PROTOCOL CONVERTER

S2000-PP

USER’S MANUAL

Table of Content

This Manual is intended to help in understanding the principles of operation and using the S2000-PP protocol converter of version **1.24**.

1. Purpose

The S2000-PP Protocol Converter is designed to integrate a Bolid manufactured fire and intrusion alarm system (Orion system devices) into third vendor equipment by using Modbus-RTU interface. The S2000-PP provides:

- Monitoring events occurred in the Orion system,
- Switching Orion system relays on / off and arming / disarming Orion system zones and partitions,
- Receiving numeric values of parameters from Orion system devices.

2. Specifications

2.1. The S2000-PP is to be powered by an external power supply providing 10.2 V to 15 V dc. It is advised to use Bolid manufactured battery backed power supplies of RIP-12 series.

2.2. Current consumption at 12 V: 30 milliamp max;

2.3. RS-485 Orion Working Parameters:

- Bits per Second: 9600;
- Start / Stop Bits: 1;
- Parity: None;
- Maximum Packet Length: 75 bytes.

2.4. Modbus/TD Interface Working Parameters:

2.4.1 Gateway for the Modbus:

- Interface Type: RS-485;
- Protocol Type: Modbus-RTU;
- Bits per Second: 1200, 2400, 9600, 19200, 38400, 57600, 115200 bit/s;
- Parity: None, Even, Odd;
- Stop Bits: 1 with parity; 1 or 2 without parity;
- Maximum Packet Length: 256 bytes.

2.4.2 Transferring events to an RS-202TD:

- Interface Type: RS-485 or RS-232TTL;
- Protocol Type: Contact ID;
- Bits per Second: 9600;
- Stop Bits: 1;
- Parity: None;
- Maximum Packet Length: 14 bytes.

2.5. The S2000-РРБ Database provides supporting:

- Maximum number of relays: 255;
- Maximum number of zones: 512;
- Maximum number of partitions: 64;
- Maximum number of user codes: 64;
- Maximum number of stored events (circular event log capacity): 256.

2.6. Pre-operation Time: 3 s max.

2.7. The S2000-PP is designed for round-the-clock operating within protected premises.

2.8. The S2000-PP is not supposed to be used in aggressive and dust environment and fire hazardous premises.

2.9. Overall Dimensions: – 55 mm x 36 mm x 22 mm.

2.10. Weight: 0.05 kg max.

2.11. Operating Temperatures: -30°C to +50°C non-condensing.

3. OPERATING

Table 1 shows operating modes of the S2000-PP:

Table 1

	ORION Interface	Modbus/TD Interface	Operating Mode
1	Master	Slave	Orion – Modbus gateway
2	Slave	Slave	
3	Master	Master	Translating events to the RS-202TD
4	Slave	Master	

3.1. Orion Interface

3.1.1. The S2000-PP can operate over the Orion Interface either in the Master mode or the Slave mode depending on the position on the jumper XP1. Defining the mode is performed on starting the program (on applying the power): if the jumper is put on the S2000-PP enters the Orion Master mode while, otherwise, if the jumper is put off the S2000-PP operates in the Orion Slave mode. The operation mode over the Modbus/TD interface and the interface mode (selecting third-vendor equipment) are specified while configuring the device.

3.1.2. In the Orion Master mode the S2000-PP polls the devices of the Orion system. Being initialized, the S2000-PP sequentially requests for statuses of all zones and relays which are enrolled in its database (the database is created when the S2000-PP is programmed). On operating, the S2000-PP changes current statuses of zones and partitions in accordance with the events being received from the devices of the Orion system. If a command to turn a relay on/off or to change the status of a zone/partition is received over the Modbus interface, the S2000-PP forwards this command to the devices of the Orion system. A single command received by the S2000-PP over the Modbus interface can cause, depending on the context, several data calls over the Orion interface with one or several devices of the Orion system.

3.1.3. The Orion Slave mode is designed for:

- Configuring the S2000-PP by means of the UProg.exe and RS485Setting.exe programs;
- Updating S2000-PP firmware by means of the Orion_prog.exe program;
- S2000-PP's operating as a gateway between the Orion system and the Modbus system.

3.1.4 This mode fundamentally differs in that the S2000 or S2000M console polls the devices of the Orion system. The S2000(M) console must be programmed (by means of the PProg.exe program) to translate events received from the devices to the S2000-PP converter. Being initialized, the S2000-PP sequentially requests the S2000(M) console for the statuses of zones and relays from the S2000-PP database. During operation the S2000-PP changes current statuses of zones, partitions, and relays in accordance with messages received from the console. If a command to turn a relay on/off or to change the status of a zone/partition is received over the Modbus interface, the S2000-PP forwards this command to the S2000(M) console which, in turns, forwards the command to the devices of the Orion system.

Notes: *1. The programs PProg.exe, UProg.exe, RS485Setting.exe, Orion_prog.exe are free and can be downloaded from the site of the Bolid Company at the address of http://www.bolid.com.*

2. Only the device can be requested for a relay status which can answer for such request:

- *Signal-20M from the version 1.02 (device version 1.01 rev 1);*
- *S2000-SP1 from the version 1.50;*
- *S2000-4 from the version 2.05;*
- *S2000-KDL from the version 1.45.*

3.2. Modbus/TD Interface

3.2.1. If the interface is used as a gateway between the Orion system and the Modbus system then the S2000-PP operates as a slave in the Modbus Slave mode responding to the Modbus Master. A single Modbus-Master device (third-vendor equipment) can have several Modbus-Slave devices (S2000-PP) connected, each of the S2000-PP having a unique address from 1 to 247 at the Modbus interface. Figure 1 shows the common packet format.

<table>
<tr><td>1 byte</td><td>1 byte</td><td colspan="5">1..252 bytes</td><td colspan="2">2 bytes</td></tr>
<tr><td rowspan="2">Address</td><td rowspan="2">Modbus Function Code</td><td colspan="5">Data Fields</td><td colspan="2">CRC Field</td></tr>
<tr><td>D_1</td><td>D_2</td><td>…</td><td>D_{N-1}</td><td>D_N</td><td>Low byte</td><td>High byte</td></tr>
</table>

Figure 1. Modbus Packet Format

The minimum packet length is 5 bytes.
The maximum packet length is 256 bytes.

A sign of the end of the packet is the delay which is equal or more than the time needed to transmit 3.5 bytes, according to the selected transmission rate.

3.3. S2000-PP Operating with a Modbus System

3.3.1. Table 2 shows a list of the functions of the Modbus protocol supported by the S2000-PP.

Table 2. **Modbus Function supported by the S2000-PP**

Modbus Function Code	Description
1 (0x01)	Reading values from several flag registers (Read Coil Status)
3 (0x03)	Reading values from several holding registers (Read Holding Registers)
5 (0x05)	Writing the value of a single flag (Force Single Coil)
6 (0x06)	Writing a value into a single holding register (Preset Single Register)
15 (0x0F)	Writing values to several flag registers (Force Multiple Coils)
16 (0x10)	Writing values to several holding registers (Preset Multiple Registers)

A command having been fulfilled successfully, the S2000-PP returns a response with the same Function Code as in the query and the requested data in the Data Fields. If the command fails, the S2000-PP returns the response with the same Function Code but with the high bit being set on. In the Data Fields of the response in such case the Error Code is transmitted. Modbus Error Codes, generated by the S2000-PP are shown in Table 3.

Table 3. **Supported Modbus Error Codes**

Error Code	Description
1	The received Function Code cannot be processed by the slave
2	The address of data specified in the request is not available for the slave
3	The value in the data field of the request is not a valid value for the slave
6	The slave is busy processing the command. The request should be retransmitted when the slave is free
15	The data have not yet been received. For example, the S2000-PP has not yet known the status of the requested zone because it has not yet received from the device (Orion-Master mode) or from the S2000M console (Orion-Slave mode) the status of this particular zone. The request should be repeated later.

Modbus-Master can send a broadcast instruction. In such case the Destination Address is equal to zero. No response for a broadcast instruction is to be sent.

3.3.2 Receiving Data from the S2000-PP

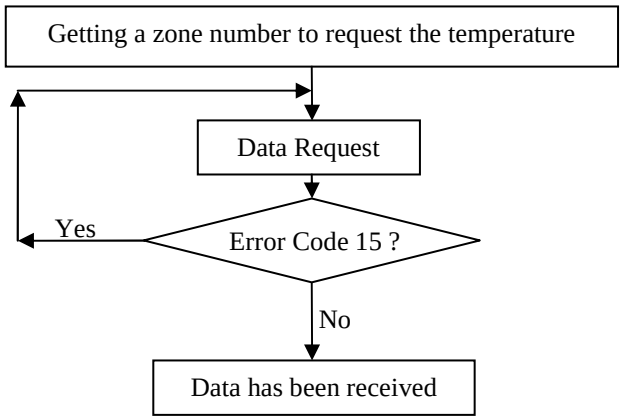
Depending on the data the Modbus-Master would like to receive it can be necessary one or two request-response transactions. The data the S2000-PP has already had in its configuration are to be received by the Modbus-Master in a single session. Such data includes:

- The maximum quantity of relays, zones, and partitions;
- The maximum number of states of zones and partitions;
- The capacity of the circular event buffer;
- The maximum event description length;
- The type and the version of the S2000-PP;
- The states of zones, partitions, and relays;
- Description of events;
- The number of non-read events;
- The number of the newest event and the number of the latest event;
- The current data and time.

Two request-response sessions are to be used:

- To receive an extended zone status: during the first session Modbus Master writes the zone number into the S2000-PP while during the second session it performs reading. The register address (the address of the first register of a sequence of registers) for reading extended zone status is the same for all the zones – **46192**;
- To receive an extended partition status: during the first session Modbus Master writes the partition number into the S2000-PP while during the second session it performs reading. The register address (the address of the first register of a sequence of registers) for reading extended partition status is the same for all the partitions – **46200**;
- To read an event by its known number: during the first session Modbus Master writes into the S2000-PP the number of the event while during the second session it performs reading. The register address (the address of the first register of a sequence of registers) for reading an event in accordance with its known number is the same for all the event numbers – **46296**;
- To receive a numeric parameter value: during the first session Modbus Master writes into the S2000-PP the zone number while during the second session it performs reading.

