. s: Hz to 100 MHz : by built-in : from tic and manual to 100 s in rrow (5 Hz, 00 Hz, 50 KHz) tem of n calibrator MHz +/- 20 Hz e tracking generator 100 dB 1 MOhm/30 pF m, selectable. connecting robes and accessories adapter(s) , etc) and ce manuals. NALYSER g accessories and	Quant.	E	Illustration	
Note:	Any similarity in above item de-	Legend: F = Fundament	als of el	lectron	ics, A = Analog electronics	s, Page
	scriptions and illustrations with specific makes or models is purely coincidental.	D = Digital elec I = Industrial el *Basic item	ctronics, ectronic	E = E s	Electronic instrumentation,	58



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Item	Description		Quant.	Use	Illustration	
Item 110.3.15	Description SWEEP FUNCTION GENERA Approx. specification - frequency range: 0 3 1/2 digit frequen level display - maximum setting err digit - max. output voltage 10 Vpp for pulse, - output impedance: 600 Ohm, - output signal forms square, triangle, p negative pulses wit DC offset - duty cycle: 50% f continuously variab 90% - operating modes: si burst, sweep, norma - sweep: internal, ex and logarithmic - sweep period should sly adjustable from - sweeping modes: si continuous with pos triggerring either from external sourc - independent setting stop frequencies - hold and reset butt - sine distortion: < to 200 kHz); < 2 % (200 KHz to 2 - triangle wave linea - square wave rise an < 60 ns - start phase: +/- 90 sly adjustable. Complete with: - supply cable - measuring cables - operation and servi	TOR, 2 MHZ s: .01 Hz - 2 MHz cy and output or: 3 % +/- 1 : 20 Vpp and continuously adjustable 50 Ohm and switchable : sine, ositive and h or without ixed and le from 10% to ngle pulse, 1 ternal, linear be continuou- 5ms to 100s ngle-shot and sibility of manually or e of start and ons 0.5 % (10 mHz MHz) rity: > 99 % d fall time: % continuou-	Quant. 2	Use D E		
Note	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental	Legend: F = Fundament D = Digital elec I = Industrial ele *Basic item	als of el tronics, ectronic	ectron E = E s	ics, $A = Analog electronics,$ Electronic instrumentation,	Page 59

CFF TH	Equipment guide list				
STILO IS	List number: 10				Data of issue
	Technical field: Electronics				November 1986
Item	Description	Quant.	Use	Illustration	I
Item	<pre>Description SWEEP FUNCTION GENERATOR, 20 MHZ Approx. specifications: frequency range: 0.01 Hz - 20 MHz 3 1/2 digit frequency and output level display maximum setting error: 5 % +/- 1 digit max. output voltage: 20 Vpp and lo Vpp for pulse, continuously adjustable output impedance: 50 0hm and 600 0hm switchable output signal forms: sine, square, triangle, positive and negative pulses with or without DC offset duty cycle: 50% fixed and continuously variable from 10% to 90% operating modes: single pulse, burst, sweep, normal, sweep linear internal and external sweep period should be continuou- sly adjustable from 5ms to 100s sweeping modes: single-shot and continuous with possibility of triggerring either manually or from external source independent setting of start and stop frequencies hold and reset buttons internal AM: adjustable between 0 % and +/- 10 % modulation frequency range: 0.01 Hz to 20 KHz sine distortion: < 0.5 % (10 mHz to 200 kHz); < 3 % (200 KHz to 20 MHz) stepped and variable attenuation: over 60 dB range triangle wave linearity: > 99 % square wave rise and fall time: < 20 ns start phase: +/- 90% continuously adjustable. Complete with: supply cable measuring cables operation and service manuals. </pre>	Quant	DE	Illustration	
i	l			·	
Note	: Any similarity in above item de- Legend : F = Fundamer	ntals of el	ectron	ics. A = Analog electronic	s. Page

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ltem	Description	<u> </u>	Quant.	Use	Illustration
110.3.17	<pre>PULSE GENERATOR, 10 MHz for experiments with electronic circuits (TTL, HNIL and MOS applications). Approx. specifications: frequency range: 0.1 Hz to 10 MHz outputs: one from +1V to +15V into 50 Ohm load continuously adjustable and two fixed TTL levels source impedance: 50 Ohm and 300 Ohm, selectable signal form: rectangular pulse positive polarity, fall and rise time about 10 ns duty factor: from about 50% to nearly 100 % pulse duration: from 50 ns to S00 ms continuously variable operating modes: continuous and single shot baseline offset: continuously variable from 0 to + 2 V jitter: less than 0.1 %. Complete with: supply cable operating and service manuals. </pre>		2	D	
110.3.18	LOGIC PULSER TTL/C-MO for diagnosing faults circuits operating fr supply. Equipped wit switch to select eith narrow pulse, or trai continuous train of p the output button. Approx. specification - pulse width into C- 1.8 - 2 micro s - max. output current - connexions: via int miniature crocodile Complete with: - sprung hook - insulating tips - IC test adaptors - operation manual.	s in logic om 5V to 15V DC h 3 positions er a simple n of 4 pulses or ulses by pressing s: MOS approx. and into TTL 0.8 micro s : 0.5 A egral lead and clips	8	D	
Note	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundament D = Digital elec I = Industrial el *Basic item	als of el tronics, ectronic	ectror E = E s	iics, A = Analog electronics, Pag Electronic instrumentation, 61

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ltem	Description		Quant.	Use	Illustration	
110.3.19	IN-CIRCUIT SEMICONDUC	TOR TESTER	2	E		
	<pre>battery powered, self locating faulty discr devices without unsol circuit configuration tester should provide of following devices: - signal and middle p transistors - signal and low powe diodes - low power thyristor switching action wi need for any gating the equipment under Complete with: - leads, prods - carrying case - two sets of batteri - operating and servi</pre>	-checking, for ret semiconductor dering in most s. The GO/NO-GO in-circuit test ower r rectifier s (for thout the signal from test).				
110.3.20	<pre>TRANSISTOR TESTER battery operated, sel facility, for measuri and NPN signal and mi transistors. Possibi signal and middle pow thyristors. Approx. specification - measuring range of - collector test curr 10,100 micro A, 1 - accuracy: +/- 3 %. Complete with: - leads, prods - two set of batterie - operating and servi</pre>	f-checking ng DC gain of PNP ddle power lity to test er diodes and s: Hfe: up to 2000 ent range: 1, and 10 mA s ce manuals.	2	Ε		
Note:	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundament D = Digital elec I = Industrial ele *Basic item	als of el tronics, ectronic	ectron E = E s	ics, A = Analog electronics Electronic instrumentation,	, Page 62

(the act	Equipment guide list					
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	Technical field: Electronics				Novem	ber 1986
Item	Description	Quant.	Use	Illustration		
110.3.21 Note	<pre>FIELD EFFECT TRANSISTOR TESTER battery operated, self-checking facility, for evaluation of parameters of the majority of junctions and Mos depletion type field effect transistors under conditions relevant to actual circuit design and device operation. Approx. specifications: - source current (Is) preset values: 100 micro A, 300 micro A, 1 mA 3 mA and 10 mA - gate source voltage (Vgs): 1.2 V, 4 V and 12 V f.s.d - gate leakage current (Ig): 12 nA, 40 nA and 120 nA f.s.d drain current (Idss) at Vgs = 0: 4 mA, 12 mA and 40 mA f.s.d pinch-off voltage (Vp) at Is = 1 micro A: 1.2V, 4V and 12V f.s.d transconductunce gfs: 1.2 mmho, 4 mmho and 12 mmho f.s.d accuracy:</pre>	1 tals of el	E	itics, A = Analog electronics		Page
	scriptions and illustrations with D = Digital elements becific makes or models is I = Industrial elements because the second sec	ctronics, lectronic	E = E cs	Electronic instrumentation,		63

purely coincidental.

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VIIIOR	List number: 10 Technical field: Electronics					Date of i Novemb	issue er 1986
Item	Description		Quant.	Use	Illustration		
110.3.22 Note	LINEAR IC/SEMICONDUCT TRACER for comprehensive tes of device performance operating conditions. of curve tracer, stan (semiconductor) test IC test fixture, test adapters, built-in po step generator, sweep selection device and resistances. Other c be considered. The tracer should tes tors (PNP, NPN transi bipolar transistors, up to 100 W power, as operational amplifier differential amplifie gulators. Complete with: - standard test fixture - test cards - lead selection devi - socket adapters - connecting cables - operating and servi NOTE: Linear IC and s curve tracer is deliver valuabl data for accura analysis and ev poses. Therefor recommended for in equipment re design or resea ted project.	OR CURVE ts and comparison under given It may consist dard fixture, linear cards, socket wer supplies, generator, lead source onfigurations may t semiconduc- stors, MOS FET, diodes, etc.) well as s comparators, rs voltage re- re ce ce manuals. emiconductor intended to e performance te design, aluation pur- e, it may be inclusion quest for a rch orienta-	1 als of el	ectror	rics, A = Analog electronics,		Page
	scriptions and illustrations with specific makes or models is purely coincidental.	D = Digital elec l = Industrial ele *Basic item	tronics, ectronic	E = [s	Electronic instrumentation,		64



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ltem	Description		Quant.	Use	Illustration
110.3.23	DIGITAL IC TESTER for general functioni majority of C-MOS and including standard TT etc.; also for testi of interface and memo less than up to 24-pi tester should show on pass/fail status. Th possible either by en type number or by aut identification via it library or by both me The tester should be separate test sockets Complete with: - comprehensive instr - service manual.	ng testing of the TTL logic IC's; L, LS, S, ALS, HC ng a wide range ry devices not n DIL. The display e test should be try of the device omatic search and s internal thods. equipped with	2	D	
110.3.24	<pre>TTL LOGIC PROBE for indicating the lo pin, on any TTL or DT operating from a 5V s Approx. specification - indication of logic coloured L.E.D.'s - possibility of dete pulses down to 30 n - operating supply vo Complete with: - sprung hook and two tips - operation instructi</pre>	gic state, pin by L circuit upply. s: state: by a cting single s duration ltage: from 5 to 15 V insulating ons.	4	D	
Note	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundament D = Digital elec I = Industrial ele *Basic item	als of el tronics, ectronic	ectron E = E s	ics, A = Analog electronics, Electronic instrumentation, 65

	Equipment guide List number: 10	list				Date of issue
	Technical field: Electronics		·			November 198
Item	Description		Quant.	Use	Illustration	
110.3.25	<pre>C-MOS LOGIC PROBE for indicating the lo C-MOS circuity operat 15V supply. Approx. specification - indication of logic coloured L.E.D's - possibility of dete pulses down to 100 - operating supply vo Complete with: - sprung hook and two tips</pre>	gic state of ing from a 5V to s: state by a cting single ns ltage 5V to 15V insulating	4	D		
110.3.26	 operation instruction LOGIC ANALYSER, 100 M for timing and state identification of fau equipment. Approx. specification data input: 16 chan threshold: selective (continuously adjus) self-test facility incorporated clock source:internation triggering: internation start source: autom or manual example memory form bits x 16 parallel operating modes: satisfies compare, store and display modes: timitiables, mapping Complete with: 	Hz analysis and for lts in digital s: nels e TTL, ECL, VAR table) should be al or external l, external or atic, external at: 504 serial channels mple, capture, search ng, state	2	D		
Note	- set of recommended - set of recommended - operation and servi : Any similarity in above item de- scriptions and illustrations with specific makes or models is	probes spares ce manuals. Legend: F = Fundamen D = Digital elec L = Industrial elec	tals of el	ectron E = E	ics, A = Analog electronics lectronic instrumentation,	, Ра да 66
	specific makes or models is purely coincidental.	I = Industrial el •Basic item	lectronic	:s		66


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Item	Description		Quant.	Use	Illustration	
Item 110.3.27	Description DIGITAL LCR METER for measuring inductal capacitance (C) and r Mains or battery oper Approx. specification - inductance measurin - accuracy: not less +/- 1 digit up to 0 and not less than + between 0.5 H and u - capacitance measuri 200 pF t - accuracy: not less +/- 1 digit up to 0 and less than +/- 2 between 0.5 micro F 200 micro F - resistance measurin 20 0 - accuracy: not less +/- 1 digit up to 1 less than +/- 5% up of measuring range	nce (L), esistance (R). ated. s: g range: 2 mH to 200 H than +/- 2% .5 H, /- 5% 1 digit p to 200 H ng range: o 200 micro F than +/- 1% .5 micro F % +/- 1 digit and up to g range: hm to 20 MOhm than +/- 1% MOhm and not to the end	Quant. 2	Use A D F I *	Illustration	
110.3.28	<pre>of measuring range - display: not less t digit - testing frequencies than 2 (for example Complete with: - testing leads - 2 sets of batteries operated) - operation and servi DECADE RESISTANCE BOX for laboratory and ed Approx specifications - resistance range:</pre>	han 3 1/2 : not less 100 Hz and 1 kHz). (if battery ce manuals. ucational use. : 0.01 Ohm to 01 Ohm steps : less than 100 mOhm ge from 100 Ohm ess than 0.1 % per resistor oltage:250 VDC.	8	E F I		
Note	: Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundament D = Digital elec I = Industrial el *Basic item	tals of el ctronics, ectronic	ectror E = { s	nics, A = Analog electronics, Electronic instrumentation,	Page 67

Equipment guide list List number: 10 Date of issue November 1986 **Technical field: Electronics** Item Description Quant. Use Illustration 8 110.3.29 Ε DECADE CAPACITANCE BOX for laboratory and educational use. F Approx. specifications: Ι 100 pF to 10 - capacitance range: micro F in 100 pF steps * - residual capacitance: 50 pF max. +/- 1% +/- 5 pF - accuracy: - maximum operating voltage:100 VDC or 100 Vpp AC. 110.3.30 DIGITAL THERMOMETER 2 Ε hand-held with wide temperature range but not less than from - 50 deg.C to + 200 deg.C, resolution 0.1 deg.C; battery operation, automatic cold junction compensation; Complete with: - surface temperature probe (with about 2m lead) for fast and accurate measurements of surface temperature of heat sinks transformers and other electronic components as well as radiators pipes etc.; probe tip dia. about 7 to 8 mm; overall length 200 to 250 mm; temperature range of a tip not less than of the main unit; time constant about 0.1s - two sets of batteries - instruction manual. Legend: F = Fundamentals of electronics, A = Analog electronics, Note: Any similarity in above item de-Page scriptions and illustrations with D = Digital electronics, E = Electronic instrumentation, specific makes or models is I = Industrial electronics 68 *Basic item purely coincidental.

