User's Guide

bintec R1200 / R1200w(u) / R3000 / R3000w / R3400 / R3800(wu)

IP

Version 3.0

Purpose

This document is part of the user's guide to the installation and configuration of bintec gateways running software release 7.4.10 or later. For up-to-the-minute information and instructions concerning the latest software release, you should always read our **Release Notes**, especially when carrying out a software update to a later release level. The latest **Release Notes** can be found at www.funkwerk-ec.com.

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R&TTE Directive 1999/5/EG

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1 IP Menu

The *IP* menu is described below.

```
R3000w Setup Tool              Funkwerk Enterprise Communications GmbH
[IP]: IP Configuration                                        MyGateway

         Routing
         Static Settings
         Network Address Translation

         Bandwidth Management (TDRC / Load Balancing / BOD)
         IP address pool WAN (PPP)
         IP address pool LAN (DHCP)
         SNMP
         Remote Authentication (RADIUS/TACACS+)
         DNS
         DynDNS
         Routing Protocols

         EXIT
```

The ***IP*** main menu provides access to the submenus:

- ***ROUTING***
- ***STATIC SETTINGS***
- ***NETWORK ADDRESS TRANSLATION***
- ***BANDWIDTH MANAGEMENT (TDRC / LOAD BALANCING / BOD)***
- ***IP ADDRESS POOL WAN (PPP)***
- ***IP ADDRESS POOL LAN (DHCP)***
- ***SNMP***
- ***REMOTE AUTHENTICATION (RADIUS/TACACS+)***
- ***DNS***
- ***DYNDNS***
- ***ROUTING PROTOCOLS***

2 Routing Submenu

The *ROUTING* submenu is described below.

The ***IP*** ➜ ***ROUTING*** menu contains a list of all your gateway's IP routes.

FLAGS show the current status (*Up*, *Dormant*, *Blocked*) and the type of route (*Gateway Route*, *Interface Route*, *Subnet Route*, *Host Route*, *Extended Route*). The protocol with which your gateway has "learned" the routing entry is shown under ***PRO***, e.g. ***LOC*** = local, i.e. configured manually.

```
R3000w Setup Tool                Funkwerk Enterprise Communications GmbH
[IP][ROUTING]: IP Routing                                       MyGateway


The flags are: U (Up), D (Dormant), B (Blocked),
               G (Gateway Route),   I (Interface Route),
               S (Subnet Route),    H (Host Route),
                                    E (Extended Route)

Destination     Gateway         Mask           Flags Met Interface Pro
192.168.0.0   192.168.0.254 255.255.255.0 US   0  en0-1    loc
192.168.1.0   192.168.100.2 255.255.255.0 DG   1  branch   loc
192.168.100.2 192.268.100.1 255.255.255.0 DH   1  branch   loc



     ADD                ADDEXT             DELETE              EXIT
```

You can add a new route with ***ADD*** or edit an existing entry by tagging it with the cursor and pressing ***ENTER***. The following menu opens:

```
R3000w Setup Tool                 Funkwerk Enterprise Communications GmbH
[IP][ROUTING][ADD]                                              MyGateway

   Route Type                     Host route
   Network                        LAN

   Destination IP Address


   Gateway IP Address
   Metric                         1


        SAVE                                    CANCEL
```

The ***ROUTING*** ➜ ***ADD/EDIT*** menu consists of the following fields:

Field	Description
Route Type	Type of route. Possible values: ■ *Host route* (default value): Route to a single host. ■ *Network route*: Route to a network. ■ *Default route*: This route is valid for all IP addresses and is only used if no other suitable route is available.
Network	Defines the type of connection (LAN, WAN). For possible values see table “NETWORK selection options,” on page 8.
Destination IP Address	Only if ***ROUTE TYPE*** *Host route* or *Network route*. IP address of the destination host or network.
Netmask	Only if ***ROUTE TYPE*** = *Network route*. Netmask for ***DESTINATION IP ADDRESS***. If no entry is made, the gateway uses a default netmask.

Field	Description
Partner / Interface	WAN partner or interface (only if ***NETWORK*** = *WAN without transit network*).
Gateway IP Address	Only for ***NETWORK*** = *LAN* or *WAN with transit network*. IP address of the host to which your gateway should forward the IP packets.
Metric	The lower the value, the higher the priority of the route (possible values *0...15*; default value is *0*).

Table 2-1: ***ROUTING*** ➜ ***ADD/EDIT*** menu fields

NETWORK offers the following selection options:

Description	Meaning
LAN	Route to a destination host or network that can be reached via your gateway's LAN connection.
WAN without transit network	Route to a destination host or network that can be reached via a WAN partner without including any transit network available.
WAN with transit network	Route to a destination host or network that can be reached via a WAN partner including any transit network available.
Refuse	Your gateway discards data packets using this route and sends a message to the sender saying the destination of the packet is unreachable.
Ignore	Your gateway discards data packets using this route without sending a message to the sender.

Description	Meaning
Local	Route to a destination host or network that can be reached via the Local interface of your gateway.

Table 2-2: ***NETWORK*** selection options

In addition to the normal routing table, the gateway can also make routing decisions based on an Extended Routing Table. Apart from the source and destination address, the gateway can also include the protocol, source and destination port, type of service (TOS) and the status of the gateway interface in the decision.

Note

Entries in the Extended Routing Table are treated preferentially compared with entries in the normal routing table.

The configuration is set up in the ***IP*** ➜ ***ROUTING*** ➜ ***ADDEXT*** menu.

```
R3000w Setup Tool                Funkwerk Enterprise Communications GmbH
[IP][ROUTING][ADD]: IP Routing - Extended Route                 MyGateway

 Route Type                    Host route
 Network                       LAN

 Destination IP Address


 Gateway IP Address
 Metric                        1
 Source Interface              don't verify
 Source IP Address
 Source Mask
 Type of Service (TOS)         00000000  TOS Mask  00000000
 Protocol                      don't verify


            SAVE                                  CANCEL
```

This menu shows the following fields in addition to the fields of the ***ROUTING*** ➜ ***ADD/EDIT*** menu:

Field	Description
Mode	Only for ***NETWORK*** = *WAN without transit network*. Defines when the interface selected under ***PARTNER / INTERFACE*** is to be used. For possible values see table “MODE selection options,” on page 10.
Source Interface	Interface over which the data packets reach the gateway. Default value is *don’t verify*.
Source IP Address	Address of the source host or network.
Source Mask	Netmask for ***SOURCE IP ADDRESS***.
Type of Service (TOS)	Possible values: 0..255 in binary format.
TOS Mask	Bit mask for ***TYPE OF SERVICE (TOS)***.
Protocol	Defines a protocol. Possible values: *don’t verify*, *icmp*, *ggp, tcp*, *egp*, *pup*, *udp*, *hmp*, *xns*, *rdp*, *rsvp*, *gre*, *esp*, *ah*, *igrp*, *ospf*, *l2tp*. Default value is *don’t verify*.
Source Port	Only if ***PROTOCOL*** = *tcp* or *udp*. Source port number or range of source port numbers (see table “Selection options of SOURCE PORT AND DESTINATION PORT,” on page 10).
Destination Port	Only if ***PROTOCOL*** = *tcp* or *udp*. Destination port number or range of destination port numbers (see table “Selection options of SOURCE PORT AND DESTINATION PORT,” on page 10).

Table 2-3: ***ROUTING*** ➜ ***ADDEXT*** menu fields

MODE offers the following selection options:

Description	Meaning
always (default value)	Always use the route.
dialup wait	Route can be used if the interface is "up". If the interface is "dormant", then dial and wait until the interface is "up".
dialup continue	Route can be used if the interface is "up". If the interface is "dormant", then select and use the alternative route (rerouting) until the interface is "up".
up only	Route can be used if the interface is "up".

Table 2-4: ***MODE*** selection options

SOURCE PORT and ***DESTINATION PORT*** offer the following selection options:

Description	Meaning
any (default value)	The route is valid for all ➤➤ **port** numbers.
specify	Enables the entry of a port number.
specify range	Enables the entry of a range of port numbers.
priv (0...1023)	Privileged port numbers: 0 ... 1023.
server (5000....32767)	Server port numbers: 5000 ... 32767.
clients 1 (1024....4999)	Client port numbers: 1024 ... 4999.
clients 2 (32768....65535)	Client port numbers: 32768 ... 65535.
unpriv (1024...65535)	Unprivileged port numbers: 1024 ... 65535.

Table 2-5: Selection options of ***SOURCE PORT AND DESTINATION PORT***

3 Static Settings Submenu

The *STATIC SETTINGS* submenu is described below.

```
R3000w Setup Tool              Funkwerk Enterprise Communications GmbH
[IP][STATIC]: IP Static Settings                              MyGateway

    Domain Name
    Primary Domain Name Server
    Secondary Domain Name Server
    Primary WINS
    Secondary WINS

    Remote CAPI Server TCP port     2662
    Remote TRACE Server TCP port    7000
    RIP UDP port                    520

    Primary BOOTP Relay Server
    Secondary BOOTP Relay Server

    Unique Source IP Address
    HTTP TCP port                   80

          SAVE                                  CANCEL
```

The ***IP*** ➜ ***STATIC SETTINGS*** menu is for configuring the general IP settings for your gateway.

The ***IP*** ➜ ***STATIC SETTINGS*** menu consists of the following fields:

Field	Description
Domain Name	Default Domain Name of Gateway.
Primary Domain Name Server	IP address of a global Domain Name Server (DNS).
Secondary Domain Name Server	IP address of an alternative global Domain Name Server.
Primary WINS	IP address of a global Windows Internet Name Server (=WINS) or NetBIOS Name Server (=NBNS).
Secondary WINS	IP address of an alternative global WINS or NBNS.

Field	Description
Remote CAPI Server TCP Port	TCP port number for ➤➤ **Remote CAPI** connections. The default value is *2662*. Deactivate with *0*.
Remote TRACE Server TCP Port	TCP port number for remote traces. The default value is *7000*. Deactivate with *0*.
RIP UDP Port	UDP port number for ➤➤ **RIP** (Routing Information Protocol). The default value is *520*. Deactivate with *0*.
Primary BOOTP Relay Server	Here you can enter the IP address of a server to which BootP or DHCP requests are forwarded.
Secondary BOOTP Relay Server	Here you can enter the IP address of an alternative BootP or DHCP server.
Unique Source IP Address	Here you can enter an IP address that is used by the gateway as source address for locally generated IP packets. This should only be configured in special cases.
HTTP TCP Port	Here you enter the TCP port for accessing the HTTP service of the gateway (HTML start page). The default value is *80*.

Table 3-1: ***STATIC SETTINGS*** menu fields

4 Network Address Translation Submenu

The *IP* ➜ *NETWORK ADDRESS TRANSLATION* menu is described below.

Network Address Translation (➤➤ **NAT**) is a feature of your gateway for defined conversion of source and destination addresses of IP packets (in ***SESSIONS REQUESTED FROM INSIDE*** and ***SESSIONS REQUESTED FROM OUTSIDE***). If NAT is activated, IP connections are still only allowed as standard in one direction, outgoing (forward) (= protective function). Exceptions to the rules can be configured (in ***SESSIONS REQUESTED FROM OUTSIDE***).

The ***IP*** ➜ ***NETWORK ADDRESS TRANSLATION*** menu shows a list of all interfaces of your gateway.

To edit an entry, tag the interface for which you wish to configure NAT with the cursor and press **Return**. The following menu opens:

```
R3000w Setup Tool              Funkwerk Enterprise Communications GmbH
[IP][NAT][EDIT]: NAT Configuration (Internet)                MyGateway


 Network Address Translation          off
 Silent Deny                          no
 PPTP Passthrough                     no

 Enter configuration for sessions:    requested from OUTSIDE
                                      requested from INSIDE




                SAVE                              CANCEL
```

The ***NETWORK ADDRESS TRANSLATION ➜ EDIT*** menu consists of the following fields:

Field	Description
Network Address Translation	Defines the type of NAT for the selected interface. Possible values: ■ *off* (default value): Do not execute NAT. ■ *on*: Execute Forward NAT. ■ *reverse*: Execute Reverse NAT.
Silent Deny	Defines whether the sender of an IP packet denied by NAT is to be informed of the denial. Possible values: ■ *no* (default value): Sender is informed by a relevant ICMP message. ■ *yes*: The sender is not informed.
PPTP Passthrough	PPTP Passthrough allows setting up and operation of several simultaneous outgoing PPTP connections of hosts in the network even if NAT is activated. Possible values: *yes* or *no*. If ***PPTP PASSTHROUGH*** = *yes*, the gateway itself cannot be configured as a tunnel endpoint.

