



**MMI**  
Solution Provider

Since 2011

## HYBRID RESEARCH ENGINE TEST SETUP USING FUEL CELL AND BATTERY DEVELOPMENT TEST SETUP

### Engine details:

Engine type: 4 stroke VCR engine  
Compression ratio: 12 to 20:1 diesel  
22.1: 1 for bio-diesel

Displacement: 661 cc  
Fuel injection: Diesel (DI),  
Hydrogen (DI/IDI), Petrol  
(DI/IDI), CH<sub>4</sub>+ CO<sub>2</sub> (DI/IDI)  
Startin method: Electronic start  
using motor and battery  
Running: Through Motor with  
out current using fuel power  
through battery.

### Dynamometer:

Make: ACCURATE  
model: E - 05  
max. power: 10 HP@ 1500 RPM  
Max Torque: 47NM@1500 to 4000  
RPM  
Torque accuracy: 0.25%



### Dynamometer Controller for Eddy Current Dynamometer (DLC 2000)

- 1) Constant Excitation Current Mode
- 2) Constant Torque Mode.
- 3) Constant Speed Mode

### Calibration Kit .

Including Calibration arm and Set of weights for checking calibration up to 4 Kg.

Cardan Shaft and Guard 11XX Series Cardan Shaft and Heavy Duty Fabricated Shaft Guard for Ensuring Operator Safety in Case of Failure of Cardan Shaft

Instrument Cabinet for housing all electronic controllers, indicators etc. with 10 meter cable loom

Magnetic Strainer Model ATE-NB15-MS

Magnetic Strainer with 100 Micron Filtration and 1/2 " BSP Screwed to Connection fitted at Water Inlet to Dynamometer

Ph : 044 - 28389151, 82200 45908, 99404 90163



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# MICRO MECH INSTRUMENTS

An ISO 9001 : 2015 Certified Company

No. 1, 2nd Cross Street, Thendral Nagar, Karapakkam, Chennai - 600 097, Tamil Nadu, INDIA.

Email - sales@micromechinstruments.com, Web - www.micromechinstruments.com



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**Hydrogen Injection system:** Hydrogen injection consists of flash back arrestor, Flame trap, 0.01 accuracy BRONKHORST IP 40 classification hydrogen mass flow controller with digital display, 25Liter capacity hydrogen storage tank, Quantem hydrogen injector with electronic controller for injection timing, Pressure etc

**Electrolyzer:** Volume of hydrogen and oxygen from electrolyzer is measured using water displacement method.

Input Voltage : 1.8V ~ 3V (D. C.)  
 Input Current : 0.7A  
 Hydrogen production rate : 100 ml per minute at 15A  
 Oxygen production rate : 50ml per minute at 15A  
 Mini PEM Electrolyzer, Tubing, Pins, Banana cables / connecting leads, Syringe

**Fuel cell:** The Horizon H-3000 PEM Fuel Cell is a 3 Kilowatt, air fed / air cooled, self-humidified hydrogen fuel cell.

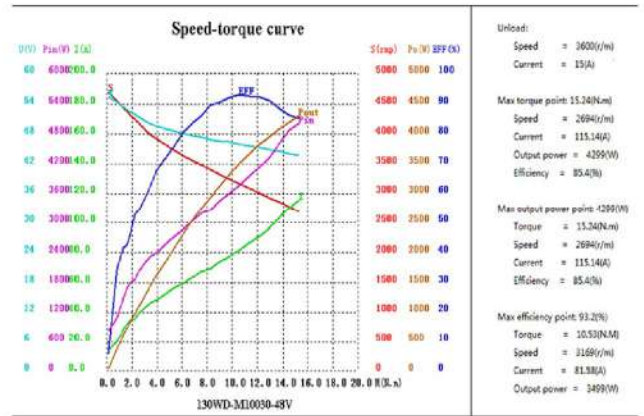
Number of Cells 72  
 Rated Power 3000W (3kW)  
 Rated Performance 43.2V @ 70A  
 Hydrogen Supply Valve 12V  
 Purging Valve Voltage 12V  
 Blower Voltage 12V  
 Reactants Hydrogen and Air  
 Ambient Temperature 5 - 30C (41 - 86F)  
 Max Stack Temperature 65 C (149 F)  
 Hydrogen Pressure 0.45 - 0.55 Bar  
 Includes: Connections/Tubing, Electronic valves  
 Electronic control box, 3kW stack with blower, Fuel cell ON/OFF switch, SCU ON/OFF switch

