General Description

Remote Power Feeding card (RPF)

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	General Description
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1 Preface

1.1 Highlight

This document describes the Remote Power Feeding card the operational method and its functions, configuration.

1.2 Structure

The following chapters can be found in this description:

1. Preface

   Basic information about the document contents.

2. General

   System overview and system elements.

3. Technical features

   Transmissions, power, etc.

4. Device reference

   Electrical parameters, user interfaces, environmental conditions, etc.

5. RPF configuration

   Remote power information.

6. Safety requirements

   Remote power information.

1.3 Revisions

Release	Date	Comments
v1.0	25-04-2012	Basic description of RPF

2 General

2.1 System overview

The RPF is a rack-type version where the SBR sub-rack provides the connection facilities and the 48/60 Vdc local power to the unit. One card has 4 separate power interfaces towards the remote areas.

The target application of the device is to provide power remotely to those areas where solving the local power source is difficult. The unit is universal: can be used to Strowger product or generally to all third party equipment which require this range of power level.

Possible applications:

- powering and supervising DAR units (*see document GenDesc DAR v3.1*),

- powering Wi-Feeder including the xDSL data link (*see document GenDesc WF v1.0)*,

- general power source to any third party device.

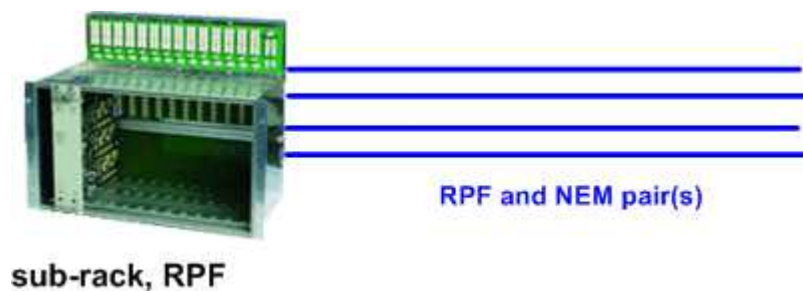The basic configuration of the system is shown below:

Figure 1. – Basic configuration

It is installed in Strowger sub-rack at the telephone Exchange where the necessary cables (48 Vdc, external power lines, xDSL lines).

2.2 System components and accessories

Independently the purpose of the installation the RPF card needs the sub-rack for physical connections and in case of demand an additional NEM card which provides the link towards the monitoring system.

RPF   Remote Power Unit with 4 independent power interface towards remote areas

SBR-14   Standard 19" sub-rack for up to 14 RPF with IDC connectors (*see document GenDesc SBR v1.0*)

NEM   Network Element Manager card for local/remote supervision (*see document GenDesc NEM v1.0*)

The RPF is a plug-in module for the standard SBR sub-racks. It has the following functions:

- provides remote power feeding voltage for remotely installed equipment on 4 separate lines,

- provides alarm and Network Management interfaces.

There are LEDs on the front panel that indicates the operating status of the system.

2.3 Network Management System

The Network Management System has 2 accesses to the devices: direct and remote.

The plug-in *Network Element Manager (NEM)* card is able to provide direct and remote supervision possibilities based on IP protocol. Both accesses require a client software installed on the PC or notebook called *Manager Monitor program*. It makes the real time monitoring, shows the electric and digital parameters of the connected systems, collects event logs and creates the visual view all of the measured parameters.

3 Technical features

3.1 Subscriber interfaces

The RPF card is able to connect ADSL lines from the Exchange in case of special applications like Wi-Feeder powering (*see document GenDesc WF v1.0*). The ADSL signal is connected to the external power lines via a simple filter.

When RPF card is used to power DAR (*see document GenDesc DAR v3.1*) it is possible to activate communication EOC channels on the power lines. The user can monitor and configure all functions of DAR via the NEM-RPF-DAR link.