If Modbus Master generates requests frequently, then to receive data it can be necessary more than two request-response sessions (especially the W2000-PPoperate as Slave in the Orion system). If, during a second session, at the moment of receiving a request for sending data the S2000-PP has not yet had them, the S2000-PP generates an error packet with the code 15. In this case it is recommended for the Modbus Master to repeat the data request after a time.



3.3.3 Numerical Parameter Values

By means of the S2000-PP the Modbus Master can get numerical values of the following parameters:

- Temperature (for such devices as S2000-IP and S2000-VT);
- Humidity (for an S2000-VT);
- Number of pulses (for an S2000-ASR2);
- Voltage and current (for RIP-12V-2A-7Ah RS and RIP-12 RS).

Because of a special request must be sent in order to get a numerical parameter value from an Orion system device, the **relevant zone type** for this alarm loop must be specified in the configuration table of zones and partitions of the S2000-PP. Please read more about configuring the S2000-PP in Section 5 of this Manual.

3.3.2. Table 4 includes the list of Modbus Functions supported by the S2000-PP.

Table 4. **Modbus Functions Supported by the S2000-PP**

Purpose	Modbus Function	Modbus Data				Packet Length	Comment
Request for maximum number of relays (R)	3	Register Address **46144**		Quantity of Registers		8	
		Hi Byte	Lo Byte	Hi Byte=0	Lo Byte=1		
Maximum number of relays		Byte Count = 2	Maximum number of relays			7	
			Hi Byte	Lo Byte			
Request for maximum number of zones (R)	3	Register Address **46145**		Quantity of Registers		8	
		Hi Byte	Lo Byte	Hi Byte=0	Lo Byte=1		
Maximum number of zones		Byte Count = 2	Maximum number of zones			7	
			Hi Byte	Lo Byte			
Request for maximum number of partitions (R)	3	Register Address **46146**		Quantity of Registers		8	
		Hi Byte	Lo Byte	Hi Byte=0	Lo Byte=1		
Maximum number of partitions		Byte Count = 2	Maximum number of partitions			7	
			Hi Byte	Lo Byte			
Request for maximum number of zone statuses (R)	3	Register Address **46147**		Quantity of Registers		8	
		Hi Byte	Lo Byte	Hi Byte=0	Lo Byte=1		
Maximum number of zone statuses		Byte Count = 2	Maximum number of zone statuses			7	
			Hi Byte	Lo Byte			
Request for max number of partition statuses (R)	3	Register Address **46148**		Quantity of Registers		8	
		Hi Byte	Lo Byte	Hi Byte=0	Lo Byte=1		
Maximum number of partition statuses		Byte Count = 2	Maximum number of partition statuses			7	
			Hi Byte	Lo Byte			
Request for maximum number of events (R)	3	Register Address **46149**		Quantity of Registers		8	
		Hi Byte	Lo Byte	Hi Byte=0	Lo Byte =1		
Maximum number of events		Byte Count = 2	Maximum number of events			7	
			Hi Byte	Lo Byte			
Request for max length of event description (R)	3	Register Address **46150**		Quantity of Registers		8	
		Hi Byte	Lo Byte	Hi Byte=0	Lo Byte =1		
Max length of event description		Byte Count = 2	Max length of event description			7	
			Hi Byte	Lo Byte			
Request for type and version of the device (R)	3	Register Address **46152**		Quantity of Registers		8	
		Hi Byte	Lo Byte	Hi Byte =0	Lo Byte =2		
Type and Version of the device		Byte Count = 2	Device Type		Device Version	9	
			Hi Byte	Lo Byte	Hi Byte	Lo Byte	

Continuation of Table 4

<table>
<tr><th>Purpose</th><th>Modbus Function</th><th colspan="6">Modbus Data</th><th>Packet Length</th><th>Comment</th></tr>
<tr><td colspan="10">Request Status and Set Status Functions</td></tr>
<tr><td rowspan="2">Request for status of the relay group (R)</td><td rowspan="3">1</td><td colspan="3">Start Relay Address 10000 + M, where M is (No of the first relay – 1)</td><td colspan="3">Quantity of Relays</td><td rowspan="2">8</td><td rowspan="2"></td></tr>
<tr><td>Hi Byte</td><td colspan="2">Lo Byte</td><td>Hi Byte = 0</td><td colspan="2">Lo Byte</td></tr>
<tr><td>Status of the relay group</td><td colspan="2">Byte Count = N</td><td colspan="5">Relay Status Bytes</td><td>5+N</td><td>Status bytes: 1 bit is for a single relay</td></tr>
<tr><td></td><td colspan="2"></td><td>1 byte</td><td colspan="2">…</td><td>N</td><td></td><td></td></tr>
<tr><td rowspan="2">Control status of a relay group (W)</td><td rowspan="4">15</td><td colspan="2" rowspan="2">Start Relay Address 10000 + M, where M is (the number of the first relay – 1)</td><td colspan="2" rowspan="2">Quantity of Relays</td><td rowspan="2">Byte Count N</td><td colspan="3" rowspan="2">Data to set the relay status</td><td rowspan="2">9 + N</td><td rowspan="2">Status bytes: 1 bit is for a single relay</td></tr>
<tr><td>Hi</td><td>Lo</td><td>Hi</td><td>Lo</td><td>1</td><td>…</td><td>N</td></tr>
<tr><td>Confirmation for controlling a relay group</td><td colspan="4">Start Relay Address 10000 + M, where M is (the number of the first relay – 1)</td><td colspan="3">Quantity of Relays</td><td>8</td><td></td></tr>
<tr><td></td><td colspan="2">Hi Byte</td><td colspan="2">Lo Byte</td><td>Hi Byte = 0</td><td colspan="2">Lo Byte</td><td></td><td></td></tr>
<tr><td rowspan="2">Control a single relay (W)</td><td rowspan="4">5</td><td colspan="4">Register Address 10000 + M, where M is (relay No - 1)</td><td colspan="3">Relay Status: 0xFFFF – Switch On 0x0000 – Switch Off</td><td>8</td><td rowspan="2"></td></tr>
<tr><td colspan="2">Hi Byte</td><td colspan="2">Lo Byte</td><td>Hi Byte</td><td colspan="2">Lo Byte</td></tr>
<tr><td rowspan="2">Confirmation for controlling a single relay</td><td colspan="4">Register Address 10000 + M, where M is (relay No - 1)</td><td colspan="3">Relay Status: 0xFFFF – Switch On 0x0000 - Switch Off</td><td>8</td><td rowspan="2">The response is the same as the request</td></tr>
<tr><td colspan="2">Hi Byte</td><td colspan="2">Lo Byte</td><td>Hi Byte</td><td colspan="2">Lo Byte</td></tr>
<tr><td rowspan="2">Zone Status Request (R)</td><td rowspan="3">3</td><td colspan="4">Register Address 40000 + M, where M is (zone No – 1)</td><td colspan="3">Quantity of Registers</td><td rowspan="2">8</td><td rowspan="2"></td></tr>
<tr><td colspan="2">Hi Byte</td><td colspan="2">Lo Byte</td><td>Hi Byte = 0</td><td colspan="2">Lo Byte =1</td></tr>
<tr><td>Zone Status Response</td><td colspan="2">Byte Count = 2</td><td colspan="5">Zone Status Bytes</td><td>7</td><td>Priority zone statuses</td></tr>
<tr><td></td><td colspan="2"></td><td colspan="3">Hi Byte (Table 5)</td><td colspan="2">Мл.байт (Table 5)</td><td></td><td></td></tr>
</table>

