Engine Tachometer

UDA 8000

CARTEC®

UDA 8000

Operating Manual

RPM Counter

Ref.-No. 2000616764

CARTEC®

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1. INTRODUCTION

The UDA 8000 RPM counter allows to carry out RPM measurements on any types of DIESEL and PETROL, 2 or 4 stroke engines, from 1 to 12 cylinders. If measurements are taken from the vehicle battery, the cylinder number is from 1 to 8.

The measurement can be carried out by :

- Sensor cable for picking up the battery signal.
- Photoelectric sensor and reflector on Diesel and petrol engines, pulleys or other rotating parts.
- Inductive clamp on the spark cable of petrol engines, with distributor ignition system, DIS and coil per plug systems.
- Piezo clamp on the injection tube of Diesel engines.
- Inductive clamp for Diesel common rail engines.

The unit works with internal rechargeable batteries.
They can be recharged also during operation by connecting the UDA 8000 to the vehicle battery or through the special 220 V mains power supply.

The different measurement functions, the automatic recharging of accumulators and switching off are made through microprocessor-controlled circuits.
Each measurement step is supported by relevant messages.

2. TECHNICAL FEATURES

The technical features of the TL150/A adapter are supplied after specifying the application (chap. 12.6).

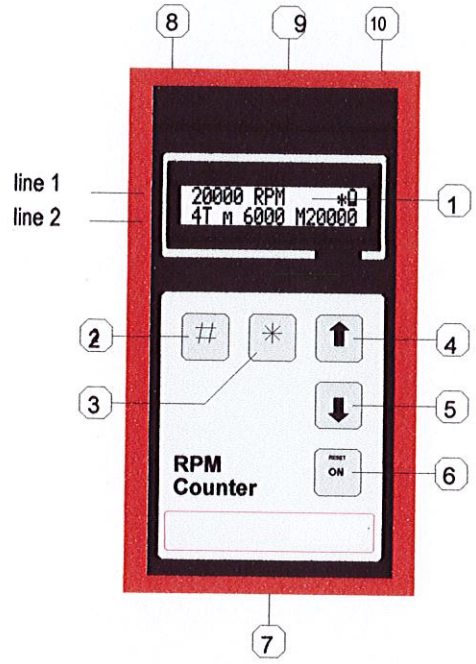
Petrol engines	100 | 20 000 RPM	± 0.5 |1%	1 |2 RPM)
Diesel engines (conventinal and common rail)	100 | 10 000 RPM	± 0.5%	1 RPM
Pulleys and rotating parts	100 | 10 000 RPM 10 000 | 60 000 RPM	± 0.5% ± 0.5 |2%	1 RPM 1 |16 RPM
Alternator (Battery ripple)	700 | 6000 RPM	± 3% (rel.) ± 50 RPM (abs.)	5 RPM ± 50 RPM
Reading frequency:	Selectable from 1 to 5 times per second		
Power supply:	6 x 1.2 V/700 mA/h Ni-MH accumulators or 2400 mA (optional)		
Autonomy:	Approx. 180 minutes with batteries charged (backlight off) Approx. 8 hours with 2400 mA/h batteries		
Recharge time:	Max. 18 hrs. (according to the state of charge)		

3. WARNINGS

- If the internal batteries discharge below the limit, a beep will be heard and the relevant message will be displayed.
  In this case the unit can be used only with the TL 152 power supply or the TL 150 cable connected to the vehicle battery.
  Recharging will start automatically during and after use, by leaving the UDA 8000 connected until the message "Battery charged" appears.
- Do not wind cables around the unit and do not approach them to rotating parts or exhaust pipes during measurement.
- Do not drop the unit, do not lean it on parts subject to strong vibrations or heat sources and do not expose it to the sunlight for a long time.
- For cleaning, use a soft cloth dampened with water.
  Do not use petrol or other aggressive solvents.
- Do not tighten the piezo clamp too much on injection tubes. Check before that the clamp's diameter is the same as the one of the tube on which it has to be mounted.

4. CONTROLS AND ACCESSORIES

FRONT VIEW



REAR VIEW

DESCRIPTION OF THE UNIT

1) Display.

2) Key for 2/4 stroke selection, display backlight and functions' switching.

3) Key to enter menu and to confirm function selected.

4) Key to select functions increase limits and thresholds for the analog bargraph RPM counter. Increases the display refresh frequency.

5) Key to select functions, decrease limits and thresholds for the analog bargraph RPM counter. Manual switch off for the specified functions.

6) Power on and initialisation key.

7) Power supply socket and battery recharge from mains.

8) Serial RS 232 connector and remote control for storage (optional).

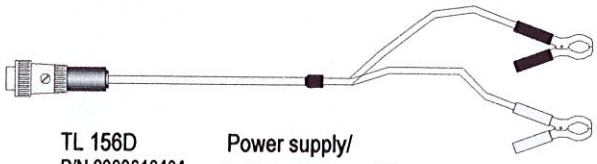
9) Signal and sensors inlet port : inductive clamp, piezo clamp or photoelectric sensor (optional).