3.2 Remote power

All remote power feeding sources and sinks meet the safety requirements of EN 60950-1 and EN 60950-21 with the following specification:

circuit category: RFT-V (optional RFT-C)

remote feeding voltage: max ± 160 Vdc, software selectable

output capacity: ≤ 20 µF line to line

current limiting: 57 ± 1 mA

unbalance shut-down: 1.5 mA to Earth

During the remote power feeding period the source continuously measures the output voltage and the unbalance of the line to the earth. These measurements can be queried via the management interface of the NEM and these are the basis of the safety precautions.

In case of unbalance is detected for more than 100 ms or in case of overload or line interruption for more than 100 ms the source switches off the power. After 10 sec from the switching off the system re-starts with the initialization phase.

The remote power feeding source is permanently switched off within 200 ms in case of internal hardware fault is detected (over voltage, over current).

The RPF card supports a safety test voltage level when no connected items at the end of the lines. This test voltage level is 50 Vdc to protect the technicians during installation (WAKE UP feature).

Inversion of the voltage polarity of the power lines has no any impact on the operation of the system.

3.3 Alarm

The RPF module provides an alarm contact to FPE (Functional and Protective Earth). The contact is closed during alarm condition and opened during normal operation.

The alarm contact has the following switching specification:

> open: residual current ≤ 50µA with voltages ≤ 75V
>
> closed: residual voltage ≤ 4,5V with currents ≤ 100mA

The alarm contacts of all units within a sub-rack can be combined to a common alarm signal and connected to the alarm board of the exchange.

The alarm sign can be strengthen by relays.

When alarm contact is closed the connected subscribers cannot be serviced. A few possible problems among many:

- the 48/60V power is off,

- no power sink can be detected on the line,

- in case of line interruption, overload or line unbalance has been detected,

- the ADSL transmission framing sync has been lost (optional),

- over voltage, over current or an internal circuit fault has been detected.

4 Device Reference

The RPF unit is plug-in module to the available sub-racks. In the sub-rack up to 14 modules can be installed. The solution yields up to 56 remote power interface at one SBR-14.
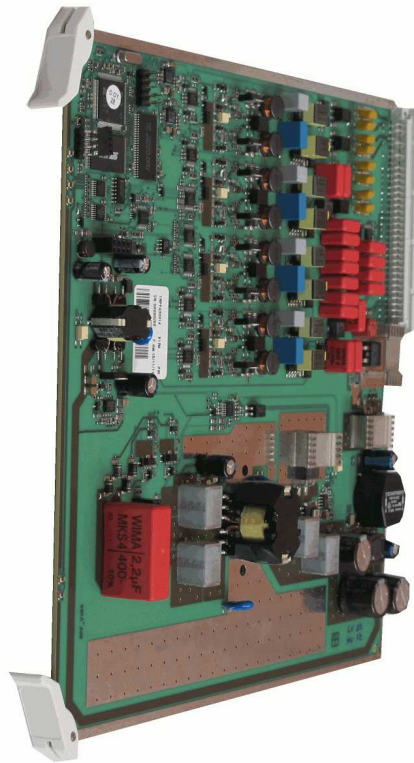
Figure 2. – RPF

4.1 Power consumption

The RPF module requires nominal 48/60 Vdc power supply input voltage. The power supply interfaces are built according to ETSI EN 300 132-2 standard with the following parameters:

input voltage:	40 .. 76 Vdc
max. power consumption:	50 W
max. power dissipation:	20 W

The above data are measured in the worst case scenario when the system was connected over 4x 1300 Ω loops and the output remote powers were the maximum.

4.2 User interface

The RPF card provides 4 independent power interfaces.

