RTU32M Redundancy Guidance

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BRODERSEN
simplifying systems

Contents

What's the Redundancy?

Redundancy is the duplication of critical components or functions of a system with the intention of increasing reliability or extend the MTBF (Mean time between failures) of a system.

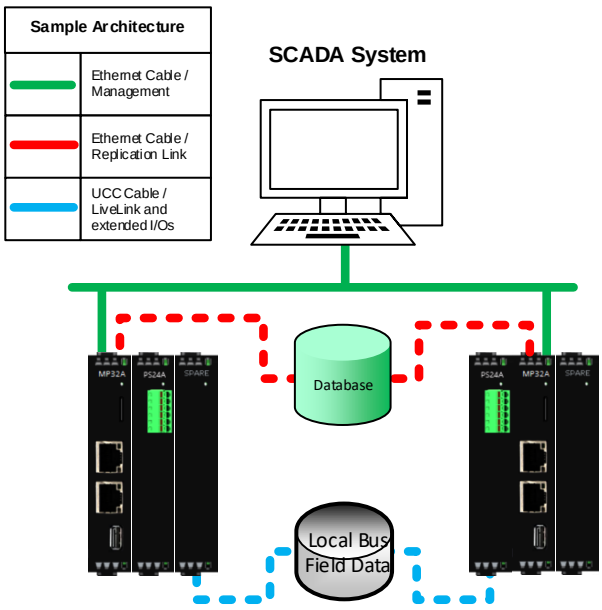
The main purpose of redundancy in a control system is to eliminate dependence on a single module while at the same time providing multiple options in case of failure. Redundancy in a control system decreases the consequences of a component failure.

The importance of a redundant system also increases in a variety of scenarios including:

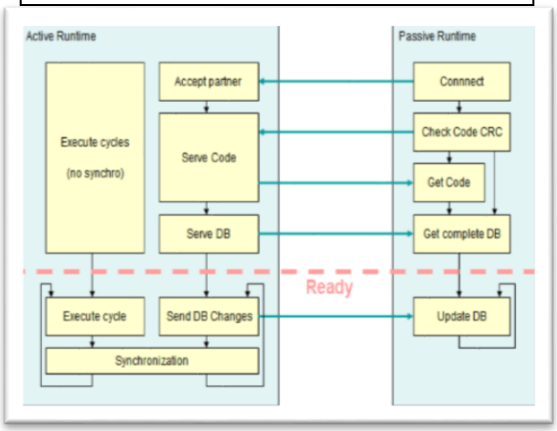
- Continuous processes
- Irreversible processes
- Extended restart times

There are different types of redundancy and it's configured according to the type and place of use. Brodersen control system can support different types of redundancy due to its special software and hardware design.

RTU32M redundancy architecture



Sequence of operations performed for data replication when the passive runtime connects to the active one



Management Link: Available connection to communicate with upstream systems, like SCADA or FEP

Replication Link: Replicate database between Primary and Partner CPU (Base on Fast Ethernet)

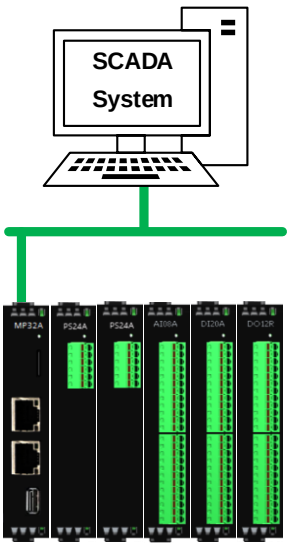
- Note: It's recommended to use dedicated LAN and make a direct connection between both of CPUs (Primary and Partner). IE: Use LAN2 on each one of CPUs for Rep-Link and LAN1 to communicate by SCADA or other systems.

Live Link: LiveLink cable connection is considered to have the same functionality as LiveLink connection via the backplane. Also it is used in parallel to the replication channel by the passive runtime to recognize that the active one has failed – and ensure that both RTU32 is NOT active at the same time.

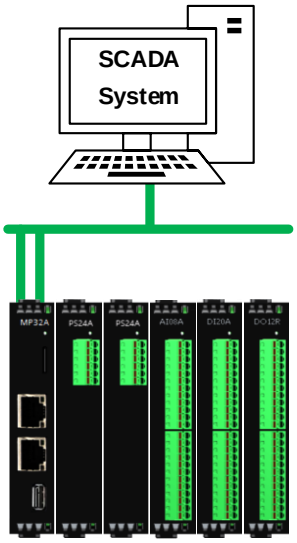
Types of redundancy in RTU32M:

Brodersen RTU32M supports five types of redundancy:

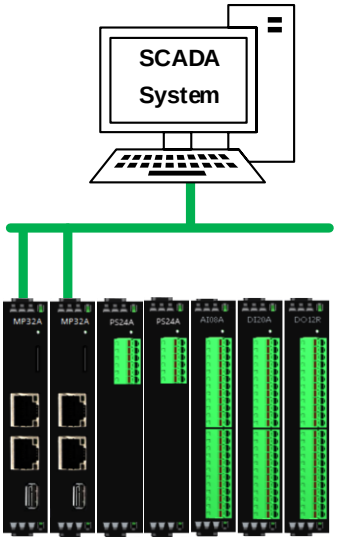
1- Power Redundancy. (It's capable of combining with other types of redundancy)
2- CPU Redundancy with Single I/O Rack.
3- CPU Redundancy with Single Shared I/O Rack.
4- CPU Redundancy with Dual I/O Configuration.
5- Network Redundancy. (It's capable of combining with other types of redundancy)