Continuation of Table` 4

<table>
<tr><th>Purpose</th><th>Modbus Function</th><th colspan="8">Modbus Data</th><th>Packet Length</th><th>Comment</th></tr>
<tr><td rowspan="2">Set a zone status (W)</td><td rowspan="4">6</td><td colspan="4">Register Address
40000 + M,
where M is (zone No – 1)</td><td colspan="4">Zone status:
109: alarm loop disarmed;
24: alarm loop armed;
142: auto extinguishing off;
148: auto extinguishing on;
143: abort discharging;
146: discharge</td><td rowspan="2">8</td><td rowspan="2"></td></tr>
<tr><td colspan="2">Hi Byte</td><td colspan="2">Lo Byte</td><td colspan="2">Hi Byte = 0</td><td colspan="2">Lo Byte</td></tr>
<tr><td rowspan="2">Confirmation for changing the zone status</td><td colspan="4">Register Address
40000 + M,
where M is (zone No – 1)</td><td colspan="4">Zone status:
109: alarm loop disarmed;
24: alarm loop armed;
142: auto extinguishing off;
148: auto extinguishing on;
143: abort discharging;
146: discharge</td><td rowspan="2">8</td><td rowspan="2">The response is the same as the request</td></tr>
<tr><td colspan="2">Hi Byte</td><td colspan="2">Lo Byte</td><td colspan="2">Hi Byte=0</td><td colspan="2">Lo Byte</td></tr>
<tr><td rowspan="2">Set the number of the zone to request extended zone status (W)</td><td rowspan="4">6</td><td colspan="4">Register Address 46176</td><td colspan="4">Zone Number</td><td rowspan="2">8</td><td rowspan="2"></td></tr>
<tr><td colspan="2">Hi Byte</td><td colspan="2">Lo Byte</td><td colspan="2">Hi Byte</td><td colspan="2">Lo Byte</td></tr>
<tr><td rowspan="2">Confirmation for setting zone number</td><td colspan="4">Register Address 46176</td><td colspan="4">Zone Number</td><td rowspan="2">8</td><td rowspan="2"></td></tr>
<tr><td colspan="2">Hi Byte</td><td colspan="2">Lo Byte</td><td colspan="2">Hi Byte</td><td colspan="2">Lo Byte</td></tr>
<tr><td rowspan="2">Request for extended status of the zone by the set number (R)</td><td rowspan="4">3</td><td colspan="4">Register Address 46192</td><td colspan="4">Quantity of Registers =
Number of Status Bytes / 2</td><td rowspan="2">8</td><td rowspan="2"></td></tr>
<tr><td colspan="2">Hi Byte</td><td colspan="2">Lo Byte</td><td colspan="2">Hi Byte = 0</td><td colspan="2">Lo Byte</td></tr>
<tr><td rowspan="2">Extended zone status</td><td rowspan="2">Byte Count</td><td colspan="2">Zone Number</td><td rowspan="2">Number of Status Bytes</td><td colspan="3">Zone Status Bytes</td><td rowspan="2">8+N</td><td rowspan="2">St.Bytes in priority descending order</td></tr>
<tr><td>Hi</td><td>Lo</td><td>Byte 1</td><td>…</td><td>Byte N</td></tr>
<tr><td rowspan="2">Partition Status Request (R)</td><td rowspan="4">3</td><td colspan="4">Register Address
44096 + M,
where M is (Part.No – 1)</td><td colspan="4">Quantity of Registers</td><td rowspan="2">8</td><td rowspan="2"></td></tr>
<tr><td colspan="2">Hi Byte</td><td colspan="2">Lo Byte</td><td colspan="2">Hi Byte = 0</td><td colspan="2">Lo Byte</td></tr>
<tr><td rowspan="2">Status of the partition</td><td colspan="3" rowspan="2">Byte Count = 2</td><td colspan="5">Status bytes</td><td rowspan="2">7</td><td rowspan="2">Priority partition statuses</td></tr>
<tr><td colspan="3">Hi Byte (Table 5)</td><td colspan="2">Lo Byte (Table 5)</td></tr>
<tr><td rowspan="2">Set the partition status (W)</td><td rowspan="4">6</td><td colspan="4">Register address
44096 + M,
where M is (Part.No – 1)</td><td colspan="4">Partition statuses:
109 – loop armed;
24 – loop disarmed</td><td rowspan="2">8</td><td rowspan="2"></td></tr>
<tr><td colspan="2">Hi Byte</td><td colspan="2">Lo Byte</td><td colspan="2">Hi Byte = 0</td><td colspan="2">Lo Byte</td></tr>
<tr><td rowspan="2">Confirmation for setting the partition status</td><td colspan="4">Register Address
44096 + M,
where M is (Part.No – 1)</td><td colspan="4">Partition statuses:
109 – loop armed;
24 – loop disarmed</td><td rowspan="2">8</td><td rowspan="2">Response = request</td></tr>
<tr><td colspan="2">Hi Byte</td><td colspan="2">Lo Byte</td><td colspan="2">Hi Byte = 0</td><td colspan="2">Lo Byte</td></tr>
</table>

Continuation of Table 4

Purpose	Modbus Function	Modbus Data								Packet Length	Comment
Set the number of the partition to request extended partition status	6	Register Address **46177**				Partition Number				8	
		Hi Byte		Lo Byte		Hi Byte = 0		Lo Byte			
Confirmation for setting the partition number		Register Address **46177**				Partition Number				8	Response = request
		Hi Byte		Lo Byte		Hi Byte = 0		Lo Byte			
Request for the extended partition status by the set number	3	Register Address **46200**				Quantity of Registers = Number of Status Bytes / 2				8	
		Hi Byte		Lo Byte		Hi Byte = 0		Lo Byte			
Extended partition status		Byte Count	Partition Number		Number of Status Bytes	Partition Status Bytes				8+N	Status Bytes in priority descending order
			Hi	Lo		Byte 1	…	Byte N			
Functions to Work with Event Log											
Request for number of the most recent event (R)	3	Register Address **46160**				Quantity of Registers				8	
		Hi Byte		Lo Byte		Hi Byte = 0		Lo Byte = 1			
Number of the most recent event		Byte Count = 2				Event Number				7	
						Hi Byte		Lo Byte			
Request for number of the oldest event (R)	3	Register Address **46161**				Quantity of Registers				8	
		Hi Byte		Lo Byte		Hi Byte = 0		Lo Byte = 1			
Number of the oldest event		Byte Count = 2				Event Number				7	
						Hi Byte		Lo Byte			
Request for number of non-read events (R)	3	Register Address **46162**				Quantity of Registers				8	
		Hi Byte		Lo Byte		Hi Byte = 0		Lo Byte = 1			
Number of non-read events		Byte Count = 2				Quantity of Events				7	
						Hi Byte = 0		Lo Byte			
Set the Event Read flag (W)	6	Register Address **46163**				Event Number					
		Hi Byte		Lo Byte		Hi Byte		Lo Byte			
Confirmation for setting the flag		Register Address **46163**				Event Number					Response = request
		Hi Byte		Lo Byte		Hi Byte		Lo Byte			

Continuation of Table 4

Purpose	Modbus Function	Modbus Data								P.Length	Comment
Clear Event Log	6	Register Address **46164**			0		0			8	
		Hi Byte		Lo Byte							
Clear Event Log Confirmation (W)		Register Address **46164**			0		0			8	Response = request
		Hi Byte		Lo Byte							
Request for event (R)	3	Register Address **46264**			Quantity of Registers = Number of event bytes / 2					8	
		Hi Byte		Lo Byte	Hi Byte = 0		Lo Byte				
The oldest non-read event		Byte Count	Event Number		Длина описания		Code		Fields: field type, field length, data	5+N	N = Quantity of Registers * 2
			Hi	Lo							
Setting the event number for request by number (W)	6	Register Address **46178**			Event Number					8	
		Hi Byte		Lo Byte	Hi Byte		Lo Byte				
Confirmation for setting the number		Register Address **46178**			Event Number					8	Response = request
		Hi Byte		Lo Byte	Hi Byte		Lo Byte				
Request for event by the number (R)	3	Register Address **46296**			Quantity of Registers = Number of Event Bytes / 2					8	
		Hi Byte		Lo Byte	Hi Byte = 0		Lo Byte				
Response to the request for the event by the number		Byte Count	Event Number		Length of description		Code		Fields: field type, field length, data	5+N	N = Quantity of Registers * 2
			Hi	Lo							
Functions for Reading Numerical Values of Parameters											
Setting the number of the zone to request temperature/humidity (W)	6	Register Address **46179**			Zone Number					8	
		Hi Byte		Lo Byte	Hi Byte		Lo Byte				
Confirmation of setting the number		Register Address **46179**			Zone Number					8	Response = request
		Hi Byte		Lo Byte	Hi Byte		Lo Byte				

Continuation of Table 4

Purpose	Modbus Function	Modbus Data							P.Length	Comment
Request for the numerical value of the temperature/humidity (R)	3	Register Address **46328**				Quantity of Registers = Number of bytes / 2			8	
		Hi Byte	Lo Byte			Hi Byte = 0	**Lo Byte = 1**			
The numerical value of the temperature/ humidity		Byte Count = 2				The numerical value is signed two's complement fixed point			7	
						Hi Byte	Lo Byte			
Setting the zone number to request for the counter (W)	6	Register Address **46180**				Zone Number			8	
		Hi Byte	Lo Byte			Hi Byte	Lo Byte			
Confirmation for setting the number		Register Address **46180**				Zone Number			8	Response = request
		Hi Byte	Lo Byte			Hi Byte	Lo Byte			
Request for the number (R)	3	Register Address **46332**				Quantity of Registers = Number of bytes / 2			8	
		Hi Byte	Lo Byte			Hi Byte = 0	**Lo Byte = 3**			
The number (counter reading)		Byte Count = 6	Byte 1 (high)	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6 (low)	11	
Setting the number of zone to request for voltage or current (W)	6	Register Address **46181**				Zone Number			8	
		Hi Byte	Lo Byte			Hi Byte	Lo Byte			
Confirm setting the number		Register Address **46181**				Zone Number			8	Response = request
		Hi Byte	Lo Byte			Hi Byte	Lo Byte			
Request for the numerical value of voltage or current (R)		Register Address **46328**				Quantity of Registers = Number of bytes / 2			8	
		Hi Byte	Lo Byte			Hi Byte = 0	**Lo Byte = 1**			
Numerical value of voltage or current		Byte Count = 2				The numerical value is signed two's complement fixed point			7	
						Hi Byte	Lo Byte			

End of Table 4

Other Functions															
Synchronization (W)	16	Register Address **46165**		Quantity of Registers		Byte Count = 6	6 bytes of data						15	Only for the Orion-Master mode
		Hi	Lo	0	3		H	M	S	D	M	Y		
Confirmation of synchronization		Register Address **46165**					Quantity of Registers						8	
		Hi Byte		Lo Byte			Hi Byte = 0			Lo Byte = 3				
Request for time and date (R)	3	Register Address **46165**					Quantity of Registers						8	
		Hi Byte		Lo Byte			Hi Byte = 0			Lo Byte = 3				
Time and date of the device		Byte Count = 6		Time and Date									11	
				H	M	S	D	M	Y					

Notes: *W – Writing;*
R – Reading;
Device Type: '36' is for S2000-PP;
Device Version: version 1.23 is transmitted as 123 (Hi Byte = 0, Lo Byte = 123), version 3.01 is transmitted as 301 (Hi Byte = 1, Lo Byte = 45).

3.3.4. The S2000-PP supports priority of statuses of zones and partitions. In responses for status requests the states of the highest priority are transmitted by first. Table 5 shows the list of events (states of alarm loops) of the Orion system along with priorities of those events which have an effect on states of zones and partitions. The most priority status has the priority index of 1. Priority decreases with increasing the index. The event which doesn't affect status of a zone or partition has an empty field in the Priority column in Table 5.

