# JETI Duplex again, unusual application of MUI sensor

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**There has been written many about JETI and it's transmission system DUPLEX 2,4 GHz. However this topic seems to be actual for a long time in future. If the development and manufacturing still goes the same rate we have got much to look forward to in future.**

During recent time period JETI has extended transmission system Duplex 2,4GHz offer by two new types of exchangeable transmitter modules, two types of interesting 5-channels receivers, expanders (allowing connecting through more telemetric sensors to one receiver) and MUI sensors (*voltage & current telemetric sensor*) for telemetrying, processing and calculating electric quantity. MUI sensors and its options made me write this article.

As you can see from the name, sensors are intended to measure tension and current. They can be connected directly to the Jetibox to create simple measuring equipment or they can be connected to every Jeti Duplex receiver. Duplex sends measured and processed data to the transmission module that generates acoustic notification and it also sends data to Jetibox where they are viewed and it is also instrumental as programmer. Pleasant fact is that after connection you needn't to adjust or activate anything. Functions and extended options of programming switches on automatically after connecting a sensor. If you disconnect a sensor functions are not viewed in order not to complicate the programming. Term, known from PC world, „plug and play"could be paraphrased as „plug and fly"

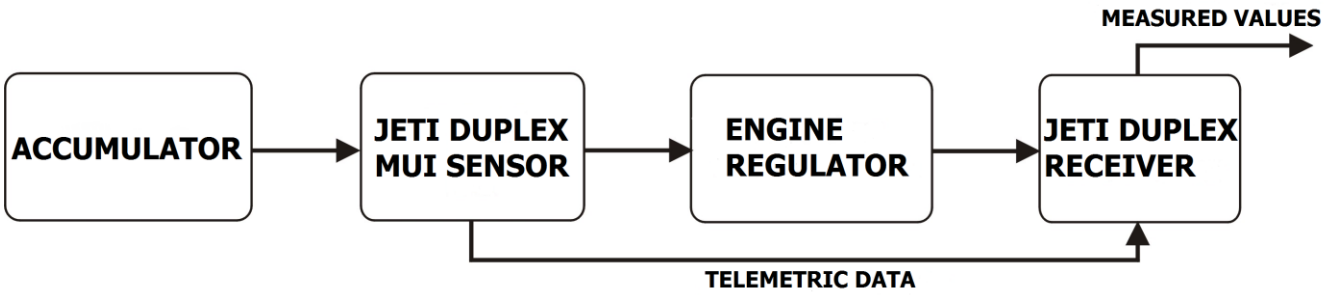
You can buy 3 kinds of MUI sensors: MUI 30, 75, 150. Their functions are the same, they only differ in maximum current loading. Every sensor has two separated and detached inputs for measuring tension and current. Thus you can measure tension and current of one accumulator with just one sensor.

**MUI sensors measures and computes these parameters:**

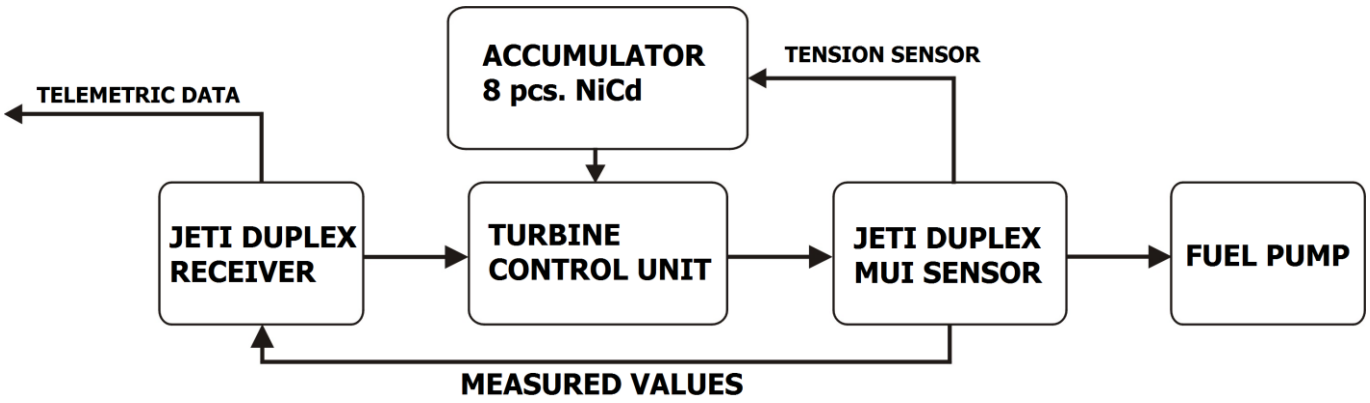
| | **Function** | **Values** | **Notification and other options** |
|---|---|---|---|
| Tension | - minimal tension<br>- maximal tension<br>- actual data | 0-60 V | alarm U – acoustic notification if the tension is under set value |
| Current | - minimal current<br>- maximal current<br>- average current<br>- actual value | do 30, 75 , 150 A | alarm I – acoustic notification if current is over set value |
| Time | - measuring engine flight time | min:sec | Adjustable value of activating current |
| Capacity | - sledování množství energie odebrané z akumulátoru | mAh | alarm C – acoustic notification if accumulator is depleted over set value |
| Current measurement accuracy | | 0,1 % | |
| Tension measurement accuracy | | 1% | |

