

FORM 10

Regulation 50 (5)

THE PUBLIC PROCUREMENT AND DISPOSAL OF PUBLIC ASSETS ACT, 2003

RECORD OF MINUTES OF PRE-BID MEETING

Procurement Reference Number			
Code of Procuring and Disposing Entity	Supplies/Works/ Non-consultancy services	Financial year	Sequence number
MOES	SUPPLIES	2019-2020	00224
Particulars of Procurement			
Subject of procurement	PPPLY, DELIVERY, INSTALLATION AND COMMISSIONING OF EQUIPMENT AND ACCESSORIES FOR GANDA PETROLEUM INSITITUTE KIGUMBA-ELECTRICAL, PERSONNEL PROTECTION AND STRUMENTATION EQUIPMENT		
Location of Pre-bid Meeting	Via zoom		
Date and time of Meeting	27th July 2020 at 11:00am		

Agenda:

Prayer

1. Communication from the chair
2. Communication from the Procurement Officer
3. Issues from the service providers.

Min.1. Payer was led by Mr Valentine Owor.

Min.2The chair welcomed the members to the meeting, thanked them for appreciating the current global conditions and attending the meeting virtually. He gave a brief background to the procurement, and welcomed the procurement officer for a brief word to the bidders before bidders could start raising issues.

Min.3.The procurement officer thanked members for turning up in big numbers and reminded the bidders to carefully read the solicitation document and adhere to all instructions to ensure avoidable mistakes are not made.

Min.4. Issues are handled in the table below.

Record of Pre-bid Meeting Minutes	
Question asked	Response given
<p>ITB 22.1 Bid Closure submission date: Is it possible to extend the bid closure to since these are many items and most manufacturers are working half day and are still under lockdown.</p>	<p>Bid submission deadline has been extended to 16th-September 2020. Time 11:00am (Local time). Refer to Addendum 1</p>
<p>ITB 11.1J Audited Books: Audited financial statements 2020 is not possible, as year is not yet finalized, is it okay to submit 2017,2018 & 2019</p>	<p>It is okay to submit Audited books for 2017,2018 & 2019. Refer to Addendum 1</p>
<p>ITB 22.1 Clarification on the “how to” submit on line</p>	<p>The details of bid submission have been provided in the bidding document. Please refer to ITB 22.1 of the Bid Data sheet.</p>
<p>For electronic submission, it is acceptable to provide MOES with a link to view and download the bid from a secure area of our website? Password can be provided shortly before bid opening. We are worried that e-mails would not get through due to file sizes</p>	<p>The submission by email is possible. The details of bid submission have been provided in the bidding document. Please refer to ITB 22.1 of the Bid Data sheet.</p>

<p>There are so many issues with the technical specification, should we raise them here?</p>	<p>Please send all the noted issues to MOES using the emails provided in the Bidding Document Section 2 Bid Data Sheet ITB 7.1 to enable MOES provide a comprehensive response.</p>
<p>ITB 20.2 Power of Attorney: International firms can not have them registered by URSB since most counties are still under lock down. To register a Power of Attorney the following is required:</p> <ol style="list-style-type: none"> 1. Original Power of Attorney 2. The members must be physically present. <p>Please guide on way forward since both the above are not possible.</p>	<p>For international firms, the Power of attorney shall be notarized. The requirement for having them registered by URSB in line with ITB 20.2 has been Reviewed– Refer to Addendum No.1.</p>

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<p>Bid Security:</p> <p>i) Kindly confirm that the beneficiary is the Ministry of Education and Sports. Despite in, BDS ITB 1.1 it is indicated that the purchaser is the Government of the Republic of Uganda.</p> <p>ii) In clause BDS ITB 19.1. It is mentioned that Bid security shall be delivered in form of a hard copy or SWIFT. As a result, is it possible to submit the copy of swift message sent by our bank to the local bank with opening instructions and submit the original through the agent after bid opening?</p> <p>iii) Is it also acceptable a bank guarantee issued by a reputable Italian bank?</p> <p>iv) In case of a soft copy submission, is it possible to email the scanned copy of the bank guarantee and submit the hard copy through our local agent after bid opening?</p>	<p>i) Yes, the purchaser is Government of the Republic of Uganda represented by Ministry of Education and Sports.</p> <p>ii) All bid securities must be submitted before the bid submission deadline</p> <p>iii) The Bank Guarantee issued by an Italian Bank can only be accepted if it has a corresponding Bank in Uganda to enforce the guarantee. Please refer to clause 19 of section 1 of the bidding document.</p> <p>iv) Yes, as long as the content and date of the soft copy are the same as the hard copy. And the hard copy reaches the MOES by the bid submission deadline.</p>
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Can we bid for a less percentage of quantities in a lot? For example, quote for 75% of a lot?	No, Quote for 100% of the quantities Refer to ITB 14.6 of the Bid Data Sheet.

ADDENDUM NO. 1 FOR SUPPLY, INSTALLATION, TRAINING USERS AND COMMISSIONING OF EQUIPMENT AND ACCESSORIES FOR UGANDA PETROLEUM INSTITUTE KIGUMBA – ELECTRICAL, PERSONNEL PROTECTION AND INSTRUMENTATION EQUIPMENT

This is to submit revised Specifications as follows:

1	ITB 22.1 Bid Closure <u>Submission on</u> 11th August 2020. Time 11:00am	<p>REPLACE: Bid Closure<u>submission on</u> 11th August 2020. Time 11:00am</p> <p style="text-align: center;">WITH</p> <p>Bid ClosBid submission date <u>hasdate has</u> been extended to 16th -September 2020. Time 11:00am</p>
2	ITB 25.1 Bid Opening 11 th August 2020. Time 11:30 am	<p>REPLACE: Bid Opening 11th August 2020. Time 11:30 am</p> <p style="text-align: center;">WITH</p> <p>Bid Opening has been extended to 16thSeptember 2020. Time 11:30 am</p>
3	ITB. 11.1(J) Abider must submit audited financial statement for the last 3 years 2020, 2019,2018.	<p>REPLACE: ITB. 11.1(J) Abider must submit audited financial statement for the last 3 years 2020, 2019,2018.</p> <p style="text-align: center;">WITH</p> <p>ITB. 11.1(J) Abider must submit audited financial statement for the past 3 financial years 2019,2018, <u>2018</u> & 2017.</p>

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5	ITB 20.2 Powers of Attorney A duly Registered Power of Attorney for local firms. A Notarized Power of Attorney for international firms. The Power of Attorney in the case of international firms must be registered with Uganda Registration Services Bureau (URSB).	REPLACE: with A duly Registered Power of Attorney for local firms. A Notarized Power of Attorney for international firms.
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REPLACED SPECIFICATIONS FOR ELECTRICAL EQUIPMENT AND TOOLS – Refer to Volume 2 of 2
specifications

Generators				
A1	DC Generator	Direct current motor compound excitation - Didactic equipment it must be also used as generator. Technical features: - Power: C1.1 kW - Voltage: 220 V - Speed: 3000 rpm - Excitation: 160 V / 0.25 A It must be possible to couple the electrical machine with other electrical machines through a hub and spider elastic gear ring in polyurethane. It must be supplied with a hooked module in aluminum with PVC label and safety terminals for the electrical connection. A schematic diagram must be shown on the hooked module. Each machine must be mounted on a base and must be provided with: - Plate that brings its axis height to the standard measure (112 mm). - Plates for fixing to the base of the machine - Four screws for fixing of the machine Inter Rail Distance of the plates: 160mm Coupling Joint: Diameter: 40mm, length 40mm Supplied with: Starting rheostat - Didactic equipment - Step-variable rheostat for the half torque starting of the DC motors of the laboratory. Excitation rheostat - Didactic equipment - Suitable for the shunt excitation of the DC machines and of the synchronous machines of the laboratory	pc	1

A1.1	Three phase AC Generator	<p>3 Phase 40kW Super Silenced Electric Diesel Generator for educational purposes</p> <ul style="list-style-type: none"> • Direct injection internal combustion engine (diesel); • Output Sockets 400V 63-32A-230V 16A • AC synchronous generator • Cooling system: WATER • Digital control screen; • Base mounted with canopy and engine accessible • Dry air filter, fuel filter, oil filter • Starter battery and start connection cable; • Supervised / 90 dB LWA • Molded case circuit breaker • Rated Voltage: 400/230V • Rated frequency (Hz): 50 • Rated Speed: 1500rpm • Fuel Capacity approx. 215ltrs • Engine Power approx. 75.0 Hp 	pc	1
A1.2	Single phase AC Generator	<ul style="list-style-type: none"> • 12.1 kW Air Cooled Diesel Generator, Voltage: 220-240 V • Super Silenced Canopy • Cooling system : AIR • Fuel type: Diesel • Frequency: 50Hz • AVR Controlled • Output Sockets 63-32-16A 230V • Number of cylinder: 2 • Rated speed: 3000rpm • Fuel capacity: 23l • Engine power: 20HP 	pc	1
Rotating Equipment				
A2	Three phase AC motors	<p>Three-phase 2 - speed squirrel cage asynchronous motor - Didactic equipment 2 or 4 pole induction motor with Dahlander-type three-phase stator winding and squirrel cage rotor.</p> <p>Technical features:</p> <ul style="list-style-type: none"> - Power: 0,9/C1.1 kW 	pc	1

		<ul style="list-style-type: none"> - Voltage: 380 V - Current: C2.5/C3.3 A - Speed: 1420/2830 rpm, 50 Hz. <p>It must be possible to couple the electrical machine with other electrical machines through a hub and spider elastic gear ring in polyurethane. It must be supplied with a hooked module in aluminum with PVC label and safety terminals for the electrical connection. A schematic diagram must be shown on the hooked module. Each machine must be mounted on a base and must be provided with:</p> <ul style="list-style-type: none"> - Plate that brings its axis height to the standard measure (112 mm). - Plates for fixing to the base of the machine - Four screws for fixing of the machine <p>Inter Rail Distance of the plates: 160mm Coupling Joint: Diameter: 40mm, length 40mm</p> <p>Supplied with: Pole changing unit – It must be used to change the number of poles in Dahlander type motors.</p>		
A3	Single phase AC motor	2-Pole, High-Speed Type: 40 W~150 W (1/19 HP~1/5 HP), Single-Phase 220/230 VA	pc	1
A4	DC motor	The DC Motor Drive package should include a permanent-magnet dc motor, a pulse-width modulated (PWM) dc motor drive, various electrical components (single-pole safety switch, fuse holder, start/stop switch, potentiometer, terminal blocks, etc.), and a motor control enclosure. The package also should include all the conduits, electric wire, fittings, and hardware required to install the dc motor drive	pc	1
	Consumables			
A5	LV (Low voltage) aM Fuse 6A 10A 20A motor protection	V :400V 6A 10A 20 A size 10x38 at least 1 should be ATEX/IECex certified	Nr	3
A6	LV (Low voltage) gG Fuse 2A 10A 20 A general protection	V:220V , 400V size 10x38 size 10x38 Make: Schneider Electric, ABB Legrand, Hager or equivalent at least 1 should be ATEX/IECex certified	Nr	3
A7	ELCB Three phase (Differential circuit breaker)	Voltage :400 V, Make: Schneider electric, ABB,Legrand,Hager or equivalent	Nr	2

	30mA 40A type : A			
A8	ELCB Three phase (Differential circuit breaker) 30mA 40A type : AC	Voltage :400 V, Make: Schneider electric, ABB,Legrand,Hager or equivalent	Nr	2
A9	ELCB Three phase (Differential circuit breaker) 30mA 63A type : A	Voltage :400 V, Make: Schneider electric, ABB,Legrand,Hager or equivalent	Nr	2
A10	ELCB Three phase (Differential circuit breaker) 300mA 40A type : A	Voltage :400 V, Make: Schneider electric, ABB,Legrand,Hager or equivalent	Nr	1
A11	ELCB Three phase (Differential circuit breaker) 300mA 63A,type AC	Voltage :400 V, Make: Schneider electric, ABB,Legrand,Hager or equivalent	Nr	1
A12	ELCB Three phase (Differential circuit breaker) 300mA 63A,type B	Voltage :400 V, Make: Schneider electric, ABB,Legrand,Hager or equivalent	Nr	1
A13	ELCB Three phase (Differential circuit breaker) 500 Ma S-Type AC	Voltage :400 V, Make: Schneider electric, ABB,Legrand,Hager or equivalent	Nr	1
A14	single phase Circuit breakers 2A different type : B,C	V:220V , Make: SCHNEIDER, ABB,Legrand,Hager or equivalent	Nr	2
A15	single phase Circuit breakers 10A different type : B,C,D	V:220V , Make: SCHNEIDER, ABB,Legrand,Hager or equivalent	Nr	3
A16	single phase Circuit breakers 16A different type : B,C,D	V:220V , Make: SCHNEIDER, ABB,Legrand,Hager or equivalent	Nr	3
A17	single phase Circuit breakers 20A different type : B,C,D	V:220V , Make: SCHNEIDER, ABB,Legrand,Hager or equivalent	Nr	3
A18	single phase Circuit breakers 32A different type : B,C,D	V:220V , Make: SCHNEIDER, ABB,Legrand,Hager or equivalent	Nr	3
A19	single phase Circuit breakers 40A different type : B,C,D	V:220V , Make: SCHNEIDER, ABB,Legrand,Hager or equivalent	Nr	3

A20	single phase Circuit breakers 63A different type : B,C,D	V:220V , Make: SCHNEIDER, ABB,Legrand,Hager or equivalent	Nr	3
A21	three phase Circuit breakers 16A different type : B,C,D	V:400V , Make: SCHNEIDER, ABB,Legrand,Hager or equivalent	Nr	3
A22	three phase Circuit breakers 20A different type : B,C,D	V:400V, Make: SCHNEIDER, ABB,Legrand,Hager or equivalent	Nr	3
A23	three phase Circuit breakers 32A different type : B,C,D	V:400V , Make: SCHNEIDER, ABB,Legrand,Hager or equivalent	Nr	3
A24	three phase Circuit breakers 40A different type : B,C,D	V:400V , Make: SCHNEIDER, ABB,Legrand,Hager or equivalent	Nr	3
A25	three phase Circuit breakers 63A different type : B,C,D	V:400V , Make: SCHNEIDER, ABB,Legrand,Hager or equivalent	Nr	3
A26	three phase Circuit breakers 100A different type : B,C,D	V:400V , Make: SCHNEIDER, ABB,Legrand,Hager or equivalent	Nr	3
A27	three phase Fuse-break switch 3 Poles +N 63 A	Voltage :400 V, Make: Schneider elctric, ABB,Legrand,Hager or equivalent	Nr	1
A28	Three phase Modular type Power switch mounted inside a distribution panel	Voltage :400 V, Make: Schneider elctric, ABB,Legrand,Hager or equivalent	Nr	1
A29	Three phases motor circuit breaker 40A, 63A	Voltage :400 V, Make: Schneider elctric, ABB,Legrand,Hager or equivalent	Nr	2
A30	Single phase motor circuit breaker 40 A	V:220V, Make: SCHNEIDER, ABB,Legrand,Hager or equivalent	Nr	1
A31	ELCB Single phase Residual circuit breaker 30mA 40A type : A	V:220V, Make: SCHNEIDER, ABB,Legrand,Hager or equivalent	Nr	2
A32	ELCB Single phase Residual circuit breaker 30mA 40A type : AC	V:220V, Make: SCHNEIDER, ABB,Legrand,Hager or equivalent	Nr	1

A33	ELCB Single phase Residual circuit breaker 30mA 63A type : AC	V:220V, Make: SCHNEIDER, ABB,Legrand,Hager or equivalent	Nr	1
A34	ELCB Single phase Residual circuit breaker 300mA 40A type : AC	V:220V , Make: SCHNEIDER, ABB,Legrand,Hager or equivalent	Nr	1
A35	ELCB Single phase Residual circuit breaker 300mA A63 type : AC	V:220V , Make: SCHNEIDER, ABB,Legrand,Hager or equivalent	Nr	1
A36	ELCB Three phase Residual circuit breaker 500mA A63 Type: AC	V:400V , Make: SCHNEIDER, ABB,Legrand,Hager or equivalent	Nr	1
A37	Three phase Power Contactor	3P(3NO) - AC3 <= 440 V 9 A > IP2x SCHNEIDER, ABB,Legrand,Hager,,,,	Nr	3
A38	Auxiliary contact	2NO + 2NC pole contact ,SCHNEIDER,ABB,Legrand,Hager,Siemens,,,,	Nr	3
A39	Timed auxiliary contacts	1NO + 1NC pole contact ,SCHNEIDER,ABB,Legrand,Hager,Siemens,,,,	Nr	3
A40	Dis connector switch three phase 3P+N	3 pole +N ,400V ,SCHNEIDER,ABB,Legrand,Hager,Siemens,,,,	Nr	2
A41	single phase extension box	8+1 Multicolor Extension cord with 3.6 Meter Wire, Fuse and Spark Suppressor (2 Pin and 3 Pin)	Nr	2
A42	Terminal Leg different type and size 2,5mm, 4mm, 6mm, 10mm	Leg different type and size 2,5mm, 4mm, 6mm, 10mm At least 1 should be a complete ATEX/IECex	Nr	4
A43	PVC Junction box different size and type 4*4 ,6*4,	PVC Junction box different size and type 4*4 ,6*4, At least 1 should be a complete ATEX/IECex	Nr	8
A44	PVC Tube Different size 20 32	PVC Tube Different size 20 32	Nr	4
A45	Accessories elbow,tee,bend	Consisting of elbow,tee,bend	Nr	3
A46	Apparent and recessed double switch	1 way 2 gang switch - apparent 5No 1 way 2gang switch- recessed 5No Make: complete ATEX/IECex set or equivalent At least 1 should be a complete ATEX/IECex set	Nr	2
A47	Apparent and recessed light switch	1 way 1 gang switch - apparent 10No 1 way 1gang switch- recessed 10No	Nr	4

		Make: complete ATEX/IECex set or equivalent		
A48	Digital time switch	Time Switch with – 24 hours + 7 days + year	Nr	1
A48	Electric sheath (flexible wiring tube) different size 16,20,32	Electric sheath (flexible wiring tube) different size 16,20,32	Nr	1
A50	Plastic cables gland different size	Assorted PG7- PG48	Nr	30
A51	METAL cables gland different size	For XLPE, PVC, SWA- BS4567 for 1.5mmsq. – 16mmsq	Nr	8
A52	Heat gun	<ul style="list-style-type: none"> • 2-stage switch for one-handed operation • Two air flow and temperature stages • Thermal protection • Rated input power: 1,600W <p>Working temperature: 300 - 500 °C</p> <ul style="list-style-type: none"> • Airflow: 240 - 450 l/min 	Nr	4
A53	special glue for pvc	Solvent cement /Tangit	Nr	1
A54	3-row electrical panel	Enclosure for circuit breakers with 3 DIN rails (35mm)	Nr	2
A55	lamps 60 w 100w	Standard LED Lamps 60W , 100W (20 pcs of each) At least 1 should be a complete ATEX/IECex set	Nr	1
A56	straight holder	Lamp holder – straight batten At least 1 should be a complete ATEX/IECex set	Nr	8
A57	angle holder	Lamp holder- Angle batten At least 1 should be a complete ATEX/IECex set	Nr	6
A58	apparent electrical outlet 16 A 32 A	Socket outlet 16A 15 pcs Socket outlets 32A 15pcs Hanging entry.	Nr	6
A59	electric cable duct	Self-adhesive white, 25mm x 16mm	Nr	6
A60	Push buttons green	Push buttons green At least 1 should be ATEX/IECex	Nr	20
A61	Push buttons red	Push buttons red At least 1 should be ATEX/IECex	Nr	4
A62	Push buttons black	Push buttons black	Nr	4

		At least 1 should be ATEX/IECex		
A63	indicator light red	indicator light red At least 1 should be ATEX/IECex	Nr	4
A64	indicator light green	indicator light green At least 1 should be ATEX/IECex	Nr	4
A65	indicator light white	indicator light white At least 1 should be ATEX/IECex	Nr	4
A66	indicator light yellow	indicator light yellow or orange At least 1 should be ATEX/IECex	Nr	4
A67	indicator light Bleu	indicator light Bleu At least 1 should be ATEX/IECex	Nr	4
A68	emergency stop button with punch	emergency stop button with punch At least 1 should be ATEX/IECex	Nr	4
A69	emergency stop button with key	emergency stop button with key At least 1 should be ATEX/IECex	Nr	4
A70	Transformer 400/24 v 100VA OR 200VA	Transformer 230- 400 V – 2 x 24V - 100VA	Nr	4
A71	Presence detector (Moving sensor)	Presence detector (Moving sensor)	Nr	1
A72	multicores cables 3 G 1,5mm ²	multicores cables 3 G 1,5mm ² / 100m	Roll	4
A73	multicores cables 3 G 2.5mm ²	multicores cables 3 G 2.5mm ² / 100m	Roll	1
A74	multicores cables 5G 1,5mm ²	multicores cables 5G 1,5mm ² / 100m	Roll	1
A75	multicores cables 5G 2,5mm ²	multicores cables 5G 2,5mm ² / 100m	Roll	1
A76	flexible multicores cables 3G1,5 mm ²	flexible multicores cables 3G1,5 mm ² / 100m	Roll	1
A77	flexible multicores cables 3G2,5 mm ²	flexible multicores cables 3G2,5 mm ² / 100m	Roll	1
A79	Electrical wire 1.5mm ² color Y-G Blue, Red , white, brown, orange ...	Electrical wire 1.5mm ² color Y-G Blue, Red , white, brown, orange 100m	Roll	1
A80	Electrical wire 2.5mm ² color Y-G Blue, Red , white, brown, orange ...	Electrical wire 2.5mm ² color Y-G Blue, Red , white, brown, orange 100m	Roll	4
A81	Electrical wire 4mm ² color Y-G Blue, Red , white,	Electrical wire 4mm ² color Y-G Blue, Red , white, brown, orange / 100m	Roll	1

	brown, orange ,,,			
A82	Electrical wire 6mm ² color Y-G Blue, Red , white, brown, orange ,,,	Electrical wire 6mm ² color Y-G Blue, Red , white, brown, orange / 100m	Roll	2
A83	Electrical wire 10mm ² colour Yellow-Green Blue, Red , white ,orange	Electrical wire 10mm ² colour Yellow-Green Blue, Red , white ,orange / 100m	Roll	1
A84	connection terminal blocks different types & sizes	connection terminal blocks different types & sizes	pkts	3
A85	Grease	for use on supplied equipment	ltrs	3
A86	Lubricant oil	for use on supplied equipment	ltrs	2
A87	Industrial Wiring Bench & Hard ware kit to be wired	<p>Industrial Wiring Bench & Hard ware kit to be wired Electric Skills Training bench</p> <p>The bench is mounted on a frame with locking castors. Test cabinet at top: equipped with a transparent door pre-equipped with buttons, indicators and selector switches for controlling panels created by students 1 hinged panel that folds back on itself Lower part that takes the pre-wired operative parts</p> <p>Hardware kit to be wired 1 Telequick plate 7 contactors and auxiliary contact blocks 1 thermal overload relay 8 thermal-magnetic circuit breakers 1 switch disconnecter Cylinders Valves Electrical and pneumatic wiring accessories Wiring terminals</p>	Nr	2
A88	Multi-Motor Starter Panels Type 4X enclosure with four KT7 motor controllers, L10 fusible disconnect switch & transformer.	<ul style="list-style-type: none"> Multi-Motor Starter Panels Type 4X enclosure with four KT7 motor controllers, L10 fusible disconnect switch & transformer. (SPRECHER + SCHUH , Schneider or equivalent) 	Nr	2

	(SPRECHER + SCHUH , Schneider)			
	Measuring Instruments			
A89	Three-phase Power Meter	<p>Three-phase electrical network analyzer with phase sequence analysis</p> <ul style="list-style-type: none"> • Voltage and Current recording • Range: 110-480V / 10-3000A • Active, Reactive and Apparent Power • Harmonics and THD • Flicker • Transient waveforms • Unbalance • USB connectivity • GSM (optional) • IP-65 enclosure 	Nr	1
A90	Multimeter clamps	<p>Remote Display True RMS AC/DC Clamp Meter with iFlex current Probe</p> <p>Key features</p> <ul style="list-style-type: none"> • Wireless technology allows the display to be carried up to 30 ft. away from the point of measurement • The removable magnetic display can be conveniently mounted where it is easily seen • iFlex® Flexible Current Probe expands the measurement range to 2500 A AC • Integrated low pass filter and state-of-the-art signal processing allows for use in noisy electrical environments while providing stable readings • Supplied with carrying case 	Nr	1
A91	DIGITAL MULTIMETER DMM 600V - AC/DC	<ul style="list-style-type: none"> • Large, easy-to-read displays • Low battery indicator • Measures at least frequency, capacitance, duty cycle, temperature • Amperage Rating : 10 • Capacitance : approx. 10 nF - 10000 µF 	Nr	1

		<ul style="list-style-type: none"> • Counts : 5999 • Diode Test : Yes • Display : Digital • Resistance : 0 Ω to 49 MΩ • Type : Auto/Manual Ranging • Voltage Rating : at least 600 • should be ATEX / IECex certified 		
A92	Earthing and short-circuiting systems	<p>Earthing and Short-Circuit kit is phase earthing equipment to be used on high voltage overhead lines. The set is designed to protect against an accidental commissioning or voltage returns during maintenance.</p> <p>Contents:</p> <ul style="list-style-type: none"> • 3 x Aluminium alloy clamps lockable by a screw for use on cylindrical conductors with diameter between 5 and 45 mm, flat bars max. 45 mm, bending bus-bars max. 45 mm and fixing points between 20 and 25 mm • 3 x PVC insulated copper cables • 3 x milling earthing lathe • 3 x nylon bag for storage 	Nr	1
A93	Auto-transformer 220 v	3 Amp Variac Variable Transformer 500VA Max 0-240 AC Volt Output regulator	Nr	2
	Hand Tools			
A94	Cord less drill machine	<p>18V Cordless Hammer Drill Driver</p> <ul style="list-style-type: none"> • Battery charge indicator • Enhanced dust and drip-proof performance • Higher power and productivity • Ergonomic design for fatigue free use • 21 Torque settings in clutch mode • Drilling capacities; 13mm(steel),65mm(Wood),16mm(concrete) • No Load speed: 0-2,000rpm (Hi) , 0-400rpm(Lo) • Max fastening torque; 91Nm 	Nr	1

		<ul style="list-style-type: none"> supplied with 2x 4.0Ah batteries & charger with carry case 		
A95	Sprit level 8";12", 18"	Sprit level 8";12", 18"	Nr	3
A96	Measuring Tap 5 Meter 8 Meter	Measuring Tape 5 Meter (5) and 8 Meter(5)	Nr	6
A97	Insulated Pliers set	<p>3 pc Basic Plier Set</p> <ul style="list-style-type: none"> Pliers set designed for grasping, bending and cutting Oil-resistant dipped handle allows for a comfortable grip Drop-forged steel is strong and durable Includes: 6" Slip Joint Pliers 6" Diagonal Pliers 6" Long Nose Pliers 	set	2
A98	Insulated Cutting Pliers	<p>4-Piece Pliers Set</p> <ul style="list-style-type: none"> four-piece pliers set with rubberized slip-resistant grips Machined jaws help grip items securely Cutting pliers feature induction-hardened cutting edges for long life Includes 8-inch slip joint, 7-inch diagonal, .8-inch lineman, and 8-inch long nose 	set	2
A99	Cable Shears and Cutters	<ul style="list-style-type: none"> Bi-material handle with secure grip grooving Curved jaw design cuts coaxial and other soft cables up to 1/2" diameter Hand ground, induction hardened blade Heat treated high chrome steel forging Interlocking joint assembly for smooth cutting 215mm Cable Cutter 	set	2
A100	Wire Stripping and Dismantling Tools	<ul style="list-style-type: none"> Convenient handle lock Spring return provides smooth and consistent operation Powder coated finish provides rust and corrosion resistance 	set	2

		<ul style="list-style-type: none"> Multi Tool convenience strips wire sizes from 10 – 20 AWG and cuts copper wire 		
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Item Nr	Item	Description	Unit	Qty
	Analog and Digital Test Equipment			
A101	Digital Storage Oscilloscope	<ul style="list-style-type: none"> 10 MHz sine and square waveforms Option 002 provides 14-bit, 50 MSa/s 8 K-point arbitrary waveform generator Ramp, triangle, noise, pulse generation with variable edge, and DC waveforms AM, FM, and PWM Modulation, linear & logarithmic sweeps and burst all standard USB, GPIB and LAN (LXI) interfaces included Graph mode for visual verification of signal settings 	Nr.	1
A102	Digital oscilloscope with memory	<ul style="list-style-type: none"> Bandwidth: 200 MHz Channels: 2 analog channels. Sample rate: Up to 2 GS/s half-channel interleaved, 1 GS/s per channel. Memory: 1 Mpt per channel. Display: 8,5"/21,6cm WVGA. Update rate: 200,000 wfms/s. Integrated 3 digit voltmeter (DVM). Integrated 5 digit frequency counter. Upgradeable: Bandwidth, serial protocol analyzer, warranty. Connectivity: 2x USB host, 1x USB device, optional GPIB, LAN, WVGA video out; BenchVue ready. 	Nr.	1
A103	Frequency Generator	<ul style="list-style-type: none"> High stability 10 MHz DDS function generator Arbitrary capability with storage for five user defined waveforms Multiple standard and complex waveforms recalled from internal memory Extensive modulation capabilities include sweep, AM, Gating, Trigger/Burst, FSK and Hop GPIB and RS-232 interfaces Included: Power Cord , Driver File. Quick Start Guide + user manual 	Nr.	1

A104	Digital Multimeter	<ul style="list-style-type: none"> • Rugged, high accuracy industrial multimeter to measure current, voltage and frequency • Offers true-RMS AC voltage and current for measuring non-linear signals • Captures intermittent as short as 250 μS • Safety rated CAT III 1000 V, CAT IV 600 V • Includes a built-in thermometer and temperature probe 	Nr.	1
A105	High-voltage megger (500 Volts)	<ul style="list-style-type: none"> • Insulation test range: o 0.1 MΩ to 2000 MΩ • Insulation test voltages: 500 V, 1000 V • With the remote test probe for repetitive or hard-to- reach testing • Auto-discharge of capacitive voltage for added user protection • AC/DC voltage: 0.1 V to 600 V • 200 mA Continuity • Resistance: 0.01 Ω to 20.00 kΩ • with auto power off • with large, backlit display • CAT IV 600 V overvoltage category rating for added user protection • Remote probe, test leads, probes and alligator clips included with each tester • Four AA alkaline batteries (NEDA 15 A or IEC LR6) for at least 1000 insulation tests 	Nr.	1
A106	Digital Multimeter	<ul style="list-style-type: none"> • Digital multimeter • True-RMS AC, AC + DC, dBm, dBV • 100 kHz AC bandwidth • MIN/MAX/AVG record with real time clock • Frequency 0.5 Hz to 1 MHz • Duty cycle & pulse width measurement • Infrared port for data capture to a PC with • Rugged, over molded case • Cat IV 600 V / Cat III 1000 V 	Nr.	1
A107	Digital Multimeter	<ul style="list-style-type: none"> • 0.025% basic DC accuracy • 50,000-count resolution with instant readings enables detailed analyses • 100 kHz ac bandwidth opens the possibilities of modern applications not possible with less capable DMMs • Internal memory allows for stand-alone logging of measurement changes (up to 3 days) identifying stable and unstable periods with a real-time stamp. • MIN MAX to record and timestamp values in real-time. • 250 μS Fast MIN MAX for peak transient capture. • Temperature readings in $^{\circ}$C or $^{\circ}$F using optional K-type thermocouple • Enhanced ranges, such as dc voltage measurements down to 10 μV, and capacitance up to 50,000 μF • Multiple reading display with bar graph has two-level backlight • On-line logging capabilities when connected to a PC and additional capability of logging 995 readings in a stand-alone application for later download to a PC. 	Nr.	1

A108	Clamp on meter	<ul style="list-style-type: none"> • True RMS Clamp Meter • Rugged, reliable True-RMS clamp meter with dc current and frequency measurements • Measures AC and DC current to 400 A • Measures AC voltage and DC voltage to 600 V • Provides True RMS AC voltage and current for accurate measurements on non-linear signals • Measures resistance to 40 kΩ with continuity detection • Measures frequency to 500 Hz 	Nr.	1
A109	Variable DC Power supply unit (0 - 30 V)	<ul style="list-style-type: none"> • Bench System DC Power Supply, Linear Regulation, Smart Analog Controls Single Output, 30V/3A, No Interfaces • Single Precision DC Bench Power Supplies, 0-30V/0-3A • Linear regulation • Ultra-compact design • True Analog controls • Low current range and current meter averaging 	Nr.	1
A110	Variable AC Power supply unit(0 - 120v)	<ul style="list-style-type: none"> • Variable AC Power Supply: 0-150V, 10A • Designed to provide isolated AC output variable from 0 to approximately 150 volts. 	Nr.	1
Instrumentation Equipment				
	Pressure Test Equipment			
B1	High precision dead weight tester	<p>Hydraulic Dead Weight Tester 100 to 17,000 psi</p> <ul style="list-style-type: none"> • 100 to 17,000 psi basement, including piston cylinder system, mass set & tool roll • Factory Calibration Stability • Masses Manufactured from Stainless Steel and can be • Adjusted to Local Gravity • Compact Dimensions for Portable Use • Reference Instrument for Factory and Calibration Laboratories for Testing, Adjustment and Calibration of Pressure Measuring Instruments • Complete, Stand-Alone System, Suitable for Field Use <p>Each Unit Includes</p> <ul style="list-style-type: none"> • Base • Dual-Area pump for filling, pressure generation and fine adjustment 	Nr.	1
B2	Standard Analog gauges (10bar, 25bar, 60bar, 100bar)	Standard Analog gauges, (10bar, 25bar, 60bar, 100bar)	Nr.	4
B3	Digital High pressure Gauges:400bar,100bar	<ul style="list-style-type: none"> • Digital pressure gauges provide an economical, portable solution for pressure measurement. • 400bar,100bar 	Nr.	2

B4	Low pressure/vacuum calibration Kit	Kit consists of: <ul style="list-style-type: none"> • pressure and vacuum hand pump, • compound pressure and vacuum gauge • and all fittings required for calibration 	Nr.	1
B5	Precision low pressure regulators (Fisher pressure regulator 0-2 bar output)	Precision low pressure regulators - 0-2 bar output,	Nr.	1
B6	Precision high pressure regulators (Fisher pressure regulator 0-5 bar output)	Precision low pressure regulators - 0-5 bar output,	Nr.	1
B7	Pneumatic calibration unit	<ul style="list-style-type: none"> • Unique design allows the user to convert from pressure to vacuum by simply twisting a knob, even with gloves on • Two outlet ports allow connection to reference pressure gauge or pressure calibrator as well as device under test, thus eliminating a tee • Large volume fine adjustment piston provides precise control, even at very low pressures • Precisely vent pressure with soft seated bleed valve 	Nr.	1
B8	Digital pressure calibrator kit	<ul style="list-style-type: none"> • Portable pressure calibrators combining practical design with state-of-the-art performance • with data storage and RS 232 interface. • Should provide error analysis for field reporting of calibration errors and pass/fail status 	Nr.	1
B9	Hydraulic pressure pump	<ul style="list-style-type: none"> • Single Speed, Hydraulic Hand Pump, 327cm³, 12.7mm Cylinder Stroke, 700 bar • Usable oil capacity: 327cm³ • Cylinder stroke: 12.7mm • Operation: Hand operated 	Nr.	1
B10	Pressure calibrator	<ul style="list-style-type: none"> • Includes pump, measure, analyze capabilities • Offers best in class pressure accuracy • Wide range from Vacuum to 1000 bar (15000 psi) • Touchscreen functionality • Quick-to-fit pressure adapters and hoses eliminate leaks 	Nr.	1
	Temperature Test Equipment			
B11	Digital thermometer	Digital Thermometer VIP Kit <ul style="list-style-type: none"> • Dual input digital thermometer can log up to 500 points of data to internal memory. • Fast response and laboratory accuracy (0.05% + 0.3°C). • Take contact temperature for checking motors, insulation, breakers, pipes, corroded connections, liquids, and 	Nr.	2

		wires with industrial standard J, K, T, E, N, R, and S type thermocouple • Two bead probe thermocouples <ul style="list-style-type: none"> • Holster • ToolPak Strap and Magnet Hanging Kit • Soft Carry Case 		
B12	Infrared Thermometer	<ul style="list-style-type: none"> • High temperature infrared thermometer that measuring from -30°C to 900°C (-22°F to 1652°F) • Offers an ultra-high 60:1 distance-to-spot ratio with dual laser sighting for fast, accurate targeting • Features a user-selectable multi-language interface • Displays the temperature plus MAX, MIN, DIF, AVG temperature • Provides adjustable emissivity and a predefined emissivity table 	Nr.	1
B13	Precision variable resistance (Decade box)	<ul style="list-style-type: none"> • Range : 10mΩ to 12kΩ • Resolution: 10mΩ steps • Number of decades: • 0.01% accuracy: 6, each decade settable from 0 to 11 	Nr.	2
B14	Set of glass thermometers	1set: glass thermometer (straight and 90°), size 150mm and Thermometer, Bourdon tube principle, size 100mm	set	1
B15	Standard thermocouples(0-100, 0-150,0-200)	Standard thermocouples(0-100, 0-150,0-200)	Nr.	3
B16	Temperature bath calibrator	<p>Temperature calibrator feature active dual- and triple-zone temperature control</p> <ul style="list-style-type: none"> • Temperature range from 32 to 699°C (90 to 1291°F) • Stability to ± 0.007°C • Dry block and liquid bath / dry block combined • Time saving fast cooling and heating times • Contamination free calibration of clamp sensors • “Plug and Play” intelligent reference sensors • Easy-to-read color display with User-friendly navigation • Lightweight and easy to carry • Multi-hole insert kits 	Nr.	1
B17	RTD simulator Process Calibrator, 4000 ohms Resistance)	<ul style="list-style-type: none"> • Process Calibrator, 4000 ohms Resistance • Measure temperature from RTD output; simulate RTD output 	Nr.	2
B18	Thermocouple (Thermocouple Calibrator,)	<ul style="list-style-type: none"> • Measure temperature from TC output • Simulate TC output • Operable with nine types of thermocouples • Calibrate linear TC transmitter with mV source function • Selectable °F or °C • Thermocouple mini-jack termination 	Nr.	2

B19	Milli-ap loop calibrator	<ul style="list-style-type: none"> The loop calibrator will check, calibrate and measure all current signal instruments in a 4 to 20 milliamp DC loop All 4 to 20 mA Loop Functions Source 0.00 to 24.00 mA or % FS reading , simulate 2-wire transmitters, measure 0-44 volts DC power & read 2-wire transmitters.	Nr.	2
	Vibration sensor calibration			
B20	Vibration calibration kits - complete Kit	Portable Stroboscope Kit Specifications; <ul style="list-style-type: none"> Flash rate range: 30 to 50,000FPM, 0.5 TO 830Hz Flash rate accuracy: +or- 0.002% of reading Flash duration: 8 tp20 microseconds Flash rate resolution: 0.01 to C1.0 FPM, selectable Virtual RPM 0 tp 200VPM External Input: Input pulse, 0.5microseconds minimum, TTL to 24V maximum with NIST Certificate of Calibration 	Nr.	1
B21	Micrometer	<ul style="list-style-type: none"> Micrometer Type: Electronic Interchangeable Anvil Outside Micrometer Range (mm): 0-100mm Anvil/Spindle Material: Steel Anvil Type: Flat Spindle Type: Flat 	Nr.	1
B22	Vibration meter	<ul style="list-style-type: none"> Hand held vibration meter Reliable, repeatable, accurate device for checking bearings and overall vibration Features innovative sensor design that minimizes measurement variations caused by device angle or contact pressure Measures overall vibration (10 Hz to 1,000 Hz) 	Nr.	1
B23	Vernier Caliper	<ul style="list-style-type: none"> Digimatic Caliper with Nib Style Jaws Measuring range of 0(0.4)-12"(0(10)-300mm with .0005"/ 0.01mm resolution. Includes IP67 level protection. Features rounded face jaws that are ideal for accurate Inside Diameter measurement. 	Nr.	1
B24	Vibration sensor Probe	50mm proximator with extension cable and Proximator sensor Ideal for measuring the differential expansion (DE) or rotor expansion (RX) of large steam turbine generators those results from the difference in growth rates between the turbine rotor and the machine stator (casing).	Nr.	1
B25	Acceleration sensor Probe	<ul style="list-style-type: none"> Monarch Sensor Pak with Accelerometer, Integral Cable, Magnetic Base, Stringer Probe and Connecting Stud 	Nr.	1
B26	Proximator	<ul style="list-style-type: none"> Proximity sensor, 3300 xl5, 8mm, 7.87v/mm, 24vdc 	Nr.	1

Fire & Gas Test Equipment				
B27	Hydro carbon sensor	Sensor, IR, Hydro Carbons <ul style="list-style-type: none"> • Power Input: 18-30VDC at 5 watts • Max Current: Average: 210 mA, peak 400 mA at 24VDC • Sensor Technology: Reliable infrared sensing technology with patented self-compensating optics and easy-to-clean • Standard Output: Standard 3-wire 4-20mA current source. 	Nr.	1
B28	Gas detection sensor	<ul style="list-style-type: none"> • Combustible (Low Voltage) Fixed Gas Detector Controller Transducer • Low level Meter capable of displaying from 0-50 percent leg • Selectable target gas - methane(ng), propane) or hydrogen(h2) • Selectable fan and alarm relay activation 	Nr.	1
B29	H2S Sensor	Gas Clip Technologies and CO Dual-Tox Sensor, Dual Tox Sensor	Nr.	1
B30	H2S detector test kit with 30%	This calibration kit includes: 34AL cyl 100ppm of Isobutylene/H2S/CO/CH4/O2 calibration gas, a demand flow regulator, a case and tubing. Suitable monitoring device included.	Nr.	1
B31	H2S detector test kit with 50%	4-gas confined space kit,LEL/Oxy/H2S/CO,w/AC charger and small padded case	Nr.	1
B32	Flame Detector	<ul style="list-style-type: none"> • Explosion- proof combined Ultraviolet and Infrared Flame detector • Built-in high speed, low power consumption, high performance 16-bit high-precision data processing chip. • Using patent narrow-band IR sensor and solar blind UV sensor. • Explosion-proof design is suitable for the hazardous locations of industrial site. • Multistage sensitivity for more occasions. • Can detect small fire much earlier. • Low maintenance cost, easy to update and improvement. • Detection Angle of 120 degrees. • Detection range up to 60 meters • suitable for a variety of fuel. 	Nr.	1
B33	Smoke detector (Infra-red and optical)	<ul style="list-style-type: none"> • Conventional infrared optical beam smoke detector • LED indicators to aid the beam alignment process • Kit includes an optical beam detector transceiver and a reflective prism 	Nr.	1
B34	Heat sensor	Detector using an optical sensing chamber. Used with most conventional fire alarm control panel.	Nr.	1
B35	Smoke detector test kit	Smoke Detector Kit with Bag, Cartridge, Battery pack	Nr.	1
B36	Heat detector test kit	Heat Detector Kit with Bag, Heat tester, Battery charger	Nr.	1
Emergency & Safety control System				

B37	Emergency shutdown skid	<p>Didactic equipment</p> <p>System for the study of the topics related to the theme of basic industrial installations. This trainer must have modular structure and it must consist of didactic panels that shall be installed on a vertical frame.</p> <p>The modularity of this didactic system must grant to the students a direct and immediate approach to the topic, offering the opportunity to study various subjects performing different experiments as:</p> <p>Single-pole control auxiliaries</p> <p>Contactor</p> <p>Logic operators</p> <p>Contactor self-supply</p> <p>Interlock between contactors</p> <p>Sequentially controlled contactors</p> <p>Exclusive-OR operator</p> <p>Excitation delayed timer</p> <p>De-excitation delayed timer</p> <p>Static timer</p> <p>The system must be composed of the following elements:</p> <p>SINGLE-PHASE TRANSFORMER</p> <p>this module must have insulated panel and safety terminals.</p> <p>Single-phase transformer for low voltage modules.</p> <p>Primary: mains voltage</p> <p>Secondary: 2 x 12 V</p> <p>Rated power: 100 VA</p> <p>THREE-PHASE POWER SUPPLY</p> <p>this module must have insulated panel</p> <p>It must be suitable for a three-phase supply at the mains voltage and frequency.</p> <p>Output: three-phase + N + T at safety terminals.</p> <p>Protection through differential magneto-thermal switch and pilot lamp.</p> <p>Key operated switch for the three-phase supply and pilot lamps for the three phases.</p> <p>EMERGENCY PUSHBUTTON</p> <p>this module must have insulated panel</p> <p>It shall be mushroom type red emergency pushbutton for the manual control and the fast opening of the circuit in case of emergency. It shall be provided with 1 NO and 1 NC contacts.</p> <p>Isolating rated voltage: 660 Vac</p> <p>Thermal rated current 10 A</p> <p>THREE PUSHBUTTONS</p> <p>this module must have insulated panel</p> <p>This item shall include three pushbuttons, red, yellow and green, complete with 1 NO and 1 NC contacts, suitable for the manual control of electric circuits in direct and alternate current.</p>	Nr.	1
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		<p>These three pushbuttons with pulse control shall automatically come back to the standard position. Red pushbutton shall be for stop or de-insertion Yellow pushbutton shall work as interval to cancel undesired conditions Green pushbutton shall be for start or insertion Isolating rated voltage: 660 Vac Thermal rated current 10 A THREE PILOT LAMPS this module must have insulated panel This item shall include three signalling LED lamps, red, yellow and green. Red lamp shall indicate danger or alarm of a potential danger or of a situation that requires an immediate action Yellow lamp shall indicate warning and a change or imminent change of operating conditions Green lamp shall indicate safety condition or of an authorization to proceed. CONTACTOR – 2 pcs this module must have insulated panel and safety terminals. It shall operate as a three-pole power switch through the use of an electromagnet. It shall be provided with 3 NO power contacts and 1 NO auxiliary contact, the module also shall contain 4 additional auxiliary contacts, 2 NO and 2 NC. Coils voltage: 24 Vac, 50/60 Hz Isolating rated voltage: 660 V Thermal rated current: 20 A Thermal rated current of the auxiliary contacts: 10 A TIME RELAY this module must have insulated panel This item shall refer to a multi-voltage and multifunction electronic timer, delayed at the excitation and at the de-excitation Power supply: from 12 to 240 Vac, 50/60 Hz Timer selection from: 0.1 to 2 sec., 1 to 20 sec., 0.1 to 2 min., 1 to 20 min. Resettlement time: less than 50 milliseconds Full scale adjustment accuracy: $\pm 5\%$ THREE-LEVEL FRAME Metal frame with three levels for fitting the modules of the laboratory CONNECTING LEADS This item must consist of a set of leads for the connection of the experiment modules of the panel system.</p>		
B38	Valve Actuator control panel	<p>Didactic equipment. This system refers to a manufacturing method where the entire production process should be controlled by a computer. It must rely on closed-loop control processes built on real-time input from sensors. Students should be able to study the theory and work with the system to get a sound knowledge of the computer-integrated manufacturing, which allows for transversal applications in the following didactic areas such as Automation, Pneumatics, Mechatronics, Electronics, and Process Control.</p>	Nr.	1

	<p>Technical parameters:</p> <p>C1.AC power supply: single-phase 3-wire , AC 220V±10% 50 Hz ;</p> <p>C2.Working Temperature: -10°C ~40°C ; environment humidity: ≤90% (25°C) ;</p> <p>C3.Power consumption: <500W ;</p> <p>4.Air compressor required, no less than 0.6MPa</p> <p>This trainer must be composed of 3 units and each one should simulate a single basic application commonly used in industry. Each unit should be supplied with real electronics, mechanics and pneumatics components. The basic modules will be the following:</p> <p><u>Conveyor unit:</u> It must show the process of materials transferred in a linear motion by means of the belt conveyor driven by geared DC motors; this unit must move materials/objects from one end to the other. Sensors should be used to sense the parts material and presence. It must be a miniature model of a real industrial conveyor system. This unit shall have the following characteristics:</p> <p>Model: Belt conveyor Type: Horizontal Flat Belt Conveyor Length: 500 mm Width: 51 mm Drive: 24VDC Geared Motor. Material detection sensors: diffuse reflection optoelectronic switch and inductive proximity switch Stop sensor: capacitance type proximity switch Belt material: Nylon woven fabric No. of I/O elements: 3 inputs and 1 output</p> <p><u>Linear transfer unit:</u> this module shall consist in an electro-pneumatic controlled linear actuator. Proximity switches must be fixed to sense the retracted and extended position of the transfer unit. This unit must transfer materials from the conveyor to the linear Pick and Place Unit with the help of a pneumatically operated rod less double acting cylinder.</p> <p>This unit shall have the following characteristics:</p> <p>Model: Linear Transfer Unit Type: Pneumatic Operated. Cylinder: Pneumatic rod less Cylinder Travel length: 200 mm Operating Pressure: 6 Bar Two magnetic sensors: voltage 24 VDC Pneumatic solenoid valve: single control solenoid valve, voltage 24 VDC</p> <p><u>Pick and place unit:</u> this module shall transfer the material from the Linear Transfer Unit end to the next Unit with the help of vertical arm, horizontal arm and angular gripper. The Pick and Place Unit must be a total electro-pneumatic control system.</p>		
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		<p>Vertical double acting cylinder: Travel length 150 mm Two magnetic sensors at the retracted and extended position of the vertical double acting cylinder, coil voltage 24 V Horizontal double acting cylinder, Travel length 80 mm Two magnetic sensors at the retracted and extended position of the horizontal double acting cylinder, coil voltage 24 V Gripper: Angular gripper; maximum capacity load : 0.5Kg. Operating pressure: 6 bars Pneumatic solenoid valve: three single control solenoid valve, voltage 24 VDC <u>Push button unit</u>: The button unit must be provided with two lighted self-reset buttons and one emergency stop button for controlling the operation of the device. Green button: LED voltage 24 V, self-reset Red button: LED voltage 24 V self-reset Emergency stop button <u>PLC</u>: The system must include a PLC and its software. It must have the following features: I/O : 20 (12 inputs) Input logic: sink or source 24 VDC voltage input 10 outputs: 8 for relay and 2 for transistor (source) <u>Air source processing unit</u>: Air filter with pressure regulator for drying gas and pressure regulation, 1pc Gas source: ≥ 0.6MPa The trainer must be supplied with manual in English language.</p>		
B39	Pneumatic valve control panel	<p>PNEUMATIC TRAINER – didactic equipment Trainer for demonstrations and experiments in the pneumatic field. The trainer must include a metal frame supporting the following modules: A pneumatic board, where all the components must be mounted and identified through a clear symbol. They must include: 2 double-acting cylinders with 3 return orifice check valves, 4 roller lever and 1 lever 3/2 valves, 2 stable and 2 unstable 5/2 valves, 2 AND, 2 OR and 1 NOT, 1 throttle valve, 1 capacity, 1 fast relief valve and 1 splitter. Supplied with 75 m of $\varnothing 4$ and 3 m of $\varnothing 6$ plastic tube, 10 tees and 10 plugs, as well as 1 pipe cutter, service manual and exercise book with experiments. An air supply vertical board, providing 1 lever main switch, 1 filter, 2 pressure regulators with 2 pressure gauges, 1 mushroom and 3 digital 3/2 push-buttons, 1 lever 5/2 selector and 1 digital 5/2 push-button. With this trainer it must be possible to perform the following exercises: CIRCUITS WITH ONLY ONE CYLINDER C1. Unstable direct control of an S.E. cylinder - A+/A- sequence C2. Unstable direct control of an S.E. cylinder - A-/A+ sequence C3. Stable direct control of an S.E. cylinder - A+/A- sequence 4. Stable direct control of a D.E. cylinder - A+/A- sequence</p>	Nr.	1

		<p>5. Unstable indirect control of a D.E. cylinder - A+/A- sequence 6. Stable indirect control of a D.E. cylinder - A+/A- sequence 7. Single Cycle (SEMIAUTOMATIC) of a D.E. cylinder-A+/A- sequence 8. Continuous Cycle (AUTOMATIQUE) of a D.E. cylinder -A+/A- sequence CIRCUITS WITH SPEED ADJUSTMENT 9. Speed adjustment of the two strokes of a D.E cylinder A+/A- sequence 10. Speed adjustment for only a section of the stroke of a D.E cylinder A+/A- sequence CIRCUITS WITH LOGIC ELEMENTS 1C1. Unstable direct control with two independent starting valves of an S.E. cylinder - A+/A- sequence 1C2. Unstable direct control with two dependent starting valves of an S.E.cylinder - A+/A- sequence 1C3. Single cycle with stroke end safety starting of a D.E.cylinder A+/A- sequence 14. Single cycle without mechanical stroke end of a D .E.cylinder A+/A- sequence 15. Applications on the ET-OU logic functions 16. Applications on the ET-OU-NON logic functions 17. Stable indirect control with only one unstable valve of a D.E. cylinder A+/A- sequence CIRCUITS WITH DELAY SYSTEMS 18. Unstable indirect control with delay at the starting of an S.E. cylinder A+/A- sequence 19. Pulse Generator 20. Extension of a short duration signal 2C1. Bimanual control with concurrency safety CIRCUITS WITH TWO CYLINDERS - SEQUENCES WITHOUT BLOCKING SIGNALS 2C2. Single cycle with several D.E. cylinders A+/B+/A-/B- sequence 2C3. Continuous cycle with several D.E. cylinders A-/B+/A+/B- sequence 24. Continuous cycle with contemporary strokes of D.E. cylinders A+/B+/A-B- sequence 25. Continuous cycle with repetitive and contemporary strokes A+/A-B+/A+/A-B- sequence INTEGRATIVE CONTROLS OF THE CIRCUITS 26. Continuous cycle with separated control of start and end cycle of a D.E. cycle A+/A- sequence 27. Continuous cycle with single cycle control - automatic of a D.E. cylinder A+/A- sequence 28. Continuous cycle with manual - automatic control of a D.E. cylinder A+/A- sequence 29. Continuous cycle with manual - automatic control of D.E. cylinders A+/B+/A-/B- sequence 30. Continuous cycle with emergency control with stop at the rejoined phase of a D.E. cylinder A+/A- sequence 3C1. Cycle with emergency control immediate return to the starting position of D.E. cylinders A+/B-/A-/B+ sequence The trainer must be supplied with manual in English language.</p>		
B40	Alarm Panel(Annunciator panel)	Alarm Annunciator Panels designed to fulfill all the requirements of all industrial plants. In this system, display and electronic controllers are separate. The modular construction allows for systems of almost any size. Installed depth of display is approximately ly 68mm (controllers are separate).	Nr.	1

		<p>System Features: Modular Multi-point Design Split Logic Controllers (separate display and electronics) One Logic Controller for each Alarm point Any number of windows Window Size: 75X50 mm (Each window can be divided into 2 or 4) Mounting: Panel mount (flush) display Illumination: 120 degree high bright, long life backlit Standard LED Colour: Yellow, Red, Green Standard Lens Colour: White, Red Installed depth (Display only): 68mm Alarm sequence to ISA-S18.1 Each Channel configurable individually Supports 4 built-in pushbuttons: Acknowledge, Reset, Test, and Mute Supports 4 external pushbuttons: Acknowledge, Reset, Test, and Mute Optically isolated Inputs Inputs: Dry Contact or Voltage inputs (NO/NC) Input Voltage: 12V, 24V, 48V, 125V, 250V (DC or AC) Alarm labeling: Engraving / Translucent film Internal Auxiliary Relay (Input or Output Repeat) Internal Common Alarm Relay High Reliability</p>		
	Training Bench and Skid			
B41	Electronic Level Training skid Kit For General Electronics Exercises	<p>Kit for general electronics exercises – didactic equipment The kit includes a set of components allowing a full course on general electronics to be developed. All components are mounted on a printed circuit board fixed to metal tacks anchored on transparent plastic material modules, allowing consequently the vision of the components and the related symbol represented on the PCB, the mechanical protection of the component, the electrical safety against accidental contacts and easy replacement of damaged components. We have 54 small plastic bases with dim. mm 39x78x30 mm and 09 with dim.mm78x78x30, both with 2 mm. terminals. All the modules are ready to be placed on a rubber circuit designer included in the kit. The set of modules are housed in briefcases. From the educational point of view, the student are trained in component recognition and in acquiring the manual skill necessary to realize a circuit following the diagrams reported in the handbook. More in detail, it includes the following components:</p>	skid	1

	<ul style="list-style-type: none"> • 4 linear potentiometers • 24 resistances, 2W • 1 VDR • 10 capacitors • 3 inductances • 4 diodes and 1 Zener diode • 1 switch • 1 rectifying bridge • 2 integrated circuits • 1 UJT • 1 DIAC • 4 transistors • 1 JFET • 1 TRIAC • 1 SCR • 30 cables of different lengths (10, 25, 50 cm) • 1 rubber circuit designer • 2 briefcases <p>With this kit it must be possible to perform the following experiments:</p> <p>DIRECT CURRENT CIRCUITS</p> <p>Ohm's law Resistances in series or in parallel connected The potentiometer Ideal voltage generator Ideal current generator Principle of superposition of effects and reciprocity theorem Power matching</p> <p>ALTERNATE CURRENT CIRCUITS</p> <p>Alternating current network: purely resistive, purely inductive and purely capacitive circuits Alternating current network. Circuit with resistance, inductance and capacitance Study of a CR and RC network in sinusoidal condition Compensated divider Series resonant circuit Parallel resonant circuit Study in transient condition of a circuit with resistance and capacitance Study of a low-pass filter realized with L and C Study of a high-pass filter realized with L and C</p>		
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	<p>CIRCUITS WITH DIODES</p> <p>Semiconductor diode</p> <p>Half-wave rectifier</p> <p>Double half-wave rectifier</p> <p>Filtering cells for a power supply unit</p> <p>Study of a power supply unit with capacitive filter</p> <p>Voltage doubler circuit</p> <p>Zener diode</p> <p>Measuring the differential resistance of a Zener diode</p> <p>Stabilizing circuit with Zener diode</p> <p>TRANSISTOR</p> <p>Output characteristics of a transistor connected in common emitter configuration</p> <p>Output characteristics of a transistor mounted in the common base configuration</p> <p>Measurement of h_{ie}, h_{fe}, h_{oe}, h_{re} parameters of a transistor</p> <p>Study of a common emitter signal amplifier</p> <p>Measurement of the response curve of a common emitter small signal R - C amplifier</p> <p>Common base amplifier</p> <p>Common collector amplifier</p> <p>Constant current generator</p> <p>Voltage stabilizer circuit with Zener and power transistor</p> <p>Study of Field Effect Transistor (FET)</p> <p>THYRISTORS</p> <p>Silicon controlled rectifier</p> <p>Study of TRIAC</p> <p>Study of DIAC</p> <p>Unijunction transistor (UJT)</p> <p>UJT blocking oscillator</p> <p>Power control through an SCR supplied with a sinusoidal voltage</p> <p>OPERATIONAL AMPLIFIER</p> <p>Operational amplifier</p> <p>Adder and integrator</p> <p>DIGITAL LOGIC</p> <p>Study of OR-AND-NOR-NAND gates</p> <p>Realization of logic units through a 7400 integrated circuit</p> <p>NON-LINEAR RESISTANCE</p> <p>Study of VDR</p> <p>The kit is supplied with relevant manual in English language.</p>		
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	<p>Supplied with: Power supply and function generator – didactic equipment Designed for use in electronics laboratories. The outputs are protected against overload and short circuits. Technical Features:</p> <p>Power Supply Section: dc output : ± 0 ÷ 15V, 300 mA 5V, 1A ac output: 2 x 12V, 1A</p> <p>Function Generator section: waveforms : Sine, Square, Triangle frequency : from 10Hz to 100KHz (4 ranges)</p> <p>On the front panel, it includes the following elements: General switch with warning light AC magnetothermic protection AC variac Fixed DC output (5V, 1A) switch DC output (5 V) warning light Variable DC output from 0 to 15V positive switch Variable DC output from 0 to 15V positive potentiometer Variable DC output from 0 to 15V negative switch Variable DC output from 0 to 15V negative potentiometer Frequency commutator Frequency variation potentiometer Sinusoidal level potentiometer AC output terminals Ground terminal Signal generator output terminals Variable DC output terminals Fixed DC output terminals</p> <p>On the back side, it includes: Power supply socket with fuse</p> <p>The kit is supplied with relevant manual in English language.</p>		
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B42	Flow instruments Training skid	<p>Automatic Control Technology Laboratory – Complete Configuration</p> <p>This laboratory must be designed for the study of the Automatic Control Technology to allow the student a practical training, based on the performance of guided experiments. Industrial type components must be educationally adapted by using a modular panel system to permit the step by step assembling from the simplest circuit to the most complex system. With this laboratory must be possible to perform the following experiments. Fundamentals of Automatic Control Technology :</p> <ul style="list-style-type: none"> •Automatic Control Theory •Processes •Controllers •Continuous Automatic Control •Discontinuous Automatic Control <p>Applications:</p> <ul style="list-style-type: none"> •Control of a DC Motor •Temperature Control •Light Control •Level Control •Flow Control <p>The laboratory must be supplied complete with a theoretical and practical manual in English language. The laboratory must be composed of the following modules:</p> <p>DC POWER SUPPLY Didactic equipment Technical features:</p> <ul style="list-style-type: none"> •Output voltages: +15 V / 0 V / - 15 V •Output current: C2.4 A (3 A for a short time) •Power supply: Single-phase from mains •Complete with two LEDs and a mains switch with pilot lamp <p>It must be mounted on an insulated didactic module, this module must show a schematic diagram and 2 mm terminals for the electrical connection; Laboratory power supply with two outputs, fixed voltage; protection from short circuit. It must include also a bus for the supply that allows the connection between the panels.</p> <p>VOLTAGE REFERENCE GENERATOR Didactic equipment This module must be suitable for the generation of a reference signal through an internal potentiometer or for transferring an external reference signal. Technical features:</p> <ul style="list-style-type: none"> •Output voltage: 0...+10 V or -10 V ...+10 V •Power supply: +15 V / 0 V / - 15 V <p>It must be mounted on an insulated didactic module, it must show a schematic diagram and 2 mm terminals for the electrical connection; two switches and one potentiometer with scale graduated knob. It must include also a bus</p>	skid	1
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	<p>for the supply that allows the connection between the panels.</p> <p>PID CONTROLLER Didactic equipment This module must simulate a standard industrial controller for use as P, PI, PD or PID regulator in automatic closed-loop control systems. Technical features: <ul style="list-style-type: none"> •Power supply: -15 V/0 V/+15 V •Input summing point for two different reference variables •UR and UC and one controlled variable UA. •Signal voltage range: -10 V . . . + 10 V •Controller continuously adjustable parameters: proportional gain $K_p = 0 . . . 1000$ integral action time $T_I = 1 \text{ ms} . . . 100 \text{ s}$ differential action time $T_D = 0.2 \text{ ms} . . . 20 \text{ s}$ •Separate input for integral element reset. •Output summing point for adding or subtracting disturbance variables It must be mounted on an insulated didactic module, it must show a schematic diagram and 2 mm terminals for the electrical connection; six selectors, two switches, two trimmers and three leds. It must include also a bus for the supply that allows the connection between the panels.</p> <p>P CONTROLLER Didactic equipment This module must simulate the proportional action controller that shall be suitable for the closed loop continuous control systems. Technical features <ul style="list-style-type: none"> •Power supply: +15 V ; 0 V ; -15 V •Signal voltage range: -10V, ..., +10V •Proportional gain $K_p = 0 \dots 100$ It must be mounted on an insulated didactic module, it must show a schematic diagram and 2 mm terminals for the electrical connection; three position switch coarse setting, one potentiometer and one led indicator of over-range. It must include also a bus for the supply that allows the connection between the panels.</p> <p>INTEGRAL-ACTION ELEMENT Didactic equipment This module must be suitable for closed loop continuous control systems. Technical features: <ul style="list-style-type: none"> •Power supply: +15 V ; 0 V ; -15 V •Signal voltage range: -10V, ..., +10V • Coefficient of the integral action $K_I = 0.1 \dots 100 \text{ s}^{-1}$ It must be mounted on an insulated didactic module, it must show a schematic diagram and 2 mm terminals for the</p>		
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	<p>electrical connection; three position switch coarse setting, one potentiometer , one integral action reset input, one switch for inclusion/exclusion of the integral action and one led indicator of over-range. It must include also a bus for the supply that allows the connection between the panels.</p> <p>DERIVATIVE-ACTION ELEMENT Didactic equipment This module must be suitable for closed loop continuous control systems. Technical features •Power supply: +15 V ; 0 V ; -15 V •Signal voltage range: -10V, ..., +10V •Coefficient of the derivative action $KD = 2 \text{ ms} \dots 2 \text{ s}$ It must be mounted on an insulated didactic module, it must show a schematic diagram and 2 mm terminals for the electrical connection; three position switch coarse setting, one potentiometer , one integral action reset input, one switch for inclusion/exclusion of the derivative action and one led indicator of over-range. It must include also a bus for the supply that allows the connection between the panels.</p> <p>SUMMING POINT – 2 INPUTS Didactic equipment This module must consist in a two input summing point, one non inverting input and one inverting input. Technical features •Power supply: +15 V ; 0 V ; -15 V •Signal voltage range: -10V, ..., +10V •Gain factor = 1 It must be mounted on an insulated didactic module, it must show a schematic diagram and 2 mm terminals for the electrical connection; one led indicator of over-range. It must include also a bus for the supply that allows the connection between the panels.</p> <p>SUMMING POINT – 5 INPUTS Didactic equipment This module must consist in a five input summing point; three of them, non inverting; it shall be used in the realization of particular configurations of the controller, using separately the elements P, I and D; the remaining inputs, one inverting and one non inverting, shall be used to add the noise variables. Technical features: •Power supply: +15 V ; 0 V ; -15 V •Signal voltage range: -10V, ..., +10V •Gain factor = 1 It must be mounted on an insulated didactic module, it must show a schematic diagram and 2 mm terminals for the electrical connection; one led indicator of over-range. It must include also a bus for the supply that allows the connection between the panels.</p> <p>SIMULATED CONTROLLED SYSTEM Didactic equipment - 2 pcs</p>		
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	<p>This module must allow the simulation of different processes, such as 1st and 2nd order processes, proportional (P) action processes, integral (I) action processes, double integral (I2) action processes.</p> <p>Technical features:</p> <ul style="list-style-type: none"> •Power supply: +15 V ; 0 V ; -15 V •Input summing point for controlling variable (y) and noise variable (z). •Signal voltage range: -10V, ..., +10V •Coefficient of the proportional action of the process $K_P = 0.2$ (attenuation)C1.5 (amplification) •Time constant $T_1 = 0.1$ 1000 s •Time constant $T_2 = 0.1$ 1000 s <p>It must be mounted on an insulated didactic module, it must show a schematic diagram and 2 mm terminals for the electrical connection; one reset input for the restoration of the initial conditions, two selectors, three potentiometers, two rotary switches for coarse setting, one push-button, two led indicators of over-range. It must include also a bus for the supply that allows the connection between the panels.</p> <p>DEAD TIME ELEMENT</p> <p>Didactic equipment</p> <p>This module must allow the insertion of an adjustable real dead time in those processes which are characterized by it.</p> <p>Technical features:</p> <ul style="list-style-type: none"> •Power supply: +15 V ; 0 V ; -15 V •Signal voltage range: -10V, ..., +10V •Proportional coefficient of the module $K_S = 1$ •Dead time $T_t = 10$ ms 100 ms / 100 ms 1 s <p>It must be mounted on an insulated didactic module, it must show a schematic diagram and 2 mm terminals for the electrical connection; one selector, one potentiometer, three switches for coarse setting for coarse setting and exclusion of the dead time, one led indicator of over-range. It must include also a bus for the supply that allows the connection between the panels.</p> <p>SECOND ORDER TRANSFER ELEMENT</p> <p>Didactic equipment</p> <p>This module must allow the analysis of the behavior of an element with proportional transfer function able to oscillate, with a delay of the second order, both in the time domain and in the frequency domain.</p> <p>Technical features:</p> <ul style="list-style-type: none"> •Power supply: +15 V ; 0 V ; -15 V •Signal voltage range: -10V, ..., +10V •Gain factor = 1 •Time constant $T = 10$ ms 30 s, selectable through two rotary switches •Damping coefficient $d = 0$ 3, with potentiometer setting <p>It must be mounted on an insulated didactic module, it must show a schematic diagram and 2 mm terminals for the electrical connection; two selectors, one potentiometer, one reset input for the restoration of the initial conditions,</p>		
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	<p>one led indicator of over-range. It must include also a bus for the supply that allows the connection between the panels.</p> <p>MANUAL/AUTOMATIC SWITCH Didactic equipment This module must allow to close the control loop, without oscillations, after a suitable setting of the system. It must be composed of a summing point to which the signal coming from a potentiometer (manual mode) and the signal coming from the controller (automatic mode), inserted through switch, will be connected.</p> <p>Technical features: <ul style="list-style-type: none"> •Power supply: +15 V ; 0 V ; -15 V •Signal voltage range: -10V, ..., +10V </p> <p>It must be mounted on an insulated didactic module, it must show a schematic diagram and 2 mm terminals for the electrical connection; one manual mode potentiometer, one manual mode/automatic mode switch, one output summing point. It must include also a bus for the supply that allows the connection between the panels.</p> <p>TWO POSITION CONTROLLER Didactic equipment – 2 pcs This module must consist in a two position controller for discontinuous closed loop control systems and it must be provided with an input summing point to which the reference variable (non inverting input) and the controlled variable (inverting input) will be connected.</p> <p>The binary state of the controller , whose hysteresis can be changed, must be visualized by means of two led; the controller shall be provided with two binary outputs at different voltages.</p> <p>Technical features: <ul style="list-style-type: none"> •Power supply: +15 V ; 0 V ; -15 V •Input summing point •Signal voltage range: -10V, ..., +10V •Output voltages: 0/+5 V ; 0/+10 V •Adjustable hysteresis: 0 ± C2.5 V </p> <p>It must be mounted on an insulated didactic module, it must show a schematic diagram and 2 mm terminals for the electrical connection; one potentiometer, one reset input for the restoration of the initial conditions, one led indicator of over-range. It must include also a bus for the supply that allows the connection between the panels.</p> <p>SAMPLE AND HOLD ELEMENT Didactic equipment This module must be used to discontinuously sample the behaviour of a continuous control on a process. The sampling frequency shall be provided by the generator which will be integrated in the module or by an external signal.</p> <p>Technical features: <ul style="list-style-type: none"> •Power supply: +15 V ; 0 V ; -15 V •Signal voltage range: -10 V, ..., +10 V •Sampling frequency: 0,2 20 Hz </p>		
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	<p>It must be mounted on an insulated didactic module, it must show a schematic diagram and 2 mm terminals for the electrical connection; one potentiometer. It must include also a bus for the supply that allows the connection between the panels.</p> <p>MOTOR-GENERATOR SET Didactic equipment This module must simulate a process for the control of the speed of a dc motor. In this module must be possible to couple an electric motor and a generator through a flywheel in order to increase the momentum of inertia of the whole system. A motor speed transducer shall provide a feedback digital signal; through a D/A converter such signal shall be available also in analogue form. Technical features: <ul style="list-style-type: none"> •Power supply: +15 V ; 0 V ; -15 V •Electric power of the motor: about 10 W •Maximum speed of the motor: 3000 min-1 •Output power from the generator: about 4 W •Output voltage from the generator: 0 20 Vdc •Digital output from the speed transducer: 60 pulses/rotation •Analogue output from the speed transducer: 1V/1000 min-1 <p>It must be mounted on an insulated didactic module, it must show a schematic diagram and 2 mm terminals for the electrical connection; and it must include a real component. It must include also a bus for the supply that allows the connection between the panels.</p> <p>LOAD SWITCH Didactic equipment This module must be developed in order to apply a load to the two pole output electric machines and it shall be controlled both manually and automatically. Technical features: <ul style="list-style-type: none"> •Power supply: +15 V ; 0 V ; -15 V •Input voltage: max. 220 Vac •Load: 3 incandescent lamps <p>It must be mounted on an insulated didactic module, it must show a schematic diagram and 4 mm safety terminals for the electrical connection; three switches for the manual control of the load, electronic control relay for the automatic control of the load, safety junctions both for the connection of the input voltage and for the connection of the rectified output voltage and three real incandescent lamps. It must include also a bus for the supply that allows the connection between the panels.</p> <p>MATCHING AMPLIFIER - didactic equipment This module must operate as matching element between signal voltage levels and standard voltages used in automatic control systems. Technical features:</p> </p></p>		
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	<ul style="list-style-type: none"> •Power supply: -15 V/0 V/+15 V •Input signal range U_i: -50 V . . . + 50 V •Coarse and fine gain setting: $0 \div 1/0 \div 10/0 \div 100$ •Connectable low pass filter with coarse and fine time constant setting: $0/ 1 \div 10 \text{ ms} / 10 \div 100 \text{ ms}$ •Connectable output offset voltage: -10 V . . . +10 V <p>It must be mounted on an insulated didactic module, it must show a schematic diagram and 2 mm terminals for the electrical connection; three potentiometers, two selectors plus one switch. It must include also a bus for the supply that allows the connection between the panels.</p> <p>TRUE RMS METER Didactic equipment</p> <p>Instrument used to measure the RMS value of the voltage, current on a single circuit branch in AC and DC. The values must be visualized on the LCD display. A digital bar graph must make it easy to monitor the RMS values and a dedicated function button allows the adjustment of its scale.</p> <p>The user can communicate with the device through the RS485 serial port using Modbus protocol, to collect data using a supervision software such as SCADA or Labview.</p> <p>Technical features:</p> <ul style="list-style-type: none"> • Automatic Scaling • Voltage: <ul style="list-style-type: none"> 0 .. 1000V DC 0 .. 1000VAC_{pp} 0 .. 750VAC_{rms} • Current: 0 .. 20 A • Accuracy: +/- 0.5% • Resolution: 16bits • Refresh rate: 0.5s • Power supply: 90-260 Vac 50/60Hz • Power consumption: 3 VA • Communication: Modbus (RS485) <p>These didactic panels must be installed on a vertical frame. This module must have insulated front panel, 4 mm. safety terminals.</p> <p>TEMPERATURE CONTROL SYSTEM Didactic equipment</p> <p>This module must represent a process for the control of the temperature, suitable for analyzing continuous and discontinuous closed loop control systems. A halogen lamp shall represent the heating element; a PTC sensor shall provide the feedback signal; a fan and a shutter valve shall allow, besides the reaching of a uniform temperature within given safety limits, also the insertion of noise variables.</p> <p>Technical features:</p>		
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	<ul style="list-style-type: none"> •Power supply: +15 V ; 0 V ; -15 V •Max. temperature: 100 °C <p>Temperature for the intervention of the bimetallic safety switch: 90100°C</p> <ul style="list-style-type: none"> •Feedback signal: <ul style="list-style-type: none"> 2 mA / 10 °C 1 V / 10 °C •Apparent dead time TU: about 10 s •Compensation time TG: about 120 s <p>It must be mounted on an insulated didactic module, it must show a schematic diagram and 2 mm terminals for the electrical connection; one potentiometer, one switch. This panel must include also a bus for the supply that allows the connection between the panels.</p> <p>LIGHT CONTROL SYSTEM</p> <p>Didactic equipment</p> <p>This module must represent a process for the control of the light.</p> <p>In this module an incandescent lamp shall represent the opto-transmitter element, while a phototransistor shall be the opt-receiver element. There shall be different possibilities for generating noise variables.</p> <p>Technical features:</p> <ul style="list-style-type: none"> •Power supply: +15 V ; 0 V ; -15 V •Signal voltage range: 0 ... 20 V •Output signal: 0 10 V •Maximum power: 10 W <p>It must be mounted on an insulated didactic module, it must show a schematic diagram and 2 mm safety terminals for the electrical connection; one potentiometer and one switch. This panel must include also a bus for the supply that allows the connection between the panels.</p> <p>TEST FUNCTION GENERATOR</p> <p>Didactic equipment</p> <p>This module shall consist in a generator of functions such as: Dirac pulse, square wave and triangular wave selectable through selection switch.</p> <p>At some terminals the output signal shall have a fixed amplitude; at other terminals the amplitude shall be continuously adjusted, from 0 V to 10 V, through a potentiometer. The frequency shall be continuously adjusted, from 0.02 Hz to 10 Hz, through a potentiometer. For what concerns the square wave, it shall be possible to set the ratio between high signal and period, by choosing between 1/2 and 9/10.</p> <p>Technical features:</p> <ul style="list-style-type: none"> •Power supply: +15 V ; 0 V ; -15 V •Output wave forms: <ul style="list-style-type: none"> •Dirac pulse function: 0 +10 VP •Triangular wave function: 0 20 VPP balanced with respect to ground 		
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	<ul style="list-style-type: none"> •Square wave function: 0 20 VPP with "high signal/period" ratio = 1/2 •Square wave function: 0 +10 VP with "high signal/period" ratio = 9/10 •Frequency of the output signal: 0.02 10 Hz •Signal Ioff for resetting the integral controllers <p>It must be mounted on an insulated didactic module, it must show a schematic diagram and 2 mm safety terminals for the electrical connection; one potentiometer and one switch, two potentiometers, one selector and one switch. This panel must include also a bus for the supply that allows the connection between the panels.</p> <p>RECEPTACLE WITH PUMP</p> <p>Didactic equipment</p> <p>This module must be used in conjunction with the filling tank and it shall consist in a water storage tank and a gear pump.</p> <p>Technical features:</p> <ul style="list-style-type: none"> •Power supply: +15 V ; 0 V ; -15 V • vessel capacity: C1.5 l minimum •Signal voltage range: 0 . . . +10 V •Power consumption of the pump: 10 W maximum •Maximum pump capacity: 60 l/h minimum •Maximum absorbed power: 25 W •Two hose connections: 8/10 mm diameter •Three meters transparent rubber hose: 8/10 mm Ø •8/10 mm Ø hose connection for the electric pump drain •8/10 mm Ø hose connection for the storage return •Transparent slot for the liquid control contained in the water storage tank <p>It must be mounted on an insulated didactic module, it must show a schematic diagram and 2 mm terminals for the electrical connection.</p> <p>FILLING TANK</p> <p>Didactic equipment</p> <p>This module must be used for the demonstration of controlled system characteristics. Slide valves must allow changing the various features of the controlled system. This module must be complete with plug-in device for sensors used to detect the liquid level and it must include a set of 10 transparent foils, printed with a vertical and a horizontal scale with graduation marks. It shall be suitable for labeling with water-soluble markers</p> <p>Technical features:</p> <ul style="list-style-type: none"> •Vessel capacity: C1.5 l minimum •Three guides for the insertion of sliding valves •Two hose connections: 8/10 mm Ø • Three meters transparent rubber hose: 8/10 mm Ø •Six sliding valves with different opening characteristics and with the same orifice for maximum level •Connection for 8/10 hose for water entry 		
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	<p>•Connection for 8/10 hose for water drain It must be mounted on an insulated didactic module.</p> <p>DIFFERENTIAL PRESSURE TRANSDUCER Didactic equipment This module must be used for connecting to the immersion tube for measuring the liquid level and to the measurement orifice gauge for flow measurement. Technical features:</p> <ul style="list-style-type: none"> •Power supply: ± 15 V •Signal voltage range: 0 . . . +10 V •Scale conversion selector: 0,2V/mbar – 0,66 V/mbar •Differential pressure: ± 70 mbar •2 hose connections •Differential pressure transducers with hose connections: 6/8 mm \varnothing • Three meters transparent rubber hose: 8/10 mm \varnothing <p>It must be mounted on an insulated didactic module, it must show a schematic diagram and 2 mm terminals for the electrical connection.</p> <p>TURBINE FLOW METER Didactic equipment This module must be used for measuring the flow according to the volumetric principle. Technical features:</p> <ul style="list-style-type: none"> • Power supply: ± 15 V •Measurement range: 10 ... 100 l/h •Measurement temperature: 20°C •Measurement medium: water •Flow: 3-90 l/h •TTL output: 175Hz for a 90 l/h flow •Analog output: 1 V for each 10 l/h •2 hose connections: 8/10 mm \varnothing •Three meters transparent rubber hose: 8/10 mm \varnothing <p>It must be mounted on an insulated didactic module, it must show a schematic diagram and 2 mm terminals for the electrical connection. This panel must include real component such as a turbine flow meter.</p> <p>SOLENOID VALVE Didactic equipment This module must consist in a two-way valve with switching amplifier. It must consist in a single-solenoid valve, normally closed, with two ways and two positions. This module shall be used to control the On/Off level of for variations in the flow control. Technical features:</p> <ul style="list-style-type: none"> • Power supply: + 15V 		
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	<ul style="list-style-type: none"> • Control voltage: > 1 • Single-solenoid valve voltage: 12 VDC • Manual control through the switch • Possibility of automatic control • 2 hose connections: 8/10 mm Ø • Three meters transparent rubber hose: 8/10 mm Ø <p>It must be mounted on an insulated didactic module, it must show a schematic diagram and 2 mm terminals for the electrical connection This panel must include real component such as a single-solenoid valve.</p> <p>POWER METER UNIT Didactic equipment This demonstration meter shall be suitable to measure the true rms of voltages and currents. Technical features: <ul style="list-style-type: none"> • Voltage 3/10/30/100/300/1000 V (input resistance 10 MΩ) • Current 0.1/0.3/1/3/10/30 A • Continuous overload protection in all ranges. • Auxiliary supply: single-phase from mains Measurement modes: RMS: AC+DC, total true r.m.s. value RMS: AC, true r.m.s. value of alternating part AV: AC+DC, arithmetical average value, with 2 leds polarity indication Switchover must be possible for all ranges and measurements modes at any time. This module must have insulated type front panel with the electrical scheme and safety terminals. One selector and three switches shall be included in this panel.</p> <p>SINGLE POLE SWITCH Didactic equipment This item shall consist in a plug-in element, normally open, with switch load 2 A, 250 V. It shall be contained in a plastic box and with a switch.</p> <p>SINGLE POLE PUSHBUTTON Didactic equipment This item shall consist in a plug-in element, normally open, with switch load 2 A, 250 V. It shall be contained in a plastic box and with a push-button.</p> <p>INTERFACE UNIT Didactic equipment Data acquisition unit with 8 analogue channels. Equipped with 2 relays and 2 analogue outputs. It must be possible to acquire continuous signals or slowly variable up to 100Hz. Description: robust metal construction, USB interface for maximum PC compatibility Clear interface for easy connection understanding Technical Features</p>		
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B43	Temperature instruments Training skid	<p>This system has been designed for the study of a model of a temperature industrial control. It is composed of two boards: Temperature Basic Control and Advanced Temperature Control</p> <p>Temperature Basic Control This board includes a small oven with a heating element and three temperature sensors (thermocouple, thermistor, and thermo-resistance) with relevant interface circuits. Complete with error amplifier that can be configured for on-off or proportional control, and with a piloting circuit of the power stage with triac. The board is supplied complete with a set of stackable, plug-in cables of suitable lengths and colors and with a training manual. Power supply: 24Vac, 1A, 50/60Hz and $\pm 15Vdc$, 100mA</p> <p>Experiments $V = f(t^\circ)$ characteristics of a thermocouple, with relevant linearization, of the thermistor and of the thermo-resistance Analysis of the operation of an on-off control Analysis of the operation of a proportional control</p> <p>Advanced Temperature Control – PID Controller This board includes two reference signal generators, a comparison node and the three terms network (proportional, integral and derivative). Complete with digital temperature indicator 100mV/$^\circ C$. This board is an option to the board "Temperature Basic Control" since it uses its oven, the heating element and the temperature transducers. The board is supplied complete with a set of stackable, plug-in cables of suitable lengths and colors and with a training</p>	skid	1

		<p>manual. Power supply: $\pm 15\text{Vdc}$, 100mA and $+5\text{Vdc}$, 150mA</p> <p>Experiments Analysis of the operation of a proportional, proportional-derivative and proportional-integral control PID control circuits PID controllers calibration</p>		
B44	Pneumatic Instruments Training Skid (Level and Flow)	<p>Didactic trainer - Trainer for demonstrations and experiments in the pneumatic field. The trainer must include a metal frame supporting the following modules: A pneumatic board, where all the components must be mounted and identified through a clear symbol. They must include: 2 double-acting cylinders with 3 return orifice check valves, 4 roller lever and 1 lever 3/2 valves, 2 stable and 2 unstable 5/2 valves, 2 AND, 2 OR and 1 NOT, 1 throttle valve, 1 capacity, 1 fast relief valve and 1 splitter. Supplied with 75 m of $\phi 4$ and 3 m of $\phi 6$ plastic tube, 10 tees and 10 plugs, as well as 1 pipe cutter, service manual and exercise book with experiments. An air supply vertical board, providing 1 lever main switch, 1 filter, 2 pressure regulators with 2 pressure gauges, 1 mushroom and 3 digital 3/2 push-buttons, 1 lever 5/2 selector and 1 digital 5/2 push-button. With this trainer it must be possible to perform the following exercises: CIRCUITS WITH ONLY ONE CYLINDER C1. Unstable direct control of an S.E. cylinder - A+/A- sequence C2. Unstable direct control of an S.E. cylinder - A-/A+ sequence C3. Stable direct control of an S.E. cylinder - A+/A- sequence 4. Stable direct control of a D.E. cylinder - A+/A- sequence 5. Unstable indirect control of a D.E. cylinder - A+/A- sequence 6. Stable indirect control of a D.E. cylinder - A+/A- sequence 7. Single Cycle (SEMIAUTOMATIC) of a D.E. cylinder-A+/A- sequence 8. Continuous Cycle (AUTOMATIC) of a D.E. cylinder -A+/A- sequence CIRCUITS WITH SPEED ADJUSTMENT 9. Speed adjustment of the two strokes of a D.E cylinder A+/A- sequence 10. Speed adjustment for only a section of the stroke of a D.E cylinder A+/A- sequence CIRCUITS WITH LOGIC ELEMENTS 1C1. Unstable direct control with two independent starting valves of an S.E. cylinder - A+/A- sequence 1C2. Unstable direct control with two dependent starting valves of an S.E.cylinder - A+/A- sequence 1C3. Single cycle with stroke end safety starting of a D.E.cylinder A+/A- sequence 14. Single cycle without mechanical stroke end of a D .E.cylinder A+/A- sequence 15. Applications on the ET-OU logic functions 16. Applications on the ET-OU-NON logic functions 17. Stable indirect control with only one unstable valve of a D.E. cylinder A+/A- sequence CIRCUITS WITH DELAY SYSTEMS 18. Unstable indirect control with delay at the starting of an S.E. cylinder A+/A- sequence</p>	skid	1

		<p>19. Pulse Generator 20. Extension of a short duration signal 2C1. Bimanual control with concurrency safety CIRCUITS WITH TWO CYLINDERS - SEQUENCES WITHOUT BLOCKING SIGNALS 2C2. Single cycle with several D.E. cylinders A+/B+/A-/B- sequence 2C3. Continuous cycle with several D.E. cylinders A-/B+/A+/B- sequence 24. Continuous cycle with contemporary strokes of D.E. cylinders A+/B+/A-B- sequence 25. Continuous cycle with repetitive and contemporary strokes A+/A-B+/A+/A-B-sequence INTEGRATIVE CONTROLS OF THE CIRCUITS 26. Continuous cycle with separated control of start and end cycle of a D.E. cycle A+/A- sequence 27. Continuous cycle with single cycle control - automatic of a D.E. cylinder A+/A- sequence 28. Continuous cycle with manual - automatic control of a D.E. cylinder A+/A- sequence 29. Continuous cycle with manual - automatic control of D.E. cylinders A+/B+/A-/B- sequence 30. Continuous cycle with emergency control with stop at the rejoined phase of a D.E. cylinder A+/A-sequence 3C1. Cycle with emergency control immediate return to the starting position of D.E. cylinders A+/B-/A-/B+ sequence The trainer must be supplied with manual in English language.</p>		
	Basic Electronic and Electric Training Kits			
B45	AC Fundamental Training panel	<p>AC CIRCUITS MODULE - didactic equipment: circuit blocks: alternating quantities, resistive circuit, capacitive circuit, R-C circuit (series and parallel), inductive circuit, R-L circuit (series and parallel), series resonant circuit, parallel resonant circuit, low-pass filter (R-C), high-pass filter (C-R), low-pass filter (L-R), high-pass filter (R-L), pass-band filter- theoretical topics: sinusoidal alternating currents and voltages, vector and symbolic representation of the sinusoidal electric quantities, product of a sinusoidal quantity by a constant, sum and difference of sinusoidal quantities, product of two sinusoidal quantities, product of a sinusoidal quantity by a complex number, elementary bipoles: R, L, C; series and parallel of the bipoles: R-L, R-C, R-L-C; oscillating circuits: frequency response of the ac circuits, low-pass filter, high-pass filter, pass-band filter. Fault simulation. It must be possible to perform the following experiences: Alternating quantities, Resistive circuit, Capacitive circuit, R-C circuit (series and parallel), Inductive circuit, R-L circuit (series and parallel), Series resonant circuit, Parallel resonant circuit, Low-pass Filter (R-C) High-pass filter (C-R), Low-pass Filter (L-R) High-pass filter (R-L), Pass-band filter. The faults must be inserted by software and by microswitches mounted on the board. The module must be provided with a EISA BUS 31+18 INTERFACE for connection to power supply and PC, with a software able to allow the study of theoretical topics through PC with hyper textual navigation according to the HTML standard. Connections and test points by 2mm terminals. Dimensions of the module: 297x260mm. The module must be supplied with a theoretical and practical manual.</p>	Nr.	1
B46	DC Fundamental Training panel	<p>DC FUNDAMENTALS - didactic equipment - circuit blocks: batteries, switches, Ohm's Law, series circuit, parallel circuit, series/parallel circuit, power, linear/Non-Linear variable resistor, voltage divider,</p>	Nr.	1

		<p>voltmeter/ammeter/Ohmmeter - theoretical topics: DC power sources, batteries, conventional directions of voltages, e.m.f. and currents, Ohm's law, circuit with linear resistance and non linear resistance, series/parallel resistive circuits, power in dc circuits, linear/non linear variable resistor, voltage/current divider circuits, direct current meters. Fault simulation. It must be possible to perform the following experiences: Batteries, Switches, Ohm's law, Series circuit, Parallel circuit, Series/Parallel circuit, Power, Linear/Non linear variable resistor, Voltage divider, Voltmeter/Ammeter/Ohmmeter. The faults must be inserted by software and by microswitches mounted on the board. The module must be provided with a EISA BUS 31+18 INTERFACE for connection to power supply and PC, with a software able to allow the study of theoretical topics through PC with hyper textual navigation according to the HTML standard. Connections and test points by 2mm terminals. Dimensions of the module: 297x260mm. The module must be supplied with a theoretical and practical manual.</p> <p>ELECTRIC NETWORKS Didactic equipment - circuit blocks: Kirchoff 's current law, Kirchoff 's voltage law, Kirchoff 's laws combined, Kirchoff 's solution with two sources, superposition, Thevenin circuits, Thevenizing a bridge circuit, Thevenin / Norton Conversion, delta to Y or Y to delta - theoretical topics: elements of an electrical network: node, arm, mesh, first Kirchoff principle, second Kirchoff principle, series resistances, parallel resistances, series-parallel connection, voltage dividers, theorem of the effect superposition, Thevenin theorem, Norton theorem, Millman theorem. Fault simulation. It must be possible to perform the following experiences: Series resistors and Kirchoff Voltage Law verification, Parallel resistors and Kirchoff Current Law verification, Series-parallel resistors, Effect superposition, Thevenin theorem, Norton theorem, Millman theorem, Voltage divider. The faults must be inserted by software and by microswitches mounted on the board. The module must be provided with a EISA BUS 31+18 INTERFACE for connection to power supply and PC, with a software able to allow the study of theoretical topics through PC with hyper textual navigation according to the HTML standard. Connections and test points by 2mm terminals. Dimensions of the module: 297x260mm. The module must be supplied with a theoretical and practical manual.</p>		
B47	Logic Fundamental Training panel	<p>LOGIC CIRCUITS - didactic equipment: - circuit blocks: logic gates, Boolean Algebra, Karnaugh's maps and combinatory networks, encoder and decoder, multiplexer and demultiplexer, electric characteristics of the TTL logic gates, the TTL logic family, the CMOS logic family - theoretical topics: binary system, logic functions, the algebraic description of the logic gates, the truth tables, the theorems of the Boolean Algebra, techniques for the minimization of the logic functions through the application of the theorems, fundamental logic operators, NOT, AND and OR logic operators, use of the AND and OR operators as control devices for the transfer of logic signals, OR-exclusive logic operator, classic form of a function, graphic representation of the functions, AND-OR-NOT function, NAND and NOR logic operators, use of the NAND and NOR operators as control devices for the transfer of logic signals, the TTL family, the CMOS family, characteristic parameters of the logic gates, definition and characteristics of a combinatory logic network, the Karnaugh' maps, the BCD code, encoders, decoders, multiplexer and demultiplexer, fault simulation. It must be possible to perform the following experiences: NOT logic gate and</p>	Nr.	1

	<p>verification of the double negation property, AND logic gate, OR logic gate, EX-OR (exclusive OR) logic gate, NAND logic gate, NOR logic gate, EX-NOR (exclusive NOR) logic gate, Verification of the associative property for the AND operator, Carrying out of a four input AND operator, Verification of the associative properties for the OR operator, Verification of operation of the AND and OR operators as control devices in the data transfer, Verification of the Boolean algebra theorems: theorems for one variable, theorems between one variable and one constant, absorption theorems, Morgan's theorem, Functional verification of the canonical forms of the EX-OR operator, Functional verification of the first canonical form of a function assigned by means of its truth table, Functional verification of a logic circuit by means of the comparison with the truth table of its logic function, Functional verification of the minimization of logic functions by means of the Karnaugh's maps, Control of a lamp with control combinatory logic circuit, Automatic selection of events, BCD decimal-binary code converter circuit, BCD - 7 segments binary code converter circuit, 4 to 1 line multiplexer or data selector switch, 1 to 4 line de multiplexer, Electric characteristics of the TTL logic gates, TTL logic family, CMOS logic family. The faults must be inserted by software and by microswitches mounted on the board. The module must be provided with a EISA BUS 31+18 INTERFACE for connection to power supply and PC, with a software able to allow the study of theoretical topics through PC with hyper textual navigation according to the HTML standard. Connections and test points by 2mm terminals. Dimensions of the module: 297x260mm. The module must be supplied with a theoretical and practical manual.</p> <p>DIGITAL CIRCUITS - didactic equipment - circuit blocks: Flip-flops: to keep unchanged for given time intervals the logic state of the output; to define the synchronous and the asynchronous input of a flip-flop; to understand the operation of type D and type T flip-flops and to be able to realize them starting from a J-K flip-flop; Counters, to understand the operating principles of the frequency dividers, to understand analogies and differences between a synchronous and an asynchronous counter, application 4 bit full adder, application 9 bit parity generator, shift registers: to understand the operating principle of the most common shift registers; to be able to understand the state tables and the time diagrams of the registers - theoretical topics: Flip-flop S-R, Flip-flop S-R with NOR operators, Flip-flop S-R with NAND operators, Flip-flop J-K, Flip-flop J-K Master-Slave, Flip-flop T, Flip-flop D, asynchronous 4 bit binary counter, synchronous 4 bit binary counter, asynchronous decimal counter, synchronous decimal counter, parity generator, adders, definition, classification and operating principle of the most common shift registers, fault simulation. It must be possible to perform the following experiences: Verification of the logic operation of an S – R flip-flop, Verification of the logic operation of a J – K flip-flop of Master-Slate type, Verification of the logic operation of a D flip-flop, Verification of the logic operation of a T type flip-flop, 4 bit asynchronous binary counter , asynchronous decimal counter , forward/backward synchronous 4-bit binary counter, BCD/Decade Up/Down counter, Bit Odd/Even Parity Generator, 4-bit Binary Adder, Parallel-serial shift registers, Serial-parallel shift registers. The faults must be inserted by software and by microswitches mounted on the board. The module must be provided with a EISA BUS 31+18 INTERFACE for connection to power supply and PC, with a software able to allow the study of theoretical topics through PC with hyper textual navigation according to the HTML standard. Connections and test points by 2mm terminals.</p>		
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	<p>Dimensions of the module: 297x260mm. The module must be supplied with a theoretical and practical manual.</p> <p>Base frame with power supply, connection to pc and virtual instrumentation with the following characteristics: 0/+15 Vdc, 1 A 0/-15 Vdc, 1 A +15 Vdc, 1 A -15 Vdc, 1 A +5 Vdc, 1 A -5 Vdc, 1 A 6 - 0 -6 Vac, 1 A</p> <ul style="list-style-type: none"> • Interface board for connection to PC. • Robust structure and modern design. • Voltage regulation and protection against over voltage or short circuit. • The base frame must be supplied complete with a set of connecting cables, terminals must be 2mm. It must be supplied with Interface EISA 31+18 - USB HID managed by microcontroller C805C1. Control of 12 relays interfaced on the BUS output and managed by software, 12 NO and 6 NC relays. <p>Dimensions: 380 x300x110 mm</p> <p>MAIN BLOCKS</p> <p>Virtual instrumentation</p> <p>Multimeter</p> <ul style="list-style-type: none"> • 3 and 3/4 digits • dc/ac voltage 400mV, 4 V, 40 V, 400 V • resistance: 400 Ohm, 4 kOhm, 40 kOhm, 400 kOhm, 40 MOhm • dc/ac current: 200 mA, 8A <p>Function Generator</p> <ul style="list-style-type: none"> • sinusoidal, square, triangular, dc • frequency: 0.1Hz - 200 kHz • output: ± 10 V • attenuator: 0 dB, -10 dB, -20dB • frequency, amplitude, offset, duty-cycle regulation <p>Digital oscilloscope</p> <ul style="list-style-type: none"> • dual trace oscilloscope • input: dc/ac, 1 MOhm • measurement ranges: 20/50/100/200/500 mV, 1/2/5V per division • sampling frequency: 100 Hz to 10MHz <p>Digital Pattern Generator</p> <p>TTL Output, output rate from 200ms to 10s between each sample</p>		
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		Output 2048 steps Pattern selection normal or automatic It displays 20 states of the patterns Logic Wave Analyzer TTL IN, 8 inputs The display shows a window of 20 states of the inputs.		
B48	Hand held communicator (HART)	<ul style="list-style-type: none"> • Wireless handheld Hart Communicator, • Supports more than fifty transmitter's advanced parameters, • Remote assistance, built-in loop power supply, • Built-in milliammeter, 	Nr.	1
	General Equipment			
B49	Digital weighing balance	200 / 0.001g 1mg Digital Analytical Balance Weighing Precision Lab Scale 220-240V	Nr.	1
B50	Grinding machine (Bench type)	Bench Grinders & Buffers Machine Type: Grinder Wheel Diameter (Inch): 6	Nr.	1
B51	Soldering/ Disordering Station	<ul style="list-style-type: none"> • Soldering Iron & desoldering Tweezers • 1 Soldering Iron & 1 desoldering Tweezers Separately Controlled With PID Programmable Control Technology • Complete Digital Control for Both The Soldering Iron & desoldering Tweezers • 10 Solder Tips, Brass Tip Cleaner • Functions: Soldering Iron Standby-Time, Adjustable Shut Down, Temp Correction, set degree °C or °F 	Nr.	1
B52	Heat Gun	<ul style="list-style-type: none"> • 4 main applications can be stored permanently, so that airflow and temperature are at the correct setting instantly • Working temperature 50 – 660°C • Airflow and temperature control in steps of ten for precise working; data is shown on an LCD display / Ergonomic design and soft grip • Heating automatically switches off and cools when overheating, for long lifetime 	Nr.	1
B53	Hand Drill machine	• Brushless Cordless Drill Set with Case, Compact Electric Hand Drill with Rechargeable 18V Li-Ion Lithium Battery, variable Speeds	Nr.	1
B54	Portable Crane	Digital Hanging Crane Scale Portable Heavy Duty Scale 660Lb/300KG	Nr.	1
B55	Drilling machine (pedestal type)	Mini Bench Drill Press Compact Drill Wood/steel Drilling 1-10mm. Height adjustment via crank.	Nr.	1
B56	Tool Cabinets	Tool cabinet (180pcs) with 7 drawers (filled with assorted tools)	Nr.	1
B57	Tool Boards	775mm High Static Rack 1000w x 550d mm Single Sided With 40 Piece Hook Kit	Nr.	1
	Digital Instrumentation Laboratory			

B58	Basic PLC Training Kit with software	<p>This modular trainer must allow the study of the PLC and HMI. The modular frame must be made of a tubular steel structure, treated with electrostatic painting. It should be composed of 4 fast fixation lines of modules without the need for tools. The components, as well as their terminals and access points, must be identified clearly with the printed symbols in silk-screen. All terminals and connection points must be available through 2 or 4 mm terminals (according to the voltage).</p> <p>Features:</p> <p><u>Touch screen module</u></p> <ul style="list-style-type: none"> • Resolution 800x480 • Color 16bit • Touch screen 4 wires. • Serial communication RS232/RS485/RS422 • Display 7 inch <p><u>Input power module</u></p> <ul style="list-style-type: none"> • With protection switch and lights • Circuit breaker with leakage protection - rated current 16A • Power input indicator • Power output indicator <p><u>DC power supply module</u></p> <ul style="list-style-type: none"> • Polarity inversion and over-current protection. • Output: fixed power supply 12Vdc, 24Vdc • Variable power supply 0-10Vdc • Digital voltmeter: range 0~20Vdc with 0.01V resolution <p><u>Digital input module (Retentive)</u></p> <ul style="list-style-type: none"> • Module with switches for digital input signals simulation. • 8 fixed contact switches with retention NC/NO, for simulating the logic levels. <p><u>Digital input module(Pulse)</u></p> <ul style="list-style-type: none"> • Module with switches for digital input signals simulation. • 8 contact pulse switches, NC/NO. <p><u>Digital input module (Retentive, Pulse)</u></p> <ul style="list-style-type: none"> • Module with switches for digital input signals simulation. • 4 contact pulse switches, NC/NO • 4 contact retention switches, NC/NO. <p><u>Digital indication module</u></p> <ul style="list-style-type: none"> • Module with 8 leds for light indication of output digital signals • Suitable for PLC with NPN or PNP outputs. <p><u>Potentiometers module</u></p>	kit	1
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	<ul style="list-style-type: none"> • Module with linear potentiometers for simulation of voltage or current signals. • Resistance 10 K 2pc <p><u>Measurement module</u></p> <ul style="list-style-type: none"> • Possibility to measure 2 signals simultaneously. • For current signals from 4 to 20 mA and the other for voltage signals from 0 to 10 Vdc. • Digital voltmeter: range 0~20Vdc with 0.01V resolution • Digital ammeter: range 0~200mA with 0.01mA resolution <p><u>Step motor module</u></p> <ul style="list-style-type: none"> • 4 bits electronic driver • 4 phase 5 wires deceleration stepper motor, 5Vdc • 4 indication lights • Code wheel display rotation <p><u>Relay module</u></p> <ul style="list-style-type: none"> • Module with 4 relays for 3 A and 24 Vdc coil • Suitable for PLC with NPN or PNP outputs • Independent of each other <p><u>DC motor module</u></p> <ul style="list-style-type: none"> • DC motor, 24Vdc input, 60rpm, stepless speed regulation. • Encoder, 24Vdc input, T-slot structure, infrared detection • 0-10V analog speed control • Suitable for PLC with NPN or PNP inputs <p><u>A/D converter module</u></p> <ul style="list-style-type: none"> • Module with Analogue/Digital converter • 8 bits A/D converter • Analogue signals input from 0 to 10 Vdc or from 4 to 20 mA. • Channel selection for 0 to 10 Vdc and 4 to 20mA • 8 Indicator lights <p><u>D/A converter module</u></p> <ul style="list-style-type: none"> • Module for Digital/Analogue converter • 8 bits D/A converter • With maximum analogue output signals adjustable from 0 to 10 Vdc or from 4 to 20 mA. • 8 Indicator lights <p><u>Accessories to be supplied:</u></p> <ul style="list-style-type: none"> • Data DVD: source code, developing software for both HMI and PLC • Experimental cable • Experimental manual 		
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	<p><u>Topics should cover</u></p> <ul style="list-style-type: none"> • Motor forward & reversal control experiment • Three-phase synchronous motor Y-Δ start control experiment • Motor sequence start and stop control experiment • Stepping motor control experiment • Touching Screen Experiment • D/A Conversion experiment • A/D Conversion experiment • PLC Analog input experiment <p>PROGRAMMABLE LOGIC CONTROLLER MODULE</p> <p>The module should embed a Siemens PLC and expansion AI AO modules. All input/output pins of PLC should be introduced to the panel. User can connect the IO pins to other application modules with 2mm test leads.</p> <p>The module must include:</p> <ul style="list-style-type: none"> • Panel and back cover • PLC and expansion AO modules • DC Power input • DC Power switch • 2mm terminals for IO interface <p>Features:</p> <p>Power supply: DC 24V Digital Input terminals with COM: 7 pcs Digital output terminals with COM: 6 pcs Analog input terminals with COM: 3 pcs Analog output terminals with COM: 2 pcs</p> <p>PLC CPU1211C details:</p> <ul style="list-style-type: none"> • The CPU should be provided with a PROFINET port for communication over a PROFINET network. • Embedded digital I/O points: Inputs, 24VDC 6 points. Outputs, 24V DC Solid state - MOSFET (sourcing) 4 points. • PTO/PWM Support: 2 (PTO/PWM) • Embedded HSC Support:3 • Analog inputs : 2 inputs. Full-scale range, 0 to 10 V • Number of plug-in modules: Communication module expansion -3CMs max. .SB, CB, BB expansion-1max. • Basic instruction speed: 0.08 μs/instruction per Boolean • Minimum scan/cycle time: Maximum scan cycle time 1 to 6000ms. Minimum scan cycle time 1 to maximum scan cycle time 		
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		<ul style="list-style-type: none"> • User memory: Work, 50 Kbytes. Load, 1 Mbyte internal, expandable up to SD card size. Retentive, 10 Kbytes • IEC 61131-3 languages: Ladder diagram, function block diagram, structured text • Operating temperature: -20...60 °C <p>Analog output module SB 1232 details:</p> <ul style="list-style-type: none"> • Number of outputs: 1 output, • Voltage range: $\pm 10V$ • Current range: 0...20 mA • Power consumption: C1.5W • Input impedance: $\geq 1000\Omega$ for voltage mode, $\leq 600\Omega$ for current mode. <p>CM1241 RS232 details:</p> <ul style="list-style-type: none"> • RS232(full-duplex) • Transmitter output voltage, $\pm 5V$ min. at $R_L=3K\Omega$ • Transmit output voltage, $\pm 15VDC$ max. • Receiver input impedance, $3K\Omega$ min • Receiver threshold/sensitivity, 0.8 V min. low, C2.4 max. high 0.5 V typical hysteresis • Receiver input voltage, $\pm 30 VDC$ max. 		
B59	Virtual system for plc study (SIMATIC S7-1200)	<p>This system must be a didactic tool for the learning of PLC programming.</p> <p>This trainer must show five virtual industrial processes in order permit to the student to learn how to program a PLC. These processes must simulate real situations as sorting, batching, palletizing, pick & place and automatic storage; the aim must be to program the PLC in order to control all these virtual processes as real systems. The system must be composed of the above mentioned automation processes based on settings that represents industrial realities. This trainer must permit also the faults simulation for sensors and actuators in open or short-circuit.</p> <p>Thanks to this virtual system, it must be possible to interact with the system as it is a real system, add or remove products from the production line in every moment of the simulation, create faults and jamming of the system.</p> <p>Main features:</p> <p>SIMATIC S7-1200 CPU 1212C (AC/DC/RLY) Signals Module 1223 (8DI/8DO) 16 digital inputs 14 digital outputs Ethernet port STEP 7 Professional SW Hardware key secured inside 3D realistic graphics Real-time physics that closely emulates what happens in real life 3D real-time sound</p>	Nr.	1

		<p>Total interactivity with the systems Friendly user interface Easy and fast to setup The information shall be exchanged between the PLC and the virtual system through a data acquisition board provided with 32 I/O isolated channels and USB interface: 16 channels with input voltage: Logic 0: 2V max., Logic 1: 5V min (60V max.) or dry contact 16 channels with output voltage: 5 ~ 40Vdc - sink current type 100mA max/channel and 1,1 A/total max. Based on the latest PC technology, this trainer shall make PLC training easy and fun. The result shall correspond to an immersive simulated environment that allows highly realistic training processes, without any risk of injury to man or damage to machines. The automation tasks shall be presented with increasing levels of difficulty, so that users can progress to more advanced exercises as they improve their skill. This trainer shall reproduce five training processes based on real world industrial scenarios. Each process shall offer standard problems found in PLC programming, presented in order of increasing level of difficulty. These training processes shall consist in: SORTING: transport cases from the entry bay to the elevators, sorting them by height BATCHING: mix three primary colors (red, green and blue) in order to obtain a desired color PALLETIZER: palletize cases up to three layers PICK & PLACE: place parts inside boxes through a three axes manipulator AUTOMATIC WAREHOUSE: transport, store and retrieve boxes from a rack The system shall be inserted in a didactic panel with 2 mm terminals for the digital inputs/outputs. The PLC must be supplied with applications in LADDER language for the control of the five simulation processes. The trainer must be supplied with manual in English language.</p>		
B60	SCADA Training kit	<p>HMI Training Course (Human Machine Interface - SCADA • This HMI Training Course (Human Machine Interface - SCADA)- is a introductory HMI SCADA course for automation engineering on scada systems. • Uses AB Rockwell's automation and controls HMI SCADA system (RSView 32) as an example• WIN 10, 8 7 and XP</p>	kit	1
B61	PLC Ladder logic training software	<p>• PLC Programmable Logic Controller Programming Ladder and Function Block Software in CD • CD with Software package with instructions and manuals • Programming, Simulation and Monitoring • Easy to learn training section -Basic and Advanced</p>	Nr.	1
B62	Digital-To-Analogue Converter Kit	<p>Digital-To-Analogue Converters This board must allow the study of the operating principle and of the main characteristics of a digital-to-analogue converter. The board must be composed of 3 independent sections: • a weighed resistances discrete components D/A converter • a discrete components D/A converter in a R-2R network</p>	kit	1

		<ul style="list-style-type: none"> a monolithic 11 bit D/A converter <p>While the first two sections are used to highlight the operating principle of two different D/A converters, the third one is used to analyse the operating modes and the characteristics of the converters that are commercially available. The board must be supplied complete with a set of stackable, plug-in cables of suitable lengths and colours and with a training manual.</p> <p>Power supply: ± 15 Vdc, 200 mA and + 5Vdc, 200mA</p> <p>Experiments:</p> <ul style="list-style-type: none"> Analysis of the operation of a weighed resistances converter Analysis of the operation of a converter in a R-2R network Analysis of the conversion errors Analysis of the operation and of the main characteristics of a monolithic converter 		
B63	Analog to Digital Converter Kit	<p>This board must allow the study of the operating principle and of the main characteristics of analogue-to-digital converters. The board must be divided in 2 sections: in the first one a discrete component realization is provided of a ramp A/D counter converter, while in the second section there is a monolithic converter. The first section must be used to highlight the operating principle of an A/D converter, while the second one is mainly used to analyze the operating modes and the characteristics of the converters that are commercially available. The board must be supplied complete with a set of stackable, plug-in cables of suitable lengths and colours and with a training manual.</p> <p>Power supply: ± 15 Vdc, 100 mA and + 5Vdc, 200mA</p> <p>Experiments</p> <ul style="list-style-type: none"> Analysis of the operation of a counter converter Analysis of the operation and of the main characteristics of a monolithic converter Analysis of the conversion errors 	kit	1
B64	Displacer Level Transmitter, Fisher or equivalent	Designed to measure liquid level, interface level, or density/specific gravity inside a vessel	Nr	1
	Process Equipment			
B65	Electromagnetic Flow Transmitter	Electromagnetic Flow Transmitter is a flow measurement device relying on the conductive properties of liquids traveling across a magnetic field to measure the flow in a pipe	Nr.	1
B67	Coriolis Flow Transmitter	The Coriolis Flow Transmitter is a flow measurement device using the Coriolis forces generated when a fluid goes through the flowmeter to measure the mass flow of liquid in a pipe	Nr.	1
B68	Vortex Flow Transmitter	Vortex Flow Transmitter. To measure the flow of high or low temperature fluids.	Nr.	1
B69	Pressure Transmitter (HART)	The Pressure Transmitter is a gauge pressure measurement device for fluids. Parameter Value Ceramic Sensor Operating Range -100 to 1000 kPa (-15 to 150 psi)	Nr.	1
B70	Guided wave Radar level	• The Guided-Radar Level Transmitter is a level measurement device using electromagnetic waves to detect the	Nr.	1

	transmitter	<p>level of liquid in the column. Transmitter includes a rod probe to guide the signal in the column and a transmitter.</p> <p><u>Ratings</u></p> <p>Power Input 24 V dc</p> <p>Operating Frequency 100 MHz to 1.5 GHz</p> <p>Measured Variable Level (via time-of-flight)</p> <p>Accuracy ± 2 mm</p> <p>Sensor Operating Temperature -40°C to 80°C (-40°F to 176°F)</p> <p>Process Temperature -40°C to 200°C (-40°F to 392°F)</p> <p>Sensor Operating Pressure Vacuum to 4000 kPa (Vacuum to 580 psi)</p> <p>Blocking Distance 200 mm (7.9 in)</p> <p>Probe Length 1.03 m (40.6 in)</p>		
B71	Differential pressure level transmitter	A differential pressure transmitter is an instrument that senses a pressure difference between two points and converts the pressure to a standardized electronic signal which can be sent to a control element. The transmitter can be configured so that its signal is either proportional to a pressure differential, a flow rate, or a level. <u>High Range and low range.</u>	Nr.	1
B72	Ultrasonic Level Transmitter	The Ultrasonic Level Transmitter is a level measurement device that uses sound waves to detect the level of liquid. The Ultrasonic Level Transmitter includes an ultrasonic sensor/emitter.	Nr.	1
B73	Capacitance type level transmitter	The Capacitive Level Transmitter (HART) is a level measurement device based on the change in the capacitance of a capacitor.	Nr.	1
B74	Paddle Wheel Flow Transmitter	The Paddle Wheel Flow Transmitter provides a measurement of the flow rate by inserting a simple paddle wheel into the flow stream. And the Ultrasonic Flow Transmitter is a device inferring the flow rate by measuring the transit-time differential between an ultrasonic pulse traveling upstream with one traveling downstream.	Nr.	1
B75	Magnetic level switch	Conductivity Level Switch is a level limit switch made of three probe rods of different lengths.	Nr.	1

B76	Vibrating level switch	The Vibrating Fork Level Switch is a level limit switch used to detect whether or not the level of water in the column has reached a set level	Nr.	1
B77	Float switch	The Float Switch is a level limit switch triggered when a float is raised by buoyancy forces as the level of liquid in the column reaches the float	Nr.	1
B78	Electronic Pressure Transmitter Range 0-16 Bar	Range 0 - 16bar	Nr.	1
B79	Electronic Pressure Transmitter Range 0-25 Bar	Range 0 - 25bar	Nr.	1
B80	Electronic Pressure switch Range 0-2 Bar	Range 0 - 2bar	Nr.	1
B81	Electronic Pressure switch Range 0-7 Bar	Range 0 - 7bar	Nr.	1
B82	Electronic Pressure Switch Range 0-12 Bar	Range 0 - 12bar	Nr.	1
B83	Pneumatic Pressure switch Range 0-10 Bar	Range 0 - 10bar	Nr.	1
B84	Pneumatic Pressure switch Range 0-16 Bar	Range 0 - 16bar	Nr.	1
B85	Pneumatic Pressure switch Range 0-20 Bar	Range 0 - 25bar	Nr.	1
B86	Pneumatic Pressure Transmitter Range 0-10 Bar	Range 0 - 2bar	Nr.	1
B87	Pneumatic Pressure Transmitter Range 0-16 Bar	Range 0 - 7bar	Nr.	1
B88	Pneumatic Pressure Transmitter Range 0-20 Bar	Range 0 - 12bar	Nr.	1
B89	Pneumatic control valve	Pneumatic Control Valve. Designed for pressure, flow, level, and temperature control applications. Includes a current-to-pressure converter which transforms a 4-20 mA input signal into a pneumatic output signal sent to the actuator of the control valve	Nr.	1
B90	Control Valve with positioner (complete set) (HART)2"	Pneumatic Control Valve with Digital Positioner (HART). The controller has a high-performance positioner.	Nr.	1
B91	Control Valve with positioner (complete set)	Pneumatic Control Valve with Digital Positioner (FISHER). The control valve also features a rugged pneumatic positioner.	Nr.	1