Table 5. The List of Events of the Orion System

Event Code	Event	The list of fields for this event (see Table 6)	Event Description	Priority (1 is the highest)
1	AC Power Restored	(2), 3, 11	Mains power 220 V has restored	62
2	AC Power Failed	(2), 3, 11	Mains power 220 V has failed	34
3	Intrusion Alarm	(2), 3, 11	The armed alarm loop has been broken	11
17	Arming Failed	(1), (2), 3, 11	While being armed, the alarm loop was broken or faulty	25
19	Test	(2), 3, 11	The smoke detector DIP-34A has responded after a special test action such as (moving a magnet close the detector or pressing test button , the Test Mode being off	
20	Test Begins	(2), 3, 11	The alarm loop is switched to the Test Mode	
21	Test Ends	(2), 3, 11	The alarm loop is switched off the Test Mode	
22	Monitoring Restored	(1), (2), 3, 11	Monitoring of the Programmable Auxiliary alarm loop has restored (switched on)	
23	Arming Delay	(1), (2), 3, 11	The exit delay or delay before arming is being counted	29
24	Alarm Loop Armed	(1), (2), 3, 11	The alarm loop has just been armed	30
34	User's Code Entered	1, 11	The user has entered his code (for example, for arming or disarming)	

Event Code	Event	The list of fields for this event (see Table 6)	Event Description	Priority (1 is the highest)
35	Auxiliary Zone Restored	(2), 3, 11		55
36	Auxiliary Zone Alarm	(2), 3, 11		40
37	Fire Alarm	(2), 3, 11	Two threshold detectors have responded in a single alarm loop, or Arming Delay after a response of a threshold detector has not yet been expired, or the measured value (temperature or smoke content) has exceeded the Fire threshold in the analog addressable zone	8
38	Auxiliary Zone 2 Alarm	(2), 3, 11	Another breaking of the auxiliary alarm loop	
39	Восстановление нормы пожарного оборудования	(2), 3, 11		56
41	Fire Trouble	(2), 3, 11	This is either an internal malfunction of the addressable detector (optical system trouble of the DIP-34A) or breaking a monitored circuit of mass and pressure of the S2000-KPB	19
42	Unknown Device	(2), 3, 11		
44	Fire Prealarm	(2), 3, 11	A response from the heat detector, or confirmed response of the smoke detector, or measured value's (temperature's or smoke content's) exceeding the Prealarm threshold in the analog addressable zone	9
45	Loop Open Failure	(2), 3, 11	An open circuit failure of the alarm loop or monitored circuit of the addressable input module	23
47	Polling Loop Restored	(2), 3, 11	The Polling Loop of the S2000-KDL has been restored after a short/open failure	64
58	Panic Alarm	(2), 3, 11	The Panic alarm loop is broken	10
71	Low Level	(2), 3, 11	The water or pressure level has decreased (for the Potok-3N)	49
72	Normal Level	(2), 3, 11	The water or pressure level is normal (for the Potok-3N)	59
74	High Level	(2), 3, 11	The water or pressure level has increased (for the Potok-3N)	48
75	Too High Level	(2), 3, 11	The pressure or water level has increased the emergency threshold (for the Potok-3N)	46
76	High Temperature	(2), 3, 11	The temperature value has exceeded a threshold value	50
77	Too Low Level	(2), 3, 11	The pressure or water level has decreased the emergency threshold (for the Potok-3N)	47
78	Normal Temperature	(2), 3, 11	The temperature value is within the given range (The thermostatic zone of the S2000-KDL)	52
82	Heat Sensor Failed	(2), 3, 11	A failure of the heat sensor (The thermostatic zone of the S2000-KDL)	20
83	Heat Sensor Restored	(2), 3, 11	The heat sensor has been restored after a failure(The thermostatic zone of the S2000-KDL)	
84	Local Programming	11		
109	Alarm Loop Disarmed	(1), (2), 3, 11	The alarm loop has just been disarmed	27
110	Alarm Reset	(2), 3, 11	The alarm has been cancelled	

Event Code	Event	The list of fields for this event (see Table 6)	Event Description	Priority (1 is the highest)
117	Ready to Arm	(2), 3, 11	The disarmed alarm loop is in norm	28
118	Entrance Alarm	(2), 3, 11	An alarm in the entrance zone	12
119	Not Ready to Arm	(2), 3, 11	Breaking of the disarmed alarm loop	26
121	Relay Open Failure	5, 11	An open circuit failure of the relay output load circuit has been detected	42
122	Relay Short Failure	5, 11	A short circuit failure of the relay output load circuit has been detected	43
123	Relay Restored	5, 11	The relay output load circuit is restored	60
126	Relay Disconnected	5, 11	The output (relay) cannot be controlled due to loss of communication with it: either the S2000-KDL controller has lost its S2000-SP2 module or the S2000-ASPT has lost the connected S2000-KPB	**41**
127	Relay Connected	5, 11	The output (relay) can be controlled again: the S2000-KDL has found its relay module S2000-SP2 lost before or the S2000-ASPT has found the connected S2000-KPB	68
128	Relay Status Change	5, 11	A change in status of the relay: switching on, switching off, or switching on and off alternately	
130	The pump is on	(2), 3, 11		37
131	The pump is off	(2), 3, 11		38
135	Auto Test Error	11	An equipment malfunction has detected	
137	Start Circuit Activation	5, 11		
139	Launch Fault	(2), 3, 11	The fire extinguishing equipment was not successfully started: the discharge command was given out but no agent outflow has been detected	
140	Manual Testing	11	Panel diagnostic mode has been started	
141	Launching Delay	(2), 3, 11	A condition to release extinguishing agent has been occurred and the Pre-Discharge Delay is being counted	5
142	Manual Discharge	(2), 3, 11	Automatic mode of starting extinguishing equipment is off	36
143	Launch Cancel	(2), 3, 11	Starting the fire extinguishing equipment was cancelled (for example, due to pressing RESET button of the S2000-ASPT during Pre-discharge Delay or due to Cancel Extinguishing command received from the S2000M console)	7
144	Extinguishing	(2), 3, 11	Fire extinguishing is in process (the launch pulse was given out and outflow of fire extinguishing agent has been detected)	1
145	Emergency Launch	(2), 3, 11	The fire extinguishing equipment was launched in emergency mode (the launch pulse was not given out but outflow of fire extinguishing detector has been detected)	2
146	Launching	(2), 3, 11	The pulse to discharge extinguishing agent was given out	3
147	Launch Blocked	(2), 3, 11	Releasing extinguishing agent has is blocked (for example, due to opening the door to the protected premises dur-	6

Event Code	Event	The list of fields for this event (see Table 6)	Event Description	Priority (1 is the highest)
			ing the Pre-discharge Delay time)	
148	Auto Discharge	(2), 3, 11	Automatic mode of starting extinguishing equipment is on	39
149	Tamper Alarm	(2), 3, 11	The device enclosure has been open	13
150	Starting Voice Announcement	5, 11		
151	Cancelling Voice Announcement Start	5, 11		
152	Tamper restored	(2), 3, 11	The device enclosure has been closed	66
153	Damper Activated	5, 11	entered the active status	54
154	Damper Restored	5, 11	The ventilation or smoke removal damper has entered the initial status	53
155	Damper Failure	5, 11	The damper has entered neither active nor initial status	45
156	Damper Error	5, 11	Incorrect status of damper monitoring circuits	44
158	Internal Zone Restored	(2), 3, 11		**67**
165	Loop Parameter Error	(2), 3, 11	The alarm loop cannot operate due to configuration errors	18
187	Disconnected	(2), 3, 11	The alarm loop is disconnected: communications between the S2000-KDL and the addressable device (or between the S2000-ASPT and connected S2000-KPB) has been lost	15
188	Connected	(2), 3, 11	Communications between the S2000-KDL and the addressable device (or between the S2000-ASPT and S2000-KPB) has been restored	65
189	Polling Loop 1 Lost	(2), 3, 11	Communications with the detector and the PL1 terminal of the controller has been lost	
190	Polling Loop 2 Lost	(2), 3, 11	Communications with the detector and the PL2 terminal of the controller has been lost	
191	Polling Loop 1 Restored	(2), 3, 11	Communications with one or several addressable devices and the PL1 terminal of the controller has been restored	
192	RIP Power Off	(2), 3, 11	RIP output voltage has been shut off (a shut off command has been executed)	
193	RIP Power On	(2), 3, 11	RIP output voltage has been turned on (a turn on command has been executed)	
194	RIP Overcurrent	(2), 3, 11	The RIP output current has exceeded a threshold value	21
195	RIP Current Restored	(2), 3, 11	RIP overcurrent has been eliminated	57
196	RIP Charger Failed	(2), 3, 11	The power charger of the RIP power supply has failed	22
197	RIP Charger Restored	(2), 3, 11	A trouble of the RIP power charger has been eliminated	58
198	Power Failed	(2), 3, 11	Power supply voltage is out of normal range	35
199	Power Restored	(2), 3, 11	Power supply voltage has returned to normal after a failure	61
200	Battery Restored	(2), 3, 11	The voltage of the system battery has returned to normal	63

Event Code	Event	The list of fields for this event (see Table 6)	Event Description	Priority (1 is the highest)
201	Polling Loop 2 Restored	(2), 3, 11	Communications with one or several addressable devices and the PL2 terminal of the controller has been restored	
202	Battery Failed	(2), 3, 11	No battery or a battery trouble	31
203	Device Restart	11	The device was restarted	69
204	Service Required	(2), 3, 11	The zone requires some service (for example, the smoke chamber of the DIP-34A is contaminated)	
205	Battery Test Error	(2), 3, 11	The battery fails the test and is found to be unsuitable for use	32
206	Low Temperature	(2), 3, 11	The temperature value has dropped below a threshold value	51
211	Low Battery Voltage	(2), 3, 11	Warning about imminent battery discharge	33
214	Loop Short Failure	(2), 3, 11	A short circuit failure of the alarm loop or monitored circuit of the addressable input module	24
215	Polling Loop Short	(2), 3, 11	A short circuit failure within the Polling Loop of the S2000-KDL	16
216	Detector Response	(2), 3, 11	An unconfirmed response from the fire detector has been received	
217	RS-485 Branch Disconnected	11	The device has lost one branch of the RS-485 ring interface	
218	RS-485 Branch Connected	11	Communication with the device over the branch of the RS-485 interface has been restored	
220	Gas Pressure Signal	(2), 3, 11	The pressure detector detects rising in pressure	
221	Gas Pressure Failure	(2), 3, 11	There is no expected pressure increase after giving the discharge command	
222	Polling Loop Trouble	(2), 3, 11	The Polling Loop of the S2000-KDL has failed (usually the voltage is too high)	17
223	Patrol Check	11	The Patrol Check circuit has activated	
241	Partition Armed	(1), 2, 11, (24)	The partition has been armed	
242	Partition Disarmed	(1), 2, 11, (24)	The partition has been disarmed	
250	Communications with the device is lost	(2), (3), 11		14
251	Communications with the device is repaired	(2), (3), 11		70

Note: The fields in parentheses can be absent

3.3.5. The S2000-PP generates an event description packet which contains additional fields identifying this event. Types and codes of additional event fields are shown in Table 6.