10) Battery power supply/signal port.

11) Homologation plate.

STANDARD ACCESSORIES

The units is supplied with only the TL156D cable. Other cables can be ordered as option, according to specific applications (see page 5).



TL 156D
P/N 2000616404

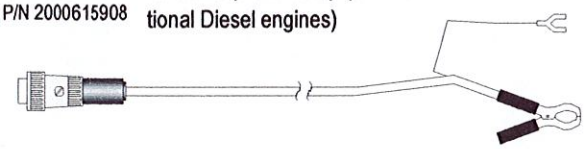
Power supply/
battery sensor cable

OPTIONAL ACCESSORIES FOR SPECIFIC APPLICATIONS

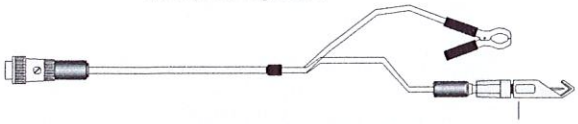
Besides to the cables listed on page 5, a special printed cicuit board can be supplied to measure RPM by picking up in most cases the alternator ripple on the battery, through the TL156D or TL151D cables (chapt.5)

The cables can also be used to recharge the internal accumulators during measurements.

TL 154D
P/N 2000615908
Cable for piezo clamp (conventional Diesel engines)

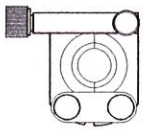


TL 157D*
P/N
Cable for RPM measurements on Saprisa regulators



Insulation piercing adapter F 95

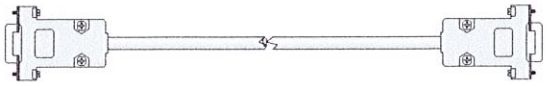
ME 0550
P/N
Piezo clamps
Diametres (in mm):
6 - 6.35 - 7 - 8 -
10 - 12 - 14



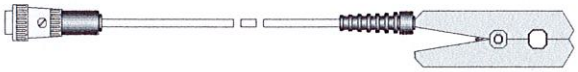
AD 61D
P/N
RPM differential adapter

TL 608
P/N
Inductive clamp for common-rail engines

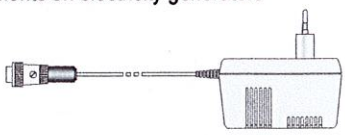
TL 159
P/N
Serial connection cable



TL 153D
P/N 2000616403
Inductive clamp for petrol engines

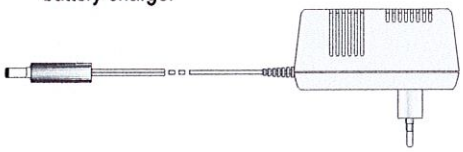


TL 150/A
P/N
Adapter for RPM and frequency measurements on electricity generators

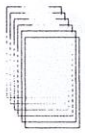


FL 61ED
P/N 2000615910
Photoelectric sensor

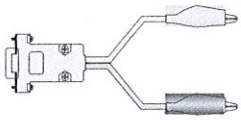
TL 152
P/N
220 V AC - 12V DC - 300 mA battery charger



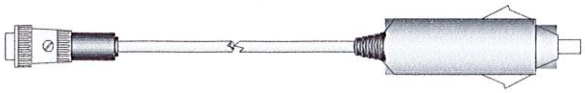
MM 1137 Reflecting tapes
P/N 2000615911



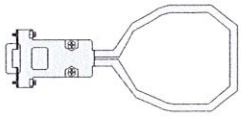
AD 201
P/N
Adapter for negative signal output



TL 151D
P/N 2000615909
Power supply cable/unfiltered light cigar ripple sensor



AD 200
P/N
2000616402
Adapter for inductive clamp

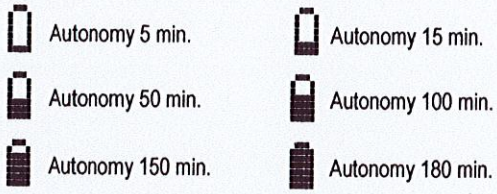


*) Only vers. 9.7L I (FOCS engines Lombardini)

5. POWER SUPPLY

The UDA 8000 works with 700mAh internal batteries. It has at least three hours autonomy with photosensor connected and backlight off.

When in use, on the right side of the display, the blinking icon of the approximate autonomy is shown. Example:



After the unit reaches the battery discharge limit, it beeps and the message Conn. ext. supply appears alternatively to the measurement. When the "beep" becomes continuous the unit switches off. It will be possible to use the unit only with the TL156D cable connected to the vehicle battery or to the TL152 AC mains battery charger.
In 24V systems connect the unit to the battery with grounded negative terminal (see Fig. 2).
To charge internal batteries, disconnect the sensors' cables and keep key ON pressed; the display will show the message Signal Missing then Battery in Charge and the relevant graph.
Leave the UDA 8000 connected for about 18 hours.
In case the TL152 battery charger is used, the message Battery in charge will appear after about 20 seconds from pressing key ON.
If the UDA 8000 is disconnected before 18 hours, the charge will be insufficient and autonomy will be reduced. With the TL156D cable connected, the charging process can be activated at the end of measurement by pressing key for about two seconds.
The unit can be switched off by pressing ✳ then ⬇ or by pressing ⬇ after two seconds from when the signal is missing.
By pressing for two seconds during measurment, the display backlight can be switched on and off.