Table 4-1: ***NETWORK ADDRESS TRANSLATION*** menu fields

4.1 Requested from OUTSIDE/INSIDE Submenu

The *REQUESTED FROM OUTSIDE/INDSIDE* menu is described below.

For other NAT settings, the ***IP ➜ NETWORK ADDRESS TRANSLATION ➜ EDIT*** menu contains two submenus (the possible settings of the two menus differ only slightly):

- ***IP ➜ NETWORK ADDRESS TRANSLATION ➜ EDIT ➜ REQUESTED FROM OUTSIDE***
  In this menu you can allow certain incoming IP connections.
- ***IP ➜ NETWORK ADDRESS TRANSLATION ➜ EDIT ➜ REQUESTED FROM INSIDE***
  In this menu you can map the source IP addresses and ports for certain outgoing IP connections (= address mapping).

Both menus show a list of the address mappings already configured. The abbreviations used are explained above the list.

```
R3000w Setup Tool                Funkwerk Enterprise Communications GmbH
[IP][NAT][EDIT][OUTSIDE][ADD]: NAT - sessions from              MyGateway
                               OUTSIDE (Internet)

Abbreviations:   r(remote) i(internal) e(external) a(address) p(port)

  Service      Conditions
  ------------------------------------------------------------
  http         ia 192.168.0.254/32, ep 80, ip 80




    ADD                 DELETE                          EXIT
```

Add an entry with ***ADD*** or edit an existing entry by tagging it with the cursor and pressing **Return**. The following menu opens:

```
R3000w Setup Tool                Funkwerk Enterprise Communications GmbH
[IP][NAT][EDIT][OUTSIDE][ADD]: NAT - sessions from            MyGateway
                              OUTSIDE (Internet)

  Service                      user defined
  Protocol                     icmp

  Remote Address
  Remote Mask


  External Address
  External Mask
  External Port                any

  Internal Address
  Internal Mask                255.255.255.255
  Internal Port                any

               SAVE                                  CANCEL
```

The ***REQUESTED FROM OUTSIDE/INSIDE*** ➜ ***ADD/EDIT*** menu consists of the following fields:

Field	Description
Service	***REQUESTED FROM OUTSIDE*** ➜ ***ADD/EDIT***: Service for which incoming connections are allowed. ***REQUESTED FROM INSIDE*** ➜ ***ADD/EDIT***: Service for which address mapping is defined for outgoing connections. Possible values: *ftp, telnet, smtp, domain/udp, domain/tcp, http, nntp, user defined* (for other services, default value)
Protocol	Only for ***SERVICE*** = *user defined*. Defines the protocol. Possible values: *icmp, tcp, udp, gre, esp, ah, l2tp,any*

Field	Description
Remote Address	Optional. IP address of a host or network at the remote end. Enable or address mapping applies only to packets of this host or network.
Remote Mask	Netmask for ***REMOTE ADDRESS***.
Remote Port Port...to Port	Only in ***REQUESTED FROM INSIDE*** ➜ ***ADD/EDIT*** menu. Only for ***SERVICE*** = *user defined*. Entry of destination port or port range for outgoing IP connections for which address mapping is to be used. Possible values: ■ *any* ■ *specify*: Enables the entry of a port number. ■ *specify range*: Enables the entry of a port number range .
External Address	External host or network IP address at the selected interface.
External Mask	Netmask for ***EXTERNAL ADDRESS***. If you use external and internal network IP addresses, the values for ***EXTERNAL MASK*** and ***INTERNAL MASK*** must be identical.

Field	Description
External Port Port...to Port	Only for ***SERVICE*** = *user defined*. ■ ***REQUESTED FROM OUTSIDE*** ➜ ***ADD/EDIT***: Only for ***SERVICE*** = *user defined*; original destination port of incoming IP connection. ■ ***REQUESTED FROM INSIDE*** ➜ ***ADD/EDIT:*** The newly set source port of the outgoing IP connection. Possible values: ■ *any* (default value): For ***REQUESTED FROM INSIDE*** ➜ ***ADD/EDIT***; this means no port mapping. ■ *specify*: Enables the entry of a port number. ■ *specify range* (only for ***REQUESTED FROM OUTSIDE*** ➜ ***ADD/EDIT***) Enables the entry of a port number range.
Internal Address	IP address of the internal host or network.
Internal Mask	Netmask for ***INTERNAL ADDRESS***. If you use external and internal network IP addresses, the values for ***EXTERNAL MASK*** and ***INTERNAL MASK*** must be identical.

Field	Description
Internal Port Port	■ ***REQUESTED FROM OUTSIDE →ADD/EDIT***: Newly set destination port of the incoming IP connection. ■ ***REQUESTED FROM INSIDE → ADD/EDIT:*** Original source port of the outgoing IP connection. Possible values: ■ *any* (default value): For ***REQUESTED FROM OUTSIDE → ADD/EDIT***; this means no port mapping. ■ *specify*: Enables the entry of a port number.

Table 4-2: ***REQUESTED FROM OUTSIDE/INSIDE*** menu fields

5 Bandwidth Management (TDRC / Load Balancing / BOD) Submenu

The *BANDWIDTH MANAGEMENT (TDRC / LOAD BALANCING / BOD)* menu is described below.

```
R3000w Setup Tool              Funkwerk Enterprise Communications GmbH
[IP][BW]: Bandwidth Management for IP                          MyGateway


        TCP Download Rate Control (TDRC)

        IP Load Balancing over Multiple Interfaces

        IP triggered Bandwidth on Demand (IP BOD)




        EXIT
```

The ***BANDWIDTH MANAGEMENT (TDRC / LOAD BALANCING / BOD)*** menu provides access to the submenu:

- ***TCP DOWNLOAD RATE CONTROL (TDRC)***
- ***IP LOAD BALANCING OVER MULTIPLE INTERFACES***
- ***IP TRIGGERED BANDWIDTH ON DEMAND (IP BOD)***

5.1 TCP Download Rate Control (TDRC) Menu

The *TCP DOWNLOAD RATE CONTROL (TDRC)* menu is decribed below.

The ***IP*** ➜ ***BANDWIDTH MANAGEMENT (TDRC / LOAD BALANCING / BOD)*** ➜ ***TCP DOWNLOAD RATE CONTROL (TDRC)*** menu displays a list of the interfaces, for

which the TDRC-Mechanismus has already been configured. (The screenshot contains example values.)

```
R3000w Setup Tool              Funkwerk Enterprise Communications GmbH
[IP][TDRC]: Configure TCP Download Rate Control                MyGateway

Interface         Mode                     Maximum Receive Rate

10001 DSL         TCP ACK prioritisation
50000 ehtoa50-0   static                   1024









    ADD                 DELETE              EXIT
```

An increasing number of network services requires that data is transferred not only as fast as possible, but also at constant transfer rates (e.g. VoIP). Your gateway offers a mechanism to ensure this especially for ADSL connections.

Constant transfer rates for low latency data streams can basically be secured in two ways.

Both mechanisms are configured in the menu ***IP*** ➜ ***Bandwidth Management (TDRC / Load Balancing / BOD)*** ➜ ***TCP Download Rate Control (TDRC)*** ➜ ***ADD/EDIT.*** (The screenshots do not show the default values.)

- On the one hand it is possible to reduce the download rate available for general usage so that a certain bandwidth is reserved for a High Priority QoS queue.

```
R3000w Setup Tool              Funkwerk Enterprise Communications GmbH
[IP][TDRC][EDIT]: Configure TCP Download Rate Control        MyGateway

  Interface             50000   ethoa50-0

  Optimize Download Rate via TCP ACK prioritisation      no
  (recommended for ADSL)

  TDRC Mode      static (fixed maximum rate for TCP download)

  Maximum TCP Download Rate (kbits/s)          1024

  Control all TCP Services                     no
  Select TCP Services >

        SAVE                                CANCEL
```

- On the other hand it is possible to use the available bandwidth as effectively as possible by prioritizing the upload of TCP ACK packets in the upstream of asynchronous ADSL connections. This avoids latency that would be created as a result of the comparatively small upload bandwidth of ADSL connections.

```
R3000w Setup Tool              Funkwerk Enterprise Communications GmbH
[IP][TDRC][EDIT]: Configure TCP Download Rate Control        MyGateway

  Interface             10001   DSL

  Optimize Download Rate via TCP ACK prioritisation      yes
  (recommended for ADSL)

        SAVE                                CANCEL
```

The menu contains the following fields:

Field	Description
Interface	Here you choose the interface the TDRC configuration is applied to.
Optimize Download Rate via TCP ACK prioritisation	Here you choose whether the download rate is to be optimized by prioritizing TCP ACK packets. If you choose *yes*, all of the following fields are no longer available. Available values are *yes* and *no*. Default is *no*.

Field	Description
TDRC Mode	Only available for ***Optimize Download Rate via TCP ACK prioritisation*** = *no.* Here you choose the TDRC (TCP Download Rate Control) policy. With the values *dynamic (maximum rate less amount of high priority traffic)* and *static (fixed maximum rate for TCP download)* you limit the download rate for TCP connections. Available values: ■ *static (fixed maximum rate for TCP download)* (default) - The download rate of TCP connections is statically restricted to the value specified by ***Maximum TCP Download Rate (kbits/s)***. ■ *dynamic (maximum rate less amount of high priority traffic)* - The download rate is restricted to a value dynamically determined. The value is computed from the value specified by ***Maximum TCP Download Rate (kbits/s)*** minus the bandwidth that is required by all QoS High Priority traffic over the current interface at the moment of adding or terminating a TCP session. This choice requires a QoS configuration for the respective interface. ■ *disabled* - The TCP download rate remains unrestricted.
Maximum TCP Download Rate (kbits/s)	Only available for ***Optimize Download Rate via TCP ACK prioritisation*** = *no.* Here you specify the maximum bandwidth in kbps for TCP downloads over this interface. Available values are *1* to *100000*, default is *1024*.

Field	Description
Control all TCP Services	Only available for ***Optimize Download Rate via TCP ACK prioritisation*** = *no*. Here you choose if the download control configured is to be applied to all TCP connections. Available values are *yes* and *no*. Default is *yes*.

Table 5-1: ***IP ➜ Bandwidth Management (TDRC / Load Balancing / BOD) ➜ TCP Download Rate Control (TDRC) ➜ ADD/EDIT***

If you choose *no* for ***Control all TCP Services***, ***Select TCP Services*** allows access to the configuration of all services that TDRC is to be applied to (the screenshot shows the preconfigured services):

```
R3000w Setup Tool                Funkwerk Enterprise Communications GmbH
[IP][TDRC][SERVICES]: Configure TCP Services                    MyGateway

 TCP Port                                Status

    80              HTTP                   builtin
    443             HTTPS                  builtin
    20              FTP Data               builtin
    110             POP3                   builtin
    143             IMAP2                  builtin



     ADD                DELETE              EXIT
```

ADD allows access to the configuration of further TCP services:

```
R3000w Setup Tool                Funkwerk Enterprise Communications GmbH
[IP][TDRC][SERVICES][ADD]: Configure TCP Services              MyGateway

     TCP Service Port              1
     Status                        enabled
     Alias Name (Description)


           SAVE                                  CANCEL
```

The menu contains the following fields:

Field	Description
TCP Service Port	Here you enter the TCP port of the service you want to configure to be observed by the TDRC.. Available values are *1* to *65535*, default is *1*.
Status	Here you choose if the TDRC is to be activated for the service configured. Available values are *enabled* and *disabled*, default is *enabled*. For the preconfigured services the state *built-in* is displayed in the ***CONFIGURE TCP SERVICES***-list.
Alias Name (Description)	Here you enter a description for the service you have configured, the maximum length of the entry is 20 characters.

Table 5-2: ***IP ➜ BANDWIDTH MANAGEMENT (TDRC / LOAD BALANCING / BOD) ➜ TCP DOWNLOAD RATE CONTROL (TDRC) ➜ ADD/EDIT ➜ SELECT TCP SERVICES ➜ ADD***

5.2 IP Load Balancing over Multiple Interfaces Submenu

The *IP Load Balancing over Multiple Interfaces* menu is described below.

The increasing amount of data traffic over the Internet necessitates the possibility of being able to send data over different interfaces to increase the total bandwidth available. IP load balancing enables the distribution of data traffic within a certain group of interfaces to be controlled.

The configuration is set in the ***IP*** ➜ ***Bandwidth Management (Load Balancing/BOD)*** ➜ ***IP Load Balancing over Multiple Interfaces*** menu.

The menu shows a list of the interface groups already configured for load balancing.