Table 6. Types of Additional Fields of Events

Code	Description	Length (bytes)
1	The number of the user in the S2000-PP database	2
2	Partition: the number of the partition	2
3	Zone: the number of the zone	2

Code	Description	Length (bytes)
5	Relay: the number of the relay	2
11	Time and date: hours, minutes, seconds, day, month, year	6
24	ID of the partition: the partition identifier in the Orion system	2

Both for Master and Slave modes the S2000-PP use its own database to assign events to zones and partitions. The only difference is that in the Slave mode the S2000-PP receives the Device Address and Loop Number from the S2000(M) console.

3.3.6. Address space of the Modbus registers of the S2000-PP is shown in Figure 2.

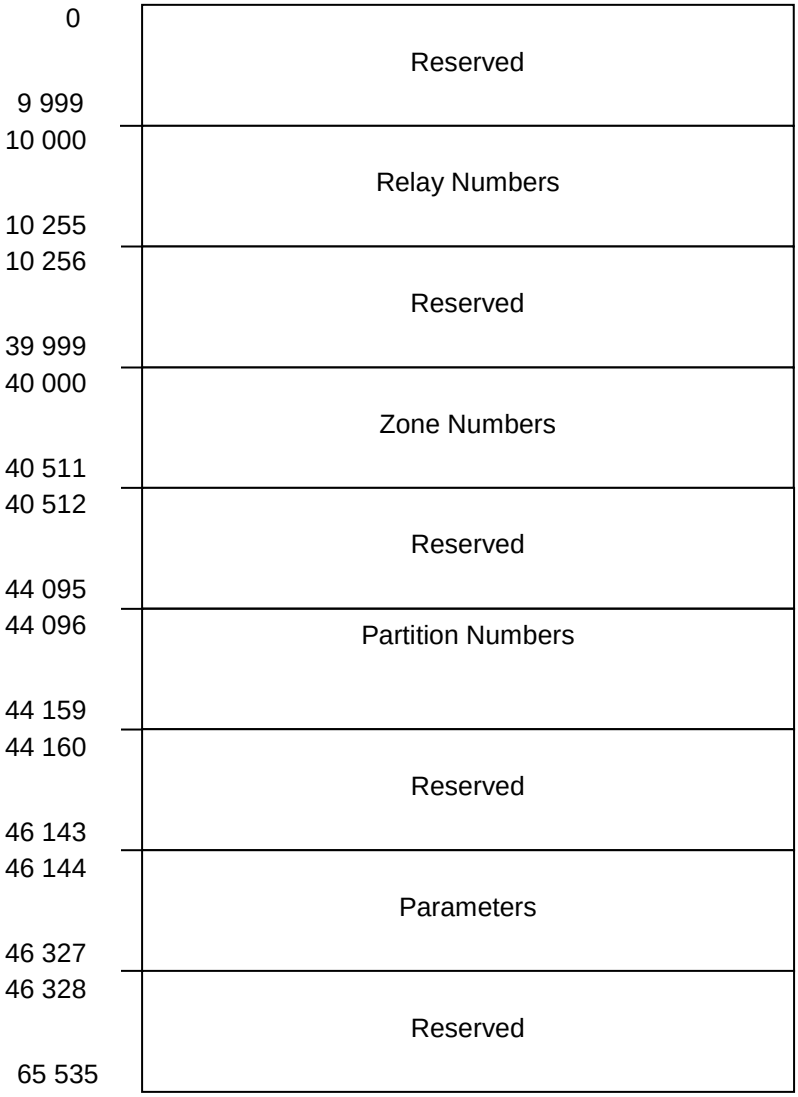


Figure 2. Modbus Registers

3.3.6. Table 7 represents the summary of Modbus addresses for various parameters of the S2000-PP.

Table 7

Modbus Address	Destination
46144	The maximum number of relays
46145	The maximum number of zones
46146	The maximum number of partitions
46147	The maximum number of zone statuses
46148	The maximum number of partition statuses
46149	The maximum number of events
46150	The maximum event length
46152	Type and version of the device
46160	The number of the most recent event
46161	The number of the oldest event
46162	The number of non-read events
46163	Setting Event Read attribute
46164	Clearing event log
46165	Time and Date
46176	Setting the number of zone for request
46177	Setting the number of partition for request
46178	Setting the number of event for request
46179	Setting the number of zone to request for values of temperature or humidity
46180	Setting the number of zone to request for values of S2000-ASR2 counter
46181	Setting the number of zone to request for values of current or voltage of RIP-12 RS
46192	Request for extended zone status
46200	Request for extended partition status
46264	Request for event
46296	Request for event by its number
46328	Request for the value of temperature/humidity/current/voltage
46332	Request for the value of S2000-ASR2 counter

4. PCB Layout

4.1. Figure 3 schematically shows the location and designation of terminals and jumpers of the S2000-PP.

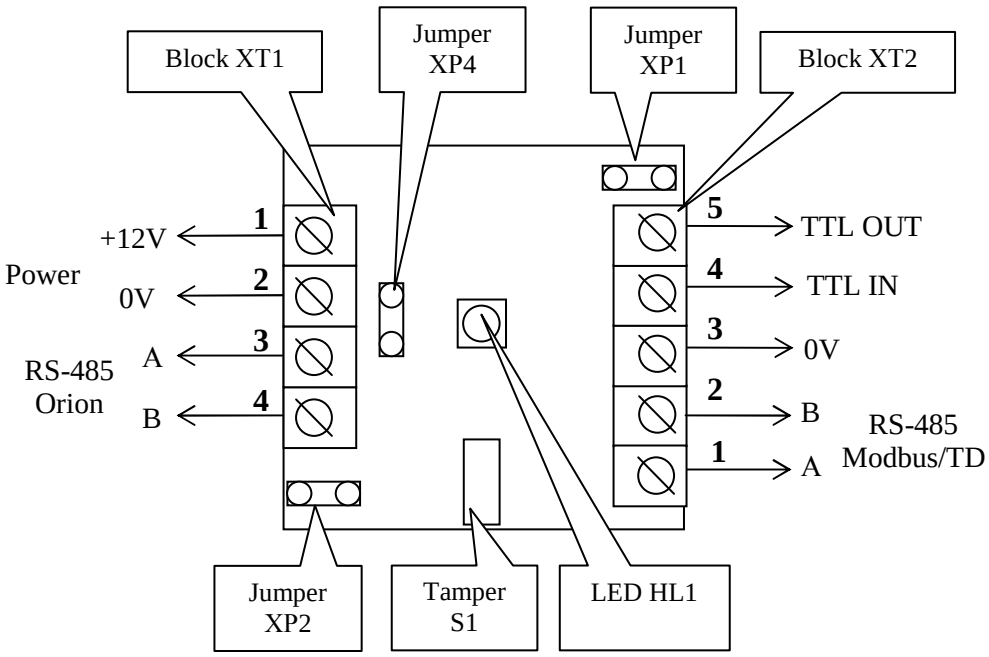


Figure 3. S2000-PP Printed Circuit Board

The jumper XP1 is designed to switch over S2000-PP modes at the ORION interface:

- If the jumper is closed (put on) the mode is ORION Master;
- If the jumper is open (put off) the mode is ORION Slave.

The jumper XP4 is designed to connect/disconnect the EOL resistor to the Orion interface line.

The jumper XP2 is designed to connect/disconnect the EOL resistor to the Modbus interface.

Tamper switch S1 detects opening and closing of the device enclosure.

The light indicator HL1 is designed to indicate S2000-PP operation modes. After applying (or re-setting) power the LED light with red for a short time, then with green for short time, and then switches off. Then the LED operates depending on S2000-PP operation mode. In the Orion Slave mode the LED switches on/off in green every two seconds in state of no communications and turns on for 5 seconds after each transmission. In the Orion Master mode the LED flashes in green at the beginning of each cycle of polling the Orion system devices. LED's flashing in read with duty cycle about 0.1 indicates an S2000-PP malfunction. In such case try to update the S2000-PP firmware using the program Orion_prog.exe.

The XT2.3, XT2.4, XT.5 are designed only for work with an RS-202TD transmitter over the RS-232 interface.

5. Preparing for Use

5.1. Before using the S2000-PP, it should be programmed:

1) Orion interface in the Master mode is configured by the program RS485Setting.exe:

- The pause before a response over RS-485: 2 ms;
- The pause before a new session without changing the direction of transmission: 6.0 ms;
- The pause before a new session with changing the direction of transmission: 6.0 ms;
- The pause between repeating of a common command: 6 ms;
- Timeout of the response to a request for new events while polling: 30 ms;
- Timeout of the response to an address command: 600 ms;
- Timeout of the response to a request for new events while searching: 6 ms;
- The number of attempts to link while polling: 6;
- The number of attempts to send an address command: 5;
- The number of times to send a common command: 3.

The parameter values specified in this clause have already been programmed during manufacturing (factory values) and provide correct operation of the S2000-PP with devices of the Orion system. These values should not be changed unless absolutely necessary.

2) Orion interface in the Slave mode is configured by the program UProg.exe:

- The pause before a response over RS-485: 2 ms;
- The address of the S2000-PP within the Orion interface: 1 to 127;
- The maximum time without requests from Master: 5 to 26 s. This parameter is used to monitor lack of Master requests and to generate communication lost messages.

3) The Modbus interface is programmed using the UProg.exe program:

- S2000-PP Address for the Modbus interface: 1 to 247;
- Bits per Second: 1200, 2400, 9600, 19200, 38400, 57600, 115200;
- Parity (none, even, odd);
- Stop Bits with parity NONE: 1 or 2;
- Interface Type: Modbus RS-485.

