User's Guide

bintec R3000w / R3400 / R3800

BRRP

Version 0.9

Purpose

This document is part of the user's guide to the installation and configuration of bintec gateways running software release 7.3.1 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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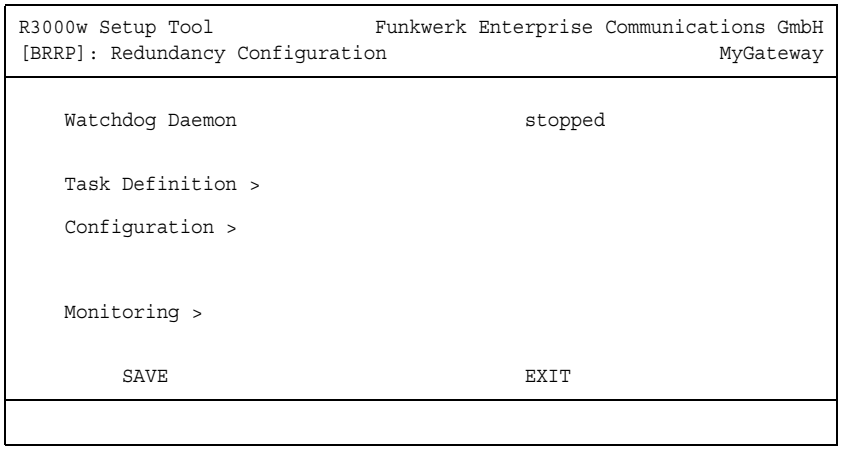
1 BRRP Menu

The fields of the *BRRP* menu are described below.



This menu is for configuring the redundancy of your gateway.

BRRP (bintec Router Redundancy Protocol) is a bintec-specific implementation of VRRP (Virtual Router Redundancy Protocol). A router redundancy procedure is used mainly to protect the data of a service of a physical gateway in a ➤➤ **LAN** or WAN connected over Ethernet. This original gateway and all gateways that could potentially protect the transmission of the data of the service over the original gateway form a logical unit, which is called a “virtual router”. If the original gateway fails, another gateway that is part of the “virtual router” takes over the service of the original gateway.

Let us take the example of a simple scenario, in which gateway A provides ➤➤ **Internet** access for the hosts in a LAN. If this gateway fails, all the hosts that have statically configured routes and have not been configured to find alternative routes dynamically no longer have access to the Internet. To prevent this, gateway B starts offering all hosts in the LAN the service that gateway A previously performed. All the tasks of a “virtual router” and the switching of services from one gateway to the other are controlled by a router redundancy procedure.

The BRRP conforms to the specifications in RFC 2338 and the relevant Internet draft. (You will find the Internet drafts at http://www.ietf.org/1id-abstracts.html.)

The configuration of a “virtual router” is carried out in the following steps:

- Configuration of a virtual interface for integration into a “virtual router” (the configuration is made in the ***Ethernet Unit x*** ➜ ***Virtual Interfaces*** ➜ ***ADD/EDIT*** menu).
  Administrative Multicasts (i.e. keepalives sent between the participating gateways) are sent over the physical interface. Virtual interfaces are therefore required for payload transmission on all gateways participating in the virtual router. These are assigned an identical virtual MAC address, which is called by the PC in the network. This means a backup gateway can take over the service if the original gateway fails.
- Configuration of the gateway for integration into a “virtual router” (configuration is made in the ***BRRP*** ➜ ***Configuration*** menu).
  This step includes defining the role of the virtual interface in the “virtual router” and the role of the master.
- Definition of the tasks that control the functions of the “virtual router” (configuration is made in the ***BRRP*** ➜ ***Task Definition*** menu).
  This step includes the configuration of the state change dependent on a state change of the master.

1.1 Terms and Definitions

A number of special terms are used to describe a “virtual router”.

The following terms are defined in the relevant RFC and the Internet draft.

Term	Meaning
VRRP Router	"A router that uses the Virtual Router Redundancy Protocol. It can be integrated into one or more "virtual routers"."

