APPLICATION NOTES:
ODIN FRAME REPLACEMENT AND REDUNDANCY

OVERVIEW

ODIN redundancy consists of three components:

- Backup and Restore
- Frame Swap
- Redundant Frame Operation

With **Backup and Restore**, AZedit can upload the complete configuration of an intercom and save it to file – not only the intercom setup, but also frame-specific data such as IP settings, RVON and OMNEO channel configuration, front-panel settings, the Port Allocation Table, etc. This configuration can then be applied to a frame. Use cases include:

- Applying the configuration to the same frame (e.g. ODIN frames in two separate OB Trucks are linked together for a production; afterwards, each frame is restored to its previous settings)
- If a frame needs to be taken out of service (e.g. one of its AIO ports is noisy), a replacement frame can be quickly put into service

Frame Swap is available for systems of two or more frames. It is similar to Backup and Restore, but there is no need to proactively save the complete configuration from AZedit. Instead, each frame keeps a copy of the complete configuration of every other frame. If a frame fails, a replacement frame can be connected in its place; then Frame Swap allows the replacement frame to replicate the configuration of the failed frame.

Redundant Frame Operation allows one or more redundant frames to be configured as part of a system. In the case of a frame failure, a redundant frame can take over operation for the failed frame. The system can be configured for automatic transfer of control (a redundant frame takes over automatically when it detects a failure) or manual transfer (a redundant frame only takes over at the direction of the user).

MINIMUM FIRMWARE VERSIONS

All three components require the following minimum versions:

- ODIN v1.6.0
- AZedit v5.7.0

LICENSING

Backup and Restore is available at no additional cost. Frame Swap requires a license for the replacement frame. Redundant Frame Operation supports two redundancy modes:

- One-to-One Redundancy is available at no additional cost
- For Intelligent Redundancy, each redundant frame requires a license

BACKUP AND RESTORE

AZedit setup files are focused on the intercom setup, such as key assignments, alphas, scroll restrictions, PL membership, IFB definitions, etc. AZedit also has the ability to save some system configuration items separately, such as the SNMP settings and the DHCP Server configuration.

Backup and Restore allows the user to save the complete configuration of all frames of an intercom, including the normal setup (key assignments, alphas, IFB definitions, etc.), global configuration data (such as the DHCP Server configuration and PAP-5032 mapping), and frame-specific data (network settings, Port Allocation Table, 2-wire channel configuration, etc.). Later on, the saved backup can be applied to a frame, reconfiguring it to the state at which the backup was made.

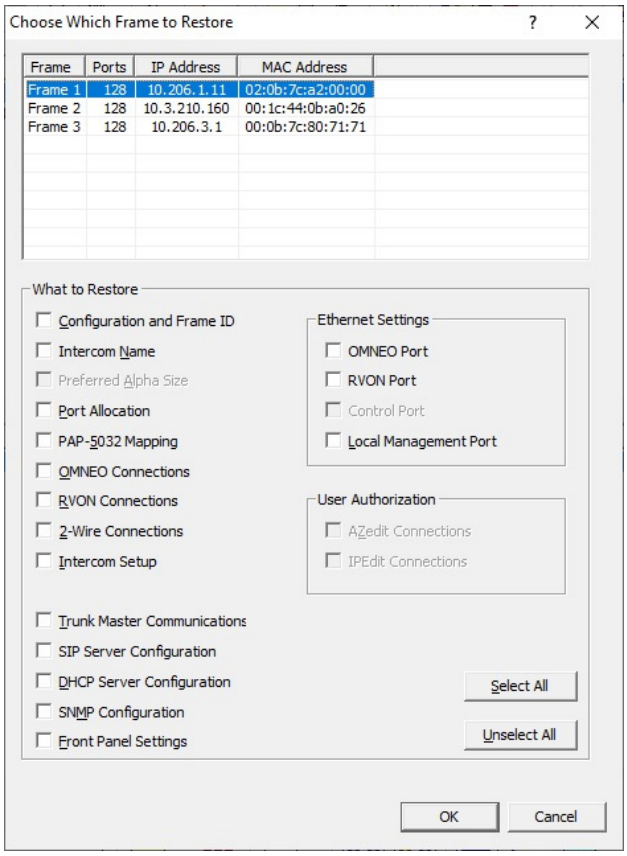
SYSTEM BACKUP

In AZedit, the new menu item Online | System Backup... is used to save the complete configuration. Operation is similar to File | Save, except that a system backup is always complete – there is no option for performing a partial save. (However, portions of the backup can be selected when restoring from the backup file.)