4) The S2000-PP database is programmed using the UProg.exe program:
The S2000-PP database consists of four tables:

- Zone and Partition Table;
- Relay Table;
- Partition ID Table;
- User ID Table.

5.1.1. Figure 4 shows an excerpt of Zone and Partition Table of the S2000-PP database.

Zone Number	Device Address	Loop Number	Partition Number	Zone Type
1	7	1	1	1
2	7	2	1	6
3	7	3	1	1

Figure 4. Zone and Partition Table

Columns of the table:

- Zone Number: The sequential number of the zone. The zone No1 has the address of the register 40000 within the address space of Modbus;
- Device Address: The address of the device within the Orion system;

- Loop Number: The number of the alarm loop monitored the zone in question or the number of the relay which circuits are monitored. The alarm loop or relay belongs to the device which address is specified in the string;
- Partition Number: The number of the Modbus partition the zone belongs to; the range of available number is 1 to 64;
- Zone Type: The code of the zone type:

  1 is for an alarm loop,
  2 is for monitored circuits of a relay,
  3 is for a device as a whole (in this case the Loop Number must be 0),
  4 is for switching on/off auto mode of releasing extinguishing agent,
  5 is for releasing or cancelling releasing extinguishing agent (S2000-ASPT);
  6 is for the temperature [degrees C] / the humidity [%];
  7 is for pulse counter;
  8 is for the voltage / current of a RIP. Requests to the following alarm loops are supported:
    No.1: Output voltage [V];
    No.2: Load current [A];
    No.3: Battery voltage [V];
    No.4: Current battery charge [%];
    No.5: Mains voltage [V].

The S2000-PP uses data from this table to:

- poll the devices of the Orion system;
- assign the events generated by the devices to zones and partitions defined by users;
- verify compatibility between a command for changing zone status and the type of the zone;
- check the match between the request for the numerical parameter value and the type of the zone and to generate a correct request to an Orion system device for receiving the numerical parameter value.

For zones with code types 6, 7, and 8 you can request not only numerical parameter values but also send regular alarm loop status requests. Figure 4 shows second zone's having the zone type code equal to 6. A request for status of this zone is a request of the Modbus register with the address 40001. But the same zone can be requested as a "numerical parameter value" by writing the zone number (2 in our case) into the Modbus register with the address of 46328. An attempt to set a zone number for requesting for numerical parameter value with non-relevant zone type code will cause receiving an error packet with code 3 from the S2000-PP.

In the Orion Master mode, to identify events generated by the S2000-PP itself and to read its status, a zone with the following attributes is to be used: Device Address = 0; Loop Number = 0; Zone Type = 3, the numbers of zone and partition can be any of the allowable range of numbers. You can add such zone into the Zone Table by doing the following: right click on the zone number you wish assign for the S2000-PP and select *Assign the Zone … for the Pollster* in the pop-up menu.

In the Orion Slave mode, to identify events generated by the S2000M console, a zone with the following attributes is to be used: Device Address = 0; Loop Number = 0; Zone Type = 3, the numbers of zone and partition can be any ones of the allowable range of numbers. To identify events from the S2000-PP itself, one of the zones is used as for any other slave devices within the Orion interface: the Device Address is the S2000-PP address in the Orion Interface, Loop Number = 0, Zone Type = 3. The Partition Number can be any one within the available range of numbers.

5.1.2. Figure 5 shows an excerpt of the relay table of the S2000-PP database.

Relay Number (Modbus)	Device Address	Relay Number
10	5	1
11	5	2
12	5	3

Figure 5. Zone and Partition Table

Columns of the table:

- Relay Number (Modbus): The sequential number of the relay. The relay No 1 has the Register Address of 10000 within the address space of Modbus;
- Device Address: The address of the device within the Orion system;
- Relay Number: The number of the relay for the device which address is specified in the string.

For the devices which have no alarm loop inputs (for example, an S2000-SP1) you should make an entry in the table of zones for a zone to identify the device itself. Otherwise, events from these devices will be ‘impersonal’, without zone and partition fields.

5.1.3. Figure 6 shows an excerpt of the table of the Partition ID of the S2000-PP database.

Partition Number (Modbus)	Partition ID
1	5001
2	6002
3	7003

Figure 6. Partition ID Table

Columns of the table:

- Partition Number (Modbus): The sequential number of the partition;
- Partition ID: Any number ranged from 1 to 65534;

If you are going to use Bolid manufactured Orion-ModBus OPC server, each Modbus partition should be assigned to a numerical partition ID.

5.1.4. Figure 7 shows an excerpt of the table of user ID of the S2000-PP database.

No	User ID
1	12345678
2	98765432

Figure 7. User ID Table

Columns of the table:

- No: The sequential number of the ID;
- User ID: The User ID in the Orion system (a credential code).

Reading a credentials and writing it into the S2000-PP database is performed by means of any other device which can read credentials such as S2000-2, S2000-4, S2000-KDL etc.

5.2. To write (load) configuration parameters to the S2000-PP:

- wire it as shown in Figure 8,
- remove the jumper XP1,
- switch on the power supply, and
- run the UProg.exe.

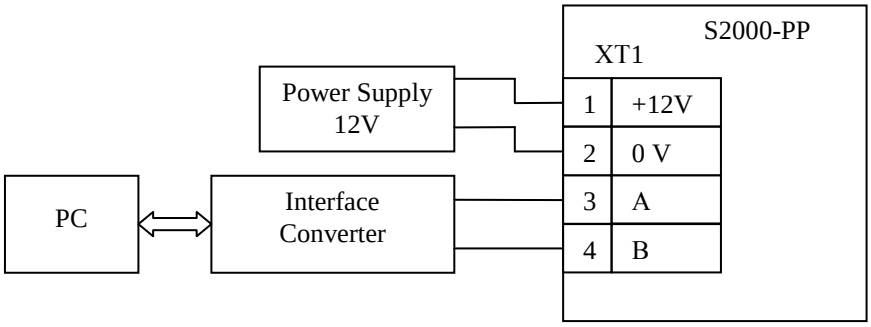


Figure 8. The Schematic for Configuring the S2000-PP

Following is to be made in the UProg.exe window:

- Read the current configuration of the S2000-PP;
- Revise the configuration as necessary;
- Write the new configuration to the S2000-PP.

Then close the UProg.exe, switch the power supply off, and put on the jumper XP1 if the S2000-PP is used in Master mode.

5.3. The S2000-PP can be mounted on a wall, behind a suspended ceiling, or on other structures of the premises at places protected against atmospheric fallouts, mechanical damage, and unauthorized access. The drilling pattern for hanging the S2000-PP by means of woodscrews is shown in Figure 9.

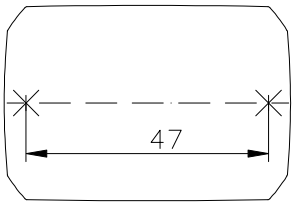


Figure 9. Drilling Pattern

6. Device Operation

6.1. Figure 10 shows the schematic for connecting the S2000-PP in the Орион Master mode to integrate a fire & intrusion alarm system from the Bolid Company (Orion system devices) into a SCADA system of the user.

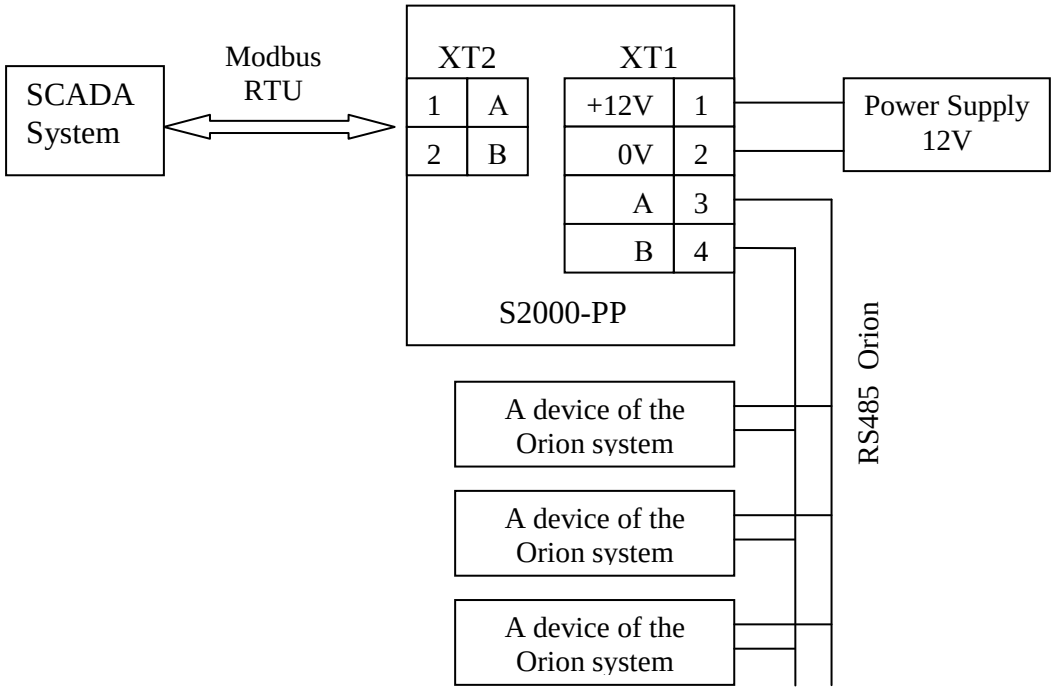


Figure 10. Connecting the S2000-PP in the Orion Master Mode

The jumper XP1 of the S2000-PP must be put on because the S2000-PP is the Master in the Orion RS-485 interface. Orion system devices must be pre-configured in accordance with their manuals and requirements of the system Project.

6.2. Figure 11 shows the schematic for connecting the S2000-PP in the Orion Slave mode to integrate a fire & intrusion alarm system from the Bolid Company (Orion system devices) into a SCADA system of the user.

