Integration Guide for
YDTA-01 firmware 1.08
YDTA-04 firmware 1.05
YDRA-01 firmware 1.05

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I. Release Notes

YDTA-01

Firmware updated to 1.08 11/04/2024

YDTA-04

Firmware updated to 1.05 11/04/2024

YDRA-01

Firmware updated to 1.05 11/04/2024

[*] fixed incorrect 2COIL_VCC behavior

[+] added new modes for gauges with internal current and voltage sources

II. Preface

Our YDTA-01, YDRA-01 and YDTA-04 (hereinafter Devices) are mature products and we got a lot of feedback on them. Multiple case studies were performed and we have noticed that the most common issue with those products is analog circuitry setup, given the multitude of gauges and sensors present on the market.

In this Application Note we will explain how to determine your fluid metering system type and how to set up our Devices to achieve the best performance.

III. Device internal structure

All our Devices have the same analog front-end circuitry (Figure 1), there are 3 inputs on each measurement channel:

Sensor — bidirectional analog I/O, depending on selected operation mode can either drive the Sensor with measurement pulses or act as a simple voltage input.

Reference — voltage input, used to switch the Device's Sensor I/O between input and output, also used to compensate for analog fluid metering circuitry voltage fluctuations.

Ground — common ground for all analog fluid metering circuitry components.

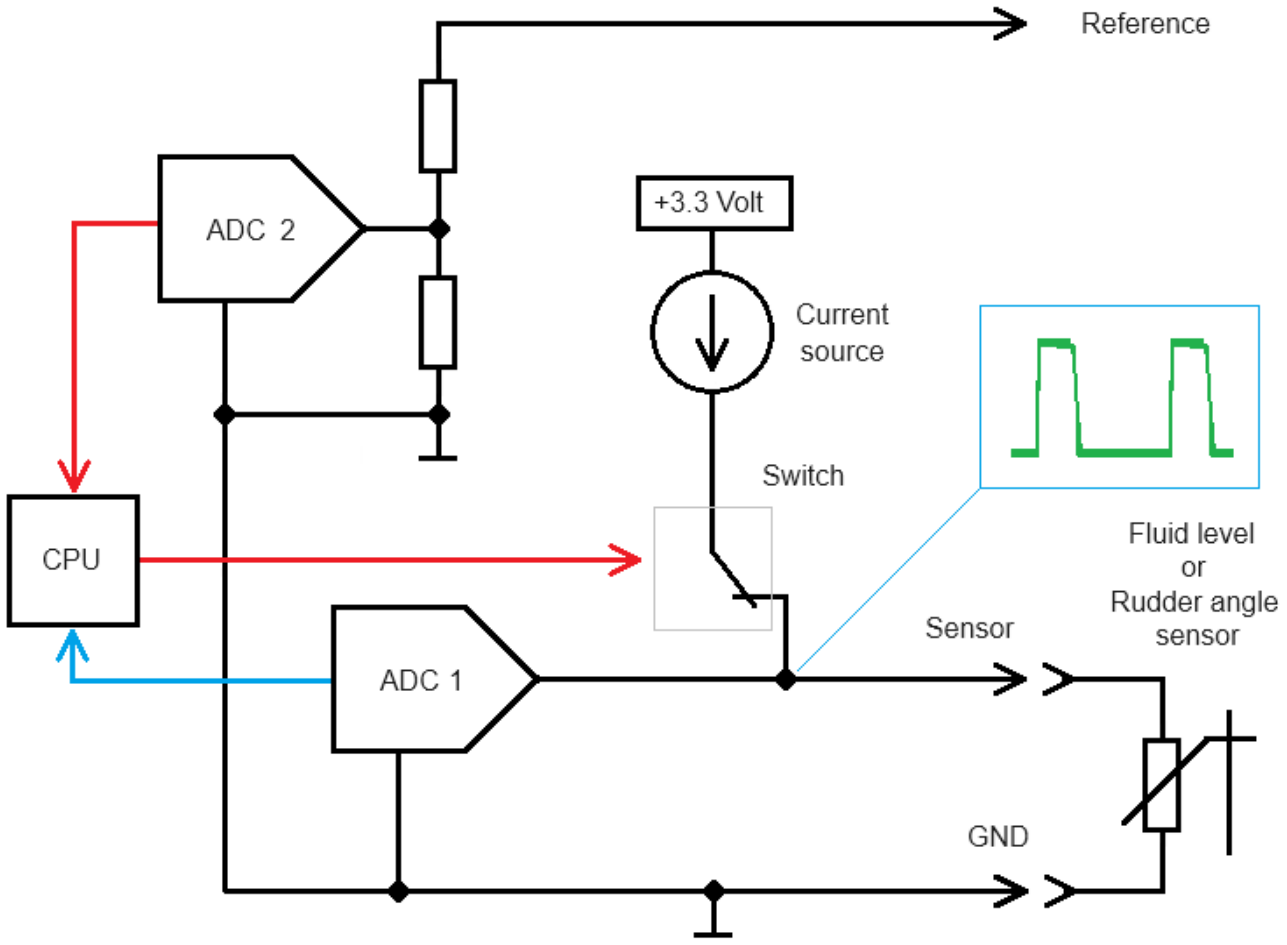

Figure 1. Device analog front-end internal structure.

IV. RESISTIVE mode

The most simple operation mode is RESISTIVE, which is factory default. Observe that only “Sensor” and “GND” terminals are connected to the Sensor, as shown on Figure 1, and “**Reference**” **input is not used**. In this mode, Device’s CPU commands Switch to open at regular intervals and connect the internal Current source to the Sensor (see the oscillogram on Figure 1). ADC 1 then measures voltage drop across the Sensor and its resistance can be derived using the Ohms law:

$$R = U / I \quad [1]$$

This setup also is the simplest to configure, you just need to specify your Sensor’s resistance values for full tank and empty tank (or full port and full starboard Rudder position for YDRA-01). You can specify nominal Sensor’s resistances given by the manufacturer, but the best results are achieved when sensor resistances are measured *in situ* on empty and full tank (or full port and full starboard Rudder position for YDRA-01), to make account for mechanical offset and resistances variation across the sensor specimens (Figure 2).

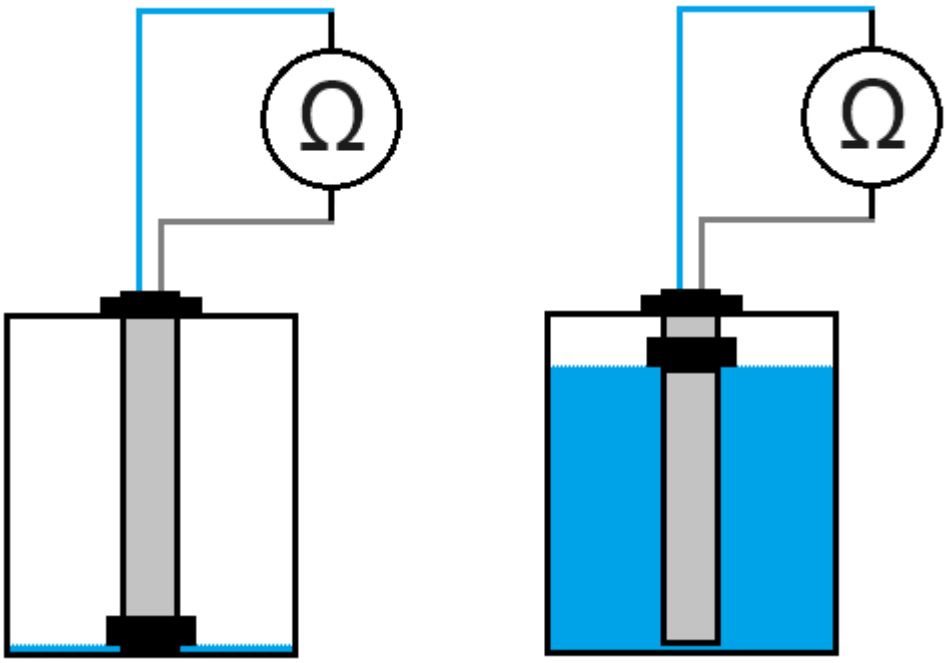

Figure 2. Empty tank and measure the Fluid level sensor actual “empty” resistance, then fill the tank and measure Fluid Level sensor actual “full” resistance.

