SOMMAIRE

Analog Electronics
Training in basic analogue functions (Ref - EAD110001)
Digital to Analogue circuits Training Monitor (Ref - EDD038060)
Analogue to Digital Converters Training Monitor (Ref - EDD038100)
Magnetic Circuits Training Monitor (Ref - EPD037650)
Core Transformers Training Monitor (Ref - PED037460)
Switching Power Supplies Training Monitor (Ref - PED037670)
Electronic Sensors Training Monitor (Ref - PED037900)

Automatic Control
Electropneumatic robot with Grafcet control (Ref - ESD030000)
3 levels hoist model, 18 ON/OFF Inputs / Outputs, (Ref - ESD250000)
5 levels elevator model, 51 ON/OFF Inputs / Outputs, CAN OPEN cell control (Ref - ESD350000)

Data processing networks
LAN_Builder, Network traffic analyser & generator (Ref - ETD840000)
Trans_LAN, study of the transmission low layers in Data processing network (Ref - ETD842500)
"DidaLAN" complete laboratory, study of low layers in the corporate Data processing networks (Ref - ETD860C)
**Digital Electronics**

- Simulator & Logic Circuit Test Monitor (Ref - EDD050000)
- Wired Combinatory Training Monitor (Ref. - EDD100001)
- Digital Logic Simulator Monitor (Ref - EDD120001)
- Programable Logic Training Monitor Ref: EDD200000

**Electrotechnics**

- Active load, electrotechnical measurement & load generation unit for DC & AC motors, Power: 1.5 kW (Ref - ELD151000)
  - 1.5 kW three-phase motor with cage rotor LSFMV90 (Ref - ELD152000)
  - 1.5 kW DC motor, parted excitation, MS100 (Ref - ELD153000)
- Test workbench for Electrotechnics (Ref - ELD100000)
- 68 Ohms, 5 Amp., load rheostat (Ref - ELD101000)

**Industrial computer Science**

**Microsystems**

- 68HC12 Microprocessor / Microcontroller study board (Ref - EID110000)
- 68332 microprocessor microcontroller study board & devices (Ref - EID210000)
- Study of one dual kernel DSP (Digital Signal Processing) (Ref : EID310000)

**Operational parts**

- Inputs / Outputs simulator (Ref - EID001000)
- Traffic lights simulator (Ref - EID002000)
- MMI extension board, graphic display device & 16 pads keypad (Ref- EID005000)
- Training unit of Industrial Local Networks applied to the car industry (Ref - CAN01A-A)
- Training unit of motor speed control (windscreen sweeper) through RLI CAN network (Ref - CAN01B-A)
- Training Multiplexed Vehicle, basic version (Ref - VMD01B-A)
- Training Multiplexed Vehicle, complete version (Ref - VMD01C-A)

**Extension cards**

- Built-in Web server (Ref - EID003000)
- CAN network interface industrial board on PC 104 bus (Ref - EID004000)
- MMI extension board, graphic display device & 16 pads keypad (Ref- EID005000)
- 8 ON/OFF RLI CAN inputs board (Ref - EID050000)
- 8 ON/OFF RLI CAN inputs board (Ref - EID051000)
- RLI CAN motor speed control board (Ref - EID052000)
- Real time kernel for the 68332 microcontroller-based target board (Ref - EID210200)
Power Electronics

Range 1 : 30 W

2 Amp. subvoltage / overvoltage Chopper monitor, with or without current control (Ref - PED020100)
30V 2 Amp, 4 quadrant chopper & single phase inverter monitor (Ref - PED020420)
Thyristor single phase rectifier monitor (Ref - PED020500)
Thyristor three-phase rectifier monitor, assisted inverter (Ref - PED020600)
2 Amp. thyristor subvoltage chopper monitor (Ref - PED020700)
Very low voltage reversible Power Supply, +/-15V 500 mAmp., 0/30V 2,5 Amp. (Ref - EMD030340)
Very Low Voltage Three-Phase Power Supply (Ref - EMD030390)
DC rotating machines load bench, 30 W (Ref - EPD037580)
AC rotating machines load bench, 30 W (Ref - EPD037820)
Speed measurement module (ref - EPD037620)
PID corrector monitor (Ref - PED020300)
5 Amp. self-inductance load (Ref - EPD037340)
Load rheostat (Ref - PMM064010)

Range 2 : 120 W

Chopper training monitor, 2 quadrants, 30 V 5 Amp. (Ref - PED020200)
DC machine load bench, 120 W (Ref - ELD037480)
PID corrector monitor (Ref - PED020300)
5 Amp. self-inductance load (Ref - EPD037340)

Range 3 : 1.5/3 kW

Speed or position servocontrol console for Power bridges: EP260000 or EP460000 (Ref - EP060000)
3kW, single -phase / three-phase Graetz bridge, graduator, assisted inverter (Re
3 kW, 1 to 4 quadrant chopper, single-phase self-operating inverter (Ref - EP460000)
1.5 kW, 1 to 4 quadrant chopper, single-phase or three-phase inverter (Ref - EP660000)
Speed variator of DC motor, 300 W to 1.5 kW, DMV242D2 (Ref - ELD154000)
Speed variator for 1.5kW three-phase asynchronous motor, SK2.5TDID (Ref - ELD155000)

Process Control

Air Temperature & Flow Process Control Unit (Ref - ERD004000)
Water Flow & Level Industrial Process Control Unit (Ref - ERD005000).
Mini-Oven Temperature Control Monitor with Electronic PID Corrector (Ref - ERD037780).
**Servo systems**

- Training in speed servocontrol (Ref - ERD037860)
- Position servocontrol training monitor (Ref - ERD037870)
- Study of speed & Position digital & analogue Servosystems (Ref - ERD050000):
  - Study & proficiency in speed & position digital & analogue servosystems (Ref - ERD100000)
  - Linear or non-linear speed & position servocontrol of one machine tool shaft (ref - ERD150000).

**Telecommunications**

- PCM (Pulse Code Modulation) Transmission / Reception training monitor, (Ref - EFD061000 et EFD062000)
- AM, FM, SSB analogue modulation & transmission (HF/VHF Band) training monitor, (Ref - EFD063000)
- AM, FM, SSB analogue reception & demodulation (HF / VHF band) training monitor (Ref - EFD064000)
- ASK, PSK, BPSK, DPSK, QPSK, QAM digital modulations training monitors (Ref - ETD038300)
- Fiber optique communication training system (ref - ETD038600)
- Signal processing in Real time DSP set, Fibula G graphic compiler (Ref : ETD410000)
- Time Division Switching Unit (ref - ETD500000)
- Trans_LAN, study of the transmission low layers in Data processing network (Ref - ETD842500)
- Guided electromagnetic waves training unit (Ref.PED022170)
Analog Electronics

Training in basic analogue functions (Ref - EAD110001)
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Analogue to Digital Converters Training Monitor (Ref - EDD038100)
Magnetic Circuits Training Monitor (Ref - EPD037650)
Core Transformers Training Monitor (Ref - PED037460)
Switching Power Supplies Training Monitor (Ref - PED037670)
Electronic Sensors Training Monitor (Ref - PED037900)
Training in basic analogue functions (Ref - EAD110001)

Specifications:

Training in basic electronic functions:
- 1 AC output for experiments on rectifiers,
- 1 +/- 12V double DC fixed output & one 0- +/- 12 V double DC variable output, with protection against short-circuits,
- 4 fully independent rectifier diodes (diode characterization, carrying out of single or double wave bridge),
- Filter with 3 biased capacitors, different values,
- Zener diode & signal diode,
- 2N2222 & BDX33 transistors (ballast transistor, transistor amplifier multivibrators),
- 2 Operational Amplifiers for OP AMP experiments, follower circuits, comparators, integrators, derivators, low-pass filters, high-pass filters, bandpass filter,

Service:
- 3 * 4 mm / 2 mm adapters,
- 3 * 2 mm / BNC adapters,
- 1 LF generator 10 Hz /1 MHz, sine, square, triangle signals,
- 1 Level generator,
- 1 free area: 4 locations (resistors, self-inductances, capacitors),
- 4 resistors, 0.25 W,
- 4 unbiased capacitors,
- 2 circuits for experiments on Power Supplies with current/voltage measurement matching differential inputs.

Photo complémentaire:
Digital to Analogue circuits Training Monitor (Ref - EDD038060)

Specifications :

- DAC with weighted resistors (8 bits),
- DAC with R/2R network (8 bits),
- DAC by counting (8 bits), 8 bits counter linked to 2 * 4 bits comparators, enabling the conversion of a digital value in the cyclic ratio of a rectangular voltage,
- Built-in DAC (8 bits),

Service functions :
- Clock F = 50 kHz,
- 8 logic state display devices by on/off contact switches,
- Built-in regulator with adjustable output voltage by multi revolutions potentiometer,
- Current / voltage conversion & amplifier / inverter with OPerational AMPlifier.
Photo complémentaire:
Analogue to Digital Converters Training Monitor (Ref - EDD038100)

Specifications:

Topics - Sample & Hold circuit, single & double ramp converters, counting converters, IC converters, single & double ramp integrator, OPerational AMPlifier integrator, comparator & three analogue switches,
Control, counting & CMOS decoding logic for the control of analogue switches,
Counting & counting display devices counting - 3 digits display with inputs: clock, reset & storage
8 bits counter in CMOS technology - Output display by electroluminescent diodes – Comparator
8 bits ADC 08000 integrated circuit, A/D conversion including the Sample & Hold circuit & the control monostable
Quartz clock with the following output frequencies: 512, 4, 2 & 1 KHz
Bounce-free logic pushbutton for manual study
Built-in regulator with adjustable output voltage by multirevolutions potentiometer & + Vref & -Vref outputs
External Power Supply: +/-15V (ref. PMM 062 170)
Photo complémentaire:
Magnetic Circuits Training Monitor (Ref - EPD037650)