Access to the menu for configuring the groups is via ***ADD/EDIT***.

```
R3000w Setup Tool                Funkwerk Enterprise Communications GmbH
[IP][IP LOAD BALANCING][ADD]                                     MyGateway


   Description
   Interface Group ID    0

   Distribution Policy   session round-robin
   Distribution Mode     always (use operational up and
                         dormant interfaces)
   Distribution Ratio    equal for all interfaces of the
                         group

   Interface 1                                  none

   Interface 2                                  none

   Interface 3                                  none

                  SAVE              CANCEL
```

The menu contains the following fields:

Field	Description
Description	Here you enter the desired description of the interface group.

Field	Description
Interface Group ID	The ID of the interface group. This is assigned by the system automatically, but can also be edited. It is used only for internal assignment of the group. The default value is *0*.
Distribution Policy	Here you select in what way the data traffic is distributed to the interfaces configured for the group. Possible values: see "DISTRIBUTION POLICY selection options" on page 31
Distribution Mode	Here you select the state the interfaces in the group may have if they are to be included in load balancing. Possible settings: ■ *always (use operational up and dormant interfaces)*: Interfaces that are either up or dormant are included (default value). ■ *up-only (operational up interfaces only):* Only interfaces that are up are included.
Distribution Ratio	Not for ***DISTRIBUTION POLICY*** = *service/source-based routing*. Here you select whether the percentage share of data traffic is to be the same for all interfaces of the group or configured individually for each interface. Possible settings: ■ *equal for all interfaces of the group* (default value): All interfaces are automatically assigned the same share. ■ *individual for all interfaces of the group*: Each interface can be assigned a share individually.

Field	Description
Interface 1 - 3	Here you select the interfaces that are to belong to the group from the available interfaces.
Distribution Fraction (in percent)	Not for ***DISTRIBUTION POLICY*** = *service/source-based routing*. Appears only for ***INTERFACE 1 - 3*** if an interface has been selected. ■ *equal for all interfaces of the group* (default value): Here the percentage of the data traffic to be assigned to an interface is diplayed. ■ *individual for all interfaces of the group*: Here you enter the percentage of the data traffic to be assigned to an interface. The meaning differs according to the ***DISTRIBUTION POLICY*** used: ■ based on the number of sessions to be distributed for *session round-robin*. ■ based on the data rate for *bandwidth load-/upload-/download-dependent*.

Table 5-3: ***IP LOAD BALANCING OVER MULTIPLE INTERFACES*** menu fields

DISTRIBUTION POLICY offers the following selection options:

Field	Description
session round-robin	A newly added session is assigned to one of the group interfaces according to the percentage assignment of sessions to the interfaces. The number of sessions is decisive.

Field	Description
bandwidth load-dependent	A newly added session is assigned to one of the group interfaces according to the share of the total data rate handled by the interfaces. Decisive is the current data rate based on the data traffic in both the send and receive direction.
bandwidth download-dependent	A newly added session is assigned to one of the group interfaces according to the share of the total data rate handled by the interfaces. Decisive is the current data rate based on the data traffic in the receive direction only.
bandwidth upload-dependent	A newly added session is assigned to one of the group interfaces according to the share of the total data rate handled by the interfaces. Decisive is the current data rate based on the data traffic in the send direction only.
service/source-based routing	A newly added session is assigned to one of the group interfaces according to the configuration of the static routing in the ***IP Load Balancing over Multiple Interfaces*** ➜ ***ADD/EDIT*** ➜ ***IP Routing List*** menu. This menu is only accessible if you have selected *service/source-based routing*. see “IP Routing List Submenu” on page 31

Table 5-4: ***Distribution Policy*** selection options

5.2.1 IP Routing List Submenu

The *IP Routing List* menu only appears if an interface has been selected in *Distribution Policy* *service/source-based routing* and *Interface 1 - 3*.

The ***IP Load Balancing over Multiple Interfaces*** ➜ ***ADD/EDIT*** ➜ ***IP Routing List*** menu contains a list of all configured routing entries. The configuration is set in ***IP Routing List*** ➜ ***ADD/EDIT***.

```
R3000w Setup Tool                Funkwerk Enterprise Communications GmbH
[IP][ROUTING][ADD]: Configure Service/Source-Based Routing    MyGateway


  Interface                      Internet1

  Type                           Host route
  Network                        WAN without transit network

  Destination IP Address

  Gateway IP Address

  Source IP Address
  Source Mask

  Protocol                       tcp
  Service                        unlisted service     Port  -1


              SAVE                              CANCEL
```

The menu contains the following fields:

Field	Description
Interface	Shows the interface to be edited. This field cannot be changed.
Type	Type of route. Possible values: ■ *Host route*: Route to a single host ■ *Network route* (default value): Route to a network ■ *Default route*: The route is valid for all IP addresses and is only used if no other suitable route is available
Network	Defines the type of connection (LAN, WAN). For possible values see table “NETWORK selection options,” on page 34.
Destination IP Address	Only if ***ROUTE TYPE*** *Host route* or *Network route*. IP address of the destination host or network.

Field	Description
Destination Mask	Only if ***ROUTE TYPE*** = *Network route* Netmask for Destination IP Address. If no entry is made, the gateway uses a default netmask.
Gateway IP Address	Only for ***NETWORK*** *LAN* or *WAN with transit network*. IP address of the host to which your gateway should forward the IP packets.
Source IP Address	IP address of the source host or network.
Source Mask	Netmask for ***SOURCE IP ADDRESS***.
Protocol	Defines a protocol. Possible values: *tcp*, *egp*, *pup*, *udp*, *hmp*, *xns*, *rdp*, *rsvp*, *gre*, *esp*, *ah*, *igrp*, *ospf*, *l2tp*, *don't verify*, *icmp*, *ggp*. The default value is *don't verify*.
Service	Here you select a predefined service for whose data traffic the entry is to apply. The value *unlisted service* is shown when accessing the menu. This is only a bookmark. The data traffic is not filtered by this entry as long as the default value *-1* is left in the ***PORT*** field.
Port	Can only be edited if ***PROTOCOL*** = *tcp* or *udp* and ***SERVICE*** = *unlisted service*. Entry of destination port for ***PROTOCOL*** *tcp* or *udp*. Possible settings are values from *-1* to *65535*. The default value *-1* means the destination port can be any port.

Table 5-5: ***IP ROUTING LIST*** ➜ ***ADD/EDIT*** menu fields

NETWORK contains the following selection options (depending on type of interface):

Description	Meaning
LAN	Route to a destination host or network that can be reached via your gateway's LAN connection.
WAN without transit network	Route to a destination host or network that can be reached via a WAN partner without including any transit network available.
WAN with transit network	Route to a destination host or network that can be reached via a WAN partner including any transit network available.

Table 5-6: ***NETWORK*** selection options

5.3 IP triggered Bandwidth on Demand (IP BOD) Submenu

The *IP TRIGGERED BANDWIDTH ON DEMAND (IP BOD)* menu is described below.

```
R3000w Setup Tool              Funkwerk Enterprise Communications GmbH
[IP][BOD]: Bandwidth on Demand for IP                          MyGateway


        Filter
        Rules for BOD
        Configure Interfaces for BOD

        EXIT
```

Application-controlled bandwidth management is configured via filters, filter rules and interface assignment.

Filter Filters define which IP packets (and thus applications) are to influence the available bandwidth.

Rule Rules define whether other ISDN B-channels are to be added to an existing connection to transfer the IP packets covered by the filters.

Chain Several rules can be interlinked to form a defined rule chain.

Interface You can also assign a rule chain individually to each interface.

Configuration is made in the following submenus:

- ***FILTER***
- ***RULES FOR BOD***
- ***CONFIGURE INTERFACES FOR BOD***

5.3.1 Filter Submenu

The *FILTER* menu is described below.

This shows a list of all configured filters (including the filters from ***IP*** ➜ ***ACCESS LISTS*** and ***QoS***.

The filters are configured in ***IP*** ➜ ***BANDWIDTH MANAGEMENT (LOAD BALANCING / BOD)*** ➜ ***IP TRIGGERED BANDWIDTH ON DEMAND (IP BOD)*** ➜ ***FILTER*** ➜ ***ADD/EDIT.***

```
R3000w Setup Tool                 Funkwerk Enterprise Communications GmbH
[IP] [BOD] [FILTER] [EDIT]                                        MyGateway

  Description
  Index

  Protocol  any

  Source Address
  Source Mask



  Destination Address
  Destination Mask


  Type of Service (TOS)   00000000              TOS Mask  00000000

                    SAVE                                    CANCEL
```

The ***FILTER*** ➜ ***ADD/EDIT*** menu contains the following fields:

Field	Description
Description	Designation of the filter. Note that only the first 10 or 15 characters are visible in other menus.
Index	Cannot be changed here. The gateway assigns a number automatically to new filters defined here.
Protocol	Defines a protocol. Possible values: *any, tcp/udp-port,icmp, ggp, ip, tcp, egp, igp, pup, chaos, udp, hmp, xns_idp, rdp, rsvp, gre, esp, ah, tlsp, skip, kryptolan, iso-ip, igrp, ospf, ipip, ipx-in-ip, vrrp, l2tp*. The default value is *any* and matches any protocol.

Field	Description
Type	Only if ***Protocol*** = *icmp*. Possible values: *any, echo reply, destination unreachable, source quench, redirect, echo, time exceeded, param problem, timestamp, timestamp reply, address mask, address mask reply*. The default value is *any*. See RFC 792.
Connection State	If ***Protocol*** = *tcp*, you can define a filter based on the state of the TCP connection. Possible values: ■ *established*: All TCP packets that would not open any new TCP connection on routing over the gateway match the filter. ■ *any* (default value): All TCP packets match the filter.
Source Address	Defines the source IP address of the data packets.
Source Mask	Netmask for ***Source Address***.
Source Port	Only for ***Protocol*** = *tcp/udp-port*. Source port number or range of source port numbers. Possible values: see “Source Port and Destination Port selection options” on page 38 The default value is *any*.
Specify Port ..to Port	If ***Source Port*** or ***Destination Port*** = *specify* or *specify range* Port numbers or range of port numbers.

Field	Description
Destination Address	Defines the destination IP address of the data packets.
Destination Mask	Netmask for ***DESTINATION ADDRESS***.
Destination Port	Only for ***PROTOCOL*** = *tcp*/*udp*-*port*. Destination port number or range of destination port numbers that matches the filter. Possible values: see "SOURCE PORT and DESTINATION PORT selection options" on page 38. The default value is *any*.
Type of Service (TOS)	Identifies the priority of the IP packet, cf. RFC 1349 and RFC 1812 (shown in binary format).
TOS Mask	Bitmask for Type of Service (shown in binary format).

Table 5-7: ***FILTER*** menu fields

SOURCE PORT and ***DESTINATION PORT*** contain the following selection options:

Field	Description
any (default value)	The route is valid for all ➤➤ **port** numbers.
specify	Enables the entry of a port number.
specify range	Enables the entry of a range of port numbers.
priv (0...1023)	Privileged port numbers: 0 ... 1023.
server (5000....32767)	Server port numbers: 5000 ... 32767.
clients 1 (1024....4999)	Client port numbers: 1024 ... 4999.
clients 2 (32768....65535)	Client port numbers: 32768 ... 65535.
unpriv (1024...65535)	Unprivileged port numbers: 1024 ... 65535.

Table 5-8: ***SOURCE PORT*** and ***DESTINATION PORT*** selection options

5.3.2 Submenu Rules for BOD

The *RULES FOR BOD* menu is described below.

All the configured rules are listed in ***IP*** ➜ ***BANDWIDTH MANAGEMENT (LOAD BALANCING / BOD)*** ➜ ***IP TRIGGERED BANDWIDTH ON DEMAND (IP BOD)*** ➜ ***RULES FOR BOD***.

Configuration is carried out in the ***ADD/EDIT*** menu.

```
R3000w Setup Tool                 Funkwerk Enterprise Communications GmbH
[IP][BOD][RULE][ADD]                                              MyGateway


  Action                    invoke  M

  Direction                 outgoing
  Number of Channels        0

  Filter                    Firstfilter (1)




           SAVE                                    CANCEL
```

The menu consists of the following fields:

Field	Description
Index	Appears only for ***EDIT***. Cannot be changed. Shows the ***INDEX*** of existing rules. The gateway assigns a number to newly defined rules automatically.
Insert behind Rule	Appears only for ***ADD*** and if at least one rule exists. Defines the existing rule behind which the new rule is inserted. You can start a new independent chain with *none*.

Field	Description
Action	Defines the action to be taken for a filtered data packet. ■ *invoke M* (default value): B-channels are added if ***FILTER*** and ***DIRECTION*** match. ■ *invoke !M*: B-channels are added if ***FILTER*** or ***DIRECTION*** do not match. ■ *deny M*: B-channels are not added if ***FILTER*** and ***DIRECTION*** match. ■ *deny !M*: B-channels are not added if ***FILTER*** or ***DIRECTION*** do not match. ■ *ignore*: Use next rule.
Direction	Direction of data packets. Possible values: ■ *outgoing* (default value): outgoing data packets ■ *incoming*: incoming data packets ■ *both*: incoming and outgoing data packets.
Number of Channels	Number of B-channels that are to be added. The default value is *0*.
Filter	Filter used.
Next Rule	Appears only if an existing rule is edited. Defines the next rule to be used.

