RS-485/RS-232-TO-ETHERNET INTERFACE CONVERTER

S2000-Ethernet

User’s Manual

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This User's Manual is designed to help in studying of principles of operation and maintenance of the S2000-Ethernet converter of version 2.52.

1 S2000-Ethernet Description and Operation

1.1 General

1.1.1 S2000-Ethernet Interface Converter (hereinafter referred to as S2000-Ethernet) is designed to translate RS-485/RS-232 data to Ethernet and back. Can be used as part of an Orion, Orion Pro, or any other system.

1.1.2 The S2000-Ethernet is to be installed within protected premises and designed for round-the-clock operation.

1.1.3 The converter is not designed to be used in aggressive or dusty conditions or in explosive and flammable premises.

1.2 Specifications

1.2.1 The S2000-Ethernet is to be powered by an external 12 V / 24 V dc power supply with output voltage of 11 V to28.4 V. We recommend you to use Bolid manufactured battery backed power supplies RIP-12 or RIP-24.

1.2.2 Current consumed in quiescent mode:

- 90 mA max @ 12 V;
- 50 mA max @ 24 V.

1.2.3 RS-485/RS-232 Interface (half-duplex):

- Baud rate: 1200, 2400, 9600, 19200, 38400, 57600, 115200 bps;
- Start bits: 1;
- 8 data bits/1 stop bit or 8 data bits/2 stop bits;
- Parity: none;
- Max packet size: 255 bytes.

1.2.4 Ethernet Interface:

- Speed: 10 Mbps;
- Adjustable half / full duplex;
- Protocols: UDP, ICMP (ping), ARP;
- Receiving / transmitting unicasts and broadcasts;
- Max number of similar interface converters to which the S2000-Ethernet retranslates data over the Ethernet channel: 9 or 8 (depending on the configuration);
- Support operation in Ethernet networks of different topology («point-to-point», «star», «tree», «mesh»).

1.2.5 Dimensions: 102 mm x 107 mm x 39 mm.

1.2.6 Weight: 200 g max.

1.2.7 Ingress protection rating: IP20.

1.2.8 The pre-operation time after powering up doesn't exceed 3 s.

1.2.9 Operation Temperatures: minus 30 to +50°C

1.3 Standard Delivery

Table 1. S2000-Ethernet Standard Delivery

Item	Qty
S2000-Ethernet Interface Converter	1
This User's Manual	1
Wood Screws	3
Wall Plugs	3
DIN 7982 Flat Head Tapping Screw with Cross Drive 2.2x6.5	1
S2000-to-PC Cable (to connect the S2000-Ethernet to a PC)	Comes separately
Package	1

1.4 S2000-Ethernet Operation

1.4.1 Light Indication

READY LED is green, RS-232/RS-485 LED is green, ETHERNET LED is green.
Table 2 shows the behavior of READY and RS-232/ RS-485 light indicators.

Table 2. READY and RS-232/RS-485 Light Indicators

Light Indicator		Destination	
		On	***Off***
READY		The device is switched on	The device is switched off
RS-232 **RS-485**	Transparent Mode and Master/Slave Event Save Mode	Receiving data at the active interface: RS-232 or RS-485	No data received at the active interface: RS-232 or RS-485
	Configuration Mode	Receiving data over RS-232	No data received from RS-232

Light behavior of ETHERNET LED is shown in Table 3. ETHERNET LED also performs an additional function to indicate conditions of communications for all data communication directions. Light behavior is defined for each direction and the direction of the highest priority is activated. Potential directions are defined by IP addresses given in the remote device list of the converter as well as permission to connect to an unknown address (if permitted by the configuration and connection has been established). Light behavior highlighted with grey means that communication has been established and data can be communicated with all possible directions. The modes not highlighted with grey should draw your attention because they mean absence of an IP partner or gateway specified in the remote device list, or mismatching of Master Keys of the S2000-Ethernet and the IP partner, or remote device list's being empty. In the process of deriving a link channel and establishing a connection light behavior not highlighted with grey can be observed for a short time. But if, otherwise, this behavior is active for a long time then:

- Ensure the gateway and IP partners given in the configuration are physically available.
- Inspect the configuration of all IP partners of the converter.

Table 3. ETHERNET LED

	Behavior	S2000-Ethernet Operation Mode				
		Event Save Mode		Transparent		Configuring
		Slave	*Master*	*S2000-Ethernet 2.X*	*S2000-Ethernet 1.X*	
Low priority ↓ High priority	**Flashes on for 3 s and off for 0.25 s**	The list of remote devices is empty	The list of remote devices is empty	The list of remote devices is empty	The list of remote devices is empty	The list of remote devices is empty
	Lit steady	Established Connection	Established Connection	For last T_2 s data to be transmitted to RS-485/232 have been received	For last T_2 s data to be transmitted to RS-485/232 have been received	Established Connection
	Flashes: on for 1 s and off for 0.1 s	-	-	For last T_2 s data to be transmitted to RS-485/232 have not been received	For last T_2 s data to be transmitted to RS-485/232 have not been received	-
	Flashes: on for 2 s and off for 1 s	Communication has been lost for more than T_2 s	Communication has been lost for more than T_2 s	Communication has been lost for more than T_2 s	-	Communication has been lost for more than T_2 s
	Flashes: on for 1 s and off for 1 s	Communication is been establishing[1]	Communication is been establishing[1]	Communication is been establishing[1]	-	Communication is been establishing[1]
	Flashes: on for 0.25 s and off for 0.25 s	No link can be established because the device/gateway from Remote Device List is not available[2]	No link can be established because the device/gateway from Remote Device List is not available	No link can be established because the device/gateway from Remote Device List is not available[2]	No link can be established because the device/gateway from Remote Device List is not available[2]	No link can be established because the device/gateway from Remote Device List is not available[2]
	Off	Not connected to the local network				

T_2 stands for the configuration parameter Communication Failure Indication Delay (30 s by default)
Below are possible reasons for communication failures:
[1] - IP partner is absent (if the IP partner is in another network, beyond the gateway)
- Master Key of the device and Master Key of its IP partner don't match
[2] - The gateway is absent (if the IP partner is in another network, beyond the gateway)
- The IP partner is absent (if the S2000-Ethernet and the IP partner are within the same network)

1.4.2 Jumper Positions

Starting from the version 2.50, the position of the jumper on the terminal XP2 (see Figure 1) defines a group of the device operation modes: Working Group and Special Group. Squares shown in color mean set positions of the jumper.

Special Group comprises the configuration mode. It provides configuring the device (by means of UProg Configuration Tool) and updating the device version (by means of Orion_Prog program**) over the RS-232 interface**.

Working Group includes the transparent mode, the Master event save mode and the Slave event save mode. Any jumper position other than Config activates Working Group but doesn't specify the mode. The type of mode is defined by the configuration parameter **Operation Mode**.

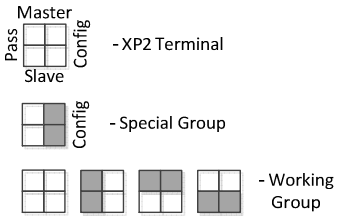


Figure 1. Selecting a Group of S2000-Ethernet Operation Modes

1.4.3 General S2000-Ethernet Application Diagrams

Figure 2 shows a general diagram for using the S2000-Ethernet as part either of an Orion system or any other system.

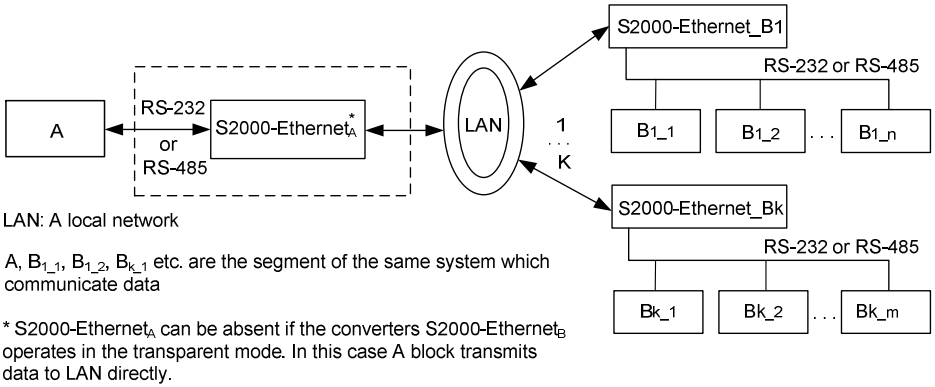


Figure 2. General S2000-Ethernet Application Diagram

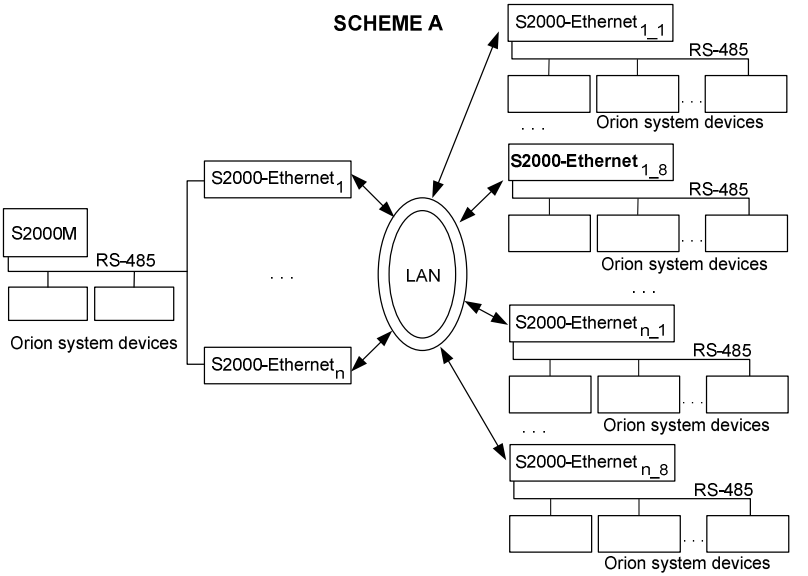
A single S2000-Ethernet can retranslate data to (maximum):

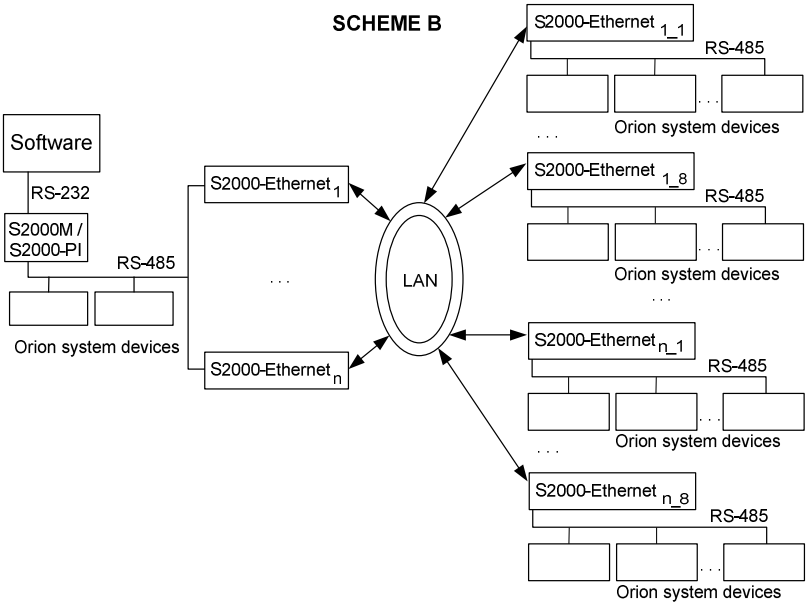
- 8 remote IP addresses if connection with an unknown address is permitted by the relevant configuration parameter;
- 9 remote IP addresses if connection with an unknown address is not permitted by the relevant configuration parameter.