ATTENTION
It is recommended to preserve the battery charge by using the display backlight only for the time strictly necessary. Disconnect the battery charger from mains during measurements. Should the unit remain unused for a long time, it is recommended to recharge accumulators every two months for about 18 hours, this operation grants the charge maintenance and the good operation of batteries.

6. READING RPM FROM VEHICLE BATTERY

RPM measurement is made by picking up the signal from the battery poles, in systems with alternator system for battery charging.
This measurement can be useful on Diesel common rail systems or petrol injection systems with coil per plug systems, where injection tubes and spark plug cables are difficult to reach.

6.1 If battery is very charged, the regulator could prevent the charging current and the measurement. In this case switch on (while the engine is off) constant electrical loads for a few minutes before test, such as: main headlights, defroster, cab and side lights.
Switching constant loads on, helps improving RPM stability during tests.

6.2 Do not switch variable loads on, such as: air conditioning, direction lights, windscreen wipers, etc. Crank the engine, bring it to normal operating temperature and stabilize idle engine speed (not beyond 1200 RPM). The charging warning light, if present, must switch off. Connect the TL156D cable to battery.

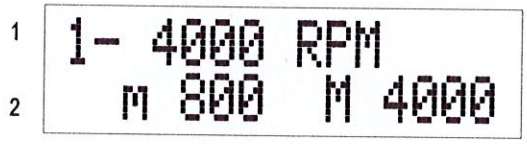
- Press key ON to initizalize the RPM counter, message 4 cylinders OK will be displayed. Select the number of cylinders through keys , ⬆ ⬇
  Confirm by pressing . ✳

Measurement has to be carried out by keeping the engine speed stable. During synchronization, the display will show:

an intermittent RPM value will be displayed then NOTE the definitive RPM display will be shown.
Example:

6.3 The reading with accelerated engine has to be carried out after the one at idle speed.

- Bring the engine to the higher engine speed, stabilize it and wait for some seconds that the measurement is processed.
- After processing, the current RPM number (M) will replace the previous one:
- Number 1 at the beginning of line 1 of the display shows the cell where the reading can be stored (see the following paragraph). Line 2 shows minimum (m) and maximum (M) values.



6.4 Storage of 20 readings (on line 1), by pressing key ⬇. The first reading wil be stored in memory cell N. 1. The display will show number 2. Store the other readings in the same way.

- To retrieve the RPM stored, press key ; the ⬆ RPM retrieved from the memory cells are displayed followed by a "M".
- The value in the memory cells can be erased by pressing ✳ In the memory cells deleted, new readings can be stored by pressing key . ⬇
- The RPM values (m) and (M), respectively minimum and maximum (line 2) can be displayed but not stored. The minimum (m) value can be updated, in case of higher speeds, by pressing key ⬇ during measurement.

Should the alternator be mounted on the flywheel and the regulator be Saprisa (or similar), connect the TL157D cable as shown in Fig. 7A or 7B and select the number of poles by following the instructions in chapter 15.

ATTENTION
Do not follow the measurement procedure with the battery clips disconnected from battery, random values could appear in this case.

If the message TRIGGERING remains on the display during the starting triggering phase, it means that signal is intermettent or ther is a higher RPM fluctuation than the one allowed for the measurement. In this case the RPM reading will not be carried out and after some seconds the relevant warning messages will be displayed.

Reading instabilities can be caused by activating the cooling fan, air conditioning compressor or other power elecrical loads.
Should it not be possible to switch off the element, carry out the measurement in the time strictly necessary between the switching on and off of the load.
In this case press key ⬆ to increase reading frequency on the display during measurement.

7. MEASUREMENTS WITH PHOTOSENSOR

Measurements with photoelectric sensor can be carried out on engine's pulleys, fans and spindles by sticking the MM 1137 reflector as in Fig.1 and 6.
Should the pulley under test have a big diameter and a high speed, use a reflector of about 1/5 of the circumference.
For small pivots and high speeds, paint half the part in white and the other half in dull black colour.
Best results are obtained by working in a not much lightened environment or with protections against direct sunlight and light reflections on the rotating part and on the sensor.

7.1 Connect the FL61ED to the SIGNAL socket and place the sensor perpendicularly to the surface of the rotating part, at about 3 to18 cm (up to 2 m with FL61LD).
For long measurements and a better stability of measurements fix the sensor firmly.

7.2 Crank the engine and press [ON]. The real time RPM reading will be displayed on the upper line, the minimum (m) and maximum (M) values will be displayed on the lower line.