It is worthless to go into details, you can download them easily from jetimodel.com. Once my friend's MUI 75 was on my table to be assembled. I was thinking how it could be benefit for me . I prefer jet models to electric models. I got an idea to use it alternatively then it was produced for. I own turbine-engines models and their engines have got really high consumption - 1kg of kerosine is enough apx. for 3 minutes of flying thus you often fly till the last drop is in the tank. Jets often glides very bad during flying with engine switched-off. I got an idea to connect the sensor not as recommended (behind accumulator) but ahead of appliance (in my case fuel pump) and use it as a fuel consumption gauge with acoustic warning when reached minimum volume of fuel

**MUI sensor recommended connection**




**MUI sensor modified connection**




If the dependance between amount of energy consumed by pump and amount of pumped fuel was linear the MUI sensor would become elegant, small and light fuel gauge that is able to process measured data, transfer them real-time to the transmitter but mainly give sound notification if the amount of fuel in tank is critical. Seems great theoretically but will it work?

I have made simple testing facility. I have adjusted DC regulator range between 0,8 – 4,7V, this is apx. range of controlling electronic of turbine. I have also choked outgoing tube in order its flow volume is the same as injection jets of turbine. I have used MUI 30 because maximal current taken by pump doesn't reach 3A even during flying at full throttle. I have used fuel pumps for Frank, Graupner, Top Jet and two other manufacturers turbines. Fuel pumps for modeller turbines are simple gear-pumps powered by DC engines often 300 or 400 series. Then I started to pump, measure, write records….pump, measure…..

If my premise was right, the energy needed to pump equal amount of fuel should be the same for all kinds of fuel pumps. The fuel pump takes higher current during higher output, but it needs shorter time to pump equal amount of fuel. One fuel pump increased its performance after every use. This fuel pump was absolutely new and hasn't been used before. Measured values were senseless because of running-in thus this fuel pump was taken out from the test. Other fuel pumps were used at least a part of season.

It is useless to put here table with values, we can summarise the result into a few sentences:

- The dependence between between amount of energy consumed by pump and amount of pumped fuel is linear
- Rate of pumping has no influence on the result
- Whole facility worked with maximal deviation 4%
- Conclusion – It works!

Maximal deviation might seem insignificant but if we have 3 litres of fuel in plane, than 4% deviation stands for indispensable 120ml. This is not small but I think this accuracy is enough for us.The difference was caused by fuel pumps. Deviation was almost non-measurable during running at half or full throttle. Highest deviations have appeared during free-running that is with tension 0,8 – 1,5V.

Practical use as well as installation is very easy. We interrupt (cut) one line-wire (electric conductor) between control unit and fuel pump and we put MUI sensor into the interruption. Be careful of polarity! If you switch polarity, nothing will short out but the sensor won't measure a current. We can use tension measuring input to monitor turbine's accumulator. This is how we can have monitored accumulator for receiver and servos(checked by sensor in receiver) and also accumulator necessary for running the turbine. Now it is necessary to find out how much energy is required for concrete engine and model. We can let turbine to run out of fuel after landing and then to take value „capacity"from the memory of sensor. Then we decrease this value by required fuel reserve and then we write this value to the memory of sensor as „capacity alarm"through Jetibox.

