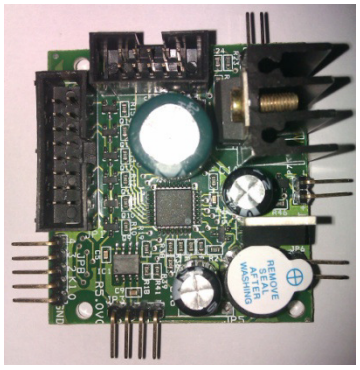
i-sys
Intelligent systems

Application Notes: **Power Supply requirement for I-SYS weighing scale PCB.**



The normal recommendation for the transformer rating for I-SYS weighing scale PCB is 12volts/ 1amps.

It's assumed that the input AC mains supply is in the range of 180 volts to 240 volts.

When AC 12volts is rectified & filtered by the 1000UF/25v capacitor as in our PCB, the DC voltage is equal to …

Vdc = 1.414 * Vac

= 1.414 * 12

= 16.97 Volts DC.

Vdc is root two times Vac.

Assuming diode drop of 0.7 volts we would get around 16 volts DC.

This 16 volts DC is fed to the input of LM317 regulator.

The output of the LM317 regulator is tuned to provide a voltage in the range of 7 to 7.5 volts for the PCB power as well as for charging the Lead acid battery (6 volts/4.5Ah).

For LM317 to regulate properly its input voltage must be 1.25volts greater than its output voltage. Suppose we are designing a charger for a 7volts output than the input to LM317 must be 8.25volts or greater.

Take care of Line regulation:

The transformer's secondary output voltage depends on primary voltage.

Usually most transformer manufacturers rate their transformers for 240V AC mains. Some may design for 230 volts & some for 220 volts AC input.

A transformer designed for higher voltages will have more turns & the core does not get saturated at higher input voltages thus causing less heating of transformer when subjected to higher input voltages of 240 to 270 volts which may happen at times in power transmission lines(also called Ferranti effect).

Let us assume that a manufacture has supplied a transformer for the following specification …

230V/12V. It means that if we apply 230volts AC at the primary winding the secondary will deliver 12 volts AC.

We can also calculate the voltage the transformer will deliver when the input mains supply falls to 180 volts(remember that in many places in our country the mains voltage can be around 150 volts due to over loading of distribution transformer).

Transformer Secondary Vac at 180 volts input = (12/230)*180 = 9.39 Volts AC. After diode drop it may be reduced to just around to 8.7 volts DC. This voltage is just enough for the LM317 to charge your battery.

Now this is as far as the AC line regulation is concerned. Next we have to deal with Load regulation of transformer.

Take care of Load Regulation of Transformer:

The current drawn by the electronic circuits in the weighing scale PCB alone is in the range of 70mA (when the display shows only single"0" in power save mode) to around 130mA (when display shows all digits when weight is kept).

The current drawn by the battery is in the range of 750mA (when battery is flat) to around a few milliamps when fully charged.

The LM317 regulator/charger IC is capable of providing currents in excess of 1amps. But in reality only around 500mA to 700mA will be flowing into battery for charging in most weighing scale machines because most transformer are rated around 10VA & trying to draw more current will cause the output of the transformer to fall. This drop in the secondary

voltage (at the 12volts side) due to loading effect of the charging battery is called load regulation of the transformer.

Now that we have our basics cleared let's discuss the actual problems we face in the field due to battery charging.

1. One of the most common complaints is that… we have mains but the machine is working in battery mode & it goes off once the battery charge is over.

Possible Cause: This can be due to prolonged low voltages at your site where the machine is installed. Prolonged low voltage will totally discharge your battery & once its flat the battery losses its property to recharge thereby permanently damaging it.

If the voltage is below 180volts we recommend that you use a stabilizer so that the voltage is maintained between 200v – 240v. Please contact us for low cost stabilizer solutions. We are currently providing triple boost stabilizers for weighing scale machines for inputs as low as 110volts.

