Mastervolt Soladin 600

SI4432 packet handling

We need to send about 20 bytes:

- all the information of the Soladin
- all the information of the WS3000 weather station (because this transceiver has an optimal connection to the outdoor weather station)
- (information from 1 to 3 very old solar systems OK400)

To be flexible, we choose variable packet length.
Furthermore, a long pre-amble, 2 sync words and CRC over data only.
The information will only be send after a request by the main computer (Rasberry-PI).

SI4432 settings RF-settings

```
2478 procedure SI4432_Init_Packet_TxRx () is
2479   -- Modulation Type      : FSK
2480   -- Frequency Deviation : 20.0 [kHz]
2481   -- Manchester           : OFF
2482   -- Carrier Frequency    : 433.92 [MHz]
2483   -- Data Rate            : 10.0 [kb/s]
2484   -- AFC                  : Enable
2485   -- Rb Error             : < 1%
```

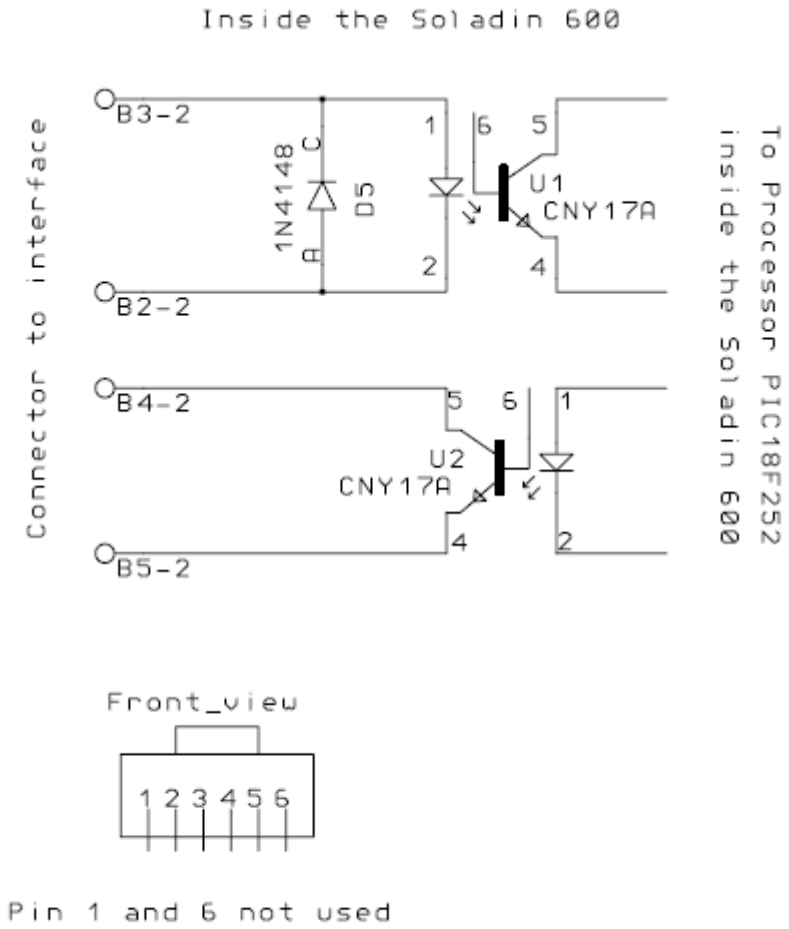
Carrier frequency because it's the defacto standard.
Baudrate 10 kHz, fast enough but not too fast.
Modulation index 4.0, by choosing an exact mutliple of 0.5 the signals are orthogonal (they have a zero correlation) and therefor the BER (bit rate error) is minimal. Every doubling of the Modulation index improves the S/N ration by a factor 8.

In the future we might investigate the following improvements:

- use GFSK modulation instead of FSK (Gaussian modulation has a lower bandwidth)
- increase the modulation index
- shift to another frequency (where not all other home automation is sited)

Soladin Interface

Knowing the inside of the Soladin 600, as shown in the pictures below



it's very easy to interface the Soladin with just 2 resistors directly to a PIC (powered from 5V or 3V3).
According to the datasheets, for a Baudrate of 9600, an IF = 10 mA is enough.
At 10 mA the worst case voltage drop over the LED = 1.2 V.
So with a powersupply of 3V3, the series resistor should be about 2V / 10mA = 200 Ohm. (For a 5V supply IF will be little higher which is no problem).
The resistor from the emitter of the photo transistor is not critical, a value of 1 kOhm downto 100 Ohm is perfect.

ToDo: schematic drawing

Test Soladin protocol

All commands shown below works and gives the same output as shown below.
My maximum power is rated at 499 W, while the Wp of the panels = 615 Wp this is not very good. Expected is that maximum power of this panels will at least at some moment be greater that 615 W, but limited by the Soladin, I would expect a maximum power of 600W.