(see and	Equipment guide	list				
I VIION	List number: 10					
	Technical field: Electronics					Date of issue November 1986
Item	Description		Quant.	Use	Illustration	
110.3.31	FIXED DC POWER SUPPLY	, 5 V	8	A		
	for laboratory experin different projects, un semiconductors and int	ments and for cilizing cegrated		D F		5v
	circuits. Short circu: output.	it protected		г Е		+ -
	Approx. specifications - stability against variation: better th	s: +/- 10% mains nan 0.1%		F		
	 ripple voltage:less ripple current: less rms 	than 2 mV rms s than 0.5 mA		I		
	- output data: voltage 2 A. Complete with operat service manuals.	e 5V; current tion and		*		
110.3.32	FIXED DC POWER SUPPLY	, 12 V	8	A		
	for laboratory experim different projects, un semiconductors and int	nents and tilizing tegrated		D F	Prest curry	12∨ ⊙ ●
	output.	lit protected		E		
	 Approx. specifications stability against + variation: better the 	s: /- 10% mains nan 0.1%		F		
	- ripple voltage: less - ripple current: les rms - output data: volta	s than 2 mV rms ss than 0.5 mA		1		
	Complete with operation	tion and				
	service manuals.					
Note:	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundament D = Digital elec I = Industrial el *Basic item	als of el ctronics, ectronic	lectron E = { s	ics, A = Analog electronics Electronic instrumentation,	s, Page 69

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$\underline{\qquad}$	Technical field: Electronics					November 1986
Item	Description		Quant.	Use	Illustration	
110.3.33	ADJUSTABLE DC POWER S for laboratory experim different projects, u semiconductors and in circuits. Output shou current operation mod Approx. specifications - stability against + mains variation: be - ripple voltage: less rms - ripple current: less rms - output ranges: 0-20 The unit should be voltmeter and ammet continuous monitoris and current. Complete with opera service manuals.	UPPLY, 0-20V ments and for tilizing tegrated ld have constant e. s: /- 10 % tter than 0.05% s than 1.5 mV s than 0.5 mA V, 0-2 A. equipped with ter to enable ng of voltage tion and	8	A D F E T I		
110.3.34	<pre>PROGRAMMABLE POWER SU for laboratory experind different projects, u semiconductors and in Approx. specifications - one voltage and cur mable output; prog 10 mV and 10 mA (1 m range) - maximum voltage out; - maximum constant cu 2.99 A and 0.999 A - stability against + variation: better - ripple voltage: less - ripple current:less The unit should be digital or analog va ammeter. Complete with opera service manual.</pre>	PPLY 0-40V, 3A ments and for tilizing tegrated circuits. s: rent program- ramming steps mA in 1 A put: 39.99 V rrent output: /- 10 % mains than 0.1 % s than 2 mV rms than 0.5mA rms equipped with oltmeter and tion and	8	A D F I *		
Note:	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundamenta D = Digital elec I = Industrial ele *Basic item	als of electronics,	ectron E = E s	ics, A = Analog electronics lectronic instrumentation,	, Page 70

STIDE.	Equipment guide					
Nonce I	Technical field: Electronics					Date of issue November 1986
ltem	Description		Quant.	Use	Illustration	
110.3.35	FIXED DC POWER SUPPLY	2x5V	2	A		
	<pre>for laboratory experim different projects, ut semiconductors and int circuits. Two fixed, separated and short ci outputs. Approx. specifications - stability against +/ variation: better t - ripple voltage: less - ripple current: less rms - output 2 x 12 V, 2A Complete with operat service manuals.</pre>	ents and ilizing egrated galvanically rcuit protected : - 10% mains han 0.1% than 2 mVrms than 0.5 mA (each output). ion and		D		
110.3.36	<pre>FIXED DC POWER SUPPLY for laboratory experim different projects, ut semiconductors and int circuits. Two fixed, separated and short ci outputs. Approx. specifications - stability against +/ variation: better - ripple voltage: less - ripple current less rms; - output: 2 x 12V, 2A Complete with operat service manuals.</pre>	2X12V ents and ilizing egrated galvanically rcuit protected : - 10% mains than 0.1%; than 2 mVrms than 0.5 mA (each output). ion and	2	A D E		
Note	Any similarity in above item de- scriptions and illustrations with specific makes or models is	Legend: F = Fundamen D = Digital elec I = Industrial el	tals of el ctronics, lectronic	ectron E = E s	ics, A = Analog electro lectronic instrumentatio	nics, Page in, 71

*Basic item

purely coincidental.

<i>UY</i> V U		list				
STION STION	List number: 10					Date of issue
	Technical field: Electronics	·		·		November 1986
Item	Description		Quant.	Use	Illustration	
110.3.37	FIXED DC POWER SUPPLY for laboratory experin different projects, ut semiconductors and int circuits. Three fixed separated and short co outputs. Approx. specifications	, 5V, 2x12V ments and for tilizing tegrated d, galvanically ircuit protected s:	2	A D E		©_0 © 0 © 0
	 stability against variation: better t ripple voltage:less ripple current: less rms output ranges: voltage 5 V 12 V 12 V 12 V Complete with operation manuals. 	<pre>+/- 10% mains than 0.1% than 2 mV rms s than 0.5 mA current 2 A 2 A 2 A on and service</pre>				
110.3.38	<pre>FIXED DC POWER SUPPLY for laboratory experim different projects, ut semiconductors and int circuits. Three fixed separated and short c: outputs. Approx. specifications - stability against - variation: better - ripple voltage:less - ripple current: less rms - output ranges: voltage 5 V</pre>	, 2x5V, 12V ments and tilizing tegrated d, galvanically ircuit protected s: +/- 10% mains r than 0.1% than 2 mV rms s than 0.5 mA current 2 A	2	A D E	Pried Guray	© 0 © 0 © 0
Note	5 V 12 V Complete with operation service manuals.	2 A 2 A on and Legend: F = Fundament D = Digital elec I = Industrial el	als of electronics, ectronic	ectron E = E	ics, A = Analog electronics, Electronic instrumentation,	Page 72

(hild)	Equipment guide list						
	Technical field: Electronics		Date of issue November 1986				
Item	Description		Use	Illustration			
Item	Description ADJUSTABLE DC POWER SUPPLY, 2x20V for laboratory experiments and for different projects, utilizing semiconductors and integrated circuits. Two continuously adjustable voltage and current outputs. All outputs should be galvanically separated and have constant current operation mode. Approx. specifications: - stability against +/- 10 % mains variation better than 0.05% - ripple voltage: less than 1.5 mV rms - ripple current: less than 0.5 mA rms - output ranges: 2 x (0-20)V, 2A (each output) The unit should be equipped with two voltammeters to enable conti- nous monitoring of voltage or current of each output. Complete with operation and service manuals.		2 A D E i i				
Nete						Page	
Note	: Any similarity in above item de- scriptions and illustrations with D = Digital ele	tals of el	lectror F = F	nics, A = Analog electror	nics, n	Page	

Villow Villow	List number: 10					Date of issue
	Technical field: Electronics					November 1986
Item	Description		Quant.	Use	Illustration	
Item 110.3.40	Description ADJUSTABLE DUAL POWER for laboratory experi different projects ut semiconductors and in Approx. specification - two galvanically se continuously adjust and current outputs current operation m - stability against variation: better - output resistance: - overload protected - voltage output rang current output rang current setting) to - preferable unit sho switched ranges: 0 10V, 10V to 15V, 20 25 V to 30 V, 30 V continuous variable each range - equipped with reset - accuracy of voltage settings: 2 % f.s - ripple voltage: les Complete with: - recommended spares - operation and servi	SUPPLY 2x35V ments and for ilizing tegrated circuits. s: parated and able voltage with constant ode +/- 10 % mains than 0.05 % less than 0.005 Ohm es: 0 - 30 V es: 0.04A (min. 2 A uld have to 5 V, 5 to V to 25V and to 35 V with control on button and current .d. s than 1 mVpp ce manuals	Quant.	A D E I		
Note	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundamenta D = Digital elec I = Industrial ele *Basic item	als of el tronics, ectronic	ectron E = E s	ics, A = Analog electronics, lectronic instrumentation,	Page 74



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SECTION 4 PRINTED CIRCUITS REALISATION AND RELATED MATERIAL

The present section offers two systems. Item 110.4.1 represents a printed circuit realisation trainer based on manufacturing technology, utilizing ultra-violet exposure apparatus and presensitized boards.

The trainer (110.4.1) along with consumables kit (110.4.2) is a self-contained system with all necessary mechanical, electrical, chemical facilities and consumables. The trainer is intended both for training as well as for small series production purposes.

The specifications below 110.4.2 are for training in manufacturing of p.c.b. s utilizing usual etch resist transfers, etch resist ink and processing. The first priority protective items are also listed.

(States	Equipment guide list				
SILOIS	List number: 10				Data of issue
	Technical field: Electronics				November 1986
ltem	Description	Quant.	Use	Illustration	
110.4.1 Note	PRINTED CIRCUIT REALIZATION TRAINER a complete set of equipment of an ultra-violet exposure type for training in production of printed circuits as well as for small series production purposes. the trainer shall consist of: - ultra-violet exposure unit with useful surface area approx. 400 x 250 mm - printed circuits etching machine - high accuracy, high speed drill with stand for printed circuits drilling - spindle capacity: 0.2 mm to 3.5 4.0 mm - spindle speed: 16000-20000 rpm - minisaw for cutting printed circuit boards, both of phenolic laminated and in glass-epoxy hard fibre, synthetic, iron and wood. The saw may be of a belt type Complete with: - two sets of UV exposure tubes - five belts for a microsaw (if of a belt driven type) - two sets of training manuals on printed circuit realization subject - operation and service manuals for UV exposure unit, printed circuit etching machine high speed drill and for minisaw	2	A D I	ics, A = Analog electronia	CS, Page
	specific makes or models is purely coincidental.	electronics, electronic	с= E s	ciectronic instrumentation,	76



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Item	Description		Quant.	Use	Illustration	
110.4.2	PRINTED CIRCUITS CONSUM consisting of all neces to produce printed circo photo etching method for The kit should includes - transparent acetate s - set of symbols, ribbo alphabet - knives for master des - phenolic material boa 1.6 mm thick, presens single and double-sico various sizes	ABLES KIT ssary materials cuits with or 16 students. sheets ons, slots, sign ards about sitized, led of	16	A D E I	TIN PLATING CRYSTALS	
	 glass-epoxy boards all thick, presensitized, double-sided of variod development of presen boards stripping liquid both set of tungsten carbin 0.8 - 0.9 - 1.0 - 1.2 set of cropping mills quartz fibre brushes cleaning protective self-welds plastic pliers acid-proof gloves of but normal sizes 	bout 1.6 mm single and bus sizes for asitized eles de drills: 2 - 1.5 mm for circuit ang varnish different				
110.4.3	but normal sizes COPPER-CLAD BOARD, SINGLE-SIDED epoxy-glass, overall thickness 1.6mm; for fabrication of printed circuit boards. Approx. size: 305 mm x 457 mm Pack of 10.			E F I		
Note	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundamenta D = Digital elec I = Industrial ele *Basic item	als of electronics, ectronics	ectroni E = E	ics, A = Analog electronics, lectronic instrumentation,	Page 77

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\square	Technical field: Electronics	Technical field: Electronics					
ltem	Description		Quant.	Use	Illustration		
110.4.4	COPPER-CLAD BOARD, DO	UBLE-SIDED	16	Е		7	
	epoxy-glass, overall mm; for fabrication circuit boards.	thickness 1.6 of printed		F I			
	Approx. size: 3 Pack of 10.	05 mm x 457 mm					
110.4.5	P.C.B. GUILLOTINE		1	E			
	hand operated, bench	mounting		F	Ĩ		
	guillotine designed t copper laminated boar bonded paper and epox it may also be used t card, plastic and lig	o cut plain and ds, both resin y glass type; o cut paper, ht aluminium.		I			
	<pre>Approx. specification - cutting width: - cutting capacity: aluminium 1.5 mm, b</pre>	s: 400 - 420 mm boards - 2 mm rass 1mm.					
	Complete with five replacement blades.	sets of					
110.4.5A	REPLACEMENT BLADES		8	E		A	
	for P.C.B. guillotine	; set of two.		F	40		
				Ι			
110.4.6	P.C.B. PRECISION DRIL	L SET	2	E			
	equipped with 12 V DC motor, low shaft ecce lock button.	100-120 W ntricity, shaft		F I			
	No-load speed: Chuck capacity: 0.6 m	16000 rpm m to 3.0-3.2 mm					
	Complete with: - power supply - drill stand						
Note	Any similarity in above item de- scriptions and illustrations with	Legend: F = Fundamenta D = Digital elec	als of el tronics,	ectron E = E	ics, A = Analog electronic lectronic instrumentation,	cs, Page	
	specific makes or models is purely coincidental.	l = Industrial ele *Basic item	ectronic	S		78	

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ltem	Description		Quant.	Use	Illustration	
110.4.6A	P.C.B HSS DRILL SET for drilling printed Approx. specification drill dia.: 0.4 - 0 1.0 - 1 and 2.	board cards <u>;</u> s: .6 - 0.8 - 0.9 .3 - 1.6 - 1.7 0 mm, each one	16	E F I		
110.4.7	P.C.B. DRILLING MACHI	NE	2	E		
	AC powered, for accur printed circuits boar	ate drilling of ds and routing		F		
	<pre>Approx. specification - vacuum suction faci removing drilling s: - high speed drilling 20000 rpm in no-loa - precision 3 jaw chu capacity - plastic guard - illumination of wor - approx. daylight un - sliding stops - maximum vertical ch about 30-35 mm Complete with: - instruction manual - service manual.</pre>	s: lity for warf motor (15000- d condition) ck: 0.4-3.0 mm king area der chuck 40 mm uck movement		1		
110.4.8	DRILL ACCESSORIES SET		2	E		
	for P.C.B drill consi 16 mm dia. saw and ma polishers and arrow h common shank approx.	sting of approx. ndrel, felt ead reamers with dia. 2.4 mm.		F	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	,
Note:	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundament D = Digital elec I = Industrial el *Basic item	als of el tronics, ectronic	ectron E = E s	ics, $A = Analog electronics, Electronic instrumentation, Electronic instrumentation,$	Page 79

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ltem	Description		Quant.	Use	Illustration		
110.4.9	ETCH RESIST P.C.B. TR consisting of: - round pad 0.D. 3.96 - round pad 0.D. 2.54 - d.i.l. pads for 14 packages-4 sheets - transistor pads in groups-4 sheets - edge plugs (2 pitch - right-angled patter for mounting 37- 25 connectors-2 sheets - p.c.b. mounting con with 10, 20, 26, 34 ways-2 sheets, - straight track in w	ANSFERS, SET mm-4 sheets mm-4 sheets and 16 pin large and small es)-2 sheets n suitable , 15 and 9 way , nector plugs , 40 and 50 idths of 06.	16	E F I			
110.4.10	ETCH RESIST INK PEN designed mainly for m cladboards. May be a rough drawing of circ boards.	arking lso used for uits directly on	16	E F I			
Note	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundamenta D = Digital elec I = Industrial ele Basic item	als of electronics, actronics	ectron E = E s	ics, A = Analog electronics, lectronic instrumentation,		Page 80