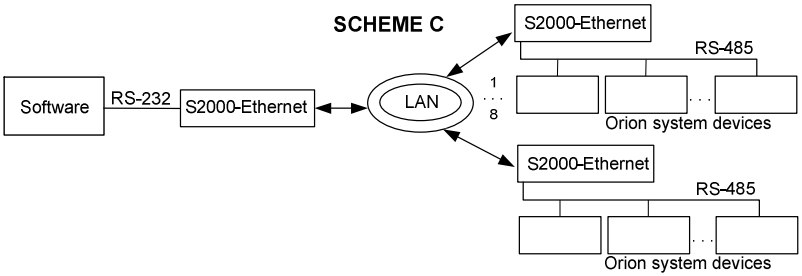
All the schemes shown above assume that connection with an unknown address is permitted.

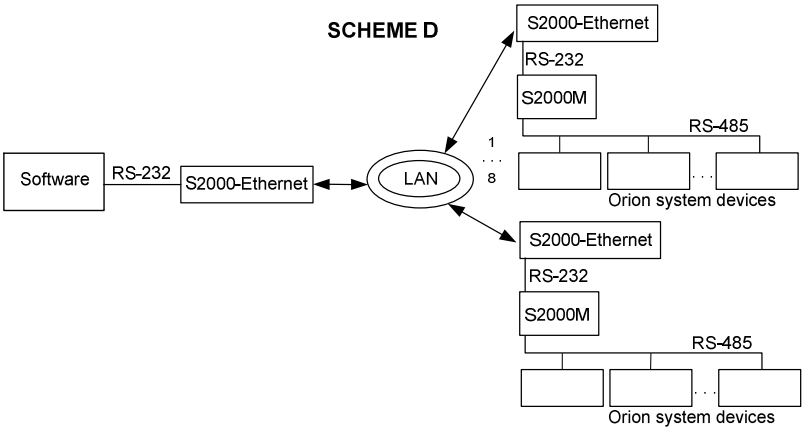
To increase the number of remote S2000-Ethernet converters, on the side «A» several S2000-Ethernet converters should be used. Each such S2000-Ethernet on the side «A» will retranslate data over the local network to its remote S2000-Ethernet converters (for example, Scheme B).

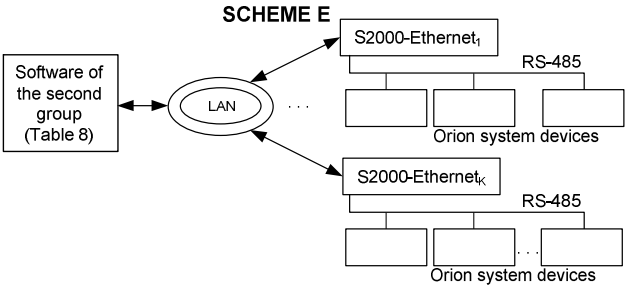
Figure 3 shows common diagrams (A – F) for using S2000-Ethernet within an Orion system.






SCHEME C
S2000-Ethernet
RS-485
Software
RS-232
S2000-Ethernet
LAN
1
8
Orion system devices
S2000-Ethernet
RS-485
Orion system devices


SCHEME D
S2000-Ethernet
RS-232
S2000M
RS-485
Software
RS-232
S2000-Ethernet
LAN
1
8
Orion system devices
S2000-Ethernet
RS-232
S2000M
RS-485
Orion system devices


SCHEME E
S2000-Ethernet1
RS-485
Software of the second group (Table 8)
LAN
Orion system devices
S2000-EthernetK
RS-485
Orion system devices

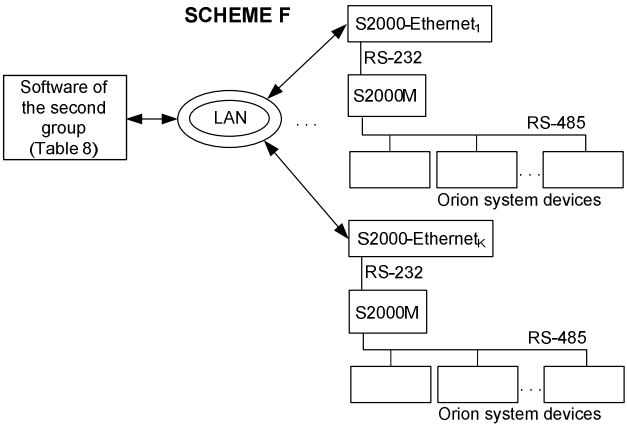


Figure 3. Common Diagrams for Using the S2000-Ethernet as a Component of an Orion System

1.4.4 Preparing the S2000-Ethernet for Operation

1.4.4.1 Configuring the S2000-Ethernet

Editing configuration parameters of the S2000-Ethernet is to be performed by means of **UProg** Configuration Tool. The last version of **UProg** is available at the site **http://bolid.com** in *Software* Section. Configuration parameters of the S2000-Ethernet along with their ranges and default values are shown in Table 5. Devices S2000-Ethernet of v.2.52 and higher support two ways to change device configuration: over the RS-232 interface (as before) and over the LAN (new). The relevant way to configure the S2000-Ethernet is to be selected by means of UProg **(such selecting is supported for UProg of v.4.1.0.52 and higher; configuring the S2000-Ethernet via a PC COM port is supported by all versions of UProg)**. Detailed instructions how to configure devices over the local network with the help of UProg is available at the site **http://bolid.com** (Section "Software").

Configuring the S2000-Ethernet over the RS-232. To configure the S2000-Ethernet over the RS-232, connect the S2000-Ethernet to a COM port of the PC and switch the device in the configuration mode (jumper position: Config) – see Figure 1.

Configuring the S2000-Ethernet over the LAN (with the help of Orion 2 Device Interface Protocol Service). The factory value of the IP address of the S2000-Ethernet is **192.168.127.254**. The device can be configured **over the LAN** in all operation modes (including Config). To have an access to the device configuration over the LAN, do the following in UProg:

- Set Orion 2 service access parameters (for communicating with devices using the Orion 2 protocol): specify the IP address of the PC where the service has been installed and the service port.
- Select the Orion 2 Service branch in the Device Tree and add a new line specifying the parameters as shown in Table 4.

Access to reading and changing of the device configuration is granted if:

- IP address of the PC with the service «Orion 2 - Device Interface Protocol» is specified in Remote Device List in S20000-Ethernet configuration. In this case, to have an access to the S2000-Ethernet the following configuration parameters of the S2000-Ethernet are required: UDP port (with the default value of 40000) and the Master key of the relevant record of Remote Device List;
- IP address of the computer where the driver has been installed **is not specified** in the list of remote devices, but connection with the unknown address is permitted in the device configuration (it is permitted by default) and this connection is not occupied by anybody at the moment. In this case, to access the S2000-Ethernet the following configuration parameters are required: UDP port of the S2000-Ethernet for unknown address (factory value 40001) and Master key for unknown address.

Factory values of Master keys of the device correspond to the default values in the UProg. If the computer where the driver is installed and the device are located in the same local network then to detect the S2000-Ethernet with the help pf UProg you should use either broadcast search (activated in UProg by default) or adding by IP address. If the computer where the driver is installed and the device are in different local networks then to detect the device by UProg you need to use the procedure of adding by IP address; in this case IP address of the S2000-Ethernet should be specified in the relevant menu. Please take into account then to detect the S2000-Ethernet located in the other local network, the configuration of the S2000-Ethernet should include the IP address of the gateway through which the other network can be accessed.

Table 4. Matching between Parameters of the UDP Line and the S2000-Ethernet in UProg

<table>
<tr><th colspan="2" rowspan="2">UProg Parameters</th><th colspan="4">Configuration Parameters of the S2000-Ethernet</th></tr>
<tr><th colspan="2">IP address* is included in the list of remote devices</th><th colspan="2">IP address* is not included in the list of remote devices</th></tr>
<tr><td rowspan="4">UDP-Port of the Line</td><td rowspan="2">Use the Same Port for Reading and Writing</td><td colspan="2">UDP Port Type of the Remote Device</td><td colspan="2">UDP Port Type of the Remote Device for an Unknown Address</td></tr>
<tr><td>Static</td><td>Dynamic</td><td>Static</td><td>Dynamic</td></tr>
<tr><td>On</td><td>UDP port of the remote device</td><td>-**</td><td>UDP port of the remote device for an unknown address</td><td>-**</td></tr>
<tr><td>Off</td><td>UDP port of the remote device</td><td>Invalid Combination</td><td>UDP port of the remote device for an unknown address</td><td>Invalid Combination</td></tr>
<tr><td colspan="2">UDP Port of Remote Devices</td><td colspan="2" rowspan="2">UDP Port of the S2000-Ethernet</td><td colspan="2" rowspan="2">UDP Port of the S2000-Ethernet for an unknown address</td></tr>
<tr><td colspan="2">UDP Port of the Device (to be given when the device is added manually)</td></tr>
<tr><td colspan="2">IP Address of the Device (to be given when the device is added manually)</td><td colspan="2">IP address of the S2000-Ethernet</td><td colspan="2">IP address of the S2000-Ethernet</td></tr>
<tr><td colspan="2">Master Key</td><td colspan="2">Master key of the relevant IP record- of the Remote Device List</td><td colspan="2">Master key for an unknown address</td></tr>
</table>

IP address* stands for the IP address of the computer where «Orion 2 - Device Interface Protocol» service is working

** The value of the listening UDP port of a remote device is dynamically updated from Source UDP Port ("Write Line UDP Port") of incoming packets. “Write Line UDP Port” takes the same value as “Line UDP Port” if the parameter «Use the Same Port for Reading and Writing» is active; otherwise the IP address* opens any vacant UDP port.

Please find out the IP address of the S2000-Ethernet, IP address of the gateway, and the subnet mask from the administrator of that local network where the device is to be installed.

Table 5. Configuration Parameters of the S2000-Ethernet

Group	Parameter	Range	Default Value and Format
RS-485/RS-232 Settings			
RS-485/RS-232	Operation Mode	Master; Slave; Transparent	Transparent
	S2000-Ethernet Address for Configuring over RS-232	1…127	127
	Interface Type	RS485; RS232	RS485

Group	Parameter	Range	Default Value and Format
	Baud Rate	1200; 2400; 9600; 19200; 38400; 57600; 115200	9600
	Data Bits and Stop Bits	8 data bits, 1 stop bit; 8 data bits, 2 stop bits	8 data bits, 1 stop bit
	Protocol	Other; Orion; Orion Pro	Orion
Extended Settings for Transparent Mode	Extra Attributes of Data Packing:	Timeout	Off
		Length	Off
		Delimiter	Off
		If Timeout is not set, RS-485/RS-232 data are transmitted to the local network when since receiving the last byte the time has elapsed equal to the time to transmit two bytes	
	Timeout (ms)	0 … 4095	0
	Maximum Sending Size	1…255	0
	Delimiter (hexadecimal form)	0…FF	0
	Delimiter Action (if active)	• Send All Data With Delimiter; • Send All Data Without Delimiter; • Receive One Byte More After Delimiter and Send	Send All
	Make a Pause on Sending	On; Off	Off
	Sending Pause (ms)	0…4095	0
Extended Settings of Master Mode	Generate Messages about Access Events	On; Off	On
Ethernet Settings			
Device Network Settings	Communication Mode	Half-duplex; full-duplex	Half-duplex
	MAC Address	Should be the same as the MAC address on the S2000-Ethernet board under the barcode	Read-only, 6 hexadecimal numbers (e.g.: 00:18:BC:09:F5:07)
	IP Address of S2000-Ethernet	–	192.168.127.254
	Subnet Mask	–	255.255.255.0
	Gateway	–	0.0.0.0
	UDP Port of S2000-Ethernet	0…65535	40000
	Acknowledgement Timeout (ms)	1…65535	80
Remote Device List (Routing Table)*	IP addresses of remote devices to which data are retranslated over the Ethernet (IP Address)	–	192.168.127.1 0.0.0.0 0.0.0.0 0.0.0.0 0.0.0.0 0.0.0.0 0.0.0.0 0.0.0.0 0.0.0.0
	Remote Device UDP Port	0…65535	9 UDP ports 40000

Group	Parameter	Range	Default Value and Format
	Remote Device UDP Port Type	Dynamic; Static	Static
	Compatibility	S2000-Ethernet (Auto) S2000-Ethernet 1.X; S2000-Ethernet 2.X; Other devices	S2000-Ethernet (Auto)
	Master Key (Encryption Key)	–	9 Master keys (only for writing)
Connection with an Unknown Address	An Unknown Address Permitted	On; Off	On
	S2000-Ethernet UDP Port for Unknown Address	0…65535	40001
	Remote Device UDP Port (Only for static UDP port)	0…65535	40001
	UDP Port Type for Unknown Address	Dynamic; Static	Static
	Master Key for Unknown Address	–	Only for writing
Link Control	Search Time (s)	1..255	10
	Connection Lifetime (s)	1..255	120
	Communication Failure Indication Delay (s)	1..255	30

Description of Configuration Parameters

➢ **RS-485/RS-232 Settings**

Group «RS-485/RS-232»

- **Operation Mode:**

  – ***Transparent Mode.*** Transmits data from the RS-232 or RS-485 interface to Ethernet and back. Designed to be used both as a part of an Orion system (for protocols Orion and Orion Pro) and for another systems (see Figure 2).

  – ***Master Event Save Mode*** (S2000-Ethernet-Master). Polls the devices in the remote segment of the RS-485 interface. The event log can store up to 255 events. This mode is used only in a system with the Orion communication Protocol.

  – ***Slave Event Save Mode*** (S2000-Ethernet-Slave)**.** Gathers data from the remote S2000-Ethernet (from S2000-Ethernet-Master) and transfers them to a Master-device of the system such as Orion Workstation, Orion Pro Workstation or other software (only for Orion protocol), or S2000M console. The event log can store up to 255 events.

  The system of S2000-Ethernet devices shall be built in accordance with one of the two following rules:
  1) All devices operate in transparent mode;
  2) All devices operate in save modes. An event save mode (compared to the transparent mode) increases the speed of communication between Orion system devices and decreases the size of data transmitted over the local network. S2000-Ethernet converters connected to a Master device of the system operate in the Slave Event Save mode while all remote S2000-Ethernet converters operate in the Master Event Save mode. Master device of the system is the software which implements polling in Orion protocol or an S2000M console.

- **Interface Type:**

  Select the type of the interface which data the configured S2000-Ethernet is supposed to translate to the local network.

  For the transparent mode, that interface is to be activated which is defined by this configuration parameter.

  For Master and Slave modes, an active interface is to be searched. Search begins with the interface which is written in the configuration parameter. Please take into account that the

active interface is searched once on powering up the device (including resetting the device and changing its configuration). Setting Interface Type in a mode with saving events is nor obligatory, but for faster searching of the active interface we recommend you to specify the interface being in use.

- **Protocol:**

  For Master and Slave modes select the "Orion" value.

  For Transparent Mode the protocol type defines the rules of optimization and sending data to RS-232/RS-485 and Ethernet:

  Orion - The mode with optimizing data. Only three last packets are retranslated to the interfaces. In case of more packets the older packets are considered as outdated and are discarded. If extended settings for the transparent mode are not given then:
    a) When data are being received in the RS-232/RS-485 interface then the packet terminator is a pause equal to a time to transmit three bytes;
    b) When data (received from the local network) are being sent to the RS-232/RS-485 interface then between the packets a pause is inserted equal to a time to transmit three bytes.

  Orion Pro, Other - The modes without optimizing data. All data received in one interface are retranslated to another interface. If extended settings are not defined for the transparent mode than:
    a) In the RS-232/RS-485 interface the packet terminator is a pause equal to a time to transmit three bytes;
    b) Packets received from the local network are sent to the RS-232/RS-485 interface without pauses.

  When the S2000-Ethernet is used within an Orion system:
  - Orion Pro protocol (including «Other») is correct only for that connection diagram in which the S2000-Ethernet retranslates data between the computer and an S2000M console if in operating condition the console is in the S2000 & PC mode.
  - Orion protocol is correct for all connection diagrams.

  When using the S2000-Ethernet as part of a third-vendor system, you can select any protocol: with optimization ("Orion") or without optimization ("Orion Pro", "Other"). If necessary you can correct the rules of transmitting data for selected protocol type using extended settings for the transparent mode.

  Note: The protocol "Orion Pro" is used within the segment of communicating data between a computer and an S2000M console being in the S2000 & PC mode. In other segments of the Orion system as well as in the segment between the computer and an S2000M console being in the S2000 / PC mode or Programming mode, the Orion protocol is used.

- **Baud Rate:**

  The baud rate for operating the S2000-Ethernet over the interface RS-232/RS-485.

  For Master and Slave modes the value of the parameter is defined by the selected type of the protocol. This parameter cannot be changed for these modes.

  For the transparent mode:

  When using the S2000-Ethernet as part of an Orion system, set the value of this parameter to
  - 9600 or 19200, if the S2000-Ethernet retranslates data between the computer and the S2000M console operating in the S2000&PC mode. This value must be the same as the baud rate of the console over the RS-232;
  - 9600 for another connection diagrams.

  Using the S2000-Ethernet in a third-vendor system set this parameter to a value which is relevant for working conditions of this system.

- **Data Bits and Stop Bits:**
  The setting is relevant only for the transparent mode. When using the S2000-Ethernet as part of an Orion system, select «8 data bits, 1 stop bit». When using the S2000-Ethernet as part of a third-vendor system, set the value in accordance with working conditions of this system.
- **RS-232 Address:**
  The address of the S2000-Ethernet, in order to access this one over the RS-232 interface. In particular, this is the address at which the program «UProg.exe» detects the S2000-Ethernet. The S2000-Ethernet is an addressable device in the RS-232 interface only in configuration mode.

Group «Extended Settings for Master Mode»

- **Generate Messages about Access Events:**
  If this attribute is set on the S2000-Ethernet independently informs Orion system devices in the local interface RS-485/RS-232 about granting access and passages generated by the devices of this interface. In such a way the devices of the local interface are informed about the events mentioned above more quickly that is important when using anti-passback rules in an access control system. In such case the SC2000-Ethernet does not translate to the interface similar information received from the main Master device of the system (a console or software). This attribute is used exclusively in the Master Event Save Mode when the S2000-Ethernet is a Master device for the local interface RS-485/ RS-232.

Group «Extended Settings for Transparent Mode»

- **Make a Pause on Sending:**
  If this attribute is set on then after transferring a portion of data received from the local network to the RS-232/RS-485 interface a pause must be made. For an Orion system it is sufficient to specify the type of the protocol in use and is not recommended to set this attribute (in this case presence of a pause and the pause value is defined by the selected type of the protocol).
- **Sending Pause:**
  The value of the pause which must be made after sending data to the interface RS-232/RS-485 before sending the subsequent data received from the local network. The parameter is considered only if the relevant attribute, Make a Pause on Sending is set on.
- **Extra Attributes of Data Packing:**
  For Orion and Orion Pro systems we recommend you not to set this parameter on, that is, to keep this parameter at its default value.
  If Extra Attributes of Data Packing are set off then data of RS-485/RS-232 are transmitted to the local network if after receiving the last byte the time has elapsed equal to the time to transmit 3 bytes (according the established transmission rate).
  Extra attributes of packing data are the additional marks with which the S2000-Ethernet understands that the data received over RS-232/RS-485 shall be transmitted to the Ethernet network.
  This parameter and the relevant settings below are designed to be used in third-vendor systems. If necessary you can set on one or several attributes of packing data. RS-232/RS-485 data will be transmitted to the local network if at least one of the set attributes is true.
  - **Delimiter:**
    The delimiter is a byte which receiving causes the S2000-Ethernet to send data received over the RS-232/RS-485 interface to the local network (in accordance with the rules defined by the subsequent parameter, Delimiter Action). This parameter is given in the hexadecimal form. The parameter is considered only if the Delimiter flag is set on.
  - **Delimiter Action:**
    The parameter defines what should be done with the delimiter and RS-232/RS-485 data after receiving the byte of the delimiter.

- *Send All Data with Delimiter*: After receiving the delimiter to transmit to the local network all received bytes and the delimiter.
- *Send All Data without Delimiter*: After receiving the delimiter to transmit to the local network all received bytes without the delimiter.
- *Receive One Byte More after Delimiter and Send*: After receiving the byte of the delimiter to receive one byte more and transmit to the local network all received bytes.

The parameter is considered if only the relevant attribute, Delimiter is set on.

- **Timeout:**

  If no data have been received over RS-232/RS-485 within the time given by this parameter then data received until this moment must be transmitted to the local network.

  The value of the parameter is considered only if the relevant attribute, Timeout is set on. If the given timeout is less than the time to transmit 2 bytes (according to the established transmission rate) it will be automatically round up to the time to transmit 2 bytes.

  If Timeout is not set on then the received data are transmitted to the local network as soon as after receiving the last byte the time has been elapsed equal to the time to transmit 3 bytes (according to the established transmission rate).

- **Maximum Sending Size:**

  The number of bytes which must be received before transmitting the data to the local network. The value of the parameter is considered if the relevant attribute, Maximum Sending Size is set on.

➢ Ethernet Settings

Group «Device Network Settings»

- **IP address of S2000-Ethernet:**

  Enter the IP address which the S2000-Ethernet will be assigned to in the local network.

- **Subnet Mask and Gateway:**

  Enter the subnet mask and the IP address of the gateway through which access to another network will be granted. A set of the devices in the subnetwork are defined by the subnet mask. For instance, for the mask 255.255.254.0 devices are located in the same local network if all 23 bits of three high bytes of their IP addresses coincide. If at least in one bit from the 23 bits the addresses disagree then the devices are located in various networks.

- **UDP Port of S2000-Ethernet:**

  UDP Port of S2000-Ethernet is the UDP port which is open in the S2000-Ethernet for receiving / transmitting data in those cases when the S2000-Ethernet communicates data with IP addresses included to the list of remote devices (the S2000-Ethernet sends data from this UDP port and expects to receive data at this UDP port). Be default, it is the port 40000.

- **Communication Mode:**

  The mode of communication of the S2000-Ethernet over the local network: *half-duplex* or *full-duplex*. Automatically network equipment detects the S2000-Ethernet as a half-duplex device. The S2000-Ethernet can operate in full-duplex mode only if it is connected to a managed network device (which can be manually configured to operate at selected ports, for example, a managed switch or router). If extended setting of the network equipment is not expected, we strictly recommend you to keep half-duplex mode.

- **Acknowledgement Timeout:**

  This is a time-out for waiting a reply acknowledging receiving data (an acknowledgement from the IP address).

  Acknowledgement Timeout = The time to transmit a packet to an IP address * 2 + 50 ms

  *«The time to transmit a packet to an IP address * 2»* is equal to the ping's round trip time (RTT). If RTT is less or equal to 30 ms then remain Acknowledgement Timeout equal to 80 ms (as set by default). So, issue a ping from any computer in the local network at the side of

the programmed S2000-Ethernet to IP partners enrolled in the remote device list (or to the computers located in the local networks where the IP partners enrolled in the remote device list are). In such a way we define the acknowledgement time-out for all the IP addresses. Then find the maximum RTT. If this RTT exceeds 30 ms then add 50 ms to this value and write the final value to the parameter "Acknowledgement Timeout". A ping command is entered in the command line of the computer in the following format:

Ping X -n Y
Ping X -t,

where: **X** stands for the IP address or name of the computer within LAN,
n specifies the number of requests sent by a ping command,
Y stands for the number of repeated ping commands,
t specifies that ping continue sending requests until interrupted.

For example: ping 192.168.10.98 -n 100
ping 192.168.10.98 -t

A command «ping –t» provides detecting failures in the communication channel namely in the cases when there is no reply or RTT is significantly more than an average device reply time. We recommend you to ensure the communication channel is stable. Acknowledgement Timeout must be set taking into account the maximum round-trip time.

Group «Remote Device List»

- **IP Address:**
  Enter the IP addresses of remote devices to which the S2000-Ethernet will retranslate data over the local network. For example, for the Slave Event Save Mode enter the IP addresses of all S2000-Ethernet-Master converters, while for the Master Event Save Mode enter the IP address of the S2000-Ethernet-Slave converter (see Figure 3 for clarity).

  Warning: In the configuration of a S2000-Ethernet-Master the IP address of the S2000-Ethernet-Slave must be written in the first record of the list of remote devices.

  Warning: Starting with the version 2.50, a single S2000-Ethernet can retranslate data maximum to:
  - 8 remote IP addresses if connection with an unknown address is permitted;
  - 9 remote IP addresses if connection with an unknown address is not permitted.

- **Remote Device UDP Port:**
  This is the listening UDP port which is open for receiving data at the relevant remote device (UDP port to which the S2000-Ethernet transmits data to the remote IP address). The value of UDP port of the remote device can be dynamically updated during device operation (this is defined by the type of the UPD port of the remote device). The default is port 40000.

- **Remote Device UDP Port Type:**
  If *static* port is selected then on sending a packet the destination UDP port will be specified as the value of Remote Device UDP Port which is defined for the current IP record in the remote device list. If *dynamic* port is selected than the destination UDP port at first takes a value specified by Remote Device UDP Port for the current IP record of the remote device list but in operation this value is dynamically updated from Source UDP Port of incoming packets. Dynamic port is relevant for a network where the communication channel between the S2000-Ethernet and a remote device is implemented with the help of the port forwarding rules which are given at the gateway through which other subnet is to be accessed. In this case the dynamic port type is relevant for an S2000-Ethernet to which from this gateway data are retranslated, because it may not be known in advance which UDP port will be open at the gateway to retranslate data.

- **Compatibility:**
  Here the rules of intercommunication with each IP record in the list of remote devices are defined. If the S2000-Ethernet retransmits data to other S2000-Ethernet converters or Orion system software then it is recommended:

1. To use the value «S2000-Ethernet (Auto) for all IP addresses except for those which are specified below in the clause 2.
2. For all the S2000-Ethernet converters v2.15 specified at the list of remote devices set the parameter to the value «S2000-Ethernet 1.X» if the system operates in the transparent mode and is built in accordance with Scheme A or Scheme B in Figure 3 (and several Orion system devices or several S2000-Ethernet converters are located in the RS-485 segment of the central S2000-Ethernet).

The parameter is used both in event save modes and in the transparent mode. On selecting a value «S2000-Ethernet» the device will automatically detect maximum capabilities of a partner. Operating in the Transparent mode with capability «S2000-Ethernet 1.X» the S2000-Ethernet doesn't provide delivery reliability and encryption. These functions are the responsibility of higher protocols and must be monitored and provided by devices which data are retranslated using S2000-Ethernet converters. Compatibility «S2000-Ethernet 2.X» is supported by S2000-Ethernet converters of version v.2.05 and higher.

For compatibility with third-party developments, a possibility to translate data without using internal headers has been implemented. For this purpose, the device should operate in the Transparent mode while Compatibility should be set to Other Devices value. In this case RS-232/RS-485 data are translated to Ethernet in UDP packets where data segments contain only data of the RS-232/RS-485 interface. As Other Devices we can consider in particular interface converters of other manufacturers which retranslate RS-232/RS-485 data to a local network using UDP.

- **Master Key:**

  Master Key is used in the Transparent mode if devices intercommunicate with Compatibility «S2000-Ethernet 2.X» and in an event save mode. If necessary, to increase privacy of data translated over the local network you can change the Master Key for each remote device (by default a single key is used for all connections). Please be careful: on changing a Master Key specify the same Master Key in configuration of the relevant remote device (for example, for the event save mode the same Master Key must be given both for the S2000-Ethernet-Slave and for the S2000-Ethernet-Master).

Group «Connection with Unknown Address»

- **An Unknown Address Permitted:**

  If this attribute is set on then the S2000-Ethernet is permitted to communicate data with an IP address not included in the list of remote devices (in this case the IP address should initiate the connection). Simultaneously only a single connection with an unknown address is permitted. To connect to an unknown IP address the following parameters should be specified: S2000-Ethernet UDP Port for Unknown Address and Master Key for Unknown Address.

- **S2000-Ethernet UDP Port for Unknown Address:**

  This is a UDP port which the S2000-Ethernet opens to send / receive data when the S2000-Ethernet communicates data with IP addresses not included on the remote device list (the S2000-Ethernet sends data from this UDP port and waits for receiving data from this UDP port). The default is port 40001.

- **Master Key for Unknown Address:**

  Master Key for Unknown Address is designed to limit access to the converter for IP addresses not included in the remote device list. Please be careful: changing Master Key for Unknown Address, do not forget to change the relevant Master Key for the relevant IP address (software or other device).

- **Remote Device UDP Port for Unknown Address:**

  Remote Device listening UDP Port for Unknown Address is the UDP port which is open to receive data at the IP address which is not included to the remote device list (the S2000-Ethernet sends data to this UDP port). The value of the UDP port for unknown

remote device can be dynamically updated in operation (it is defined by the type of UDP destination port). The default for each IP record is port 40001.

- **Remote Device UDP Port Type for Unknown Address:**
  Is *static* port is specified then the destination UDP port is equal to the value given by the parameter «Remote Device UDP Port for Unknown Address». If *dynamic* port type is specified then the value of Remote Device UDP Port for Unknown Address is filled in and updated in operation from the field Source UDP Port of incoming packets. Dynamic port is relevant for a network structure where the communication channel between the S2000-Ethernet and a remote device is implemented using the rules of port forwarding specified for the gateway through which another subnetwork can be reached. In this case dynamic port type is relevant for the S2000-Ethernet to which this gateway retranslates traffic, because the number of the UDP port open at the gateway for retranslating data can be unknown prior to operation. The default port type is static.

Group «Link Control»

- **Search Time:**
  The parameter performs two functions:
  1. In case of a communication loss it defines the period for trying to establish a connection (or to get service information). By such a way, useless traffic resulting from trying to connect with a missing remote device can be minimized. The parameter is used in all operation modes of the device (except for the configuration mode).
  2. If a connection has been established the parameter defines to period of checking connectivity. In accordance with the given period the S2000-Ethernet sequentially checks communication with all remote devices connection with which has been established before. The parameter is used in the Transparent mode if the devices communicate in the second version of the internal protocol (Compatibility S2000-Ethernet (Auto), S2000-Ethernet 2.X) and in the mode with saving events.

- **Connection Lifetime:**
  The value of this parameter must exceed at least twice the Search Time and must exceed Communication Failure Indication Delay. The parameter performs several functions:
  1. Defines a delay between a moment of time when the device has found link disconnection and a moment of time the device registers a communication loss. Operating in the Slave Event Save Mode, the S2000-Ethernet-Slave dose not loss the devices connected to the relevant direction of the S2000-Ethernet-Master during this time.
  2. Within this time efforts are taken to establish connection or to receive service information from the S2000-Ethernet for which a communication failure has been detected. In case of not restoring connection within this time than next effort to restore connection (or to receive service information) are carried out in accordance with Search Time.

- **Communication Failure Indication Delay:**
  The parameter Communication Failure Indication Delay must be less than Connection Lifetime. The parameter performs several functions defining a time-out since the moment X on elapsing which ETHERNET LED switches to the relevant light mode (the parameter T_2 from Table 3):
  1. In case of encrypted communication with an IP address the parameter defines the delay in indicating by ETHERNET LED the fact of communication loss since the moment the communication loss has been detected.
  2. For the Transparent mode the parameter defines the time since payload designed to be transmitted to RS-232/485 have not been received on elapsing which ETHERNET LED switches to the relevant indication mode.

  For example, the default values can be replaced with the following values:
  – Search Time: 5 s;
  – Communication Lifetime: 10 ;
  – Communication Failure Indication Delay: 3 s.

The device provides a possibility to change some configuration parameters by means of combinations of short and long presses on the tamper switch located on the device PCB. A long press means pressing and holding the tamper switch pressed for more than a half of second but less than 6 s. A short press means pressing and holding the tamper switch pressed for 0.02…0.5 s. A pause between presses should be at least 0.02 s. Not pressing the tamper switch for more than 2 s is considered as the end of pressing. Pressing the tamper switch for more than 6 s cancels the press combination. All possible combinations and their destination are shown below:

- Resetting the device settings to default values: short-short-long-long-short-short-long-long;
- Changing the type of the interface RS-232/RS-485: short-short-short-long-long;
- Unsetting the RS-232 address and time parameters of operation in the interface for Master/Slave modes (the time parameters which are set with the help of RS485Settings): long-long-long-short.

1.4.4.2 Settings Timeouts and Delays

Table 6. Parameters of RS-232/RS-485 to Be Changed

Master Device of the System	Operation Mode of the S2000-Ethernet	
	Transparent	***Event Save (only Orion protocol)***
Orion Workstation, Orion Pro Workstation, and other software	Request Waiting Timeout* [1] Broadcast Turnaround Delay (only for Orion Protocol) [1] Command Waiting Timeout [1]	Request Waiting Timeout ≥ 80 ms Broadcast Turnaround Delay [1] Command Waiting Timeout [3]
UProg, PProg	Request Waiting Timeout [1] Command Waiting Timeout [1]	Request Waiting Timeout ≥ 80 ms Command Waiting Timeout [1]
S2000M	Session Delay Without Change of Direction [4] Search Timeout* [1] Broadcast Turnaround Delay [1] Event Request Timeout *[1] Command Request Timeout [1]	Search Timeout ≥ 50 ms Broadcast Turnaround Delay [2] Event Request Timeout ≥ 80 ms Command Request Timeout[3]
Orion Pro Workstation, UProg and other software for emulating a virtual COM port	Broadcast Turnaround Delay (for Orion protocol) ≥ 10 ms. LAN Transmission Timeout ≥ T	Not used
Third-vendor systems	Relevant software timeouts [1]	Not used

Note:

***** – The value of the parameter must be calculated by formula and the double value must be used if more than one central S2000-Ethernet converter is located within a single RS-485 segment (e.g., the scheme B in Figure 3).

1 – The value of the parameter is calculated by formula:

$$P_{(1)} \geq X + T + 15 * N\,(ms)$$

2 – The value of the parameter is calculated by formula:

$$P_{(2)} \geq X + T + \frac{15 * N}{Y}\,(ms)$$

3 – The value of the parameter is calculated by formula:

$$P_{(3)} \geq X + T\,(ms)$$

4 – The value of the parameter is calculated by formula:

$$P_{(4)} \geq P_{(2)} - 30\,(ms)$$

For all formulae:

X stands for the default value of the parameter;

T stands for the configuration parameter of the S2000-Ethernet, Acknowledgement Timeout;

N stands for the number of IP addresses with which the S2000-Ethernet communicates data (in fact, this is the number of used records in the list of remote devices);

Y stands for the console parameter Broadcast Repeat Number (by default it is 6; must be at least 3).

Before using the SC2000-Ethernet as a part of an Orion system it is necessary to change settings of the S2000M console and software as recommended in Table 6. Software parameters can be changed with the help of the program **«Settings.exe»** (Table 8). S2000M console parameters can be changed with the help of the program **«RS485Settings.exe»**. These programs can be downloaded for free from the site **http://bolid.ru**.

For S2000-Ethernet converters of earlier versions, the recommendations for setting time parameters differ from those shown below. If S2000-Ethernet of various versions (v.1.15, v.2.15 and v2.50 and higher) are used in a single systems then time parameters of software and the console should be adjusted in accordance with the recommendations of the current Manual.

Before using the SC2000-Ethernet as a part of a third-vendor system it is necessary to take into consideration that S2000-Ethernet converters bring delays in data communications. You should increase the relevant timeouts for devices or software in accordance with recommendations in Table 6.

Table 7. Summary Table of Parameters for T = 80 ms, N = 9 and Y = 6 (See above)

Master Device of the System	Operation Mode of the S2000-Ethernet	
	Transparent	***Event Save***
Orion Workstation, Orion Pro Workstation, UProg, PProg and other software	Request Waiting Timeout [1] ≥ 245 ms Broadcast Turnaround Delay (only for Orion protocol)[1] ≥ 215 ms Command Waiting Timeout [1] ≥ 815 ms	Request Waiting Timeout ≥80 ms Broadcast Turnaround Delay [1] ≥215 ms Command Waiting Timeout [3] ≥ 680 ms
S2000M Console	Session Delay Without Change of Direction [4] ≥ 100 ms Search Timeout[1] ≥ 225 ms Broadcast Turnaround Delay [1] ≥ 215 ms Event Request Timeout [1] ≥ 240 ms Command Request Timeout [1] ≥ 800 ms	Search Timeout ≥50 ms Broadcast Turnaround Delay [2] ≥ 110 ms Event Request Timeout ≥ 80 ms Command Request Timeout [3] ≥ 680 ms
Orion Pro Workstation, UProg and other software (virtual COM port)	Broadcast Turnaround Delay (only for Orion protocol) ≥ 10 ms. LAN Transmission Timeout ≥ 100 ms.	Not Used

In order the S2000-Ethernet to operate as a virtual COM port, the parameter Data Communicating Device (WorkType) is to be set to «S2000-Ethernet». In this case software (Orion Pro Workstation, UProg etc.) for the selected logical COM port will communicate data not through the COM port of the computer but via the network card (local network). The parameter WorkType is to be set with the help of Settings.exe.

In Table 8 you can see the versions of software for which (and for the versions which are higher) setting of all parameters specified in Table 5 is supported.

Settings.exe of versions lower than **v.2.00 build 14** doesn't support setting Broadcast Turnaround Delay (PauseTotalCommand) and Data Communicating Device (WorkType). In this case a more recent version of **Settings.exe** should be downloaded**.**

Software operating in Orion Pro protocol as well as UProg and PProg do not use the Broadcast Turnaround Delay parameter (PauseTotalCommand) even though it is presented in the list of parameters. Orion Pro protocol is used for communicating data between a computer and an S2000M

console in the S2000&PC mode. In other segments of the Orion system and in the segment between the computer and the S2000M console in the S2000/PC mode or in the Programming mode, Orion protocol is used.

Table 8. The List of Software which Specifies Where to Set Time Parameters

Group	Software	Version	Settings Software Tab
First	Orion	v.7.6+	Common RS
	UProg[1]	All versions	
	PProg[1]	All versions	
	ComServer	v.1.15+	
Second	Orion Pro	v.1.11+	Port_N, where **N** stands for the number of the COM port for communicating data
	S2000 Workstation	v.2.06 build 28+	
	Orion Control Module	v.1.22+	
	UProg[2]	All versions	
	PProg[2]	v3.1+	

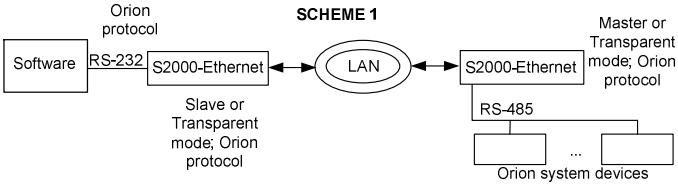
WARNING: Software with footnotes (UProg and PProg) depending on the value of Data Communicating Device given on the Port_N tab uses the values of the time parameters either from RS tab or from Port_N tab, where N stands for the number of the used COM port. In this case:

[1] - Data Communicating Device = «COM Port of PC» (ObmenComPort)

[2] - Data Communicating Device = «S2000-Ethernet» (ObmenEthernet)

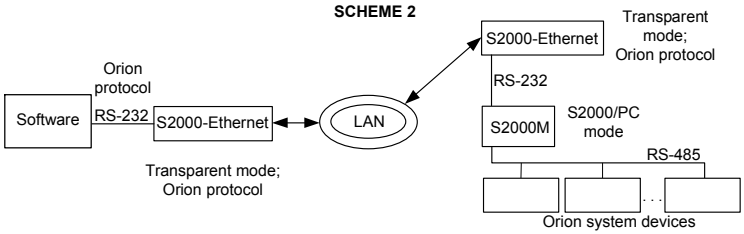
1.4.5 Typical Schematics for Using the S2000-Ethernet as Part of an Orion system

In the figure "Scheme 1" below the S2000-Ethernet converters retranslate data communications of Orion protocol between software and devices. So, the registry settings must be changed in accordance with Table 6 and Table 8.



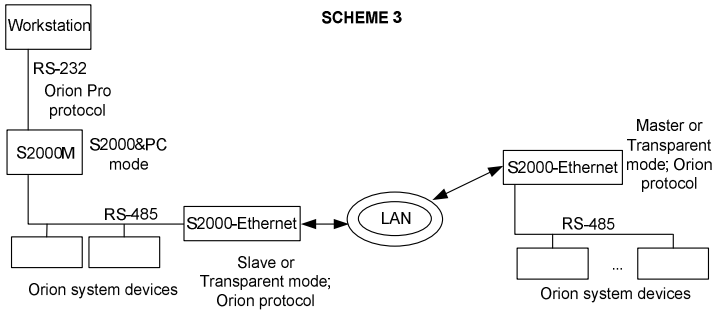
In the figure "Scheme 2" below the Master device of the system at a certain time is either software or the console. Data are communicated in Orion protocol. In such case as to the console and the devices are physically located in the same segment of the interface. Thus, the S2000-Ethernet converters retranslate data communications only between the software and the Orion system devices. So:

- the registry settings must be changed in accordance with Table 6 and Table 8;
- the console settings must not be changed.



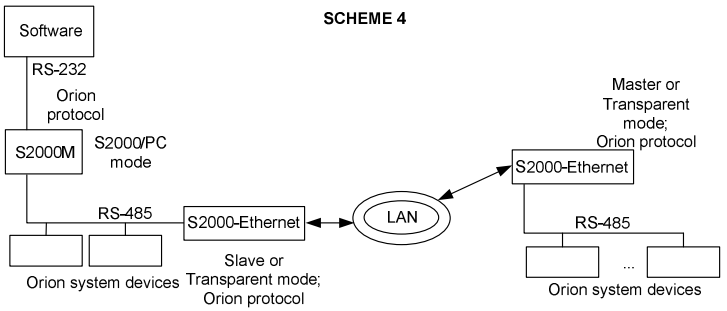
In the figure “Scheme 3” below the S2000-Ethernet converters retranslate data of an RS-485 segment, namely communicating data in Orion protocol between the console and Orion system devices. Orion Pro protocol data between the Workstation and the console (S2000 & PC mode) are communicated within an RS-232 segment. So:

– the registry settings must not be changed;
– the console settings must be changed in accordance with Table 6.



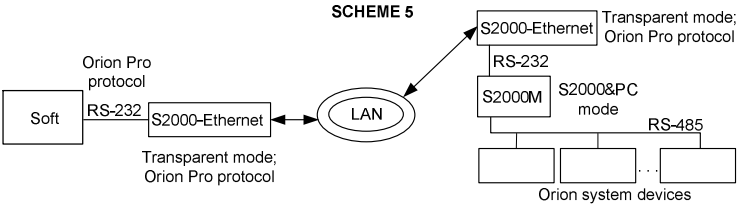
In the figure “Scheme 4” below both the console and the software can be a Master device in the system. Thus, the S2000-Ethernet converters sometimes can retranslate both data communications between the software and the devices and data communications between the console and the devices. In both cases the retranslated data are in Orion protocol. So:

– the registry settings must be changed in accordance with Table 6 and Table 8;
– the console settings must be changed in accordance with Table 6.



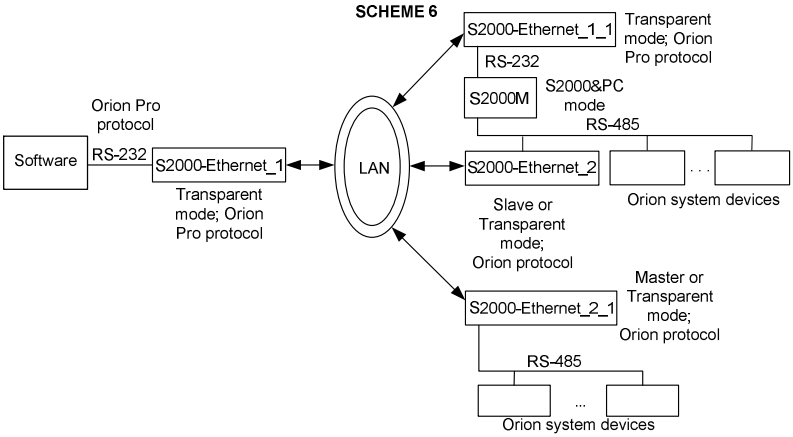
In the figure “Scheme 5” below the S2000-Ethernet retranslates data of the RS-232 segment between the software and the console (S2000 & PC mode), namely these are data in Orion Pro protocol. In this case the console and Orion system devices are physically located in the same segment of the interface operating in Orion protocol. Based upon this:

- the registry settings must be changed in accordance with Table 6 and Table 8;
- the console settings must not be changed.



In the figure “Scheme 6” below two groups of S2000-Ethernet converters are in use. The S2000-Ethernet with the prefix «1» retranslates data of the RS-232 segment between the software and the computer (S2000 & PC mode) namely the data of Orion Pro protocol. The S2000-Ethernet with the prefix 2 retranslates data of the RS-485 segment between the console and Orion system devices namely data in Orion protocol. So, the following parameters must be changed:

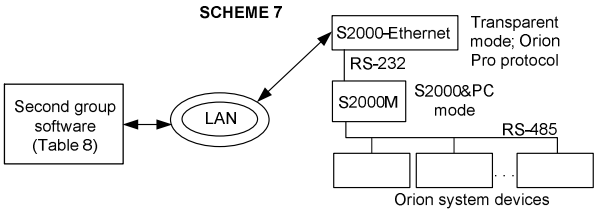
- the registry settings must be changed in accordance with Table 6 and Table 8;
- the console settings must be changed in accordance with Table 6.

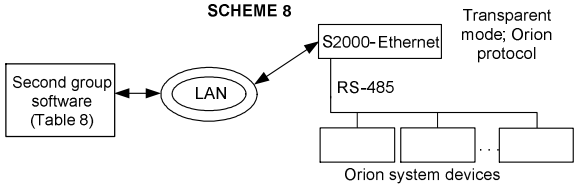


In the figures “Scheme 7” and “Scheme 8” below the S2000-Ethernet converter is used in the mode of a virtual COM port. In the *scheme 7* the S2000-Ethernet retranslates data in Orion Pro protocol between the software and the S2000M console (the console operates in the S2000 & PC mode). In the *scheme 8* the S2000-Ethernet retranslates data in Orion protocol between the software and Orion system devices. Programming the device for operating in the mode of virtual COM port is described in Section 1.4.6.1 . A PC can be connected to several S2000-Ethernet converters operating in the mode of virtual COM port:

1) Several remote S2000-Ethernet converters are connected to a virtual COM port. In this case the addresses of devices connected to various S2000-Ethernet must be the unique ones (for the *scheme 7* the console addresses must be unique; for the *scheme 8* the addresses of Orion system devices of the RS-485 interface must be unique).

2) Remote S2000-Ethernet converters are connected to different virtual COM ports. In this case the addresses of the devices connected to various S2000-Ethernet can be not unique (for example, if a system is built in accordance with the *scheme 8* the address «5» within the RS-485 interface can be assigned to two various devices one of which is connected via the S2000-Ethernet$_n$ to the COM port "Port10" while another is connected via the S2000-Ethernet$_m$ to the COM port "Port11").





1.4.6 An Example of Setting Configuration Parameters of the S2000-Ethernet

1.4.6.1 Settings for a Typical Diagram of Connecting the S2000-Ethernet in the Mode of Virtual COM Port (Retranslating Data between the Computer and the S2000-Ethernet)

Before programming the device it is necessary to get from your network administrator information about the IP address of the S2000-Ethernet, the subnet mask, the gateway for access to another subnetwork and the IP address of the computer.

To program working parameters of the S2000-Ethernet in the mode of virtual COM port:

1. Download from the Software Section of **http://bolid.com** the program **«Settings.exe»** (this program is also provided with Orion Pro software).
2. Run the program **«Settings.exe»** with administrator privileges (for Windows 7 and higher).
3. Select a COM port which is not really on this PC (for example, Port5).
4. Select S2000-Ethernet in the field Data Communicating Device.
5. In the fields «IP» and «Port» define the IP address of the S2000-Ethernet and the UDP of the S2000-Ethernet (if several virtual COM ports are in use then define individual UDP ports - 40000, 40002 etc. – for each of them; do not use the value given by the S2000-Ethernet configuration parameter S2000-Ethernet UDP Port for Unknown Address).
6. If Round Trip Time (RTT) exceeds 30 ms then in the field «LAN Transmit Timeout» enter a value of $N \geq 50 + max\_RTT$ (ms).
7. If in routine operation the S2000-Ethernet is expected to translate Orion protocol then set the Broadcast Turnaround Delay to the value of 10 ms.
8. Press the button «Write to Registry» and quit the program **«Settings.exe»**.
9. Run the program **«UProg»** and read the configuration of the S2000-Ethernet (the device configuration can be read or changed either over the RS-232 interface or via LAN, see 1.4.4.1).
10. In the configuration of the S2000-Ethernet on the tab «RS-485/RS-232» select:
    - If devices are connected to the S2000-Ethernet over the RS-485 interface then select «RS-485» for Interface Type and «Orion» for Protocol;
    - If an 2000M is connected to the S2000-Ethernet over the RS-232 interface than select «RS-232» for Interface Type and «Orion Pro» (or «Orion») for Protocol;
    - Transparent operation mode.
11. In the configuration of the S2000-Ethernet on the tab «Ethernet»:

– Enter the IP address in the field «IP Address of S2000-Ethernet»;
– In the field «Subnet Mask» define the subnet mask of the local network;
– In the field «Gateway» specify the gateway for access to the other network.
– In the list of remote devices enter the IP address of the computer and set the UDP port of the remote device to the value given for the relevant virtual COM port (see Clause 5 above).
– If Round Trip Time (RTT) exceeds 30 ms then set the value of Acknowledgement Timeout to N = 50 + max_RTT (ms);

12. Write the configuration to the S2000-Ethernet. If the device is in the configuration mode (the jumper is in the «Config» position) then switch it to an operation mode (put the jumper on in a position other than «Config»).

13. Connect the S2000-Ethernet to the computer directly (by a point-to-point connection) using a *cross-over* cable or through a switch using a *straight-through* cable (see cable wiring in Figure 7).

14. Now setting has been completed and we proceed to checking the virtual COM port.

15. To test communication, use **UProg.** If the devices are connected to the S2000-Ethernet through the S2000 console (in accordance with Scheme 7) then switch the console to the programming mode (see User's Manual for the console).

16. Run **UProg** (for UProg of versions 4.1.0.52 and higher select the node «Computer» in the Device Tree), specify the number of added COM port (see Clause 3) as the polled port and run polling. To do so, select *Device → Read Configuration*. The window of device searching will be displayed. In the field Serial Port enter the number of added virtual COM port (see Clause 3) and press the Search button. The procedure of search having been completed, a list of all devices on the RS-485 interface which are connected to the selected port will appear on the screen.

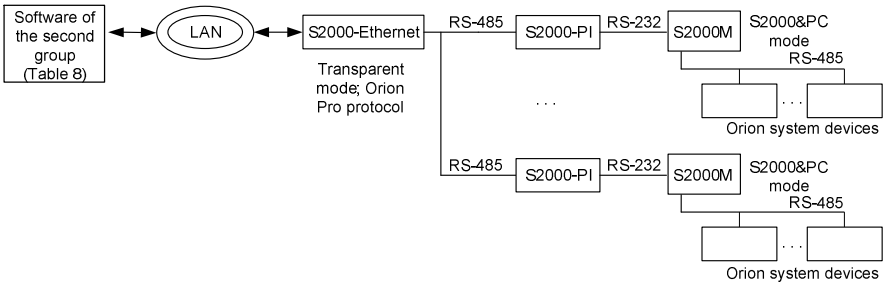


Figure 4. Diagram for Connection of Several S2000M Consoles to a Single Virtual COM Port

Note: *Please take into account that a single virtual COM port can be connected only to a single S2000M console through a single S2000-Ethernet over the RS-232 interface. To increase the number of connected consoles, please use S2000-PI RS-232- to-RS-485 interface converters (see* Figure 1*).*

1.4.6.2 Setting a Typical Connection for Retranslating Data between S2000-Ethernet Converters

Let we need to integrate in a system several Orion system devices which are located in various buildings (**Orion communication protocol**). Assume, taking into account territorial scratching, we need to use fourteen S2000-Ethernet converters. Maximum number of S2000-Ethernet converters which IP addresses can be written to the list of remote devices of a single S2000-Ethernet is eight. So, to connect fourteen remote S2000-Ethernet converters we need two another S2000-Ethernet converters which will be located on the side of a Master device of the system (Orion workstation, S2000M console). Orion workstation polls devices only at one COM port. Hence, we cannot connect the both S2000-Ethernet converters to two COM ports of the computer. So, to connect the both S2000-Ethernet to the Orion workstation we need to use either S2000-PI RS-232-to-RS-485 interface converter or an S2000M console (the console operates either in the S2000 / PC mode or in the programming mode). With this in mind we will use the connection diagram shown in Figure 2.

The S2000M console will operate in the S2000 / PC mode. In this case the Master device of the system can be sometimes the console and software in other time. (That is, if Orion software is active then the console operates in the mode of interface converter; if data have not been communicated over RS-232 for a time specified in the console configuration then the console switches to the mode of polling devices over RS-485). To use S2000-Ethernet in such a system, it is necessary to change time settings both for the S2000M console and software. Let's consider the two operation modes of the S2000-Ethernet: the transparent mode and the event save mode.

Time parameters of software can be changed by means of the program **«Settings.exe»** or manually in Registry Editor (Table 6 and Table 8). The time parameters of the S2000M console can be changed by means of the program **«RS485Settings.exe»** (to set parameters, switch the console to the programming mode). The programs are free and available at **http://bolid.ru**.

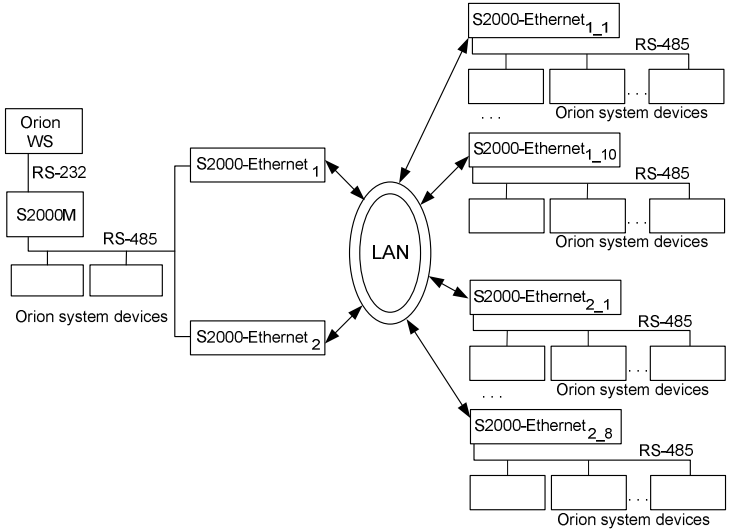


Figure 5. An Example of Connection Diagram for the S2000-Ethernet

Note: *The S2000M console in the scheme above can also operate in the S2000 & PC mode. In this case the system can be managed simultaneously from the console and from the Orion workstation. In doing so the time parameters of software are constant and you need only to set the time parameters of the S2000M console in accordance with recommendations below discussed for the S2000 / PC mode.*

Prior to setting the timeouts for the software and the console, let's configure the S2000-Ethernet converters. An S2000-Ethernet configuration can be read or written either over the RS-232 interface or via the local network (see 1.4.4.1 for more information).

➢ **RS-485/RS-232 Settings**

1. In accordance with the system construction mentioned above, all the S2000-Ethernet converters use the interface type **RS-485**.
2. On retranslating Orion protocol the baud rate will be equal to **9600**.
3. The type of protocol in use is **Orion**.
4. The S2000-Ethernet is an addressable device only for the configuration mode. So the default address 127 can be remained the same.
5. The parameters of interface operations: 8 data bits, 1 stop bit.
6. If the S2000-Ethernet system operates in the transparent mode then select the Transparent mode. If the S2000-Ethernet system operates in event save mode then select the Slave mode for the devices on the side with the console and software; select the Master mode for the devices located in remote interfaces.

7. If the S2000-Ethernet is used in an Orion or Orion Pro system then extra attributes of data packing are not recommended to be set on. So, do not tick all three attribute boxes.
8. If using the S2000-Ethernet in an Orion or Orion Pro system, you are not recommended to set on the parameter Make a Pause on Sending. So, do not tick this box.
9. Leave the parameter Generate Messages about Access Events set on.

- **Ethernet Settings**

Before configuring the devices it is necessary to ask the network administrator for the information about IP addresses of the S2000-Ethernet converters, subnet mask and IP addresses of gateways.

1. Define the IP address of each the S2000-Ethernet (Table 9).
2. Define the subnet mask for each the S2000-Ethernet (Table 9).
3. Define the gateway for each the S2000-Ethernet (Table 9).
4. Remain the S2000-Ethernet UDP Port as **40000** (default value).
5. Remain the Acknowledgement Timeout in its default value 80 ms; it will be programmed later after configuring S2000-Ethernet converters.
6. For each S2000-Ethernet in the remote device list specify addresses of the S2000-Ethernet from which data from the local network should be received and, correspondently, to which the RS-485 data should be retranslated (Table 9).
7. Remain parameters Remote Device UDP Port for all records in the remote device list as **40000** (default values).
8. In accordance with the recommendations let Compatibility is set to the value «S2000-Ethernet (Auto)».
9. Remain Master Key for all records in the remote device as set by default.
10. Communication Mode remains half-duplex because full-duplex is reachable only if managed network equipment is available.
11. Remain the attribute of permitting connection with an unknown address set on in order in further with the help of Master Key for Unknown Address we can configure the device from any host in the local network. The parameters for an unknown address remains in its default values.
12. Search Time is in its default value.
13. Connection Lifetime is in its default value.
14. Communication Failure Indication Delay is in its default value.

Table 9. The List of Remote S2000-Ethernet Converters for the Given Example

Diagram Notation	IP Address	Mask	IP Table	IP Address of Gateway
S2000-Ethernet$_1$	192.168.10.101	255.255.254.0	192.168.10.1	192.168.10.50
			192.168.10.2	
			192.168.10.3	
			192.168.10.4	
			192.168.10.5	
			192.168.10.6	
			192.168.10.7	
			192.168.10.8	
S2000-Ethernet$_2$	192.168.10.102	255.255.254.0	192.168.10.11	192.168.10.50
			192.168.10.12	
			192.168.10.13	
			192.168.9.1	
			192.168.9.2	
			192.168.9.3	
S2000-Ethernet$_{1_1}$	192.168.10.1	255.255.254.0	192.168.10.101	192.168.10.140

Diagram Notation	IP Address	Mask	IP Table	IP Address of Gateway
S2000-Ethernet$_{1_2}$	192.168.10.2	255.255.254.0	192.168.10.101	192.168.10.140
S2000-Ethernet$_{1_3}$	192.168.10.3	255.255.254.0	192.168.10.101	192.168.10.140
S2000-Ethernet$_{1_4}$	192.168.10.4	255.255.254.0	192.168.10.101	192.168.10.140
S2000-Ethernet$_{1_5}$	192.168.10.5	255.255.254.0	192.168.10.101	192.168.10.140
S2000-Ethernet$_{1_6}$	192.168.10.6	255.255.254.0	192.168.10.101	192.168.10.140
S2000-Ethernet$_{1_7}$	192.168.10.7	255.255.254.0	192.168.10.101	192.168.10.140
S2000-Ethernet$_{1_8}$	192.168.10.8	255.255.254.0	192.168.10.101	192.168.10.140
S2000-Ethernet$_{2_1}$	192.168.10.11	255.255.254.0	192.168.10.102	192.168.10.140
S2000-Ethernet$_{2_2}$	192.168.10.12	255.255.254.0	192.168.10.102	192.168.10.140
S2000-Ethernet$_{2_3}$	192.168.10.13	255.255.254.0	192.168.10.102	192.168.10.140
S2000-Ethernet$_{2_4}$	192.168.9.1	255.255.255.0	192.168.10.102	192.168.9.10
S2000-Ethernet$_{2_5}$	192.168.9.2	255.255.255.0	192.168.10.102	192.168.9.10
S2000-Ethernet$_{2_6}$	192.168.9.3	255.255.255.0	192.168.10.102	192.168.9.10

➢ **Setting timeouts of the software, the console, and the S2000-Ethernet**

Sufficient values of timeouts used by the software and the console depend on the time of transferring a packet between the S2000-Ethernet devices and are defined by Acknowledgement Timeout of the S2000-Ethernet. The factory value of this parameter is 80 ms. These 80 ms include a time to transmit the packet over the local network (30 ms) and a guaranteed time to process the packet by the S2000-Ethernet (50 ms). An actual time to transmit the packet over the local network can exceed 30 ms. Try to ping the S2000-Ethernet from any computer in the network. If Round Trip Time exceeds 30 ms and equals to X ms than Acknowledgement Timeout = 50 + X = Y ms. If Round Trip Time is less or equal to 30 ms then it is recommended to leave Acknowledgement Timeout be equal to 80 ms (the default value).

So, we issue ping from any computer of the local network from the side of S2000-Ethernet_1 and S2000-Ethernet_2. At first we shall find out Acknowledgement Timeout for S2000-Ethernet_1. Let's ping successively all eight IP records of the remote device list. Enter to the command line:

```
ping 192.168.10.1 –n 100
ping 192.168.10.2 –n 100
ping 192.168.10.3 –n 100
ping 192.168.10.4 –n 100
ping 192.168.10.5 –n 100
ping 192.168.10.6 –n 100
ping 192.168.10.7 –n 100
ping 192.168.10.8 –n 100
```

Select the maximum value from the received replies. Assume the time doesn't exceed 30 ms. If so, let's remain the configuration parameter Acknowledgement Timeout for S2000-Ethernet_1 and all S2000-Ethernet_1_n as its default value 80 ms.

Similarly for S2000-Ethernet_2. Successively ping all six IP records of its remote device list. Enter in the command line:

```
ping 192.168.10.11 –n 100
ping 192.168.10.12 –n 100
ping 192.168.10.13 –n 100
ping 192.168.9.1 –n 100
ping 192.168.9.2 –n 100
ping 192.168.9.3 –n 100
```

Select the maximum value from the received replies. For example, in one reply RTT = 70 ms. Then for S2000-Ethernet_2 and all S2000-Ethernet_2_m enrolled in its remote device list Acknowledgement Timeout = 50 ms + 70 ms = 120 ms. Write the end value to all devices of S2000-Ethernet_2.

Let's proceed to estimation of parameters of software and the console.

Parameters of RS-232/RS-485 to be changed are listed in Table 5. Taking into account the default values of parameters for software and the console we estimate the parameters in accordance with recommendation of Clause 1.4.4.2.

Parameters with the index 1 are calculated by the formula below:

$$P_{(1)} \geq X + T + 15 * N(ms)$$

Parameters with the index 2 are calculated by the formula below:

$$P_{(2)} \geq X + T + \frac{15 * N}{Y}(ms)$$

Parameters with the index 3 are calculated by the formula below:

$$P_{(3)} \geq X + T(ms)$$

Parameters with the index 4 are calculated by the formula below:

$$P_{(4)} \geq P_{(2)} - 30(ms)$$

For all the formulae:

X stands for the default parameter value;

T stands for the S2000-Ethernet parameter *Acknowledgement Timeout*;

N stands for the quantity of remote S2000-Ethernet converters with which the S2000-Ethernet on the side of the Master system device communicates data;

Y stands for the console parameter «Broadcast Repeat Number».

For both S2000-Ethernet converters calculate values of all time parameters which use all formulae mentioned above and select the maximum value for each parameter.

Event Save Mode – Software:

Request Waiting Timeout = 80 ms
Broadcast Turnaround Delay [1]_1 = 0 + 80 + 15*8 = 200 ms,
Command Waiting Timeout [3]_1 = 600 + 80 = 680 ms.

Broadcast Turnaround Delay[1]_2 = 0 + 120 + 15*6 = 210 ms,
Command Waiting Timeout [3]_2 = 600 + 120 = 720 ms.

Values with the index 2 must be used because:
Broadcast Turnaround Delay_2 > Broadcast Turnaround Delay_1,
Command Waiting Timeout_2 > Command Waiting Timeout_1.

Event Save Mode – S2000M Console:

Search Timeout = 50 ms,
Event Request Timeout = 80 ms.

Broadcast Turnaround Delay[2]_1 = 5 + 80 + (15*8)/6 = 105 ms,
Command Request Timeout[3]_1 = 600 + 80 = 680 ms.

Broadcast Turnaround Delay[2]_2 = 5 + 120 + (15*6)/6 = 140 ms,
Command Request Timeout[3]_2 = 600 + 120 = 720 ms.

We must use the values with the index 2 because:
Broadcast Turnaround Delay_2 > Broadcast Turnaround Delay_1,
Command Request Timeout_2 > Command Request Timeout_1.

Transparent Mode – Software

Request Waiting Timeout [1]_1 = 30 + 80 + 15*8 = 230 ms,
Broadcast Turnaround Delay [1]_1 = 0 + 80 + 15*8 = 200 ms,
Command Waiting Timeout [1]_1 = 600 + 80 + 15*8 = 800 ms.

Request Waiting Timeout [1]_2 = 30 + 120 + 15*6 = 240 ms,
Broadcast Turnaround Delay [1]_2 = 0 + 120 + 15*6 = 210 ms,
Command Waiting Timeout[1]_2 = 600 + 120 + 15*6 = 810 ms.

Values with the index 2 must be used because:

Request Waiting Timeout_2 > Request Waiting Timeout_1,
Broadcast Turnaround Delay_2 > Broadcast Turnaround Delay_1,
Command Waiting Timeout_2 > Command Waiting Timeout_1.

Transparent Mode – S2000M Console:

Session Delay Without Change of Direction[4]_1 = 0 + 80 + (15*8)/6 = 100 ms
Search Timeout[1]_1 = 6 + 80 + 15*8 = 206 ms,
Broadcast Turnaround Delay[1]_1 = 5 + 80 + 15*8 = 205 ms,
Event Request Timeout[1]_1 = 30 + 80 + 15*8 = 230 ms,
Command Request Timeout[1]_1 = 600 + 80 + 15*8 = 800 ms.

Session Delay Without Change of Direction[4]_1 = 0 + 120 + (15*6)/6 = 130 ms
Search Timeout[1]_2 = 6 + 120 + 15*6 = 216 ms,
Broadcast Turnaround Delay[1]_2 = 5 + 120 + 15*6 = 215 ms,
Event Request Timeout[1]_2 = 30 + 120 + 15*6 = 240 ms,
Command Request Timeout[1]_2 = 600 + 120 + 15*6 = 810 ms.

We must use the values with the index 2 because:
Session Delay Without Ch. of Dir.[4]_2 > Session Delay Without Ch. of Dir.[4]_1
Search Timeout_2 > Search Timeout_1,
Broadcast Turnaround Delay_2 > Broadcast Turnaround Delay_1,
Event Request Timeout_2 > Event Request Timeout_1,
Command Request Timeout_2 > Command Request Timeout_1.

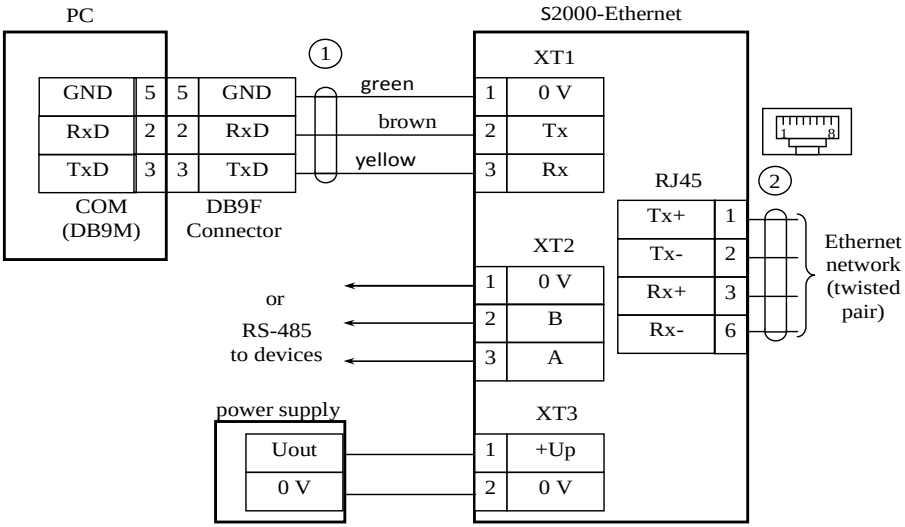
RS-232/RS-485 parameters which must be changed for the example in question are summarized in Table 10. Taking into account that in the scheme in use more than one S2000-Ethernet converter is located in the same RS-485 segment we should use double values of parameters market with symbol *.

Table 10. Summary Table of Calculated Parameters which Must Be Changed

System Master Device	Operation Mode of the S2000-Ethernet System	
	Transparent	***Event Save***
Orion Workstation, Orion Pro Workstation, UProg, PProg and other software	Request Waiting Timeout*[1] = 480 ms Broadcast Turnaround Delay (only for Orion protocol)[1] = 210 ms Command Waiting Timeout[1] = 810 ms	Request Waiting Timeout = 80 ms Broadcast Turnaround Delay[1] = 210 ms Command Waiting Timeout[3] = 720 ms
S2000M Console	Session Delay Without Ch.of Dir.[4] ≥ 130 ms Search Timeout*[1] = 432 ms Broadcast Turnaround Delay[1] = 215 ms Event Request Timeout*[1] = 480 ms Command Request Timeout[1] = 810 ms	Search Timeout = 50 ms Broadcast Turnaround Delay[2] = 140 ms Event Request Timeout ≥ 80 ms Command Request Timeout[3] = 720 ms

2 Operation Guidelines

2.1 Connection Diagram



PC: a personal computer;
1: S2000-to-PC connection cable;
Power supply: a 12 V to 28.4 V dc power supply providing at least 100 mA;
2: Ethernet cable

Figure 6. S2000-Ethernet Wiring Diagram

2.2 Connecting the S2000-Ethernet to a LAN

To connect two S2000-Ethernet convertors directly, without a hub or switch, a *cross-over* cable should be used (see Figure 7). So, only two S2000-Ethernet convertors can be connected at the same time (point-to-point connection).

To connect three or more S2000-Ethernet convertors you should have a hub or a network switch. In this case a *straight through* cable should be used (see Figure 7).

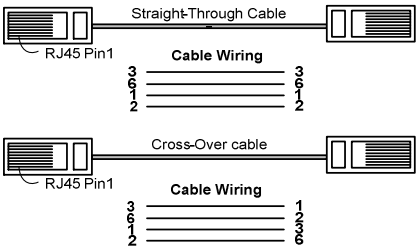


Figure 7. Types of Ethernet Cables

3 Overall and Mounting Dimensions

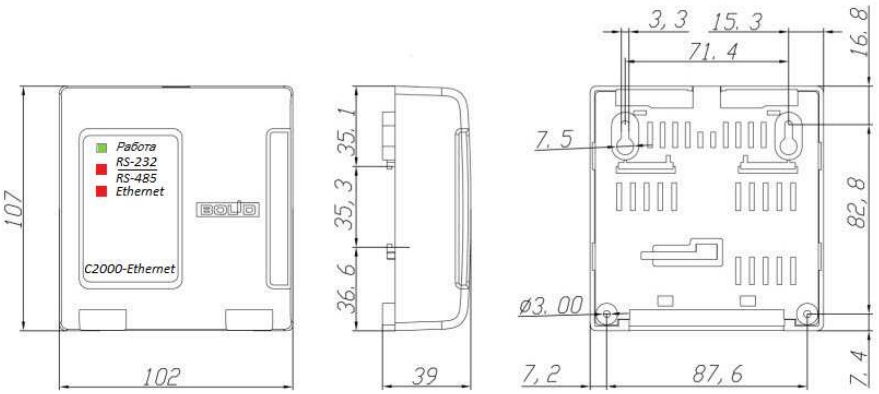


Figure 8. Overall and Mounting Dimensions

4 Manufacturer Address

CJSC NVP Bolid
4 Pionerskaya Str., Korolev, Moscow Region 141070, Russia.
Tel./fax: +7 **(495) 775-71-55** (multi-channel)
E-mail: info@bolid.ru

Technical support: support@bolid.ru

http://bolid.ru.