The same applies to the YDRA-01 unit, measure sensor resistances on full PORT and full STBD Rudder deflections.

Warning! Low resistance circuitry! Note that Fluid level sensor usually has low resistance, so make sure to select the right measurement range and calibrate zero on an Ohmmeter. Also make sure that Ohmmeter probes make good contact with sensor wires. If your sensor has long wires, measure at the longest distance from the Sensor.

Tip: to improve measurement results, measure several (3..5) times, than take an average.

To switch **YDTA-01** or **YDRA-01** to RESISTIVE mode, either use configuration file and set:

```
CONNECTION=RESISTIVE
```

or send "YD command" by setting Device's Installation Description 2 field to:

```
YD:CONNECTION RESISTIVE
```

YDTA-04 has 4 measurement channels, A, B, C and D, so the "YD Command" should also specify the channel, for example, to configure channel B, send command:

```
YD:CONNECTION B RESISTIVE
```

Than all is left to do is to **set Sensor's resistances**.

For YDTA-01 use either configuration file, set:

```
OHMS_EMPTY=R_empty
OHMS_FULL=R_full
```

or "YD commands":

```
YD:OHMS_EMPTY R_empty
YD:OHMS_FULL R_full
```

where `R_empty` and `R_full` are values on Ohms, measured on empty and full tank.

YDTA-04 has 4 measurement channels, A, B, C and D, so the "YD Command" should also specify the channel, for example, to configure channel B, send commands:

```
YD:OHMS_SENSOR B R_empty R_full
```

where `R_empty` and `R_full` are values on Ohms, measured on empty and full tank.

For YDRA-01 use either configuration file, set:

```
OHMS_PORT=R_max_port
OHMS_STBD=R_max_stbd
```

or “YD commands”:

```
YD:OHMS_PORT R_max_port
YD:OHMS_STBD R_max_stbd
```

where `R_max_port` and `R_max_stbd` are values on Ohms, measured on full port and full starboard Rudder deflections.

Note that Devices analog front-end can drive sensors with any resistance range in the interval from 0 to 400 Ohms. Standard fluid level sensors have resistance within that range, but some Rudder sensors have higher resistances.

YDRA-01 internal impedance on “Sensor” input is ~68 kOhm, so Rudder position Sensors with max. resistance up to 1 kOhm can be “conditioned” by adding an extra precision resistor in parallel (R1 on Figure 3).

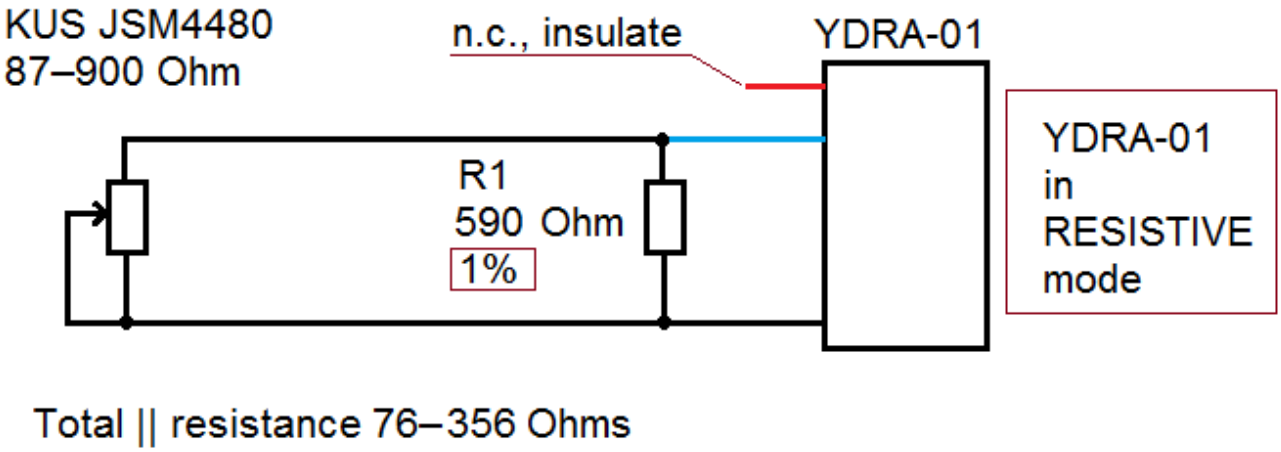

Figure 3. KUS JSM4480 has native range from 87 to 900 Ohms, when resistor R1 is connected, total parallel resistance range is shifted into YDRA-01 range.

Sensors with higher range, like Raymarine M81105 which has ~5 kOhm max. resistance are recommended to use in VOLTAGE mode with an extra voltage supply wire, see next Section, Figure 5.

V. VOLTAGE mode

VOLTAGE mode can be used with “smart” sensors that output voltage, proportional to fuel level or Rudder deflection angle. In this mode, internal Device’s Current source is disconnected, and Device’s ADC 1 and ADC 2 just measure voltage levels on “Sensor” and “Reference” inputs like shown on Figure 4:

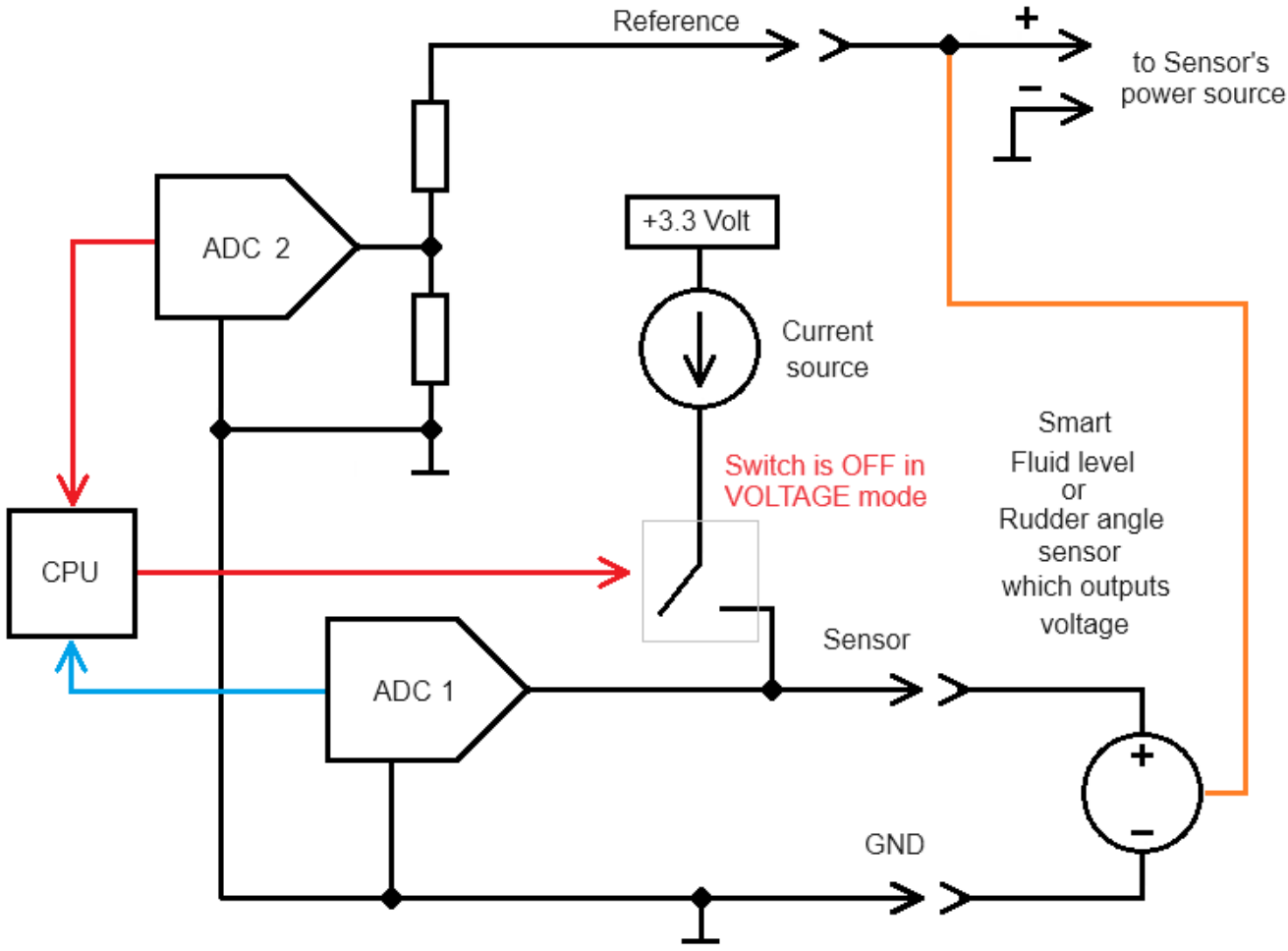

Figure 4. Device analog front-end in VOLTAGE mode has internal current source disconnected and “Sensor” terminal acts as a voltage measurement input.

