Solar Panel Input Switch to MPPT Controller

Controlled by SSB – Power On

(Dec 6,2020, G Nicholl, SV Coho)

Problem to Solve

The feed lines from the Solar Panels to the MPPT Solar Controller are often run nearby the SSB Antenna feeds, i.e the back of the boat. The MPPT varies the panel voltage and in doing so sets up signal inputs on the lines between the solar panels and the MPPT controllers, these signals find there way into the antenna system as noise. Interference in my case was 1 to 1.5 S units from 3Mhz to 8Mhz, and an erratic noise that effectively blanked voice reception on some desired frequencies.

Turning off the MPPT controller from the 12V Battery panel does not solve to remove the interference. The panel voltage can power the MPPT controller and the MPPT keeps the panel at the MPPT operating voltage even though the MPPT is not passing power to the 12+ Battery. Victon MPPT controllers will drop noise when disconnected from the 12V+ but within several seconds the noise returns as the MPPT resumes operation with the solar panels providing MPPT operating power.

It is desirable to disconnect the panels from the controller whenever the radio is powered on. Separate switches mean often the panels get left disconnected after the radio is turned off. Since switches needed to be installed, I opted for relays remotely controlled mainly due to the location of the MPPT controllers and the desire to minimize excessive cabling runs.

Summary Description

The SSB radio is a Furuno F1501 (1986). There are no external 12V+ sources which turn on with the radio that are accessible therefore the 12V+ feeding the Antenna Tuner (ATU) was chosen as a source of 12V tied to the radio ON state. The ATU has a 1 Amp fuse so the limiting current is 1 A and I know that the SSB is designed for at least 1A on this line. Tapping into the radio internally means determining the current rating of the tie in point and opening the radio, something I wished to avoid.

The 1A current is low so I installed a current buffer by adding an NTE R46 relay to provide up to 5A current while only drawing 0.03A off the ATU 12V+. This also allows further accessories to be powered in the future off this same line.

The 5A current source is the 12V+ main line into the radio and is fused to 30A.

When the SSB is turned on the ATU is powered and the NTE R46 is powered. This shifts the 12V+ Com to the NO from the NC position. As a result the three relays on the three MPPT solar inputs are opened from NC to NO and the panels are isolated from the MPPT controllers and the lines no longer transmit noise to the SSB antenna system.

When the radio is turned off the NTE R46 (R4) is at 0V and shifts to NC turning off power to the R2, R3, R4. These then revert to NC and the solar panels are reconnected to the MPPT controller and the batteries charge. No need to remember to manually shift back or crawl to access a manual switch.

Note 1 - Power Source from ATU to Power the Current Buffer Relay

There is a 1A fuse in the ATU. It was necessary to open the ATU Control Cable a short distance to access the Red power wire. An 20AWG wire was spliced in and the incision was insulated and closed. Be careful if the cable is disconnected to have the plug and threaded plug ferrule below the incision as the diameter will increase and the ferrule will not pass from above.

A 1A glass fuse was soldered to the 20awg wire and covered with heat shrink. Should R4 fail the fuse protects the radio and the fuse is the same as the ATU fuse rating.

Note 2 - Buffer Relay

A NTE R46 was chosen. It is small with low power requirements to operate. Vin 12V, 360mv through 400ohms for a current of 0.03A. The switch is rated to 5A at 12/24VDC. The relay is small and has PCB solder pins. The Com and NO pins were soldered to 16AWG, the coil pins were soldered to 20AWG.

The entire assembly was attached to the main radio 12V power terminal strip hidden in the locker below the radio. It was all heat shrunk as there is no need to access.

Note 3 - Protection Fuse and Optional Switch

Immediately after the R4 relay a 1A inline glass fuse holder was installed far enough down the line to be easily accessible either to change the fuse rating or to change a blown fuse. Ideally this would be before the R4 relay but is not accessible at this position. There is a 40A fuse on the main panel that protects the radio and the R4 relay, although 40A is 8x the R4 rating.

A switch was considered to prevent the radio from turning off the panels but it is only optional and I can see no need for this addition.

Note 5 – Relay Logic

The Relay Comm (30) feeds to the MPPT Controller. The switching is occurring to turn on and off the Solar Panel from the MPPT controller. The Solar Panel is on the NC (87a) which is connected as a default when the radio is not on. When the relay is high, 85 at 12V+, the switch shifts to NO and disconnects the panels. Any system which depends on normal operation of the panel and MPPT though NO (87) is not recommended as the high power through the relay depends on the coil strength, any degrade or interruption in the coil (85 – 86) results in unnecessary high current load interruptions. Also unnecessary coil current is used to hold the panels on line.

Note 6 – Relay Rating

The relays R2, R3, R4 are Hella type HD Cube relays, 40A – 12/24V. Some similar relays are rated lower at only 25A. The 40A 24V relay is roughly 960W. Maximum closing voltage is 40V, opening 100V.