Table 5-9: ***RULES FOR BOD*** menu fields

You can reorganize the indexing of the rules in the ***IP*** ➜ ***BANDWIDTH MANAGEMENT (LOAD BALANCING / BOD)*** ➜ ***IP TRIGGERED BANDWIDTH ON DEMAND (IP BOD)*** ➜ ***RULES FOR BOD*** ➜ ***REORG*** menu, but the sequence of the configured rules is retained. The rule that is to receive rule ***INDEX 1*** is defined in the ***INDEX OF RULE THAT GETS INDEX 1*** field.

```
R3000w Setup Tool              Funkwerk Enterprise Communications GmbH
[IP][BOD][RULE][REORG]: Reorganize Rules                       MyGateway


       Index of Rule that gets Index 1      none


            REORG                                  CANCEL
```

The rule chain that starts with rule ***INDEX** 1* is always applied as standard to the interface of the gateway (e.g. WAN partner).

5.3.3 Configure Interfaces for BOD Submenu

The *CONFIGURE INTERFACES FOR BOD* menu is described below.

All the WAN partner interfaces are listed in the ***IP*** ➜ ***BANDWIDTH MANAGEMENT (LOAD BALANCING / BOD)*** ➜ ***IP TRIGGERED BANDWIDTH ON DEMAND (IP BOD)*** ➜ ***RULES FOR BOD*** menu.

Assign the selected interfaces to the start of a rule chain in ***CONFIGURE INTERFACES FOR BOD*** ➜ ***EDIT***.

```
R3000w Setup Tool              Funkwerk Enterprise Communications GmbH
[IP][BOD][INTERFACES][EDIT]                                    MyGateway


 Interface                branch
 First Rule               RI 1 FI 1 (Firstfilter)


           SAVE                                  CANCEL
```

The menu consists of the following fields:

Field	Description
Interface	Name of interface that has been selected. This field cannot be edited.
First Rule	Defines the start of the rule chain to be applied to data packets received over ***INTERFACE***. If you enter *none* (default value), you specify that no filters are used for ***INTERFACE***.

Table 5-10: ***CONFIGURE INTERFACES FOR BOD ➜ EDIT*** menu fields

6 IP Address Pool WAN (PPP) Submenu

The *IP Address Pool WAN (PPP)* menu is described below.

The ***IP ➜ IP Address Pool WAN (PPP)*** menu is for setting up a pool of IP addresses that your gateway as dynamic IP address server can assign to WAN partners to enable them to dial in.

All the configured IP address pools are listed here. The configuration is set up in the ***IP address pool WAN (PPP) ➜ ADD/EDIT*** menu.

```
R3000w Setup Tool                Funkwerk Enterprise Communications GmbH
[IP][DYNAMIC][EDIT]                                              MyGateway

 Pool ID                                    0
 IP Address                                 192.168.0.11
 Number of Consecutive Addresses            2




           SAVE                                      CANCEL
```

The menu contains the following fields:

Field	Description
Pool ID	Unique number for identifying an IP address pool.
IP Address	First IP address in the range.
Number of Consecutive Addresses	Number of IP addresses in the range, including the first IP address. The default value is *1*.

Table 6-1: ***IP Address Pool WAN (PPP)*** menu fields

7 IP Address Pool LAN (DHCP) Submenu

The *IP Address Pool LAN (DHCP)* menu is described below.

IP* ➜ *IP Address Pool LAN (DHCP) is used for configuring the gateway as ➤➤ **DHCP** server (Dynamic Host Configuration Protocol).

All the configured interfaces and relevant IP address pools are listed here. The configuration is set up in the ***IP Address Pool LAN (DHCP)* ➜ *ADD/EDIT*** menu.

```
R3000w Setup Tool              Funkwerk Enterprise Communications GmbH
[IP][DHCP][ADD]: Define Range of IP Addresses                 MyGateway


  Interface                                 en1-0
  Type                                      Any
  IP Address
  Number of Consecutive Addresses           1
  Lease Time (Minutes)                      120
  MAC Address
  Alive Test Period (seconds, 0=disabled)   0

  Gateway
  NetBT Node Type                           not specified



        SAVE                                 CANCEL
```

The menu contains the following fields:

Field	Description
Interface	Interface to which the address pool is assigned. When a DHCP request is received over ***Interface***, one of the addresses from the address pool is assigned.

Field	Description
Type	Restrict the use of the DHCP address pool for specific client types: ■ *IPSec*: DHCP address pool is only used for IPSec clients. ■ *Non-IPSec*: DHCP address pool is not used for IPSec clients. ■ *Any*: DHCP address pool is used for all clients.
IP Address	First IP address in the address pool.
Number of Consecutive Addresses	Total number of IP addresses in the address pool, including the first IP address (***IP ADDRESS***). The default value is *1*.
Lease Time (Minutes)	Defines the length of time an address from the pool is assigned to a host. After the ***LEASE TIME (MINUTES)*** expires, the address can be reassigned. The default value is *1*20.
MAC Address	Only for ***NUMBER OF CONSECUTIVE ADDRESSES*** = *1* ***IP ADDRESS*** is only assigned to the device with ***MAC ADDRESS***.
Client Identifier	Only for ***NUMBER OF CONSECUTIVE ADDRESSES*** = *1* If you highlight the ***MAC ADDRESS*** field, you can alternatively select the option ***CLIENT IDENTIFIER***. This is required, if no MAC address is available, e.g. if the IPSec client is run on a PC without Ethernet equipment. Thus enter the client name here.

Field	Description
Alive Test Period (seconds, 0=disabled)	Specifies a period (in seconds) for checking that the clients, which got an IP address from ***IP ADDRESS POOL LAN (DHCP)***, are still alive. If not, the IP addressed can be assigned to further requesting clients. Possible values are *0..65535*. Default value is *0*. If set to 0, no alive check is performed.
Gateway	Defines which IP address is transferred to the DHCP client as gateway. If no IP address is entered here, the IP address defined in ***INTERFACE*** is transferred.
NetBT Node Type	Defines how and in which order the host carries out resolution of NetBIOS names to IP addresses. Possible values: ■ *not specified* (default value) ■ *Broadcast Node* ■ *Point-to-Point Node* ■ *Mixed Node* ■ *Hybrid Node*

Table 7-1: ***IP ADDRESS POOL LAN (DHCP)*** menu fields

8 SNMP Submenu

The *IP* ➜ *SNMP* menu is described below.

```
R3000w Setup Tool              Funkwerk Enterprise Communications GmbH
[IP][SNMP]: SNMP Configuration                                MyGateway


     SNMP versions              v1|v2c|v3

     SNMP listen UDP port       161
     SNMP trap UDP port         162
     SNMP trap broadcasting     off
     SNMP trap community        snmp-Trap




        SAVE                                  CANCEL
```

IP ➜ ***SNMP*** is for changing the basic ➤➤ **SNMP** settings.

The ***SNMP*** menu contains the following fields:

Field	Description
SNMP versions	This parameter determines which SNMP version the gateway allows for listening for external SNMP access and for sending SNMP traps to external networks. Available values are: ■ *v1|v2c|v3* (default) - The gateway accepts SNMP access of the versions 1, 2c and 3. ■ *off* - The gateway accepts no external SNMP access, i.e. SNMP access is possible exclusively from the console of the gateway (e.g. via SSH or the serial interface). ■ *v1|v2c* - The gateway accepts SNMP access of the versions 1 and 2c which supports 64 bit counters and access control through SNMP communities. ■ *v3* - The gateway accepts only SNMP access of version 3, supporting "real" user management and access control through access levels. You can find further information on all SNMP versions in the corresponding RFCs and Drafts: ■ SNMP V. 1: RFC 1157 ■ SNMP V. 2c: RFC 1901 – 1908 ■ SNMP V. 3: RFC 3410 – 3418.
SNMP listen UDP port	Here you enter the number of the UDP port on which the gateway accepts SNMP requests. The default value is *161*. *0* deactivates the feature.

Field	Description
SNMP trap UDP port	Here you enter the number of the UDP port to which the gateway sends SNMP traps. The default value is *162*. *0* deactivates the feature.
SNMP trap broadcasting	For activating SNMP trap broadcasting. The gateway then sends SNMP traps to the broadcast address of the LAN. Possible values are *on* and *off* (default value).
SNMP trap community	Here you can enter an SNMP ID. This must be sent by the SNMP Manager with every SNMP request so that this is accepted by your gateway. The default value is *snmp-Trap*.

Table 8-1: ***IP*** ➜ ***SNMP*** menu fields

9 Remote Authentication (RADIUS/TACACS+) Submenu

The *REMOTE AUTHENTICATION (RADIUS/TACACS+)* menu is described below.

The ***IP*** ➜ ***REMOTE AUTHENTICATION (RADIUS/TACACS+)*** menu offers access to the following submenus:

- ***RADIUS AUTHENTICATION AND ACCOUNTING***
- ***TACACS+ AUTHENTICATION AND AUTHORIZATION***

9.1 RADIUS Authentication and Accounting Submenu

The *AUTHENTICATION AND ACCOUNTING* menu is described below.

Client / Server

RADIUS (Remote Authentication Dial In User Service) is a service that enables authentication and configuration information to be exchanged between your gateway and a RADIUS server. The RADIUS server administrates a database with information about user authentication and configuration and for statistical recording of connection data.

RADIUS can be used for:

- authentication
- accounting
- exchanging configuration data.

For an incoming connection, the bintec gateway sends a request with user name and password to the RADIUS server, which then searches its database. If the user is found and can be authenticated, the RADIUS server sends corresponding confirmation to the gateway. This confirmation also contains parameters (called RADIUS attributes), which the gateway uses as WAN connection parameters.

If the RADIUS server is used for accounting, the gateway sends an accounting message at the start of the connection and a message at the end of the connection. These start and end messages also contain statistical information about the connection (IP address, user name, throughput, costs).

RADIUS packets

The following types of packets are sent between the RADIUS server and bintec gateway (client):

Type	Purpose
ACCESS_REQUEST	Client –> Server If an access request is received by the gateway, a request is sent to the RADIUS server if no corresponding WAN partner has been found in the gateway.
ACCESS_ACCEPT	Server –> Client If the RADIUS server has authenticated the information contained in the ACCESS_REQUEST, it sends an ACCESS_ACCEPT to the gateway together with the parameters used for setting up the connection.
ACCESS_REJECT	Server –> Client If the information contained in the ACCESS_REQUEST does not correspond to the information in the user database of the RADIUS server, it sends an ACCESS_REJECT to reject the connection.
ACCOUNTING_START	Client -> Server If a RADIUS server is used for accounting, the gateway sends an accounting message to the RADIUS server at the start of each connection.
ACCOUNTING_STOP	Client -> Server If a RADIUS server is used for accounting, the gateway sends an accounting message to the RADIUS server at the end of each connection.

All the RADIUS servers currently configured are listed in the ***IP*** ➜ ***RADIUS SERVER*** menu.

The configuration is set up in ***IP*** ➜ ***RADIUS SERVER*** ➜ ***ADD/EDIT***.

```
R3000w Setup Tool                 Funkwerk Enterprise Communications GmbH
[IP][RADIUS][ADD]                                                MyGateway

Protocol                        authentication

IP Address
Password

Priority                        0
Policy                          authoritative

Port                            1812
Timeout (ms)                    1000
Retries                         1
State                           active
Validate                        enabled
Dialout                         disabled
Alive Check (if inactive)       enabled

          SAVE                                    CANCEL
```

The menu contains the following fields:

Field	Description
Protocol	Defines whether the RADIUS server is used for authentication purposes or accounting. Possible values: ■ *authentication* (default value) - The RADIUS server is used for controlling access to a network. ■ *accounting* - The RADIUS server is used for recording connection data. ■ *shell login* - The RADIUS server is used for controlling access to the SNMP shell of the gateway. ■ *IPSec* - The RADIUS server is used for sending configuration data for IPSec peers to the gateway. ■ *802.1x* - The RADIUS server is used for authenticating WLAN clients according to 802.1x standard.
IP Address	The IP address of the RADIUS server.
Password	Common password used for communication between the RADIUS server and gateway.
Priority	Priority of the RADIUS server. If a number of RADIUS server entries exist, the server with the highest priority is used first. If this server does not answer, the server with the next lower priority is used. Possible values: Whole numbers from *0* (highest priority) to *7* (lowest priority). The default value is *0*.