Status LEDs

STATUS/green	ON	power on – normal state
	OFF	channel is OFF
	flash/1 Hz	wakeup state

System LEDs

CPU/green	ON	power on – normal state
	OFF	power problem

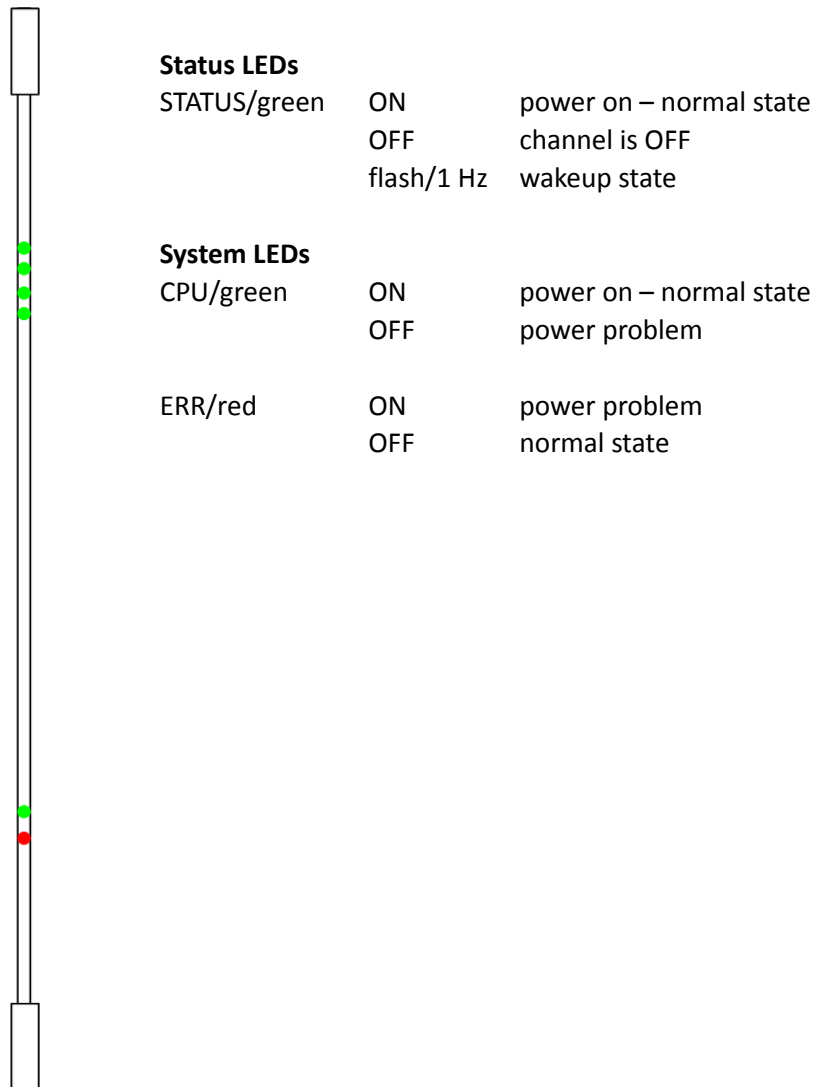| ERR/red	ON	power problem
	OFF	normal state

Figure 3. – RPF user interface

4.3 Mechanical parameters

The mechanical properties of the units are the followings:

Dimension (H x W x D):   262 x 30 x 225 mm

Weights: 550 g

Installation: SBR-14 sub-rack designed by Strowger

4.4 Environmental conditions

The RPF module was designed and tested to meet the following environmental requirements of ETSI standards:

Operation:	ETSI ETS 300 019-1-3 class 3.1
Storage:	ETSI ETS 300 019-1-1 class 1.2
Transport:	ETSI ETS 300 019-1-2 class 2.2
Operational temperature:	+5 .. +40 °C
Relative humidity:	0 .. 95 % non-condensing
Protection:	IP20

5 RPF configuration

All parameters of the connected RPF equipment are shown on different tabs selecting the unit at tree-view. The RPF port number where the power and the communication are done is also indicated on the top of the screen.

Figure 4. – NMS – unit identification

On *Figure 4.* the RPF (ARPF9009) is monitored by NEM (called test) and it is installed in the slot 6 of the sub-rack (06). The NEM card monitors the RPF on the first communication line at sub-rack 4 (104).