My three solar arrays are run through three MPPT controllers to provide system redundancy and flexibility. They are Victon 100/30, 100/15 and 75/15 MPPT controllers. The maximum panel voltage is first and the maximum output current is the second. In total 650W of panels feed these controllers at 36V. In all 6 panels in 3 sets of 2 matched panels run in series. I estimate that the maximum panel efficiency is 67%. Therefore the largest panel is 340W x 0.67% or 227W. There is therefore more than adequate power rating in a 40A 12V cube relay. One needs to consider if running 3 panels in series for 56 volts input. This would exceed the relay rating of maximum closing voltage of 40V across the switch, opening voltage is 100V max.

Summary

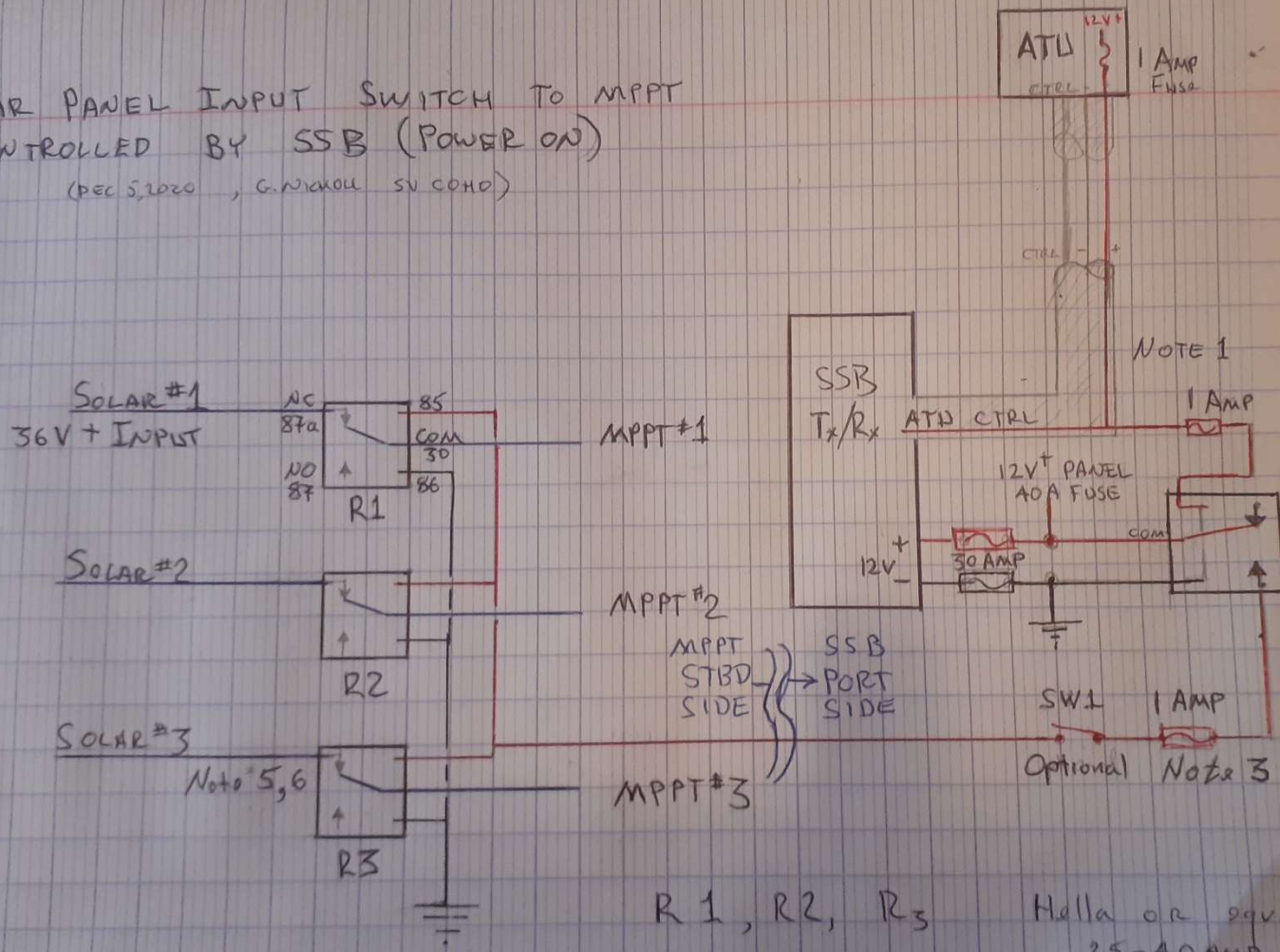
The relays switch off the panels from the MPPT controllers which are noisy because of noise on the line between the controller and the panel which finds its way onto the SSB Antenna system

When installing the panels and controllers installing switches was considered but discarded mainly due to access to the controller and the wiring involved to put the switch in a suitable location. There is no need for a switch as the MPPT controller uses 24hr access to the panels for some built in functions.

This modification successfully disconnects the panels when using the SSB radio and achieves a significant noise reduction (S 1 to 1.5) which makes the difference in hearing and not hearing other stations.

SOLAR PANEL INPUT SWITCH TO MPPT CONTROLLED BY SSB (POWER ON)

(DEC 5, 2020 , G. NIKOU SV COHO)



R1, R2, R3 Hella or equivilent 25-40 AMP 12/24V

R4 NTE R46, 5A-12V, 360mW Coil Coil Current 0.03A (A003)