Field	Description
Policy	Defines how the bintec gateway responds if a negative answer is received to a request. Possible values: ■ *authoritative* (default value): A negative answer to a request is accepted. ■ *non authoritative*: A negative answer to a request is not accepted. A request is sent to the next RADIUS server until the gateway receives an answer from a server configured as authoritative.
Port	TCP port used for RADIUS data. RFC 2138 defines the default ports as 1812 for authentication (1645 in older RFCs) and 1813 for accounting (1645 in older RFCs). You can obtain the port to be used from the documentation for your RADIUS server. The default value is *1812*.
Timeout (ms)	Maximum waiting time in milliseconds between the ACCESS_REQUEST and answer. After timeout, the request is repeated according to ***RETRIES*** or the next configured RADIUS server is requested. Possible values: Whole numbers between *50* and *50000*. The default value is *1000* (1 second).

Field	Description
Retries	Number of repetitions if a request is not answered. If an answer is still not received after these retries, ***STATE*** is set to *inactive*. The gateway then tries to reach the server every 20 seconds; if the server answers, ***STATE*** is set to *active* again. Possible values: Whole numbers between *0* and *10*. The default value is *1*. To prevent ***STATE*** being set to *inactive*, set this value to *0*.
State	State of the RADIUS server. Possible values: ■ *active* (default value): Server answers requests. ■ *inactive*: Server does not answer (see ***RETRIES***). ■ *disabled*: Requests to a certain RADIUS server are temporarily deactivated.
Validate	Possible values: ■ *enabled* (default value): The gateway checks the identity of the RADIUS server using the MD5 checksum from ***PASSWORD***. This option should be activated for security purposes. ■ *disabled*: This option should only be selected in special cases.

Field	Description
Dialout	Here you can define whether the gateway receives requests from RADIUS server dialout routes. This enables temporary interfaces to be configured automatically and the gateway can initiate outgoing connections that are not configured permanently. Possible values: *enabled*, *disabled* (default value).
Alive Check (if inactive)	Here you can activate a check of the reachability of a RADIUS server in ***STATE*** *inactive*. ■ *enabled* (default value): An Alive Check is carried out regularly (every 20 seconds) by sending an ACCESS_REQUEST to the IP address of the RADIUS server. If the server is reachable, ***STATE*** is set to *active* again. If the RADIUS server is only reachable over a dialup connection, this can cause additional costs if the server is *inactive* for a long time. ■ *disabled*: Alive Check is not carried out.

Table 9-1: ***RADIUS SERVER*** menu fields

9.2 TACACS+ Authentication and Authorization Submenu

The *TACACS+ AUTHENTICATION AND AUTHORIZATION* menu is described below.

The ***IP*** ➜ ***REMOTE AUTHENTICATION (RADIUS/TACACS+)*** ➜ ***TACACS+ AUTHENTICATION AND AUTHORIZATION*** menu displays a list of all already configured TACACS+ servers.

```
R3000w Setup Tool              Funkwerk Enterprise Communications GmbH
[IP][TACACS+]: Configure TACACS+ Server                        MyGateway


 IP Address       Priority     AdminStatus         OperStatus

192.168.0.100     0            up                  up




    ADD                DELETE              EXIT
```

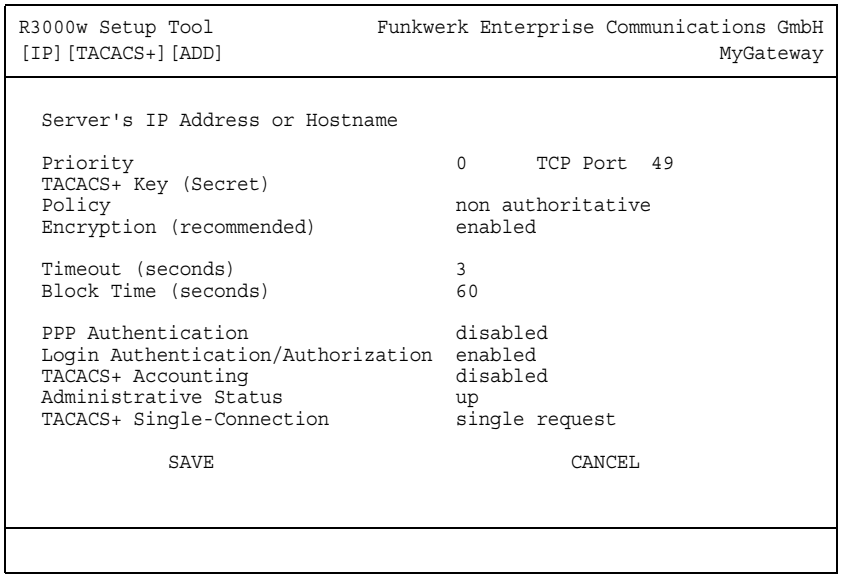
The TACACS+ protocol provides access control for gateways, network access servers and other network devices via one or more centralized servers. TACACS+ is an AAA protocol and thus provides authentication, authorization and accounting services (bintec gateways do not support TACACS+ Accounting at present).

Your bintec Gateway provides for the following TACACS+ funtions:

- Authentication for login shell
- Authentication for ppp connections
- Command authorization on the shell (e.g. telnet, setup. show)

TACACS+ uses TCP port 49 and sets up a secure and encrypted connection.

Configuration of a TACACS+ server is carried out in the ***IP*** ➜ ***REMOTE AUTHENTICATION (RADIUS/TACACS+)*** ➜ ***TACACS+ AUTHENTICATION AND AUTHORIZATION*** ➜ ***ADD/EDIT*** menu.



It contains the following configuration options:

Field	Description
Server's IP Address or Hostname	Here you enter the IP address of the TACACS+ server that is to be queried for AAA (Authentication, Authorization, Accounting) request. (bintec gateways do not support TACACS+ Accounting at present.)
Priority	Here you assign a priority to the current TACACS+ server. The server with the lowest value is the first one used for a TACACS+ AAA request. If there is no response or the access was denied (only for ***POLICY*** = *non authoritative*), the entry with the next lowest priority will be used. Available values are *0* to *9*, the default value is *0*.

Field	Description
TCP Port	Here the default TCP port used for the TACACS+ protocol is set to *49*. The value cannot be changed.
TACACS+ Key (Secret)	Here you enter the password used to authenticate and (if applicable) encrypt the data exchange between the TACACS+ server and the Network Access Server (your gateway) (encryption only for ***ENCRYPTION (RECOMMENDED)*** = *enabled*). The maximum length of the entry is 32 characters.
Policy	Here you can choose the interpretation of the TACACS+ reply. Available values: ■ *authoritative*: A negative answer to a request is accepted, i.e. no further TACACS+ server sent a request. ■ *non authoritative* (default value): The TACACS+ servers are sent a request according to their ***PRIORITY***, until a positive answer or, if the request was sent to an authoritativen server, a negative answer is sent back. The gateway-internal user management is not disabled when using TACACS+ and is checked after all TACACS+ servers had been queried.

Field	Description
Encryption (recommended)	Here you can choose whether the data exchange between the TACACS+ server and the NAS is encrypted. Available values are *enabled* (default value) and *disabled*. ■ *enabled*: The TACACS+ packets are MD5 encrypted. ■ *disabled*: The packets and therefore all related information are sent unencrypted. Unencrypted transfer is not recommended for standard usage, but for debug purposes only.
Timeout (seconds)	Here you enter the time in seconds the NAS waits for a TACACS+ response. If no reply is received during waiting time, the next configured TACACS+ server is queried (only for ***POLICY*** = *non authoritative*) and the current server is set into a *blocked* state (see ***OPERSTATUS*** = *blocked* in ***IP*** ➜ ***REMOTE AUTHENTICATION (RADIUS/TACACS+)*** ➜ ***TACACS+ AUTHENTICATION AND AUTHORIZATION***). Available values are *1* to *60*, the default value is *3*.
Block Time (seconds)	Here you enter the amount of time in seconds for which the current server is set to a blocked state. After the Block Time has ended, the server is set to the state specified for the field ***ADMINISTRATIVE STATUS*** (see below). Available values are *0* to *3600*, the default value is *60*. A value of *0* means that the server is never set to a *blocked* state and thus no further servers are queried.

Field	Description
PPP Authentication	This function is not supported by **R3000 Series**. It may be included in a later version of our system software. Here you define whether the current TACACS+ server is used for authentication of the ppp-dialin-clients.
Login Authentication/Authorization	Here you can choose whether to use the current TACACS+ server for login authentication to a gateway. Available choices are *enabled* (default value) and *disabled*.
TACACS+ Accounting	This function is not supported by **R3000 Series**. It may be included in a later version of our system software. Here you define whether accounting for ppp connections and login is used.
Administrative Status	Here you can choose the status the server is to be put in. Possible values: ■ *up* (default value): The associated server is used for authentication, authorization and accounting according to the priority (see field ***PRIORITY***) and the current operational status (see ***OPERSTATUS*** in ***IP*** ➜ ***REMOTE AUTHENTICATION (RADIUS/TACACS+)*** ➜ ***TACACS+ AUTHENTICATION AND AUTHORIZATION***). ■ *down*: This entry will not be considered for TACACS+ AAA requests.

Field	Description
TACACS+ Single-Connection	■ *single request* (default value): Multiple TACACS+ sessions (subsequent TACACS+ requests) may be supported simultaneously over a single TCP connection. ■ *multiple requests*: Multiple sessions are not being multiplexed over a single TCP connection, a new connection will be opened for each TACACS+ session and closed at the end of that session.

Table 9-2: ***IP*** ➜ ***Remote Authentication (RADIUS/TACACS+)*** ➜ ***TACACS+ Authentication and Authorization*** ➜ ***ADD/EDIT***

10 DNS Submenu

The *DNS* menu is described below.

```
R3000w Setup Tool              Funkwerk Enterprise Communications GmbH
[IP][DNS]: IP Configuration - Nameservice                     MyGateway


   Positive Cache                   enabled
   Negative Cache                   enabled

   Overwrite Global Nameservers     yes
   Default Interface                none

   DHCP Assignment                  self
   IPCP Assignment                  global

   Static Hosts                     (0)
   Forwarded Domains                (0)
   Dynamic Cache                    (0 pos 0 neg)

   Advanced Settings...             Global Statistics...


              SAVE                            CANCEL
```

Name Resolution with the Gateway

The gateway offers the following options for name resolution:

- DNS proxy function, for forwarding DNS requests sent to the gateway to a suitable DNS server. This also includes specific forwarding of certain domains (Forwarded Domains).
- DNS cache, for saving the positive and negative results of DNS requests.
- Static entries (Static Hosts), for manually defining or preventing assignments of IP addresses to names.
- DNS monitoring, for providing an overview of DNS requests in the gateway.

Global Name Server

The IP addresses of global name servers that are asked if the gateway cannot answer requests itself or by forwarding entries are entered in ***IP*** ➜ ***STATIC SETTINGS***.

For local applications, the IP address of the gateway itself or the general loopback address (127.0.0.1) can be entered as global name server.

The gateway can also receive the addresses of the global name servers dynamically from WAN partners or if necessary transfer these to WAN partners:

Name Resolution Strategy in the Gateway

A DNS request is handled by the gateway as follows:

1. If possible, the request is answered directly from the static or dynamic cache with IP address or negative answer.
2. Otherwise, if a suitable forwarding entry exists, the relevant DNS server is asked, if necessary by setting up a WAN connection at extra cost. If the DNS server can resolve the name, the information is forwarded and a dynamic entry created in the cache.
3. Otherwise, if global name servers are entered, the Primary Domain Name Server then the Secondary Domain Name Server are asked. If the IP address of the gateway or the loopback address is entered for local applications, these are ignored here. If one of the DNS servers can resolve the name, the information is forwarded and a dynamic entry created in the cache.
4. Otherwise, if a WAN partner is selected as default interface, the associated DNS server is asked, if necessary by setting up a WAN connection at extra cost. If one of the DNS servers can resolve the name, the information is forwarded and a dynamic entry created in the cache.
5. Otherwise, if overwriting the addresses of the global name servers is allowed (***Overwrite Global Nameserver*** = *yes*), a connection is set up – if necessary at extra cost – to the first WAN partner configured to enable DNS server addresses to be requested from DNS servers, if this has not been attempted previously. If name server negotiation is successful, these are entered as global name servers and are therefore available for further requests.
6. Otherwise the initial request is answered with a server error.

If one of the DNS servers answers with “non-existent domain”, the initial request is immediately answered accordingly and a corresponding negative entry is made in the DNS cache of the gateway.

The configuration is set up in ***IP*** ➜ ***DNS***.