7.3 To store minimum (m) and maximum (M) values (line 2) and real time values (line 1), follow the instructions in chap. 12.1 and 12,2 respectively.

1 20000 RPM *0
2 2T m 6000 M20000

ATTENTION
The sensor's orientation toward continuous or intermittent light sources can cause short signal interruptions, causing the disappearance of the asterix on the display and the freezing of values.
They will be updated when the signal appears again.
In case of measurements in the engine compartment, fix the sensor securely so that possible vibrations will not loosen it as this may cause serious damages to the engine and the operator.
The photoelectric sensor has to be positioned toward the reflecting surface as shown in fig. 1, otherwise readings could be unstable, wrong or intermittent.

POSITIONING OF PHOTOELECTRIC SENSOR FOR MEASUREMENTS ON ROTATING PARTS

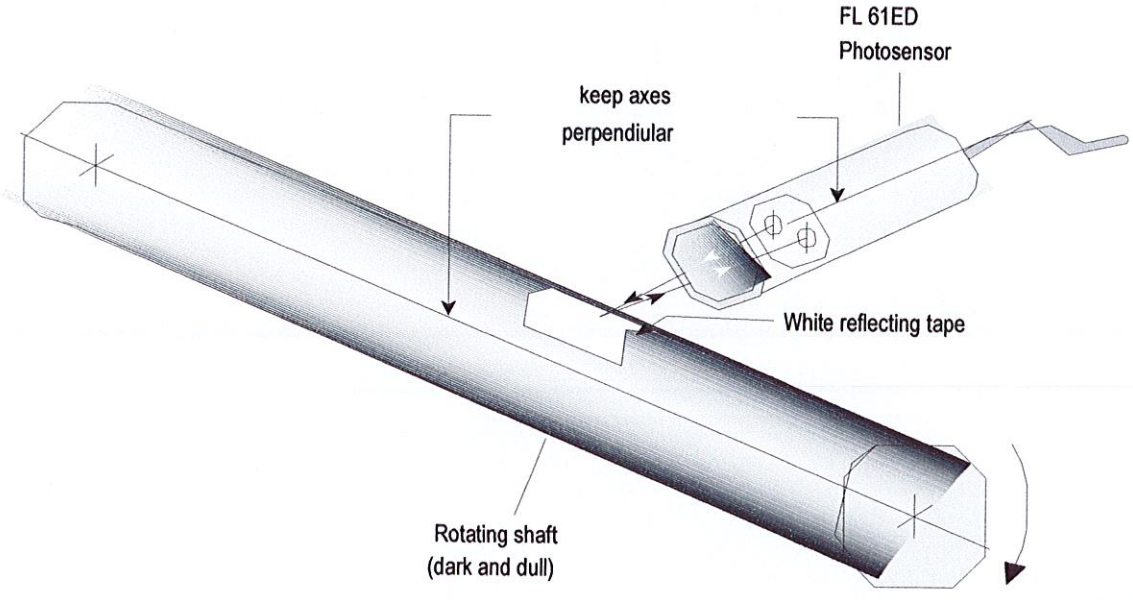


FIG. 2

8. MEASUREMENTS ON PETROL ENGINES

Connect the clamp as shown in fig. 2. The inductive clamp can be connected to any spark cable, with the arrow pointing towards the spark-plug.

In coil per plug systems connect the TL153D clamp, with the arrow pointing to the opposite direction of the spark-plug, on the cables going to the coil primary connector that groups: 12 V power cable, coil negative and high voltage ground wire.
Pay attention that the clamp's cores match.

8.1 Crank the engine and press [ON].
With a regular signal the blinking icon ✳ is displayed. If the clamp's cable is interrupted or the clamp is not connected, the icon ✳ does not appear and the message No signal is displayed.

8.2 In DIS systems, select 2 strokes by pressing [#].
If the signal is missing, reverse the clamp.
During measurement the minimum (m) and maximum (M) values (RPM hunting) will be shown in line 2. The real time RPM reading will be displayed in line 1.

8.3 To store minimum (m) and maximum (M) values (line 2) and real time values (line1), follow the instructions in chap. 12.1 and 12.2 respectively.

1 20000 RPM ✳0
2 4T m 6000 M20000

ATTENTION
Short signal interruptions make the asterix disappear and cause a freezing of the measured values on display. They update if the signal reappears.
If the display is unstable, carry out the following checks:

- Check that the clamp's cores match,if neessary clean them.
- Space out the cable, on which the clamp is mounted, from the other cables.
- Discharges between the poles or to ground in the distributor cap or in the cables due to fissures or humidity.
- Unit too near to high voltage cables or to ignition coil.
- Anti-noise resistance with a too high value or poor spark energy.