Most of the “Smart” sensors have an internal voltage stabilizer and their voltage output level does not depend on Sensor’s power source voltage, so Device’s “Reference” input should be left not connected.

However, if you will use high-resistance Sensor, powered from non-stabilized voltage source, like a resistor powered from DC instruments bus (see Figure 5), connect this unstable voltage source to “Reference” input and Device will use voltage measured on its “Reference” input to scale voltage readings on its “Sensor” input.

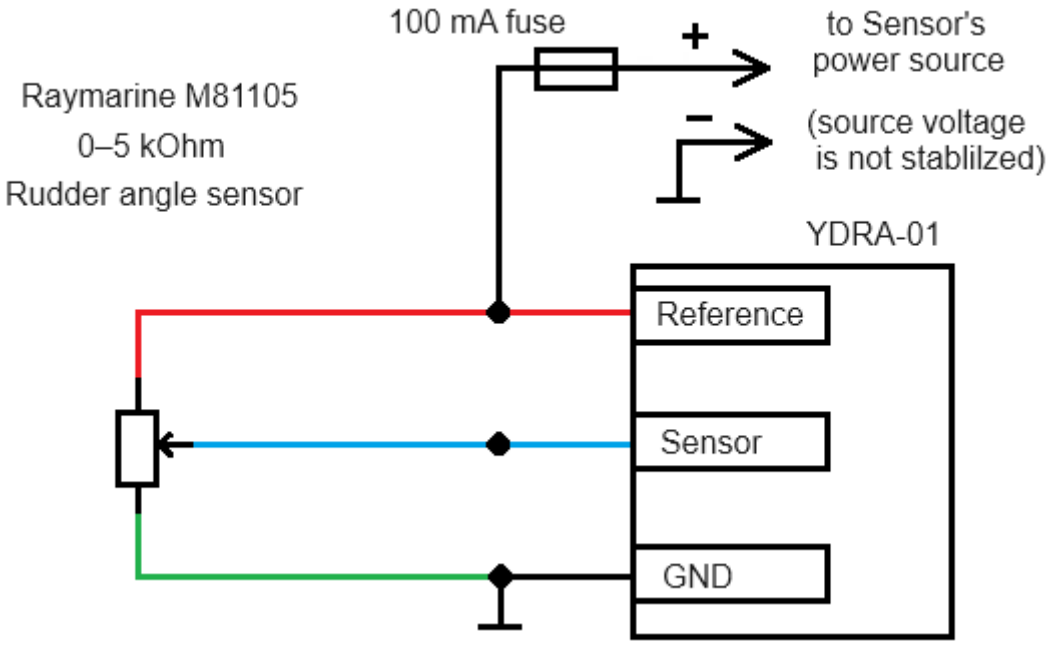

Figure 5. Example of high-resistance sensor used in VOLTAGE mode. Power sensor from DC source to convert it to voltage-output sensor. “Reference” input is used to compensate for power source voltage fluctuations.

There are also lot of “Smart” sensors which output current instead of voltage, with current proportional to fluid level or angular position. Industry standard sensors provide 4–20 mA current range. They can also be easily converted to voltage sources, just load the sensor’s output with 250 Ohm precision resistor (1% metal film recommended), and you will get 1–5 Volt range voltage source (Figures 6,7).

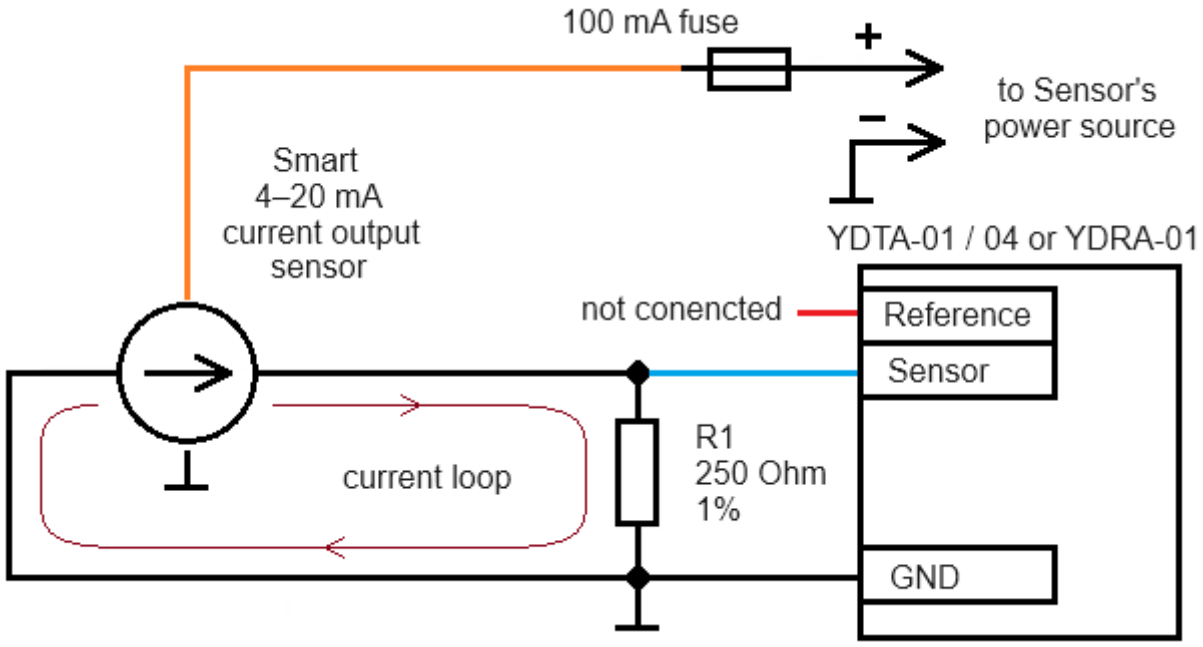

Figure 6. “Smart” current-output sensor with dedicated current output is turned into voltage source. This connection scheme is for a sensor that has a separate power source inputs and current loop outputs.

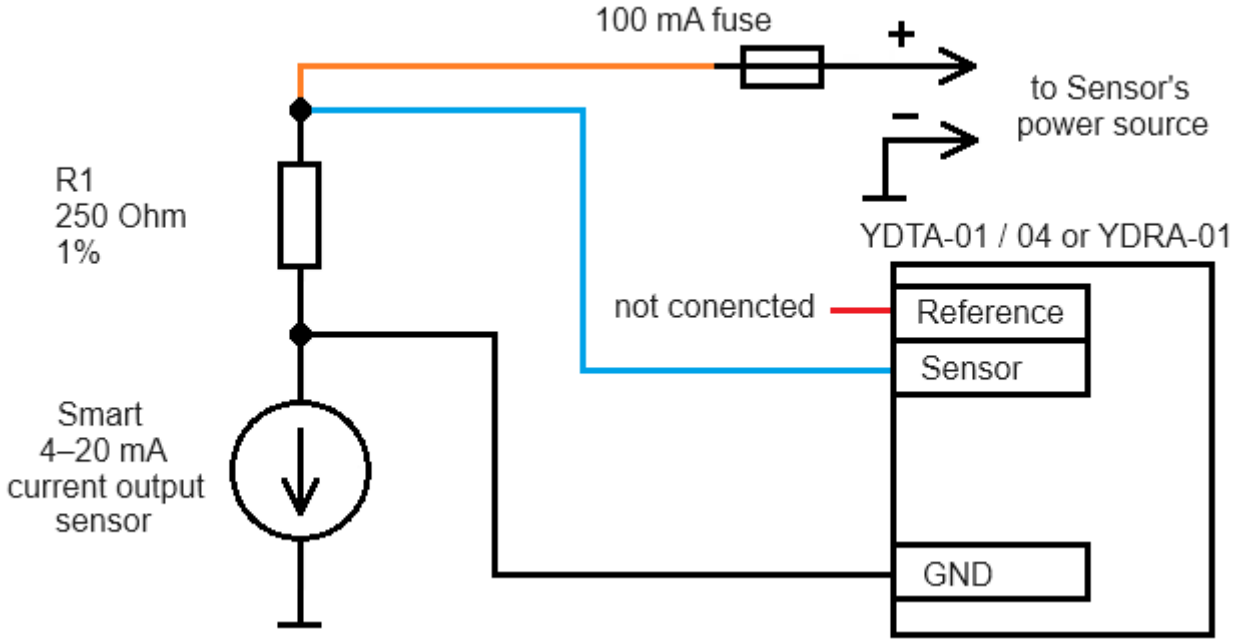

Figure 7. "Smart" current-output sensor with no dedicated current output is turned into voltage source. This connection scheme is for a sensor that has no separate power source inputs and current loop outputs.

