

DPM Elettronica Srl:

Head office - Italy

Year of Establishment - 1991

Expertise – Electronic Systems Research and Development, Domotics and Security sensors.

Drones Bench –

DronesBench is the first device in the world designed to ensure a strategic solution for the control and safe management of professional drones, which offers a series of integrated services of fundamental importance for the diagnosis, testing, setting and flight simulation.

Drones Bench Measures:

- The thrust provided by the drone
- Instantaneous power consumption of the drone
- Pitch, yaw and roll instantaneous angles

Objectives:

- 1) Evaluate and compare the technical quality of drones
- 2) To improve the technical quality of their drones and certify their efficiency.

DRONE LAB

Sl No.	Equipment Model	Capacity
1	Drone Scale	Up to 1 Kg Payload
2	DB M1/4	Up to 4 Kg Payload
3	DB M2/15	Up to 15 Kg Payload

DronesBench - DB M2/15

English	Italian	Values
Bench diameter	Diametro banco	1910 mm
Bench height	Altezza banco	1123 mm
Head diameter	Diametro testa	196 mm
Head weight	Peso testa	2879 gr
Total weight	Peso totale	34.089 gr
IE - DE	IE - DE	> 200 mm
IE + DE	IE + DE	< 1800 mm
Max drone weight	Peso max drone	15.000 gr
Max drone payload	Payload massimo drone	2800 gr 2800 + x gr (1)
Support base for fixing the drone	Base di appoggio drone	500x150mm
Max voltage of the battery (12S)	Massima tensione drone misurabile	50 V
Max current of the drone	Massima corrente drone misurabile	50 A
Connector for drone's battery	Connettore per collegamento alla batteria del drone	XT 60 maschio (male)
Connector for drone	Connettore per collegamento al drone	XT 60 femmina (female)
Capability to test	Capacità di test	1500 Drones/Year or one per hour)
(1) Adding weights of 3043g under the measure's head	(1) aggiungendo zavorre di 3043g sotto la testa di misura	X max = 3043x4 g
All the values may be changed without notice!		



Up to 15 Kg payload

DronesBench - DB M1/4

English	Italian	Values
Bench diameter	Diametro banco	1036 mm
Bench height	Altezza banco	1085 mm
Head diameter	Diametro testa	196 mm
Head weight	Peso testa	2449 gr
Total weight	Peso totale	26.316 gr
IE - DE	IE - DE	> 200 mm
IE + DE	IE + DE	< 900 mm
Max drone weight	Peso max drone	4000 gr
Max drone payload	Payload massimo drone	2400 gr 2400+x gr (1)
Support base for fixing the drone	Base di appoggio drone	500x150mm
Max voltage of the battery (12S)	Massima tensione drone misurabile	50 V
Max current of the drone	Massima corrente drone misurabile	50 A
Connector for drone's battery	Connettore per collegamento alla batteria del drone	XT 60 maschio (male)
Connector for drone	Connettore per collegamento al drone	XT 60 femmina (female)
Capability to test	Capacità di test	1500 Drones/Year or one per hour)
(1) Adding weights of 3043g under the measure's head	(1) aggiungendo zavorre di 3043g sotto la testa di misura	X max = 3043x4 g
All the values may be changed without notice!		