CONNECTION ON PETROL ENGINES WITH DISTRIBUTOR SYSTEM

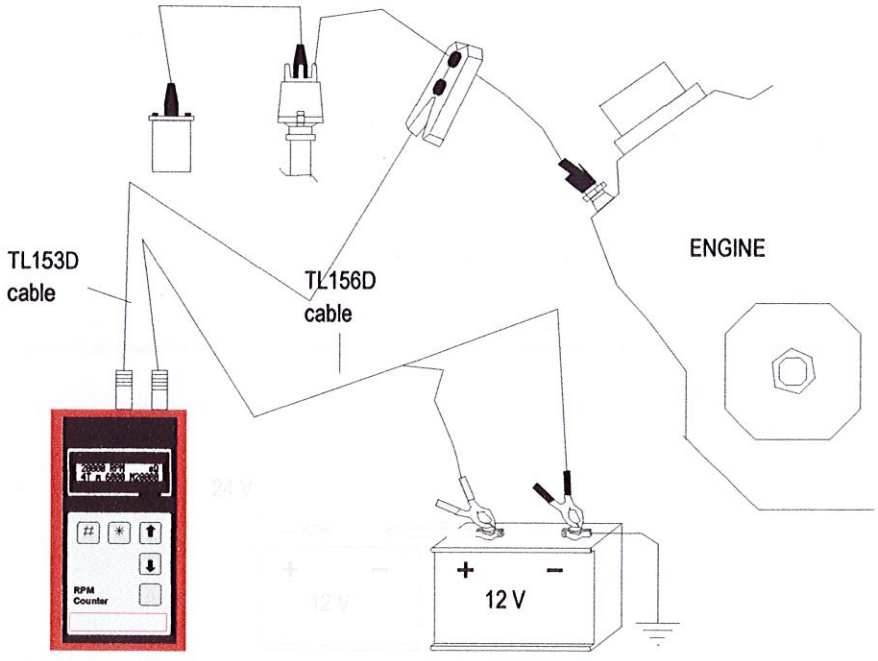


FIG. 3

9. MEASUREMENTS ON DIESEL ENGINES

Connect the UDA 8000 as shown in Fig. 4. 4T (four strokes) will be displayed on line 2.

9.1 Clean a straight part of the injection tube of about 1 cm by removing possible paint with a special liquid or a thin abrasive cloth (fig. 3).

9.2 Make sure that the piezo clamp is of the same diameter of the tube on which it has to be mounted. Do not mount the 6mm clamp on 1/4" (6.35 mm) it could get damaged irreparably.

9.3 Do not overtight the clamp (screw it 1/5 of a turn after its blocking).

9.4 Start the engine and bring it to the speed you want to test. Press ON. The display will show the real time RPM on line 1, the idle (m) and the accelerated (M) speed on line 2.

1 2000 RPM *0
2 4T m 600 M 2000

9.5 To store minimum (m) and maximum (M) values (line 2) and real time values (line1), follow the instructions in chap. 12.1 and 12.2 respectively.

CLEANING OF INJECTION TUBE

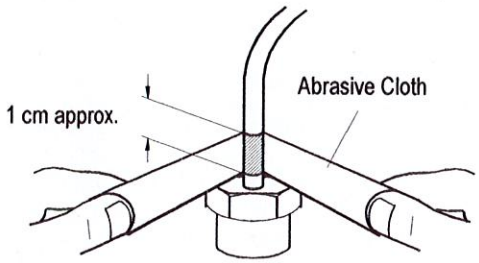


FIG. 4

ATTENTION

Short signal interruptions make the asterix disappear and cause a freezing of the measured values on display. They update if the signal reappears.

If the display is unstable, carry out the following checks:

- Low injection pressure.
- Vibrations of the tube caused by loosening or lack of fastening collars.
- Loosened clamp on the tube, damaged internal collar, bad contact or tube deformation.
- Bad contact of the black clip with the engine ground or interruption of the red cable.
- Cracks of the ceramic part of the clamp due to an excessive tightening or a wrong diameter