2. One other problem is… The mains supply has resumed but the machine is not getting ON.

Our weighing scale PCB continuously checks the battery voltage & switches the display ON only if the battery voltage has reached the correct level for it to resume operation.

The various battery set-point voltages are as follows…

Low battery indication: 5.6Volts. When the battery voltage falls below 5.6volts the board will display a scrolling banner "LOUU bAttEry" at every 30 seconds interval.

Low battery trip: 5.2Volts. When the battery voltage falls below 5.2volts the display segments go blank to save power. Remember that the board is still ON the microcontroller is still drawing power at this point.

Auto restart voltage after a trip: 5.8Volts. If the machine switches OFF the display it will come ON again only if the voltage reaches 5.8volts.

Most Important Instruction: Once the machine starts to indicate low battery, the user must switch OFF the machine & restart the machine only after mains power resumes.

If the user does not switch OFF the machine the battery will be completely drained & if its voltage falls less than 3volts, the battery may get permanently damaged & can never be

revived at times. When the battery voltage has fallen to such low voltages, even if main supply resumes, the battery voltage can not rise to 5.8volts immediately. The battery draws a large current say around 1amp at less than the low battery trip voltage of 5.2Vdc & so the transformer due to its regulation will have its secondary voltage reduced to around 6Vac - 7Vac maintaining the voltage lesser than the low battery trip threshold voltage range. As the battery gets charged, its voltage starts to rise & the charging current slowly drops. This continuous until battery is completely charged & the voltage has reached to the set voltage of the LM317 regulator IC. Once the batteries voltage rises beyond low battery trip voltage value, the weighing scale board will start to work normally.

So if you have a site that has perennial low voltage we recommend that you use a stabilizer.

Instruct your customers to switch OFF the machine once they see the low battery indication.

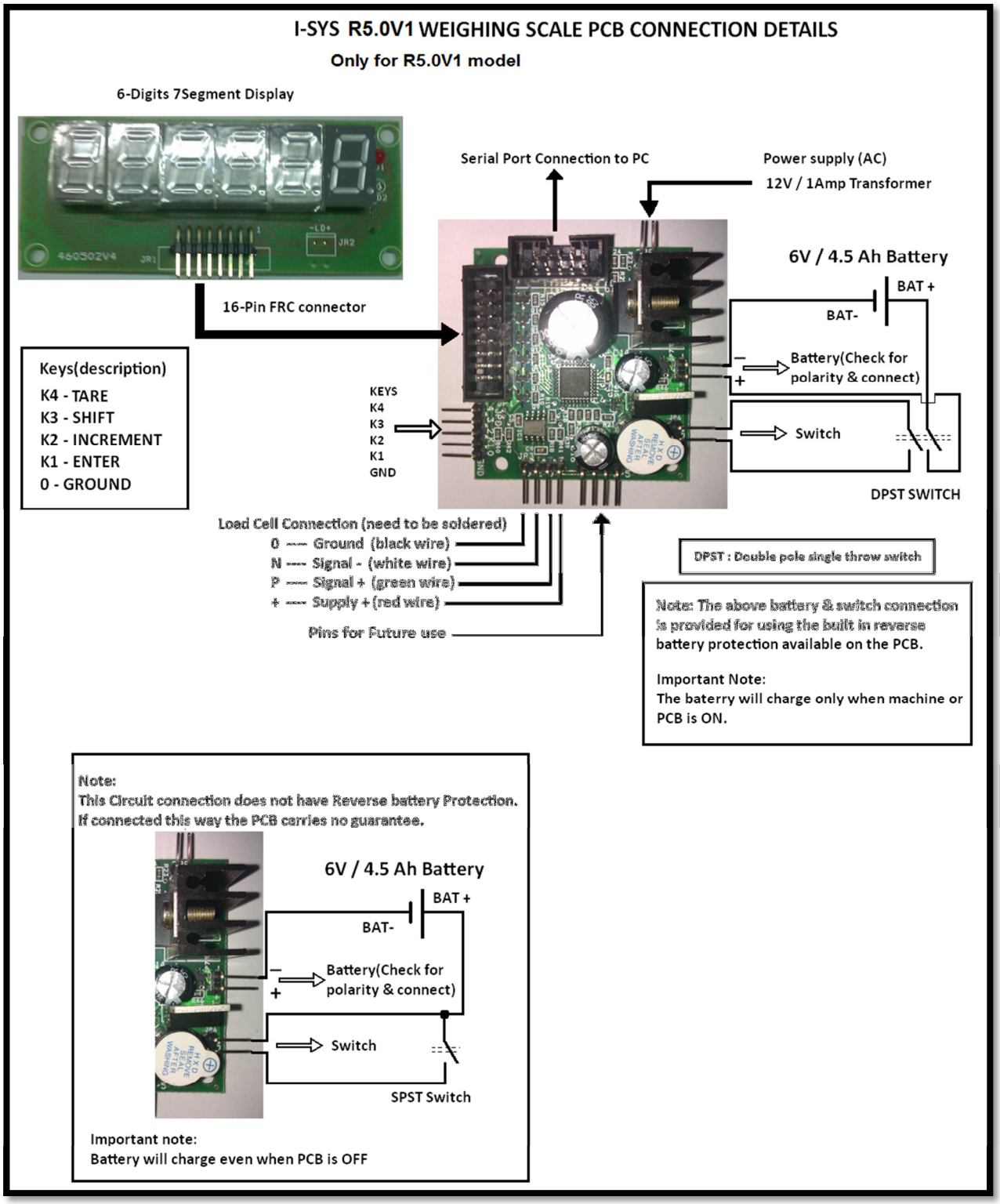
I-SYS R5.0V1 Weighing scale PCB Reverse Battery Protection