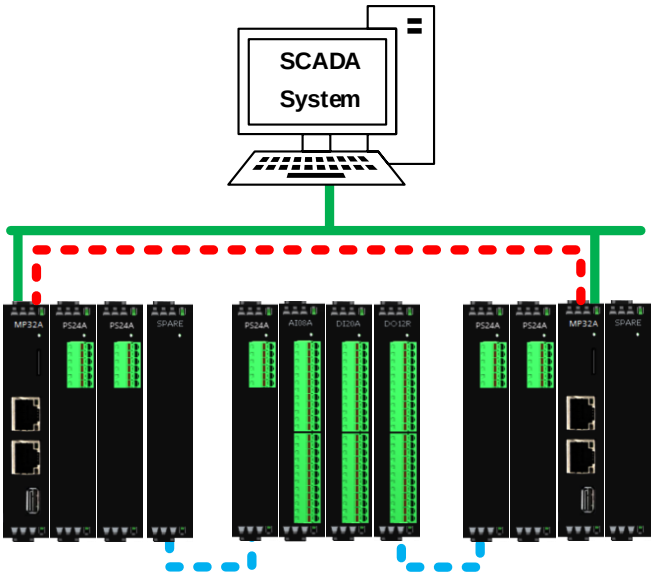
1-Redundant Power
Single Network



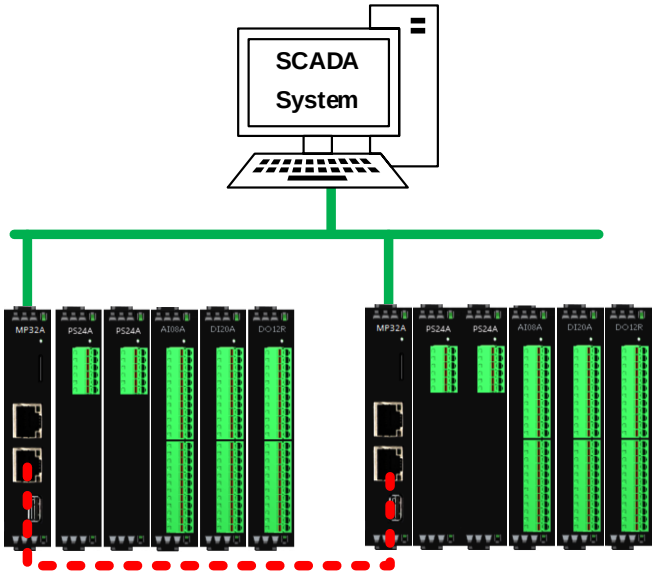
5-Redundant Power
Network Redundant



2-Redundant Power
CPU Redundant Single I/O Rack



3-Redundant Power
Single Share I/O



4-Redundant Power
Dual I/O Configuration

1- Power redundancy

RTU32M is able to energize by a redundant power supply with different types of input voltage, which means the system can power on by two separate DC main inputs with a wide range of voltage. (10~30 VDC, 30~60 VDC, 50~150 VDC)

Note: (It's capable of combining with other types of redundancy)

2- CPU Redundancy with single I/O (Single Rack)

This type of redundancy contains two pieces of MP32A (Main Controller unit) as redundant CPU in Hot Standby mode.

Note: This type of redundancy is configurable as redundant network too.

3- CPU Redundancy with single I/O (Shared I/O)

This type of redundancy contains two packs of CPU and Communication module with one set of extended I/O (Shared I/O).

Note: This type of redundancy is configurable as redundant network too.

CPUs are mounted on left and right side of I/O Rack and they can read the I/Os from both of side.

4- CPU Redundancy with dual I/O Configuration

This type of redundancy contains two packs of mirrored control system completely. (Power, CPU, I/Os, Communication modules)

All I/Os must be wired as double.

5- Communication Redundancy

Redundancy in network communication only. It included all type of communication and protocols, even serial types. (Single Network, Dual Network, HSR, PRP)

Note: (It's capable of combining with other types of redundancy)

Type	Power Redundancy	CPU Redundancy	Network Redundancy	I/O Redundancy	Two way to read I/Os
1	Yes	No	Yes	Yes	No
2	Yes	Yes	Yes	Yes	No
3	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	Yes	Don't care
5	Yes	No	Yes	Yes	No

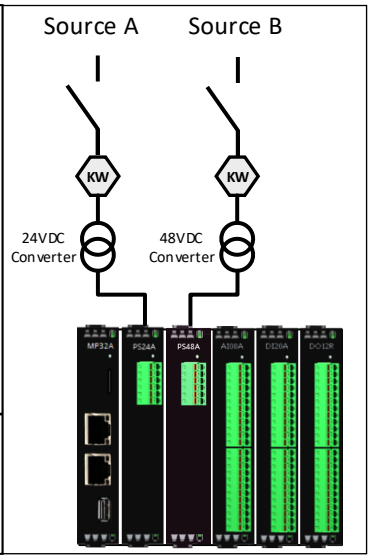
how to setup redundancy in Brodersen RTU32M

1- Power redundancy

Power redundancy implementation doesn't need changes in the software application, it only needs to have two power supply modules.

Below figure shows the architecture of power redundancy in RTU32M:

Types of Power Supplies
1- PS24A (24VDC – 12~30VDC) 2- PS48A (48VDC – 20~600VDC) 3- PS96A (96VDC – 60~150VDC)
Note: One or Two types of power supplies will be choosing for Power Redundancy

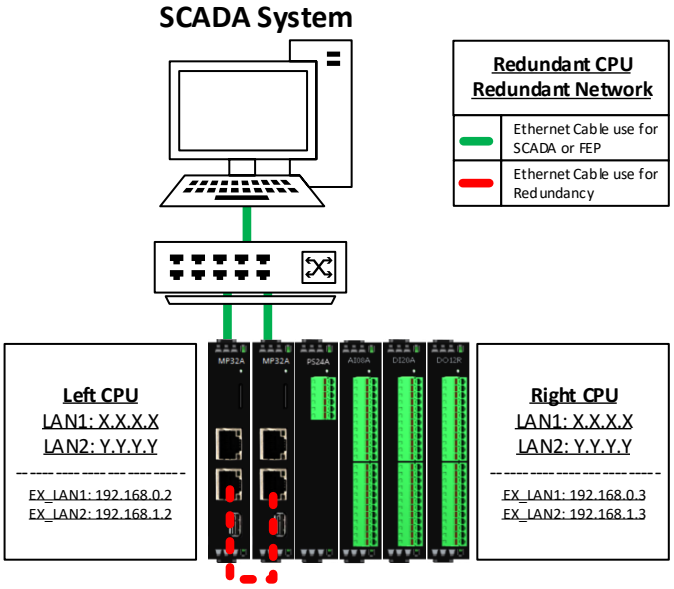


Note: The system can be sourced by two different power sources.