The menu contains the following fields:

Field	Description
Positive Cache	Activation of the positive dynamic cache. Possible values: ■ *enabled* (default value): Successfully resolved names and IP addresses are saved in the cache. ■ *flush*: All positive dynamic entries in the cache are deleted. ■ *disabled*: Successfully resolved names and IP addresses are not saved in the cache and existing dynamic positive entries are deleted.
Negative Cache	Activation of the negative dynamic cache. Possible values: ■ *enabled* (default value): Requested names for which a DNS server has sent a negative answer are saved as negative entries in the cache. ■ *flush*: All negative dynamic entries in the cache are deleted. ■ *disabled*: Names that could not be resolved are not saved in the cache and existing dynamic negative entries are deleted.

Field	Description
Overwrite Global Nameservers	Defines whether the addresses of the global name servers in the gateway (in ***IP*** ➜ ***STATIC SETTINGS***) may be overwritten with name server addresses sent by WAN partners. Possible values: ■ *yes* (default value) ■ *no*
Default Interface	Defines the WAN partner to which a connection is set up for name server negotiation if other name resolution attempts were not successful. The default value is *none*.
DHCP Assignment	Defines which name server addresses are sent to the DHCP client if the gateway is used as DHCP server. Possible values: ■ *none*: No name server address is sent. ■ *self* (default value): The address of the gateway is sent as name server address. ■ *global*: The addresses of the global name servers entered in the gateway are sent.
IPCP Assignment	Defines which name server addresses are sent by the gateway to a WAN partner in dynamic name server negotiation. Possible values: ■ *none*: No name server address is sent. ■ *self*: The address of the gateway is sent as name server address. ■ *global* (default value): The addresses of the global name servers entered in the gateway are sent.
Static Hosts	The number of static entries is shown in brackets.

Field	Description
Forwarded Domains	The number of forwarding entries is shown in brackets.
Dynamic Cache	The number of positive and negative dynamic entries in the DNS cache is shown in brackets.

Table 10-1: ***DNS*** menu fields

This menu provides access to the following submenus:

- ***STATIC HOSTS***
- ***FORWARDED DOMAINS***
- ***DYNAMIC CACHE***
- ***ADVANCED SETTINGS...***
- ***GLOBAL STATISTICS...***

10.1 Static Hosts Submenu

The *IP* ➜ *DNS* ➜ *STATIC HOSTS* submenu is described below.

```
R3000w Setup Tool                 Funkwerk Enterprise Communications GmbH
[IP] [DNS] [HOSTS] [ADD]                                        MyGateway

 Default Domain:

 Name
 Response      positive
 Address
 TTL           86400


                SAVE                                  CANCEL
```

This menu shows a list of Static Hosts already configured. This can be added to or edited in the ***STATIC HOSTS*** ➜ ***ADD/EDIT*** menu.

The menu contains the following fields:

Field	Description
Default Domain	Shows the domain name of the gateway entered in ***IP*** ➜ ***STATIC SETTINGS***.
Name	Host name, which is assigned the ***ADDRESS*** with this static entry. Can also start with the wildcard *, e.g. *.funkwerk-ec.com. If an incomplete name is entered without a dot, this is completed with "***. <DEFAULT DOMAIN>.***" after pressing **SAVE**.
Response	Type of static entry. Possible values: ■ *positive* (default value): A DNS request for ***NAME*** is answered with the associated ***ADDRESS***. ■ *ignore*: A DNS request is ignored; no answer is given. ■ *negative*: A DNS request for ***NAME*** is answered with a negative answer.
Address	Only for ***RESPONSE*** = *positive* IP address that is assigned to ***NAME***.
TTL	Period of validity of the assignment of ***NAME*** to ***ADDRESS*** in seconds (only relevant for ***RESPONSE*** = *positive*), which is sent to requesting hosts. The default value is *86400* (= 24 h).

Table 10-2: ***STATIC HOSTS*** menu fields

10.2 Forwarded Domains Submenu

The *IP* ➜ *DNS* ➜ *FORWARDED DOMAINS* submenu is described below.

```
R3000w Setup Tool                Funkwerk Enterprise Communications GmbH
[IP][DNS][FORWARDS][ADD]                                        MyGateway

 Global Nameservers: none, Default Interface: none
 Default Domain:

 Name

 Interface     none

 TTL           86400

                SAVE                                  CANCEL
```

This menu shows a list of Forwarded Domains already configured. This can be added to or edited in the ***FORWARDED DOMAINS*** ➜ ***ADD/EDIT*** menu.

The menu contains the following fields:

Field	Description
Global Nameservers	Shows the global name servers entered in ***IP*** ➜ ***STATIC SETTINGS***.
Default Domain	Shows the domain name of the gateway entered in ***IP*** ➜ ***STATIC SETTINGS***.
Name	Host name that is to be resolved with this forwarding entry. Can also start with the wildcard *, e.g. *.funkwerk.de. If an incomplete name is entered without a dot, this is completed with "***.<DEFAULT DOMAIN>.***" after pressing **SAVE**.

Field	Description
Interface	Defines the WAN partner to which a connection is to be set up for the resolution of ***NAME***. The default value is *none*.
TTL	Substitute value for the TTL value supplied by the DNS server in a positive answer, if this is *0* or exceeds ***MAXIMUM TTL FOR POS CACHE ENTRIES***. The TTL value indicates the period of validity of the assignment of the name to the IP address in seconds. The default value is *86400* (= 24 h).

Table 10-3: ***FORWARDED DOMAINS*** menu fields

10.3 Dynamic Cache Submenu

The *IP* ➜ *DNS* ➜ *DYNAMIC CACHE* submenu is described below.

```
R3000w Setup Tool              Funkwerk Enterprise Communications GmbH
[IP][DNS][DYNAMIC]: Nameservice - Dynamic Cache              MyGateway

 Name                                  Address         Resp  TTL      Ref




    DELETE              STATIC              EXIT
```

The ***Menu IP ➜ DNS ➜ Dynamic Cache*** is used to show the DNS entries learned dynamically by the DNS servers. Here dynamic entries can also be converted to static entries or deleted. The list contains the following columns:

Column	Meaning
Name	Host name to which ***Address*** is assigned.
Address	IP address that is assigned to ***Name***.
Resp	Type of dynamic entry. Possible values: ■ *pos* (positive): A DNS request for ***Name*** is answered with the associated IP address. ■ *neg* (negative): A DNS request for ***Name*** is answered with a negative answer.
TTL	Shows how many seconds the dynamic entry still remains in the cache. The entry is deleted on expiry of ***TTL***. When a positive dynamic entry is saved in the cache, the value is taken from the answer from the DNS server. If this value is *0* or exceeds ***Maximum TTL for Pos Cache entries***, the value is set to ***Maximum TTL for Pos Cache entries***. For a negative dynamic entry, the value is set to ***Maximum TTL for Neg Cache entries***. The display is not updated.
Ref	Shows how often the entry has been called.

Table 10-4: ***Dynamic Cache*** menu fields

A dynamic entry can be converted to a static entry by tagging the entry with the **Space** bar and confirming with **STATIC**.

The relevant entry then disappears from ***IP ➜ DNS ➜ Dynamic Cache*** and is listed in ***IP ➜ DNS ➜ Static Hosts***. ***TTL*** is transferred in this operation.

10.4 Advanced Settings Submenu

The *IP* ➜ *DNS* ➜ *ADVANCED SETTINGS* submenu is described below.

```
R3000w Setup Tool              Funkwerk Enterprise Communications GmbH
[IP][DNS][ADVANCED]: Nameservice - Advanced Settings          MyGateway


     Maximum Number of DNS Records        100



     Maximum TTL for Pos Cache entries    86400
     Maximum TTL for Neg Cache Entries    86400


     SAVE                CANCEL
```

The menu contains the following fields:

Field	Description
Maximum Number of DNS Records	Maximum total number of static and dynamic entries. Once this value is reached, the dynamic entry not requested for the longest period of time is deleted when a new entry is added. If ***MAXIMUM NUMBER OF DNS RECORDS*** is reduced by the user, dynamic entries are deleted if necessary. Static entries are not deleted; ***MAXIMUM NUMBER OF DNS RECORDS*** cannot be set to a lower value than the current number of existing static entries. Possible values: *0* .. *1000*. The default value is *100*.

Field	Description
Maximum TTL for Pos Cache entries	For a positive dynamic entry in the cache this is set to ***TTL***, if the TTL field of the DNS record received has the value *0* or exceeds ***MAXIMUM TTL FOR POS CACHE ENTRIES***. The default value is *86400*.
Maximum TTL for Neg Cache Entries	Is set to ***TTL*** for a negative dynamic entry in the cache. The default value is *86400*.

Table 10-5: ***ADVANCED SETTINGS...*** menu fields

10.5 Global Statistics Submenu

The *IP* ➜ *DNS* ➜ *GLOBAL STATISTICS* submenu is described below.

```
R3000w Setup Tool              Funkwerk Enterprise Communications GmbH
[IP][DNS][STATISTICS]: Nameservice - Global Statistics       MyGateway


  Received DNS Packets                 0
  Invalid DNS Packets                  0

  DNS Requests                         0
  Cache Hits                           0
  Forwarded Requests                   0

  Cache Hitrate (%)                    0

  Successfully Answered Queries        0
  Server Failures                      0



  EXIT
```

Contains the following fields (the menu is updated every second):

Field	Description
Received DNS Packets	Shows the number of received DNS packets addressed direct to the gateway, including the answer packets for forwarded requests.
Invalid DNS Packets	Shows the number of invalid DNS packets received and addressed direct to the gateway.
DNS Requests	Shows the number of valid DNS requests received and addressed direct to the gateway.
Cache Hits	Shows the number of requests that were answered with static or dynamic entries from the cache.
Forwarded Requests	Shows the number of requests forwarded to other name servers.
Cache Hitrate (%)	Shows the number of ***CACHE HITS*** per ***DNS REQUEST*** in %.
Successfully Answered Queries	Shows the number of successfully answered requests (positive and negative).
Server Failures	Shows the number of requests that were not answered by any name server (either positively or negatively).

Table 10-6: ***GLOBAL STATISTICS...*** menu fields

11 DynDNS Submenu

The *DynDNS* menu is described below.

The use of dynamic IP addresses has the disadvantage that a host in the network can no longer be found once its IP address has changed. Dynamic DNS ensures that your gateway can still be reached after changing the IP address.

The following configuration steps are necessary:

- Registration of a host name at a DynDNS provider
- Configuration of the gateway

Registration

The registration of a host name means that you define an individual user name for the DynDNS service, e.g. *dyn_client*. The service providers offer various domain names for this, so that a unique host name results for your gateway, e.g. *dyn_client.provider.com*. The DynDNS provider relieves you of the task of answering all DNS requests concerning the host *dyn_client.provider.com* with the dynamic IP address of your gateway.

To ensure that the provider always knows the current IP address of your gateway, the gateway contacts the provider when setting up a new connection and propagates its present IP address.

Configuration of the gateway

The configuration is set up in ***IP*** ➜ ***DynDNS***. The first menu window contains a list of the entries already configured for using DynDNS services.

```
R3000w Setup Tool              Funkwerk Enterprise Communications GmbH
[IP][DYNDNS]: Dynamic DNS Service                              MyGateway

  DynDNS Services:


Host Name                Interface  Permission    State
dyn_client.provider.com  internet   enabled       up_to_date




 DynDNS Provider List>

     ADD                 DELETE              EXIT
```

From here you can also access the ***IP*** ➜ ***DYNDNS*** ➜ ***DYNDNS PROVIDER LIST*** submenu.

In the ***IP*** ➜ ***DYNDNS*** ➜ ***ADD/EDIT*** menu, you can configure name resolution over a DynDNS provider or change an existing configuration:

```
R3000w Setup Tool                 Funkwerk Enterprise Communications GmbH
[IP] [DYNDNS] [ADD]                                              MyGateway

  Host Name
  Interface                   en0-1
  User
  Password

  Provider                    dyndns
  MX
  Wildcard                    off
  Permission                  enabled




            SAVE                                    CANCEL
```

The menu contains the following fields:

Field	Description
Host Name	Full host name as registered with the DynDNS provider.
Interface	Defines the WAN interface whose IP address is to be propagated over the DynDNS service (e.g. the interface of the Internet Service Provider).
User	User name as registered with the DynDNS provider.
Password	Password as registered with the DynDNS provider.

Field	Description
Provider	Selection of a preconfigured DynDNS provider. A choice of DynDNS providers is already available in the unconfigured state and their protocols are supported. The default value is *dyndns*.
MX	Full host name of a mail server, to which e-mails are forwarded if the host currently configured is not to receive mail. Ask your provider about this forwarding service and make sure e-mails can be received from the host entered as MX.
Wildcard	Here you can activate the forwarding of all subdomains of ***HOST NAME*** to the current IP address of ***INTERFACE***. Possible values: ■ *on*: The additional name resolution is activated. ■ *off* (default value): The additional name resolution is deactivated.
Permission	Here you can activate or deactivate the DynDNS entry just configured. Possible values are: ■ *enabled* (default value): Entry is activated. ■ *disabled*: Entry is deactivated.