Note that current loop technology is not sensitive to loop wires parasitic resistance, so this sensor type is recommended to use on extra long wires. Put 250 Ohm resistor as close to Device inputs as possible. Do not connect "Reference" input.

Measure output voltage on full and empty tank (or full port and full starboard Rudder position for YDRA-01). You can specify nominal Sensor's voltages given by the manufacturer, but the best results are achieved when sensor's output voltages are measured *in situ* on empty and full tank (or full port and full starboard Rudder position for YDRA-01), to make account for mechanical offset and resistances variation across the sensor specimens.

If you got sensor with **voltage output that depends on** (**scales with**) **power voltage**, like on Figure 5, also measure voltage applied to "Reference" input. To achieve best results, measure at the same time as voltage on full and empty tank (or full port and full starboard Rudder position for YDRA-01) and try to keep "Reference" voltage stable during the whole measurement session, e. g. on fully charged battery or even better on shore power.

To switch **YDTA-01** or **YDRA-01** to VOLTAGE mode, either use configuration file and set:

```
CONNECTION=VOLTAGE
```

or send "YD command" by setting Device's Installation Description 2 field to:

```
YD:CONNECTION VOLTAGE
```

YDTA-04 has 4 measurement channels, A, B, C and D, so the "YD Command" should also specify the channel, for example, to configure channel B, send command:

```
YD:CONNECTION B VOLTAGE
```

Than all is left to do is to **set Sensor's output voltages**.

For YDTA-01 use either configuration file, set:

```
VOLTS_EMPTY=V_empty
VOLTS_FULL=V_full
```

or via “YD commands”:

```
YD:VOLTS_EMPTY V_empty
YD:VOLTS_FULL V_full
```

where `V_empty` and `V_full` are values in Volts, measured across the sensor on empty and full tank.

If sensor with voltage output that depends on (scales with) power voltage is used, connect “Reference” input and also set measured reference voltage, either via configuration file, set:

```
REFERENCE=V_reference
```

or via “YD command”:

```
YD:REFERENCE V_reference
```

where `V_reference` is the value in Volts, measured on Device “Reference” input.

YDTA-04 has 4 measurement channels, A, B, C and D, so the “YD Command” should also specify the channel, for example, to configure channel B, send commands:

```
YD:VOLTS_SENSOR B V_empty V_full
```

where `V_empty` and `V_full` are values on Volts, measured on empty and full tank.

If sensor with voltage output that depends on (scales with) power voltage is used, connect “Reference” input and set measured reference voltage, for example, to configure channel B, send command:

```
YD:REFERENCE B V_reference
```

where `V_reference` is the value in Volts, measured on Device “Reference” input.

For YDRA-01 use either configuration file, set:

```
VOLTS_PORT=V_max_port
VOLTS_STBD=V_max_stbd
```

or “YD commands”:

```
YD:VOLTS_PORT V_max_port
YD:VOLTS_STBD V_max_stbd
```

where `V_max_port` and `V_max_stbd` are values on Volts, measured on full port and full starboard Rudder deflections.

If sensor with voltage output that depends on (scales with) power voltage is used, connect “Reference” input and also set measured reference voltage, either via configuration file, set:

```
REFERENCE=V_reference
```

or via “YD command”:

```
YD:REFERENCE V_reference
```

where `V_reference` is the value in Volts, measured on Device “Reference” input.

VI. 1COIL and 2COIL_VCC modes

All examples above are for simple sensor-to-Device connections, but what if we need to connect Device to a fluid level or rudder angle metering system that already has a gauge? In such systems gauge may be powered ON or OFF and we expect the Device to be able to get data in both cases, when gauge is powered and not powered.

First, you need to determine the gauge type.

One coil gauge

This is the oldest gauge type, pretty much an ammeter with rather high coil impedance.

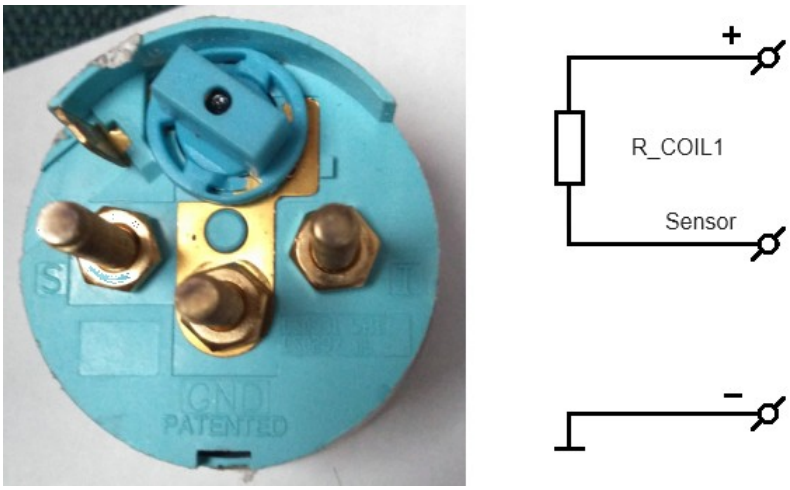

Figure 8. 1-coil gauge and its internal schematic.

This gauge usually has only 3 terminals, (not counting the separate illumination terminal): “+” or “I” for power, “S” or “Sensor” for sensor connection and “–” or “GND” for ground (Figure 7.).

To confirm if you get 1-coiled gauge, disconnect all wires from the gauge and measure resistances:

1) between “+” and “Sensor” in both probes polarities, you should get the same resistance value, in order of hundreds of Ohms, let’s call it `R_COIL1`;

2) between “–” and “Sensor” in both probes polarities, you should get very high resistance, close to infinity;

3) between “+” and “–” in both probes polarities, you should get very high resistance, close to infinity.

If all 3 conditions above match, measure the sensor resistances as outlined in Section IV and connect Device and sensor to gauge as shown on Figure 8.