Equipment guide list List number: 10 Date of issue Technical field: Electronics November 1986 Quant. Use Item Description Illustration 110.4.11 P.C.B. MODULAR PREPARATION SYSTEM 2 E consisting of three tanks: F processing, etching and washing; made from plastic material; for maximum T board sizes 225 x 250 mm; tank Heated capacity approx. 41. The system is Processing Tank intended both for training and for prototype development of single and double-sided printed circuit boards. It may also be used for small production purposes. The heated processing tank should incorporate thermostatically controlled heating element adjustable over the range 10-60 deg.C Heated Bubble Etch Tank The p.c.b. etch tank should incorporate fixed temperature setting (40-45 deg.C) thermostatically controlled as well as a bubble agitator. The spray wash tank is for rinsing processing chemicals from the surfaces of boards between states to prevent contamination of subsequent solutions and after the final process. Complete with: Spray Wash Tank holding baskets, 3 pcs drain fittings, 3 pcs - approx. 1 m drain pipes, 3 pcs PRINTED CIRCUITS PROCESSING 110.4.12 8 Ε CHEMICALS F ferric chloride hexahydrate crystals suitable for copper-clad circuit Ι boards. Pack of 2 kg. Legend: F = Fundamentals of electronics, A = Analog electronics, Note: Any similarity in above item de-Page scriptions and illustrations with D = Digital electronics, E = Electronic instrumentation, specific makes or models is I = Industrial electronics 81 purely coincidental. *Basic item

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Item	Description	Quant.	Use	Illustration	
110.4.13	P.C.B. TIN-PLATING CRYSTALS	8	E		
	to produce a plated solderable finish on printed circuit copper track.		F	The Astronom	\mathbf{P}
	Preparation of working solution should be by simple addition of water. Pack for 4 1 of solution. Complete with instruction sheet.		I		/
110.4.14	ELECTRICALLY CONDUCTIVE PAINT	4	Е		
	a silver-loaded conductive paint for		F		
	It may also be used to paint-on an electrical screen or to make electrical connections to non-solderable surfaces. Touch-dry time approx. 15 min and completely dry in 12 hrs. Low volume resistivity of about 0.001 Ohm. In about 3 to 5 ml bottles.		I	CONDUCTIVE TRANS	
110.4.15	BENCH LIGHT, FLUORESCENT	16	E	S	
	with universal bench mounting clamp.		F		3
	Counter-balanced floating arm action with multi-position joints; 2 standard 15W, 450 x 26 mm fluorescent tubes.		I		
	Complete with 10 15W replacement tubes.				
110.4.16	P.C.B. RETAINER/HOLDER	16	Е		
	with a clamp max. size 70 mm.		F		
			т		
Note:	Any similarity in above item de- scriptions and illustrations with D = Digital electronic	tals of el	ectron E = F	ics, A = Analog electronics	, Page
	specific makes or models is I = Industrial el purely coincidental. Basic item	ectronic	s	· · · · · · · · · · · · · · · · · · ·	82

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Item	Description		Quant.	Use	Illustration		
		······································					
110.4.17	P.C.B. INSPECTION GLAS	55	2	E			
	8x magnification lens	. Complete with		F			
	integral graticule ind divisions 0.2 mm, enal measurements to be mad	licating metric oling detailed de.		I			
110.4.18	PRINTED CIRCUIT WORK-	FRAME	16	Е			
	for holding p.c.b. du	ring assembly.		F			
	Spring loaded board retention bars. Should be suitable for construction, repair and small production runs. Approx. working area 220 x 270 mm.			I	Comparison of the second secon	» —)	
110.4.19	SAFETY SPECTACLES		16	Е		J	
	shall be expandable to	o protect		F			
against most eye hazards. Shall f over prescription glasses.	rds. Shall fit sses.		I				
110.4.20A	RUBBER PROTECTIVE GLO	VES, SMALL	16	Е			
	for work with p.c.b. chemicals as well as protection against a substances including alkalis, detergents, solvents. The gloves high tensile strength properties within the	processing ensure variety of most acids, oils, fats and should retain and elastic ir lifetime.		F			
Note	: Any similarity in above item de-	Legend: F = Fundament	als of el		nics, A = Analog electronics	s, Pag	je
	specific makes or models is purely coincidental.	I = Industrial el Basic item	ectronic	s S		83	

E. T	Equipment guide list				
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ltem	Description	Quant.	Use	Illustration	
110.4.20B	RUBBER PROTECTIVE GLOVES, MEDIUM	16	E		
	for work with p.c.b. processing chemicals as well as ensure protection against a variety of		F	E	
	substances including most acids, alkalis, detergents, oils, fats and solvents. The gloves should retain high tensile strength and elastic properties within their lifetime.		1		
110.4.20C	RUBBER PROTECTIVE GLOVES, LARGE	16	Е		
	for work with p.c.b. processing chemicals as well as ensure		F	E	
	substances including most acids, alkalis, detergents, oils, fats and solvents. The gloves should retain high tensile strength and elastic properties within their lifetime.		I		
•					
Note	: Any similarity in above item de- scriptions and illustrations with D = Digit	amentals of e al electronics, trial electronic	lectron E = E	ics, A = Analog electro Electronic instrumentatio	nics, Page n, Sa



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SECTION 5 MACHINES AND TOOLS

This section specifies a minimum of machines, tools and dimension measuring instruments which are necessary in electronic engineering technology for production and repair of electronic devices. If necessary, the user may obtain support utilizing specifications from related guides Nos. 9, 11 and from guides 1, 2, 3, 4, 6 and 15.

Item Description Quart Use Mustration 110.5.1 DIGITAL MICROMETER, 0-25 mm 16 E 110.5.2 Clamp, ratchet stop, vernier thimble scale and carbide tipped measuring faces, to ensure use of micrometer in a conventional manner in case of battery or electronic circuity failure. 0.01 mm - display accuracy: 0.01 mm - - presenting guide required - - one sparts optimic 0.01 mm - adjustable maintenance spanner - - instructions manual 16 110.5.2 DIGITAL CALIPER, 0-150 mm for accurate inside, outside depth and stop measurements. Approx. specifications: - measuring range: 0.01 mm - automatic power-off facility - automatic power-off facility - automatic power-off facility - automatic power-off facility - sifted atrap - instructions sheet.	(10)	Equipment guide List number: 10 Technical field: Electronics	e list		_		Date of i Novemb	ssue er 1986
110.5.1 DIGITAL MICROMETER, 0-25 mm 16 E with high accuracy and resolution 0.001 mm. Should include traditional features such as spinale locking clamp, ratchet stop, vernier thimble scale and carbide tipped measuring faces, to ensure use of micrometer in a conventional manner in case of battery or electronic circuity failure. I Approx, specifications: 0.001 mm	ltem	Description	· · · · · · · · · · · · · · · · · · ·	Quant.	Use	Illustration		
with high accuracy and resolution 0.001 mm. Should include traditional features such as splite locking clamp, ratchet stop, vernier thimble scale and carbide tipped measuring faces, to ensure use of micrometer in a conventional manner in case of battery or electronic circuity failure. F Approx. specifications: - thimble graduation: 0.01 mm - display accuracy: 0.001 mm - pre-setting to a required reference value - automatic power-off facility Complete with: - internelly fitted battery - one spare battery - adjustable maintenance spanner - instructions manual 16 E 110.5.2 DIGITAL CALIPER, 0-150 mm - resolution: - measuring range: 0 - 150 mm - resolution: - measuring range: 0 - 150 mm - automatic power-off facility - automatic wear compensation. Complete with: - safe storage box - firted battery - one spare replacement battery - instructions sheet. 16 E F Itomatic power-off facility - automatic wear compensation. Complete with: - safe storage box - firted battery - one spare replacement battery - instructions sheet. 16 E F Note: any amilarity in above item de- serptions and librations 16 E F F Instructions sheet. - Distal electronics, A - Analog electronics, - Distal electronics, E - Electronics, E - Analog electronics, - Distal electronics = C - Battonic strumentation. P	110.5.1	DIGITAL MICROMETER, 0	-25 mm	16	E			
Approx. specifications: 0.01 mm - thimble graduation: 0.001 mm - pre-setting to a required reference value 0.001 mm - automatic power-off facility Complete with: - internally fitted battery - one spare battery - safe storage box - adjustable maintenance spanner - instructions manual 16 110.5.2 DIGITAL CALIPER, 0-150 mm 16 for accurate inside, outside depth and step measurements. - 0.01 mm - measuring range: 0 - 150 mm - resolution: - measuring range: 0 - 0.01 mm - automatic wear compensation. Complete with: - safe storage box - fitted battery - one spare replacement battery - instructions sheet. Note: Any similarity in above iten decomponent battery D = Digital beetronics: A = Analog electronics. P		with high accuracy an 0.001 mm. Should incl features such as spin clamp, ratchet stop, scale and carbide tip faces, to ensure use a conventional manner battery or electronic failure.	d resolution ude traditional dle locking vernier thimble ped measuring of micrometer in in case of circuity		F			
110.5.2 DIGITAL CALIPER, 0-150 mm 16 E for accurate inside, outside depth and step measurements. 16 E Approx. specifications: - measuring range: 0 - 150 mm - resolution: 0.01 mm - automatic power-off facility - automatic wear compensation. I Complete with: - safe storage box - fitted battery - one spare replacement battery - instructions sheet. I I Note: Any similarity in above item de- seriptions and illustrations with Legend: F = Fundamentals of electronics, A = Analog electronics, D = Digital electronics, E = Electronic instrumentation. P		<pre>Approx. specification - thimble graduation: - display accuracy: - pre-setting to a re reference value - automatic power-off Complete with: - internally fitted b - one spare battery - safe storage box - adjustable maintena - instructions manual</pre>	s: 0.01 mm 0.001 mm quired facility attery nce spanner					
Note: Any similarity in above item de- scriptions and illustrations with Legend: F = Fundamentals of electronics, A = Analog electronics, D = Digital electronics, E = Electronic instrumentation.	110.5.2	DIGITAL CALIPER, 0-15 for accurate inside, and step measurements Approx. specification - measuring range: - resolution: - automatic power-off - automatic wear comp Complete with: - safe storage box - fitted battery - one spare replaceme - instructions sheet.	0 mm outside depth s: 0 - 150 mm facility ensation. nt battery	16	E F I	·		
specific makes or models is	Note	: Any similarity in above item de- scriptions and illustrations with	Legend: F = Fundament D = Digital elec	als of el tronics,	ectron E = E	ics, A = Analog electronics, lectronic instrumentation,		Page

(Fr. 11)	Equipment guide	e list				
GIIO!	List number: 10					Date of issue
	Technical field: Electronics					November 1986
ltem	Description		Quant.	Use	Illustration	
110.5.3	RULER, 300 mm made from steel, metr	ic.	16	E F I	(Managana and Angeletic (2127.025.527.20)
110 5 4	MEASURING TAPE 3m		16	E		
110.5.4	made from steel, metri resistant epoxy coatin slide lock and automa	ic, scratch ng, rust-proof, tic return.	10	,F I	A STATISTICS	
110.5.5	COIL WINDING MACHINE		1	E		
	<pre>bench-mounted, power- clutch and brake built winding head, electro- traverse clutch system winding length, wire p system, winding speed five-figure turns coun pre-set of automatic of designed for winding and mains transformers medium power Approx. specifications - wire range: 0.05 to - max. winding speed: in 9 speeds - coil dimensions: len max. dia. 150 mm - machine control: has operated clutch - electric motor: abor Complete with: - reel carrier - essential accessorie - operating and mainter - operating - opera</pre>	driven, with t into the -magnetic m for setting pitch control control, nter with machine stop, inductors, audio s of small and s: 2.5 mm dia. 250-5500 r.p.m ngth 2-200 mm nd or foot ut 0.5 kW es enance manuals		F		
Note:	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundamenta D = Digital elec I ≈ Industrial ele *Basic item	als of electronics,	ectron E = E s	ics, A = Analog electronics lectronic instrumentation,	, Page 87

-	Equipment guide	list					
A June 1	Technical field: Electronics					Date of Novem	issue ber 1986
Item	Description		Quant.	Use	Illustration	L	
110.5.6	BENCH GRINDER - 150 mm double-ended type wit totally enclosed motor bearings, safety appro- wheel guards and eye adjustable tool rests control switch and sin grinding wheels, threa three 60 grit; operat Approx. specification - dia. of wheel: - width of wheel: - distance between who - spindle speed: - motor, 1-phase:	m h direct drive, r with ball oved closed shields, , complete with x vitrified e 36 grit and ion manual. s: 150 mm 25 mm eels: 325 mm 3000 r.p.m 0.4 kW		F			
110.5.7	SHEARS, 190 mm general purpose, for metal shim, plastic, fabrics; one blade se spring return and a s lock jaws closed.	cutting wires, card, paper and rrated, with afety catch to	16	E F I			
110.5.7A	SCRIBER - 175 mm with one straight and right-angled point, k hardened and ground. Approx. length:	one nurled handle, 175 mm	16	E F I			Ì
110.5.8	JUNIOR HACKSAW, 230 m adjustable tension, 1 conventional hacksaw Complete with 50 spar	m 50 mm long blades. e blades.	16	E F I			٢
Note	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundament D = Digital elec I = Industrial el *Basic item	tals of el ctronics, lectronic	ectron E = E s	ics, A = Analog electronics Electronic instrumentation,	5,	Page 88

(the second sec	Equipment guide list				· .
	List number: 10 Technical field: Electronics	Date of issue November 1986			
ltem	Description	Quant.	Use	Illustration	
110.5.8A	HACKSAW BLADES, 150 mm	16	E		