Term	Meaning
Virtual Router	"An abstract object controlled by the VRRP, which is used as default router for the hosts of a LAN. It comprises a Virtual Router Identifier (ID, editor's comment) and a group of associated IP addresses in a common LAN. A VRRP router can protect the data traffic of one or more "virtual routers"."
IP Address Owner	"The VRRP router that possesses the IP address(es) of the virtual router as real interface address(es). This is the router that – if active - answers packets for ➤➤ **ICMP** pings, ➤➤ **TCP** connections, etc. to one of these ➤➤ **IP addresses**." This means the router that possesses priority 255 is the "IP Address Owner"."
Primary IP Address	"An IP address that is selected from the group of real interface addresses. A possible algorithm option is the selection of the first address. VRRP advertisements are always sent with the primary IP address as source of the IP packet."
VRRP Advertisement	A keepalive that the master sends to the backup gateways to indicate his reachability.
Virtual Router Master	"The VRRP router that takes over forwarding the packets that have been sent to the IP addresses associated with the "virtual router". It is also responsible for answering ➤➤ **ARP** (Address Resolution Protocol) requests for these IP addresses. Note that the "IP Address Owner" is always master if reachable."
Virtual Router Backup	"The group of VRRP routers that take over responsibility for forwarding the packets if the master fails."

Table 1-1: Terms for "virtual router"

1.2 Configuration of a Virtual Interface

The configuration of a virtual interface is not carried out in the ***BRRP*** menu, but in the ***VIRTUAL INTERFACES*** submenu, which is configured via the ***ETHERNET UNIT x*** menu. The following settings are obligatory if a virtual interface is to be configured as member in a “virtual router”:

- The value of the ***IP CONFIGURATION*** field in the ***ETHERNET UNIT x*** ➜ ***VIRTUAL INTERFACES*** menu must be set to *BRRP* or *BRRP over VLAN*.
- A virtual MAC address is obligatory. If you do not enter a MAC address, the entry is incomplete and cannot be saved. For the purpose of optimum interoperability and RFC conformity, the first 10 characters of the MAC address are suggested for you. You can edit these if required, but you are advised to use the predefined string. The last two (freely selectable) characters should indicate the Virtual Router ID (01, 02 ...).
- You must enter the addresses of the “virtual router” master as IP address and MAC address, regardless of whether you wish to use the virtual interface as master or backup.

Once you have configured the virtual interface, you can start the configuration in the ***BRRP*** menu.

The ***BRRP*** menu consists of the following field:

Field	Description
Watchdog Daemon	Here you activate (*running*) or deactivate (*stopped*) the Watchdog Daemon. The default value is *stopped*.

Table 1-2: ***BRRP*** menu field

The following ***BRRP*** submenus are used to define all the processes controlled by the BRRP:

- ***TASK DEFINITION***
- ***CONFIGURATION***

- ***MONITORING***.

2 Task Definition Submenu

The *TASK DEFINITION* submenu is described below.

```
R3000w Setup Tool                Funkwerk Enterprise Communications GmbH
[BRRP][TASKS]: Task List                                        MyGateway

Task              Master                                  Slave
ID    Protocol  Trigger  VR_ID/IFC   Protocol    Action    VR_ID/IFC

1     BRRP      any      1           BRRP        sync      1




   ADD                  DELETE               EXIT
```

Note

TASK DEFINITION cannot be configured until you have created a virtual interface for BRRP in ***ETHERNET*** ➜ ***VIRTUAL INTERFACES*** and participation in the virtual router has been defined in the ***BRRP*** ➜ ***CONFIGURATION*** menu.

The Watchdog Daemon is configured in the ***BRRP*** ➜ ***TASK DEFINITION*** menu, i.e. you define how the master state is determined and how state changes are handled.

The following criteria of the “virtual router” master are observed as trigger for actions by the backup (slave):

- Which IP address is to be checked for availability: This is defined first by the ID of the “virtual router” associated with a configuration that is set in ***BRRP CONFIGURATION***, and second by the specification of an interface that refers to an entry in the ***IFTABLE***.
- Which mechanism is used to determine the master state: This is either the BRRP advertisements of the master or the ***OPERSTATUS*** of the relevant interface.
- Which master state triggers the action configured for the backup.