FRAME RESTORE

To apply a saved backup, go online, and select the menu item Online | Frame Restore... AZedit then brings up a dialog to select the backup file.

Once a file is selected, AZedit displays a list of configuration items that are contained in the file, and allows the selection of which configuration items are to be applied (the default is to apply everything).



Once the user clicks Apply, the changes are sent to the intercom, much like sending a regular AZedit setup file. The frame may need to reboot once, e.g. if the intercom size and/or frame mapping table changes.

Once the configuration has been applied, the frame is ready to go.

MULTI-FRAME CONSIDERATIONS

Backup and Restore is supported with multi-frame intercoms, subject to the following considerations:

- When performing a system backup, data is saved from all frames that are currently communicating. But if a frame is not connected (e.g. only frames 1 and 2 of a 3-frame system are present), the frame-specific data for the disconnected frames is not included.

- A saved backup can only be applied to one frame at a time (the one to which AZedit is connected). If a saved multi-frame configuration needs to be applied to multiple frames, then it must be applied to each frame separately.

- When applying a saved configuration, if the saved configuration was created from a multi-frame intercom, AZedit displays a list of frames (the frame number, the IP address of the control [AZedit] interface, and the OMNEO device name), and allow the user to select which frame's configuration is to be applied. If the current frame is included in the saved configuration (based on the MAC addresses in the frame mapping table), AZedit will automatically select that frame as the default.

- The frame mapping table (for the current frame) will be updated with the current frame's IP and MAC addresses. However, if the backup was saved from a different frame, it will be necessary to manually update the frame mapping table for the other frames in the system, so that they refer to the MAC address of the new frame.

OTHER NOTES

For a single-frame ODIN, the contents of the four Saved Setups are not preserved.

Downloaded contents are not preserved. This includes firmware versions; license files; the graphical screen saver; the splash screen; fonts; icons; and language packs.

FRAME SWAP

Frame Swap is used to replace a single frame in a multi-frame ODIN intercom. It is similar to Backup and Restore, but it is performed from the ODIN front panel, and does not involve AZedit. Instead, the replacement frame receives the intercom configuration (including its frame-specific settings) and the intercom setup from another frame in the system.

When the system is operating normally, frame-specific configuration is replicated across all frames (along with the intercom setup). Thus, if one frame fails, the other frames already have an up-to-date copy of the failed frame's configuration, and can make this available for Frame Swap.

Frame Swap is only available for multi-frame intercoms.

The replacement frame requires a Frame Swap license; however, the frames in the existing system do not require a license.

TERMINOLOGY

Replacement Frame	The new frame that is to substitute for the failed frame.
Host Frame	The frame to which the replacement frame is initially connected, and from which it receives its configuration and the intercom setup.

WORKFLOW

Suppose frame 3 of a 4-frame system has failed, and is to be replaced. The workflow would be as follows:

1. Remove the failed frame from the system.
2. Connect the control (AZedit) interface of the replacement frame (which will become the new frame 3) to the network.
3. Connect one of the IFL uplinks of the replacement frame to one of the IFL downlinks of frame 2 (which will become the host frame). Alternatively, connect a downlink of the replacement frame to an uplink of frame 4, in which case frame 4 becomes the host frame.
4. Power on the replacement frame. Press and hold the left shaft encoder, and keep pressing it until initialization is complete and the home screen is displayed. This enables the Frame Swap menu item.
5. On the replacement frame, select Configuration | System | Frame Swap