2- CPU Redundancy with single I/O (Single Rack)

This type of redundancy contains two MP32A as redundant CPU in Hot Standby mode.

Note: This type of redundancy is configurable as redundant network too.



Setup IP addresses on both of RTUs and enable redundancy function on them.

➢ Primary RTU Setup.

1- Power on the RTU set, make a direct connection to LAN-1 on the left side MP32A and open web browser with following IP 192.168.0.1.

2- Open network tab on ‘’System Configuration\Network’’. See Figure 1.
   A. Set the communication IP address for LAN-1. (In this case: 192.168.0.2)
   B. Set the IP Address for LAN-2 to use for redundancy.
      a. Deselect ‘’DHCP checkbox’’ for Ethernet LAN-2.
      b. Set the IP Address, Subnet Mask, gateway. (See this case example in below)
         IP Address : 192.168.1.2
         Subnet Mask : 255.255.255.0
         Default Gateway: Blank

3- Set the redundant partner system configuration in ‘’Runtime system\Redundancy Settings\Partners RTU32’’. See Figure 2.
   A. Select Use Redundancy checkbox.
   B. Set the partner IP address (In this case: 192.168.1.3).
   C. Choose primary state. (One of RTUs must be work as primary and other one work as secondary or redundant).
      a. In this case this RTU is primary.

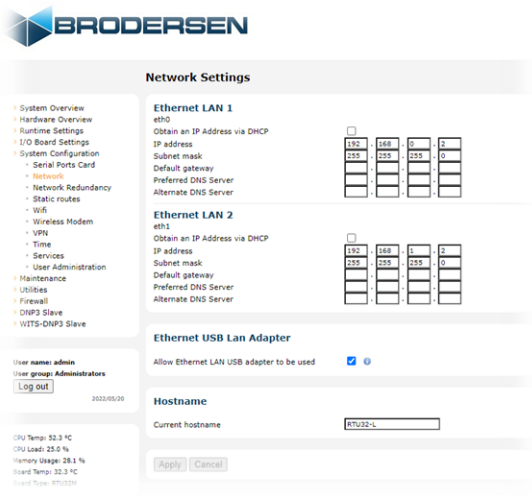


Figure - 1

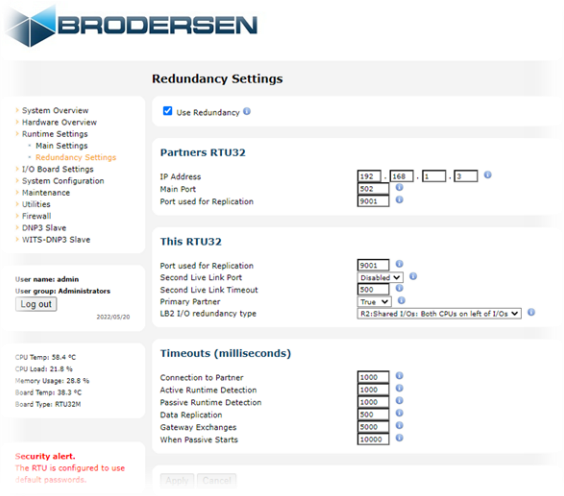


Figure - 2

➢ Partner RTU Setup.

1- Change the direct connection from LAN-1 on the left side MP32A and to LAN-1 on right side MP32A open web browser with following IP 192.168.0.1.

2- Open network tab on ‘’System Configuration\Network’’. See Figure 3.
   A. Set the communication IP address for LAN-1. (In this case: 192.168.0.3)
   B. Set the IP Address for LAN-2 to use for redundancy.
      a. Deselect ‘’DHCP checkbox’’ for Ethernet LAN-2.
      b. Set the IP Address, Subnet Mask, gateway. (See this case example in below)
         IP Address : 192.168.1.3
         Subnet Mask : 255.255.255.0
         Default Gateway: Blank

3- Set the redundant partner system configuration in ‘’Runtime system\Redundancy Settings\Partners RTU32’’. See Figure 2.
   A. Select Use Redundancy checkbox.
   B. Set the partner IP address (In this case: 192.168.1.2).
   C. Choose primary state. (One of RTUs must be work as primary and other one work as secondary or redundant).
      a. In this case this RTU is primary.

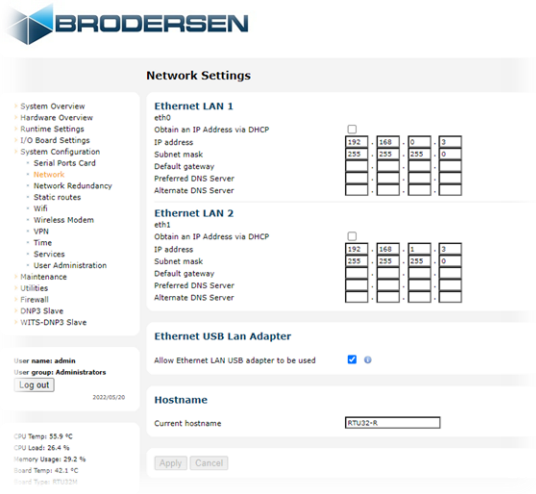


Figure - 3

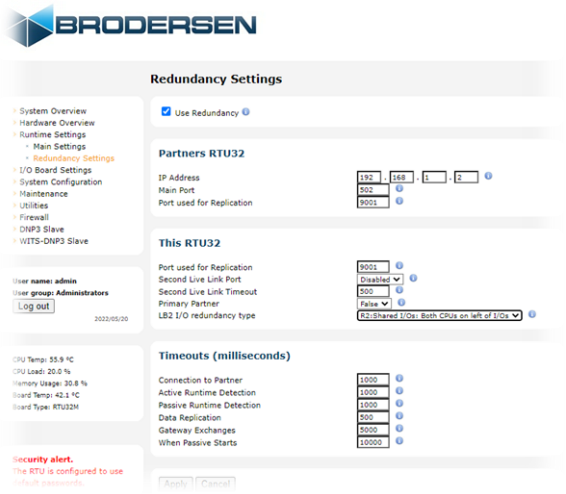


Figure - 4

4- Turn off RTU.