Up to 4 Kg payload

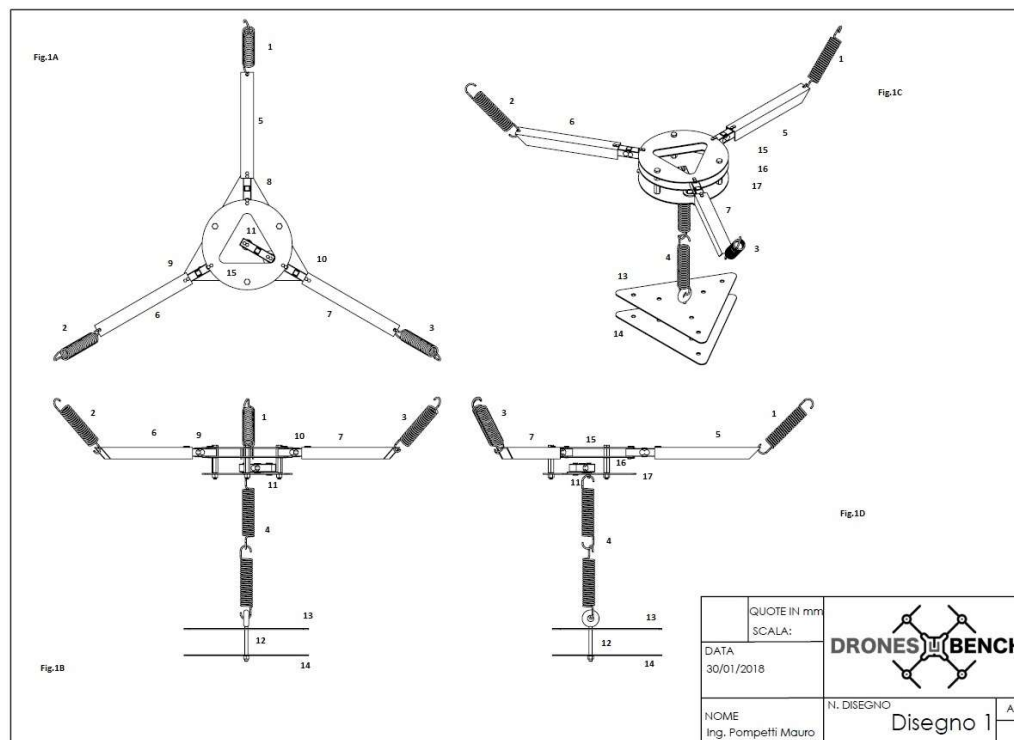
Drone Scale

Dronescale		
English	Italian	Values
Bench diameter	Diametro banco	880 mm
Bench height	Altezza banco	760 - 1300 mm
Head diameter	Diametro testa	40 mm
Head weight	Peso testa	1921 gr
Total weight	Peso totale*	3705 gr
Max drone weight	Peso max drone**	1000 gr
Max drone payload	Payload massimo drone	~2472 gr*** ~2472+x gr***
Support base for fixing the drone	Base di appoggio drone	240x240mm
Max voltage of the battery (12S)	Max tensione drone misurabile	50 V
Max current of the drone	Max corrente drone misurabile	100 A