6. The replacement frame and the host frame both perform validation checks. If these checks pass, a warning and confirmation pop-up is displayed.
7. Select Continue, then press the Home button 5 times to proceed with the Frame Swap.
8. The host frame updates its frame mapping table to reflect the new MAC address for the replacement frame. It then forwards the updated frame mapping table to the other frames via the IFL.
9. The host frame downloads the intercom configuration and intercom setup to the replacement frame, including the frame-specific configuration. As part of this process, the replacement frame may reboot once. Throughout the process, the replacement frame displays a pop-up indicating that the frame replacement is in progress.
10. Once the reconfiguration is complete, the replacement frame clears the pop-up.
11. Connect the remaining cables (remaining IFL cables, OMNEO and RVON Ethernet, AIO ports, 2-wire ports, etc.)

OTHER NOTES

The replacement frame receives the IP settings for its various interfaces from the host frame. The IP settings for the control (AZedit) interface are transferred via IFL, so it is not necessary to set the IP address of the control port for the replacement frame before initiating the frame swap.

Some of the configuration data is transferred via IFL; however, the majority of the information is transferred from the host frame to the replacement frame via Ethernet, once the replacement frame has received its IP settings.

The replacement frame is not automatically enrolled in DDM. If DDM is being used, the replacement frame must be manually enrolled in DDM.

REDUNDANT FRAME OPERATION

Frame Restore and Frame Swap are used to replace a failed frame (or, in the case of Frame Restore, to restore a frame to a previous configuration). In contrast, Redundant Frame Operation allows a system to be configured with one or more redundant frames. The redundant frames track changes to the intercom setup (key assignments, alphas, IFB definitions, etc.) and status (what keypanel talk and listen keys are currently on, etc.), allowing for a rapid changeover if one of the active frames fails.

Redundant Frame Operation is configured via the frame mapping table.

TERMINOLOGY

Core Frame	A frame which is active by default. Core frame X can be active as frame #X, or it can be standby.
Redundant Frame	A frame which is standby by default. Redundant frames are referred to as “Redundant A”, “Redundant B”, etc., since (for Intelligent redundancy) a redundant frame can be configured take over for more than one core frame.
N+M Redundancy	A system of N core frames plus M redundant frames. Typical examples are “N+1” (e.g. “3+1”, meaning a 3-frame system plus a single redundant frame) and “N+N” (where there is a redundant frame for each core frame).
Guarded Frames	For each redundant frame, the set of core frames that it is allowed to replace. For one-to-one redundancy, this is fixed (Redundant A guards Core 1, Redundant B guards Core 2, etc.). For Intelligent redundancy, the user can configure which core frames are guarded by each redundant frame.

FRAME START-UP

When a frame starts up, it does not automatically become active, even if it is a core frame – there may be another frame that has taken over for it. Instead, it monitors the other frames (as defined in the frame mapping table) via Ethernet messaging and via IFL, to determine if and when to go active.

A core frame will always go active if it does not detect a replacement frame acting on its behalf, even if the transfer mode is set to manual.

In manual transfer mode, if a redundant frame goes active because of a user request, it saves this information (including its frame number within the system) in non-volatile memory. If the frame is restarted, it will check to see if another frame is active as that frame number. If so, it will “forget” this information, and will revert to normal standby operation. But if it doesn’t detect another frame acting as that frame, it will automatically go active, resuming operation as previously (even with transfer of control set to manual).

REDUNDANCY OPTIONS

AUTOMATIC TRANSFER OF CONTROL

Each redundant frame continually monitors the frames that it guards. If it detects a failure, it automatically takes over for the failed frame. If a core frame fails, and there are multiple redundant frames guarding it, the lowest-numbered eligible redundant frame takes over.

MANUAL TRANSFER OF CONTROL

Each redundant frame continually monitors the frames that it guards. However, if it detects a failure, it does not automatically become active – this action has to be initiated by the user, either via AZedit or at the front panel.

As discussed above, at start-up a redundant frame which was previously active will check to see if the frame it replaced has been restored; if not, the redundant frame will go active, and continue its operation as a replacement.

REDUNDANCY OPTIONS CONT.