➢ RTUs are ready to use.

1- Turn on both of RTUs.
2- After 25 seconds one of CUPs goes to primary state. Status LED on MP32A will indicate yellow color, and other CPU will be hot standby state, Status LED on MP32A module will indicate blinking yellow color.
3- The system is ready to be programmed. Connect primary RTU to WorkSuite for uploading program.

➢ Note:

Redundancy Functions:

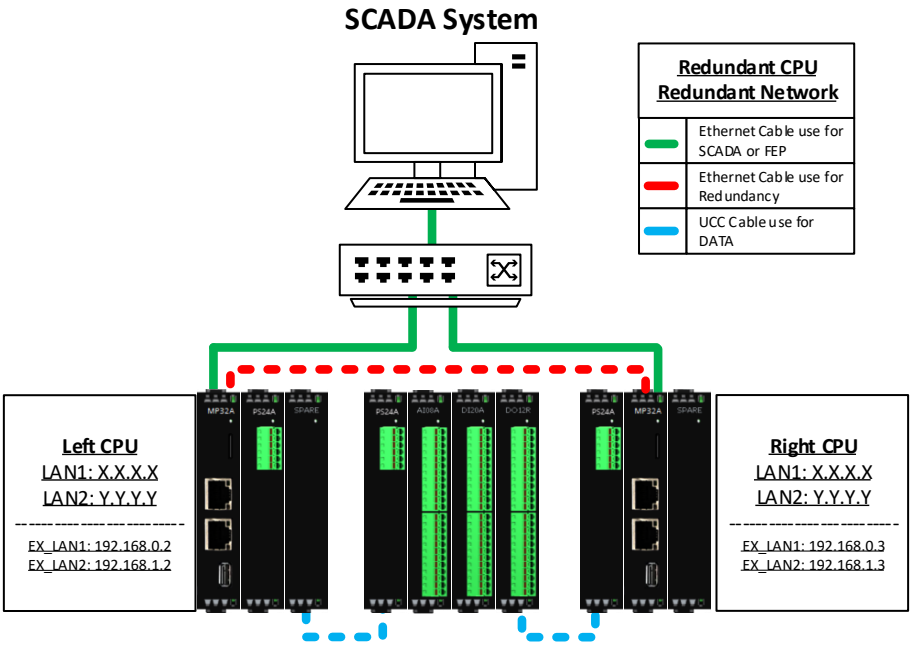
1- In this type of redundancy, there are access to LAN-1 on primary RTU.
2- If you lose your CPU or Power supply on Primary RTU, Secondary RTU change state to primary.
3- Rules can be programmed to change the swop from active RTU to passive RTU, this is based on conditions from logic.

3- CPU Redundancy with single I/O (Shared I/O)

This type of redundancy contains two CPUs and Communication module with one set of extended I/O (Shared I/O).

Note: This type of redundancy is configurable as redundant network too.

CPUs are mounted on left and right side of I/O Rack and they can read the I/Os from both of side.



Setup IP addresses on both of RTUs and enable redundancy function on them.

➢ Primary RTU Setup.

4- Turn on the RTU set, make a direct connection to LAN-1 on the left side MP32A and open web browser with following address192.168.0.1.

5- Open network tab on ‘’System Configuration\Network’’. See Figure 1.

   A. Set the communication IP address for LAN-1. (In this case: 192.168.0.2)
   B. Set the IP Address for LAN-2 to use for redundancy.
      a. Deselect ‘’DHCP checkbox’’ for Ethernet LAN-2.
      b. Set the IP Address, Subnet Mask, gateway. (See this case example in below)

         IP Address : 192.168.1.2
         Subnet Mask : 255.255.255.0
         Default Gateway: Blank

6- Set the redundant partner system configuration in ‘’Runtime system\Redundancy Settings\Partners RTU32’’. See Figure 2.

   A. Select Use Redundancy checkbox.
   B. Set the partner IP address (In this case: 192.168.1.3).
   C. Choose primary state. (One of RTUs must be primary and the other secondary).

a. In this case this RTU is primary.

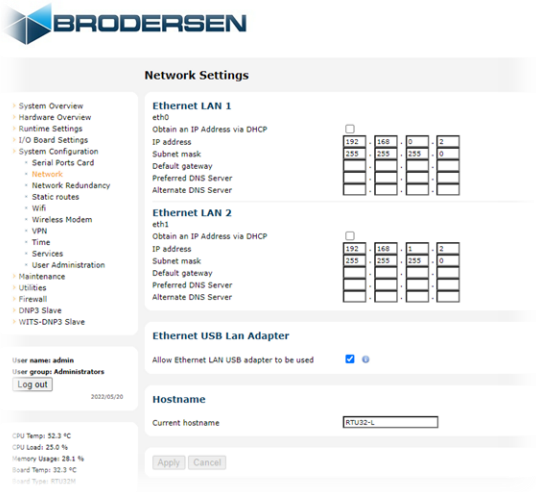


Figure - 1

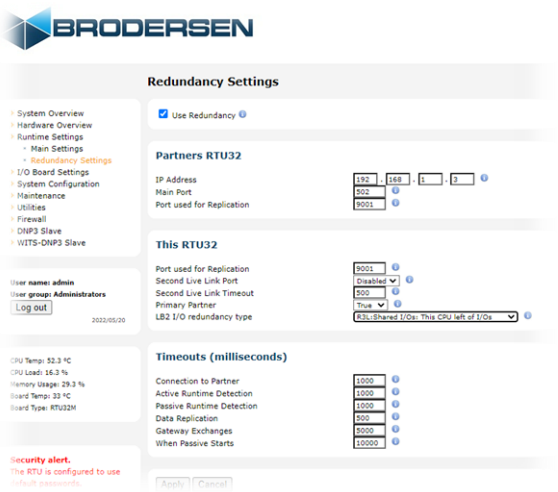


Figure - 2

➢ Partner RTU Setup.