The parameters of the “virtual router” backup action are defined under the following aspects:

- Which interface reacts to the master state configured as trigger: The interface can be specified by a Virtual Router ID (VRID) that is associated with a BRRP configuration or by an interface definition.
- The mechanism with which the backup reacts to the trigger: This can be the BRRP or the OperStatus of an interface.
- Which action the backup executes.

These parameters are specified in the ***BRRP*** ➜ ***TASK DEFINITION*** menu.

A list of all configuration tasks is shown on opening the menu. Tasks can be added or edited in the ***ADD/EDIT*** menu (the screenshot contains example values).

```
R3000w Setup Tool              Funkwerk Enterprise Communications GmbH
[BRRP][TASKS][ADD]: Redundancy Task Definition                MyGateway


       Task ID                     1

       Master Interface Protocol   BRRP
       Master Action               any
       Master Interface            1

       Slave Interface Protocol    BRRP
       Slave Admin Action          sync
       Slave Interface             2


            SAVE                                    CANCEL
```

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

Field	Description
Task ID	The task IDs can be assigned as required. They are not used for gateway-internal processes, but for the logical arrangement of tasks.

Field	Description
Master Interface Protocol	This parameter defines which mechanism is used for monitoring the master. Possible values: ■ *BRRP* (default value with configured virtual router): The BRRP-specific state advertisements are used for determining the state of the master. The master sends advertisements as per its configuration in the ***CONFIGURATION*** menu. ■ *IFC - operStatus* (default value without configured virtual router): The ***OPERSTATUS*** of ***MASTER INTERFACE*** is determined. The ***OPERSTATUS*** can be seen in the ***IFTABLE***.

Field	Description
Master Action	This parameter defines the trigger of the task to be configured. The possible values depend on the selection in ***Master Interface Protocol***: ■ For ***Master Interface Protocol*** = *BRRP*: – *Initialize* (default value): The gateways associated with the virtual router are waiting for a startup event. – *Backup*: The availability of the master router is monitored. – *Master*: The virtual router is forwarding packets for IP addresses that are associated with this router. – *any*: ***Master Action*** = *Initialize*, *Backup* or *Master*. This option is only to be applied with ***Slave Action*** = *sync*. For detailed information about the BRRP state see table "BRRP states," on page 11. ■ For ***Master Interface Protocol*** = *IFOperStatus*: – *up* (default value): The interface is active. – *down*: The interface is inactive.
Virtual Router ID	This field can only be edited if ***Master Interface Protocol*** is set to *BRRP*. This parameter defines which interface is to be checked by selecting a Virtual Router ID (VRID). The Watchdog Daemon requests the detailed information entered in ***Configuration***. The default value is *0* (if no VRID is defined) or the smallest VRID defined.

Field	Description
Master Interface	This field can only be edited if ***Master Interface Protocol*** is set to *IFC - operStatus*. This parameter defines which BRRP interface is to be checked by selecting an interface name. The Watchdog Daemon requests details in the ***ifTable***.
Slave Interface Protocol	This parameter defines which mechanism the backup uses to react to the trigger: ■ *BRRP* (default value with configured virtual router): The backup changes to the BRRP state defined by the parameter selected in ***Slave Admin Action***. ■ *IFC - adminStatus* (default value without configured virtual router): The backup changes to the ***adminStatus*** defined by the parameter selected in ***Slave Admin Action***.

Field	Description
Slave Admin Action	The following values are possible, depending on the trigger mechanism selected in ***Slave Interface Protocol***: ■ *up*: – For *BRRP* this means that the interface of the BRRP gateway in the “virtual router” is activated. It changes to the initial state (default value). – For *IFC - adminStatus* this means that the router interface ***Slave Interface*** changes to *up*. ■ *down*: – For *BRRP* this means that the interface of the BRRP gateway in the “virtual router” is deactivated. – For *IFC - adminStatus* this means that the router interface ***Slave Interface*** changes to *down*. ■ *none*: – For *IFC - adminStatus* only: Means that no action is triggered (default value). ■ *sync*: – only for ***Slave Interface Protocol*** = *BRRP* The gateway synchronizes its BRRP state according to the state of the other gateways participating in the virtual router.