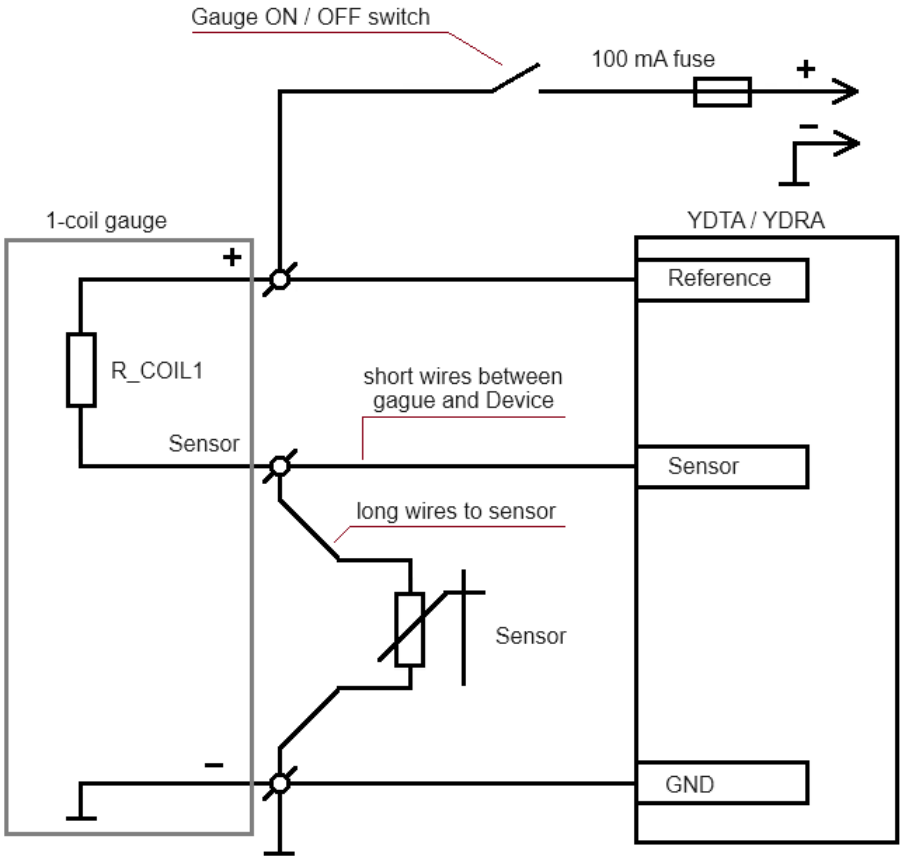

Figure 9. Connection to a 1-coil gauge

To switch **YDTA-01** or **YDRA-01** to 1COIL mode, either use configuration file and set:

```
CONNECTION=1COIL
```

or send “YD command” by setting Device’s Installation Description 2 field to:

```
YD:CONNECTION 1COIL
```

YDTA-04 has 4 measurement channels, A, B, C and D, so the “YD Command” should also specify the channel, for example, to configure channel B, send command:

```
YD:CONNECTION B 1COIL
```

Than all is left to do is to **set Sensor’s resistances and Gauge’s coil resistance** measured earlier.

For YDTA-01 use either configuration file, set:

```
OHMS_EMPTY=R_empty
OHMS_FULL=R_full
OHMS_COIL_1=R_COIL1
```

or “YD commands”:

```
YD:OHMS_EMPTY R_empty
YD:OHMS_FULL R_full
YD:COIL_1 R_COIL1
```

where `R_empty` and `R_full` are values on Ohms, measured on empty and full tank and `R_COIL1` is gauge’s single coil resistance.

YDTA-04 has 4 measurement channels, A, B, C and D, so the “YD Command” should also specify the channel, for example, to configure channel B, send commands:

```
YD:OHMS_SENSOR B R_empty R_full
YD:OHMS_GAUGE B R_COIL1
```

where `R_empty` and `R_full` are values on Ohms, measured on empty and full tank and `R_COIL1` is gauge’s single coil resistance.

For YDRA-01 use either configuration file, set:

```
OHMS_PORT=R_max_port
OHMS_STBD=R_max_stbd
OHMS_COIL_1=R_COIL1
```

or “YD commands”:

```
YD:OHMS_PORT R_max_port
YD:OHMS_STBD R_max_stbd
YD:COIL_1 R_COIL1
```

where `R_max_port` and `R_max_stbd` are values on Ohms, measured on full port and full starboard Rudder deflections and `R_COIL1` is gauge’s single coil resistance.

Two coil gauge

One-coiled gauges have a drawback, their reading depends on (scales linearly) with applied voltage. As usually gauges power positive terminal is directly connected to non-stabilized DC bus, two-coiled gauges were developed, they have coils winded in opposite directions, thus readings depend much less on the input voltage fluctuations.

This gauge usually also has only 3 terminals, (not counting the separate illumination terminals): “+” or “I” for power, “S” or “Sensor” for sensor connection and “−” or “GND” for ground (Figure 9.).

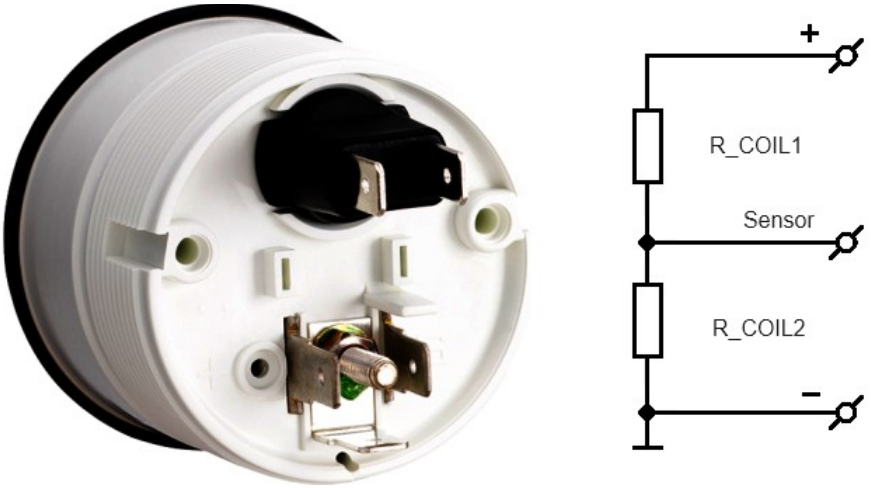

Figure 10. 1-coil gauge and its internal schematic.

To confirm if you get 2-coiled gauge, disconnect all wires from the gauge and measure resistances:

1) between “+” and “Sensor” in both probes polarities, you should get the same resistance value, in order of hundreds of Ohms, let’s call it `R_COIL1`;

2) between “−” and “Sensor” in both probes polarities, you should get the same resistance value, in order of hundreds of Ohms, let’s call it `R_COIL2`;

3) between “+” and “−” in both probes polarities, you should get value equal to `R_COIL1` + `R_COIL2`.

If all 3 conditions above match, measure the sensor resistances as outlined in Section IV and connect Device and sensor to gauge as shown on Figure 10.

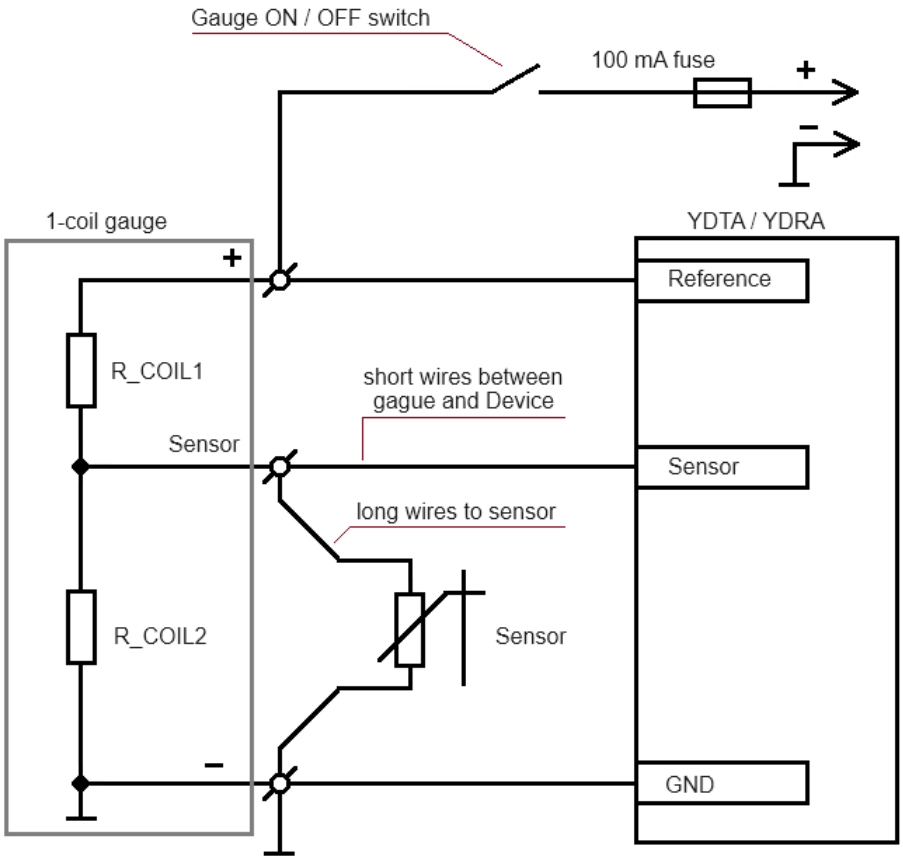

Figure 11. Connection to a 2-coil gauge

To switch **YDTA-01** or **YDRA-01** to 2COIL mode, either use configuration file and set:

```
CONNECTION=2COIL_VCC
```

or send "YD command" by setting Device's Installation Description 2 field to:

```
YD:CONNECTION 2COIL_VCC
```

YDTA-04 has 4 measurement channels, A, B, C and D, so the "YD Command" should also specify the channel, for example, to configure channel B, send command:

```
YD:CONNECTION B 2COIL_VCC
```

Than all is left to do is to **set Sensor's resistances and Gauge's coils resistances** measured earlier.