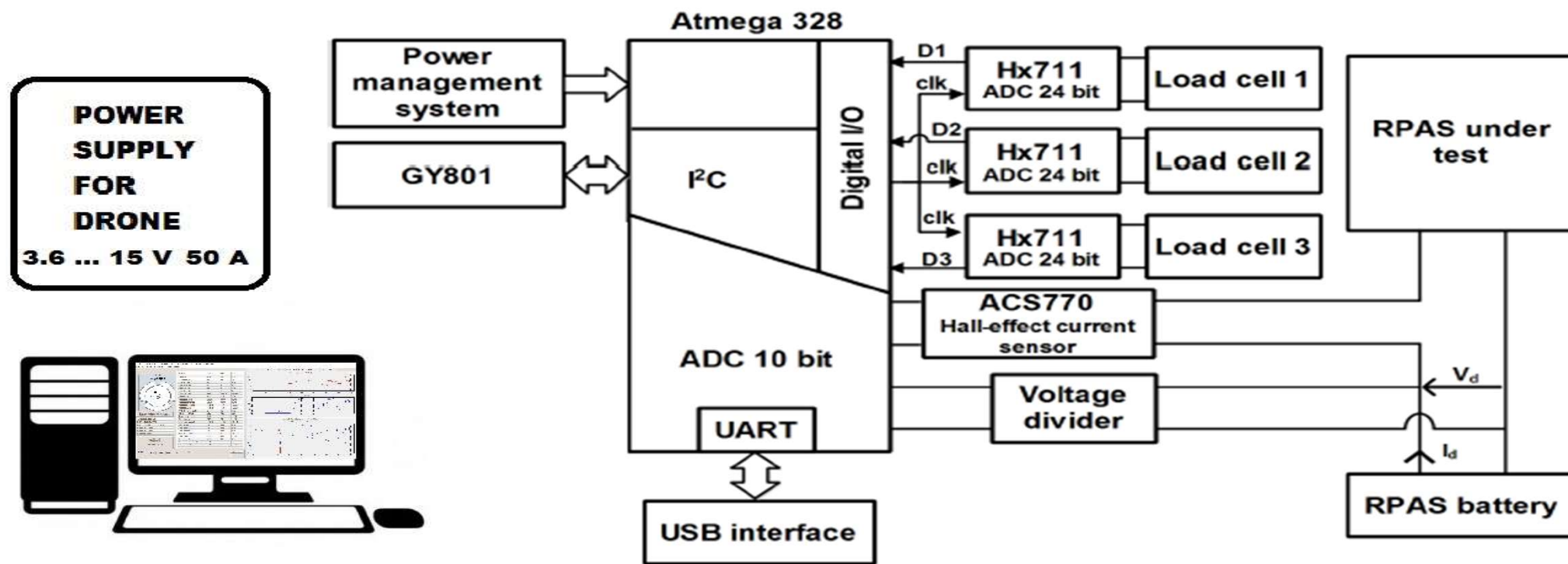
Up to 1 Kg payload

DronesBench Architecture



The Fourth Spring Measure

DronesBench Block Diagram



RS485 Port

Wifi connection

Drone Power Supply

From The Desk	From The Battery
To be used when doing spot or continuous operations on the drone.	To be used for the production of the drone certificate or to evaluate the residual efficiency of the battery.

- Connect the cable from the power supply to the measuring head.
- Set the power supply knob to the voltage suitable for the 4.2V (1S) 8.4V (2S) 12.6V (3S) 16.2V * (4S) drone and check in the program under Voltage.

The power supply generates at most about 15V therefore allows measures of the DB index in the simulation of batteries up to 3S. From the 4S up use more power supply connected together.

DronesBench Index

DBI depends on the different levels of thrust and speed of the propellers.

The DBI is evaluated at the take-off of the drone (t_0):

$$DBI = \frac{F^2(t_0)}{V_d(t_0) I_d(t_0)}, \quad (1)$$

Where:

$F_2(t)$ vertical force produced by the drone

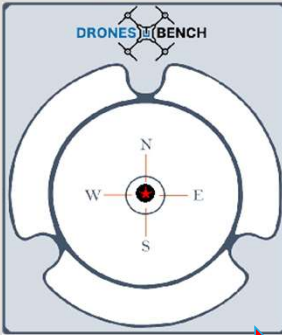
$V_d(t)$ voltage on the battery terminals

$I_d(t)$ current supplied by the battery

Software View

DroneBench User Interface

File Link Power Zeroing View Language ?



DroneBench status

Bench voltage [V]:	12.20
Bench current [mA]:	120
Geom.compensation [%]	4
Head loss [V]:	0.6
Head loss [W]:	30
Head loss [%]:	2

12.25.32
20/05/2017

Pwr Start Pause End Zero Freeze ☐ Com5

Measure	Live	Nom.	Max
Voltage [V]:	10.81	10.81	9.6
Current [A]:	13.64	13.64	48.2
Power [W]:	147.45	147.45	462.72
Energy [Wh]:	22.698	22.698	21693
Capacity [mAh]:	2099	2099	2099
Efficiency [%]:	70	70	70
Pressure [mBar]:	1030	1030	1030
Temperature [°C]:	24.2	24.2	24.2
Wires' losses[W]:	3.4	3.4	3.4
Conn.'s losses [W]:	1.2	1.2	1.2
Unit's losses [W]:	6.2	6.2	6.2
Total losses [W]:	9.8	9.8	9.8
Spec.power [W/kgf]	210	210	199
DB Index [g/W]:	5.1	5.1	5.01
Pitch [degrees]:	0	0	0
Roll [degrees]:	0	0	0
Yaw [degrees]:	0	0	0
Load X [kgf]:	0	0	0.01
Load Y [kgf]:	0	0	0.00
Load XY [kgf]:	0	0	0.01
Direction [gradi]:	18	18	22
Load Z [kgf]:	0.01	0.01	-1.57
Drone's weight [kg]:	0.75	0.75	0.75
Load capacity [kgf]:	-1.57	-1.57	-1.57
Thrust Z [kgf]:	0.76	0.76	2.32
Loudness [db]			

Level Certificate's Input Certificate's Measure Grafics Settings Meas.details

DroneBench

Testa Media Firmware

Head serial 00000010 fw release 4.1 Data fw 30/01/2017

Head dia 200 head weight 1500 Res.[ohm] 0,010

lim.sensor 10000 Max weight 5000 H1 300

Base 1 metro

Harms length 500 H0 [mm] 100

Molla media

Dia ext [mm] 380 Dia int [mm] 150 L [mm] 38

K=-F/s 50 L.Spirale 380 Codice 1

Catena piccola

chain width 380

n rings 18 chain ring H 150 chain ring L 38

Server

ip address 192.168.0.1 port 10000

rxanswer rxanswer connect

Operatore

Operator Ing.Massimiliano Matrella

Name certifying company DPM Elettronica Srl

Address City Via San Alfonso de Liguori, 61 Postal code 71121

Phone +39 329 6353404 @mail ut@dronebench.com

Logo Marchio.jpg Image FieraScreen.jpg

Gradienti e allarmi

Measure	DM	Min	Max
Voltage [mV]	100	10000	16000
Current [mA]	100	0	20000
DB Index [gf/W]	1	3	10
X load [gf]	100	0	400
Y load [gf]	100	0	700
Z load [gf]	100	3000	-2000
Period [s]	60		

