## MODBUS Communication for Prosense Detectors and Panels

Prosense detectors and panel can communiciate through RS485 Serial interface with up to 32 devices. The addressing of detectors starts from 1 and can be adjusted bu customer. The control panel is always has address number 0. Prosense DP32 control panel has MODBUS communication feature. DP4 and DP8 has same feature just to communicate with monitoring software on computer.

## Connection

DP32 Panel can be connected and monitor 32 detectors with RS485 serial connection. V+, V- (GND), A and B ports must be connected via using four-wire cable. Detector connections supply 27VDC power to detector and read the output signal of detector from A and B ports. Thus connections should be made correctly to do not cause any damage on the detectors. Detector power connection should be done with 1.5mm$^2$ cross section cable. The total distance between control panel and detectors should not exceed 800 meters. Detector connections should be made with 4 core cable wire that 2 for power and 2 for RS485 and pin definitions are as follows:

| | | |
|---|---|---|
| V+ | output | +24VDC (Only for panel and detectors, do not use for any other device) |
| V- | output | -VDC |
| A | input | RS485 port A |
| B | input | RS485 port B |

**Table 1: Connection pin definitions**

The wiring for detectors utilized with RS485 board should be done by using connection cable EIA RS485 2 core wires with section 0.22 / 0.35 mm2 and shielded. Nominal capacity between the wires should be < 50pF/m and nominal impedance should be 120 Ohms.

The V+, V- ports and A, B ports are located different sockets in DP32 main board. These ports are formed in same or different sockets on Prosense detector address modules. The connections should be done with care to do not mix power and RS485 ports. All detectors will be connected through one cable via hopping one detector to another till the last detector on the line. The connection schema is given in below diagram:

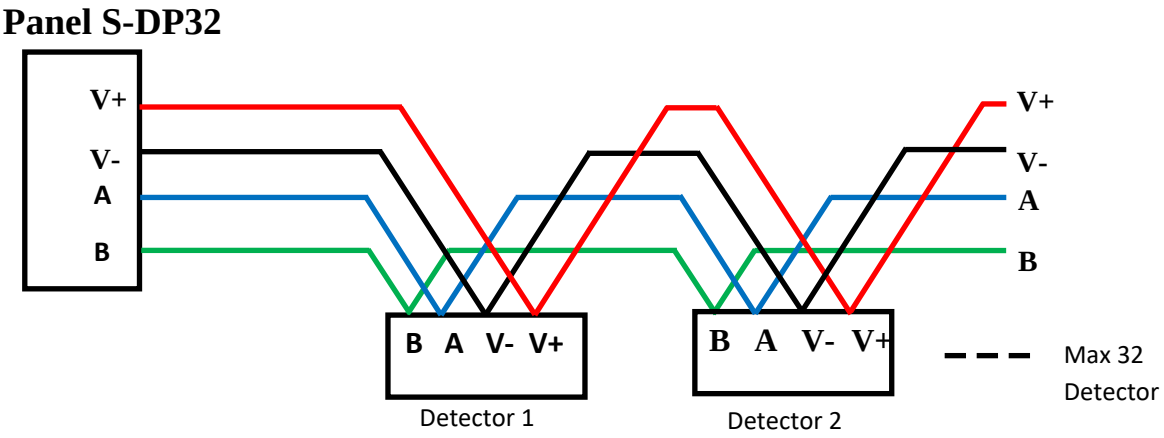


**Diagram 1: Panel to detector connections**

There should be one master device and up to 32 slave devices in RS485 communication. The master is DP32 control panel and detectors will be the slave devices:

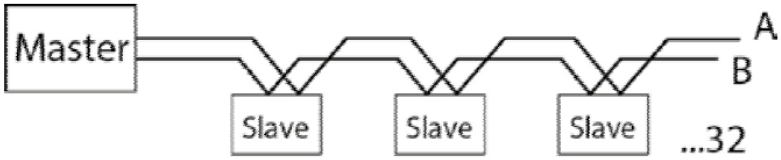


**Diagram 2: RS485 communication**

Each detector connected to same DP32 panel should have unique address. Detectors having same address would not be recognised by control panel. DP32 panel can communicate up to 32 detectors. In case less than 32 detectors connected, control panel would not show non-existent detectors. Unused detectors should be deactivated on channel settings menu steps.

