

# SEM

Electronic Measurement  
Instrumentation Laboratory

digital multimeter

power supply

oscilloscope

frequencymeter

digital inductance meter

function generator

digital capacitance meter

# SEM

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## LABORATORY POWER SUPPLY DL 3155SEM01

### TECHNICAL FEATURES:

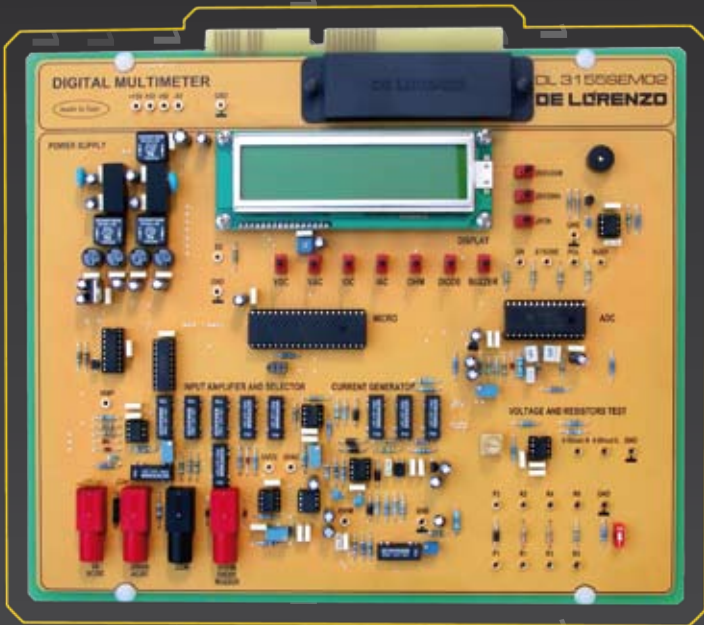
- Dual power supply: 0-15V, 0-0.5A
- Voltage regulation
- Current regulation
- Two and four wire connection
- Parallel connection
- Series connection
- Tracking

### MAIN BLOCKS THAT FORM A LABORATORY POWER SUPPLY:

- Pre-regulation and input filters
- Voltage regulation
- Current regulation
- Programming inputs
- Resistive load
- Constant voltage load
- Constant current load

### LIST OF EXPERIMENTS:

- Evaluation of a laboratory power supply
- Measurement of the output resistance
- Ripple and load variations
- Power supply interruptions
- Power supplies and electronic loads



## DIGITAL MULTIMETER

DL 3155SEM02

### TECHNICAL FEATURES:

- DC and AC voltage measurements (2-20-200V full scale)
- DC and AC current measurements (200mA-2A full scale)
- Measurements of resistance up to 20Mohm
- Measurement of the conduction voltage for PN junctions at 1 mA and at 100uA
- Low resistance acoustic alarm

### MAIN BLOCKS THAT FORM THE DIGITAL MULTIMETER:

- Power supply
- Voltmeter inputs
- Ammeter inputs
- Control of the ohmmeter current
- Control of the current for the diode test
- RMS alternating current converter
- Analogue-digital converter
- Microcontroller
- Push-buttons reading
- Display writing

### LIST OF EXPERIMENTS:

- Evaluation of the characteristics of a digital multimeter
- Voltage measurements on open circuits
- Measurement of the internal resistance of the voltmeter
- Voltage measurements on closed circuits
- Resistance measurements in direct mode
- Resistance measurements through the voltage – current ratio
- Current measurements
- Measurement of the internal resistance of the ammeter

# FUNCTION GENERATOR

DL 3155SEM03

## TECHNICAL FEATURES:

- Generation of sinusoidal, triangular and square type periodic signals
- TTL output 0-5V
- Frequency regulation from 0.1 Hz to 1 MHz
- Amplitude regulation from 100mVpp to 10Vpp
- Attenuator 0-20-40 dB, selectable
- Output impedance 50 Ohm
- Offset regulation

## MAIN BLOCKS THAT FORM THE FUNCTION GENERATOR:

- Reference oscillator
- Frequency control
- Microcontroller
- Selection of the wave form to be generated
- Output amplifier

## LIST OF EXPERIMENTS:

- Ideal voltage and current generators
- Evaluation of the characteristics of a function generator
- No-load generator
- Generator with 50 Ohm termination
- Frequency stability
- Amplitude stability

# FREQUENCYMETER

DL 3155SEM04

## TECHNICAL FEATURES:

- Counter-frequencymeter with range from 0Hz to 20MHz
- Frequency measurement
- Period measurement
- Number of events
- Pulse width
- 7-digit display
- Internal or external time base
- Two analogue inputs
  - > 100mV sensitivity
  - > 50 Ohm or high impedance input impedance
  - > input attenuator from 20dB
  - > maximum input voltage: 50V
- One digital input
  - > TTL - CMOS compatibility
  - > maximum input amplitude: 15V