110.5.8A	HACKSAW BLADES, 150 mm	n	16	Е		
	for junior hacksaw. Pa	ack of 10 pcs.		F	Commence and the second	
				Ι		
110.5.9	INDUSTRIAL SCISSORS, 2	210 mm	16	Е		
	general purpose; made carbon steel; cross ov action and bevelled bi	from hardened ver cutting lades.		F I		く
	Approx. overall lengt	h: 210 mm				
110.5.10	TRIMMING KNIFE, 160 mr	n	16	E		
	a retractable blade for scoring copper boards transfers, drafting fir etc.	or cutting and , plastics, etch ilms, labels,		F I		>
	Approx. overall length	h 160 mm				
	Complete with: - a set of five heavy stored in the handle - two sets of replaced	duty blades e nent blades				
110.5.11	SCALPEL, 140 mm		16	E		•
	with interchangeable	blades.		F		
	Complete with two sets replacement blades Approx. overall lengt	s of h: 140 mm		I		
110.5.12	BALL PEIN HAMMER, 15	0 0	16	E	Ó	\mathbf{i}
	1211, 144, 131	- 0		F		7
				I		
Note:	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundame D = Digital e I = Industrial *Basic item	entals of el lectronics, l electronic	ectron E = E s	ics, A = Analog electronics, Electronic instrumentation,	Page 89
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Non-Cal	Technical field: Electronics					Date of issue November 1986
Item	Description		Quant.	Use	Illustration	,
110.5.13	MARKING PUNCHES, ALPH SET for permanent identif of instrument panels, tools etc. Consistin alphabetical (A to Z numerical (0 to 9) se height 3 mm; complet	A-NUMERICAL ication, marking machine frames, g of and &) and t. Character e with boxes.	1	E F I		
110.5.14	AUTOMATIC CENTRE PUNC	H, 120 mm	16	E F		
110.5.15	<pre>BENCH DRILL PRESS, 6 for light engineering it should ensure accu printed card boards, equipment housings an activities. Spindle driven. Approx. specification - drill capacity: 0 5-6 spindle speeds</pre>	5 mm applications; rate drilling of electronic d for similar may be belt s: 8 mm to 6.5 mm in the range pm to 3500 rpm al feed: max. 40-45 mm op clearance: 150-180 mm base plate keys lt driven)	1	I F I		
Note	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundamenta D = Digital elect I = Industrial ele *Basic item	als of el tronics, ectronic	ectron E = E s	ics, A = Analog electronics Electronic instrumentation,	, Page 90



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ltem	Description		Quant.	Use	Illustration	
110.5.15A	SET OF DRILLS, 0.8-6.1 for electronic worksho consisting of: dia: 0.8 - 1.0 - 1.2 1.8 - 2.0 mm dia: 2.1 - 2.3 - 2.5 3.2 - 3.3 - 3.5 4.1 - 4.2 - 4.5 5.1 - 5.5 - 6.0	5 mm, HSS op actitivies, - 1.5 - 1.6 - each 10 pcs - 2.6 - 3.0 - - 3.7 - 4.0 - 4.8 - 5.0 - - 6.5 mm each 5 pcs	4	E F I		
110.5.15B	PIN CHUCK to be supplied with th interchangeable jaws of drill shank capacity : 2.5 mm dia. Chuck shank dia: max	hree sizes of to ensure a range of 0 to x. 6 to 6.5 mm	2	E F I		
110.5.15C	SMALL MACHINE VICE for use in drilling an operations. The vice effectively grip round and irregular sections mounting or clamping of jaws should be made of and the base may be for Approx. specifications - jaw width - jaw depth - base area	nd light milling should d, square thin s; for easy on drill stands; f hardened steel rom cast iron. s: 80 mm 30 mm 150 x 150 mm	1	E F I		
Note:	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundament D = Digital elec I = Industrial ele *Basic item	als of el tronics, ectronic	ectron E = E s	ics, $A = Analog electronics,$ Electronic instrumentation,	Page 91

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ltem	Description	·····	Quant.	Use	Illustration	
110.5.16	ELECTRIC HAND DRILL,	10 mm	2	Е		
	with continuous speed forward and reverse re drilling capacity 10	control, otation. Maximum		F		
	hammer action. Complete with: - chuck key - drilling depth guide - instructions manual	e		Ι		• •
110.5.17	G-CLAMP SWIVEL VICE		8	E		
	Approx. specification: - 360 deg.C swivel vid - jaw width about 60 f - jaw opening about 40 - G-clamp throat max. 70 mm	s: ce mm 0 mm size about		F		
110.5.18	HAND HELD PIN VICE		16	E		
	made from steel. - jaw width - opening - overall length abou	20 mm 8 mm t 125 mm		F		2 (Pr
110.5.19	HSS DIE SET		16	Е		$\overline{)}$
	ISO metric split form of the following: M2 M3.5 - M4.0 - M5.	set consisting - M2.5 - M3 -		F I	0	
110.5.20	DIE STOCK		16	E		
	for ISO metric discs three setting screws.	M2 to M5 with		F)
				-		
Note	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundament D = Digital elec I = Industrial ele *Basic item	als of el tronics, ectronic	ectron E = E s	ics, A = Analog electronics lectronic instrumentation,	, Page 92



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Item	Description	·	Quant.	Use	Illustration	
110.5.21	HSS TAP SET for ISO metric straigh thread taps set consis following sizes: M2 - M3.5 - M4.0 - M5.0. H includes coarse and fi	t flute ground ting of the M2.5 - M3.0 - Cach size ne tap.	16	E F I		
110.5.22	TAP WRENCH chuck type. Jaw capaci 5 mm. Complete with 7	ty of 2.8 mm to '-bar.	16	E F I		
110.5.23	NEEDLE FILE SET of six files (hand, so half-round, three-squa in plastic wallet. Approx. length:	quare, warding, are and round) 140 mm	16	E F I		
110.5.24	FILE SET hand files with plasts handles, for general u 200 mm long, set const files: flat second cut, flat half-round second cut round second cut and s square second cut and thin cut, second cut a	ic or wooden use, double cut, isting of 10 smooth cut, and smooth cut smooth cut, and smooth cut.	4	E F I		
Note	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundament D = Digital elec I = Industrial el *Basic item	tals of el ctronics, ectronic	ectron E = E s	ics, A = Analog electronics lectronic instrumentation,	, Page 93

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ET IN	Equipment guide	e lîst				
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Item	Description		Quant.	Use	Illustration	
		·····				
110.5.25	SCREWDRIVER SET		16	E		
	consisting of four fl	at bed parallel		F		
	tip sizes 3 mm - 4 mm	- 5 mm and 8 mm				
	0, 1, 2 and 3. Compl	ete either with	-	I		
	plastic wallet of wit	n plastic box.				
110.5.26	JEWELLER'S SCREWDRIVE	R SET	16			
	consisting of six par	allel tip sizes				
	0.6 mm to 2.5 mm and tip sizes 1.5 mm to 3	four crosshead				
	Complete either with	plastic wallet				
	of with plastic box.					
						1/
110.5.27	TUNING SCREWDRIVER SE	Т	16			
	for timing cored coil	S,				
	potentiometers, etc.,	all plastic;				
	set comprising:	rivers of				
	three sizes approx.	$2 \text{ mm} \times 0.4 \text{ mm}$				
	crosshead tips of t	wo sizes: No.1				
	and No.2.					
110.5.28	SCREW GRIPPING TOOL S	ET, PARALLEL	16			
	for gripping slotted	head screws				
	during location and e	xtraction; the ly insulated				
	along the shaft with	integral finger				-
	heads via a spring lo	aded sleeve trap				7
	The set should consis	and driving. t of following				
	blade sizes: 2.5 mm 5 mm and 6 mm.	- 3 mm - 4 mm -				
1						
Note	: Any similarity in above item de- scriptions and illustrations with	Legend: F = Fundamenta D = Digital elec	als of el tronics.	ectron E = E	ics, A = Analog electronics, lectronic instrumentation.	Page
	specific makes or models is purely coincidental.	I = Industrial ele *Basic item	ectronic	s		94
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ltem	Description		Quant.	Use	Illustration		
110.5.29	SCREW GRIPPING TOOL SI TIP	ET, PHILLIPS	16	E			
	for gripping crosshead location and extraction must be completely inst the shaft with integra Screws should be held via a spring loaded s for positioning and d should consist of fol sizes: 0, 1, 2 and 3.	d screws during on; the tool sulated along al finger grip. by their heads leeve trap ready riving. The set lowing blade		F	Change		
110.5.30	CLASP PICK-UP		16	E			
	for picking up compon hardware from areas o	ents and f difficult		F			
	access; made from flo maximum overall reach mm. The pick-up end should have the form spring-loaded jaws; b a push button from the tool. Max. jaw openin	exible tubing; about 500-550 of this tool of a pair of e controlled by e end of this g 15 mm.		I	⇒		
110.5.31	TWEEZERS SET		16	E			
	four pcs, comprising curved point, reverse	straight point, d action and		F			
	flat nose tweezers fo and electronic compon Tweezers should be fr Total length approx.	r precising work ent handling. om hard steel. 150 mm.		I			•
110.5.32	MAGNETIC PICK-UP		16	E			
	for picking up magnet and hardware from are	ic components as of difficult		F			
	access; made from fle maximum overall reach mm; to handle max. 50	xible tubing; about 500-550 Og weight.		I			
Note	Any similarity in above item de- scriptions and illustrations with	Legend: F = Fundament D = Digital elec L = Industrial el	als of el tronics,	ectror E = f	nics, A = Analog electronics Electronic instrumentation,		Page
	purely coincidental.	*Basic item					95

(And	Equipment guide	list				
No.	List number: 10 Technical field: Electronics					Date of issue November 1986
ltem	Description		Quant.	Use	Illustration	
110.5.33	NUT SPINNER SET seven pcs comprising following nuts : M2 - M3.5 - M4 - M5 - M6.	sizes for the M2.5 - M3 -	2	E F I		
110.5.34	TOOL SET selection of high qua for electronic servic containing:	lity hand tools e works	16	EF		
	 combination pliers long nose pliers side cutters circlip pliers wire stripper box spanner kit inspection mirror tweezers special scissors Alan key set offset screwdriver screwdriver/voltage clamping screwdrive screw holder) selection of flat at bit screwdrivers with andles. Complete set housed appropriate comparts 	tester r (with nd Phillips th plastic in case with ments.				
110.5.35	FLAT NOSE PLIERS, 140 for assembly, forming maintenance in electr micro-mechanical trad Approx. overall lengt	mm , adjusting and onic and es. h: 140 mm	16	E F I		
Note	: Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundamer D = Digital ele I = Industrial e *Basic item	ntals of electronics,	ectron E = E s	ics, A = Analog electronics	s, Page 96



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(tem	Description	,,	Quant.	Use	Illustration	
			16			
110.5.36	UTILITY PLIERS, 150 mm small size, high quality with serrated jaws and p Made from hardened chrom steel.	y slip joint, pipe grip. ne-vanadium	16	E F I		t D
	Max. jaw opening 20 mm; position selection Approx. overall length:	five 150 mm				
110.5.37	CUTTING PLIERS, 1.2 mm		16	E		
	for intensive cutting of wire, specially hard ins up to 1.2 mm dia.	f all types of sulated copper		F I	-0-	
	approx. overall length jaw length:	150 mm about 20 mm				
110.5.38	CUTTING PLIERS, 0.8 mm		16	E		
	for intensive cutting of wire, specially hard ins wire up to 0.8 mm dia.	f all type of sulated copper		F	0	
	Approx. overall length jaw length:	125 mm about 16 mm				
110.5.39	CUTTING PLIERS, 0.5 mm		16	E		
	for cutting of all types specially hard copper wi mm dia.	s of wire, ire up to 0.5		F		
	Approx. overall length:	110 mm		T		
110.5.40	NEEDLE NOSE PLIERS, EXT	RA LONG	16	E		į
1	straight jaws (about 50	mm long)		F		
	Approx. overall length:	140 mm		I		
Note	Legend: F = Fundamentals of electronics, A = Analog electronics, Secretions and illustrations with specific makes or models is purely coincidental. Legend: F = Fundamentals of electronics, A = Analog electronics, D = Digital electronics, E = Electronic instrumentation, I = Industrial electronics					Page 97

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Item	Technical field: Electronics				Data of loove
Item					November 198
	Description	Quant.	Use	Illustration	
110.5.41	NEEDLE NOSE PLIERS, STANDARD	16	Е		
	straight jaws (about 40 mm long);		F		
	Approx. overall length: 140 mm		I		
110.5.42	NEEDLE NOSE ANGLED PLIERS, LONG	16	E		
	jaws angled at 40 deg. to 45 deg. (about 30 mm long).		F		
	Approx. overall length: 140 mm		I		
110.5.43	SHAPING PLIERS, 120 mm	16	Е		
	non-serrated jaws with chamfered inside edges for precise shaping of electronic components in position.		F		
	Approx. overall length: 120 mm		-		
110.5.44	ROUND NOSE PLIERS, 120 mm	16	E		
	for all wire shaping in the electronic and micro-mechanical fields.		F I		
	Overall length: 120 mm				
110.5.45	COMBINED WRAPPING TOOL	16	E		
	comprising wire stripping, wrapping and unwrapping operations with 0.25 mm dia. insulated wires and 0.85 mm diagonal terminal pins. Complete with instruction sheet.		F I		
Note:	Any similarity in above item de- scriptions and illustrations with D = Digital ele	ntals of electronics,	ectron E = E	ics, A = Analog electronics, lectronic instrumentation,	Page



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Item	Description	<u></u>	Quant.	Use	Illustration	L	
110.5.46	I.C. INSERTERS AND EX general purpose, to sinsertion and extract packages up to 16 way one inserter and one of	TRACTORS, SET implify the ion of d.i.1. . Set of two: extractor.	16	E F I			
110.5.47	TOOL BOX for storing trainee ha tray cautilever type. Approx. overall dimens L 470 mm x W 200 mm x	and tools, four sions: H 230 mm.	16	E F I			
110.5.48	SOLDERING STATION with temperature cont: approximately 120 and 30-40 W low voltage so spike free power cont: earth lead for establ: local grounding; proto C-MOS IC's. Complete so one 40W soldering iron	rol between 420 deg.C; for oldering irons; rol; antistatic ishing guaranted ection for MOS, with one 30W and ns.	4	E F I			
110.5.48A	SOLDERING IRON, 30W low-voltage to suit a controlled soldering s 110.5.48. Complete with bits.	temperature station item th set of spare	8	E F I			
110.5.48B	SOLDERING IRON, 40W low-voltage to suit a controlled soldering 110.5.48. Complete wi replacement bits.	temperature station item th a set of	8	E F I			
Note	: Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundament D = Digital elec I = Industrial el *Basic item	tals of el ctronics, ectronic	ectron E = E s	ics, A = Analog electronics lectronic instrumentation,	5,	Page 99

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			Quant.	Use		
110.5.49	GENERAL PURPOSE SOLDE 15W mains operation. Com of replacement bits.	RING IRON, plete with a set	16	E F I		
110.5.50	GENERAL PURPOSE SOLDE 30W mains operation. Com of replacement bits.	RING IRON, plete with a set	16	E F I		
110.5.51	GENERAL PURPOSE SOLDE 40W mains operation. Com of replacement bits.	RING IRON, plete with a set	16	E F I		
110.5.52	GENERAL PURPOSE SOLDE 100W mains operation. Com of replacement bits.	RING IRON, plete with a set	2	E F I		
110.5.53	SOLDERING IRON STAND		16	E F I	0000	
110.5.54	INSTANT SOLDERING GUN for fast heat applica soldering, should rea temperature (about 35 about 10 seconds. Complete with: - five spare indicati - five spare tips	tion and ch maximum tip 0 deg.C) in ng lamps	2	E F I		
Note	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundament D = Digital elec I = Industrial el *Basic item	als of el tronics, ectronic	ectron E = E s	ics, A = Analog electronics Electronic instrumentation,	, Page 100