Table 11-1: ***DYNDNS*** menu fields

The ***IP*** ➜ ***DYNDNS*** ➜ ***DYNDNS PROVIDER LIST*** menu shows a list of the preconfigured providers. You cannot edit or delete the preconfigured providers.

A new provider is configured in the ***IP*** ➜ ***DYNDNS*** ➜ ***DYNDNS PROVIDER LIST*** ➜ ***ADD/EDIT*** menu.

```
R3000w Setup Tool              Funkwerk Enterprise Communications GmbH
[IP] [DYNDNS] [DYNDNS PROVIDER] [ADD]                          MyGateway

 Name
 Server
 Path
 Port                          80

 Protocol                      dyndns

 Minimum Wait (sec)            300


          SAVE                                    CANCEL
```

The menu contains the following fields:

Field	Description
Name	Here you can give the provider any name you like.
Server	Host name or IP address of the server on which the provider's DynDNS service runs.
Path	Path on the provider's server, where the script for administration of your gateway's IP address can be found. Ask your provider for the path to be used.
Port	Port at which your gateway is to reach your provider's server. Ask your provider for the relevant port. Default value: *80*.

Field	Description
Protocol	Here you select one of the protocols implemented. The following are available: ■ *dyndns* (default value) (www.dyndns.org) ■ *static dyndns* (www.dyndns.org) ■ *ods* (http://www.ods.org) ■ *hn* (http://hn.org) ■ *dyns* (http://dyns.cx) ■ *GnuDIP HTML* (http://gnudip2.sourceforge.net) ■ *GnuDIP TCP* (http://gnudip2.sourceforge.net) ■ *custom dyndns* (www.dyndns.org)
Minimum Wait (sec)	Here you enter the minimum time (in seconds) that the gateway must wait before it is allowed to propagate its current IP address to the DynDNS provider again. The default value is *300* seconds.

Table 11-2: ***DynDNS Provider List*** ➜ ***ADD/EDIT*** menu fields

12 Routing Protocols Submenu

The *ROUTING PROTOCOLS* menu is described below.

```
R3000w Setup Tool              Funkwerk Enterprise Communications GmbH
[IP][ROUTING]: Routing protocols                              MyGateway

               Routed                    running

               RIP >

               OSPF


              SAVE                        CANCEL
```

The contents of a gateway's routing table can be configured statically. A gateway also has the option of updating its routing tables dynamically by exchanging information with other gateways. This information exchange is specified in a routing protocol.

Routing protocols allow the gateway to adapt to changing network conditions dynamically and quickly find the best routing solutions in complex networks. One of the most frequently used routing protocols is ***RIP***. It is explained briefly in the following chapters.

The ***ROUTING PROTOCOLS*** submenu is part of the ***IP*** menu. This shows the state of the Routing Daemon (***ROUTED***) and enables it to be activated or deactivated (with ***ROUTED*** = *running* or *stopped*).

The possible states of the Routing Daemon are:

- *running*: Activates RIP (dependent on the interface-specific RIP configuration) and OSPF.
- *stopped*: Deactivates RIP (dependent on the interface-specific RIP configuration) and OSPF.

The ***IP*** ➜ ***ROUTING PROTOCOLS*** menu also provides access to the ***RIP*** submenu.

The use of the routing protocols is activated globally in the ***IP*** ➜ ***ROUTING PROTOCOLS*** ➜ ***ROUTED*** menu. RIP is also activated on the respective interface by selecting the relevant protocol version in ***RIP SEND*** or ***RIP RECEIVE***.

12.1 RIP Submenu

The *RIP* menu is described below.

```
R3000w Setup Tool              Funkwerk Enterprise Communications GmbH
[IP][ROUTING][RIP]: RIP configuration                          MyGateway

      UDP port                              520

      Static Settings >

      Timer >

      Filter >


      SAVE                                  CANCEL
```

The ***IP*** ➜ ***ROUTING PROTOCOLS*** ➜ ***RIP*** menu is used for making global RIP settings. The activation of RIP is set specific to interface in ***IP*** ➜ ***ADVANCED SETTINGS*** of the respective interface menu.

A gateway exchanges routing information with other gateways using the RIP (Routing Information Protocol). A gateway sends messages to remote networks every 30 seconds using information from its own current routing table. The complete routing table is always exchanged in this process. If triggered RIP is used, information is only exchanged if the routing information has changed and only the changed information is sent.

Observing the information sent by other gateways enables new routes and shorter paths for existing routes to be saved in the routing table. As intermediate routes between networks can become unreachable, RIP removes routes that

are older than 5 minutes (i.e. routes not verified in the last 300 seconds). Routes learnt are not deleted if triggered RIP is used.

Note

The setting option ***UDP PORT***, which is used for sending and receiving RIP updates, is only for test purposes. If the setting is changed, this can mean that the gateway sends and listens at a port to which no other gateways react. The default value *520* should be retained.

The ***IP*** ➜ ***ROUTING PROTOCOLS*** ➜ ***RIP*** menu provides access to three other submenus, in which you can define exactly how RIP updates are handled:

- ***STATIC SETTINGS***
- ***TIMER***
- ***FILTER***.

12.1.1 Static Settings Submenu

The *STATIC SETTINGS* menu is described below.

```
R3000w Setup Tool              Funkwerk Enterprise Communications GmbH
[IP][ROUTING][RIP][STATIC]: RIP Static Settings                MyGateway

      Default Route distribution         enabled
      Poisoned Reverse                   disabled
      RFC 2453 variable timer            enabled
      RFC 2091 variable timer            disabled


      SAVE                               CANCEL
```

The ***IP*** ➜ ***ROUTING PROTOCOLS*** ➜ ***RIP*** ➜ ***STATIC SETTINGS*** menu is for configuring basic RIP parameters. It contains the following fields:

Field	Description
Default Route distribution	Here you determine whether the default route of your gateway is to be propagated via RIP updates. Possible values: ■ *disabled* ■ *enabled* The default value is *enabled*.
Poisoned Reverse	Procedure for preventing routing loops With standard RIP, the routes learnt are propagated over all interfaces with ***RIP SEND*** activated. With ***POISONED REVERSE***, the gateway propagates over the interface over which it learnt the routes, with the metric (Next Hop Count) 16 (=“Network is not reachable“). Possible values: ■ *disabled* ■ *enabled* The default value is *disabled*.
RFC 2453 variable timer	Here you can determine whether the timers described in RFC 2453 are to use the values you can configure in the ***IP*** ➜ ***ROUTING PROTOCOLS*** ➜ ***RIP*** ➜ ***TIMER*** menu. Possible values are: ■ *disabled* ■ *enabled* (default value) If you select *disabled*, the times defined in RFC are retained for the timeouts.

Field	Description
RFC 2091 variable timer	Here you can determine whether the timers described in RFC 2091 are to use the values you can configure in the ***IP*** ➜ ***ROUTING PROTOCOLS*** ➜ ***RIP*** ➜ ***TIMER*** menu. Possible values are: ■ *disabled* (default value) ■ *enabled* If you keep the *disabled* setting, the times defined in RFC are retained for the timeouts.

Table 12-1: ***STATIC SETTINGS*** menu fields

The timers that can be activated in the ***STATIC SETTINGS*** menu are configured in the ***IP*** ➜ ***ROUTING PROTOCOLS*** ➜ ***RIP*** ➜ ***TIMER*** menu.

12.1.2 Timer Submenu

The *TIMER* menu is described below.

```
R3000w Setup Tool              Funkwerk Enterprise Communications GmbH
[IP][ROUTING][RIP][TIMER]: RIP timer configuration           MyGateway


       Timer for RIP V2 (RFC 2453)
       ---------------------------
       Update Timer                        30
       Route Timeout                       180
       Garbage Collection Timer            120

       Timer for Triggered RIP (RFC 2091)
       ----------------------------------
       Hold down timer                     120
       Retransmission timer                5



              SAVE                                    CANCEL
```

In this menu you can configure the timers defined by RFC 2091 and RFC 2453 for the various events in the lifetime of a route.

The menu is divided into fields for configuration of the ***RIP-V2 TIMER (RFC 2453)*** and ***TRIGGERED-RIP TIMER (RFC 2091)***.

The ***TIMER*** menu contains the following fields (all timers are stated in seconds):

Field	Description
Update Timer	An RIP update is sent on expiry of this period of time. The default value is *30*.
Route Timeout	The ***ROUTE TIMEOUT*** is activated after the last update of a route. After timeout, the route is deactivated and the ***GARBAGE COLLECTION TIMER*** is started. The default value is *180*.
Garbage Collection Timer	The ***GARBAGE COLLECTION TIMER*** is started as soon as the route timeout has expired. After this timeout, the invalid route is deleted from the ***IPROUTETABLE*** if no further update is received for the route. The default value is *120*.
Hold down timer	The ***HOLD DOWN TIMER*** is activated as soon as the gateway contains an unreachable route (metric 16). After this timeout, the route is deleted from the ***IPROUTETABLE***, if applicable. The default value is *120*.

Field	Description
Retransmission timer	After this timeout, update request or update response packets are sent again until an update flush or update acknowledge packet arrives. The default value is *5*.

Table 12-2: ***TIMER*** menu fields

12.1.3 Filter Submenu

The *FILTER* menu is described below.

```
R3000w Setup Tool              Funkwerk Enterprise Communications GmbH
[IP][ROUTING][RIP][FILTER]: RIP Distribution Filter          MyGateway

 Interface   Direction   State    IP Address    Netmask    Priority




   ADD                 DELETE              EXIT
```

In the ***IP*** ➜ ***ROUTING PROTOCOLS*** ➜ ***RIP*** ➜ ***FILTER*** menu, you can define exactly which routes are to be exported or imported.

You can use the following strategies for this:

- You explicitly deactivate the import or export of certain routes. The import or export of all other routes that are not listed is still allowed.
- You explicitly activate the import or export of certain routes. In this case, you must also explicitly deactivate the import or export of all other routes. You can do this using a filter for ***IP ADDRESS*** = no entry (this corresponds to the IP address 0.0.0.0) with ***NETMASK*** = no entry (this corresponds to the netmask 0.0.0.0) and ***DISTRIBUTION*** = *disabled*. To make sure this filter is used last, you must assign it the lowest priority.

You configure a filter for a default route with the following values:

- ***IP ADDRESS*** = no entry (this corresponds to the IP address 0.0.0.0) with ***NETMASK*** = *255.255.255.255*.

The first menu window shows a list of the filters already configured.

The fields shown correspond to the options configurable in the ***ADD/EDIT*** submenu. The value for the ***DISTRIBUTION*** variable is shown under ***STATE***.

```
R3000w Setup Tool                Funkwerk Enterprise Communications GmbH
[IP][ROUTING][RIP][FILTER][ADD]: Define RIP Filter                MyGateway


        Interface                                  en1-0
        IP Address
        Netmask
        Priority                                   1
        Direction                                  import
        Distribution                               disabled
        Metric1 offset on interface up             0
        Metric1 offset on interface dormant        0


                SAVE                                    CANCEL
```

The ***FILTER*** ➜ ***ADD/EDIT*** menu contains the following fields:

Field	Description
Interface	Here you define the interface to which the rule to be configured applies.
IP Address	Here you enter the IP address to which the rule is to be applied. This address can be in the LAN or WAN. The rules for incoming and outgoing RIP packets (import or export) for the same IP address must be separately configured. You can enter individual host addresses or network addresses.
Netmask	Here you enter the netmask of ***IP ADDRESS***.

Field	Description
Priority	Here you enter the priority with which the filter is to be used. If different filters with overlapping IP address range exist, the filter with the higher priority is used first. This enables a single host route to be imported from an IP address range that is actually disabled, if the rule that allows this has a higher priority than the rule that disables the address range. Possible values are *1* to *16*, where *1* corresponds to the highest priority. The default value is *1*.
Direction	Here you define whether the filter applies to the export or import of routes. Possible values are: ■ *import* ■ *export.* The default value is *import*.
Distribution	Here you define whether this filter allows or denies export or import from/to the gateway. Possible values are: ■ *enabled* ■ *disabled* The default value is *disabled*.
Metric1 offset on interface up	Here you enter whether and to what extent the metric of an imported or exported route is to be changed if the interface concerned is active (up). Possible values are *-16* to *16*. The default value is *0*.

Field	Description
Metric1 offset on interface dormant	Here you enter whether and to what extent the metric of an imported or exported route is to be changed if the interface concerned is inactive (dormant). Possible values are *-16* to *16*. The default value is *0*.