ONE-TO-ONE REDUNDANCY

With one-to-one redundancy, the user cannot configure guard information for redundant frames. Instead, each redundant frame guards the corresponding core frame (Redundant A guards Core 1, Redundant B guards Core 2, etc.).

It is not necessary to define all the redundant frames. For example, a 3-frame system might be configured so that only a single redundant frame (Redundant A) is defined. In that case, if Core 1 fails, Redundant A can take over for it; but Core 2 and Core 3 would not have any protection.

One-to-one redundancy is always available; it does not require a license.

INTELLIGENT REDUNDANCY

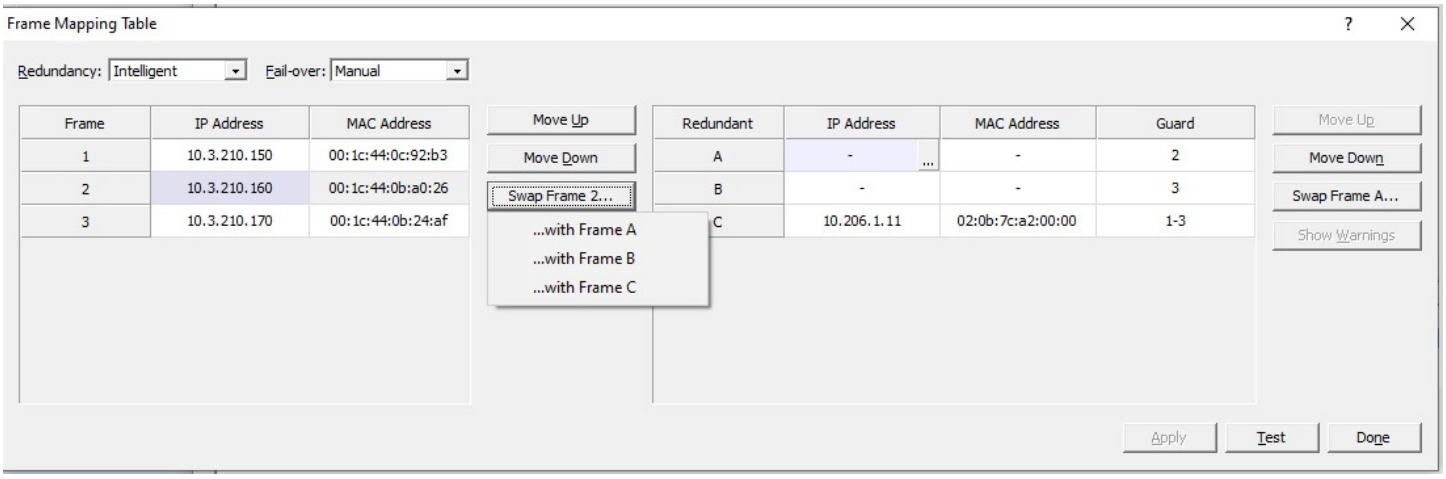
With Intelligent Redundancy, the user can configure which core frames are guarded by each redundant frame. Since frame failures are uncommon, a system might be configured with just 1 or 2 redundant frames. For example, a 5+2 system would consist of 5 core frames plus 2 redundant frames. In this case, one would typically configure the redundant frames so that each guards all 5 core frames.

Another system might be set up as a 3-frame system, but the user decides that frame 3 is less critical, and does not need to be guarded. In that case, one might configure the system as a 3+1 system, where the redundant frame guards frames 1 and 2, but not frame 3.

Each redundant frame requires a license. However, core frames never require a license.