For YDTA-01 use either configuration file, set:

```
OHMS_EMPTY=R_empty
OHMS_FULL=R_full
```

```
OHMS_COIL_1=R_COIL1
OHMS_COIL_2=R_COIL2
```

or “YD commands”:

```
YD:OHMS_EMPTY R_empty
YD:OHMS_FULL R_full
YD:COIL_1 R_COIL1
YD:COIL_2 R_COIL2
```

where `R_empty` and `R_full` are values on Ohms, measured on empty and full tank and `R_COIL1` and `R_COIL2` are gauge’s both coils resistances.

YDTA-04 has 4 measurement channels, A, B, C and D, so the “YD Command” should also specify the channel, for example, to configure channel B, send commands:

```
YD:OHMS_SENSOR B R_empty R_full
YD:OHMS_GAUGE B R_COIL1 R_COIL2
```

where `R_empty` and `R_full` are values on Ohms, measured on empty and full tank and `R_COIL1` and `R_COIL2` are gauge’s both coils resistances.

For YDRA-01 use either configuration file, set:

```
OHMS_PORT=R_max_port
OHMS_STBD=R_max_stbd
OHMS_COIL_1=R_COIL1
OHMS_COIL_2=R_COIL2
```

or “YD commands”:

```
YD:OHMS_PORT R_max_port
YD:OHMS_STBD R_max_stbd
YD:COIL_1 R_COIL1
YD:COIL_2 R_COIL2
```

where `R_max_port` and `R_max_stbd` are values on Ohms, measured on full port and full starboard Rudder deflections and `R_COIL1` and `R_COIL2` are gauge's both coils resistances.

"Smart" gauge with high-impedance input

Most popular nowadays are "Smart" gauges with internal microprocessor measurement and control circuitry.

One of such gauges family is a motorized gauge with internal reference voltage source connected in series with a resistor:

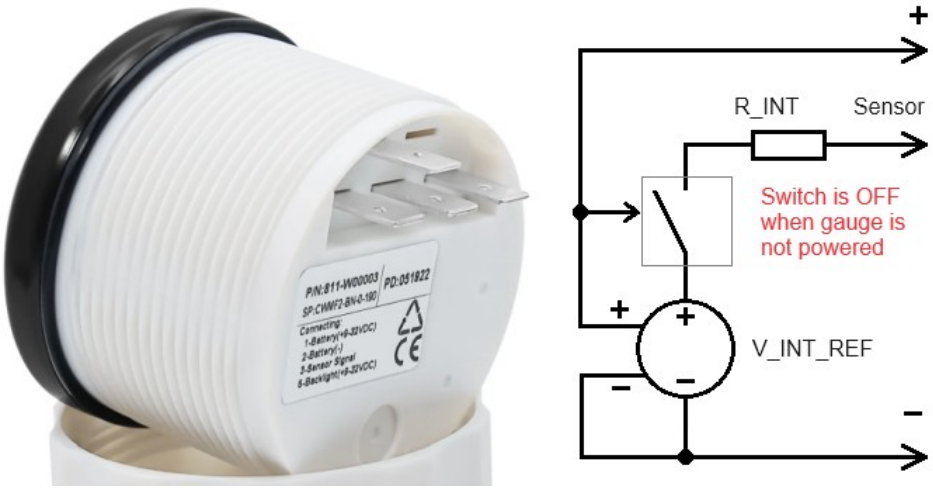

Figure 12. Gauge with internal reference voltage source.

Note that when gauge is not powered, its "Sensor" input has very high impedance in respect to both "–" and "+" and impedance between "+" and "–" is also very high, until voltage level is kept below the gauge's power-up threshold voltage.

To confirm if you get "Smart" gauge with high-impedance input, disconnect all wires from the gauge and measure resistances:

1) between "+" and "Sensor" in both probes polarities;

2) between "–" and "Sensor" in both probes polarities;

3) between "+" and "–" in both probes polarities

In all 3 cases you should get very high value, close to infinity.

If all 3 conditions above match, proceed and connect only power to the gauge, to “+” and “–” respectively, do not connect the sensor but measure the voltage between gauge’s “Sensor” and “–” terminals. Let's call this voltage `V_INT_REF`. Usually 5 Volt.

Voltage should be stable. If you observe that voltage fluctuates with regular intervals, that means your gauge drives sensor with pulses of current to save on energy and our Devices can not be used.

If you got a stable voltage, proceed and connect a precision (1% or better) resistor, which has a resistance `R_LOAD` close to fluid level / Rudder sensor's 50% resistance to gauge instead of the sensor, between gauge's “Sensor” and “–” terminals power up the gauge and measure voltage between the gauge's "Sensor" terminal in respect to gauge's “–” terminal. Let's call this voltage `V_LOAD`.

Now we can calculate the gauge's internal in-series resistance `R_INT` using a formula:

```
R_INT = ( ( V_INT_REF * R_LOAD ) / V_LOAD ) – R_LOAD [2]
```

If all tests above match, measure the sensor resistances as outlined in Section IV and connect Device and sensor to gauge as shown on Figure 12.

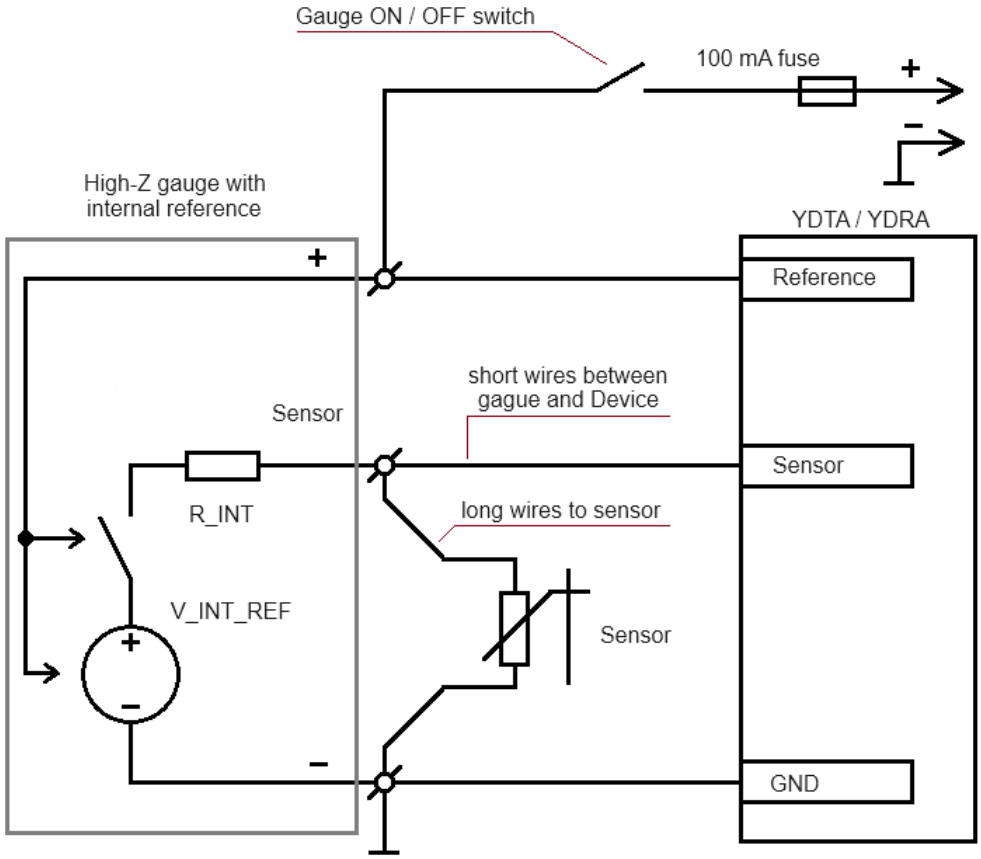

Figure 13. Connection to a high-impedance gauge with internal reference.