Topics:

- Energy conversion by iron core, ferrite core or pulse transformers,
- Smoothing coil,
- Integration by OP AMP that the integration constant can be modified,
- Pulse generator, adjustable frequency & duration,
- Diode & capacitor rectification & filtering,
- Power OP AMP amplification,
- Load resistor,
- Power resistor, diode & zener diode (use in demagnetization, for instance).
Core Transformers Training Monitor (Ref - PED037460)

Specifications:

- Iron core transformer,
- Ferrite core transformer,
- Power amplifier,
- Integrator,
- Current measurement amplifier,
- Multiplier,
- Ramp generator,
- Low-pass filter (filtre passe-bas),

External Power Supply: +/- 15 dc V, 400 mAmp & 6/12 dc V 3Amp.
Switching Power Supplies Training Monitor (Ref - PED037670)

Specifications :

- Transformers energy conversion (Flyback, Forward & Push Pull),
- Smoothing,
- Transistor controlled switching,
- RC circuit load,
- Pulse generator, adjustable frequency & duration,
- “Diode / capacitor” detection (enabling the energy transfer display)

External Power Supply, DC 6/12 V, 5Amp.
Electronic Sensors Training Monitor (Ref - PED037900)

Specifications :

Modulation modes:
- Incandescent lamp,
- Red, yellow, green electroluminescent diodes,
- Infrared diode,
- Fiber optics transmitter,
- Opto coupling device,

De modulation modes:
- Photoresistor,
- Phototransistor,
- Fiber optics receiver,
- Fiber optics detector,
- Photodiode,
- Photocell.
Automatic Control

Electropneumatic robot with Grafcet control (Ref - ESD030000)
3 levels hoist model, 18 ON/OFF Inputs / Outputs, (Ref - ESD250000)
5 levels elevator model, 51 ON/OFF Inputs / Outputs, CAN OPEN cell control (Ref - ESD350000)
Electropneumatic robot with Grafcet control (Ref - ESD030000)

Specifications:

The ESD030B robot unit was developed in collaboration with the Schneider Company. It represents a model of pieces plugging flexible cell.

The Unit includes:

One electropneumatic robot moving on 5 axis (translation, forward/backward, up/down, rotation & gripper opening/closing, which totalizes 10 different controls (4 bistables & 2 monostables devices) & 11 sensors,
One plugging station having 1 bistable control & 3 sensors (piece presence, up & down positions of the jack),
One inflow store with pieces presence sensor,
One outflow ramp,
One flexible cell control device, totalizing:
Output: 2 operation modes, 1 emergency stop loop (emergency button, door opening, pressure loss),
Input: 1 pressure supply,
One system Power Supply board & one air conditioning set.

It is designed for demonstrating the control principle by PC Computer, of one industrial automatic process (with Grafcet interpreter) or by PLC (by DB25 & DB37 connectors or Inputs/Outputs wiring by Zelio, TSX terminals...
Grafcet editor provided in basic version, characteristics:

- Editor, enabling to draw the Grafcet with the basic tools: step, transition, AND / OR divergence/convergence, macro steps...
- Generator, converting the GRAFCET into execute code, checking the syntax & coherence between target-variables & used variables...
- Simulator, operating the GRAFCET in simulation, one "click" on the input variable enables the activation of the corresponding transition, the whole graph can be tested before controlling the actuated part.
- Interpreter, enabling the execution & control following the modes: step-by-step, path, quick.

Some characteristics:

- 256 steps, 256 transitions, 256 * 8 bits memories, macro steps, possible simultaneous operation of several independent Grafcets.

Photo complémentaire:
3 levels hoist model, 18 ON/OFF Inputs / Outputs, (Ref - ESD250000)

Specifications:
3 levels Hoist model, 18 ON/OFF Inputs / Outputs, compatible with any Programmable Logic Controller (PLC) having Inputs / Outputs from 5 to 24 V DC, common point at + or -.

Description of Inputs (controller outputs):

- 3 car calls display,
- 1 Up control,
- 1 Down control,
- 3 floor calls display.

Outputs (controller outputs):

- 3 car calls, located on the vertical front panel,
- 3 car calls (inside the car, located on the control panel),
- 3 detectors with car presence display,
- Emergency stop with display,
- Car overweight detection,
- Car driving motor voltage & current images,
230V / 50Hz built-in Power Supply.
Grafcet editor, provided in basic version, characteristics:

- Editor, enabling to draw the Grafcet with the basic tools, step, transition, AND / OR divergence/convergence, macro steps...
- Generator, converting the GRAFCET into execute code, check the syntax & coherence between the target & used variables...
- Simulator, executing the GRAFCET in simulation, one "click" on the input variable enables to activate the corresponding transition, the whole graph can be tested before operating the actuated part.
- Interpreter, enabling the execute & control following the modes: step-by-step, path, quick.

Some characteristics:
- 256 steps, 256 transitions, 256 * 8 bits memories, macro steps, possible simultaneous operation of several independent Grafcets.

Photos complémentaires:
5 levels elevator model, 51 ON/OFF Inputs / Outputs, CAN OPEN cell control (Ref - ESD350000)

Specifications :

**Inputs (PLC outputs) :**

- 5 lights for level car presence,
- 5 lights for car call recording (passenger on the floor),
- 5 lights for car call recording (passenger inside the car),
- 1 light for emergency stop recording,
- 1 door opening control,
- 1 car up motion control,
- 1 car down motion control,
- 4 lights for up motion (level 0 to 3),
- 4 lights for down motion (level 4 to 1),

**Outputs (PLC inputs) :**

- 5 level calls (car buttons),
- 4 car calls for up motion (level buttons),
- 4 car calls for down motion (level buttons),
- 1 car overweight detection,
- 1 emergency stop (car button),
- 5 door opening detections.

Grafcet editor provided in basic version, characteristics :

- Editor, enabling the GRAFCET drawing with the basic tools, step, transition, AND / OR divergence/convergence, macro steps...
- Generator, converting the GRAFCET into execute code, check the syntax & the coherence between target variables & used variables...
- Simulator, executes the GRAFCET in simulation, one "click" on the input variable enables to activate the corresponding transition, the whole graph can be tested before operating the actuated part.
- Interpreter, it enables the execute & control operation following the modes : step-by-step, path, quick.

Some characteristics :
- 256 steps, 256 transitions, 256 * 8 bits memories, macro-steps, possible simultaneous operation of several independent Grafcets.

Photo complémentaire:
Data processing networks

LAN_Builder, Network traffic analyser & generator (Ref - ETD840000)
Trans_LAN, study of the transmission low layers in Data processing network (Ref - ETD842500)
"DidaLAN" complete laboratory, study of low layers in the corporate Data processing networks
(Ref - ETD860C)
LAN_Builder, Network traffic analyser & generator (Ref - ETD840000)

Technical specifications:

Traffic generator, description:

- The traffic generator modules enable the reconstruction of network "inter" & "intra" traffic, typical of corporate networks,
- They transmit frames reconstituting the communication between virtual machines, in local area or in corporate network area (across routers),
- The traffic generators match the Ethernet standard protocols, at level 2 & level 3 of the OSI model.
- Using an intuitive MMI, through a web navigator (or through joystick display devices in short mode), the generated traffic configuration is fast & simple,
- Each transmitter module (4 in each ETD840000 rack) emulates a network traffic up to 255 PC computers, which means in total 1000 workstations,
Several virtual networks, level 2 & 3, can therefore be constituted.

Traffic analyser, description:

Local traffic analysis & underscoring of the infrastructure problems, (four analysed parameters):
- The used transmission band,
- Collisions,
- Broadcasts,
- Errors,

Analysis of the inter-segment traffic & optimization of the network architecture

For the segmented networks, it is possible to analyse the communication matrix, in low layer (MAC addresses), or in logic level (IP addresses). The identification of the "top senders" & "top receivers", refines the analysis in order to optimize the segmentation, physically (switched networks), or logic (across the routers). All these parameters can be obtained with the help of measurements, carried out by the LAN_Builder probe, or generated by remote agents living in the network, through the SNMP protocole.

Photos complémentaires:
Trans_LAN, study of the transmission low layers in Data processing network (Ref - ETD842500)

Specifications :
Self-operated or PC controlled through Ethernet, the trans_LAN integrates all necessary functions for the acquisition of indispensable abilities to a corporate network fitter.
RG58 & UTP leads are included into the stand, enabling the underscoring of phenomena that can be found on the network lines.

Wiring fault generator
- Polarity inversion on the 1/2 pair,
- Crossing between pairs 1/2 & 3/6,
- Mispairing on pairs 1/2 & 3/6
- in/out Balun BNC, enabling matched connection: 50Ω/100Ω; in order to read or send a signal on the twisted pair 1/2,
- Balun NEXT / Balun FEXT BNC, enabling matched connection: 50Ω/100Ω; in order to read or send a signal on any twisted pair.

12 codes baseband generator
- Codes : NRZ, RZ, AMI, Manchester, differentialManchester, Miller, HDB3, CMI, 4b/5b, 4b/3t, FM, MFM",
- Clock period: from 40 to 9999 ns,
- Selection of the binary flow to be encoded: pseudo-random, high state, low state, serie of 0 & 1
(up to 8x0 / 8x1 alternately)
- Maximum amplitude: 4V on high impedance load, 2V on 50Ω load.