**For example:**

- Sensor has shown 200mAh as energy taken for depleting the fuel tank
- Required reserve is 20% of fuel in tank (=200 -20% = 160 mAh)
- We set „capacity alarm" to 160

The result is that when the fuel pump after start up of the turbine consumes 160 mAh (takes 80% of fuel from tanks) , acoustic alarm gives me the notification. This valids only when you start with full tank.

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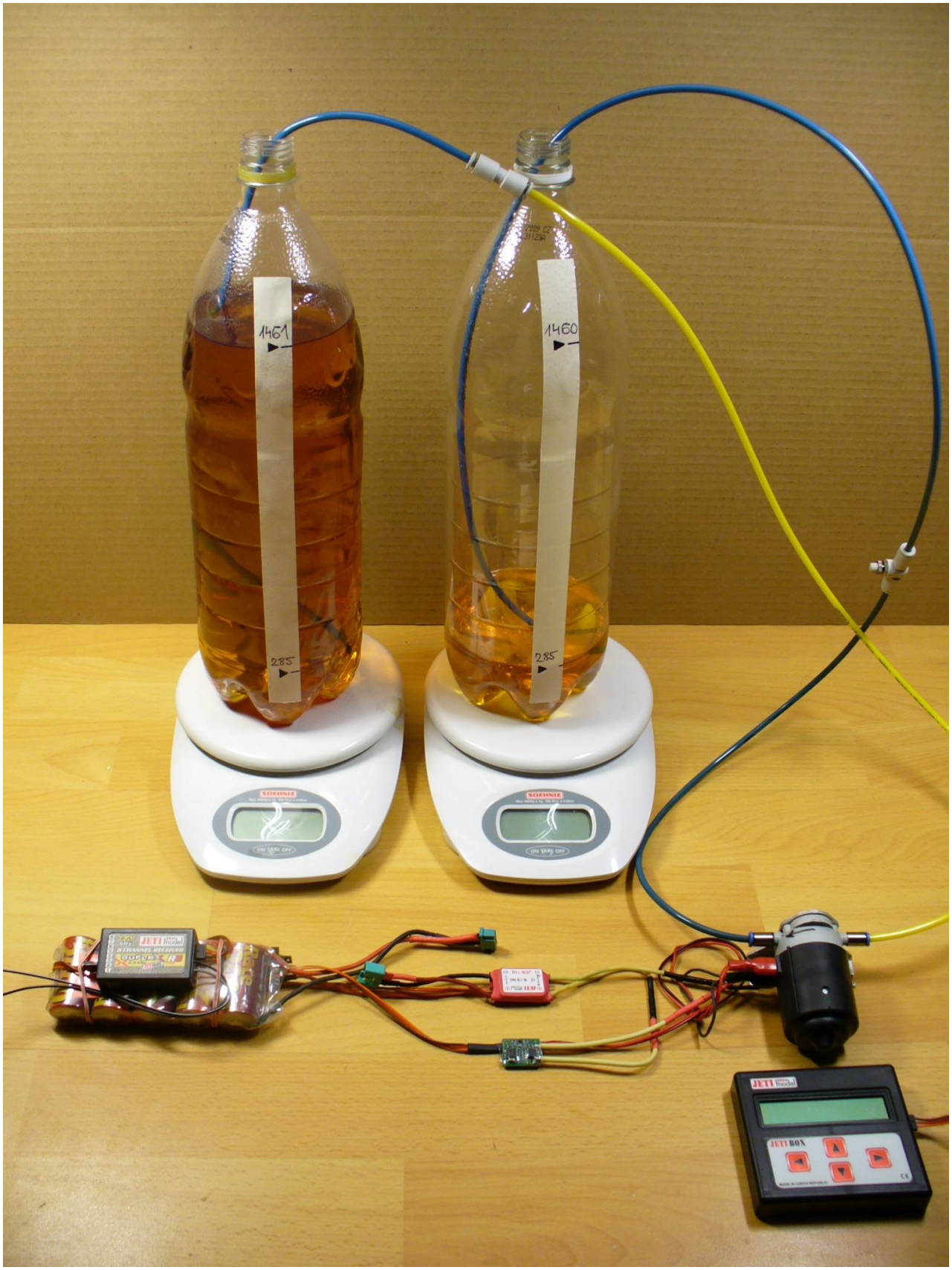
***Testing facility***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