5- Change the direct connection from LAN-1 on the left side MP32A and to LAN-1 on right side MP32A open web browser by 192.168.0.1.

6- Open network tab on ‘’System Configuration\Network’’. See Figure 3.

A. Set the communication IP address for LAN-1. (In this case: 192.168.0.3)

B. Set the IP Address for LAN-2 to use for redundancy.

a. Deselect ‘’DHCP checkbox’’ for Ethernet LAN-2.

b. Set the IP Address, Subnet Mask, gateway. (See this case example in below)

IP Address : 192.168.1.3
Subnet Mask : 255.255.255.0
Default Gateway: Blank

7- Set the redundant partner system configuration in ‘’Runtime system\Redundancy Settings\Partners RTU32’’. See Figure 2.

A. Select Use Redundancy checkbox.

B. Set the partner IP address (In this case: 192.168.1.2).

C. Choose primary state. (One of RTUs must be work as primary and other one work as secondary or redundant).

a. In this case this RTU is primary.

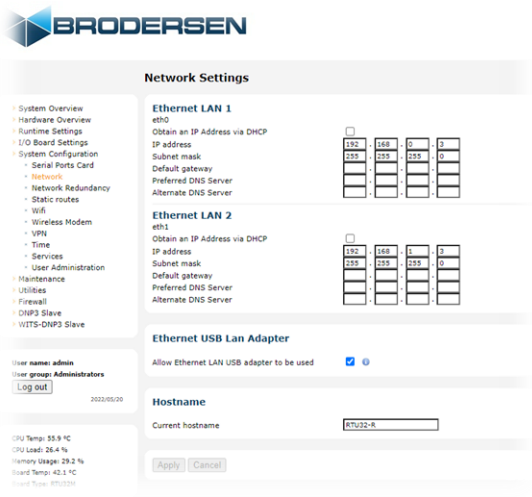


Figure - 3

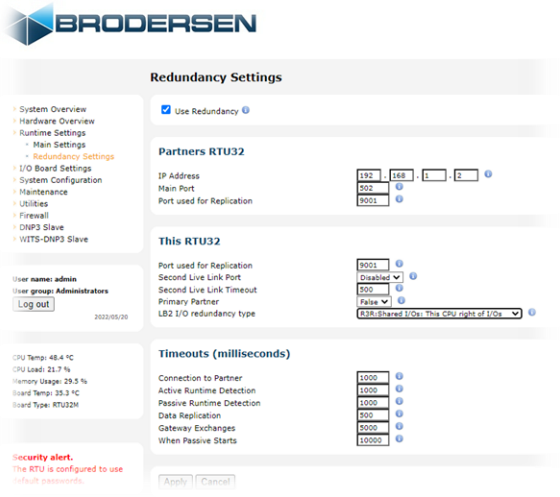


Figure - 4

8- Turn off RTU.

➢ RTUs are ready to use.

4- Turn on both of RTUs.
5- After 25 seconds one of the CUPs will go to primary state (Status LED on MP32A module will indicate yellow) the second RTU will be in hot standby state (Status LED on MP32A module will indicate blinking yellow).
6- The system is ready to be programmed from WorkSuite, It is only necessary to program the active/primary RTU, program will automatically be mirrored from active to passive RTU

➢ Note:

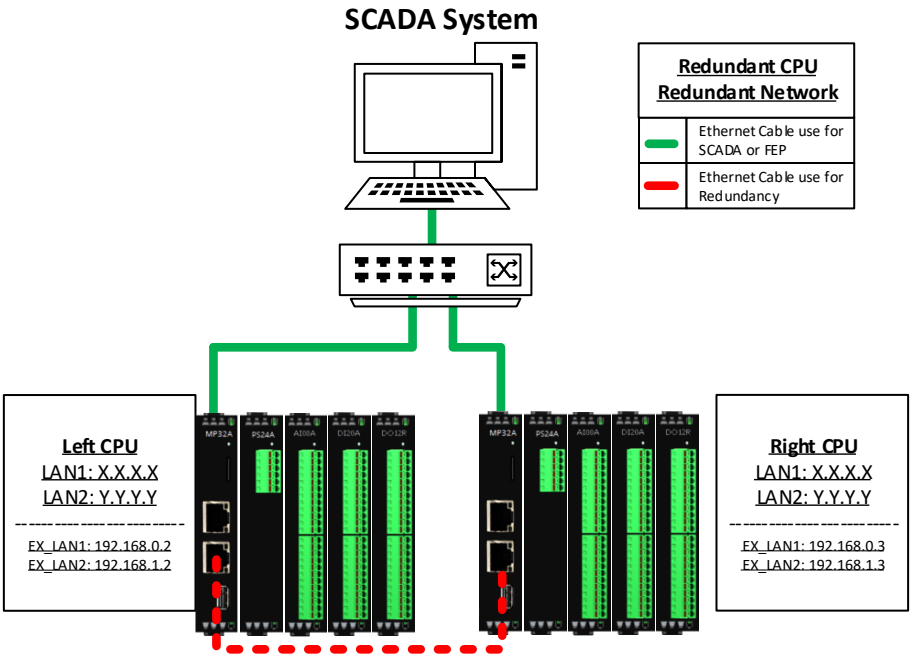
Redundancy Functions:

4- In this type of redundancy, there are access to LAN-1 on primary RTU.
5- If CPU are malfunction or Power supply fail, Secondary RTU change state to primary.
6- Rules can be programmed to change the swop from active RTU to passive RTU, this is based on conditions from logic.

4- CPU Redundancy with dual I/O configuration

This type of redundancy contains two packs of RTU with the same components (Mirror).

Note: This type of redundancy is configurable as redundant network too.



Setup IP addresses on both of RTUs and enable redundancy function on them.

➢ Primary RTU Setup.