Broadband generator
- ASK, FSK, PSK & QAM,
- Encoding, NRZ,
- Transmitted message: Pseudo_random, high state, low state, serie of 0 & 1 (up to 8x0 / 8x1, alternately),

ON/OFF outputs
2 TTL outputs are available on the front panel, DATA (binary flow) & CLK (binary clock)

Photos complémentaires:
"DidaLAN" complete laboratory, study of low layers in the corporate Data processing networks (Ref - ETD860C)

Technical specifications:
The "DidaLAN" lab is specially designed for the training of network specialists. Training networks are totally isolated from the outside. This distinctive feature is fundamental, because it enables the Students to carry out all possible experiments without disturbing the school (University, Technical College...).

One set of training & industrial tools are included in this laboratory (Hubs, Switches, routers, load generators, network analyser, wiring fault generator, code generator (RZ, RZ, Manchester..., digital modulations: ASK, PSK, FSK QAM).

Details of the ETD860C standard laboratory, 8 workstations, 16 Students:

Data processing cabinet, 42 units with 3 areas, 2 of them are lockable:
- 2 Hubs,
- 2 Switches,
- 2 routers
  1 mixing panel,

Teacher's workstation:
- 1 Teacher's desk with storage cabinet & 1 chair,
- 1 PC,
- 1 network cable certifier,
Connected to the cabinet by permanent network.

Student's workstation (6 to 8 stations, recommended):
- 1 Student's desk with storage cabinet & 1 chair,
- 1 PC,
Connected to the cabinet by permanent network & 2 "training" networks.

Full training literature,
Installation & commissioning ensured by our Company.
Optional, training by our specialist, University Lecturer / Researcher.

Photos complémentaires:
Digital Electronics

Simulator & Logic Circuit Test Monitor (Ref - EDD050000)
Wired Combinatory Training Monitor (Ref. - EDD100001)
Digital Logic Simulator Monitor (Ref - EDD120001)
Programable Logic Training Monitor Ref. : EDD200000
Specifications:
- 4 zero insertion sockets with 2mm connection,
- 2 * 16 pins, 7.62 mm sockets,
- 1 * 28 pins, 7.62/15.24 mm sockets,
- 1 * support 40 broches 7.62/15.24 mm,

Les 2 supports 7.62/15.24 mm permettent l’implantation des circuits larges et étroits,

Services:
- 2 afficheurs 7 segments avec décodeur,
- 12 clefs générateurs 0 et 1,
- 2 poussoirs traités antirebond pour les travaux pratiques sur les bascules, compteurs et registres à décalage,
- 1 horloge programmable de 0,1 Hz à 10 KHz à réglage par bonds à poussoir (avec visualisation de la gamme par LED) et réglage fin par potentiomètre,
- 12 LEDs de visualisation interfacées par transistors,
- 2 adaptateurs 2 mm / BNC pour connexion sur appareils de mesure externe,
- 1 Alimentation intégrée 5 Vdc avec protection contre les courts circuits (entrée 7 à 12 V AC/DC).
Wired Combinatory Training Monitor (Ref. - EDD100001)

Topics:
Combinatory logic with discrete components
- 2 Resistors, 3 Diodes, 1 Transistor (carrying out of functions: AND, OR, NOR, NAND based on D & DT technology),
Combinatory logic with TTL technology,
- 6 NOT,
- Functions with 2 inputs, 8 AND, 8 NAND, , 8 OR, 8 NOR, 4 XOR, 3 NOR with 3 inputs, Functions with 3 inputs, 3 NAND, 3 NOR,
Flip-Flops :- 2 RS Flip-Flops,
- 2 RSH Flip-Flops,
- 2 D Flip-Flops,
- 4 JK Flip-Flops,
Components:
- 1 Potentiometer,
- 1 Bounce-free pushbutton, 1 pushbutton to be bounce-free processed (as an Experiment),
- 1 Fixed clock: 1 KHz, 1 variable clock: 100 Hz to 2 KHz
- 8 Logic state generators, 8 LED display devices,
- 2 BNC/ 2 mm sockets adaptors.
Photos complémentaires:
Digital Logic Simulator Monitor (Ref - EDD120001)

Specifications:
Amplification function
- 4 NAND with 2 inputs, open collector & 4 Pull-up resistors,
- 2 x 4 buffers (3 states) grouped common control,
Digital
- 2 demultiplexer circuits, 2 to 4,
- 2 multiplexer circuits, 4 to 1,
- 1 parallel / serial shift register,
- 1 programmable Up & Down counter,
- 1 ALU, Arithmetic Logic Unit, 8 operations (Set, Reset, Addition, Subtraction A-B & B-A, - OR, AND, XOR),
Service
- 5 Vdc external Power Supply from the EDD100000 module,
- 7 segments display device with decoder,
- 3 level generation keys.
Photos complémentaires:
Programable Logic Training Monitor Ref. : EDD200000

Specifications:
The EDD 200 board is based on one EPLD MACH4 circuit, with 44 pins, manufactured by LATTICE. It is provided with one VHDL edition & downloading program.
It includes:
- 5 level generator keys (4 counter inputs, 1 programing input)
- 1 bounce-free pushbutton (JK clock, counter)
- 4 LED Display device
- 2 multiplexed 7 segments display devices
- 1 PC 104 standard connector enabling the study of this interface on the EID serial board or on any other available board
- 1 Centronics connector, 360 pins, JTAG standard
- 1 switchable clock: 2 Hz, 2 KHz
Test points are located around the component, in order to facilitate the reading of Inputs/Outputs on the oscilloscope.
Photos complémentaires:
Electrotechnics

Active load, electrotechnical measurement & load generation unit for DC & AC motors, Power:
1.5 kW (Ref - ELD151000)
1.5 kW three-phase motor with cage rotor LSFMV90 (Ref - ELD152000)
1.5 kW DC motor, parted excitation, MS100 (Ref - ELD153000)
Test workbench for Electrotechnics (Ref - ELD100000)
68 Ohms, 5 Amp., load rheostat (Ref - ELD101000)
Active load, electrotechnical measurement & load generation unit for DC & AC motors, Power: 1.5 kW (Ref - ELD151000)

Technical specifications:

Composition:
The load is constituted of one 1.5 kW brushless motor with optical encoder on shaft end. One control desk, linked to PC computer, generates the selected load profiles and ensures electrical or mechanical acquisitions (speed, torque, current, voltage, power...). The rotating machine to be tested are fastened on the shaft end. The control & acquisition system is easy to use, the sensors are built-in.

Load profiles:
This unit enables to generate one load profile on the motor. Test Power: 300 W to 1.5 kW:
- Braking torque, function of the speed,
- Braking torque, function of the speed square,
- Constant torque,
- Torque generating inertia.

Acquisition:
Acquisition of electrical & mechanical values: current, voltage, speed & torque (calculated)
Drawing & analysis of the motors specific curves (current/voltage/speed/torque)
Aid to alternator coupling to the Mains
Connection:
Three-phase Power Supply: 400 V 50Hz
Measurements through 4mm sockets,
PC via USB
Optical encoder outputs, 1096 points, biphased for Practical Work on Servosystems
1.5 kW three-phase motor with cage rotor LSFMV90 (Ref - ELD152000)

Technical specifications:

- Three-phase asynchronous motor operating in motor mode or alternator mode,
- Average power : 1.5 kW,
- Cage rotor, speed: 1500 Rev. /min,
- Average voltage: AC three-phase 230/400 V,
- Average current: 6.1Amp./3.5 Amp.,
- PTO probe,
- Dual output shaft.
1.5 kW DC motor, parted excitation, MS100 (Ref - ELD153000)

Technical specifications:

- DC motor operating in motor mode or generator mode,
- Average power: 1.5 KW at 1500 rev./min,
- Armature voltage: 200V,
- Armature current: 9.2 Amp.,
- Excitation current: 440 mAmp.,
- PTO probe,
- Provided with dual output shaft,
- Didactic terminal with sockets.
Test workbench for Electrotechnics (Ref - ELD100000)

Technical specifications:

Safety devices:
- Emergency stop button,
- ON / OFF lights,
- Front tetrapolar cutout ensuring the general protection,
- Built-in insulation transformer,
- 4 mm safety sockets.

Mains Power Supply:
- Input: 400 V Three-phase + neutral + earth.

Workstation Power Supplies:
- Built-in Power Supplies (table feet) switch selection,
- Variable three-phase voltage: 0/400 V, 8 Amp.,
- DC voltage: 0/290 V 16 Amp., by rectifier bridge on three-phase autotransformer (wave rate: about 5%),
- Auxiliary Power Supplies: DC voltage 0/250 V 2 Amp., for motor excitation or generator,
- 6 single-phase current sockets.
Measurement:
- Voltmeter & ammeter on three-phase variable power supply,
- Voltmeter & ammeter on DC variable power supply.
68 Ohms, 5 Amp., load rheostat (Ref - ELD101000)

Specifications:
- Module average power: 2000 W,
- Average current: 5 Amp.,
- Maximum resistor: 68 Ohms,

The ELD101000 rheostat is recommended in triplicate in order to have one three-phase resistive load with 3 resistors totally independent. This enables the carrying out of experiments on the graduator below (EP260000) or the study of phase unbalance situations.
Industrial computer Science

Microsystems

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8 ON/OFF RLI CAN inputs board (Ref - EID051000)
RLI CAN motor speed control board (Ref - EID052000)
Real time kernel for the 68332 microcontroller-based target board (Ref - EID210200)
Industrial computer Science

Microsystems

68HC12 Microprocessor / Microcontroller study board (Ref - EID110000)
68332 microprocessor microcontroller study board & devices (Ref - EID210000)
Study of one dual kernel DSP (Digital Signal Processing) (Ref : EID310000)
EID 110 000

68HC12 Microprocessor / Microcontroller study board (Ref - EID110000)

Technical specifications:

Hardware:
- Architecture of one 8/16 bits micro-system, microprocessor-based, microcontroller, 68HC12 (fully compatible 68HC11) 16 MHz clock,
- Storage: 256 Kbytes, EEPROM flash,
- EEPROM 4 Kbytes,
- RAM 8 bits 12+ 128 Kbytes,
- Serial port: USB, RS232, SPI, I2C, CAN,
- 16 characters, ASCII LCD display device,
- 5 pads keypad / joystick,
- PC104 bus, giving access to many available Inputs / Outputs boards,
- 24 bits parallel port, 6 Analogue I & 4 O on HE10 40 pts, SPI port & I2C.