Field	Description
Virtual Router ID	This field can only be edited if ***SLAVE INTERFACE PROTOCOL*** is set to *BRRP*. The backup searches the BRRP advertisements sent by the master to obtain information on whether the “virtual router” is to be started or stopped. This means a VRID must be defined. The default value is *0* or the smallest VRID defined.
Slave Interface	This field can only be edited if ***SLAVE INTERFACE PROTOCOL*** is set to *IFC - adminStatus*. The backup cannot determine if the “virtual router” is to be started or stopped. The BRRP interface must therefore be selected.

Table 2-1: ***TASK DEFINITION*** menu fields

BRRP states The BRRP specifies three different possible states that BRRP routers can have. The behavior of the BRRP router changes according to the state. The various forms of behavior are very complex and have a large number of dependencies (especially in the master state).

The router has the following possible states and corresponding forms of behavior:

State	Behavior
Initialize	The purpose of this state is to wait for a startup event. If the BRRP router is activated, it behaves as follows: ■ If the local priority is *255*: – the router sends a BRRP advertisement. – the router sends an additional ARP (Address Resolution Protocol) packet that contains the MAC address of the “virtual router” for each IP address connected to the “virtual router”. – the router sets the internal Advertisement Timer to the configured Advertisement Interval. – the router changes to the master state. ■ In all other cases: – the router sets the internal Master Down Timer to the calculated Master Down Interval. – the router changes to the backup state.

State	Behavior
Backup	The purpose of the backup state is to monitor the availability and state of the master. A BRRP router behaves as follows in this state: ■ It does not answer ARP requests for the IP addresses connected to the “virtual router”. ■ It discards packets if these have a Destination Link Layer MAC address the same as the MAC address of the “virtual router”. ■ It accepts no packets that are addressed to one or more IP address(es) connected to the “virtual router”. ■ If the BRRP router is deactivated: – it stops the internal Master Down Timer. – it changes to the initialize state.

State	Behavior
Master	In the master state the router acts as forwarding router for the IP addresses connected to the “virtual router”. The BRRP router behaves as follows in this state: ■ It answers ARP requests for IP addresses connected to the “virtual router”. ■ It forwards packets that have a Destination Link Layer MAC address the same as the MAC address of the “virtual router”. ■ It accepts no packets addressed to IP addresses connected to the “virtual router” if it is not the owner of the IP address. If the BRRP router is deactivated: ■ it stops the internal Advertisement Timer. ■ it sends an advertisement with priority = 0. ■ it changes to the initialize state. If the internal Advertisement Timer starts: ■ it sends an advertisement. ■ it resets the internal Advertisement Timer to the Advertisement Interval. If an advertisement is received: ■ if the priority in the advertisement is 0: – it sends an advertisement. – it resets the internal Advertisement Timer to the Advertisement Interval.

State	Behavior
Master (cont.)	■ if the priority in the advertisement is higher than the local priority or the priority in the advertisement is the same as the local priority and the ***PRIMARY IP ADDRESS*** of the sender is higher than the local ***PRIMARY IP ADDRESS***: – it stops the internal Advertisement Timer. – it sets the internal Master Down Timer to the calculated Master Down Interval. – it changes to the backup state. ■ if the priority in the advertisement is lower than the local priority: – is discards the advertisement.

Table 2-2: ***BRRP STATES***

3 Submenu Configuration

The *CONFIGURATION* submenu is described below.

```
R3000w Setup Tool              Funkwerk Enterprise Communications GmbH
[BRRP][DAEMON]: Virtual Router List                          MyGateway

 VrID  Prio  State  Interface  IP-Address     MAC-Address
 1     255   master en1-0-1    192.168.1.254  00005e000101
 2     255   slave  en1-3-1    172.16.1.254   00005e000102



   ADD                 DELETE              EXIT
```

The first step in the configuration of the processes controlled by BRRP is to define the participants in the “virtual router” in the ***BRRP*** ➜ ***CONFIGURATION*** menu.

Opening the ***CONFIGURATION*** menu shows a list of the “virtual routers”.