At the upper part of the Component panel the user can select the configuration access (Config ON-OFF). These parameters belong to the supervision hierarchy. The main reason of its function is to avoid of more modifications from different remote locations at the same time.

Enable the configuration access the name of the actual user will appear after the button. During one's configuration period the other users has no access for any configuration.

Figure 5. – NMS – configuration

Restore (*button*)	The user can load back the parameters last stored in the Eeprom.
Store (*button*)	Save the modified parameters into the Eeprom. Leaving the device without pushing this button the executed modifications will be lost.

During modification by any user a "MODIFICATION" (blue) signal appears after the buttons.

Enable the configuration access the name of the actual user will appear after the button. During one's configuration period the other users have no access for any configuration.
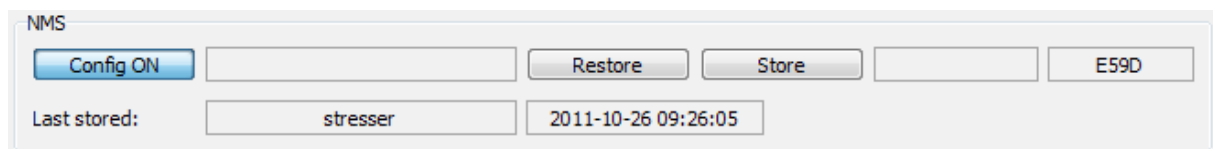
Notes
(1) In order to save the modifications it is necessary to push the 'Store' button. Leaving the surface of the modified system without using this button the configuration changes will be lost.
(2) When the communication is lost between the system and the monitor program then the program shows the last known state of the system. When the system hadn't been detected at all yet the SYSTEM tab will be red and the equipment data is missing.

5.1 System

On the system tab the user can monitor the basic parameters there are the general inventory information like serial number, software/hardware date, hardware type, software checksum, operational time or element internal temperature.

Serial number	SW Date	SW Checksum	HW production Date	HW version	System uptime	Temperature [C]
0000014	2011-10-25	11A3	2000-01-01	RPF_V1R3	21:24:45	33

Inventory Data

Figure 6. – NMS – inventory data

On the lower part the user can check the connected remote devices and the general status of the system.

Remote devices

Serial number	SW Name	SW Date	SW Checksum	HW production Date	HW version
0000000	AREP9008	2012-01-17	E854	2000-01-01	REP_V2R4
0000000		----------	0000	----------	
0000000		----------	0000	----------	
0000000		----------	0000	----------	

General system status

Network time :	2012-01-19 12:23:03	System RESET
Local time :	2012-01-19 12:23:03	
NEM IP address :	192.168.0.93	
NMS IP address :		

Figure 7. – NMS – general system status

Remote devices	Name, sw date and sw checksum of the connected remote devices.

General system status

Network time	Actual GMT (Greenwich Mean Time).
Local time	Actual real time in the area.
NEM IP address	IP address of the Network Element Manager card.
NMS IP address	IP address of the Network Management System.
System reset (*button*)	System re-start.

5.2 RPF

This tab shows the output power budget of the RPF panel.

Remote power feeding settings

Common Voltage Generator
Enable/disable	The output voltage is enable or disabled commonly.
Output voltage	Voltage levels of channels (up to 320 Vdc).
Current limit (*roll window*)	Adjustable current limitation according to national standards (60 or 100 mA).
RFTC enable/disable	Using this option it is possible to enable the conditions belonging to RFT-C circuit. The default is RFT-V conditions.

Line
Power output (*buttons*)	Enable or disable the output powers channel by channel.
Wakeup control (*buttons*)	Enable or disable the 50 Vdc wakeup voltage channel by channel. Disabling this function the channel is powered by the full power right at start-up.
Restore RPF factory default (*button*)	Re-set all factory settings of the card.