The equipment should provide digital output signal according to measured gas levels and also default values and adjusted values. The analogue output should be linear regarding measured gas level. Analogue output should be inhibited in case of special states.

Communication:

Both detector and control panel must comply below requirements:

**Wiring and protocol:** MODBUS solution over serial line should implement an electrical interface in accordance with EIA/TIA-485 standard. This standard allows point to point and multipoint systems, in a “two-wire configuration”. On a 2W-bus, at any time one driver only has the right for transmitting.

**RTU Transmission Mode:** When devices communicate on a MODBUS serial line using the RTU (Remote Terminal Unit) mode, each 8–bit byte in a message contains two 4–bit hexadecimal characters. Each message must be transmitted in a continuous stream of characters.

**Data format:** The format for each byte ( 11 bits ) in RTU mode is :

- Coding System: 8–bit binary
- Bits per Byte: 1 start bit
- 8 data bits, least significant bit sent first
- 1 bit for parity completion
- 1 stop bit

**Data Signaling Rate:** 9600 bps is the required . Implemented baud rate must be respected better than 1% in transmission situation, and must accept an error of 2% in reception situation.

**CRC Checking:** The RTU mode includes an error–checking field that is based on a Cyclical Redundancy Checking (**CRC**) method performed on the message contents. The CRC field checks the contents of the entire message. It is applied regardless of any parity checking method used for the individual characters of the message. The CRC field contains a 16–bit

value implemented as two 8–bit bytes. The CRC field is appended to the message as the last field in the message. When this is done, the low–order byte of the field is appended first, followed by the high–order byte. The CRC high–order byte is the last byte to be sent in the message. The CRC value is calculated by the sending device, which appends the CRC to the message. The receiving device recalculates a CRC during receipt of the message, and compares the calculated value to the actual value it received in the CRC field. If the two values are not equal, an error results. The CRC calculation is started by first pre-loading a 16–bit register to all 1's. Then a process begins of applying successive 8–bit bytes of the message to the current contents of the register. Only the eight bits of data in each character are used for generating the CRC. Start and stop bits and the parity bit, do not apply to the CRC.

The Serial output must provide communication to Prosense DP series control panels via RS485 Modbus communication. The data structure must use below mapping:

**A description data to be sent or received**

| **11** | **04** | **0008** | **0001** | **CRC** |
|---|---|---|---|---|
| Device address<br><br>(11Hex=17th adress's device) | 'Read register"<br><br>command | First register address to be read<br><br>(Hex=8th register => #30009) | Number of registers to be read (1Hex=1 register) only register 30009 | Cyclic redundancy check |

**Response from slave device**

| **11** | **04** | **02** | **000A** | **CRC** |
|---|---|---|---|---|
| Device address | 'Read register" command | Number of data bytes<br><br>(1 register=> 1x2 byte=2byte) | 30009 register's data | Cyclic redundancy check |

**To be sent**

**[01][04][00][00][08][F1][CC]**

**To be received**

**[01][04][10][00][41][00][D6][00][01][00][19][00][03][00][00][00][00][00][00][72][27]**

**From left to right;**

| | |
|---|---|
| **Red:** | Gas Type(For exp. 65 is oxygen for the received data from detector 6524,<br>for other gases see the gas_list) |
| **Black** | Measured Gas concentration ( 16 bit, for oxygen shows 250maximum value should be divided to 10. For other gases should be read as it is) |
| **Yellow** | 0001= Detector is running, 0000= Detector is faulted |
| **Blue** | Show the range in decimal (for Oxygen Max.25, that is to say 25%Vol detector. Other gases 100 % LEL<br>or XXX PPM) |
| **Red** | Measurment Unit (4=%LEL, 3=%VOL, 2=PPM) |