FRAME MAPPING TABLE

The following screen shot shows the important elements of the frame mapping table:



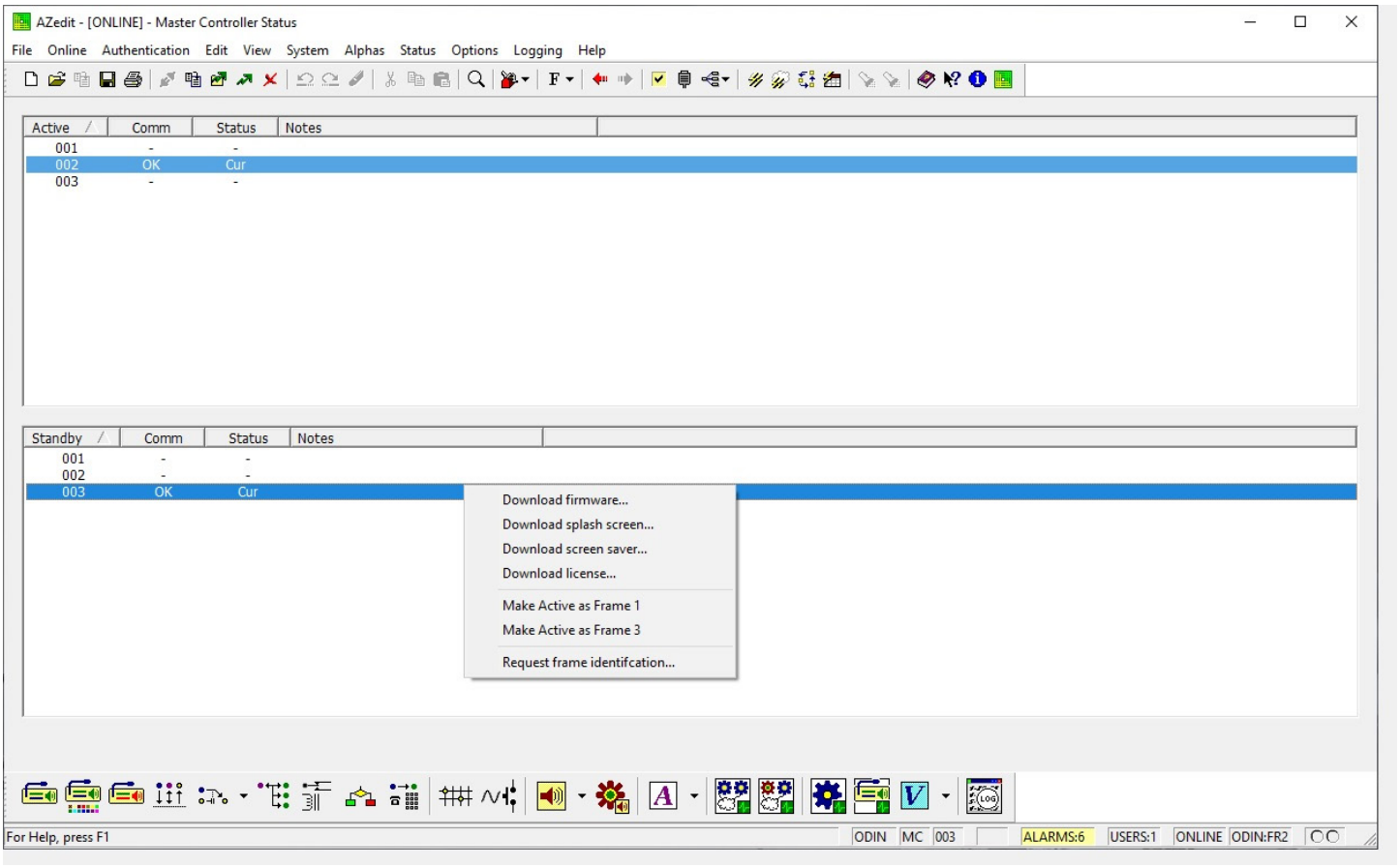
The Redundancy Mode can be set to None, One-to-One, or Intelligent. (If it is set to None, the Transfer Mode and Redundant frames are all hidden.) The Transfer Mode can be set to Auto or Manual.

For each redundant frame, the Guards field defines the core frames for which it can act as a replacement. If the redundancy mode is set to One-to-One, the Guards field is read-only.

The “Move Up” and “Move Down” buttons allow the (core or redundant) entries to be re-ordered. The “Swap Frame...” buttons allow core and redundant entries to be swapped.

CONTROLLER STATUS

The Status | Master Controller view has been updated to display the status of both active and standby devices together.