☐ Bip enable

Filter 1

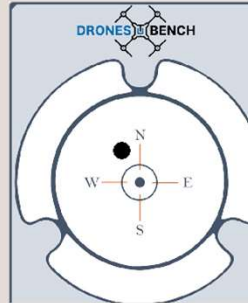
Confirm

The GUI of “DroneBench”

Software View

DroneBench - DPM Elettronica Srl tel.:+39 329 6353404 mail: ut@dronebench.com

File Link Power Azzeramenti Vista Lingua ?



DroneBench status

Tensione banco [V]:	
Corrente banco [mA]:	
Correz. geometrica [%]:	0,0
Perdite testa [V]:	
Perdite testa [W]:	
Perdite testa [%]:	

10.55.20

07/03/2017

Freeze ☐
Pwr
Inizio
Pausa
Fine
Zero

Misure	Live	Nom.	Max
Tensione [V]:	15,0	14,7	13,9
Corrente [A]:	0,7	21,6	32,4
Potenza [W]:	10	316	451
Energia [Wh]:	9	5	2
Capacità [mAh]:	637	367	159
Efficienza [%]:	21	12	5
Pressione [mBar]:	1004,9	1004,8	1004,7
Temperatura:	17,0	16,0	17,0
Perdite cavi[W]:	0,000	0,000	0,000
Perdite conn.[W]:	0,000	0,000	0,000
Perdite centr.[W]:	-1,201	-1,201	-1,201
Perdite tot. [W]:	-1,201	-1,201	-1,201
Potenza spec. [W/kgf]	0	142	150
Indice DB [g/W]:	0,00	7,06	6,66
Beccheggio [gradi]:	0,70	-2,81	-5,63
Rollio [gradi]:	2,81	2,81	-5,63
Imbardata [gradi]:	-112,9	-120,6	-121,4
Forza X [kgf]:	0,00	0,00	0,00
Forza Y [kgf]:	0,02	0,00	0,00
Forza XY [kgf]:	0,00	0,00	0,00
Direzione [gradi]:	-89	77	60
Forza Z [kgf]:	2,26	0,03	-0,74
Peso drone [kg]:	2,29	2,26	2,26
Cap.tà di carico [kgf]:	-0,83	-0,83	-0,76
Spinta Z [kgf]:	-0,04	-2,23	-3,00