History data from day 0 (today) to day 9 (9 days ago) can be requested by the following commands
11 00 00 00 9A 00 00 00 AB
11 00 00 00 9A 01 00 00 AC
11 00 00 00 9A 02 00 00 AD

```
11 00 00 00 9A 03 00 00 AE
11 00 00 00 9A 04 00 00 AF
11 00 00 00 9A 05 00 00 B0
11 00 00 00 9A 06 00 00 B1
11 00 00 00 9A 07 00 00 B2
11 00 00 00 9A 08 00 00 B3
11 00 00 00 9A 09 00 00 B4
```

Soladin protocol

hard to find on the web:

Soladin

From Fswiki

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The **Soladin** 600 is a small grid connected inverter sold in Europe by Mastervolt. It features a serial port that when combined with a small adapter can connect the inverter to a computer for monitoring the power levels and status of the device. The only software that Mastervolt provide is for Windows only.

Contents

Main Specifications

Maximum input power	600 W
MPP voltage	40-125 V
Maximum voltage	155 V
Nom. rated current	8A

Net voltage	184-265 V
Cos phi	0.99
European efficiency	91 %
Maximum efficiency	93 %

Hardware Interface

Although Mastervolt describes the interface as RS485, it is not compatible with it. The interface uses two lines for each direction of communication with two optocouplers in the **Soladin**. An RS232 adapter named PC-link can be purchased from Mastervolt for connection to a PC. Communication runs at 9,600 bps with 8 data bits and no parity.

Serial Protocol

Every packet has the following common fields:

The first 4 bytes contain the packets source and destination:

`0x0000`: 16 bit destination address for the packet.
`0x0000`: 16 bit source address for the packet.
`0x0000`: 16 bit command ID.

The master device (the computer) uses address 0x0000. In the probe command from the Windows software, the source and destination addresses are both set to 0x0000. This may indicate the packet is a broadcast packet intended for all non-master devices on the bus. All data is transmitted as big-endian (most significant byte first).

`0x00`: The last byte of every packet is a checksum. It is the lower 8 bits of the sum of all the previous bytes in the packet.

I've included the responses to each command from my **Soladin** 600, address 0x0011. This appears to be the same address for all **Soladin** 600's.

0xC1: Probe

The first packet transmitted seems to be a probe command. Note that the source and destination addresses are both set to 0x0000.

```
TX: 00 00 00 00 C1 00 00 00 C1

RX: 00 00 11 00 C1 F3 00 00 C5
```

Other than the device address, the response from my **Soladin** 600 doesn't appear to contain any information.

- In cases where there are more than once device, will they all respond to this command?
- Can a devices address be changed?

0xB4: Firmware Information

Returns version information about the firmware.

```
TX: 11 00 00 00 B4 00 00 00 C5

RX: 00 00 11 00 B4 F3 00 00 00 00 00 00 00 E3 00 04 01 34 06 00 00 00 00 00 00 00 00 00 00 DA
```

0xE3: Firmware ID
0x0104: Firmware version (1.04)
0x0634: Firmware date

0xB6: Device Stats

Returns statistics about the operation of the device.

```
TX: 11 00 00 00 B6 00 00 00 C7

RX: 00 00 11 00 B6 F3 00 00 04 03 35 00 8A 13 F4 00 00 00 24 00 90 0B 00 1F DB BC 01 00 00 00 FD
```

0x06: 0x0000: Flags, normal operation in the response above
0x08: 0x0304: PV voltage * 10 = 77.2 V in the response above
0x0A: 0x0035: PV amperage * 100 = 0.53 A
0x0C: 0x138A: Grid frequency * 100 = 50.02 Hz
0x0E: 0x00F4: Grid voltage = 224 V
0x10: 0x0000: Unknown
0x12: 0x0024: Grid power output = 36 W
0x14: 0x000B90: Total grid power output * 100 = 29.60 kWh
0x17: 0x1F: Device temperature = 31 °C
0x18: 0x0001BCDB: Total operating time = 113883 minutes
0x1C: 0x0000: Unknown

Flags

Flags are bit mapped and represent current status of the inverter. Normal operation of the inverter is identified with no flag being set.

0x0001: Usolar too high
0x0002: Usolar too low
0x0004: No Grid
0x0008: Uac too high
0x0010: Uac too low
0x0020: Fac too high
0x0040: Fac too low
0x0080: Temperature too high
0x0100: Hardware failure
0x0200: Starting
0x0400: Max power
0x0800: Max current

0xB9: Read Maximum Power

Returns maximum output power of the inverter.

```
TX: 11 00 00 00 B9 00 00 00 CA

RX: 00 00 11 00 B9 F3 00 00 20 00 00 00 1B 00 21 00 22 00 00 00 E5 02 7E 48 36 00 00 00 00 00 1E
```

0x18: 0x0036: Maximum power = 54 W

0x97: Reset Maximum Power

Resets maximum output power returned by command `0xB9`.

```
TX: 11 00 00 00 97 01 00 00 A9
```

```
RX: 00 00 11 00 97 01 00 00 A9
```

0x9A: History Data

The inverter stores data (grid energy and time) for last 10 days. The inverter has no clock built-in, a day is therefore defined as operating season.

```
TX: 11 00 00 00 9A 00 00 00 AB
```

`0x05: 0x00`: Day to read. 0 - today, 9 - 9 days before today.

```
RX: 00 00 11 00 9A 54 05 00 04
```

`0x05: 0x54`: Daily operation time * 5 min = 420 minutes
`0x06: 0x0005`: Grid output * 100 = 0.05 kWh