Software:
One Jtag probe enables to put the student in true industrial development situation, using the Warriorcode (trade mark of the Freescale C°), providing the following facilities:
- PC editor,
- Cross assembler,
- Cross compiler,
- Debugger monitor: hard breakpoint, condition breakpoint, C step-by-step, assembler, display of
Input / Outputs simulator, EID001000:
In order to underscore the Inputs / Outputs of one microsystem & facilitate the Student's first steps in programming, one Input / Output is provided. It includes:
- ON/OFF inputs (micro-system), 8 microswitchs,
- ON/OFF outputs (micro-system), 8 LED,
- Analogue input (micro-system), 1 potentiometer,
- Analogue output (micro-system), 1 LED with test point,
- 1 * 7 segments display device,
- 1 bounce-free pushbutton for the interrupt implementation.

Photos complémentaires:
68332 microprocessor microcontroller study board & devices (Ref - EID210000)

Technical specifications :

Hardware :
- Architecture of a 68332 16/32 bits micro system, microprocessor-based, micro-controller, 16.7 MHz clock,
- RAM 128 Kbytes of 16 bits,
- ROM 128 Kbytes « flashs »,
- Serial port: USB, RS232, SPI, I2C,
- PC104 bus giving access to many available inputs / outputs boards,
- Port // 24 bits,
- 6 I & 4 O (analogue).

Software :
- PC editor,
- Cross assembler,
- Debugger monitor, stop points, display of registers, storage area...
- C & C&lt;tt;q++&lt;/tt;q cross compiler, GNU with StDIO (Standard Data Input Output) libraries, String (characters string control), Math (floating calculation), low level function library (interrupt control, USB et RS232 ports control...) provided, linker specifically configured for the EID 210 000 board.
EID001000 inputs / outputs simulator:
In order to underscore the inputs / outputs of a micro-system & facilitate the Student's first steps in the study & programing, one input / output simulator is provided. It includes:
- ON/OFF inputs (micro-system), 8 microswitches,
- ON/OFF outputs (micro-system), 8 LED's,
- Analogue input (micro-system), 1 potentiometer,
- Analogue output (micro-system), 1 LED with test point,
- 1* 7 segments display device,
- 1 bounce-free pushbutton for the interrupt implementation.

Photos complémentaires:
Study of one dual kernel DSP (Digital Signal Processing) (Ref: EID310000)

Technical specifications:

Matériel:
- Dual kernel processor, DSP 5672x family, 24 bits, developed by Freescale, computing power: 2 x 200 MIPS, internal RAM memory: 2 x 92 Kbytes + 64 Kbytes,
- SDRAM 32 Mbytes,
- Inputs / Outputs parallel port, 2 x 8 bits,
- 1 CODEC audio stereo, Inputs / Outputs: 24 bits, 96 kHz,
- 2 analogue Inputs / Outputs, broad band, 10 bits,

Programs:
Standard version:
- Development environment,
- Éditeur,
- C GNU compiler,
Optional:
- Fibula G object compiler,
Enabling, from optimized graphic objects, the creation of signal processing programs.
Some functions:
- 219 Macros in objects form,
- Possible creation of one's own macro,
- Virtual oscilloscope...

Photos complémentaires:
Industrial computer Science

Operational parts

Inputs / Outputs simulator (Ref - EID001000)
Traffic lights simulator (Ref - EID002000)
MMI extension board, graphic display device & 16 pads keypad (Ref - EID005000)
Training unit of Industrial Local Networks applied to the car industry (Ref - CAN01A-A)
Training unit of motor speed control (windscreen sweeper) through RLI CAN network (Ref - CAN01B-A)
Training Multiplexed Vehicle, basic version (Ref - VMD01B-A)
Training Multiplexed Vehicle, complete version (Ref - VMD01C-A)
Inputs / Outputs simulator (Ref - EID001000)

Specifications:

It can be connected to the 40 points Inputs / Outputs port of the EID 210 000 or EID 110 000 boards, enabling the simulation of actuated parts:
- 8 display LED’s on the port outputs,
- 8 Microswitches on the port inputs,
- 1 bounce-free pushbutton (interrupt implementations),
- 1 Potentiometer on analogue input,
- 1 LED with test point (display on oscilloscope) on analogue output.
Traffic lights simulator (Ref - EID002000)

Specifications:
The traffic lights simulator is operated by 5 VDC supply, it is directly compatible with the industrial Data Processing target-boards of the EID110000 & EID210000 serie...

Topics:
19 input Variables (outputs for the micro-system)
Main road:
- 2 independent traffic lights, opposite roads, (2 Red's, 2 Yellow's, 2 Green's, 6 variables)
- 2 combined pedestrians lights, (1 Red, 1 Green)
- Left slip road, 2 independent lights, (2 Red's, 2 Yellow's, 2 Green's)
Secondary road:
- 2 combined lights, (1 Red, 1 Yellow, 1 Green),
- 2 associated pedestrians lights, (1 Red, 1 Green),

5 output variables (inputs for the micro-system:
- 1 pedestrian call for the main road,
- 1 pedestrian call call for the secondary road,
- 2 left slip road car detections,
- 1 secondary road car detection.
Photo complémentaire:
MMI extension board, graphic display device & 16 pads keypad (Ref-EID005000)

Technical specifications:
- 16 pads matrix keypad,
- ASCII display device, (7 to 20) x 16 characters and/or 128 x 64 graphic, monochrome,
- Piezoelectric buzzer, 4 KHz,
- Real time clock, alarm,
- 114 bits saved static RAM.
Photo complémentaire:
Training unit of Industrial Local Networks applied to the car industry (Ref - CAN01A-A)

Specifications:
The CAN 01 A unit option is constituted of one PVC stand onto which the inputs/outputs CAN boards and buses are plugged on. This an option of the EID110000, 210000 boards or PC unit. It includes:
- One industrial board (ATON SYSTEM) carrying out the CAN interface,
- One ON/OFF, 8 inputs acquisition board (microswitches plugged on the board enable the simulation of the comodo device),
- Four ON/OFF, 4 outputs boards (LED's located on the output board enable the simulation & also the display of the optical blocks filament state),
This unit enables to put the Student face up to the development situation. Progressive & full Practical Workswith solutions are provided with the equipment.
Training unit of motor speed control (windscreen sweeper) through RLI CAN network (Ref - CAN01B-A)

Specifications:
The CAN 01 B is also one option of the EID110000, 21000 boards or PC computer. It includes:
- One industrial board (proposed by ATON SYSTEM), that carries out the CAN interface,
- One motor / CAN speed control board, the motor + reducer+ encoder assembly, the winscreen sweeper assembly,
- One input board (control of analogue signal, one potentiometer & microswitches enabling the simulation of the windscreen sweeper "commodo" device).
This unit put the Student face to the development situation, progressive & complete Practical Works with solutions are provided together with the equipment.
Training Multiplexed Vehicle, basic version (Ref - VMD01B-A)

Specifications:
The Training Multiplexed Vehicle is the perfect tool to put the Student faced to a development situation in Design Office.

Composition:
- 1 Study board of the 32 bits 68332 (CPU32) microcontroller, frequency: 16.7 MHz, USB Port, RS232, PC104 Bus, 24 bits // port, 6 A/D I & 4 A/D O, with editor, cross assembler linker, debugger, technical manual
- 1 Inputs / Outputs simulator, with 40 points cable layer, USB leads, Power Supplies,
- 1 CAN bus board on PC 104,
- 1 board with 16 pads keypad, 7 x 16 ASCII characters display device and/or 128x64 monochrome graphic, with PC104 layer
- 1 CAN bus module, 8 ON/OFF inputs & one analogue input with Supply bus lead & CAN,
- 1 CAN bus module, 4 ON/OFF outputs & 4 inputs with Supply bus lead & CAN,
- 1 car modeled socket, scale 1/4, pre-fitted out,
- 1 set of industrial components: 1 light commodo, 2 front optical sets, 30W, sidelights/headlights/full beams, 2 indicators, 2 back optical sets stop lights/sidelights/indicators, horn, each module is provided with connectors,
- 1 C & C++ compiler,

Many Experiments are provided with the equipment. These Experiments enable a large didactical progression, from the discovery of the microcontroller, the control of inputs / outputs, serial (USB, CPI, I2C), parallel, to the skill of a CAN Industrial Local Network applied to the Car Industry.
Training Multiplexed Vehicle, complete version (Ref - VMD01C-A)