The R5.0V1 weighing scale PCBs comes with smart reverse battery protection. This feature helps unskilled service engineers to replace battery without the fear of damaging the PCB due to accidental reverse battery connection. The R5.0V1 can be connected in two modes, with & without reverse battery protection & their wiring schematics is given below…

An intelligent PMOSFET circuit prevents damage to the weighing scale PCB if the battery is connected in the wrong way. The PMOSFET powers the PCB from the battery supply & also charges the battery when mains supply is present & this is does only when the battery is connected to the correct polarity terminals of the PCB. This mode requires the use of 2pole switch as shown below. In this protected mode the battery will charge only when the PCB is ON & the mains supply is present.

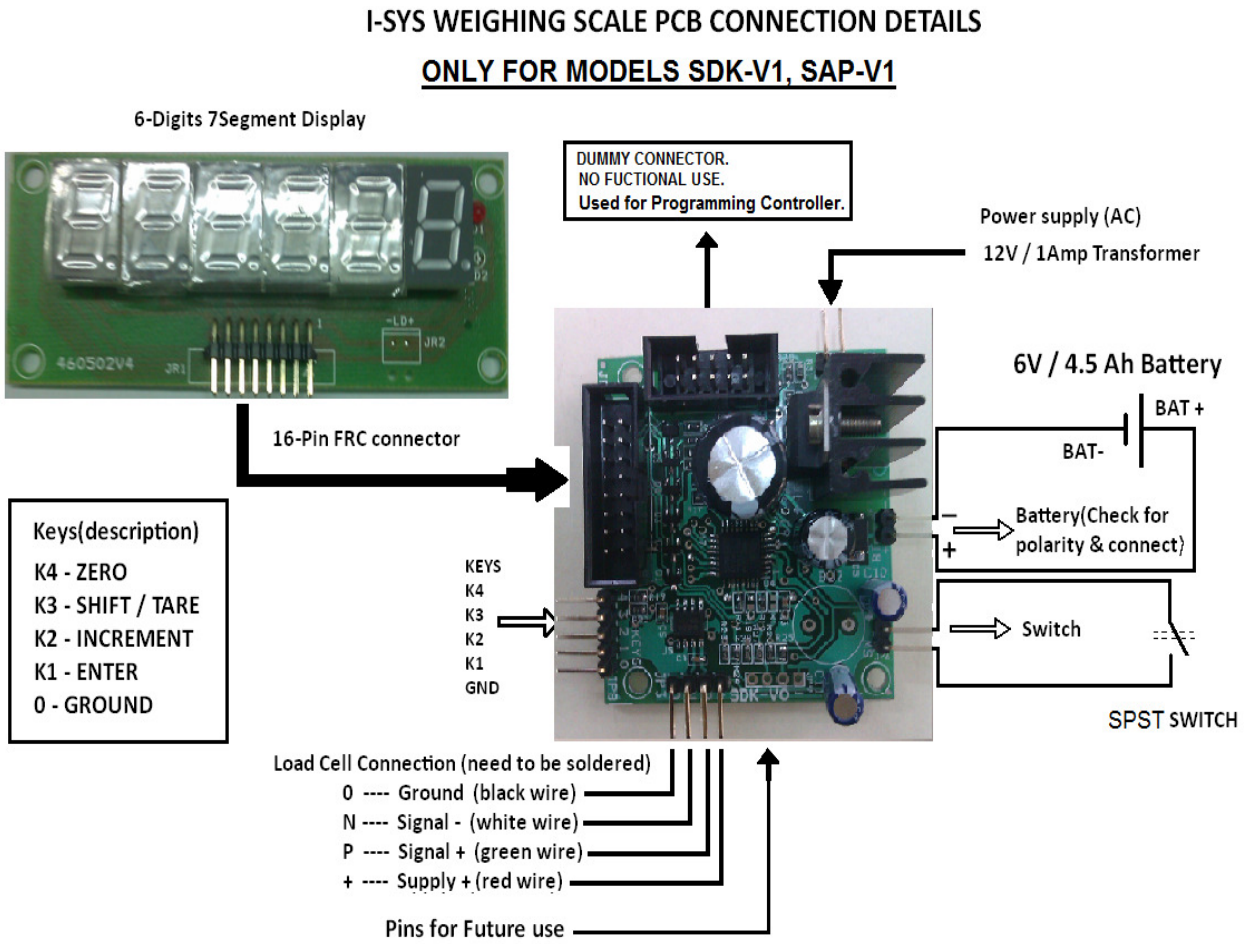
The PMOSFET has a current rating of 2.5Amps. So, short circuiting any live part of the PCB will allow the 6v/4.5Ah battery to deliver currents in excess of 10Amps destroying the MOSFET & the charging circuit. Take proper care in wiring & mounting of the PCB on the chassis of the machine to avoid such short circuits.

In the event of accidental damage to the PMOSFET you can still be able to use the PCB if you try connecting the PCB in the unprotected mode for battery connection. Please note that the guarantee for the PCB is void if the board is used in the unprotected mode.



In the unprotected mode you can use a SPST switch. The battery will get charged even when the PCB is in OFF condition. Connecting the battery in the wrong polarity will permanently damage the PCB & the PCB will carry no guarantee.

I-SYS SDK-Vx, SAP-Vx Weighing Scale PCB Battery Connection Details



The Low cost SDK / SAP PCB models do not have reverse battery protection. Hence connecting the battery in reverse will damage the PCB. The PCB is provided with a simple PCB fuse track(copper track / trace) & reverse diode for protection. In the event of a reverse battery connection the reverse diode on the PCB will burn out along with the supply track & thereby protecting the PCB from further damage. Any qualified service engineer will be able to identify & service the burnt diode & track to make the PCB operational.

Please contact us directly if you are facing any technical problems with our board.

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