FITTING THE PIEZOELECTRIC CLAMP ON DIESEL ENGINES

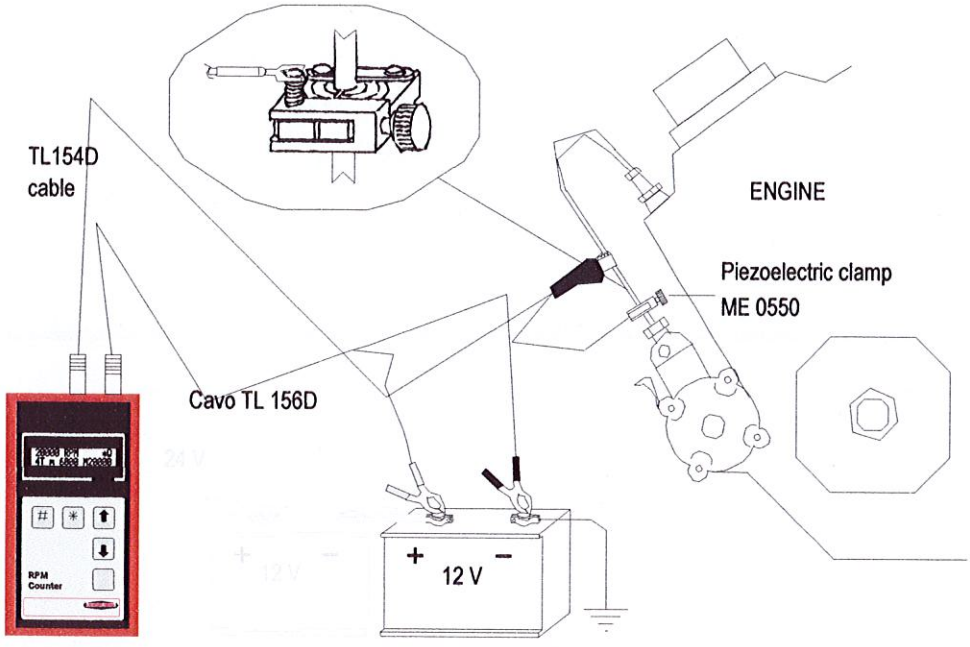


FIG. 5

10. MEASUREMENTS ON DIESEL COMMON RAIL SYSTEMS

Engines with Unijet systems (two injections), Multijet systems (five injections) and with piezoelectric injectors can be checked.

10.1 Connect the unit as shown in fig. 5 With the engine stopped, remove the connector from an injector.
Unwind cables and connect the clamp to the injector control cable, with the arrow pointing toward the injector.
The connection with the arrow poiting toward the opposite direction does not influence readings.

10.2 Reconnect the connector by making sure that the locking catch is ON. Press key ON.

10.3 Start the engine and bring it to the desired speed. The message 4T (4 strokes) will be displayed.

1 2000 RPM *0
2 4T m 600 M 2000

Line 1 will show RPM in real time while line 2 the minimum (m) and maximum (M) RPM read (RPM hunting).

10.4 To store minimum (m) and maximum (M) readings (line 2) and real time readings (line 1) follow the instructions in chapter 12.1 and 12.2 respectively.

ATTENTION
In systems with common rail injection, if the magnetic- or piezoelectric injectors' connector is accidentally disconnected or a cable is interrupted, the injector could remain open and damage the engine. Also fault codes in the ECU could be generated.

- All the operations of disconnection and reconnection have to be necessarily made with the engine stopped.
- At the end of the test, wind the cables and reconnect as in origin, by paying maximum attention to re-hook the connector.

CONNECTING THE CLAMP ON COMMON RAIL SYSTEMS

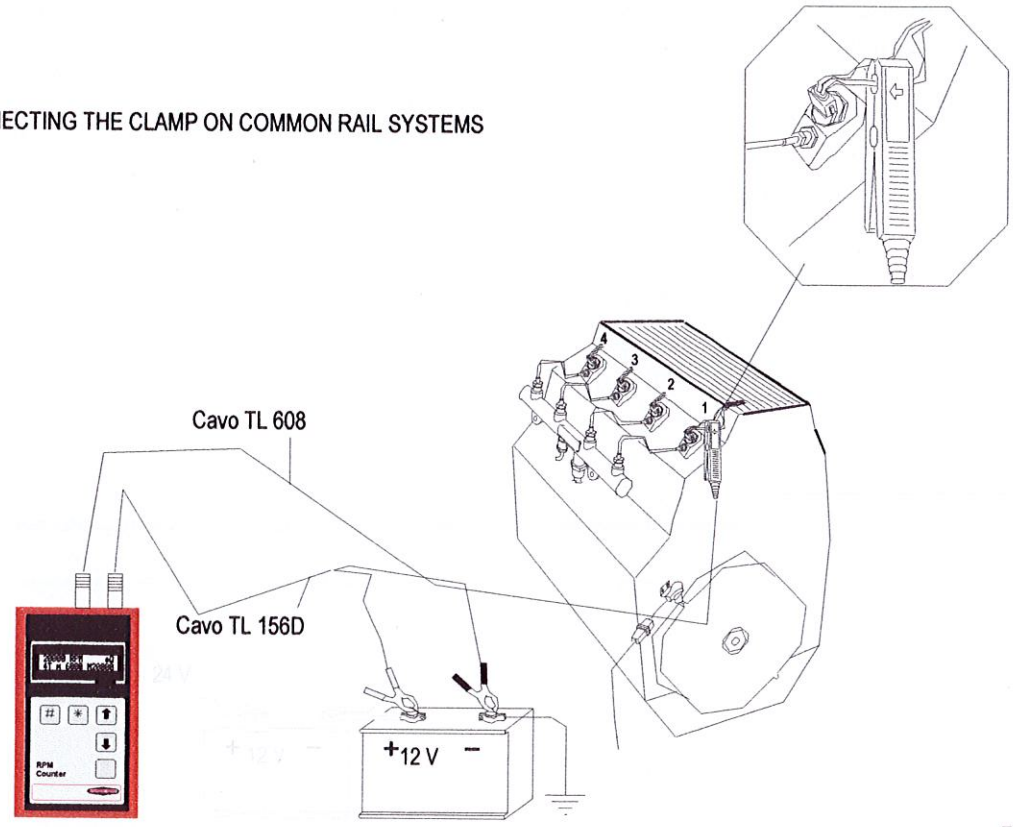


Fig. 5

11. DIFFERENTIAL RPM MEASUREMENTS

Possible faults of viscous coupling systems of the cooling fan can be found on Diesel engines by connecting only the FL 61ED (or FL 61LD) sensor as shown in fig. 6.