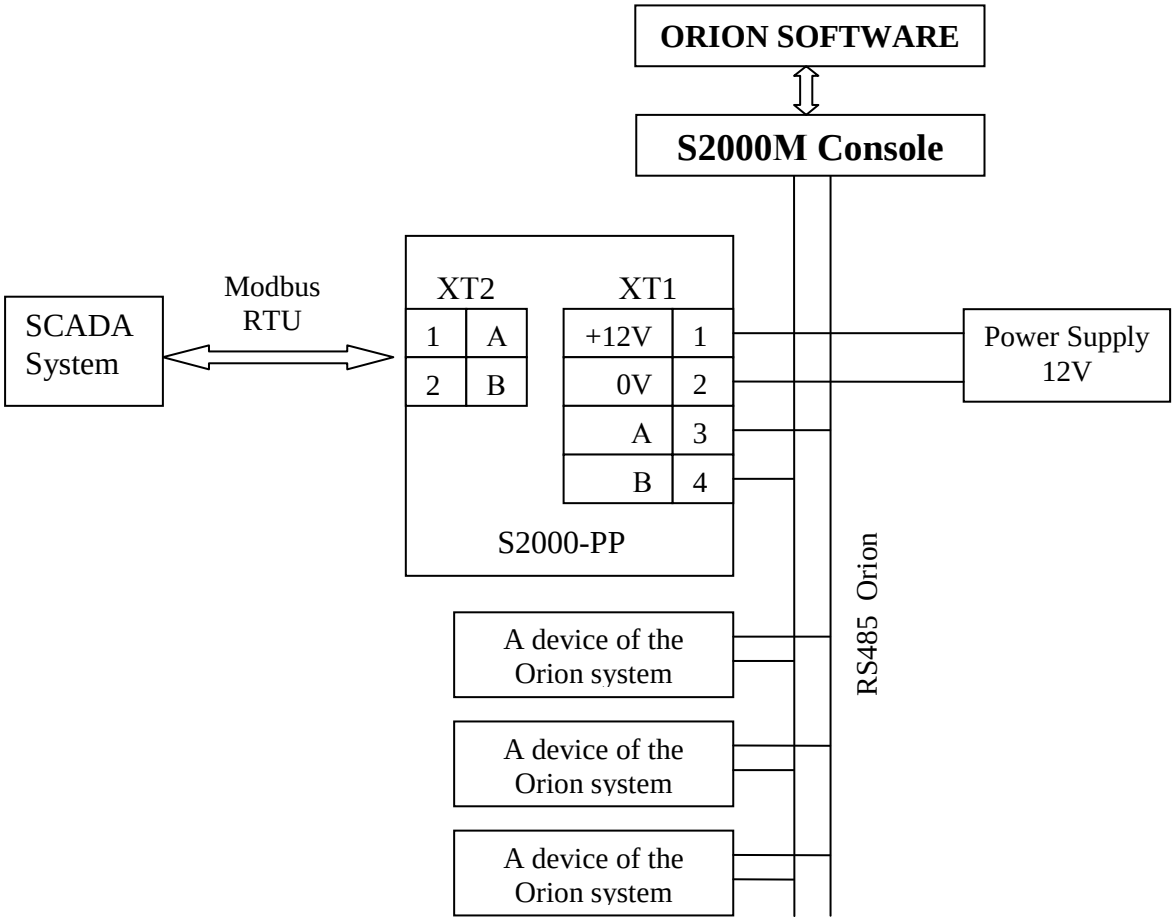


Figure 11. Connecting the S2000-PP in the Orion Slave Mode

The jumper XP1 of the S2000-PP must be **removed** because the S2000-PP is the **Slave** in the Orion RS485 interface. Orion system devices must be pre-configured in accordance with their manuals and requirements of the system Project.

6.3. Figure 12 shows a schematic for connecting the transmitter to the S2000-PP in accordance with TTL interface scheme.

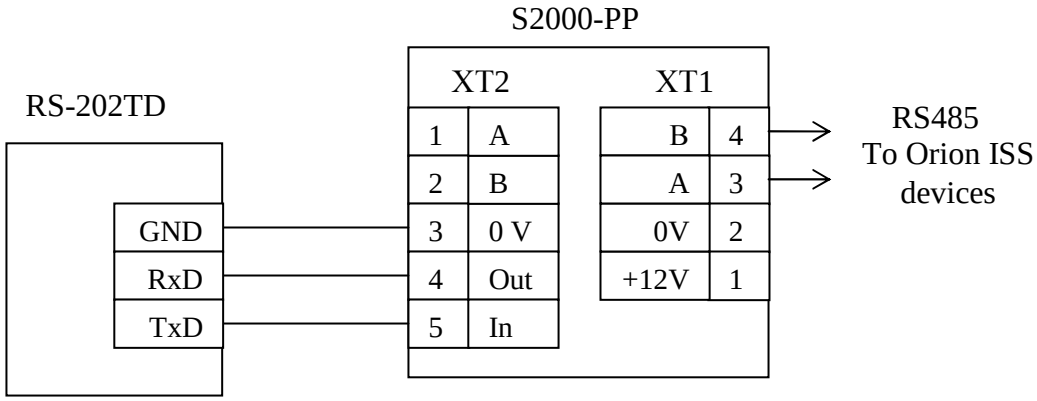
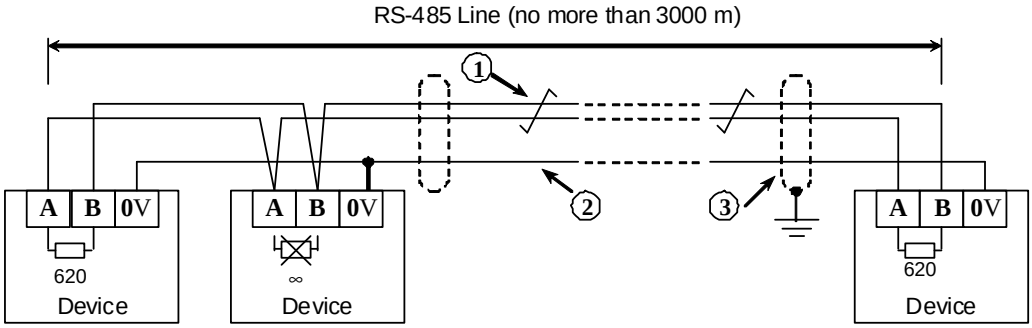


Figure 12. Connecting the Transmitter to the S2000-PP

6.4. **Guidelines for Connecting the S2000-PP and Devices over the RS-485 Interface**

The RS-485 interface uses connections between the devices as a 'bus' when all the devices are connected to the interface by a pair of wires (lines A and B). This interface bus should be matched at the two ends by termination resistors which are to be installed at the first and the last devices in the line. Most devices have built-in termination resistance, which can be included to the line by putting on the special jumper. Upon delivering the devices jumpers are put on, so the jumpers should be removed for all the devices except the first and the last devices in the RS-485 line. The S2000-PP can be connected at any place of the RS-485 line. If it is the first or the last device in the line, its jumper XP2(4)must be put on, otherwise this one must be removed. Branches on the RS-485 line are undesirable because they increase the signal distortion in the line, but practically they are acceptable with a small length of the branches (not more than 20 meters). No termination resistors should be connected to the branches. To make long branches, use S2000-PI repeaters.

In a scattered system where the S2000-PP and devices connected to a single RS-485 line are powered by various power supplies, the circuits 0 V of all the devices and the S2000-PP must be coupled in order to equalize their potentials. Otherwise, communications between the S2000-PP and the devices can be unstable. If a cable with several twisted pairs of wires is in use, a free pair can be used to equalize potential. For this purpose also the shield of a shielded twisted pair can be used **provided that the shield is NOT grounded**. It should also be taken into account the possibility of linking 0 V with a protective earth circuit in the equipment used in the OPS and SCADA system. Figure 13 shows a schematic for connecting the devices and the S2000-PP to the RS-485 interface line.



1 – RS-485 signal line (twisted pair);
2 – equipotential bonding conductor;
3 – shield (if a shielded cable is in use).

Figure 13. The Schematic for Connecting Devices to the RS-485 Interface

6.5. **Receiving information from Orion system devices**

SCADA can receive information from Orion system devices by two ways:

- Requesting for status of the zone or relay;
- Requesting for event.

Request for status of zones (or relays) is reasonable on system startup, in order to find out current statuses of zones. This way is inefficient in relation to traffic usage because you request and receive statuses of all the zones, including the ones which statuses have not changed.

Requests for events allow optimizing the traffic and fast receiving changes in zone statuses. The S200-PP supports two ways to request for events:

- Request for the oldest event;
- Request for the event which number was given preliminary.

The S2000-PP dispatches the events by the following rules:

- After filling the circular event log (the event log capacity is 256) the S2000-PP writes a current event to the place of the oldest event;

- Receiving a request for event (Modbus Address = 46264) the S2000-PP returns the oldest non-read event;

- An event is considered to be read only after the Event Read flag (Modbus Address = 46163) is set on for this event;

- If the S2000-PP has no non-read events, it returns an event with all bytes equal to zero as a response to a request for event.