The Notes column indicates whether a standby frame is a core frame, or an active frame is a redundant frame. For example, if the user selects “Make Active as Frame 1”, then the status screen will update to show two active frames (frame 1 and frame 2); and the note for frame 1 will display “Normally Redundant Frame C”.

Right-clicking a device presents a context menu, which includes options for transfer of control. It also allows standby devices to be downloaded.

CONFIGURATION REQUIREMENTS

IFL WIRING

For full redundancy, the Inter-Frame Links must be wired in a loop. In this way, there are two audio paths between any pair of frames ("clockwise" and "anti-clockwise" around the ring), and any single fault (frame or IFL failure) does not impact audio between the other frames.

For non-redundant systems (core frames only), the frames need to be wired in order: 1 to 2 to 3 to ... to N to 1, with the downlink of one frame connected to the uplink of the next frame. Other wiring options will work, but it is then non-trivial to detect wiring issues, and an alarm will be generated to warn that the wiring is not as expected.

For redundant systems, the wiring rules are relaxed. Redundant frames may be positioned anywhere in the ring. But if two core frames are adjacent (wired to each other), then they must have adjacent frame numbers. For example, if a downlink of core frame 1 is wired to a core frame other than frame 2, an alarm will be generated.

For a single-frame redundant system (1+1 redundancy), an IFL connection is still required between the frames. No audio is transported across the link, but the link is still required for control, monitoring, and data transfer.

SUBNETS

If a redundant frame takes over for a failed frame, its network settings are handled as follows:

Control (AZedit)	Redundant frame keeps its own settings
OMNEO	Redundant frame keeps its own settings
RVON	Redundant frame uses failed frame's settings
Local Management Port	Redundant frame uses failed frame's settings

This has the following implications:

- The Local Management Port (LMP) should use DHCP. If not, the LMP for the redundant frame must be on the same subnet as the LMP for any frame it guards.
- The RVON port for the redundant frame must be on the same subnet as the RVON port for any frame it guards. Since RVON works across subnets, this is not an onerous condition.
- If the OMNEO port for the redundant frame is on a different subnet than the OMNEO port for a frame it guards, then the system must be configured with a multi-subnet OMNEO solution, such as using an ARNI-E.

DEVICE NAMES

If a core frame fails, and a redundant frame takes over as its replacement, the redundant frame starts using the failed frame's device name.

Once the failed core frame is restored to service, it will stay standby (if the replacement is still active). In this state, it will change its device name back to its host name ("CAP6-xxxxxx", where xxxxxx are the last 6 characters of the OMNEO Audio MAC address).

If the device name was never changed, the redundant frame will be using this device name, and there will be a conflict, which could result in the active (redundant) frame changing its device name, causing all OMNEO connections to be lost.

To prevent this issue, it is necessary to change the device name from the default, for any core frame that has one or more frames guarding it. If this is not the case, an alarm will be generated to inform the user of the issue.

DANTE DOMAIN MANAGER

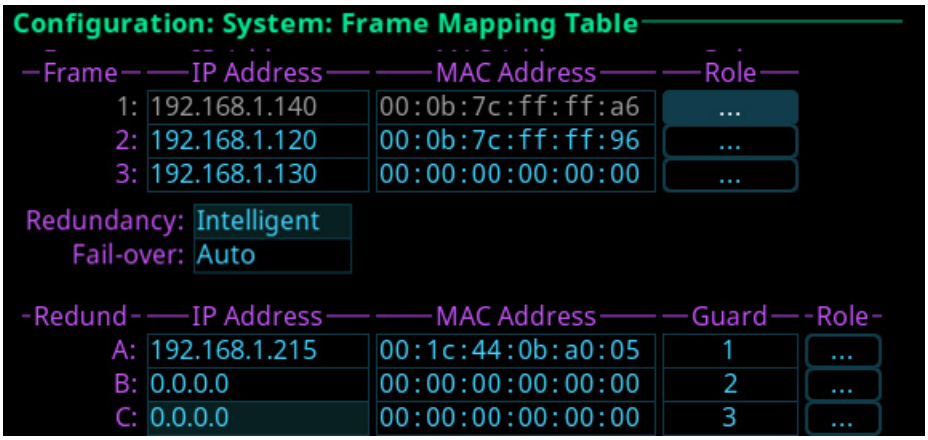
If DDM is being used, each frame (core and redundant) must be explicitly enrolled in DDM.