Equipment guide list List number: 10 Date of issue November 1986 **Technical field: Electronics** Item Illustration Description Quant. Use 110.5.55 **DE-SOLDERING STATION** 1 Е for general purpose de-soldering F including repetitive de-soldering in production environment. The station Т may be equipped, for example, with dry vane pump. Approx. specifications: - bit temperature continuously adjustable from about 80 deg.C to 450 deg.C - operational modes: vacuum and pressure low level peak voltage at the de-solder tip (less than 20 mV) to ensure safe activity in MOS environment - vacuum rate at tip about 6 mm Hg - pressure rate up to 5 bar - approximate power of de-soldering station 100-110 W Complete with: six de-soldering bits for example 0.6 mm, 0.9 mm and 1.5 mm (2 each) set of cleaning brushes - set of filters - five solder collection facility - two replacement heating elements 110.5.56 DE-SOLDERING TOOL 16 Е standard, high suction single handed F operation, push button release. Ι Complete with: - two standard and two micro design replacement suction nozzles - two replacement sealing washers. Legend: F = Fundamentals of electronics, A = Analog electronics, Page Note: Any similarity in above item de-D = Digital electronics, E = Electronic instrumentation, scriptions and illustrations with I = Industrial electronics 101 specific makes or models is purely coincidental. Basic item

FILOR	Equipment guide list				
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Item	Description	Quant.	Use	Illustration	
110.5.57	<pre>VARIABLE TEMPERATURE SOLDERING IRON a high quality, solid-state, thermostatically controlled soldering iron. Approx. specifications: - heating element about 50W - adjustable temperature range from 200 deg. to 400 deg. C - visual indication of on/off state.</pre>	2	E F I		
110.5.57A	I.C. DE-SOLDERING BITS SET pre-tinned, iron clad copper de-soldering bit for 14/16 d.i.l. packages and TO-99 cases, for use with variable temperature soldering iron 110.5.57. Each bit should be supplied with a shim.	4	E F I		
110.5.58	HEAT SINK to protect transistors and other temperature sensitive devices from excessive heat when soldering	16	E F I		3
110.5.59	INSPECTION MIRROR Approx. specifications: - adjustable - approx. dia: 30 - 35 mm - overall length: about 300 mm	16	E F I	C	
Note	: Any similarity in above item de- scriptions and illustrations with D = Digital	nentals of el electronics,	ectron E = E	ics, A = Analog electronics lectronic instrumentation,	, Page
	specific makes or models is I = Industria purely coincidental. *Basic item	al electronic	s		102
(the set	Equipment guide list				
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VIION	List number: 10				
	Technical field: Electronics				November 1986
Item	Description	Quant.	Use	Illustration	
					<u> </u>
110.5.60	ILLUMINATED INSPECTION GLASS	16	Е		
	6 X to 8 X magnification, hand held with graticule for clear detailed inspection work. Battery supplied.		F		
	Complete with five sets of batteries and two spare bulbs.		-		
110.5.61	TEST LEADS	16	E		
	set of 2 (red and black colour);		F		
	rating not less than 5.0 A and 2 kV r.m.s., extra flexible cable terminated at each end with a 4 mm		Ι		
	length about 1m.				
110.5.62	TEST PRODS, 4 mm	16	Е		
	set of two (red and black) rating 5A and 2 kV r.m.s.; connection by 4 mm socket at the rear Approx overall		F		
	length 150 mm.	-	Ţ		
110.5.63	SPRING-LOADED HOOK GRIP	16	E	-	
	soldered connections; consisting of a pair (red and black). Should be		F		
	suitable for p.c.b. use. Working voltage not less than 50 V.		I		
110.5.64	I.C. TEST CLIPS, SET	16	E		
	for reducing a risk of accidental		F		
	Shorting during measurements. Comprising three test clips to attach easily on to standard d.i.l. packages up to 16, 28 or 40 pins. All contact surfaces should be gold plated.		I		
Note	: Any similarity in above item de- scriptions and illustrations with D = Digital elec	als of el tronics,	ectron E = E	ics, A = Analog electronics Rectronic instrumentation,	, Page
	specific makes or models is I = Industrial el purely coincidental. Basic item	ectronic	s		103

List number: 10

L

	Technical field: Electronics					
ltem	Description		Quant.	Use	Illustration	
110.5.65	WORK STATION ANTI-STA consisting of bench ma 120 cm and floor mat 120 cm), wrist strap connecting cables beta floor mat and on inder Mat surface resistivit to 100000 Ohm/square	TIC KIT at approx. 60 x (approx. 120 x and earthing ween bench mat, pendant earth. ty about 10000 cm.	16	E F I		
110.5.66	LABORATORY ELECTRIC O for drying varnished transformers and for temperature stability circuits with temperat from 40 to 250 deg. C fluctuations plus or n at any setting betweet deg. C, internal dimet 400 x 480 x 380 mm (1 rated power approx. 1 with accessories, oper service manual.	VEN coils, chokes, testing of electronic ture controlled , temperature minus 1 deg. C n 40 and 250 nsions approx. H x W x D), kW, complete ration and	. 1	E F I		
Note	: Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundamer D = Digital ele I = Industrial *Basic item	ntals of ele ectronics, electronics	ectron E = E s	ics, A = Analog electroni lectronic instrumentation,	cs, Page 104



List number: 10 Technical field: Electronics

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SECTION 6 COMPONENTS AND CONSUMABLES

This section deals only with the general purpose first priority consumables, as well as fastening and maintenance products for all set-ups, except for trainers.

The trainers shall be supplied with set(s) of components and consumables usually for two years of operation and their reordering should be done in accordance with a recommended list of components attached to each particular trainer.

The coverage of all existing components is not possible (the semiconductor list alone would include over 300000 items) and cannot be satisfactory due to permanent modification of parameters and the appearance on the market of new devices. Therefore, depending upon the aims and level of the project, the list of necessary components must be decided based on latest manufacturers' catalogues.

However, as a general guidance the following groups of devices may be needed by projects: cables, cable accessories, connectors, equipment housings, special fasteners, filters, fuses, indicators, micromotors, opto-electronic devices, passive components such as resistors and capacitors, of different types and values, relays, sodenoids, semiconductors, sensors, special service aids, speakers, microphones, switches, timers, counters, controllers, transformers and other wound components, conduits, circuit breakers, terminals.

Electronic components as well as any electronic equipment should be stored in a dry area where the temperature does not change drastically. Storage media parameters are usually given in operation manuals and data sheets.

List number: 10

Technical field: Electronics

	rechnical held: Electronics					November 1986
Item	Description		Quant.	Use	Illustration	
110.6.1A	SOLDER, STANDARD 60/40 tin/lead multic experimental and prod five cores of non-cor full melting temperat 185-190 deg.C. On dr	ore solder for uction activity; rosive flux; ure about ums of 500 g.	16	E F I		
110.6.1B	SOLDER, LOW MELTING P for repairs of fabric melting point less th Approx. composition: lead, 2% silver. On	OINT ated boards; an 180 deg.C; 62% tin, 36% drums of 500 g.	16	E F I		
110.6.1C	SOLDER, ALL PURPOSE for jointing aluminium brass, nickel, copper steel. Approx. composition: 18% tin, 80% lead, 2% should contain cores soluble flux. Approx. temperature o 270 deg. C. On drums	m, tin, plate, or stainless silver; of water f full melting of 500 g.	16	E F I		
110.6.2A	DE-SOLDER BRAID, 1mm f flux impregnated copp speed removal of sold excess heating; lengt	WIDE er braid for er without h 10 m.	16	E F I		
Note:	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundament D = Digital elec I = Industrial ele *Basic item	als of el tronics, ectronic	ectron E = E s	ics, A = Analog electronics lectronic instrumentation,	, Page 106



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Technical field: Electronics

Item	L Description		Quant.	Use	Illustration	
110.6.2B	DE-SOLDER BRAID, 2mm	√IDE	16	E		a)
	flux impregnated copposed removal of sold excess heating; lengt	er braid for er without n 10 m.		F I		8
110.6.3A	PLAIN ALUMINIUM SHEET	S, 1.2 mm	16	E		
	for fabrication of ca chassis, etc. with a plastic cover to prev before use.	ses, panels, protective ent scratching		F I		
	Pack of five sheets. Approx. size: 24	00 mm x 300 mm				
110.6.3B	PLAIN ALUMINIUM SHEET	S, 2.0 mm	16	E		
	for fabrication of car chassis, etc. with a plastic cover to prev- before use.	ses, panels, protective ent scratching		F		
	Pack of five sheets. Approx. size: 3	00 mm x 500 mm				
110.6.4	CLEAR PLASTIC SHEET,	3 mm	16	Е		
	for front panels, sca prototype development etc.	le windows, base boards,		F I		
	Approx. size: 3	00 mm x 500 mm				
110.6.5A	SCREW FIXING FEET, 12	.5 mm DIA.	2	E		
	for equipment housing	s, pack of 100		F		
				Ι		
Note	I : Any similarity in above item de- scriptions and illustrations with	Legend: F = Fundamen D = Digital elec	tals of el	ectron E = E	hics, A = Analog electronics, Electronic instrumentation,	Page
	specific makes or models is purely coincidental.	l = Industrial e *Basic item	lectronic	S		107

List number: 10

(III)

Date of issue November 19

	Technical field: Electronics				No	vember 1986
ltem	Description	c	Quant.	Use	Illustration	
110.6.5B	SCREW FIXING FEET, 15.5	mm DIA.	2	E		
	for equipment housings, pcs.	pack of 50	-	F		
	•			Ι		
110.6.5C	SCREW FIXING FEET, 19 m	m DIA.	2	E		
	for equipment housings,	pack of 50		F		
	2001			Ι		
110.6.6	SCREW KITS, SLOTTED PAN	HEAD	16	E		
				F	O	
	In packs of 100 pcs. Metric: M2 - M2.5 - M3	- M3.5 - M5		Ι		
	Threaded length: 6 mm	to 40 mm				
110.6.7	SCREW KITS, SLOTTED COU	NTERSINK	16	E		
	HEAD			F		
	Screws made from brass. In packs of 100 pcs. Metric: M2 0 - M2 5 - M	30 - M35		I		
	M4 Overall length:	6 to 20 mm				
110.6.8	SCREW KITS, SLOTTED COU HEAD	NTERS INK	16	E		
	Screws made from brass.			r T		
	In packs of 100 pcs. Metric: M2.0 - M2.5 - M	13.0 - M3.5				
	Overall length:	6 to 40 mm				
Note:	Any similarity in above item de- scriptions and illustrations with specific makes or models is	Legend: F = Fundamentals D = Digital electron I = Industrial electron	s of ele onics, ctronic:	ectron E = E s	ics, $A = Analog electronics, lectronic instrumentation,$	Page
	purely coincidental.	*Basic item				

(III)	Equipment guide	list		<u> </u>		Date of issue
<u> </u>	Technical field: Electronics					November 1986
Item	Description		Quant.	Use	Illustration	
110.6.9	NUT AND WASHER KITS,	METRIC	16	E		
	Made from brass. In packs containing m washers and shakeproo about 2000 pcs in tot Metric: M2 - M2.5 - M and M5	uts, plain f washers al. 3 - M3.5 - M4		F		\odot
110.6.10	INSULATED WRAPPING WI 0.25mm/RED	RE,	16	E F		
	length 100 m on a ree	1.		Ι		
110.6.11	INSULATED WRAPPING WI 0.25mm/BLUE	RE,	16	E		
	length 100 m on a ree	1.		F I		
110.6.12	INSULATED WRAPPING WI 0.25mm/BLACK	RE,	16	E		
	length 100 m on a ree	1.		I		
110.6.13	INSULATED WRAPPING WI 0.25mm/YELLOW	RE,	16	E		Ô.
	length 100 m on a ree	1.		F I		8
110.6.14	INSULATED WRAPPING WI 0.25mm/GREEN	RE,	16	E		
	length 100 m on a ree	1.		F I		
Note	: Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F ≃ Fundam D = Digital e I = Industria *Basic item	entals of el electronics, I electronic	ectron E = E s	ics, A = Analog electronics Electronic instrumentation,	, Page 109

ET TO	Equipment guide list				
No.	List number: 10				Date of issue
	Technical field: Electronics		•		November 1986
Item	Description	Quant.	Use	Illustration	
110.6.15	INSULATED WRAPPING TERMINAL PINS, 18 mm	16	E		9
	press fit type, 0.85 mm diagonal, box		F		
	or packet of 100 pcs.		I		
110.6.16	D.I.L. SOCKET, LOW PROFILE, 6-WAY	60	Е		
	tin-plated, for high density circuit layouts, pack of four pcs.		F	H	
			Ι		
110.6.17	D.I.L. SOCKET, LOW PROFILE, 8-WAY	60	E		
	layouts, pack of four pcs.		F		
			I		
110.6.18	D.I.L. SOCKET, LOW PROFILE, 14-WAY	60	E		
	tin-plated, for high density circuit		F		
	layouts, pack of four pcs.		т		
			-		
110.6.19	D.I.L. SOCKET, LOW PROFILE, 20-WAY	60	Е		
	tin-plated, for high density circuit		F		ν
			I	. Pro-	
			_		
110.6.20	D.I.L. SOCKET, LOW PROFILE, 28-WAY	60	E		
	tin-plated, for high density circuit layouts, pack of four pcs.		F		V
			Ι	- Au	
Note	: Any similarity in above item de- scriptions and illustrations with D = Digital ele	tals of el ctronics,	ectron E = E	nics, A = Analog electronics Electronic instrumentation,	, Page
	specific makes or models is I = Industrial e purely coincidental. Basic item	ectronic	S		