RPF Remote power feeding output

Common Voltage Generator

State	ON
Alarm	
U+ [V]	91.1
U- [V]	91.5
Test voltage [V]	0.0

Line	#1	#2	#3	#4
State	ON	ON	WAKEUP	ON
Alarm				
U+ [V]	89.6	89.6	0.0	89.6
U- [V]	90.4	89.6	53.2	89.9
I+ [mA]	26.1	25.8	0.0	27.0
I- [mA]	26.1	26.1	0.1	26.7
Iasym [mA]	0.0	0.3	0.1	0.3

Figure 9. – NMS – RPF status

Common Voltage Generator
   State   System power budget.
       „ON"/green   Normal operation, full power is out.
       „OFF"/yellow   Remote power off.
       „WAKEUP"/yellow   Start-up state checking the presence of remote item. Only 50 Vdc is out on the line.
   Alarm/red   Alarm or power information.
       „OVERLOAD"   Short circuit or high load.
       „OPEN CIRCUIT"   Open pair or current is less than 3 mA.
       „UNSYMMETRY"   More than 16 kΩ in pair (A-B).
       „OVER-VOLTAGE"   Over-voltage.
       „OVER-CURRENT"   Over-current.
   U+ (V)   The output positive voltage (Vdc) indicating the balance to earth.
   U- (V)   The output negative voltage (Vdc) indicating the balance to earth.
   Test voltage (V)   Testing voltage level for internal circuits.
Line
   Alarm   As above but indicated by channel.
   U+, U- (V)   As above but indicated by channel.
   I+, I- (mA)   Current consumption by channel (mA) floating to earth.
   Iasym (mA)   Current consumption asymmetry to earth.

5.3 Modem

The user can enable or disable the monitoring option in every channel. It is useful when supervision is not necessary or not available at remote equipment; the important role is only powering the remote equipment.
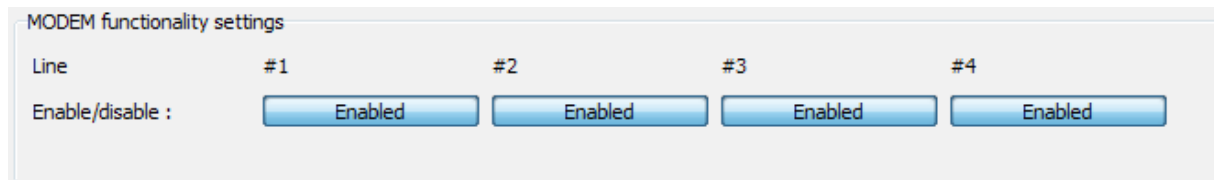

Figure 10. – NMS – modem feature

6 Safety requirements

a) The remote feeding system has been classified as a RFT-V circuit. The RPF provides up to 320 Vdc nominal voltage line to line (± 160 Vdc nominal voltage line to earth).

b) Effective capacitances (including part tolerance)

- between the connection points for the conductors of the Telecommunication Network

RPF RPF_1 out: $C_1 \leq 20.53$ µF (more RPF channels add +1.2 µF)

RPF_{1-4} out: $C_{1-4} \leq 24.13$ µF

- between the connection point for one conductor of the Telecommunication Network and Earth

RPF $C_{RPU} \leq 6.1$ µF

c) At the time of installation a system assessment shall be carried out to ensure that the:

- $C_{TOTAL1} \leq 100$ µF between line to line

where:

$C_{TOTAL1} = C_{RPF1-4OUTTOTAL} + C_{RPF1-4INTOTAL} + C_{RPFLINE1-4}$

- $C_{TOTAL2} \leq 15$ µF between line to earth

d) At the time of installation it shall be checked that the voltage rating of the wiring of the Telecommunication Network is adequate for the normal RFT circuit voltage together with the transients.

e) At the time of installation it shall be checked that the circuits to be connected together are either RFT-C circuits or all RFT-V circuits.