7- Turn on the RTU, make a direct connection to LAN-1 on MP32A in one of sets and open web browser with following address 192.168.0.1.

8- Open network tab on ‘’System Configuration\Network’’. See Figure 1.

A. Set the communication IP address for LAN-1. (In this case: 192.168.0.2)

B. Set the IP Address for LAN-2 to use for redundancy.

a. Deselect ‘’DHCP checkbox’’ for Ethernet LAN-2.

b. Set the IP Address, Subnet Mask, gateway. (See this case example in below)

IP Address : 192.168.1.2
Subnet Mask : 255.255.255.0
Default Gateway: Blank

9- Set the redundant partner system configuration in ‘’Runtime system\Redundancy Settings\Partners RTU32’’. See Figure 2.

A. Select Use Redundancy checkbox.

B. Set the partner IP address (In this case: 192.168.1.3).

C. Choose primary state. (One of RTUs must be work as primary and other one work as secondary or redundant).

a. In this case this RTU is primary.

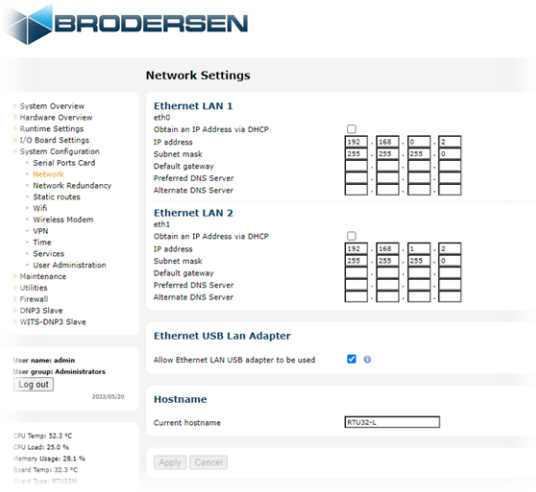


Figure - 1

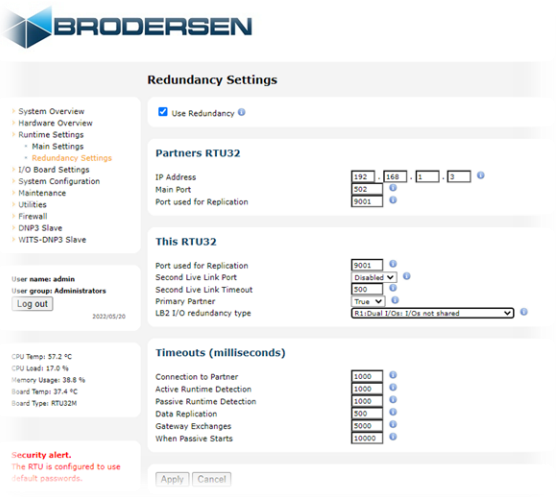


Figure - 2

➢ Partner RTU Setup.

9- Change the direct connection from LAN-1 on current connected set to LAN-1 on other set and open web browser by 192.168.0.1.

10- Open network tab on ''System Configuration\Network''. See Figure 3.

A. Set the communication IP address for LAN-1. (In this case: 192.168.0.3)

B. Set the IP Address for LAN-2 to use for redundancy.

a. Deselect ''DHCP checkbox'' for Ethernet LAN-2.

b. Set the IP Address, Subnet Mask, gateway. (See this case example in below)

IP Address : 192.168.1.3
Subnet Mask : 255.255.255.0
Default Gateway: Blank

11- Set the redundant partner system configuration in ''Runtime system\Redundancy Settings\Partners RTU32''. See Figure 2.

A. Select Use Redundancy checkbox.

B. Set the partner IP address (In this case: 192.168.1.2).

C. Choose primary state. (One of RTUs must be work as primary and other one work as secondary or redundant).

a. In this case this RTU is primary.

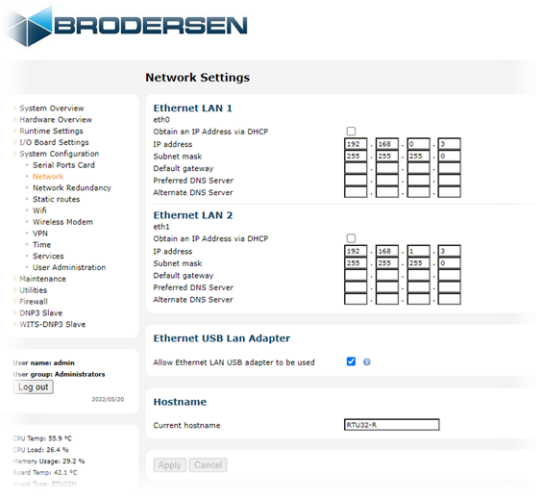


Figure - 3

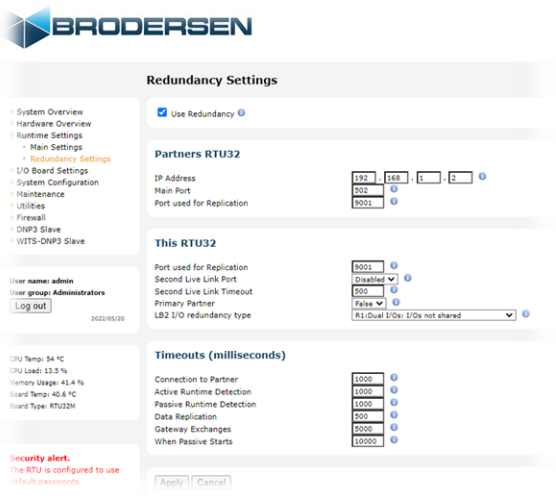


Figure - 4

12- Turn off RTU.

➢ RTUs are ready to use.