6.6. **Examples of Modbus requests and responses from the S2000-PP**

6.6.1. Requesting for status of the zone No 9 from the S2000-PP with the address of 15:

Slave Address	Modbus Function	Data				CRC16	
		Register Address = 40008		Quantity of Registers			
		Hi Byte	Lo Byte	Hi Byte	Lo Byte		
0x0F	0x03	0x9C	0x48	0x0	0x01		

The response from the S2000-PP is: the alarm loop is disarmed, the polling loop is repaired:

Slave Address	Modbus Function	Data			CRC16	
		Byte Count	Bytes of Status			
0x0F	0x03	2	0x6D	0x2F		

6.6.2. Requesting for extended status of the partition No 3 from the S2000-PP with the address of 15:
Step 1. Setting the partition number (No 3):

Slave Address	Modbus Function	Data				CRC16	
		Register Address = 46177		Partition Number			
		Hi Byte	Lo Byte	Hi Byte	Lo Byte		
0x0F	0x06	0xB4	0x61	0x0	0x03		

The confirmation from the S2000-PP:

Slave Address	Modbus Function	Data				CRC16	
		Register Address = 46177		Partition Number			
		Hi Byte	Lo Byte	Hi Byte	Lo Byte		
0x0F	0x06	0xB4	0x61	0x0	0x03		

Step 2. Request for extended status of the partition with the length of 16 bytes:

Slave Address	Modbus Function	Data				CRC16	
		Register Address = 46200		Quantity of Registers			
		Hi Byte	Lo Byte	Hi Byte	Lo Byte		
0x0F	0x03	0xB4	0x78	0x0	0x10		

The response from the S2000-PP: the bytes of extended status of the partition:

Slave Address	Modbus Function	Byte Count = 16	Partition Number		Number of Status Bytes = 13	Bytes of Status D1, D2,…, D13	CRC16	
0x0F	0x03		Hi=0	Lo=3				

6.6.3. Reading an event (28 bytes) from the S2000-PP with the address of 15:

Slave Address	Modbus Function	Data				CRC16	
		Register Address = 46264		Quantity of Registers = Number of the Event Bytes/ 2			
		Hi Byte	Lo Byte	Hi Byte	Lo Byte		
0x0F	0x03	0xB4	0xB8	0x0	0x0E		

The response of the S2000-PP: the bytes of the event No32:

Slave Address	Modbus Function	Byte Count = 0x1C	Event Number = 32		Description Length = 0x19	Event Code = 0x6D	Event Fields D1…D24	CRC16	
0x0F	0x03		0	0x20					

Event Fields:

D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16	D17	D18	D19	D20	D21	D22	D23	D24
3	2	0	8	2	2	0	3	18	2	1	5	1	2	0	1	B	6	C	20	10	5	5	B
Zone				Partition				Partition ID				User				Time and Date							

Event No 32: The Zone No 8 which is included to the Partition No 3 (ID=261) is disarmed by the User No 1 on the 5th of May at 12:32:16

6.6.4. Reading an event (28 bytes) from the S2000-PP with the address of 15:

Slave Address	Modbus Function	Data				CRC16	
		Register Address = 46264		Quantity of Registers = Number of the Event Bytes/ 2			
		Hi Byte	Lo Byte	Hi Byte	Lo Byte		
0x0F	0x03	0xB4	0xB8	0x0	0x0E		

The response of the S2000-PP: the bytes of the event No33:

Slave Address	Modbus Function	Byte Count = 0x1C	Event Number = 33		Description Length = 0x11	Event Code = 0x80	Event Fields D1…D24	CRC16	
0x0F	0x03		0	0x21					

Event Fields:

D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16	D17	D18	D19	D20	D21	D22	D23	D24
5	2	0	C	7	2	0	1	B	6	C	22	1	7	4	E	0	0	0	0	0	0	0	0
Relay				Relay Status				Time and Date															

Event No 33: Status of the Relay No 12 has been changed, now the relay is ON, the 7th of April, 2014 at 12:34:016

6.6.5. Setting the relays No 1 and No 3 to the status ‘ON’, and the relay No 2 to the status ‘OFF’. The address of the S2000-PP is 1.

Slave Address	Modbus Function	Data						CRC16	
		Register Address = 10000		Number of Relays		Byte Count	Data for Setting the Relay		
		Hi	Lo	Hi	LO				
0x01	0x0F	0x27	0x10	0	3	1	0x05		

The response from the S2000-PP confirming setting the relay status

Slave Address	Modbus Function	Register Address = 10000		Number of Relays		CRC16	
0x01	0x0F	0x27	0x10	0	3		

6.6.6. Request for the numerical number of temperature from the S2000-PP with the address 3:

Step 1. Setting the number of the zone to request for temperature (the zone No.37):

Slave Address	Modbus Function	Data				CRC16	
		Register Address = 46179		Zone Number			
		Hi Byte	Lo Byte	Hi Byte	Lo Byte		
0x03	0x06	0xB4	0x63	0x0	0x25		

The response of the S2000-PP: confirmation:

Slave Address	Modbus Function	Data				CRC16	
		Register Address = 46179		Zone Number			
		Hi Byte	Lo Byte	Hi Byte	Lo Byte		
0x03	0x06	0xB4	0x63	0x0	0x25		

Step 2. Request for the numeric value of the temperature:

Slave Address	Modbus Function	Data				CRC16	
		Register Address = 46328		Quantity of Registers			
		Hi Byte	Lo Byte	Hi Byte	Lo Byte		
0x03	0x03	0xB4	0xF8	0x0	0x1		

Variant 1. The response of the S2000-PP is a numeric value of temperature higher than 0.

Slave Address	Modbus Function	Data			CRC16	
		Byte Count	Temperature Value			
0x03	0x03	2	Hi Byte (integral part) 0x1A	Lo Byte (fractional part) 0x70		

The temperature value is in signed two’s complement fixed point data format: the high byte contains the integral part of the value while the low byte contains the fractional part of the value.

The sign of the value is stored in the high bit (b7) of the high byte: 0 for a positive value and 1 for a negative value.

How to decode the received value:

1) Concatenate the bytes:
   0x100 * Hi Byte + Lo Byte = 0x100 * 0x1A + 0x70 = 0x1A70 = 6768 (decimal)
2) T = 6768 / 256 = 26.4375 [°C]

So, the temperature is equal to 26.4375 degrees centigrade.

Variant 2. The response of the S2000-PP is a numeric value of temperature below 0.

Slave Address	Modbus Function	Data			CRC16	
		Byte Count	Temperature Value			
0x03	0x03	2	Hi Byte (integral part) 0xEC	Lo Byte (fractional part) 0xD0		

The temperature value is in signed two's complement fixed point data format: the high byte contains the integral part of the value while the low byte contains the fractional part of the value.

The sign of the value is stored in the high bit (b7) of the high byte: 0 for a positive value and 1 for a negative value.

How to decode the received value:

1) Concatenate the bytes:
   0x100 * Hi Byte + Lo Byte = 0x100*0xEC + 0xD0 = 0xECD0
2) Invert the bits:
   NOT(ECD0) = 0x132F
3) Add 1:
   0x132F + 1 = 0x1330 = 4912 (decimal)
4) T' = 4912 / 256 = 19.1875
5) "Apply the sign":
   T = T' * (– 1) = – 19.1875 [°C]

So, the temperature is equal to minus 19.1875 degrees centigrade.

If a high level language can be used to process received data then the received codes can be automatically converted to real numbers (including the signs).

Below is a conversion function in Delphi Pascal:

```
Function GetValue (hi: byte; low: byte): single;     // definition of the function, two parameters
                                                        are passed
Var valueSI: smallint;                               // local variable
Begin
    valueSI:= hi * 256 + low;                        // concatenation of bytes
    Result:= valueSI/256;                            // getting a result
End;
```

6.6.7. Request for the value of the S2000-ASR2 from the S2000-PP with the address 3:

Step 1. Setting the number of the zone to request for the counter value (the zone No.40):

Slave Address	Modbus Function	Data				CRC16	
		Register Address = 46180		Zone Number			
		Hi Byte	Lo Byte	Hi Byte	Lo Byte		
0x03	0x06	0xB4	0x64	0x0	0x28		

The response of the S2000-PP: confirmation:

Slave Address	Modbus Function	Data				CRC16	
		Register Address = 46180		Zone Number			
		Hi Byte	Lo Byte	Hi Byte	Lo Byte		
0x03	0x06	0xB4	0x64	0x0	0x28		

Step 2. Request for the value of the counter:

Slave Address	Modbus Function	Data				CRC16	
		Register Address = 46332		Quantity of Registers			
		Hi Byte	Lo Byte	Hi Byte	Lo Byte		
0x03	0x03	0xB4	0xFC	0x0	0x3		

The response of the S2000-PP is the counter value.

Slave Address	Modbus Function	Data		CRC16	
		Byte Count	Counter Value		
0x03	0x03	6	D1, D2, D3, D4, D5, D6		

The counter value occupies six bytes: the D1 is the highest byte while D6 is the lowest byte.

6.6.8. Request for the value of the output voltage of the RIP (loop No.1) from the S2000-PP with the address 3:

Step 1. Setting the number of the zone to request for the voltage (the zone No.41):

Slave Address	Modbus Function	Data				CRC16	
		Register Address = 46181		Zone Number			
		Hi Byte	Lo Byte	Hi Byte	Lo Byte		
0x03	0x06	0xB4	0x65	0x0	0x29		

The response of the S2000-PP: confirmation:

Slave Address	Modbus Function	Data				CRC16	
		Register Address = 46181		Zone Number			
		Hi Byte	Lo Byte	Hi Byte	Lo Byte		
0x03	0x06	0xB4	0x65	0x0	0x29		

Step 2. Request for the value of the voltage:

Slave Address	Modbus Function	Data				CRC16	
		Register Address = 46328		Quantity of Registers			
		Hi Byte	Lo Byte	Hi Byte	Lo Byte		
0x03	0x03	0xB4	0xF8	0x0	0x1		

The response of the S2000-PP is a numeric value of the voltage.

Slave Address	Modbus Function	Data			CRC16	
		Byte Count	Temperature Value			
0x03	0x03	2	Hi Byte (integral part) 0x0D	Lo Byte (fractional part) 0xD2		

The voltage value is in signed two’s complement fixed point data format: the high byte contains the integral part of the value while the low byte contains the fractional part of the value.

The sign of the value is stored in the high bit (b7) of the high byte: 0 for a positive value and 1 for a negative value.

How to decode the received value:

1) Concatenate the bytes:
   0x100 * Hi Byte + Lo Byte = 0x100 * 0x0D + 0xD2 = 0x0DD2 = 3538 (decimal)
2) U = 3538 / 256 = 13.82 [V]

So, the voltage is equal to 13.82 volts.

The GetValue function (see Clause 6.6.6 above) will also return the correct value of the voltage.

7. Standard Delivery

Find the following unpacking your S2000-PP:

1) S2000-PP Protocol Converter – 1 pcs.;
2) User's Manual – 1 pcs.;
3) Woodscrew 1-3x25.016 – 2 pcs.;
4) Wall Plug 6 x 30 – 2 pcs.;
5) Bolid Software CD – 1 pcs.;
6) Package – 1 pcs.

8. Manufacturer Information

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