List number: 10

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<u> </u>	Technical field: Electronics					November 1986
ltem	Description		Quant.	Use	Illustration	
110.6.21	D.I.L. SOCKET, LOW PR tin-plated, for high layouts, pack of four	OFILE, 40-WAY density circuit pcs.	60	E F I		
110.6.22	D.I.L. SOCKET, WIRE W 8-WAY wire-wrap size 0.85 m tin-plated; pack of f	RAPPING, m diagonal; our pcs.	60	E ~F I		1
110.6.23	D.I.L. SOCKET, WIRE W 14-WAY wire-wrap size 0.85 m tin-plated; pack of f	RAPPING, m diagonal; our pcs.	60	E F I		
110.6.24	D.I.L. SOCKET, WIRE W 18-WAY wire-wrap size 0.85 m tin-plated; pack of f	RAPPING, m diagonal; ive pcs.	60	E F I	N.S. STATE	
110.6.25	D.I.L. SOCKET, WIRE W 20-WAY wire-wrap size 0.85 m tin-plated; pack of f	RAPPING, m diagonal; ive pcs.	60	E F I		
110.6.26	D.I.L. SOCKETS, WIRE 24-WAY wire-wrap size 0.85 m plated, pack of four	WRAPPING, m diagonal, tin pcs.	60	E F I		
Note	: Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundament D = Digital elec I = Industrial el *Basic item	als of el tronics, ectronic	ectron E ≈ E s	ics, A = Analog electronics lectronic instrumentation,	, Page 111

(See the	Equipment guide list				
	List number: 10			Dete	of issue
	Technical field: Electronics			Nov	ember 1986
ltem	Description	Quant.	Use	Illustration	
110.6.27	D.I.L. SOCKETS, WIRE WRAPPING,	60	E		
	28-WAY		F		
	wire-wrap size 0.85 mm diagonal, tin plated, pack of four pcs.		I		
110.6.28	D.I.L. SOCKETS, WIRE WRAPPING,	60	E		
	40-WAY		F		
	plated, pack of four pcs.	1	I		
110.6.29	MULTI-WAY WIRE POSTS, SET	60	E		
	for soldering to p.c.b. and subsequent solderless connections of		F		
	wires to p.c.b. via these posts. Se of five comprising: two-way,	t	I		
	three-way, four-way, five-way and six-way posts.			U	
				A	
110.6.30	P.C.B. PILLARS, STANDARD	16	E		
	moulded nylon types; in packs of 25 spacers and 25 caps.		F		
			I	Ŭ	
110.6.31A	P.C.B. SPACERS WITH STUD. 10 mm	10	E		
	made from brass; in packs of 50 pcs.		F		
			I		
110.6.31B	P.C.B. SPACERS WITH STUD, 15 mm	10	E		
	made from brass; in packs of 50 pcs.		F		
			I		
Note	: Any similarity in above item de- scriptions and illustrations with D = Digita	mentals of e	lectron E = f	inics, A = Analog electronics, Electronic instrumentation.	Page
	specific makes or models is I = Industri purely coincidental. *Basic iter	rial electronic	s		112

Equipment guide list		<u> t . </u>			
Technical field: Electronics					
Description	Quant.	Use	Illustration		
· · · · · · · · · · · · · · · · · · ·					
P.C.B. SPACERS WITH STUD, 25 mm	10	E			
made from brass; in packs of 50 pcs.		F	a chu an ci sunnna		
		I			
INSULATED TERMINALS, 4 mm	16	E			
set of seven colours: black, blue,		F	P. R. 12		
in packs of five pcs of each colour. Total quantity per set is 35 pcs.		I		0	
	16	r			
BANANA PLUGS, 4 mm	10	ь –			
green, brown, red, white and yellow; in packs of 10 pcs of each colour		F		9	
Total quantity per set is 70 pcs.		I			
CROCODILE CLIPS, STANDARD	16	E	, e	Sy and the second se	
in packs of 20 pcs.		F		9	
		Ι			
CROCODILE CLIPS, MINIATURE	16	E		A STATE OF THE STA	
INSULATED		F			
10 pcs. Set of two colours; total quantity 20 pcs.		I	Contraction of the second seco		
4					
	Equipment guide list List number: 10 Technical field: Electronics Description P.C.B. SPACERS WITH STUD, 25 mm made from brass; in packs of 50 pcs. INSULATED TERMINALS, 4 mm set of seven colours: black, blue, green, brown, red, white and yellow; in packs of five pcs of each colour. Total quantity per set is 35 pcs. BANANA PLUGS, 4 mm set of seven colours: black, blue, green, brown, red, white and yellow; in packs of 10 pcs of each colour. Total quantity per set is 70 pcs. CROCODILE CLIPS, STANDARD in packs of 20 pcs. CROCODILE CLIPS, MINIATURE INSULATED with insulating covers; in packs of 10 pcs. Set of two colours; total quantity 20 pcs.	Equipment guide listList number: 10Technical field: ElectronicsDescriptionDescriptionQuantP.C.B. SPACERS WITH STUD, 25 mm10made from brass; in packs of 50 pcs.10INSULATED TERMINALS, 4 mm16set of seven colours: black, blue, green, brown, red, white and yellow; in packs of five pcs of each colour. Total quantity per set is 35 pcs.16BANANA PLUGS, 4 mm16set of seven colours: black, blue, green, brown, red, white and yellow; in packs of 10 pcs of each colour. Total quantity per set is 70 pcs.16cROCODILE CLIPS, STANDARD16in packs of 20 pcs.16with insulating covers; in packs of 10 pcs. Set of two colours; total quantity 20 pcs.16	Equipment guide listList number: 10Technical field: ElectronicsDescriptionQuant. UseP.C.B. SPACERS WITH STUD, 25 mm10made from brass; in packs of 50 pcs.1IIINSULATED TERMINALS, 4 mm16set of seven colours: black, blue, green, brown, red, white and yellow; in packs of five pcs of each colour. Total quantity per set is 35 pcs.16BANANA PLUGS, 4 mm16set of seven colours: black, blue, green, brown, red, white and yellow; in packs of 10 pcs of each colour. Total quantity per set is 70 pcs.16CROCODILE CLIPS, STANDARD in packs of 20 pcs.16Ein packs of 20 pcs.IWith insulating covers; in packs of 10 pcs. Set of two colours; total quantity 20 pcs.16	Equipment guide list List number: 10 Technical field: Electronics Description Quant Use Illustration P.C.B. SPACERS WITH STUD, 25 mm 10 E F made from brass; in packs of 50 pcs. I I INSULATED TERMINALS, 4 mm 16 E F set of seven colours: black, blue, green, brown, red, white and yellow; in packs of five pcs of each colour. Total quantity per set is 35 pcs. 16 E BANANA PLUGS, 4 mm 16 E F I set of seven colours: black, blue, green, brown, red, white and yellow; in packs of 10 pcs of each colour. Total quantity per set is 70 pcs. 16 E GROCODILE CLIPS, STANDARD 16 E F in packs of 20 pcs. I I I With insulating covers; in packs of I I E F In packs of 20 pcs. I I I With insulating covers; in packs of I I I I	

Note: Any similarity in above item descriptions and illustrations with specific makes or models is purely coincidental.

Page

	Equipment guide	e list				Date of issue
	Technical field: Electronics					November 1986
Item	Description		Quant.	Use	Illustration	
110.6.35	HEAT SINK COMPOUND to provide high heat semiconductor devices high insulation resi be chemically inert, moisture repelling wi stability.	transfer between and heat sinks; stance; should shock absorbing, th long-term	16	E F I	HEAT SINK COMPOUND	
110.6.36	INSULATING VARNISH a quick air drying va for insulating wound p.c.b.'s, transformer dry in air about 15 m hardening in 24 hrs.	rnish suitable components, s, etc. Touch in. Full In 500 ml tins.	8	E F I	INSULATING VARNISH	
110.6.37	CONTACT CLEANING AERO general purpose degre cleaner; should be su cleaning of electroni hardware. In about 3	SOL asing agent and itable for c components and 00 ml tins.	4	E F I		
110.6.38	SELF-AMALGAMATING TAP to produce waterproof Approx. width: In 10 m rolls.	E joints. 20-25 mm	16	E F I		
110.6.39	EPOXY ADHESIVE, QUICK consisting of two par hardner; should be s with metals, wood, gl plastics; approx. set min; in standard pack approx. 16g net tubes	SET ts resin and uitable for use ass and most ting time 5-10 , containing two	16	E F I	EPoxy ADHE Esin ADHES HARDEN	
Note	: Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundament D = Digital elec I = Industrial el *Basic item	als of el tronics, ectronic	ectron E = E s	ics, A = Analog electronic lectronic instrumentation,	s, Page

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	Technical field: Electronics					November 1986
ltem	Description		Quant.	Use	Illustration	
110.6.40	SINGLE COMPONENT STRO	NG ADHESIVE	16	E	L	
	based possibly on cyar component; should for in seconds; suitable metals, most plastics and rubber.	noacrylate m a clear bond for use with , ceramics, wood		F	Advestive	
	In 20 g bottles.					
110.6.41	STORAGE CARRYING CASE		16	E		
	for storing electroni	c components for		F		
	steel-framed rack of drawers and a tray co larger components and and top open for easy front fasteners shoul with two locks, key o Approx. dimensions: L 380 mm x W 320 Approx. capacity: 1 drawers of about th sizes.	clear plastic ntainer for tools; front access; the d be equipped perated. mm x D 180 mm tray and 14 ree different		I		
Note	Any similarity in above item de-	Legend: F = Fundament D = Digital elec	als of e	lectror E = 1	nics, A = Analog electronic Electronic instrumentation	s, Page
	specific makes or models is purely coincidental.	l = Industrial el *Basic item	ectronic	s		115

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List number: 10 Technical field: Electronics

SECTION 7 TRAINING AIDS AND REFERENCE LIBRARY

This section lists the overhead transparencies and videotapes related to the topics presented by the trainers and training kits. These audio-visual aids are helpful to the trainee for reviewing principles presented in the course, or for instructing trainees who may have missed a few classes.

The aids are also helpful to the instructor for basic reviews, while moving on to more complex theories and experiments.

Also included in this section is a reference library list consisting of semiconductors and components data books, handbooks on principles of electronics and design, standards and computer related literature (programming manuals, computer operating systems).

(Con with	Equipment guide	list				<u> </u>
MION	List number: 10 Technical field: Electronics					Date of issue November 1986
ltem	Description		Quant.	Use	Illustration	<u> </u>
110.7.1	OH TRANSPARENCIES, AC FUNDAMENTALS one set of standard-s transparencies, clear using multi-colours t components, current, shall be consistent w experiments listed in Minimum number of tra	/DC ize overhead ly labelled and o distinguish etc. Topics ith the 110.1.1. nsparencies: 10.	1	F		
110.7.2	VIDEOCASSETTES, AC/DC one set of videotapes local replay capabili colour and covering t in 110.1.1. Minimum cassettes: six.	FUNDAMENTALS , formatted to ties, in full he topics listed number of	1	F		
110.7.3	OHT, POWER SUPPLIES A one set of standard-s multi-colour overhead to present the topics 110.1.2. Minimum numb transparencies: 10.	ND AMPLIFIERS ize, transparencies listed in er of	1	A F		
110.7.4	VDC, POWER SUPPLIES A one set of videocasse colour, to present and topics listed in 110. for local replay capal language needs. Minim cassettes: six.	ND AMPLIFIERS ttes in full d explain the 1.2. Formatted bilities and um number of	1	A F		
Note	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundament D = Digital elec I = Industrial el *Basic item	als of electronics,	ectroni E = E	cs, A = Analog electronics, lectronic instrumentation,	Page 118

الماجه موتل	Equipment guide	list				
MID	List number: 10					
	Technical field: Electronics					Date of issue November 1986
Item	Description		Quant.	Use	Illustration	I
110.7.5	OH, TRANSPARENCIES, A one set of standard-s transparencies, multi clearly labelled and the topics covered in	NALOG LOGIC ize overhead -coloured, consistent with 110.1.3.	1	A		
110.7.6	Minimum number of tra VIDEOCASSETTES, ANALO one set of videocasse colour which shall pr explain the topics li Minimum hours of cas	nsparencies: 10. G LOGIC ttes in full esent and sted in 110.1.3. settes: 10.	1	А		
110.7.7	OH TRANSPARENCIES, DI one set of standard-s transparencies, multi clearly labelled and the topics covered in Minimum number of tra	GITAL LOGIC ize overhead -coloured, consistent with 110.1.4. nsparencies: 10.	1	D		
110.7.8	VIDEOCASSETTES, DIGIT one set of videotapes to present and explai listed in 110.1.4. M tapes: 10.	AL LOGIC in full colour n the topics inimum hours of	1	D		
110.7.9	OH TRANSPARENCIES, MI one set of standard-s transparencies, multi clearly labelled and the topics covered in Minimum number of tra	CROPROCESSORS ize overhead -coloured, consistent with 110.1.7. nsparencies: 10.	1	D		
Note	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundament D = Digital elec I = Industrial el *Basic item	als of el tronics, ectronic	ectron E = E s	ics, A = Analog electronic: Electronic instrumentation,	s, Page 119

VIION	Equipment guide list List number: 10 Technical field: Electronics				Date of issue November 1986
ltem	Description	Quant.	Use	Illustration	<u></u>
110.7.10	VIDEOCASSETTES, MICROPROCESSORS one set of videocassettes, in full colour, which shall present and explain the topics covered in 110.1.7. Minimum hours of tapes: 10.	1	D		
110.7.11	OH TRANSPARENCIES, POWER CONTROL one set of standard-size overhead transparencies, clearly labelled, multi-coloured, to be compatible with item 110.1.6. Minimum number of transparencies: 10.	1	I		
110.7.12	VIDEOCASSETTES, POWER CONTROL one set of videocassettes, in full colour, to explain power control subject and compatible with item 110.1.6.	1	Ι		
110.7.13	DATA BOOK, TRANSISTORS a comprehensive data book to include all electrical and mechanical data of audio, general purpose, high frequency, switching transistors and other p-n-p and n-p-n devices in use.	2	A D		
110.7.14	DATA BOOK, DIODES a comprehensive data book to include all electrical and mechanical data of signal diodes and voltage reference diodes, low power rectifiers in use.	2	A D		
Note	: Any similarity in above item de- scriptions and illustrations with specific makes or models is understand	tals of electronics,	lectron E = E s	nics, A = Analog electronic Electronic instrumentation,	cs, Page 120



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Technical field: Electronics

Item	Description		Quant.	Use	Illustration	
110.7.15	DATA BOOK, THYRISTORS a comprehensive data h all electrical and mee thyristors and triacs	book to include chanical data of in use.	2	I		
110.7.16	DATA BOOK, DIGITAL IC a comprehensive data h all electrical and med all digital IC's in us exception of microprod	'S book to include chanical data of se with cessors.	2	D		
110.7.17	DATA BOOK, LINEAR IC's a comprehensive data l all electrical and me operational amplifiers connectors, video amp switches, etc. in use	S book to include chanical data of s, comparators, lifiers, analog	2	А		
110.7.18	DATA BOOK, INTERFACE a comprehensive data l all electrical and me interface integrated o	IC'S book to include chanical data of circuits in use.	2	D		
110.7.19	DATA BOOK, MEMORY IC's a comprehensive data a all electrical and me memory integrated cire	S book to`include chanical data of cuits in use.	2	D		
Note	: Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundament D = Digital elec I = Industrial el *Basic item	als of el ctronics, ectronic	ectron E = E s	ics, $A = Analog electronics, Electronic instrumentation,$	Page 121