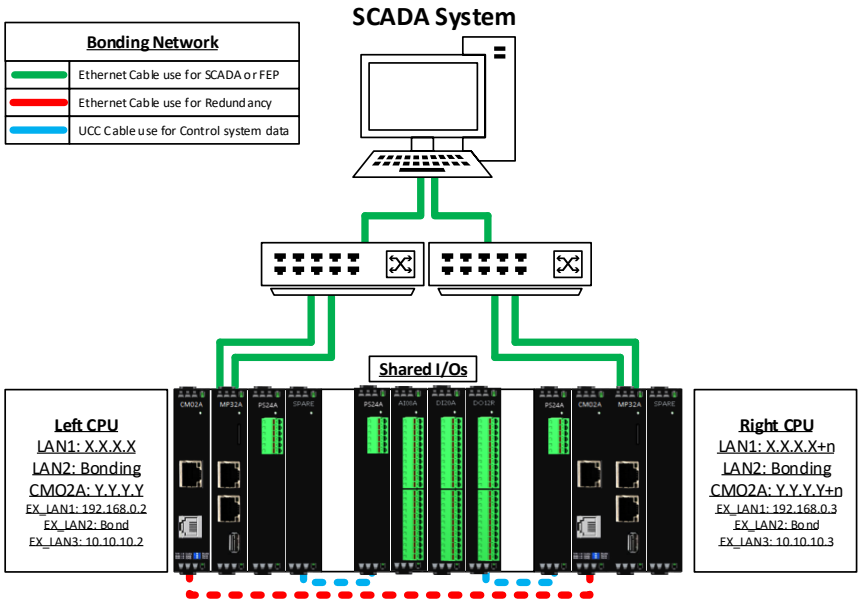
7- Turn on both of RTUs.
8- After 25 seconds one of the CUPs will go to primary state (Status LED on MP32A module will indicate yellow) the second RTU will be in hot standby state (Status LED on MP32A module will indicate blinking yellow).
9- The system is ready to be programmed from WorkSuite, It is only necessary to program the active/primary RTU, program will automatically be mirrored from active to passive RTU.

➢ Note:

Redundancy Functions:

7- In this type of redundancy, there are access to LAN-1 on primary RTU.
8- If CPU are malfunction or Power supply fail, Secondary RTU change state to primary.
9- Rules can be programmed to change the swop from active RTU to passive RTU, this is based on conditions from logic.

5- Example of combination of CPU and Network Redundancy (Bonding IP) in Brodersen RTU32M.



Setup IP addresses on both of RTUs and enable redundancy function on them.

➢ Primary RTU Setup.

Turn on the first RTU and open web browser with following address 192.168.0.1.

13- Set the communication IP address in System ''Configuration\Network Redundancy\Network Bonding'' and select Enable Network Bonding on Active-Backup mode. See Figure 1.

A. In this case: 192.168.0.2.

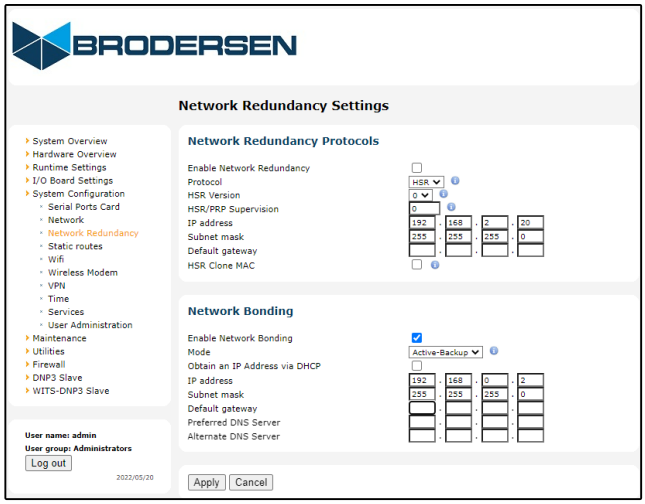


Figure 1

14- Set the IP to use redundancy in ''System Configuration\Network''. See Figure 2.

A. In this case: 10.10.10.2.

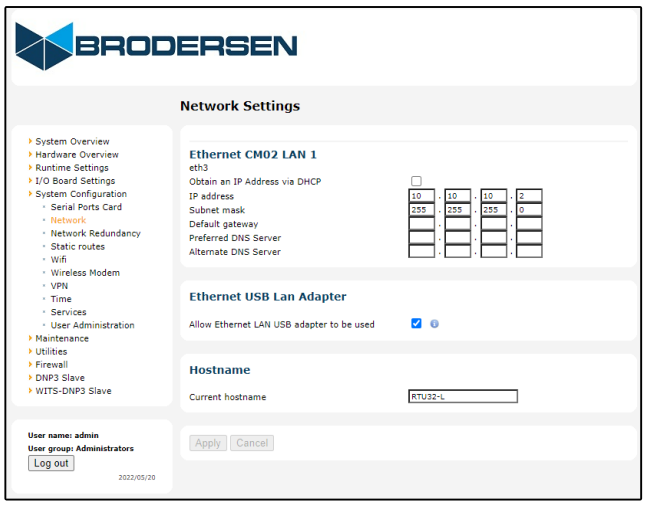


Figure 2

15- Set the redundant partner system configuration in ''Runtime system\Redundancy Settings\Partners RTU32''. See Figure 3.

A. Select Use Redundancy.
B. Set the partner IP address (In this case: 10.10.10.3).
C. Choose primary state. (One of RTUs must be work as primary and other one work as secondary or redundant).
    a. In this case this RTU is primary.
D. Choose your RTU position in R3 types. (One of RTUs is in the left of I/Os and other one is on the right)
    a. In this case this RTU in on the left side of I\Os.

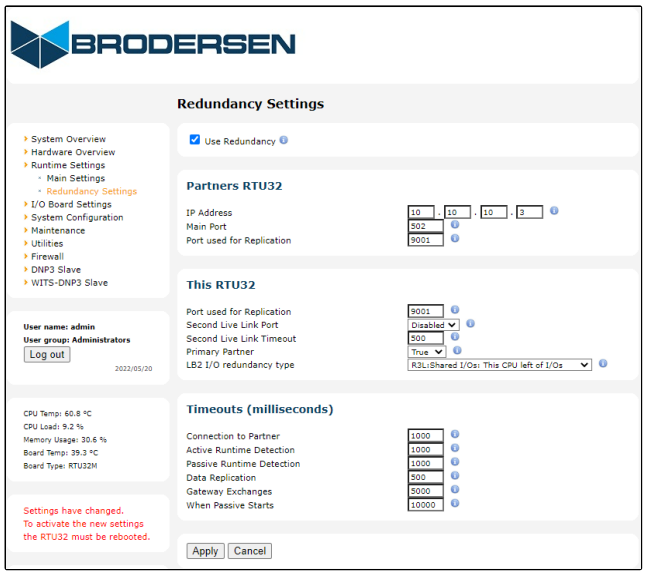


Figure 3

16- Turn off RTU.