Specifications:
The Training Multiplexed Vehicle (VMD) is the ideal tool to put the Student faced to the development situation in Design Office. Constituted of:
- 1 68332 32 bits microcontroller study board, (CPU32), clock: 16.7 MHz, USB port, RS232, PC104 bus, 24 bits parallel port, 6 D/A I & 4 D/A O, with editor, cross assembler linker, debugger, technical guide,
- 1 Inputs/Outputs simulator, with 40 points layer, USB leads, Power Supplies,
- 1 CAN bus board on PC 104,
- 1 board with 16 pads keypad & display device, 7 x 16 ASCII characters and/ or 128x64 monochrome graphic, with its PC104 layer,
- 1 CAN bus module, 8 ON/OFF inputs & one analogue input with bus lead, Supply & CAN,
- 1 CAN bus module, 4 ON/OFF outputs & 4 ON/OFF outputs with bus lead, Supply & CAN,
- 1 Car modelized socket, scale: 1/4, pre fitted out,
- 1 Set of industrial components: 1 light comodo, 2 front optical sets, 30W, sidelights/headlights/full lights, 2 indicators, 2 back optical sets stoplights/sidelights/indicators, horn, each module with its connectors,
- 1 CAN bus module motor servocontrol, motor/encoder, stand, CAN bus lead, Supply & 1 windscreen sweeper,
- 1 Ethernet board,10 Mbits, with TCP/IP cell, sockets, Web server, SPI bus, I2C.
- 1 C & C++ compiler,
- 1 MTR86 real time kernel (single-stand version)
Many Practicals are provided with the equipment. These Experiments enable a very didactical progression, from the discovery of the microcontroller, the control of inputs / outputs, serial (USB, CPI, I2C), parallel, to the skill of one CAN Industrial Local Network, applied to the Car Industry, speed control, implementation of one integrated Web server.
Industrial computer Science

Extension cards

Built-in Web server (Ref - EID003000)
CAN network interface industrial board on PC 104 bus (Ref - EID004000)
MMI extension board, graphic display device & 16 pads keypad (Ref - EID005000)
8 ON/OFF RLI CAN inputs board (Ref - EID050000)
8 ON/OFF RLI CAN inputs board (Ref - EID051000)
RLI CAN motor speed control board (Ref - EID052000)
Real time kernel for the 68332 microcontroller-based target board (Ref - EID210200)
Built-in Web server (Ref - EID003000)

Specifications:
The EID 003 000 Web server board is proposed at PC 104 industrial standard. It can be plugged on the EID 210 000 basic board or on any other board equipped of this bus.
The board uses the IP2022 microcontroller (Internet processor), developed by UBICOM & is operating on the Ethernet 10 Mbits/s network.
The program drivers are provided: TCP/IP stack, sockets, Web server, SPI bus, I2C, built-in « ping » function,
- RJ 45 Ethernet 10 base-T connector, connection to the mother-board by PC104,
- Control of the TELNET port (PORT 23) & WEB server (port 80).
CAN network interface industrial board on PC 104 bus (Ref - EID004000)

Specifications:
At the PC 104 industrial standard, the board can be plugged on the EID 210 00 basic board. The communication is achieved in 8 bits mode by the PC 104 bus.
Elle utilise le contrôleur CAN SJA 1000 de Philips et possède une interface ligne de type opto électronique.
Elle est développée et fabriquée par la société ATON SYSTEME.
Spécifications :
- Vitesse de communication jusqu’à 1 Mbits/s,
- Livrée avec les drivers EID 210 000 des buffers circulaires FIFO en émission et réception,
- La structure des données permet la gestion des modes CAN standard et étendu (TP en mode étendu).
MMI extension board, graphic display device & 16 pads keypad (Ref-EID005000)

Technical specifications:
- 16 pads matrix keypad,
- ASCII display device, (7 to 20) x 16 characters and/or 128 x 64 graphic, monochrome,
- Piezoelectric buzzer, 4 KHz,
- Real time clock, alarm,
- 114 bits saved static RAM.
Photo complémentaire:
8 ON/OFF RLI CAN inputs board (Ref - EID050000)

Specifications:

This board enables the reading of the remote input variables through the CA network. It can be self-operated, with 4 microswitches; 4 pushbuttons enable the simulation of the operator control device, 8 display LED's for the input state visual control. One 10 points connector enables the connection to one car "comodo". The board is based on one MC25050P expander CAN developed by Microchip, layers 2 & 3 are interfaced by the layer line Tranceiver: "182C250".
8 ON/OFF RLI CAN inputs board (Ref - EID051000)

Specifications:
The EID051000 interface board controls the car optical devices in normal operating mode. LED’s enable the operation in simulation mode, one microswitch simulates the light filament braking in order to implement the light bulbs test programing modules.

- 1 MC25050P CAN expander (Microchip), layers 2 & 3 ensures the digital information output & the CAN program interface,
- The 82C250 line Tranceiver, layer 1, ensures the line interface,
- 4 VN016 power amplifiers ensures the current amplification of the 4 output bits intended to the optical set filaments.
RLI CAN motor speed control board (Ref - EID052000)

Specifications:
Motor PWM control, (windscreen sweeper with speed control in the case of actuated parts: CAN01B or VMD01C).
Control of the track ends safety devices,
1 CAN expander MC25050P Microchip, layers 2 and 3, ensuring the digital information output & the CAN program interface,
1 82C250 Line tranceiver, layer 1, ensuring the line interface.
Real time kernel for the 68332 microcontroller-based target board (Ref - EID210200)

Specifications :
The MTR86 is a real time multitask specially designed & configured for the EID210000 target board. The implemented version controls the board specific resources (control of RS232 & USB ports…) One part of the kernel code is in flash eprom, which enables to minimize the size of the code to be downloaded.

Topics :
- Tasks dynamic creation (32 maximum), priorities (32 maximum),
- Tasks immediate or cyclic initiation,
- Tasks destruction & clearing,
- Interrupt procedure control, count semaphore control,
- Resources control, number of requests : 24,
- Meeting synchronization,
- Communication by tubes, letter boxes & messages,
- Inputs / Outputs unblocking control,
- Statistic storage of the resources used by the processor,
- Quantum duration dynamic or static modification from 1 to 50 ms,
- Tasks user's mode execution.
Power Electronics

Range 1 : 30 W

2 Amp. subvoltage / overvoltage Chopper monitor, with or without current control (Ref - PED020100)
30V 2 Amp, 4 quadrant chopper & single phase inverter monitor (Ref - PED020420)
Thyristor single phase rectifier monitor (Ref - PED020500)
Thyristor three-phase rectifier monitor, assisted inverter (Ref - PED020600)
2 Amp. thyristor subvoltage chopper monitor (Ref - PED020700)
Very low voltage reversible Power Supply, +/-15V 500 mAmp., 0/30V 2,5 Amp. (Ref - EMD030340)
Very Low Voltage Three-Phase Power Supply (Ref - EMD030390)
DC rotating machines load bench, 30 W (Ref - EPD037580)
AC rotating machines load bench, 30 W (Ref - EPD037820)
Speed measurement module (ref - EPD037620)
PID corrector monitor (Ref - PED020300)
5 Amp. self-inductance load (Ref - EPD037340)
Load rheostat (Ref - PMM064010)

Range 2 : 120 W

Chopper training monitor, 2 quadrants, 30 V 5 Amp. (Ref - PED020200)
DC machine load bench, 120 W (Ref - ELD037480)
PID corrector monitor (Ref - PED020300)
5 Amp. self-inductance load (Ref - EPD037340)

Range 3 : 1.5/3 kW

Speed or position servocontrol console for Power bridges: EP260000 or EP460000 (Ref - EP060000)
3kW, single -phase / three-phase Graetz bridge, graduator, assisted inverter (Ref - EP460000)
3 kW, 1 to 4 quadrant chopper, single-phase self-operating inverter (Ref - EP460000)
1.5 kW, 1 to 4 quadrant chopper, single-phase or three-phase inverter (Ref - EP660000)
Speed variator of DC motor, 300 W to 1.5 kW, DMV242D2 (Ref - ELD154000)
Speed variator for 1.5kW three-phase asynchronous motor, SK2.5TDID (Ref - ELD155000)
Power Electronics

Range 1: 30 W

2 Amp. subvoltage / overvoltage Chopper monitor, with or without current control (Ref - PED020100)
30V 2 Amp, 4 quadrant chopper & single phase inverter monitor (Ref - PED020420)
Thyristor single phase rectifier monitor (Ref - PED020500)
Thyristor three-phase rectifier monitor, assisted inverter (Ref - PED020600)
2 Amp. thyristor subvoltage chopper monitor (Ref - PED020700)
Very low voltage reversible Power Supply, +/-15V 500 mAmp., 0/30V 2,5 Amp. (Ref - EMD030340)
Very Low Voltage Three-Phase Power Supply (Ref - EMD030390)
DC rotating machines load bench, 30 W (Ref - EPD037580)
AC rotating machines load bench, 30 W (Ref - EPD037820)
Speed measurement module (ref - EPD037620)
PID corrector monitor (Ref - PED020300)
5 Amp. self-inductance load (Ref - EPD037340)
Load rheostat (Ref - PMM064010)
2 Amp. subvoltage / overvoltage Chopper monitor, with or without current control (Ref - PED020100)

Specifications:

Study of the subvoltage chopper (serial chopper)
Study of the overvoltage chopper (ou parallel chopper)

Supply voltage: 30 V
Maximum current: 2 Amp.
Chopping frequency: 200 Hz to 2 kHz
DC voltage cyclic ratio linear control: between -10V to +10V
Current control, adjustable between 0 & 2Amp.
Photo complémentaire:
30V 2 Amp, 4 quadrant chopper & single phase inverter monitor (Ref - PED020420)

Specifications:

Four quadrant chopper operation:

- Supply average voltage: 30 V
- Output average current: 2 Amp.
- Chopping maximum frequency: 2 kHz
- DC voltage cyclic ratio linear control, adjustable between -10V to +10V

Inverter operation:

- Modulation maximum frequency: 2 kHz
- Average current: 2Amp. peak, 1.5Amp. eff.
- Maximum frequency: 100 Hz.