To use our Device with such gauge, you need to use “extended” 1COIL mode with an extra settings `1COIL_REF` and another meaning of `OHMS_COIL_1` parameter.

To switch **YDTA-01** or **YDRA-01** to `1COIL` mode, either use configuration file and set:

```
CONNECTION=1COIL
```

or send “YD command” by setting Device’s Installation Description 2 field to:

```
YD:CONNECTION 1COIL
```

YDTA-04 has 4 measurement channels, A, B, C and D, so the “YD Command” should also specify the channel, for example, to configure channel B, send command:

```
YD:CONNECTION B 1COIL
```

Than all is left to do is to **set Sensor’s resistances and Gauge’s internal reference resistance and voltage** measured earlier.

For YDTA-01 use either configuration file, set:

```
OHMS_EMPTY=R_empty
OHMS_FULL=R_full
OHMS_COIL_1=R_INT
1COIL_REF=V_INT_REF
```

or “YD commands”:

```
YD:OHMS_EMPTY R_empty
YD:OHMS_FULL R_full
YD:COIL_1 R_INT
YD:1COIL_REF V_INT_REF
```

where `R_empty` and `R_full` are values on Ohms, measured on empty and full tank, `V_INT_REF` is measured gauge’s reference voltage and `R_INT` is calculated gauge’s internal resistance.

YDTA-04 has 4 measurement channels, A, B, C and D, so the “YD Command” should also specify the channel, for example, to configure channel B, send commands:

```
YD:OHMS_SENSOR B R_empty R_full
YD:OHMS_GAUGE B R_INT
YD:1COIL_REF B V_INT_REF
```

where `R_empty` and `R_full` are values on Ohms, measured on empty and full tank, `V_INT_REF` is measured gauge's reference voltage and `R_INT` is calculated gauge's internal resistance.

For YDRA-01 use either configuration file, set:

```
OHMS_PORT=R_max_port
OHMS_STBD=R_max_stbd
OHMS_COIL_1=R_INT
1COIL_REF=V_INT_REF
```

or "YD commands":

```
YD:OHMS_PORT R_max_port
YD:OHMS_STBD R_max_stbd
YD:COIL_1 R_INT
YD:1COIL_REF V_INT_REF
```

where `R_max_port` and `R_max_stbd` are values on Ohms, measured on full port and full starboard Rudder deflections, `V_INT_REF` is measured gauge's reference voltage and `R_INT` is calculated gauge's internal resistance.

“Smart” gauge with low-impedance and extra internal resistive load

Those modern gauges are manufactured by KUS/WEMA and they have a 5-pin header connector shown on Figure 13.

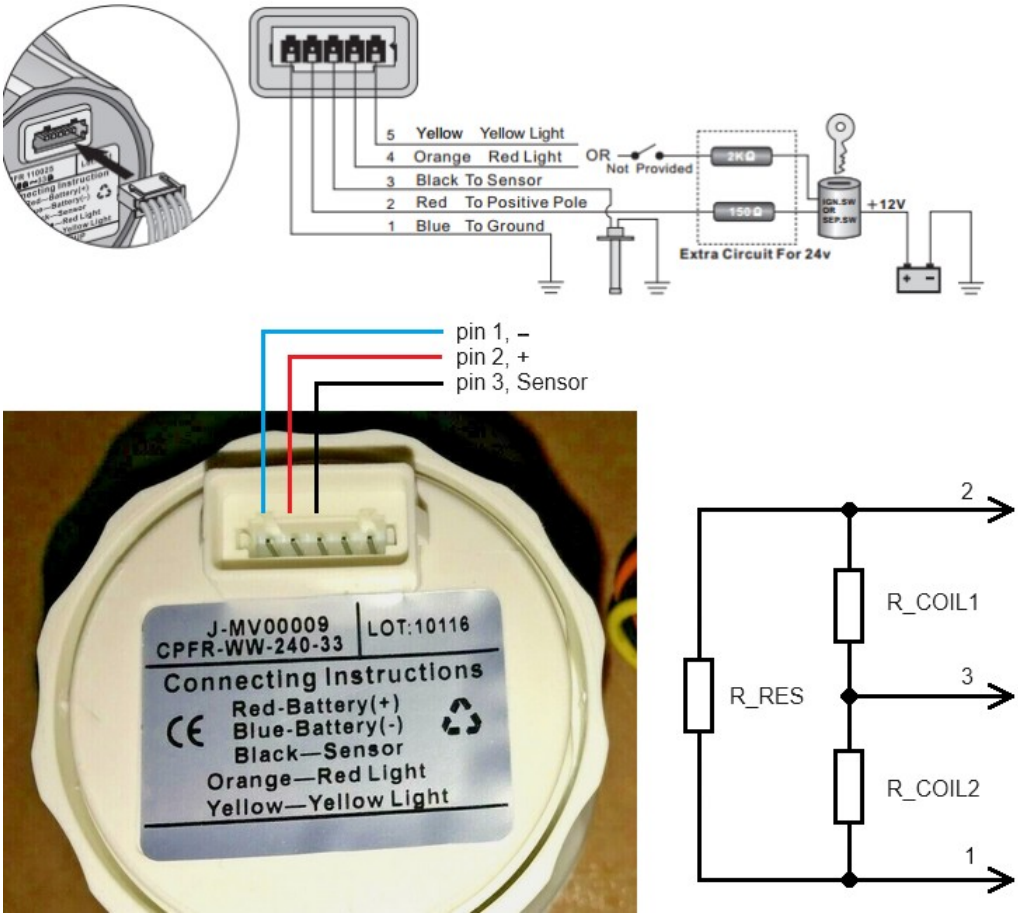

Figure 14. KUS/WEMA gauge pinout, view, and internal schematic.

Those gauges are similar to 2-coil gauges, but have an extra internal resistor `R_RES` connected between “+” and “−”.

To confirm if you get gauge with such extra resistor, disconnect all wires from the gauge and measure resistances — you should get **the same values in both forward and reverse probes polarity**:

1) between pin 1 (“Battery −”, Blue) and pin 3 (“Sensor”, Black), let's call this value `R1`

2) between pin 2 (“Battery +”, Red) and pin 3 (“Sensor”, Black), `R2`

3) between pin 1 (“Battery −”, Blue) and pin 2 (“Battery +”, Red), `R3`

4) connect pins 1 and 2 (“Battery –”, Blue and “Battery +”, Red) together and measure resistance between them and pin 3 (“Sensor”, Black), R4

All of those resistance values should not change when probes polarity is inverted, if you got different resistance value when probes polarity is inverted, this gauge is not compatible and you can only use it in VOLTAGE mode, with fluid values available only when gauge is powered.

If all tests above match, measure the sensor resistances as outlined in Section IV and connect Device and sensor to gauge as shown on Figure 14.