On petrol engines replace the piezo clamp by the TL 153D inductive clamp.

11.1 Bring RPM and engine temperature, measured with the on-board thermometer, at the RPM choosen.

11.2 Press and release key ON. After displaying RPM, press ✳ then keys ⬆ or ⬇ to select Differential RPM. Press ✳ to confirm. Check that the fan's RPM are within the limits foreseen by the manufacturer.

11.3 Engine RPM will be displayed on line 2. If the signal from the photoelectric sensor is missing, the message "Signal missing" will be displayed on line 1.
If the signal from the piezoelectric sensor is missing, the message "Signal missing" will be displayed and no measurement will be carried out.

11.4 It is possible to store only the RPM reading of line 1 as described in chapter 12.2.

12. STORAGE AND SPECIAL MEASUREMENTS

During operation, press keys ✳ and ⬆ or ⬇ to select storage of measurements or any of the functions described in the following paragraphs. Press ✳ to confirm selection.

12.1 Storage of Minimum and Maximum RPM
Allows to store the RPM hunting read on line 2 (chap. 7,8,9 and 10).

- Press key ⬇ during measurement, minimum (m) and maximum (M) RPM will blink. By pressing key ⬇ again, values will be stored in the memory cells n. 21 and 22 and reading will be restored. New values can be stored with the same procedure, the previous ones will be erased.

12.2 Storage of Real Time Measurements
Select function Storage as described at the beginning of this chapter. It is possible to store 20 measurements in real time by pressing key ⬇.

1 2500 RPM *0
2 4T m 2400 M 2600

CONNECTION FOR DIFFERENTIAL RPM MEASUREMENT OF FAN/DIESEL ENGINE

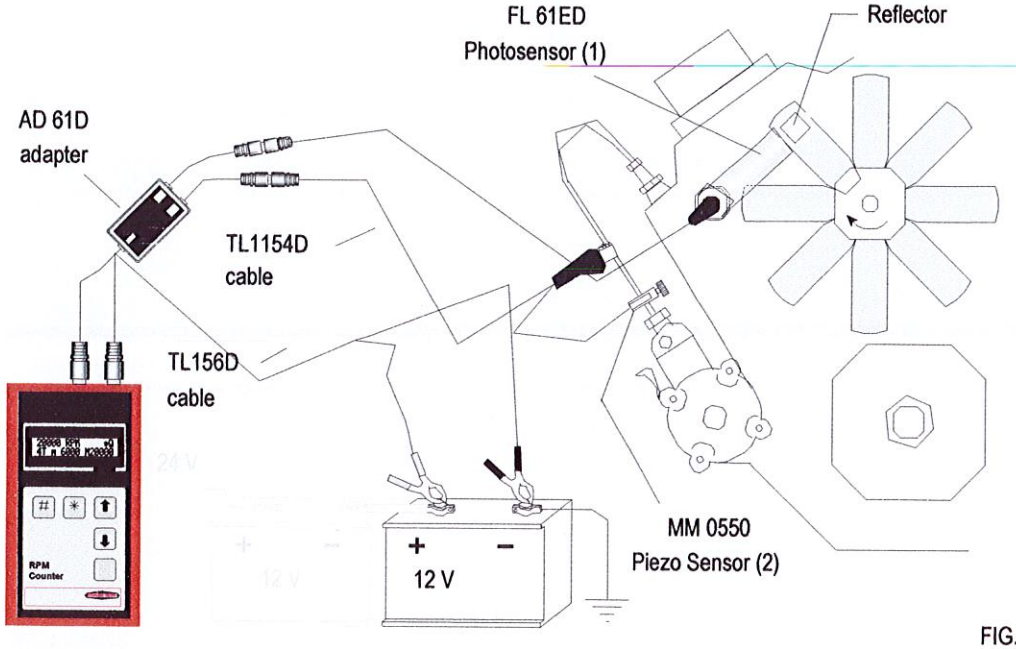


FIG. 6

- After memory cell n. 20, the unit will store other readings starting from cell n. 1 and erases the readings previously stored.

- By pressing keys [#] and [↓] the unit will show the reading stored. By pressing [#] again, it goes back to the Storage function.

12.3 Retrieving stored measurements

It allows to display the sequence of the readings stored. Connect the correct cable to signal and select function Retrieve data. Press [✳] to confirm.

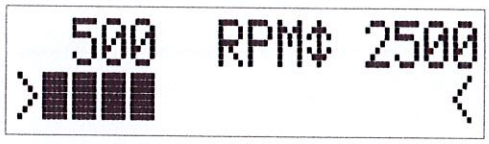
- Through keys [↓] select the memory cell to be displayed. The retrived real time measurements will appear. Press key [↑] to go back.