Topics: Shifted self-controlled inverter, with pulse width modulation, constant U/f control, pulse width modulation, external sine signal voltage control, maximum amplitude: 10V & frequency
Photo complémentaire:
Thyristor single phase rectifier monitor (Ref - PED020500)

Specifications:

Not controlled:
Single wave
Double wave

Controlled:
Single wave, all thyristors bridge,
Double wave, all thyristors bridge,
Double wave, thyristors bridge & free wheel diode,
Double wave, with dual bridge,
Double wave, dual bridge & free wheel diode.
Photo complémentaire:
Thyristor three-phase rectifier monitor, assisted inverter (Ref - PED020600)

Specifications:

Not controlled:
Single wave, three-phase (P3)
Dual wave, three-phase (PD3)

Controlled:
Single wave, three-phase all thyristors bridge,
Dual wave, three-phase all thyristors bridge, with or without free wheel diode,
Three-phase dual bridge, with or without free wheel diode,
Assisted inverter.
Photo complémentaire:
2 Amp. thyristor subvoltage chopper monitor (Ref - PED020700)

Specifications :

- Extinction circuit thyristor serial chopper device,
- Built-in differential voltage measurement probe,
- Built-in current measurement probe,

Topics :
- Selection of the manual or automatic control,
- Adjustable cyclic ratio between 1 & 99%,
- Variable frequency,
- Operation with R load,
- Operation with motor.
Photo complémentaire:
**EMD 030 340**

Very low voltage reversible Power Supply, +/-15V 500 mAmp., 0/30V 2,5 Amp. (Ref - EMD030340)

Specifications :

Control boards Power Supply : fixed +/-15 DC V, 500 mAmp.,
Adjustable DC Power Supply : 0/30 V ,reversible current 2,5 Amp. ,
Mains reference:  24 V, 0,2 Amp. for the synchronisation of single phase rectifier bridges (PED 020 500),
Single phase Power AC Power Supply : 2 x 24 AC V, 2,5 Amp.
Very Low Voltage Three-Phase Power Supply (Ref - EMD030390)

Specifications:

Three-phase Power Supply: 3 channels 24 V 2,5 Amp., with possible star/triangle wiring,
Reference outputs: 3 channelss 24 V, 0,2 Amp. for the synchronization of the power bridges,
Protection: fuses on the power channels, resistors on the synchronization channels,
Mains supply through standard 3 + 1 pins plug.
DC rotating machines load bench, 30 W (Ref - EPD037580)

Specifications:

Voltage: DC 24 V,
Torque constant: 11.3 rev./min/mNm,
Average power: 27 W,
Maximum yield: 70%,
Permanent maximum current: 1.6 Amp.,
Speed at permanent maximum current: 3 000 rev./min,
Rotor inertia: 142 gem2,

The bench can be provided with one optional speed measurement device (EPD037620), ensuring the measurement, the 4 digits display & one analogue image output of this speed, in order to carry out experiments in Control.
AC rotating machines load bench, 30 W (Ref - EPD037820)

Specifications:
Operation voltage: AC 24 V,
Average frequency: 50 Hz,
Idling speed: 2 900 tr/min,
Power consumption: 28.4 W,
Starting torque: 23.4 m.Nm,
Power factor: 0.57.
Speed measurement module (ref - EPD037620)

Specifications:

Speed measurement by optical sensor on additional disk,
7 segments display device,
Analogue output gain : 1 V for 1 000 rev./min,
External socket Power Supply (provided).
PID corrector monitor (Ref - PED020300)

Specifications:

Set value generator function by potentiometer, also possible set value control by external LF generator,
Proportional branch, potentiometer gain adjustment,
Integral branch, potentiometer gain adjustment,
Derivative branch, potentiometer gain adjustment,
Adder device constituted of 3 independent comparators, followed by one 3 inputs adder circuit.
5 Amp. self-inductance load (Ref - EPD037340)

Specifications:

5 output inductance load module with common point: 1, 2, 4, 6, 8 mH,
Maximum permanent current: 5 Amp.,
Silicium sheet core,
Overvoltage coefficient: 22.
Load rheostat (Ref - PMM064010)

Specifications:
Maximum resistance: 33 Ohms,
Power: 320 W,
Average current: 3.2 Amp.
Power Electronics

Range 2 : 120 W

- Chopper training monitor, 2 quadrants, 30 V 5 Amp. (Ref - PED020200)
- DC machine load bench, 120 W (Ref - ELD037480)
- PID corrector monitor (Ref - PED020300)
- 5 Amp. self-inductance load (Ref - EPD037340)
Chopper training monitor, 2 quadrants, 30 V 5 Amp. (Ref - PED020200)

Specifications:

1 quadrant, subvolting chopper, 30 V 5 Amp.,
Energy recovery chopper,
Chopping maximum frequency: 2 kHz,
DC machine load bench, 120 W (Ref - ELD037480)

Specifications:

- Operating rated voltage: DC 24 V,
- Rated current: 5Amp., 6.4 Amp. maximum,
- Rated current speed: 300 rev./min,
- Mechanical power: 95 W,
- Parted excitation, current: 900 mAmp.
PID corrector monitor (Ref - PED020300)

Specifications:

Set value generator function by potentiometer, also possible set value control by external LF generator,
Proportional branch, potentiometer gain adjustment,
Integral branch, potentiometer gain adjustment,
Derivative branch, potentiometer gain adjustment,
Adder device constituted of 3 independent comparators, followed by one 3 inputs adder circuit.
5 Amp. self-inductance load (Ref - EPD037340)

Specifications:

5 output inductance load module with common point: 1, 2, 4, 6, 8 mH,
Maximum permanent current : 5 Amp.,
Silicium sheet core,
Overvoltage coefficient : 22.
Power Electronics

Range 3 : 1.5/3 kW

Speed or position servocontrol console for Power bridges: EP260000 or EP46000 (Ref - EP06000)

3kW, single-phase / three-phase Graetz bridge, graduator, assisted inverter (Ref - EP06000)

3 kW, 1 to 4 quadrant chopper, single-phase self-operating inverter (Ref - EP460000)
1.5 kW, 1 to 4 quadrant chopper, single-phase or three-phase inverter (Ref - EP660000)

Speed variator of DC motor, 300 W to 1.5 kW, DMV242D2 (Ref - ELD154000)

Speed variator for 1.5kW three-phase asynchronous motor, SK2.5TDID (Ref - ELD155000)
Speed or position servocontrol console for Power bridges: EP260000 or EP46000 (Ref - EP060000)

Specifications :

Description matérielle :

- The EP 060 000 module is connected to one PC through USB link, it includes one powerfull microcontroller board controlling the unit through the Power bridges.
  - The feedback loop is carried out either by one tachogenerator, 0/90 DCV, or by incremental encoder (RS485 standard).
  - The motor control is current or voltage mode. In both case, current & voltage limitations are activated.
  - 4 BNC plugs enable to display of motor voltage & current signals, Set value & Control signals values.
  - 1 Entrée BNC permet de faire du suivi de consigne.

Logic topics :

- Selection of the system structure: open / closed loops, speed control position control (only on EP460000),
- Selection of the control mode & specific values : constant step, ramp, sine, trapezoid,
- Selection of the corrector (P, PI, PD, PID) & adjustment of the parameters,
- Selection of the mechanical load, (constant braking, speed function, speed square function)
- Selection of the acquisition & storage parameters.

It also enables the structured flow of experimental test campaign:
- Request of the time response display of one (several ) specific value(s) : position, speed, acceleration, motor current, motor voltage, set value, gap, corrector output, etc.
- Modification of the time diagram scales (zoom on X, on Y)
- Storage of the running test configuration, comparison with the previous tests.
- Determination of the specific values in Automatic Control (time constant, response time at 5%, overshoot amplitude, etc.)

Photo complémentaire:
3kW, single-phase / three-phase Graetz bridge, graduator, assisted inverter (Re)

Specifications:

Topics:

Single-phase rectifier bridges:
"All diodes" PD2, all thyristors PD2, symmetrical dual PD2, asymmetrical dual PD2,
Three-phase rectifier bridges:
"All diodes" PD3, dual PD3, all thyristors PD3,
Others:
Assisted-inverter,
Dual three-phase inverter,
All thyristors three-phase graduator,
Single-phase graduator.

Safety devices:

Excitation cut,
Locked output voltage (load protection),
Short-circuit detection before start,  
Permanent supervision of peak & average load currents,  
Current insulated outputs in every branch of the bridge,  
Insulated outputs of the thyristors control circuits.

Optional:  
With the EP060000 module, the EP2600000 Graetz bridge enables the study of a speed servocontrol of one 1.5kW DC motor.

Photo complémentaire:
3 kW, 1 to 4 quadrant chopper, single-phase self-operating inverter (Ref - EP460000)

Topics:

Each branch is equipped one insulated current probe with BNC output,

Choppers:
- Serial,
- Voltage reversible,
- Current reversible,
- Four quadrants,
- Sserial dual mixed (0 E 0 / 0 –E 0),
- Operating frequency: from 1,5625 Hz to 25,600 kHz

Inverters:
- Full wave, shifted control & fixed frequency,
- Full wave, shifted control & variable frequency,
- PWM +/-E, +/0/-E,

Safety devices:
- Supervision of the excitation current,
- Protection against short-circuits, (short-circuit resistant, even at full load),
- Supervision of the Power Supply : minimum 12 V; maximum 300V before start,
- Supervision of the load current of the filter capacitor at start,
- Emergency stop when the reversible capacitor voltage exceeds 380V,
- Supervision of the current in the discharge transistor,
- Supervision of the reversible capacitor voltage,
- Supervision of the heat dissipators temperature.

Optional :
With the EP060000 module, the EP4600000 chopper bridge enables the study of one 1.5 kW DC motor speed servocontrol with tachogenerato, & also the study of one 1.5 kW DC motor position servocontrol with optical incremental encoder with e RS485 output.