Bolla

Data 07/02/2017

Ora 16.16.15

Rumorosità

Perdite frame

Autonomia

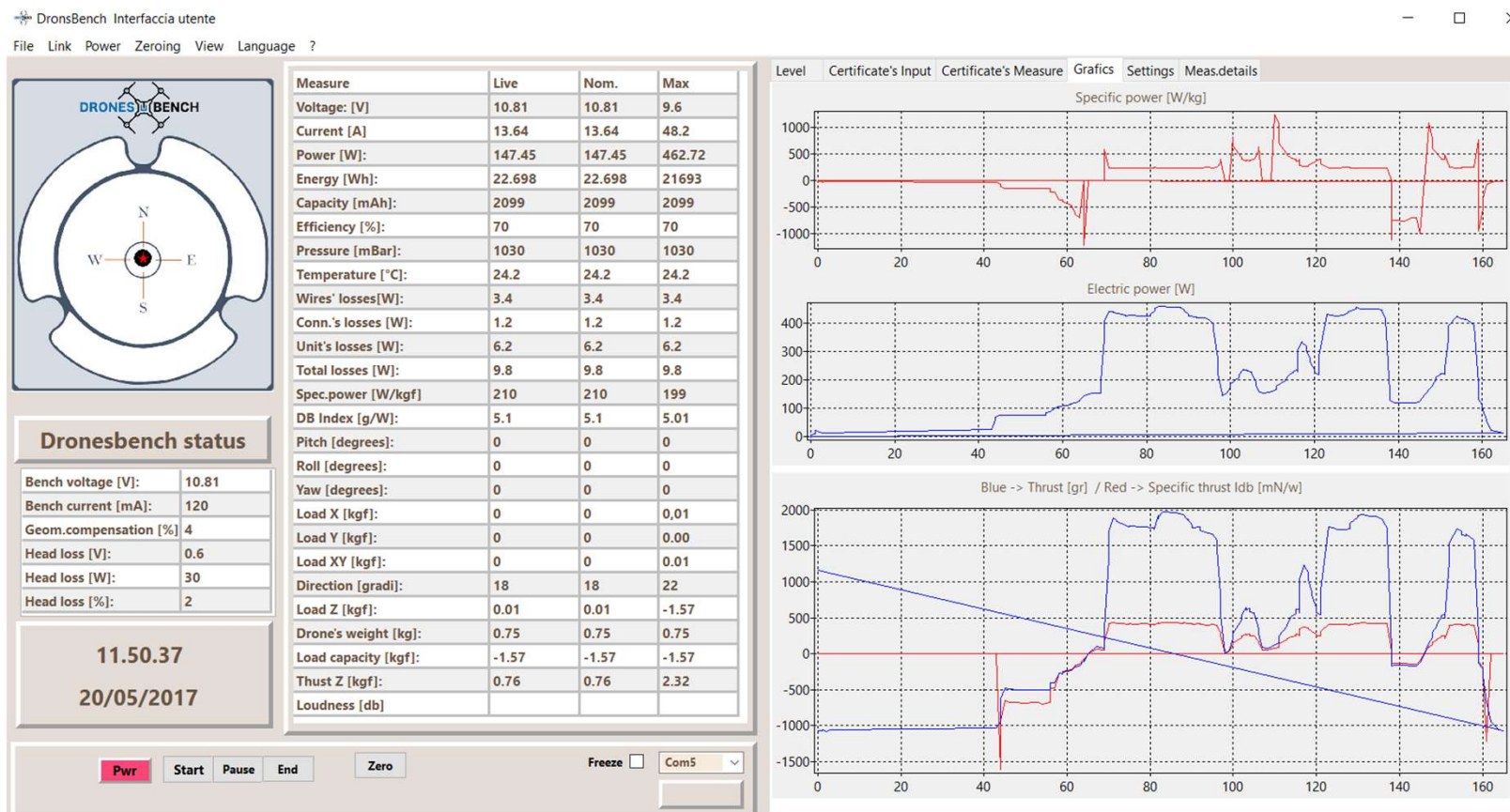
Nota dell'operatore

Grafici

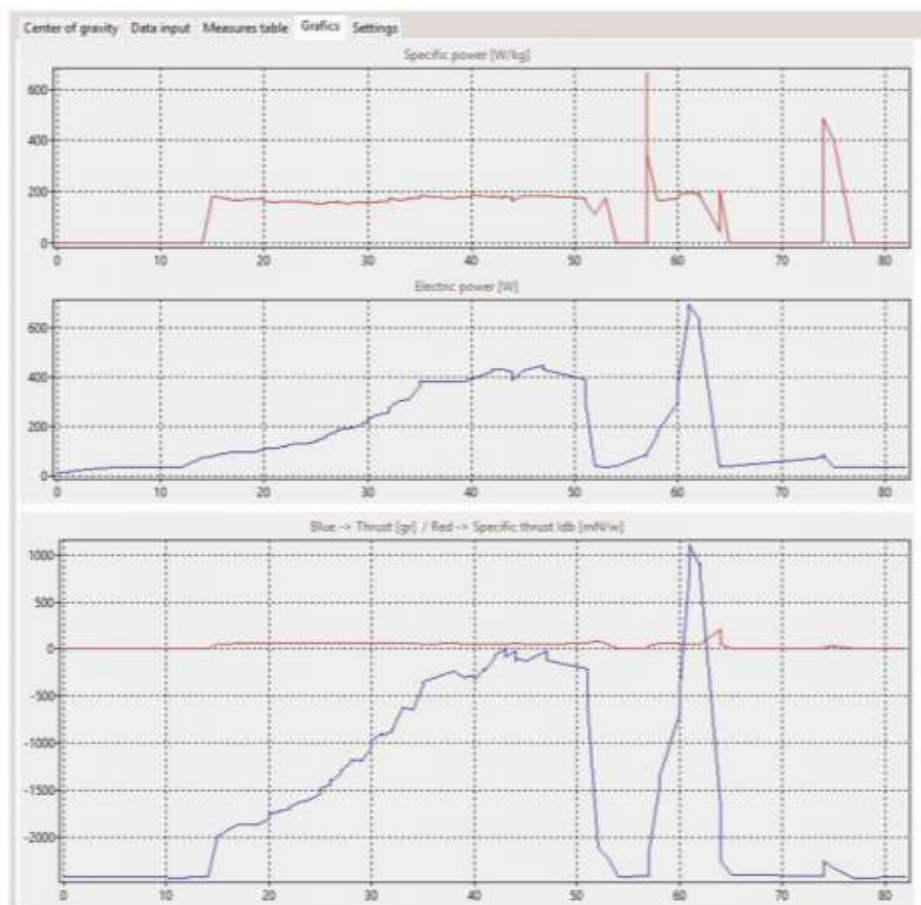
Data ora	Secondi	Forza Z	Forza X	Forza Y	Tensione	Corrente	Potenza	Pot.spec	Idb	Perd.	Causa
16.16.15	0	2234	0	18	15,0	-0,1	-1,2	0	0,00	0	Start
16.16.16	0	2234	0	18	15,0	0,2	3,6	2	0,00	0	Dcorrente
16.16.16	0	2233	0	11	15,0	0,4	6,0	0	0,00	-1	Dcorrente
16.16.17	1	2234	0	28	15,0	0,6	8,9	0	0,00	-1	Dcorrente
16.16.17	1	2224	0	18	15,0	0,7	10,7	0	0,00	-1	Dcorrente
16.16.18	1	2215	0	28	15,0	1,5	21,7	0	1,92	-1	Dcorrente
16.16.18	2	2238	0	24	15,0	0,9	13,2	0	0,00	-1	Dcorrente
16.16.19	3	2221	0	18	15,0	0,7	11,0	0	0,00	-1	Dcorrente
16.17.02	43	2197	0	18	15,0	1,6	24,5	411	2,43	-1	Dcorrente
16.17.03	44	2107	-1	22	15,0	3,9	58,8	395	2,53	-1	Dcorrente
16.17.03	44	1781	-3	3	15,0	4,5	66,6	140	7,15	-1	Dcorrente
16.17.04	45	1644	-2	-9	15,0	5,0	74,0	121	8,28	-1	Dcorrente
16.17.05	46	1647	-3	-1	15,0	4,8	72,4	119	8,42	-1	Dcorrente
16.17.07	48	1664	-2	7	15,0	5,0	74,0	125	8,00	-1	Dcorrente
16.17.08	49	1662	-1	16	15,0	4,8	72,4	122	8,21	-1	Dcorrente
16.17.13	53	1667	-1	0	15,0	5,0	74,5	126	7,92	-1	Dcorrente
16.17.14	54	1664	-2	3	15,0	4,8	72,4	122	8,19	-1	Dcorrente
16.17.16	56	1665	0	0	15,0	5,0	74,3	126	7,96	-1	Dcorrente