(Equipment guide	list			· · · ·	
AUDI	List number: 10					Data af issue
	Technical field: Electronics					November 1986
ltem	Description		Quant.	Use	Illustration	
110.7.20	DATA BOOK, MICROPROCE a comprehensive data all electrical and me all modern microproce	SSORS book to include chanical data of ssors in use.	2	D		
110.7.21	DATA BOOK, VOLTAGE RE a comprehensive data all electrical and me voltage regulators, so pass, shunt, precision regulators in use.	GULATORS book to include chanical data of witches, serial n voltage	2	F		
110.7.22	DATA BOOK, OPTOELECTR a comprehensive data all electrical and me modern optoelectronic	ONIC DEVICES book to include chanical data of devices in use.	2	I		
110.7.23	DATA BOOK, POWER SEMI a comprehensive data all electrical and me power semiconductors	CONDUCTORS book to include chanical data of in use.	2	I		
110.7.24	DATA BOOK, MICROCOMPU a comprehensive data all major microcomput	TER SYSTEMS book covering er systems.	2	D		
110.7.25	DATA BOOK, CERAMIC CA a comprehensive data electrical and mechan modern ceramic capaci	PACITORS book to include ical data of tors.	2	A D F		
Note:	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundament D = Digital elec I = Industrial el *Basic item	tals of el ctronics, lectronic	ectron E = E s	ics, A = Analog electronics lectronic instrumentation,	, Page 122



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Date of issue November 1986

Technical field: Electronics

ltem	Description		Quant.	Use	Illustration	
110.7.26	DATA BOOK, ELECTROLYT a comprehensive data electrical and mechan modern electrolytic ca	IC CAPACITORS book to include ical data of apacitors.	2	A D F		
110.7.27	DATA BOOK, RESISTORS a comprehensive data electrical and mechan kind of resistors.	book to include ical data of all	2	A D F		
110.7.28	HANDBOOK, P.C.B. DESIG for initial stage of circuits development. include the typical a as used in modern cir ground rules for prep as well as conversion diagrams and artwork. cover component and 1 optimum I.C. grouping boards, flexible circ manufacturing techniq requirements, ground r.f.i. shielding.	GN electronic The book should rtwork layouts cuity and give aring schematic into wiring It should ogic theory, multilayer uits, p.c.b. ues and plane rules anf	2	A D F		
Note	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundament D = Digital elec I = Industrial el *Basic item	als of el tronics, ectronic	ectror E = E s	tics, $A = Analog electronics,$ Electronic instrumentation,	Page 123

	Equipment guide	e list				Date of issue
Item	Description	, <u></u> ,,	Quant.	Use	Illustration	
110.7.29	HANDBOOK, SOLDERING I a comprehensive refer soldering in the manu development of electr The book should cover materials, soldering joint design, quality wetting theory, therm alloys, fluxes and fl soldering, machine so including reflow, man desoldering and resol title of the book dep only and the offered other title)	N ELECTRONICS ence on facture and onic assemblies. solderable techniques, assessment, al aspects uxing, p.c.b. ldering ual soldering, dering. (The icts subject book may bear	2	F		
110.7.30	HANDBOOK, PRACTICAL E the book or series of cover fundamentals of electronics necessary application including instrumentation. It trainee exercise orie major laboratory exer introductory material	LECTRONICS books should electricity and for industrial should be nted and contain cises and	2	F		
110.7.31	HANDBOOK, LINEAR ELEC a comprehensive guide electronics circuits operational amplifier shall include applica amps, inverters, non- followers, differenti analog computing circ instrumentation, acti regulated power suppl detectors, zero detec amplifiers, waveform A converters, demodul transducer circuits p methods of troublesho circuits.	TRONICS on linear based on the . The book tions of op inverting al amplifiers, outs, ve filters, ies, threshold tors, d.c. generation, D to ation, reamplifiers and ooting in linear	2	F		
Note	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundament D = Digital elec I = Industrial ele •Basic item	als of el tronics, ectronic	ectron E = E s	ics, A = Analog electronics lectronic instrumentation,	s, Page 124

List number: 10 Date of issue Technical field: Electronics November 1986 Item Quant. Use Illustration Description 2 D 110.7.32 HANDBOOK, DIGITAL ELECTRONICS the book should explain the fundamentals of conventional computing; how microcomputers and microprocessors work; input-output peripherals; machine language programming; flow charting; high level programming; data transmission and communication. 2 Ι 110.7.33 HANDBOOK, CONTROL ENGINEERING the book should cover microprocessor based systems and power electronics in control engineering. It should include both theory and worked out examples of transducers, linear amplifiers and computers, power electronics, electrical machines, digital control, speed control, position control, hydraulic and pneumatic control. 2 I 110.7.34 BOOK, SENSORS, DETECTORS, TRANSDUCERS the book should give a comprehensive coverage of sensors in common use in detection, intrumentation and control, the construction, performance and typical application of potentiometers, syncros, variable transformers, strain gauges, vibration transducers, accelerometers, crystals, pressure sensors, proximity detectors, frequency, current, power and voltage transducers, fluid level and flow meters, ultrasonic and microwave detection, photodetectors, temperature sensors. Note: Any similarity in above item de-Legend: F = Fundamentals of electronics, A = Analog electronics, Page scriptions and illustrations with D = Digital electronics, E = Electronic instrumentation, I = Industrial electronics specific makes or models is 125 *Basic item purely coincidental.

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STION ST	List number: 10					Date of issue
	Technical field: Electronics		Quant	1100	Illustration	November 198
	Description	100 11 0 12 14 14 10 10 10 10 10 10 10 10 10 10 10 10 10	Quant.	Use		
110.7.35	HANDBOOK, DIGITAL INS the book should cover fundamentals of the t and use of digital in their components, log counters, timers, ope amplifiers, analog to converters.	TRUMENTATION the heory, design struments and ic circuitries, rational digital	4	D		
110 7 36	HANDBOOK FLECTRONIC	FILTER DESIGN	4	A		
110.7.50	the book should provi comprehensive theoret both active and passi on an electronic tech practice and design o book should give broa build sophisticated f recourse to high math book should include: bandpass filter inclu function types as wel lines, equalisers and	de a ical coverage of ve filter design nician level, riented. The d guidelines to ilters without ematics. The low, high and ding elliptical l as delay LC refinements.		F		
110 7 37	HANDBOOK OSCILLOSCOP	FS	8	Δ		7
	the book should cover operation of general oscilloscopes, their and applications as w types, sampling, spec state analysers.	detailed purpose basic circuity ell as storage trum and logic		D F I		
Note	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundament D = Digital elec I = Industrial ele *Basic item	L als of el stronics, ectronic	ectron E = E s	ics, A = Analog electronics lectronic instrumentation,	s, Page 126

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	Technical field: Electronics					Novemb	er 1986
ltem	Description		Quant.	Use	Illustration		
110.7.38	REFERENCE BOOK, ELECT CIRCUITS the book should conta diagrams of proven pr solid-stage circuits wide number of applic instrumentation, audi counters, automotive, lamp and motor contro noise suppression, mi fibre optic, communic	RONIC in practical edesigned for use in a ations: o, frequency clocks, alarms, l, protection, croprocessors, ations, etc.	8	A F D E I			
110.7.39	BOOK, STANDARD INTERN the book containing f Standard Internationa Units, their relation different previous sy may also probably inc characteristics and p materials related to electronic engineerin	ATIONAL (SI) ull coverage of l System of ship to stems of units, lude roperties of electrical and g.	16	A D F I			
110.7.40	HANDBOOK, CAD PRINCIP APPLICATIONS the book should give information on two-an dimensional computer systems. It shall co following instruction units, properties, sw input, output, group library, hatch, inqui give an approach to e selection of CAD, bas requirements.	LES, practical d-three aided design ver at least the s and menus: itches, filer, , window, re as well as valuation and ed on	8	D			
110.7.41	PROGRAMMING MANUAL, B	ASIC	16	D			
Note	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundamenta D = Digital elect I = Industrial elec *Basic item	Is of ele ronics, ctronic:	ectron E = E s	ics, A = Analog electronics lectronic instrumentation,	,	Page 127

(IIO)	<i>Equipment guide</i> List number: 10	list				Date of issue
	Technical field: Electronics					November 1986
ltem	Description		Quant.	Use	Illustration	
110.7.42	PROGRAMMING MANUAL, P	ASCAL	16	D		
110.7.43	PROGRAMMING MANUAL, C	OBOL	16	D		
110.7.44	PROGRAMMING MANUAL, F	ORTRAN	16	D		
110.7.45	HANDBOOK, COMPUTER OP SYSTEMS the book should descr operating systems in	ERATING ibe the major use.	4	D		
110.7.46	HANDBOOK DIGITAL INST the book should cover fundamentals of the t and use of digital in their components, lo counters, timers, ope amplifiers, analogue convertors.	RUMENTATION the heory, design struments and gic circuitries, rational to digital	8	D		
Note	Any similarity in above item de- scriptions and illustrations with specific makes or models is purely coincidental.	Legend: F = Fundamenta D = Digital elec I = Industrial ele *Basic item	als of el tronics, ectronic	ectron E = E s	ics, A = Analog electronics lectronic instrumentation,	, Page 128



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WORKSHOP LAYOUTS FOR ELECTRONICS

1. These layouts show how the required equipment items may be suitably arranged. They also show additional accomodation for storage of training equipment. However, the range of equipment and placing of individual items will depend on various local conditions, such as:

- (a) accomodation at the existing site(s), (area, number of rooms, placement of utilities, etc.);
- (b) training programme and its schedule: number of trainees, classes, laboratory hours;
- (c) availability of furniture;
- (d) climatic conditions;
- (e) plans for future upgrading of training programmes.

2. Workbenches should be provided with safe electrical fittings and the whole workshop should be powered via a common switch box, equipped with safety protection devices. It is further recommended in some premises that each bench be equipped with an isolating transformer (of adequate power) to ensure safe working conditions on AC mains voltage. For safety reasons, it is also recommended that the workshop floor be covered with an insulating material (wood, plastic, etc.), especially when the workbenches are supplied directly from an AC mains line.

3. In areas where the AC mains voltage is not kept constant within a tolerance of 10%, a suitable AC voltage stabiliser should be used.

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Item no.

AC MOTOR SPEED CONTROL UNIT	110.1.10
ADJUSTABLE DC POWER SUPPLY, 0-20V	110.3.33
ADJUSTABLE DC POWER SUPPLY, 2x20V	110.3.39
ADJUSTABLE DUAL POWER SUPPLY 2x35V	110.3.40
ANALOG AC MILLIVOLTMETER, 12 MHZ	110.3.3
ANALOG DC MICROVOLTMETER	110.3.4
ANALOG ELECTRONIC AC/DC MULTIMETER	110.3.2
ANALOG GENERAL PURPOSE AVOMETER	110.3.1
ANALOG LOGIC TRAINER	110.1.3
ANGULAR POSITION UNIT	110.1.11
AUTOMATIC CENTRE PUNCH, 120 mm	110.5.14
BALL PLEIN HAMMER, 150 g	110.5.12
BANANA PLUGS, 4 mm	110.6.33
BASIC ELECTRICITY & ELECTRONICS TRAINER	110.1.1
BENCH DRILL PRESS, 6.5 mm	110.5.15
BENCH LIGHT, FLUORESCENT	110.4.15
BOOK, SENSORS, DETECTORS, TRANSDUCERS	110.7.34
BOOK, STANDARD INTERNATIONAL (SI)	110.7.39
C-MOS LOGIC PROBE CAMERA FOR SPECTRUM ANALYSER CLASP PICK-UP CLEAR PLASTIC SHEET, 3 mm CNC MACHINE SYSTEM, 3D COLOUR MARKERS SET COMBINED WRAPPING TOOL COMPACT OPTICAL DISK COMPUTER AIDED DESIGN SOFTWARE COMPUTER AIDED PCB DESIGN AND MANUFACTURING COMPUTER CLEANING SOLVENT COMPUTER DESK CONTACT CLEANING AEROSOL COPPER-CLAD BOARD, DOUBLE-SIDED COPPER-CLAD BOARD, SINGLE-SIDED COUNTER, 40 MHz CROCODILE CLIPS, MINIATURE INSULATED CROCODILE CLIPS, STANDARD CUTTING PLIERS, 0.5 mm CUTTING PLIERS, 0.8 mm CUTTING PLIERS, 1.2 mm	110.3.25 $110.3.14A$ $110.5.30$ $110.6.4$ $110.2.37$ $110.2.22A$ $110.5.45$ $110.2.33$ $110.2.11$ $110.2.36$ $110.2.45$ $110.2.45$ $110.4.4$ $110.4.3$ $110.4.3$ $110.6.34B$ $110.6.34B$ $110.6.34A$ $110.5.39$ $110.5.38$ $110.5.37$
D.I.L. SOCKET, LOW PROFILE, 14-WAY D.I.L. SOCKET, LOW PROFILE, 20-WAY D.I.L. SOCKET, LOW PROFILE, 28-WAY D.I.L. SOCKET, LOW PROFILE, 40-WAY D.I.L. SOCKET, LOW PROFILE, 6-WAY D.I.L. SOCKET, LOW PROFILE, 8-WAY D.I.L. SOCKET, WIRE WRAPPING, 14-WAY D.I.L. SOCKET, WIRE WRAPPING, 18-WAY D.I.L. SOCKET, WIRE WRAPPING, 20-WAY D.I.L. SOCKET, WIRE WRAPPING, 8-WAY D.I.L. SOCKETS, WIRE WRAPPING, 24-WAY D.I.L. SOCKETS, WIRE WRAPPING, 28-WAY	110.6.18 $110.6.20$ $110.6.21$ $110.6.16$ $110.6.23$ $110.6.24$ $110.6.25$ $110.6.22$ $110.6.22$ $110.6.26$ $110.6.27$