Restore the Storage function by pressing [#] and vice versa.

12.4 Measurements through bargraph

Allows to check on an analog bargraph if the engine accelerations reach or exceed the limits set. When the limits are exceeded, a beep will be heard.

- Connect the cable to signal. Select bargraph and confirm with [✳].
- Set the minimum limit by keeping key [↑] or [↓] pressed. Confirm with [✳].



Press [↑] or [↓] to set the maximum limit, confirm with [✳] and proceed with measurement.

12.5 RPM threshold

The drift from a limit set can be checked.

- Press [✳], select RPM threshold from 100 to 5400 RPM through keys [↑] or [↓] and confirm with [✳].

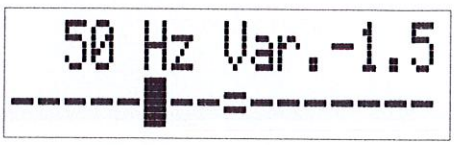
The engine speed set will correspond to symbol "=" in the centre of the bargraph.

- Press [#] and through [↑] and [↓] select the RPM variation from 1 to 9 for each dash of the bargraph.
- Press key [#] to return to measurement; the index relevant to the variation will position itself on a dash of the analog bargraph.
  The value of the variation from the preset engine speed will be displayed on the top right side of the display. Symbols << and >> show that limits are exceeded.

12.6 Electricity Generators' Frequency

Allows to check the tolerance of the frequency drift of electrical energy generators.

- Connect the TL150/A adapter to the 220V service socket on the generator's panel. Press keys [✳] and [↑] until the message Gen. Frequency is displayed. Confirm with [✳].
- Press [↑] or [↓] to select 50 or 60 Hz operating frequency.
  The selected frequency will correspond to symbol "=" in the centre of the analog bargraph.



- Press [#] and key [↑] or [↓] to select the value of deviation frequency from .5 to 1 Hertz for each dash of the analog bargraph.
- Press key [#] To return to measurement. The variation index will position itself on a dash of the analog bargraph. The variation in Herz will be displayed on the top right side of the display.

13. SERIAL COMMUNICATION

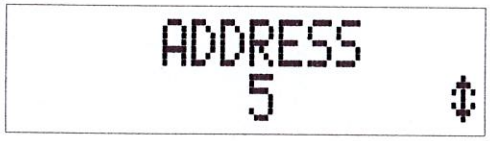
The UDA 8000 satisfies the requirements of the Italian Ministerial Decree MCTC Net for official car inspections.

The characteristics of the serial communication are the following:

Baud rate:	9600 bits per second
Data bits:	8
Parity:	None
Stop bit:	1
Flux control: Data update:	None Once per second

The instrument is preset at address 1 for data transmission. To modify the preset address value use the following procedure:

- Press and release key [ON]. Immediately after keep the key [↓] pressed until the current address appears on the display.
- To modify the address, use keys [↑] or [↓] and choose a number from 0 to 9.
  Press [✳] to confirm.



- The UDA 8000 will restart automatically with the new settings.

NOTE
The UDA 8000 Link software for serial RS 232 communication to PC can be supplied optionally. It allows to display and store on PC the minimum and maximum RPM measured in the various functions of the unit.

The UDA 8000 Link can not be supplied for software version 9.7L I, 9.7L E and 9.7L F.

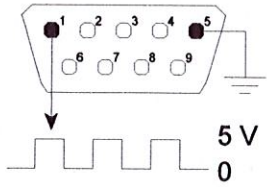
14. DIGITAL SIGNAL OUTPUT

During RPM measurements the UDA 8000 supplies a digital (TTL) signal on pin 1 of the serial connector.

This signal is a square wave with 50% duty cycle and a variable frequency according to RPM:

$$\text{Freq.} = \frac{\text{RPM}}{120}$$

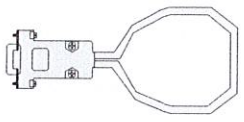
where the frequency is expressed in Hertz.
The digital signal can be sent to RPM counters of smoke meters, gas analysers or other equipment with an input impedance of about 5 kΩ.
The equipment should be set for measurements on 4 stroke engines.



Front view of the UDA 8000 serial connector

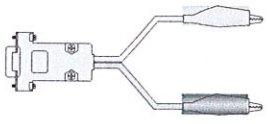
14.1 Signal pick-up with adapters

By connecting the AD 200 adapter to the serial socket of UDA 8000, the RPM signal can be picked up on the adapter's Jumper from the inductive clamp of gas analysers or of other equipment.



AD 200
Adapter for inductive clamps

To pick-up a negative signal, similar to that of piezo clamps mounted on Diesel injection tubes, connect the AD 201 adapter to the serial socket of UDA 8000 and pick up the signal on red and black clips.



AD 201
Adapter for picking - up negative signals.