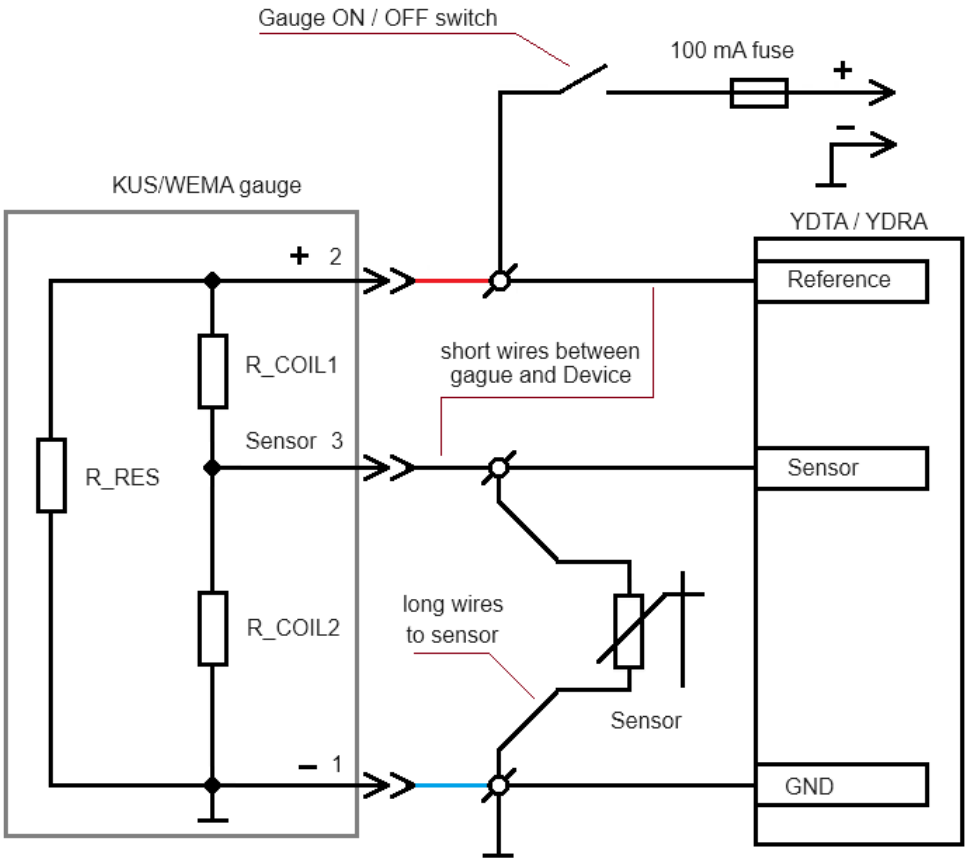

Figure 15. Connection to KUS/WEMA gauge.

Then calculate 3 resistances values for gauge resistance network: `R_COIL1`, `R_COIL2` and `R_RES` either

a) using the formulae:

```
R_COIL2 = SQRT(R3 * R4 ^2 / (R2-R4))                    [3]

R_COIL1 = R4 * R_COIL2 / (R_COIL2-R4)                   [4]

R_RES = R3 * (R_COIL1+R_COIL2)/(R_COIL1+R_COIL2+R3)     [5]
```

b) using a form on this webpage: https://yachtd.com/kus.html

c) Excel file you can download at https://www.yachtd.com/downloads/

To use our Device with this gauge, you need to use `2COIL_VCC` mode.

To switch **YDTA-01** or **YDRA-01** to `2COIL_VCC` mode, either use configuration file and set:

```
CONNECTION=2COIL_VCC
```

or send "YD command" by setting Device's Installation Description 2 field to:

```
YD:CONNECTION 2COIL_VCC
```

YDTA-04 has 4 measurement channels, A, B, C and D, so the "YD Command" should also specify the channel, for example, to configure channel B, send command:

```
YD:CONNECTION B 2COIL_VCC
```

Than all is left to do is to **set Sensor's resistances and Gauge's coils resistances** measured earlier.

For YDTA-01 use either configuration file, set:

```
OHMS_EMPTY=R_empty
OHMS_FULL=R_full
OHMS_COIL_1=R_COIL1
OHMS_COIL_2=R_COIL2
OHMS_RES=R_RES
```

or "YD commands":

```
YD:OHMS_EMPTY R_empty
YD:OHMS_FULL R_full
YD:COIL_1 R_COIL1
YD:COIL_2 R_COIL2
YD:OHMS_RES R_RES
```

where `R_empty` and `R_full` are values on Ohms, measured on empty and full tank and `R_COIL1`, `R_COIL2` and `R_RES` are calculated gauge's "virtual coils" resistances.

YDTA-04 has 4 measurement channels, A, B, C and D, so the "YD Command" should also specify the channel, for example, to configure channel B, send commands:

```
YD:OHMS_SENSOR B R_empty R_full
YD:OHMS_GAUGE B R_COIL1 R_COIL2 R_RES
```

where `R_empty` and `R_full` are values on Ohms, measured on empty and full tank and `R_COIL1`, `R_COIL2` and `R_RES` are calculated gauge's "virtual coils" resistances.

For YDRA-01 use either configuration file, set:

```
OHMS_PORT=R_max_port
OHMS_STBD=R_max_stbd
OHMS_COIL_1=R_COIL1
OHMS_COIL_2=R_COIL2
OHMS_RES=R_RES
```

or "YD commands":

```
YD:OHMS_PORT R_max_port
YD:OHMS_STBD R_max_stbd
YD:COIL_1 R_COIL1
YD:COIL_2 R_COIL2
YD:OHMS_RES R_RES
```

where R_max_port and R_max_stbd are values on Ohms, measured on full port and full starboard Rudder deflections and R_COIL1, R_COIL2 and R_RES are calculated gauge's "virtual coils" resistances.

VII. Multiple gauges or other extra loads on the same power source rail

Please, note the “Gauge ON/OFF” switch on all wiring diagrams shown on Figures 8, 10 and 14. This switch is required for correct YDTA/YDRA measurement operation when gauge is OFF. Ideally, each gauge should have an individual switch, totally disconnecting the gauge from the rest of the power circuitry.

However, most panels have multiple gauges, and their power input (”+” terminals) are typically connected to the same power source “DC +” wire and several gauges are turned ON/OFF using one switch.

In such case, when the gauges power is turned OFF, some extra YDTA/YDRA drive current will flow via the power source “DC +” wire through the other gauges/loads and it will lead to a significant measurement error (measured values will differ significantly when the gauge is ON vs OFF).

Hopefully, adding more switches is not necessary, there is a better solution, just add a diode in series to gauge’s power input to block that “flow back” current like shown on Figure 15.

Recommended diode is of Schottky type, rated for 1 Ampere or higher forward current.

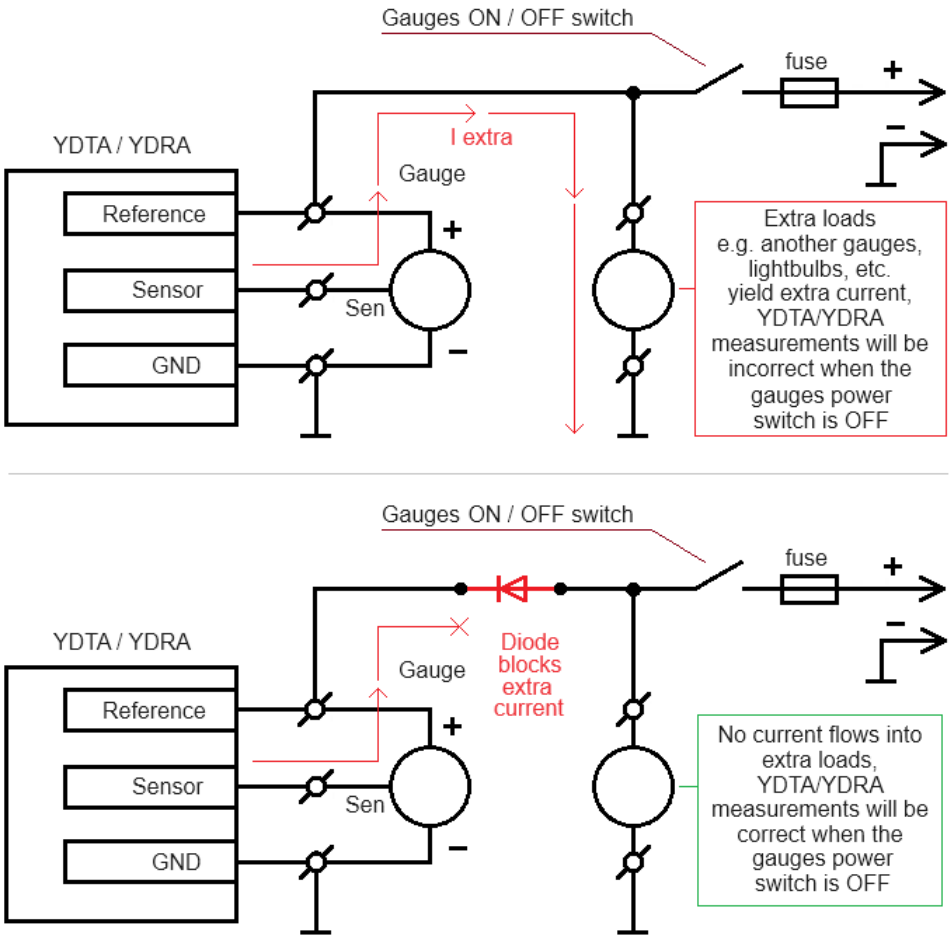

Figure 16. Extra loads on power rail will yield measurement error when the gauges power switch is OFF (top diagram).
Adding a diode blocks that current and resolves an issue (bottom diagram).