## MAIN BLOCKS THAT FORM THE FREQUENCYMETER:

- Reference oscillator
- Frequency control
- Microcontroller
- Selection of gate and clock
- Input amplifier
- Trigger

## LIST OF EXPERIMENTS:

- Evaluation of the characteristics of a frequencymeter
- Frequency stability
- Frequency jitter
- Trigger level stability
- Stability of the input amplifier
- Possibility to select the inputs

# OSCILLOSCOPE

DL 3155SEM05

## TECHNICAL FEATURES:

- Two inputs from 1mV to 50V
- Sensitivity (10mV/div, 50mV/div, 100mV/div, 500mV/div, 1V/div, 5V/div, 10V/div)
- Minimum/maximum sampling frequency: 0.5Hz /10MHz
- 8 bit converter
- Bandwidth 1MHz
- AC/DC input selection
- LCD display
- Channel A, Channel B, XY display
- Time base: 1 $\mu$ s-20s/div (10 points per division)
- Channel A, Channel B, Ext trigger
- Sensitivity of the trigger: 1 division

## MAIN BLOCKS THAT FORM THE OSCILLOSCOPE:

- Input amplifier
- Amplitude control
- Analogue – digital converter
- Channel memory
- Trigger
- Reference oscillator
- Control of the time axis
- Microcontroller
- LCD display
- Control digital inputs

## LIST OF EXPERIMENTS:

- Evaluation of the characteristics of an oscilloscope
- Maximum sampling speed
- Maximum band-pass
- Effect of under-sampling
- Stability of the trigger level
- Stability of the input amplifier
- Sensitivity of the inputs
- Possible visualizations of the signals

# DIGITAL INDUCTANCE METER

DL 3155SEM06

## TECHNICAL FEATURES:

- Two and four wire measurement
- 100Hz, 120Hz, 1kHz generator
- Measurement from 1 $\mu$ H to 999H

## MAIN BLOCKS THAT FORM THE INDUCTANCE METER:

- Generator in alternating current controlled by the microcontroller
  - Input amplifier
- Analogue – digital converter
- Microcontroller
  - Display
- Control digital inputs

## LIST OF EXPERIMENTS:

- Evaluation of the characteristics of an inductance meter
- Characteristics of an inductance
  - Measurement field
- Frequencies used by the generator
  - Q R Z correlated measurements

# DIGITAL CAPACITANCE METER

DL 3155SEM07

## TECHNICAL FEATURES:

- Two and four wire measurement
- 100Hz, 120Hz, 1kHz generator
- Measurement from 10pF to 999mF

## MAIN BLOCKS THAT FORM THE CAPACITANCE METER:

- Generator in alternating current controlled by the microcontroller
- Input amplifier
- Analogue – digital converter
- Microcontroller
- Display
- Control digital inputs

## LIST OF EXPERIMENTS:

- Evaluation of the characteristics of a capacitance meter
- Characteristics of a capacitor
- Measurement field
- Frequencies used by the generator
- Q EDR Z correlated measurements

## POWER SUPPLY



### DL 3155AL2RM

Alternatively, the following power supplies can be used:

- DL 2155AL2
- DL 3155AL5
- DL 2555ALD

# SEM

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## PURPOSES

This Laboratory has two main purposes: to inform as well as to train students. We want to teach young people how to properly set up a measurement problem, how to organize the relevant system and how to guarantee the validity of the results that he will obtain. The Laboratory illustrates the main measurement methodologies, the characteristics of the physical quantities, the operating principles and the mode of using the digital instrumentation that are most frequently used in laboratories and in the industrial field.

## EDUCATIONAL OBJECTIVES

The objectives of the Electronic Measurement Instrumentation Laboratory are to provide the theoretical bases as well as the practical experiences that are necessary to cope with the measurement problems that a technician or an engineer will encounter during his work activity. The laboratory will teach the basic principles of the measurement theory, the architectures and the techniques behind the main measurement and signal processing instrumentation. The hands-on experience will include exercises on methods and instruments that are used in the electronic measurements for what concerns the characterization of electric and electronic components and circuits.

## PROGRAM SUMMARY

- Measurements and measurement methods
- Measurement uncertainties evaluation
- Direct and indirect measurement methods
- The characteristics of a measurement device
- The International System of Units
- The measurement generation diagram
- The measurement electronic chain
- Signal conditioning circuits
- The signal sampling modes in digital instruments
- Digital instrumentation: measurement of the frequency; measurement of time intervals
- The digital multimeters
- The measurement of voltages and currents
- The measurement of resistances, inductances, capacitances



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