Photo complémentaire:
1.5 kW, 1 to 4 quadrant chopper, single-phase or three-phase inverter (Ref - EP660000)

Topics:

Each branch is equipped of one insolated probe with BNC output

Chopper:
- Serial,
- Voltage reversible,
- Current reversible,
- Four quadrants
- Serial, dual mixed (0 +E 0 / 0 –E 0 ),

Inverters:
Single-phase
- Full wave, shifted control, fixed frequency,
- Full wave, shifted control, variable frequency,
- PWM +/-E, +/-0/-E,
Three-phase
- Full wave, shifted control, fixed frequency,
- Full wave, shifted control, variable frequency,
- PWM +/-E, +/-0/-E,
Closed loop control (linked with the EP 661 000 control console):
- Speed & position servocontrol of a DC motor,
- Speed & position servocontrol of a three-phase motor (vectorial control),
- Study of different correctors: P, PI, PID, cascade, state feedback, Z transform,
- Generation of new correctors by integrated C compiler....

Safety devices:
- Supervision of the excitation current,
- Protection against short-circuits, (shortproof, even at full load),
- Supervision of Power Supply: minimum 12 V; maximum 240V before start,
- Load current control of the filter capacitor at start,
- Emergency stop if the reversible capacitor voltage exceeds 260V,
- Supervision of the current in the discharge transistor,
- Supervision of the reversible capacitor voltage,
- Supervision of the heat dissipators temperature.

Control panel:
The control panel ensures the user’s interface & the system control.

Optional:
EP661100, graphic compiler, enabling the carrying out of:
- Standard assemblies, (serial chopper, dual mixed serial chopper, single-phase or three-phase PWM inverter...)
- Servocontrol structures, (speed or position servocontrol of DC motor, vectorial control of three-phase motor...).

Photo complémentaire:
Caractéristiques techniques :

- Démarrage progressif sur moteur CC,
- Récupération d'énergie sur ponts de graëtz doubles,
- Mise en évidence du plan couple vitesse dans les 4 quadrants.
- Visualisation de l'état de fonctionnement du variateur (surcharge, pont A ou B actif, verrouillage)

Sécurités :

- Disjoncteur magnéto-thermique
- Induit par Protistor FERRAZ
- Rupture d'excitation par relais à manque de courant
- Entrée sonde PTO (Protection Thermique à l'Ouverture)

Réglages :

- Sélection du sens de marche par sélecteur
- Potentiomètres de réglage accessibles en face avant :
  - Vitesse max,
- Réglage de la compensation de courant d'induit,
- Réglage de la stabilité (fonction des caractéristiques de la charge, inertie, frottements…),
- Contrôle des rampes d'accélération et décélération,
- Limitation de courant d'induit moteur.
Speed variator for 1.5kW three-phase asynchronous motor, SK2.5TDID
(Ref - ELD155000)

Technical specifications:

Available set value & display outputs:
- 1 analogue input: 0 - 10 V,
- 1 analogue input: 4 - 20 mAmp.,
- 1 motor speed image output,
- 1 analogue output: 0 - 10 V,
- 1 relay output: 250 V / 2 Amp.,

Safety devices:
- padlockable magneto-thermic cutout: 4 to 6.3 Amp.,
- Thermal protection probe input at the opening.

Adjustments:
- Acceleration ramp,
- Deceleration ramp,
- PID activation,
- Integral gain adjustment,
- Proportional gain adjustment,
- Automatic calibration of the motor characteristics.
Process Control

Air Temperature & Flow Process Control Unit (Ref - ERD004000)
Water Flow & Level Industrial Process Control Unit (Ref - ERD005000).
Mini-Oven Temperature Control Monitor with Electronic PID Corrector (Ref - ERD037780).
Air Temperature & Flow Process Control Unit (Ref - ERD004000)

Topics (use with the ERD010000 IRPI controller):

Study of the current loop,
Test in Open Loop of an air flow control,
Test in Open Loop of temperature control on air flow,
Flow control with corrector: P, PI, PID, Z transform,
Air temperature control with corrector: P, PI, PID, Z transform, by negative action on the flow,
cascade & dual loop,
Simulation of a process.
Photos complémentaires:
Water Flow & Level Industrial Process Control Unit (Ref - ERD005000).

Topics:

- Study of flow / level sensor characteristics,
- Digital PID control, ON/OFF, fuzzy logic, Z transform,
- flow,
- level, 1st or 2nd order, with or without pure lag,
- Level cascade control with P, PI, PID controller.
- Development of new correctors (RST...).
Photos complémentaires:
Mini-Oven Temperature Control Monitor with Electronic PID Corrector (Ref - ERD037780).

Functions:

Set value level generator,
Feedback loop set value comparator,
PID or ON/OFF corrector with individual adjustment of each term: Proportional, Integral & Derivative, Adder.
Sensors; several technologies are available:
Resistive probe with positive coefficient,
Platinum probe: PT100 AT#61527; at 0°C,
Resistive probe with negative coefficient: CTN 22 KAT#61527; at 20 °C,
Thermoelectric effect probe.
Servo systems

Training in speed servocontrol (Ref - ERD037860)
Position servocontrol training monitor (Ref - ERD037870)
Study of speed & Position digital & analogue Servosystems (Ref - ERD050000) :
Study & proficiency in speed & position digital & analogue servosystems (Ref - ERD100000)
Linear or non-linear speed & position servocontrol of one machine tool shaft (ref - ERD150000).
Training in speed servocontrol (Ref - ERD037860)

Functions:
Set value generator,
Comparator,
Electronic Proportional & Proportional/Integral correctors,
PWM power amplifier,
Speed feedback loop by Hall Effect sensor & frequency/voltage converter,
DC 1.2W generator load
Photo complémentaire:
Position servocontrol training monitor (Ref - ERD037870)

Functions:
- Set value generator,
- Comparator,
- Proportional, Proportional & Derivative electronic correctors,
- Current linear mode power amplifier,
- Feedback loop by potentiometer with limits & saturations display,
- Inertia disk load with additional weights,
- DC motor, 12Vdc, 1.7W.
Photo complémentaire:
Study of speed & Position digital & analogue Servosystems (Ref - ERD050000):

The ERD 050000 electromechanical unit is built in a PVC case.

Into this case are located:
- One mechanical device, including:
  - One DC motor, 24 Vdc (characteristics, cf. thereafter),
  - One DC generator, coupled to the motor by OLDHAM joint, enabling the generation of various mechanical loads,
- One graduated disk for displaying the position & behavior of the rotating device,
- One electronic board with high level, power microprocessor, ensuring the system real time control & communication to PC microcomputer (RS232 serial link or USB),
- One power electronic board for carrying out the motor power interface, as well as the generator interface for the armature current control (simulating various mechanical loads),

One program on Windows enables the selection of:
- The system structure: open loop/closed loop, speed or position,
- The control type & the characteristic values: constant step, ramp, sine, trapezoid, external,
- The corrector: P, PI, PD, PID with parameters adjustments, (optional: « Z » corrector, 4th order),
- The mechanical load profile: constant torque (weighty load), viscous friction (in a.x), fluid friction
- The time response display of one (or several) characteristic magnitude(s): position, speed, acceleration, motor current, motor voltage, set value, gap, corrector output, etc
- The assistance to the measurement of typical values in automatic control: time constant, overshoot, stabilisation at 5%, harmonic calculation, sinusoidal.

Photos complémentaires:
Study & proficiency in speed & position digital & analogue servosystems (Ref - ERD100000)

Topics:

Selection of the structure: speed & position open & closed loops.
Selection of the excitation mode: constant step, ramp, trapezoid, sine, internal or external set value following (potentiometer).
Selection of the power interface for the motor supply: Voltage or current control.
Selection of the corrector: P/PD/PI/PID; ON/OFF; Digital; cascade; state feedback;
  (optional), writing of new correctors by the use of C programs, ex: RST, Z correctors Z...
Selection of the adjustable driven mechanical load:
  Fluid friction by Eddy current,
  Dry friction by shaft brake block,
  Inertia by graduated disk & additional weight.
Photos complémentaires:
Linear or non-linear speed & position servocontrol of one machine tool shaft (ref - ERD150000).

Functions:

Selection of the structure: open or closed loop, speed & position.
Selection of the excitation mode: constant step, ramp, trapezoid, sine.
Selection of the power interface for the motor supply: Voltage or current control.
Selection of the corrector: P/PD/PI/PID ; ON/OFF; Digital; Cascade; state feedback; (optional), writing of new corrector by C programs, ex. : RST, Z corrector...
Selection of the system positioning (vertical or horizontal), enabling to underscore the behavior of a servosystem on a weighty load.
Telecommunications

PCM (Pulse Code Modulation) Transmission / Reception training monitor, (Ref - EFD061000 et EFD062000)
AM, FM, SSB analogue modulation & transmission (HF/VHF Band) training monitor, (Ref - EFD063000)
AM, FM, SSB analogue reception & demodulation (HF / VHF band) training monitor (Ref - EFD064000)
ASK, PSK, BPSK, DPSK, QPSK, QAM digital modulations training monitors (Ref - ETD038300)
Fiber optique communication training system (ref - ETD038600)
Signal processing in Real time DSP set, Fibula G graphic compiler (Ref : ETD410000)
Time Division Switching Unit (ref - ETD500000)
Trans_LAN, study of the transmission low layers in Data processing network (Ref - ETD842500)
Guided electromagnetic waves training unit (Ref.PED022170)
PCM (Pulse Code Modulation) Transmission / Reception training monitor, (Ref - EFD061000 et EFD062000)

Specifications:

EFD061000 PCM transmission monitor

- Voice input, adjustable gain amplifier, output level adjustment,
- Impedance matching,
- Attenuation: 3, 6 or 9dB
- Filtering lowpass &#8209; with cut off frequency at 3400 Hz
- Adjustable amplification,
- Sample & Hold device,
- A/D conversion, 7 bits + sign, LED display, adjustable frequency from 4 to 8 KHz, (Shannon's Theorem).
- // Serial conversion,
- Transmission.