	Item no.
D.I.L. SOCKETS, WIRE WRAPPING, 40-WAY	110.6.28
DATA BOOK, CERAMIC CAPACITORS	110.7.25
DATA BOOK, DIGITAL IC'S	110.7.16
DATA BOOK, DIODES	110.7.14
DATA BOOK, ELECTROLYTIC CAPACITORS	110.7.26
DATA BOOK, INTERFACE IC'S	110.7.18
DATA BOOK, LINEAR IC'S	110.7.17
DATA BOOK, MEMORY IC'S	110.7.19
DATA BOOK, MICROCOMPUTER SYSTEMS	110.7.24
DATA BOOK, MICROPROCESSORS	110.7.20
DATA BOOK, OPTOELECTRONIC DEVICES	110.7.22
DATA BOOK, POWER SEMICONDUCTORS	110.7.23
DATA BOOK, RESISTORS	110.7.27
DATA BOOK, THYRISTORS	110.7.15
DATA BOOK, TRANSISTORS	110.7.13
DATA BOUK, VULIAGE REGULATORS	110.7.21
DATADASE SUFIWARE	110.2.4
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DE-SOLDER BRAID, IMM WIDE DE-SOLDER BRAID, 2mm WIDE	110.0.2A
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DE SOLDERING STRITON	110.5.55
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DECADE RESISTANCE BOX	110.3.28
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DIGITAL CALIPER. 0-150 mm	110.5.2
DIGITAL EXERCISES KIT	110.1.5
DIGITAL IC TESTER	110.3.23
DIGITAL LCR METER	110.3.27
DIGITAL LOGIC TRAINER	110.1.4
DIGITAL MICROMETER, 0-25 mm	110.5.1
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DIGITAL RMS MULTIMETER, DC-20 MHZ	110.3.5
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DIGITAL THERMOMETER	110.3.30
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DUT MATRIX PRINTER, A4	110.2.15
DUUBLE FLUPPY DISK DRIVE, 5.25 INCH	110.2.24
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DOAL TRACE OSCILLOSCOFE, SO-75 Finz	110.3.9
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ELECTRICALLY CONDUCTIVE PAINT	110.4.14
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EPOXY ADHESIVE, QUICK SET	110.6.39
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ETCH RESIST P.C.B. TRANSFERS, SET	110.4.9
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LITED DC DOMED SUDDIA 372A LITED DC DOMED SUDDIA 372A	110 3 25
FINED DO FOWER SUFFLI 2X3V	110 2 24
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	110.3.16
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HANDBOOK, DIGITAL INSTRUMENTATION	110.7.35
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HANDBOOK, LINEAR ELECTRONICS	110.7.31
HANDBOOK, OSCILLOSCOPES	110.7.37
HANDBOOK, P.C.B. DESIGN	110.7.28
HANDBOOK, PRACTICAL ELECTRONICS	110.7.30
HANDBOOK, SOLDERING IN ELECTRONICS	110.7.29
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HSS TAP SET	110.5.21
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110.4.7	PERCEUSE POUR CCI
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110.4.11 110.4.12 110.4.13 110.4.14	PRODUITS CHIMIQUES DE TRAITEMENT DE CIRCUITS IMPRIMES CRISTAUX D'ETAMAGE POUR CCI PEINTURE, CONDUCTEUR D'ELECTRICITE
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110.4.11 110.4.12 110.4.13 110.4.14 110.4.15 110.4.16 110.4.17	SYSTEME DE PREPARATION MODULATRE POUR CCT PRODUITS CHIMIQUES DE TRAITEMENT DE CIRCUITS IMPRIMES CRISTAUX D'ETAMAGE POUR CCI PEINTURE, CONDUCTEUR D'ELECTRICITE LUMIERE DE BANC, FLUORESCENTE PORTE/SUPPORT DE CCI VERRE D'INSPECTION DE CCI
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110.4.11 110.4.12 110.4.13 110.4.14 110.4.15 110.4.16 110.4.17 110.4.18 110.4.19 110.4.20A	SYSTEME DE PREPARATION MODULATRE POUR CCT PRODUITS CHIMIQUES DE TRAITEMENT DE CIRCUITS IMPRIMES CRISTAUX D'ETAMAGE POUR CCI PEINTURE, CONDUCTEUR D'ELECTRICITE LUMIERE DE BANC, FLUORESCENTE PORTE/SUPPORT DE CCI VERRE D'INSPECTION DE CCI CADRE DE CIRCUIT IMPRIME LUNETTES PROTECTRICES GANTS PROTECTEUR, CAOUTCHOUC, PETITS
110.4.11 110.4.12 110.4.13 110.4.14 110.4.15 110.4.16 110.4.17 110.4.18 110.4.19 110.4.20A 110.4.20B	SYSTEME DE PREPARATION MODULATRE POUR CCT PRODUITS CHIMIQUES DE TRAITEMENT DE CIRCUITS IMPRIMES CRISTAUX D'ETAMAGE POUR CCI PEINTURE, CONDUCTEUR D'ELECTRICITE LUMIERE DE BANC, FLUORESCENTE PORTE/SUPPORT DE CCI VERRE D'INSPECTION DE CCI CADRE DE CIRCUIT IMPRIME LUNETTES PROTECTRICES GANTS PROTECTEUR, CAOUTCHOUC, PETITS GANTS PROTECTEUR, CAOUTCHOUC, MOYENS

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110 5 1	
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110.5.2	PIED A COULISSE NUMERIQUE, U-ISU mm
110.5.3	REGLE, 300 mm
110.5.4	METRE, 3 m
110.5.5	MACHINE A EMBOBINER
110.5.6	MEULEUSE D'ETABLI - 150 mm
110.5.7	CISAILLES, 190 mm
110.5.7A	POINTE A TRACER, 175 mm
110.5.8	SCIE A METAUX, PETITE, 230 mm
110.5.8A	LAMES DE SCIE A METAUX, 150 mm
110.5.9	CISEAU, TYPE INDUSTRIEL, 210 mm
110.5.10	COUTEAU DE DECOUPAGE, 160 mm
110.5.11	SCALPEL, 140 mm
110.5.12	MARTEAU A TETE RONDE, 150 g
110.5.13	POINCON DE MARQUAGE, ENSEMBLE ALPHANUMERIQUE
110.5.14	POINTEAU DE CENTRAGE AUTOMATIQUE, 120 mm
110.5.15	BATI DE PERCEUSE D'ETABLI, 6.5 mm
110.5.15A	JEU DE FORETS, 0.8 - 6.5 mm ACIER RAPIDE
110.5.15B	MANDRIN A CLEF
110.5.15C	ETAU, PETIT
110.5.16	PERCEUSE A MAIN ELECTRIQUE, 10 mm
110.5.17	BRIDE DE FIXATION G, A ROTULE
110.5.18	PETIT ETAU DE MACHINE
110.5.19	JEU DE FILIERES, ACIER RAPIDE
110.5.20	FILIERES
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110.5.22	TOURNE A GAUCHE, TARAUD
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110.5.30	PINCE A GRIFFES
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110.5.35	PINCES A NEZ PLAT, 140 mm
110.5.36	PINCES UNIVERSELLES, 150 mm
110.5.37	PINCES DE COUPE, 1.2 mm
110.5.38	PINCES DE COUPE, 0.8 mm
110.5.39	PINCES DE COUPE, 0.5 mm
110.5.40	PINCES A NEZ AIGUILLE, EXTRA LONGUES
110.5.41	PINCES A NEZ AIGUILLE, STANDARD
110.5.42	PINCES COUDEES A NEZ AIGUILLE, LONGUES
110.5.43	PINCE DE FORMAGE, 120 mm
110.5.44	PINCES A NEZ ROND, 120 mm
110.5.45	OUTIL D'ENVELOPPAGE COMBINE
110.5.46	JEU D'OUTILS D'EXTRACTION ET D'INSERTION DE CIRCUITS INTEGRES
110.5.47	BOITE A OUTILS

POSTE DE SOUDAGE
FER A SOUDER, 30W
FER A SOUDER, 40W
FER A SOUDER UNIVERSEL, 15 W
FER A SOUDER UNIVERSEL, 30 W
FER A SOUDER UNIVERSEL, 40 W
FER A SOUDER UNIVERSEL, 100 W
PORTE-FER A SOUDER
PISTOLET A SOUDER INSTANTANE
POSTE DE DESSOUDAGE
OUTIL DE DESSOUDAGE
FER A SOUDER A TEMPERATURE VARIABLE
JEU D'EMBOUT DE DESSOUDAGE DE CIRCUITS INTEGRES
PUITS DE CHALEUR
MIROIR D'INSPECTION
VERRE D'INSPECTION ECLAIRE
CORDONS D'ESSAI
BAGUETTES D'ESSAI, 4 mm
CROCHET A RESSORT
JEU DE PINCES D'ESSAI DE CIRCUITS INTEGRES
NECESSAIRE ANTISTATIQUE POUR POSTE DE TRAVAIL
FOUR ELECTRIQUE DE LABORATOIRE

CHAPITRE 6 COMPOSANTS ET PRODUITS DE CONSOMMATION

110.6.1A	SOUDURE, STANDARD
110.6.1B	SOUDURE, POINT DE FUSION BAS
110.6.1C	SOUDURE, UNIVERSELLE
110.6.2A	FIL DE DESSOUDAGE, 1 mm DE LARGE
110.6.2B	FIL DE DESSOUDAGE, 2 mm DE LARGE
110.6.3A	FEUILLES D'ALUMIMIUM SIMPLE, 1.2 mm
110.6.3B	FEUILLES D'ALUMINIUM SIMPLE, 2.0 mm
110.6.4	FEUILLES DE PLASTIQUE TRANSPARENT, 3 mm
110.6.5A	PIED A VIS, DIA. 12.5 mm
110.6.5B	PIED A VIS, DIA. 15.5 mm
110.6.5C	PIED A VIS, DIA. 19 mm
110.6.6	ENSEMBLES DE VIS, TETE PLATE A FENTE
110.6.7	ENSEMBLES DE VIS, TETE FRAISEE A FENTE
110.6.8	ENSEMBLES DE VIS, TETE FRAISEE A FENTE
110.6.9	ENSEMBLES D'ECROUS ET RONDELLES, METRIQUES
110.6.10	FIL D'ENVELOPPAGE ISOLE, 0.25 mm/ROUGE
110.6.11	FIL D'ENVELOPPAGE ISOLE, 0.25 mm/BLEU
110.6.12	FIL D'ENVELOPPAGE ISOLE, 0.25 mm/NOIR
110.6.13	FIL D'ENVELOPPAGE ISOLE, 0.25 mm/JAUNE
110.6.14	FIL D'ENVELOPPAGE ISOLE, 0.25 mm/VERT
110.6.15	FICHE DE TERMINAISON, ENVELOPPAGE ISOLE, 18 mm
110.6.16	DOUILLE, D.I.L., BASSE, 6 VOIES
110.6.17	DOUILLE, D.I.L., BASSE, 8 VOIES
110.6.18	DOUILLE, D.I.L., BASSE, 14 VOIES
110.6.19	DOUILLE, D.I.L., BASSE, 20 VOIES
110.6.20	DOUILLE, D.I.L., BASSE, 28 VOIES
110.6.21	DOUILLE, D.I.L., BASSE, 40 VOIES
110.6.22	DOUILLE, D.I.L., ENVELOPPAGE DE FIL, 8 VOIES
110.6.23	DOUILLE, D.I.L., ENVELOPPAGE DE FIL, 14 VOIES

110.6.24	DOUILLE, D.I.L., ENVELOPPAGE DE FIL, 18 VOIES
110.6.25	DOUILLE, D.I.L., ENVELOPPAGE DE FIL, 20 VOIES
110.6.26	DOUILLE, D.I.L., ENVELOPPAGE DE FIL 24 VOIES
110.6.27	DOUILLE, D.I.L., ENVELOPPAGE DE FIL 28 VOIES
110.6.28	DOUILLE, D.I.L., ENVELOPPAGE DE FIL 40 VOIES
110.6.29	POSTES DE FILS MULTI-VOIES, JEU
110.6.30	COLONNES DE CCI, STANDARD
110.6.31A	ENTRETOISES DE CCI AVEC GOUJON, 10 mm
110.6.31B	ENTRETOISES DE CCI AVEC GOUJON, 15 mm
110.6.31C	ENTRETOISES DE CCI AVEC GOUJON, 25 mm
110.6.32	COSSES ISOLEES, 4 mm
110.6.33	PRISES BANANE, 4 mm
110.6.34A	PINCES CROCODILE, STANDARD
110.6.34B	PINCES CROCODILE, MINIATURES, ISOLEES
110.6.35	COMPOSE DISSIPATEUR THERMIQUE
110.6.36	VERNIS ISOLANT
110.6.37	AEROSOL DE NETTOYAGE DE CONTACT
110.6.38	BANDE AUTO- AMALGAMANTE
110.6.39	ADHESIF EPOXY, PRISE RAPIDE
110.6.40	ADHESIF PUISSANT A COMPOSANT SIMPLE
110.6.41	MALLETTE DE RANGEMENT PORTABLE

CHAPITRE 7 AIDE A LA FORMATION ET BIBLIOTHEQUE DE REFERENCE

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110.7.2	CASSETTES VIDEO - PRINCIPES CA/CC
110.7.3	TRANSPARENTS DE RETROPROJECTION - ALIMENTATIONS ET AMPLIFICATEURS
110.7.4	CASSETTES VIDEO - ALIMENTATIONS ET AMPLIFICATEURS
110.7.5	TRANSPARENTS DE RETROPROJECTION - ANALOGIQUE LOGIQUE
110.7.6	CASSETTES VIDEO - ANALOGIQUE LOGIQUE
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110.7.33	MANUEL - TECHNIQUES DES REGLAGES
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DISCOS FLEXIBLES, 5,25 PULGADAS
DISCOS FLEXIBLES, 5,25 PULGADAS
CAJA ALMACENAMIENTO DISCOS DE 5,25 PULGADAS
DISCOS DE 3.5 PULGADAS
CAJA ALMACENAMIENTO DISCOS DE 3.5 PULGADAS
DISCO DURO, EXTERNO
ONDULADOR DE CINTA
CASETE DE ALMACENAMIENTO
UNIDAD DE MANDO PARA DISCO OPTICO COMPACTO
DISCO OPTICO COMPACTO
PANTALLA DE VIDEO MONOCROMATICA
PANTALLA DE VIDEO A COLOR RGB
FABRICACION Y DISENO DE TCI POR COMPUTADORA
SISTEMA DE MANDO DIGITAL POR COMPUTADORA
REGULADOR DE TENSION DE LINEA, 400 VA
REGULADOR DE TENSION DE LINEA, 800 VA
FUENTE DE POTENCIA ININTERRUMPIBLE, 250 VA
FUENTE DE POTENCIA ININTERRUMPIBLE, 500 VA
MESA COMPUTADORA
MESA IMPRESORA
ARMARIO PARA COMPUTADORA PERSONAL
EQUIPO DE LIMPIEZA P/UNIDAD MANDO DE DISCO FLEXIBLE
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ILO	TECHNICAL CO-OPERAT AND SUBCONTRACTING BR	ION EQUIPMENT ANCH (EQUIPRO))	EQUIPMENT REQUEST
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Reference: ILO Equipment Planning Guide No. 10 - Electronics

The following suggestions are given to improve the guide:

Name: Institution: Address:

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