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

```
R3000w Setup Tool              Funkwerk Enterprise Communications GmbH
[BRRP][DAEMON][ADD]: Configure Virtual Router                MyGateway

       Virtual Router ID           1
       Virtual Router State        down

       Priority                    100
       Advertisment Interface      en1-0

       Virtual Interface           en1-0-1
       Master IP-Address           192.168.1.254
       MAC-Address                 00005e000101

       Advertisement Interval      1
       Master Down Interval        3
       Pre-empt Mode               true
       Authentication Type         No Authentication
       Authentication Key

            SAVE                                CANCEL
```

The menu consists of the following fields:

Field	Description
Virtual Router ID	Here you select the Virtual Router Identifier (VRID). The VRID identifies the “virtual router” in the LAN and is part of every BRRP advertisement packet that is sent by the current master. A value for this parameter is generated automatically when a new entry is created, but this value can be changed. Possible values are whole numbers between *1* and *255*.
Virtual Router State	This parameter defines the state of the virtual interface in the “virtual router”. Options are *up* and *down*. The state set here does not refer to the whole “virtual router”, but only to the participation of the virtual interface in the “virtual router”. The default value is *down*. Note that the parameters of the “virtual router” can only be configured if the interface is inactive in the “virtual router”. To deactivate an active “virtual router”, set the ***VIRTUAL ROUTER STATE*** to *down* and press **SAVE**. You can then return to the ***ADD/EDIT*** menu and change the parameters.
Priority	This parameter defines the logical priority of the virtual interface in the “virtual router”. Possible values are between *1* and *255*. The value *255* defines that this virtual interface always functions as master as soon as it is active. Each value below the ***PRIORITY*** of the master defines a slave in the “virtual router” (or backup): The higher the value, the higher the priority. The default value is *100*.

Field	Description
Advertisement Interface	This parameter defines the interface via which the BRRP advertisments are sent. According to the configuration the respective physical interface (given that an IP address has been assigned) and all virtual interfaces with configured IP address, not being specified for BRRP only, are available. If ***BRIDGING*** = *enabled* on the physical interface, a respective virtual interface with the required route has to be configured to be able to send and receive BRRP advertisements.
Virtual Interface	This parameter defines which interface is to participate in the “virtual router”. All virtual ➤➤ **Ethernet** interfaces tagged for BRRP can be selected.
Master IP-Address	This field shows the ➤➤ **IP address** of the virtual interface of the master. This value cannot be changed, as it is defined by the interface you have selected.
MAC Address	This field shows the ➤➤ **MAC address** of the virtual interface of the master. This value cannot be changed, as it is defined by the interface you have selected.
Advertisement Interval	This parameter defines how often a BRRP advertisement packet is sent if the virtual interface is defined as master. Only the current master sends BRRP advertisements. Possible values are whole numbers between *1* and *255*. The value is indicated in seconds and the default value is *1.* An Advertisement Timer based on the Advertisement Interval runs in the router and an advertisement packet is sent when the timer expires.

Field	Description
Master Down Interval	The value entered here defines the number of BRRP advertisements that must fail before the backup assumes that the master is inactive and takes over the role of master. A Master Down Timer based on the Master Down Interval runs in the router; when this timer expires, the backup assumes that the master is not reachable if no advertisement has been received. The effective Master Down Interval corresponds to the time calculated from the number of expected but omitted BRRP advertisements, the Advertisement Interval and the so-called Skew Time, which adds a minimum time dependent on the priority of the virtual interface in the “virtual router” (the higher the priority, the shorter the time added, so that a backup with higher priority reacts before one with a low priority). Possible values are whole numbers between *1* and *255* and the default value is *3*.
Pre-empt Mode	This parameter defines whether a backup with higher priority has priority over a master with low priority. Possible values: ■ *true* (default value): Activates the feature. ■ *false*: Deactivates the feature. Note the following exception: If ***PRIORITY*** *255* is selected, the gateway with this priority certainly takes over the master role, i.e. the setting in Pre-empt Mode is not considered. You should therefore select a ***PRIORITY*** lower than *255* if you wish to use Pre-empt Mode.