EFD062000 PCM reception monitor

- Reception,
- Serial // conversion &#8209; 7 bits,
- D/A conversion by R/2R circuit R&#8209; 0/10V output, on 7 bits,
- Adder &#8209;10V & +10V by adding the D7 sign bit,
- Filtering: bandpass,
- Attenuation,
- power amplification.

Photo complémentaire:
AM, FM, SSB analogue modulation & transmission (HF/VHF Band) training monitor, (Ref - EFD063000)

Specifications:

Master Board
- The SYSCOM TX transmission monitor is the basic frame, which all RF functions, as "Mini-modules", are plugged on. Use maximum frequency: 1 GHz,
- Diode balanced mixer,

FM Broad Band (BB) transmission & FM Narrow Band (NB) transmission Mini-modules

- VHF voltage-controlled oscillator, - Frequency band: 98 to 138 MHz, resolution: 10 kHz, output level: 10 dBm
- Modulated Quartz (varicap) Narrow Band frequency Modulator, nominal frequency: 10.7 MHz, frequency range: 2.5 Khz,
- VHF large signals amplifier, central frequency: 130 MHz, C or AB class, output power: 13 dBm.

Amplitude Modulation (AM) & Single Side Band (SSB) Modulation Transmission mini-modules
- HF voltage-controlled oscillator, frequency band: 16.4 or 27 MHz (switched), resolution: 500 Hz,
- AM, DSB & SSB Modulator, (upper or lower side band), elimination of the undesirable band by quartz filter, AM & DSB central frequency: 10.6 MHz, SSB central frequency: 10.6 MHz +/-2.5kHz, audiofrequency passband: 0.1/40 kHz,
- HF large signals amplifier, central frequency: 27 MHz, nominal power: 13 dBm, C or AB class.

Photo complémentaire:
EFD 064 000

AM, FM, SSB analogue reception & demodulation (HF / VHF band) training monitor (Ref - EFD064000)

Specifications :

Master board

- The SYSCOM RX receiver is the basic frame, where functions, as "mini-modules" are plugged on. Use maximum frequency: 1 GHz,
- Diode balanced mixer ,
- HF preamplifier: 1 MHz to 1 GHz,

"NBFM" narrow band FM receiver mini-modules

- VHF voltage-controlled oscillator, frequency range: 98 to 138 MHz, resolution: 10 khz,
- VHF pre-selector,
- 10.7 Mhz quartz primary intermediary filter, central frequency: 10.7 MHz, bandpass: 7.5 kHz (-3 dB),
- Phase quadrature NBFM demodulator, central frequency: 455 kHz, frequency range: 2.5kHz, audio bandpass 300-3000 Hz.

"BBFM" broad band FM receiver mini-modules
- 10.7 MHz primary IF ceramic filter, central frequency: 10.7 MHz, minimum passband: 280 kHz (-6dB),
- Phase quadrature broad band FM demodulator, central frequency: 10.7 MHz, minimum passband: 15/40 kHz.

mini-modules, study of the Amplitude Modulation reception (AM), & nSingle Side Band (SSB)

- HF voltage-controlled oscillator, 2 frequency bands: 13 to 18 MHz and 23 to 33 MHz,
- 10.6 MHz quartz IF filter (SSB), central frequency: 10.6 MHz, minimum passband: 4,2 kHz (-6dB),
- 10.6 MHz AM IF AVC amplifier, operation frequency: 10.6 MHz, passband: 500 kHz,
- Diode or mixer AM demodulator, SSB by "BFO" mixer, central frequencies: 10.6 MHz, audio band: 4 kHz.

Photo complémentaire:
ASK, PSK, BPSK, DPSK, QPSK, QAM digital modulations training monitors (Ref - ETD038300)

Technical specifications:

Study of a signal digital transmission complete chain:
- Microphone, LFG or TTL inputs,
- Transmission supports: cable pair, coaxial cable, optic fibres, infrared, AM 27 Mhz radio link,
- Digital modulation & demodulation: ASK, FSK, BPSK, DPSK, QPSK & QAM,
- DFD detection (Dual Filter Detector) & PLL detection (Phase Lock Loop),

List of proposed Experiments:

TP 1 A/D & D/A conversion, sampling & quantification
TP 2 ASK modulation & demodulation
TP 3 FSK modulation, demodulation by dual filters (DFD, Dual Filter Detector)
TP 4 Comparison between ASK & FSK (DFD)
TP 5 Study of the PLL
TP 6 FSK demodulation by PLL
TP 7 Comparison between FSK, detected by DFD & by PLL
TP 8 Carrier recovery
TP 9 BPSK modulation & demodulation
TP 10 DPSK modulation & demodulation
TP 11 QPSK modulation & demodulation
TP 12 DQPSK modulation & demodulation
TP 13 QAM modulation & demodulation
TP 14 Comparison between phase modulations
TP 15 Diagram of the eye
TP 16 Phase modulation constellations
TP 17 Comparison between the modulation transmission speeds
Fiber optique communication training system (ref - ETD038600)

Technical characteristics:

Emitter module:
- Six different photo-emitters with cyclic selection, two branches can be simultaneously activated for the PWM applications,
- Laser emitter with power control

Receiver module:
- The signal entering the digital channel follows a series of filtering and amplification processes for subsequent comparison with a reference level.
- Analogic gain 40 db,
- Numérique signalfunction,
- Optique Wattmeter,
- Accessories includes.
Signal processing in Real time DSP set, Fibula G graphic compiler (Ref : ETD410000)

Technical specifications :

Hardware :
- DSP processor, Freescale, dual kernel, DSP 5672x range,
- computational power: 2 x 200 MIPS,
- USB link,

Software :
- Fibula G optimized code graphic compiler,
- Operation under XP Windows environment (or later) - Pro versions,

General topics :
- 8 channels virtual oscilloscope,
- Signal theory, sampling, quantification, FFT, IIR or FIR filters,
- Introduction to the baseband digital modulations: ASK, PSK, FSK, QAM,
- Information & encoding theory, channel, FEC, BER measurement, information flow...
Photo complémentaire:
Specifications:

The switching unit enables the study of new-generation telephone exchange units & its digital & analogue signals:

Signaux displayed on the switching unit:

- Subscribers sets, (SLIC/CODEC) with synchronization signals (encoding of the A/µ law),
- Time Intervals, incoming PCM, outgoing PCM, 32 Time Channels in total, with standard flow of 2MB,
- Connection network (Conversation Time Memory, associated registers & control memory),
- Time base with all synchronization signals of Time Intervals PCM 32,

Remote communications:

- Study of ring remote communication,
- Study of HDB3 encoding & PCM transmission at the ETSI/UIT-T standard,
- Re-synchronization of remote time frames,
- Control of one semaphore channel, signalization protocol (Industrial Data Processing).
Photo complémentaire:
ETD 842 500

Trans_LAN, study of the transmission low layers in Data processing network (Ref - ETD842500)

Specifications:
Self-operated or PC controlled through Ethernet, the trans_LAN integrates all necessary functions for the acquisition of indispensable abilities to a corporate network fitter. RG58 & UTP leads are included into the stand, enabling the underscoring of phenomena that can be found on the network lines.

Wiring fault generator
- Polarity inversion on the 1/2 pair,
- Crossing between pairs 1/2 & 3/6,
- Mispairing on pairs 1/2 & 3/6
- in/out Balun BNC, enabling matched connection: 50&937;/100&937; in order to read or send a signal on the twisted pair 1/2,
- Balun NEXT / Balun FEXT BNC, enabling matched connection: 50&937;/100&937; in order to read or send a signal on any twisted pair.

12 codes baseband generator
- Codes: NRZ, RZ, AMI, Manchester, differentialManchester, Miller, HDB3, CMI, 4b/5b, 4b/3t, FM, MFM",
- Clock period: from 40 to 9999 ns,
- Selection of the binary flow to be encoded: pseudo-random, high state, low state, serie of 0 & 1
Maximum amplitude: 4V on high impedance load, 2V on 50Ω load.

Broadband generator
- ASK, FSK, PSK & QAM,
- Encoding, NRZ,
- Transmitted message: Pseudo_random, high state, low state, serie of 0 & 1 (up to 8x0 / 8x1, alternately),

ON/OFF outputs
2 TTL outputs are available on the front panel, DATA (binary flow) & CLK (binary clock)

Photos complémentaires:
Guided electromagnetic waves training unit (Ref.PED022170)

One detailed handbook proposes 10 main experiments:

1 - The GUN oscillator: study of one hyperfrequency source. Negative resistor operation, transmission range, characteristics…
2 - Detector & modulator: theory & operation of one PIN diode modulator and one X'tal detector.
3 - Propagation modes, wavelength & phase speed inside the wave guide: experimental study of the hyperfrequency waves propagation in free space & inside the wave guide.
4 - Resonance cavity passband: experimental checking of the relation between Q & the bandpass of a resonance cavity.
5 - Power measurement: study of the possible differences of the power measurement.
6 - Impedance measurements: determination of unknown impedances with the Smith abacus.
7 - Stationary waves measurements: how to measure a stationary wave ratio with the SWRmeter or with a slot line?.
8 - Attenuation measurement: how to measure the components attenuation in a hyperfrequency system.
9 - Basic properties of a scattering coupling device: study of properties, coupling coefficient & directivity.
10 - Study of a wave guide hybrid T: basic principle, measurement method of the hybrid T characteristics.
Photo complémentaire: