R&S® IP-GATE

IP gateway for ISDN encryption devices
The R&S®IP-GATE is an IP interface for the most recent models of the R&S®MKS9680 and ELCRODAT 6-2 encryption devices. Used with R&S®MKS9680 and ELCRODAT 6-2 encryption devices, the R&S®IP-GATE enables communications on land- and satellite-based IP networks to the highest security standards.

**At a glance**

The R&S®IP-GATE is a gateway that enables ISDN terminal equipment to communicate over IP networks. The support of the ISDN data service allows the setup for secure end-to-end communications with ISDN encryption devices on ISDN and IP networks.

The R&S®IP-GATE is optimized to work with ELCRODAT 6-2 (version 7.70 or later) and R&S®MKS9680 encryption devices. The R&S®IP-GATE is available in a number of models designed specifically for the R&S®MKS9680 and ELCRODAT 6-2 S BRI encryption devices and the ELCRODAT 6-2 M PRI encryption device. The R&S®IP-GATE includes internal mechanisms for secure communications with R&S®MKS9680 and ELCRODAT 6-2 encryption devices over IP-based satellite channels even under difficult transmission conditions. Plus, it comes with mechanisms that support synchronous multichannel transmissions.

With the R&S®VoIP-SERVER software, the R&S®IP-GATE can operate as an ASTERISK server that can act as a gateway between ISDN and IP networks. R&S®VoIP-SERVER supports the IAX2 and the SIP protocol.

**Key facts**

- Gateway for R&S®MKS9680 and ELCRODAT 6-2 encryption devices on IP networks
- Gateway for encrypted end-to-end communications with the R&S®MKS9680 and ELCRODAT 6-2 over IP-based satellite links
- Local and remote administration
R&S®IP-GATE

Benefits and key features

Gateway for R&S®MKS9680 and ELCRODAT 6-2 devices on IP networks
- Support of ISDN data service
- Support of redirect functionality
- Support of server-to-server communications using SIP or IAX2
- Support of outband signaling on the ELCRODAT 6-2
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Direct connection between two R&S®IP-GATE devices
- Two R&S®IP-GATE devices in client-server mode
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Adaptive jitter buffer
- Jitter buffer for connections with high error rates and under difficult transmission conditions
- Support of synchronous ISDN channel bonding for a higher data rate
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Local and remote administration
- Web-based administration
- Parameter setting with configuration scripts
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Available models, software

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<th>Description</th>
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<tr>
<td>R&amp;S®IP-GATE 2S0</td>
<td>Model with two ISDN BRI ports</td>
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<td>Model with four ISDN BRI ports</td>
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<td>R&amp;S®VolP-SERVER</td>
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Support of ISDN data service
VoIP telephony is already common and will continue to become increasingly widespread. Unlike telephones on the conventional public switched telephone network (PSTN), VoIP telephones on IP networks are accessed using their IP address. VoIP phones need to be able to call not just other VoIP phones but also phones on the PSTN, and vice versa (see connection 1 in the graphic on this page). For this to function, a VoIP phone has to be assigned a phone number that can be called from the PSTN. This phone number and the IP address of the VoIP phone on its IP network must be associated with one another and mapped accordingly by a gateway. This task is commonly carried out by SIP servers. VoIP phones have to register with a provider’s SIP server. The server assigns them a unique SIP ID along with a PSTN phone number. VoIP phones announce their IP address to the provider’s SIP server when they are switched on and whenever their IP address changes. This enables the server to map the current IP address to the right SIP ID and phone number.

**VoIP scenario**

GW: gateway IP ↔ telephony
Calls between VoIP subscribers registered on different SIP servers are usually routed over the PSTN (see connection 3 in the graphic on page 4). This involves decoding and re-encoding the voice signal. Only rarely do VoIP calls run directly from server to server without being routed over the PSTN. In these instances, too, the voice signal is usually decoded and re-encoded by the SIP servers.

If VoIP subscribers are registered on the same provider’s SIP server, calls are routed over the IP network without decoding and re-encoding the voice signal. The media path can be optimized through redirection (see connection 2 in the graphic on page 4).

SIP servers mostly support telephony over gateways to the PSTN but no other services. The R&S®IP-GATE is an IP terminal equipped additionally with ISDN ports for connecting R&S®MKS9680 and ELCRODAT 6-2 ISDN encryption devices. These encryption devices use ISDN’s transparent data service for encrypted communications. This prevents re-encoding and, therefore, the falsification of encrypted information on the transmission link. SIP providers’ gateways usually do not support the ISDN data service and reject data calls.

The R&S®VoIP-SERVER software is an ASTERISK server which manages connected IP devices in accordance with the IAX2 protocol. The server assigns PSTN phone numbers to these devices as necessary. R&S®VoIP-SERVER’s gateway functionality supports the ISDN data service and does not re-encode the voice data. This means that R&S®MKS9680 and ELCRODAT 6-2 ISDN encryption devices connected to an R&S®IP-GATE on an IP network can successfully conduct encrypted communications with other encryption devices connected on ISDN (see connection 1 in the graphic on this page).

Highly secure end-to-end encryption on ISDN and IP networks
**Support of redirect functionality**

If one of two terminals communicating with one another is on an IP network and the other on the PSTN, they always communicate over a server.

If both the terminals are R&S®IP-GATE devices installed on the same IP network and registered with the same R&S®VoIP-SERVER, they can communicate with one another directly over the IP network without involving the VoIP server. To do so, they need to obtain the required connection information from the R&S®VoIP-SERVER (see connection 2 in the graphic on page 5). This is known as redirect functionality.

With redirect, the central VoIP server is only needed to set up the connection. There is no load on the VoIP server when the two R&S®IP-GATE devices are communicating.

**Support of server-to-server communications using SIP or IAX2**

Larger locations often have their own SIP servers to manage their on-site VoIP phones. Besides encrypted connections, the ELCRODAT 6-2 encryption device from Rohde & Schwarz also supports plain connections. This means that a user connected to an ELCRODAT 6-2 can communicate with another user on a VoIP phone over an unencrypted link. Because the two users are registered on different servers, the connection generally runs over the PSTN.

To enable an ISDN phone and a VoIP phone to communicate over the IP network when at the same location, R&S®VoIP-SERVER supports SIP in addition to IAX2. Over SIP (or IAX2), the R&S®VoIP-SERVER and the on-site SIP server can exchange the required connection information, as long as the SIP server provides this capability.

**Support of outband signaling on the ELCRODAT 6-2**

ELCRODAT 6-2 encryption devices support outband signaling on ISDN. Outband signaling employs the ISDN supplementary services sub addressing (SUB) and user-to-user signaling 1 (UUS1).

Most public SIP and ASTERISK servers do not support ISDN-standard supplementary services via the SIP or IAX2 protocol. To enable ELCRODAT 6-2 encryption devices with optional outband signaling to be used over IP networks, the R&S®IP-GATE and R&S®VoIP-SERVER support this type of signaling. This capability means that ELCRODAT 6-2 encryption devices can be cascaded on IP networks, for example.
Direct connection between two R&S®IP-GATE devices

Two R&S®IP-GATE devices in client-server mode
If two R&S®IP-GATE devices are communicating regularly on a local IP network that has a satellite connection, they should do so directly without contacting a VoIP server over the satellite link.

On larger local IP networks, this can be accomplished using a separate, local VoIP server. If two R&S®IP-GATE devices primarily communicate with one another, then one of the two may be operated in server mode. This R&S®IP-GATE then essentially behaves like an R&S®VoIP-SERVER, with the exception that it will accept just one R&S®IP-GATE as a client.

In the graphic, R&S®IP-GATE (A) is operating in server mode and R&S®IP-GATE (B) in client mode. R&S®IP-GATE (A) must be assigned either a fixed IP address or a unique DNS name. This approach enables a bidirectional link between the two R&S®IP-GATE devices (A) and (B) (see connection 1 in the graphic), eliminating the need to involve costly satellite communications in running a local, direct link.

The R&S®IP-GATE (A) in server mode can be registered with an R&S®VoIP-SERVER on its home network. This means that both R&S®IP-GATE devices can communicate over an R&S®VoIP-SERVER via satellite (connection 2). For example, via the R&S®VoIP-SERVER on the home network, they can communicate with the ELCRODAT 6-2 M-ST (to obtain a certificate update, for example; connection 3) or with other devices on ISDN (connection 4) or on an IP network (connection 5).
Adaptive jitter buffer

Jitter buffer for connections with high error rates and under difficult transmission conditions
The R&S®IP-GATE is used as a gateway between ISDN encryption devices and a packet-switched IP network. On the receive side, the ISDN encryption devices need data to arrive in a continuous stream. On IP networks, however, data packets often have different latencies. With satellite communications in particular, error rates can be high, resulting in lost packets. Furthermore, the sequence of packets received is often different from the order in which they were sent.

The R&S®IP-GATE has an internal adaptive jitter buffer. The purpose of this buffer is to compensate for latency fluctuations, replace lost packets with dummy packets, and restore the original packet sequence. This enables the ISDN encryption devices to receive data in a continuous stream. The jitter buffer is adaptive, which means it can adjust to the transmission quality of each connection.

Particularly with satellite communications and with data rerouted on IP networks, latency can fluctuate heavily, but the R&S®IP-GATE can also adjust to accommodate this.
Support of synchronous ISDN channel bonding for a higher data rate

For video and other types of communications requiring higher data rates on ISDN, terminal devices can connect with one another over multiple, parallel ISDN channels. The terminal devices assume that latency is more or less the same on the individual channels across the network. However, this is not always the case, particularly with IP-based satellite communications. Here, the difference in latency is often so large that the terminals are unable to aggregate the data on the individual channels to form a continuous data stream.

The adaptive jitter buffer in the R&S®IP-GATE treats individual channels connecting two terminals as one and balances the latency differences between the channels. The overall latency may be greater than for the fastest (virtual) channel as a result, but the difference between the individual ISDN channels is corrected. The R&S®IP-GATE thus provides a multichannel connection with a continuous data stream, even with major latency differences and fluctuations in latency.
Local and remote administration

**Web-based administration**

The R&S®IP-GATE can be managed via a web interface from a computer connected over a LAN or WAN. The R&S®IP-GATE also has a built-in DHCP server to enable a computer to be connected directly to its LAN port. Remote management takes place over a dedicated VPN.

The web interface has pages for setting parameters that control communications with the VoIP server, for defining the jitter buffer’s characteristics, and for configuring a VPN as well as the WAN, LAN and ISDN ports.

**Setting parameters using configuration scripts**

As an alternative to setting parameters via the web interface, users can create a configuration script containing a full set of parameters and download the script to the R&S®IP-GATE.

**Software updates**

The software in the R&S®IP-GATE can be updated. Software updates are signed centrally. The R&S®IP-GATE verifies the digital signature of software updates before it applies them.
Specifications

<table>
<thead>
<tr>
<th>Encryption device</th>
<th>R&amp;S®IP-GATE model</th>
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<tbody>
<tr>
<td>ELCRODAT 6-2 S, version 7.70 and later</td>
<td>R&amp;S®IP-GATE 2S0, R&amp;S®IP-GATE 4S0</td>
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<tr>
<td>ELCRODAT 6-2 M, version 7.70 and later</td>
<td>R&amp;S®IP-GATE S2M</td>
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<tr>
<td>R&amp;S®MKS9680</td>
<td>R&amp;S®IP-GATE 2S0, R&amp;S®IP-GATE 4S0</td>
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**R&S®IP-GATE interfaces**

<table>
<thead>
<tr>
<th>R&amp;S®IP-GATE 2S0</th>
<th>R&amp;S®IP-GATE 4S0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>plug-in power supply</td>
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<tr>
<td>R&amp;S®IP-GATE 2S0</td>
<td>1 x WAN port</td>
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<td>R&amp;S®IP-GATE 4S0</td>
<td>ETH 1000</td>
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<td>R&amp;S®IP-GATE 2S0</td>
<td>2 x ISDN BRI port</td>
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<tr>
<td>R&amp;S®IP-GATE 4S0</td>
<td>Euro-ISDN (DSS1)</td>
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<tr>
<td>R&amp;S®IP-GATE 2S0</td>
<td>1 x LAN port for local management</td>
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<tr>
<td>R&amp;S®IP-GATE 4S0</td>
<td>ETH 100</td>
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<tr>
<td>R&amp;S®IP-GATE 2S0</td>
<td>1 x USB port for downloading parameters</td>
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<tr>
<td>R&amp;S®IP-GATE 4S0</td>
<td>USB 2.0</td>
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**VoIP protocols supported by the R&S®IP-GATE**

<table>
<thead>
<tr>
<th></th>
<th>RFC3261</th>
<th>RFC5456</th>
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<tbody>
<tr>
<td>SIP</td>
<td></td>
<td></td>
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<tr>
<td>IAX2</td>
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**General data**

<table>
<thead>
<tr>
<th>Dimensions (W × H × D)</th>
<th>R&amp;S®IP-GATE 2S0, R&amp;S®IP-GATE 4S0</th>
<th>approx. 206 mm × 77 mm × 230 mm (8.1 in × 3.0 in × 9.1 in)</th>
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</thead>
<tbody>
<tr>
<td>Weight</td>
<td>R&amp;S®IP-GATE 2S0, R&amp;S®IP-GATE 4S0</td>
<td>approx. 1.8 kg (4.0 lb)</td>
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</table>

**Ordering information**

<table>
<thead>
<tr>
<th>Designation</th>
<th>Type</th>
<th>Order No.</th>
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</thead>
<tbody>
<tr>
<td>2 x Basic Rate Interface (BRI)</td>
<td>R&amp;S®IP-GATE 2S0</td>
<td>5415.2580.02</td>
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<tr>
<td>4 x Basic Rate Interface (BRI)</td>
<td>R&amp;S®IP-GATE 4S0</td>
<td>5415.2597.02</td>
</tr>
<tr>
<td>1 x Primary Rate Interface (PRI)</td>
<td>R&amp;S®IP-GATE S2M</td>
<td>5415.2600.02</td>
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<tr>
<td>Software</td>
<td>R&amp;S®VoIP-SERVER</td>
<td>5415.2651.02</td>
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About Rohde & Schwarz
Rohde & Schwarz is an independent group of companies specializing in electronics. It is a leading supplier of solutions in the fields of test and measurement, broadcasting, radiomonitoring and radiolocation, as well as secure communications. Established more than 75 years ago, Rohde & Schwarz has a global presence and a dedicated service network in over 70 countries. Company headquarters are in Munich, Germany.

Environmental commitment
- Energy-efficient products
- Continuous improvement in environmental sustainability
- ISO 14001-certified environmental management system

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