	FC 2"			
B92	Control valve with positioner actuator FO 2"	Electric Control Valve. Transforms a 4-20 mA input signal directly into a specific opening of the control valve. A 0-10 V dc output is used as a feedback signal to monitor the position of the valve.	Nr.	1
B93	Delete			
B94	Solenoid valve (electric)	The Solenoid Valve is a simple unidirectional, direct-acting, normally closed valve made of brass which can be used to effect on/off control on a process. The Solenoid Valve fully opens when a 24 V dc signal is applied to the electrical connectors wired to the solenoid.	set	1
B95	Single well control panel (Baker Huges)	<ul style="list-style-type: none"> • Panel Supply: 100 to 150 psig (689 kPa to 1 MPa) [6.89 to 10.3 bar] clean, dry, filtered, instrument quality gas or air • Enclosure: 25w x 20d x 30h in. (635 x 508 x 762 mm); 12 ga. 316L stainless steel. • Tubing: 316L stainless steel, welded and drawn. • Tube Fittings: 316 stainless steel • Pressure Pilots:, panel mounted, 500 to 2000 psig range • Hydraulic Pump: (with hand pump). • Hydraulic Circuit Working Pressure: 6000 psi (41 MPa) [413 bar]. • Hydraulic Reservoir: 5 gallon (C1.892 m3) capacity 	Nr.	1
B96	Thermocouple Temperature Transmitter (0-100°C (K-type))	0-100 ⁰ C (K-type)	Nr.	4
B97	Thermocouple Temperature Transmitter ((0-200°C (K-type))	0-200 ⁰ C(k-type)	Nr.	4
B98	RTD Temperature Transmitter ((0-100°C PT-100)	0-100 ⁰ C(PT-100)	Nr.	4
B99	RTD Temperature Transmitter (0-200°C,PT-100)	0-200 ⁰ C(PT-100)	Nr.	4
B100	Capillary tube temperature gauge (0-100°C (Bimetallic thermometer)	0-100 ⁰ C Bimatalic thermometer	Nr.	4
B101	Capillary tube temperature gauge (0-200°C (Bimetallic thermometer)	0-200 ⁰ C Bimatalic thermometers	Nr.	4
B102	Capillary tube temperature gauge (0-100°C (Gas filled thermometer)	0-100 ⁰ C Gas filled thermometers	Nr.	4

B103	Capillary tube temperature gauge (0-200°C (Gas filled thermometer)	0-200°C Gas filled thermometers	Nr.	4
B104	Capillary tube temperature switch (0-100°C (Bimetallic)	0-100°C Bimatalic	Nr.	4
B105	Capillary tube temperature switch (0-200°C Bimetallic)	0-200°C Bimatalic	Nr.	4
B106	Capillary tube temperature switch(0-100°C Gas filled)	0-100°C Gas filled	Nr.	4
B107	Capillary tube temperature switch(0-200°C Gas filled)	0-200°C Gas filled	Nr.	4
B108	Thermocouple Temperature sensor (0-1000C (K-type)	0-100°C (K-type)	Nr.	4
B109	Thermocouple Temperature sensor (0-2000C (K-type)	0-200°C(k-type)	Nr.	4
B110	RTD Temperature sensor (0-1000C (PT100, 3-wire)3	0-100°C(PT-100) 3 wire	Nr.	4
B111	RTD Temperature sen4or (0-2000C (PT100, 3-wire)	0-200°C(PT-100) 3 wire	Nr.	4
B112	RTD Temperature sen5or (0-1000C (PT100, 4-wire)	0-100°C(PT-100) 4 wire	Nr.	4
B113	RTD Temperature sen6or (0-2000C (PT100,4-wire)	0-200°C(PT-100) 4 wire	Nr.	4
B114	Thermo well	Platinum RTD and J-Type Thermocouple including connector and thermowell	Nr.	1
B115	Differential Pressure transmitter (Analog)	Pressure Switch with Analog Output is a digital pressure gauge ranging from 0 kPa (0 psi) to 1000 kPa (145 psi).	Nr.	1
B116	Turbine flow meters	Flow meter Trainer to examine different principles of operation of flow meters. including turbine wheel flowmeter and the meters mentioned hereunder.	Nr.	1
B117	Paddle wheel flow meter	Paddle wheel flow meter for Trainer	Nr.	1
B118	Magnetic flow meters	Electromagnetic flow meter for trainer	Nr.	1
B119	Vortex flow meters	Vortex flow meter for trainer	Nr.	1
B120	Bypass flow meter	Bypass flow meter for trainer	Nr.	1
B121	Ultrasonic flow meter	Ultrasonic and orifice plate flow meter for trainer	Nr.	1
B122	Rota meter	Rota meter for trainer	Nr.	1
B123	Set of orifice plate (different types)	Orifice Plate. Includes three different plates. Requires the use of a differential-pressure transmitter	Nr.	1

	Accessories			
B124	Insulation Tape	Self adhesive PVC Electrical Insulation Tape 4metres -box of 100 , Extremely flexible , Ideal for cable insulation and marking	Box	2
B125	Teflon tape	Teflon Laminated Tapes, Usage: Sealing, Heat Transfer ,single sided, size 3" pack of 100	Box	2
B126	SS Tube fittings All types and size	Assorted (Nipples, elbows, end plugs, adapters, unions - 1/8", 1/4",3/8",1/2"	set	50
B127	Copper tube fittings all types and size	Assorted (Nipples, elbows, end plugs, adapters, unions - 1/8", 1/4",3/8",1/2"	set	30
B128	PVC Tube (1/8", 1/4",3/8",1/2")	1/8", 1/4",3/8",1/2"	set	8
B129	SS Tube-(1/4",3/8",1/2") (1 length 5 meter)	1/8", 1/4",3/8",1/2"	set	6
B130	SS Ball Valve 1/2", 1/4"	(0.5sqr.mm,1sqr.mm, C1.5sqr.mm, 2sqr.mm,C2.5sqr.mm	set	8
B131	Needle Valve 1/2", 1/4"	C1.5 sq. mm	set	8
B132	Electrical wire (0.5sqr.mm,1sqr.mm, C1.5sqr.mm, 2sqr.mm,C2.5sqr.mm)	Electrical wire, one roll (100mtrs) of each of(0.5sqr.mm,1sqr.mm, C1.5sqr.mm, 2sqr.mm,C2.5sqr.mm)	set	2
B133	PVC 2pair cable (C1.5mm)	C1.5mm TWE PVC cable , grey colour	rolls	2
B134	Copper tube-1/4"	Copper tube-1/4", white	pce	10
B135	Grease- Gray	Grease- Gray	tins	6
B136	Grease- white	Grease- white	tins	2
B137	Lubricant oil	Lubricant oil	tins	10
B138	Solder led and wax	Soldering gun and Wax	set	10
B139	Resistos (50,100,200)Ω, (.5,C1.C2.C3.4.5.6.7.8.)KΩ	set of resistors (50,100,200)Ω, (.5,C1.C2.C3.4.5.6.7.8.)KΩ	set	100
B140	Capacitors (pF and μf) (different values)	Assorted - 1 μf, 100 μf,500 μf,1000 μf, 1 pf	set	50
B141	Inductors (different values)	Assorted	set	20
B142	General purpose PCB	Heavy duty (16A)	set	20
B143	Extension cable 16ams	1,5mm, C2.5mm	Nr.	20
B144	Terminal strip (C1.5sqmm,C2.5sqmm)	Terminal strip (C1.5sqmm,C2.5sqmm)	set	40
B145	Terminal Leg (U-type, pin-type), (C1.5sqmm, C2.5sqmm)	Terminal Leg (U-type, pin-type), (C1.5sqmm, C2.5sqmm)	set	8

	C2.5sqmm)											
B146	Plug and socket	4mm,6mm,8mm,10mm,12mm	set	20								
B147	Metallic Cable Gland 20mm,25mm and 32mm	4mm,6mm,8mm,10mm,12mm	set	50								
B148	Armed Cable 20mm,25mm, and 32mm	Heavy duty (16A)	Roll @	6								
B149	Diode IN4001,4002,4003	Diode IN4001,4002,4003	set	100								
B150	Zener diode (IN47)	Zener diode (IN47)	set	100								
B151	Transistor(NPN(9575GJ)	Transistor(NPN(9575GJ)	set	50								
B152	Transistor PNP	Transistor PNP	set	50								
B153	Gates IC (AND, OR, NOR, NOT, NAND)	AND, OR, NOR,	set	80								
B154	Hydraulic oil	Standard grade	ltrs	20								
B155	Soap solution	Standard grade	ltrs	20								
B156	Cotton waste	Cotton waste		2								
B157	Goggles	• Concealer Clear Anti-Fog Dual Mold Safety Goggle Top of Form with Elastic Headband	prs	50								
B158	Hand gloves	Made from cotton and polyester fibers with a latex coated palm	prs	50								
B159	Helmet	• Helmet- Hard hat with attached face shield and ear muffs	Nr.	50								
B160	Oil Can	PE material, 5 ltr capacity	pce	10								
B161	Transmitter Clamping Bracket	• Bracket for mounting Transmitter • L type supplied with all necessary bolts	set	10								
B162	'U' clamp 2", 1",	'U' clamp 2", 1", required for Transmitter bracket	set	24								
	Technicians tool box											
B163	Each technician tool box contains the following items	<u>3-tray metal tool box</u> <ul style="list-style-type: none"> • <u>Useful load: 20 kg.</u> • <u>Volume: 13 dm³.</u> • <u>Dimensions Should be big enough to contain the following:</u> <u>Contents</u> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 5%; text-align: center;">1</td> <td style="width: 30%;">Combination Pliers</td> <td style="width: 60%;"> <ul style="list-style-type: none"> • Moulded plastic handles and slip guards. • Tempered, curved jaws with induction hardened cutting edges. • Length (mm) 160 • Type Combination </td> <td style="width: 5%; text-align: center;">1</td> </tr> <tr> <td style="text-align: center;">2</td> <td>Side cutter</td> <td> <ul style="list-style-type: none"> • Side cutting pliers • Width 2C1.5 mm - Length 160 mm </td> <td style="text-align: center;">1</td> </tr> </table>	1	Combination Pliers	<ul style="list-style-type: none"> • Moulded plastic handles and slip guards. • Tempered, curved jaws with induction hardened cutting edges. • Length (mm) 160 • Type Combination 	1	2	Side cutter	<ul style="list-style-type: none"> • Side cutting pliers • Width 2C1.5 mm - Length 160 mm 	1	set	5
1	Combination Pliers	<ul style="list-style-type: none"> • Moulded plastic handles and slip guards. • Tempered, curved jaws with induction hardened cutting edges. • Length (mm) 160 • Type Combination 	1									
2	Side cutter	<ul style="list-style-type: none"> • Side cutting pliers • Width 2C1.5 mm - Length 160 mm 	1									

3	Wire stripper	• Wire Stripper 20-30 Awg	1
4	Long nose plier	• Long nose pliers • Jaw capacity: 14AWG • Overall length: 200mm	1
5	Water pump plier	• Water Pump Pliers 12 Groove Joint • 300mm Plumbers Wrench	1
6	Circle clip tool	• Circle clip pliers 24mm	1
7	Tweezers	• Stainless Steel Anti-Magnetic Economy Tweezers with Curved Fine Point Tips, • 4-1/2" Long	1
8	Grip plier	• Grip pliers • Size: 11"	1
9	Sprit Level (8")	• Spirit Level: • Size: 8" • Material: Aluminum Frame and, Steel Colour: Yellow, red	1
10	Ring spanner (4mm - 24mm)	Ring spanner (4mm - 24mm)	1
11	Socket spanner(Box spanner 6mm - 24mm)	Ring spanner (4mm - 24mm)	1
12	Double end spanner(4mm - 24mm)	Socket spanner(Box spanner 6mm -24mm)	1
13	BA Spanner set	Double end spanner(4mm - 24mm)	1
14	Adjustable rinch 6",8",10",12"	Adjustable rinch 6",8",10",12"	1
15	Pipe Wrench 12"	Pipe Wrench 12"	1
16	Pipe Wrench 8"	Pipe Wrench 8"	1
17	Pipe Wrench 6"	Pipe Wrench 6"	1
18	Chisel	• Flat Chisel • 150mm Width: 17x11 mm	1
19	Center punch	• Chrome-vanadium steel forged, hardened to 52 to 58 HRc. • Diameter 10 mm Lenght 115 mm	1
20	Flat screw driver (different length and size)	• Electrician Flat Tip Screwdriver • Blade Size Dia x Length (mm):4.5x75,4.5x100,4.5x125,4.5x200, 6.0x100,6.0x125,6.0x150,6.0x250,6.0x300	1
21	Philips screwdriver (different length and size)	Philips screwdriver (different length and size)	1
22	Tester screw driver	• Philips screwdriver (different length and size) • Blade Size Dia x Length (mm):4.5x75,4.5x100,4.5x125,4.5x200, 6.0x100,6.0x125,6.0x150,6.0x250,6.0x300	1
23	Screw driver set	Standard set	1
24	Watch maker screw driver set	• 9 Pcs Precision Watch Flat Blade Slotted Screwdriver Set Watchmakers Tool • Supplied in fitting plastic case or container	1
25	Snabi screw driver set	End user to specify	1
26	Allen key set	• Allen keys • Hexagon keys manufactured from hardened and tempered chrome vanadium steel. • Held in plastic storage holder. CONTENTS:	1

			1.5, 2.0, 2.5,C3.0, 4.0, 5.0, 5.5 and 6.0 mm			
27	Key set		<ul style="list-style-type: none"> Allen Key Set 	1		
28	Metallic Hacksaw Frame with blade		Heavy-duty aluminum handle hacksaw frame with 12" bi-metal blade	1		
29	Junior Hacksaw blade with blade		Junior Hacksaw blade with blade	1		
30	Hammer 1/4 kg		Hammer 1/4 kg	1		
31	Teflon hammer		Cotton waste	1		
32	Flat File set		<ul style="list-style-type: none"> File flat with plastic handle Flat file with parallel width and tapered in thickness for general material removal Sizes 6,8,10 and 10 inches 	1		
33	Tri angle File set		<ul style="list-style-type: none"> Tri angle File set Sizes 6,8,10 and 10 inches 	1		
35	Electrician Knife		<p>Electrician's Pocket Knife</p> <ul style="list-style-type: none"> Wire stripping notches on blade, stripping sizes 14-10 AWG Satin 440A stainless steel drop point blade wooden handle for corrosion resistance Liner lock secures blade in open position Approximate dimensions: 9.5 x 4.5 x 0.7 inches 	1		
35	Sesser		Cotton waste	1		
36	Tube Bender 1/2"		Tube Bender 1/2"	1		
37	Tube Bender 3/8"		Tube Bender 3/8"	1		
38	Tube Bender 1/4"		Tube Bender 1/4"	1		
39	Tube Bender 1/8"		Tube Bender 1/8"	1		
40	Tube cutter		<ul style="list-style-type: none"> Stainless Steel Tubing Cutter Cutting capacity: 1/4-inch to 1-3/8-inch (6 mm to 35 mm) cutting capacity 	1		
41	Tube cutter blade		<ul style="list-style-type: none"> 1/4-inch to 1-3/8-inch (6 mm to 35 mm) Ideal for cutting copper, aluminum, brass or plastic tubing 	1		
42	Mallet		Soft and hard faced, wood handle. Weight 650g	1		
43	Measuring Tape		2M locking taper measure	1		
44	Steel Scale		Steel Scale	1		
45	Soldering iron kit		<ul style="list-style-type: none"> Soldering iron with iron stand 	1		

			<ul style="list-style-type: none"> • Rating [W] 30 • Peak temp \pm 10% [°] 420 • Voltage\Volt 230 				
		46	Right Angle	Steel Scale		1	

C	PERSONNEL PROTECTIVE EQUIPMENT (PPE)			
C1	Helmets, set of various sizes	<ul style="list-style-type: none"> • Hard hat with attached face shield and ear muffs • Set of various standard sizes 	Pc	300
C2	Gloves, set of various sizes	<ul style="list-style-type: none"> • Made from cotton and polyester fibers with a latex coated palm • Set of various standard sizes 	Pr	300
C3	Thermal gloves, set of various sizes	<ul style="list-style-type: none"> • For keeping hands warm • Set of various standard sizes 	set	Delete
C4	Overalls, set of various sizes	<ul style="list-style-type: none"> • Overalls for adults- men, various standard sizes(40) • Overall for adults- Ladies, various standard sizes(20) 	set	300
C5	Safety goggles	<ul style="list-style-type: none"> • Concealer Clear Anti-Fog Dual Mold Safety Goggle Top of Form with Elastic Headband 	Pr	300
C6	Safety shoes	<ul style="list-style-type: none"> • Men's Slip Resistant Buster Steel Toe Boots – Different sizes (40) • Ladies Slip Resistant Buster Steel Toe Boots – Different sizes (20) 	Pr	300
C7	Aprons	<ul style="list-style-type: none"> • Men's aprons – Different sizes (40) • Ladies aprons – Different sizes (20) 	Pc	300
C8	Ear plugs	<ul style="list-style-type: none"> • An earplug is a device that is meant to be inserted in the ear canal to protect the user's ears against water, dust etc. 	Pr	300