Field	Description
Authentication Type	This parameter defines the type of authentication used for exchanging the BRRP advertisement packets. Selection options: ■ *No Authentication* (default value): No authentication is used. ■ *Plain Text Password*: BRRP advertisement packets are authenticated by a plain text password. All packets that cannot be authenticated are discarded. (VRRP RFC and the Internet draft provide for the use of IP authentication headers. This option will be implemented later.)
Authentication Key	Only for ***AUTHENTICATION TYPE*** = *Plain Text Password*. The authentication key is entered here. Note that this is the same for all virtual interfaces participating in the “virtual router”.

Table 3-1: ***CONFIGURATION*** menu fields

4 Monitoring Submenu

The *MONITORING* submenu is described below.

```
R3000w Setup Tool              Funkwerk Enterprise Communications GmbH
[BRRP][MONITOR]: Virtual Router Monitoring                    MyGateway

 VrID  Prio  State       Interface     Master-IP-Addr   Errors

    1   100  down        en0-1-1       0.0.0.0          0
    2   100  down        en0-1-2       0.0.0.0          0




 EXIT
```

The ***BRRP*** ➜ ***MONITORING*** menu displays a list of all "virtual routers".

The list contains the following data:

Column	Description
VrID	ID of the “virtual router”
Prio	Configured priority: ■ *255* = Master ■ *<255* = Slave
State	The current state of the BRRP gateway in the “virtual router”.
Interface	Interface within the "virtual router"
Master-IP-Addr	IP address of the virtual interface of the master.
Errors	Total sum of received defective packets.

Table 4-1: Virtual Router Monitoring List

Detailed statistical information about the individual “virtual routers” are displayed by positionning the cursor on the desired “virtual router” list entry and pressing the **Return** key.

```
R3000w Setup Tool                Funkwerk Enterprise Communications GmbH
[BRRP][MONITOR][DETAILS]: Virtual Router Details                MyGateway


       Virtual Router ID                        1
       Virtual Router State                     backup

       Become Master                            2
       Advertisements Received                  23536

       Advertisement Interval Errors            0
       Version Errors                           0
       Authentication Errors                    0
       Authentication Type Mismatch             0
       Invalid Authentication Type              30
       Invalid Type Packets Received            0
       Packet Length Errors                     0
       IP TTL Errors                            0
       Checksum Errors                          0

                           EXIT
```

The ***MONITORING*** menu consists of the following fields:

Field	Description
Virtual Router ID	Here you select the ID of the “virtual router” whose statistics you wish to see.
Virtual Router State	The current state of the BRRP gateway in the “virtual router”. This field can have the following values: ■ *initialize*: The BRRP gateway waits for a startup event. ■ *backup*: The BRRP gateway monitors the reachability of the master router. ■ *master*: The BRRP gateway forwards packets to ➤➤ **IP addresses** that are linked to this router.

Field	Description
Become Master	The total number of state transitions of the BRRP gateway to *master*.
Advertisements Received	The total number of BRRP advertisements received by BRRP gateway.
Advertisement Interval Errors	The total number of BRRP advertisement packets received whose advertisement interval differs from that configured on the local BRRP gateway.
Version Errors	The total number of BRRP packets received with unknown or unsupported version number.
Authentication Errors	The total number of BRRP packets received with wrong ***AUTHENTICATION KEY***.
Authentication Type Mismatch	The total number of packets received in which the ***AUTHENTICATION TYPE*** is known, but not the same as the authentication type configured locally.
Invalid Authentication Type	The total number of packets received with a completely unknown authentication type.
Invalid Type Packets Received	The number of BRRP packets received by the “virtual router” with an invalid value in the ‘type’ field of the BRRP header. The correct value for ‘type’ is ‘1’ (‘advertisement’).
Packet Length Errors	The total number of packets received with a smaller packet length than the length specified in the BRRP header.
IP TTL Errors	The total number of BRRP packets received by the “virtual router” with IP TTL (Time-To-Live) not equal to 255.
Checksum Errors	The total number of BRRP packets received with an invalid BRRP checksum.

Table 4-2: ***MONITORING*** menu fields

Index: BRRP