**Motor with control system:**

This Set up Consists of following items,

3KW BLDC Motor, BLDC Controller, Battery with charger

4 HP BLDC MOTOR  
 Square Flange Size 130 mm  
 Motor Weight 12kg  
 Rated Voltage 48V DC  
 Rated Current 77 A  
 Rated Power 3000 W



**BLDC CONTROLLER:** High-speed low-loss synchronous rectification PWM modulation.  
 Size 200\*146\*62 mm  
 Weight 3.5 kg  
 Frequency of Operation 16.6kHz  
 Standby Current < 0.5mA  
 5V Sensor Supply Current 40mA

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**MEASURING INSTRUMENTS**

**AIR INTAKE MEASUREMENT:** Differential pressure transmitter will be provided to measure the engine air flow rate , 1% Total Error Band, CE Compliance EN55022 Emissions Class A & B

**FUEL FLOW MEASUREMENT:** Make: CYNERGY 3  
2 No's of optical liquid level sensor will be provided to measure the fuel consumption with facilities of fully automatic mode in constant volume  
CC tube, 10 Liter capacity fuel tank with fuel hose will be supplied  
Cable length Standard: 25cm, Mounting thread : M1 x1, Wire size:: 24AWG

**LOAD MEASUREMENT:** Make: SENSOTECH  
Range: 0 - 100 Kg, Standardized output : 3mv/V standardized output  
Compliance: Sealed to IP67 standard / Traceable to NIST standards, USA

**WATER FLOW MEASUREMENT:** 2 No's of 0 - 600 LPH acrylic body rotameter will be provided to find the water cooling rate

**Combustion analyzer kit:**

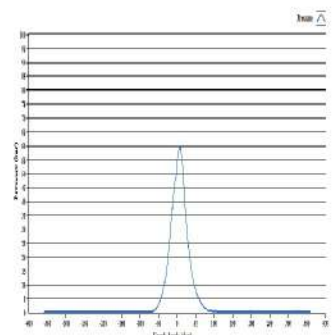
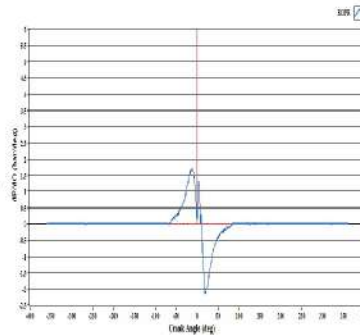
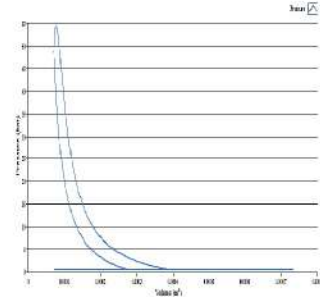
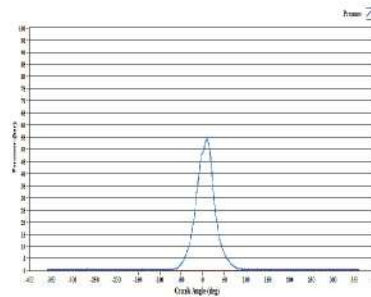
Combustion pressure sensor: KISTLER make 0 - 300 bar pressure sensor with charge amplifier and connecting cable, Sensitivity ( $\pm 0,5\%$ ) : 40 mV/bar, Linearity :  $\pm 0.5\%$  FSO, Supply voltage: 7 to 32 VDC

Crank angle encoder: KISTLER make Resolution :  $3600 \times 0.1^\circ$ , Speed range: 0 ... 12 000 1/min, Operating Volt: 10-30VDC, Resolution : 3600 PPR  
Accessories: Crank Angle Encoder, Encoder Electronic LVDS Connecting cable (L = 10 m)

**DATA ACQUISITION SYSTEM**

Make: NI, Model: NI USB 6361  
Analog Input : 16 Single Ended, 8 Differential  
Ground reference : AI GND  
Digital Input/output : 4 Digital I/ Counter Input: 2  
Timing accuracy : 50 ppm  
Timing resolution: 50 ns  
Output range:  $\pm 10$  V  
Output coupling: DC  
Input high voltage (VIH): 2.2 V -5.25 V  
Input low voltage (VIL) : 0 V 0.8 V  
Frequency : 2.8 MHZ

- Crank Angle Vs Pressure
- Crank Angle Vs Rate of Pressure Rise
- Volume Vs Pressure
- log (volume) Vs log(pressure)
- Crank Angle Vs Heat Release Rate
- Crank Angle Vs Cumulative Heat Release Rate
- All the Output Result are Stored in one Excel Sheet



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