16.17.17	56	1633	-2	29	15,0	5,4	81,2	130	7,68	-1	Dcorrente
16.17.17	56	1562	-3	39	15,0	5,6	83,3	120	8,33	-1	Dcorrente
16.17.18	57	1564	-2	28	15,0	5,7	85,4	123	8,11	-1	Dcorrente
16.17.18	58	1431	-1	12	14,9	6,7	99,4	121	8,30	-1	Dcorrente
16.17.19	59	1441	-1	-16	14,9	6,8	101,2	124	8,05	-1	Dcorrente

COM4
Attenzione errore apertura porta seriale
Operatore: Ing.Massimiliano Matrella

Software View



Test Results



CE	Builder: Flytop, Roma	Model: Flysmart 2.0
Date check: 26 giu 2016	Weight: 2400 g	Battery: Lipo 4s 6c 10 Ah
DBI (DronesBench Index): 75,41 mN/W	Minimum DBI at take-off: 60,31 mN/W	Max power: 722 W

DronesBench Index (DBI) indicates the power efficiency of the drone as a whole.

Performance Evaluation

- Weight transportable in safety
- Horizontal forces
- Autonomy
- Efficiency Idb
- Powered required for take-off
- Maximum power
- Losses
- And more others that you may see in the certification report

DronesBench Videos

Measurement Laboratory & Certification

<https://www.youtube.com/watch?v=ol2F2gliEz0>

The first DronesBench

<https://www.youtube.com/watch?v=uq6dT2nTA3c>

The Webinar with Indus Institute of Technology, Indus University

<http://www.dronesbench.it/en/indus-institute-of-technology-and-dronesbench-webinar/>

THANK YOU

Let's FLY TOGETHER

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