Table 12-3: ***FILTER*** menu fields

12.2 OSPF Submenu

The *OSPF* menu is described below.

```
R3000w Setup Tool                Funkwerk Enterprise Communications GmbH
[IP][ROUTING][OSPF]: OSPF Configuration                          MyGateway


                Static Settings
                Interfaces
                Areas

                EXIT
```

The ***IP*** ➜ ***ROUTING PROTOCOLS*** ➜ ***OSPF*** menu differs from RIP in that all global and interface-specific OSPF settings are made here.

OSPF (Open Shortest Path First) is a routing protocol that is frequently used in larger networks as an alternative to RIP. It was originally developed to avoid a number of limitations of RIP (when used in larger networks).

The problems (with RIP) avoided by OSPF include:

- Reduced network load
  After a short initialization phase, routing information is not sent periodically as with RIP, but only changed routing information.

- Authentication
  Gateway authentication can be configured to increase the security when exchanging routing information.
- Routing Traffic Control
  Gateways can be combined to form areas to limit the traffic created by exchanging routing information.
- Connection costs
  OSPF differs from RIP in that the connection costs are not calculated from the number of next hops, but from the bandwidth of the respective transport medium.
- No limitation of the number of hops
  The limitation of the maximum number of 16 hops for RIP does not exist for OSPF.

Although the OSPF protocol is considerably more complex than RIP, the basic concept is the same, i.e. OSPF also determines the best path for forwarding the packets in each case.

Autonomous System

OSPF is an Interior Gateway Protocol that is used to distribute routing information within an autonomous system (AS). The Link State Updates are exchanged between the gateways by flooding. Each change of routing information is passed to all gateways in the network. OSPF areas are defined to limit the number of Link State Updates. All gateways of an area have an identical Link State database.

Area Border Routers

An area is interface-specific. Gateways whose interfaces belong to several areas and connect these to the backbone are called Area Border Routers (ABR). ABRs therefore contain the information of the backbone area and all areas connected. A gateway whose interfaces are all incorporated in one area are called Internal Routers (IR).

Link State Packets

There are three types of Link State packets: Router links show the state of the interfaces of a gateway that belong to a certain area. Summary links are generated by the ABR to define how the information on reachability in the network is exchanged between areas. Usually all information is sent to the backbone area, which then passes the information to the other areas. Network links are sent by Designated Routers (DS) within a segment and propagate all gateways that are

connected to a certain multi-access segment like Ethernet, Token Ring and FDDI (also NBMA). External links point to networks outside the AS. These networks are incorporated in OSPF using redistribution. In this case, an Autonomous System Border Router (ASBR) incorporates these external routes in the AS.

Authentication It is possible to increase security by authenticating the OSPF packets, so that the gateways can participate in Routing Domains using predefined passwords.

Backbone Area It is recommended that several areas are defined in larger networks. If more than one area is configured, one of these areas must possess the area ID 0.0.0.0, which defines the backbone area. This must be the center point of all areas, i.e. all areas must be physically connected to the backbone area. Occasionally, gateways cannot be physically connected directly to the backbone area and virtual links must be set up.

Virtual links The purpose of virtual links is to connect areas in which no physical connection to the backbone is possible and to maintain the connection of the backbone in case of a failure of the 0.0.0.0 area.

Summary links Summarizing is the term given to the consolidation of the various routes into a single advertisement (summary link). This is usually done by the ABR at the area borders.

Stub area Certain areas can be defined as stub areas in OSPF. This prevents external networks, e.g. those propagated from other protocols by redistribution in OSPF, being propagated into the stub area. Externally routing of such areas is propagated with a default route. The configuration of a stub area reduces the database size in the area and reduces the amount of storage space needed on the gateways incorporated in the area.

The ***IP*** ➜ ***OSPF*** menu provides access to the following submenus:

- ***STATIC SETTINGS***
- ***INTERFACES***
- ***AREAS***.

12.2.1 Static Settings Submenu

The *STATIC SETTINGS* menu is described below.

```
R3000w Setup Tool                 Funkwerk Enterprise Communications GmbH
[IP][ROUTING][OSPF][STATIC]: OSPF Static Settings                MyGateway


  OSPF                                                        enabled
  Generate Default Route for the AS                           no
  Propagate Routes on discard/refuse interfaces               no




            SAVE                                    CANCEL
```

The ***IP*** ➜ ***ROUTING PROTOCOLS*** ➜ ***OSPF*** ➜ ***STATIC SETTINGS*** menu contains global OSPF parameters. OSPF on the gateway is activated in this menu.

The ***STATIC SETTINGS*** menu contains the following fields:

Field	Description
OSPF	Activates (*enabled,* default value) or deactivates (*disabled*) OSPF.
Generate Default Route for the AS	If this value is set to *yes*, the gateway propagates a default route over all active OSPF interfaces (see ***ADMIN STATUS*** field in the ***IP*** ➜ ***OSPF*** ➜ ***INTERFACES*** menu). The default value is *no*.

Field	Description
Propagate Routes on discard/refuse interfaces	The logical interfaces REFUSE and IGNORE have the following meaning: REFUSE means (if a route exists on this) that packets from this interface are discarded and an ICMP Unreachable Reply is generated. IGNORE means (if a route exists on this) that packets from this interface are discarded without comment. If the value is *yes*, routes connected to the two discard/refuse interfaces are saved by OSPF in its database. If the value is *no* (default value), these routes are ignored.

Table 12-4: ***STATIC SETTINGS*** menu fields

12.2.2 Interfaces Submenu

The *INTERFACES* menu is described below.

```
R3000w Setup Tool                Funkwerk Enterprise Communications GmbH
[IP][ROUTING][OSPF][INTERFACE]: Interface Configuration       MyGateway


 Interface   Area     IP Adddress  AdminStatus State Metric
 en0-1       0.0.0.0  192.16.0.181  passive    down  10
 en0-1-snap  0.0.0.0  0.0.0.0       passive    down  10
 vss8-0      0.0.0.0  0.0.0.0       passive    down  1
 vss8-0-snap 0.0.0.0  0.0.0.0       passive    down  1
 vss8-1      0.0.0.0  0.0.0.0       passive    down  1
 vss8-1-snap 0.0.0.0  0.0.0.0       passive    down  1



 EXIT
```

Note

If your interfaces are not only to be assigned to backbone area 0.0.0.0, you must first define other OSPF areas in ***IP*** ➜ ***ROUTING PROTOCOLS*** ➜ ***OSPF*** ➜ ***AREAS*** ➜ ***ADD***.

All OSPF-capable gateway interfaces are listed here and all interface-specific settings made.

The configuration is set up in ***ADD/EDIT***.

```
R3000w Setup Tool                Funkwerk Enterprise Communications GmbH
[IP][ROUTING][OSPF][INTERFACE][EDIT]: Configure Interface    MyGateway
                                      en0-1


     Admin Status                passive (propagate routes)
     Area ID                     0.0.0.0

     Metric Determination        auto (ifSpeed)
     Metric (direct routes)      10

     Authentication Type         none
     Authentication Key

     Export indirect static routes  no


               SAVE                                  CANCEL
```

The menu contains the following fields:

Field	Description
Admin Status	The status of an OSPF interface defines whether routes are propagated and/or OSPF protocol packets are sent over the interface. If OSPF is not yet activated, only the ***ADMIN STATUS*** field is shown (in this case changes are irrelevant). Possible values: ■ *active (propagate routes + run OSPF)*: OSPF is activated for this interface, i.e. routes are propagated and/or OSPF protocol packets are sent over this interface. ■ *passive (propagate routes)*: OSPF is not activated for this interface, i.e. no routes are propagated or OSPF protocol packets sent over this interface. Networks reachable over this interface are, however, included when calculating the routing information and propagated over active interfaces. ■ *off*: OSPF is completely deactivated for this interface.
Area ID	Identifies the area to which this interface is assigned.
Metric Determination	Defines how the metric of this interface is calculated. See table “METRIC DETERMINATION selection options,” on page 102.

Field	Description
Metric (direct routes)	Shows the base metric value. The basis of the metric actually used for a route is a base metric value, which is obtained from the bandwidth of the interface: BMV = 100,000,000 / bandwidth in bps This results in, for example, 1 for 100Mbit Ethernet or 1562 for dialup ISDN interfaces (1 B-channel). This value is then adjusted if necessary depending on the ***METRIC DETERMINATION***. If you have selected *fixed* for ***METRIC DETERMINATION***, you can enter the value for the metric here.
Authentication Type	The type of authentication used if OSPF packets are sent over this OSPF interface (or incoming packets checked). Defines how the key in the ***AUTHENTICATION KEY*** field is used. The default value is *none*. If set to *simple*, the key is sent as a text string in each packet. If set to *md5*, the key is used to create a hash, which is sent with each packet. The default value is *none*.
Authentication Key	A text string used in conjunction with the defined ***AUTHENTICATION TYPE***.
Export indirect static routes	If this value is set to *no* (default), only direct routes (i.e. routes to networks reached directly over this interface) are propagated over active OSPF interfaces (see ***ADMIN STATUS*** field). If the value is set to *yes*, indirect static routes are propagated over active interfaces.

Table 12-5: ***INTERFACES*** menu fields

METRIC DETERMINATION offers the following selection options:

Description	Meaning
auto (ifSpeed)	Metric = the value of the basis metric, which is based on the bandwidth (***IFSPEED***) of the interface.
fixed	The metric defined in the following field is always used, i.e. there is no automatic calculation of the metric.
auto + adjust	If the interface is in the *up* state, the metric actually used is calculated as follows: Metric = <automatically determined BMV> - 10. Otherwise the automatically calculated metric is used.
fixed + adjust	If the interface is in the *up* state, the metric actually used is calculated as follows: Metric = <fixed metric)> - 10. Otherwise the fixed metric is used.

Table 12-6: ***METRIC DETERMINATION*** selection options

12.2.3 Areas Submenu

The *AREAS* menu is described below.

```
R3000w Setup Tool                 Funkwerk Enterprise Communications GmbH
[IP][ROUTING][OSPF][AREA]: Area Configuration                   MyGateway


  Area ID          Import External Routes
  0.0.0.0          yes


   ADD                  DELETE               EXIT
```

OSPF areas must be defined before the gateway interface can be assigned to an area.

An exception is the backbone area, which is generated automatically on booting and to which all interface assignments are set by default, if they are not explicitly assigned to another area.

The ***IP*** ➜ ***ROUTING PROTOCOLS*** ➜ ***OSPF*** ➜ ***AREAS*** menu contains a list of all configured OSPF areas (***AREAS***). The configuration is set up in ***ADD/EDIT***.

```
R3000w Setup Tool                Funkwerk Enterprise Communications GmbH
[[IP][ROUTING][OSPF][AREA][ADD]                                  MyGateway


   Area ID                                  0.0.0.0

   Import external routes                   no
   Import summary routes                    no
   Create area default route (only ABR)     no


   Area Ranges >


          SAVE                                      CANCEL
```

The ***AREAS*** ➜ ***ADD/EDIT*** menu consists of the following fields:

Field	Description
Area ID	Identifies the OSPF area to which this entry belongs. The backbone area is *0.0.0.0*.
Import external routes	Specifies whether the gateway routing information generated from external autonomous systems (not areas) is to be imported. *Yes* (default value) activates import. If *no*, this area is defined as a so-called stub area.
Import summary routes	Only if ***IMPORT EXTERNAL ROUTES*** = *no*. Defines whether summary LSAs (routing information generated by Area Border Gateway) are to be sent to the stub area.

Field	Description
Create area default route (only ABR)	Only if ***IMPORT EXTERNAL ROUTES*** = *no*. The Area Border Gateway sends no LSAs to the stub area, but propagates only a default route.

Table 12-7: ***AREAS*** menu fields

AREA RANGES Submenu

The options in this submenu are only to be used for configuration of the Area Border Gateway. Here you can combine network routes into a complete subnetwork. The complete subnetwork is propagated instead of the subnetworks actually learnt.

```
R3000w Setup Tool                Funkwerk Enterprise Communications GmbH
[IP] [ROUTING] [OSPF] [AREA] [ADD] [RANGE] [ADD]                    MyGateway


     Address
     Mask

     Advertise Matching                yes




          SAVE                                    CANCEL
```

The configuration is set up in ***ADD/EDIT***.

The menu consists of the following fields:

Field	Description
Address	Here you enter the IP address of the area to be combined.
Mask	Netmask for ***ADDRESS***

Field	Description
Advertise Matching	Subnetworks that are combined into areas either initiate propagation of the given combination (*yes*), or cause the subnetwork not to be propagated outside the area at all (*no*), i.e. neither the actual subnetworks nor the combined overall subnetwork are propagated. Possible values: *yes* (default value), *no*.

Table 12-8: ***AREA RANGE*** menu fields

Index: IP