➢ Secondary (Redundant) RTU setup.

Turn on the second RTU and open web browser by 192.168.0.1.

17- Set the communication IP address in System ''Configuration\Network Redundancy\Network Bonding'' and select Enable Network Bonding on Active-Backup mode. See Figure 4.

A. In this case: 192.168.0.3.

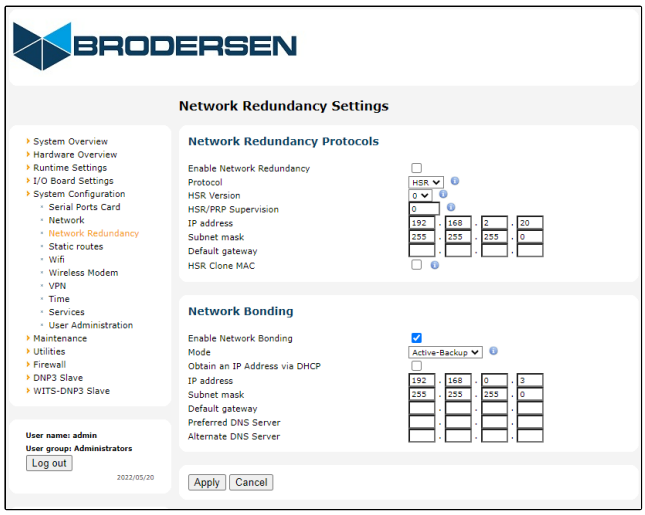


Figure 4

18- Set the IP to use redundancy in ''System Configuration\Network''. See Figure 5.

A. In this case: 10.10.10.3.

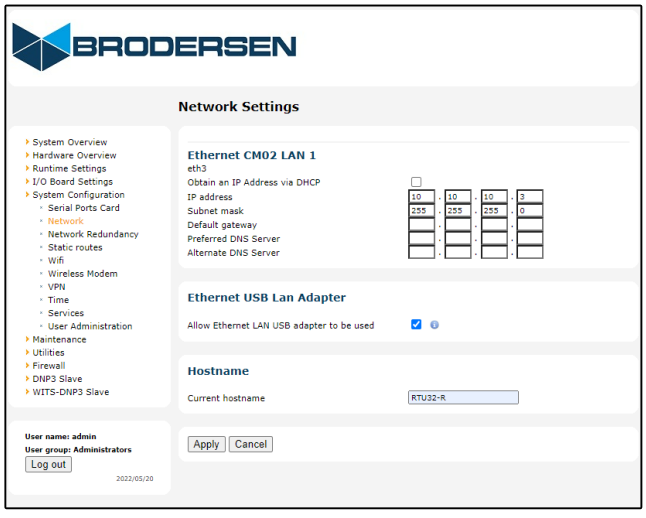


Figure 5

19- Set the redundant partner system configuration in ''Runtime system\Redundancy Settings\Partners RTU32''. See Figure 6.

A. Select Use Redundancy.

B. Set the partner IP address (In this case: 10.10.10.2).
C. Choose primary state. (One of RTUs must work as primary and other one as secondary).
    a. In this case this RTU is secondary.
D. Choose your RTU position in R3 types. (One of RTUs is in the left of I/Os and other one is on the right)
    a. In this case this RTU in on the side of I\Os.

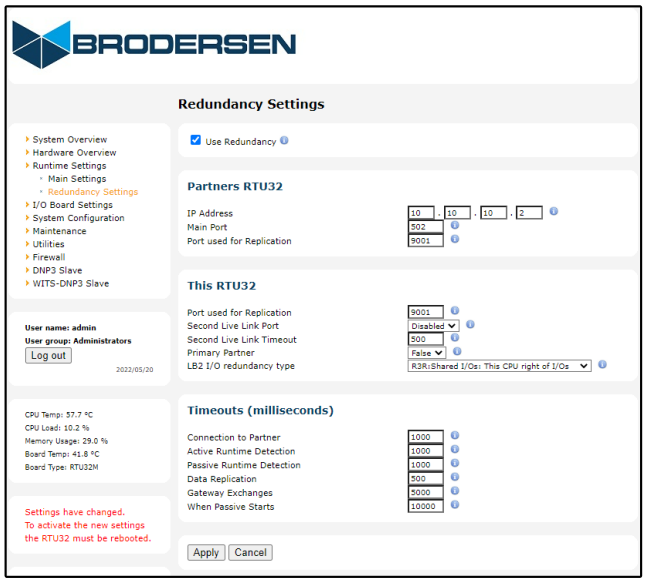


Figure 6

20- Turn off RTU.

➢ RTUs are ready to use.

21- Turn on both RTUs.
22- After 25 seconds one of the RTUs will go to primary state (Status LED on MP32A module will indicate yellow) the second RTU will be in hot standby state (Status LED on MP32A module will indicate blinking yellow).
23- The system is now ready to be programmed from Brodersen WorkSuite. It is only necessary to program the active/primary RTU, i.e., the application code will automatically be transferred to the passive RTU.

➢ Note:

Redundancy Functions:

- In this type of redundancy, the two network cards on the RTU are bonded into a virtual one which is accessible via one IP address. If the LAN 1 fails, the RTU automatically uses LAN 2.

- If the CPU module or power supply fails on the active RTU, the standby RTU automatically changes its state to active in less than a second

- It is possible to create some rules, which specifies when and if the standby RTU should takeover as active RTU. The rules need to be implemented in application code.