FRONT PANEL SUPPORT

CONFIGURATION

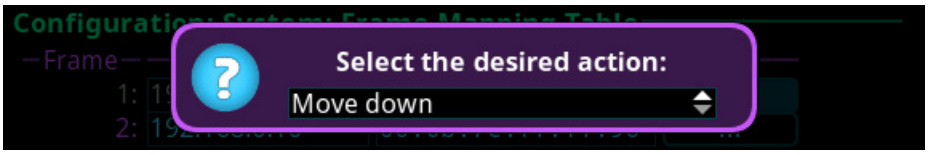
ODIN redundancy is configured via Configuration | System | Frame Mapping Table.

For each row, a "..." button brings up a menu of possible options.



Options include:

- Delete the current entry
- Move the current entry up or down (swap it with the preceding / following row)
- (For a core frame) Swap the current entry with redundant entry X
- (For a redundant frame) Swap the current entry with core entry X
- Select frame with IP address W.X.Y.Z (if a frame with that IP address is connected via IFL, but doesn't exist in the frame mapping table)



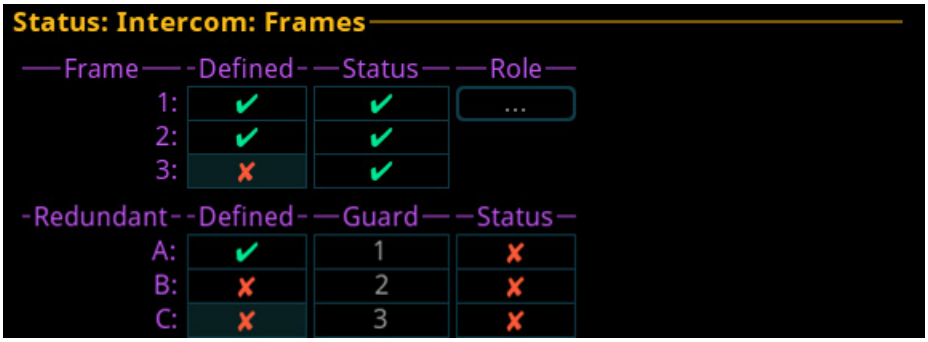
If the "..." button is used to select the IP address of a connected frame, the system checks to see whether that frame's configuration (system size and options) matches the current configuration. If not, a warning is displayed; if the user confirms the selection, the selected frame is automatically reconfigured (and it will reboot) when the frame mapping table changes are saved.

If the redundant mode is set to Intelligent, the "Guard" field for a redundant frame can be edited as follows: Press SEL to start editing. Then press digit X to toggle whether frame X is guarded. For example, if the Guard field displays "1-3" (it is guarding frames 1 through 3), and you press 2, then the display changes to "1,3" (it is guarding frames 1 and 3). Press SEL again to exit edit mode, or press CLR to discard the changes.

FRONT PANEL SUPPORT CONT.

STATUS

A summary of frame status can be seen via Status | System | Frames.



The first section of the form shows the status of the core frames:

- Whether it is defined in the frame mapping table
- The status. This can be a check mark (frame is active), an X (frame is not talking), or “Standby” (frame is currently standby).

The second section shows the status of the redundant frames:

- Whether it is defined in the frame mapping table
- What core frames it is configured to guard
- The status. This can be a check mark (frame is standby), an X (frame is not talking), or “Frame X” (frame is active, and has taken over for Core X).
- A “...” button. Selecting this field brings up a pop-up giving the user the available option(s) for going active or going standby. The button is grayed out if there are no available actions.

FRONT PANEL LED

ODIN has 3 front-panel LEDs, to the left of the LCD: Status; Active/Standby; and Fault.

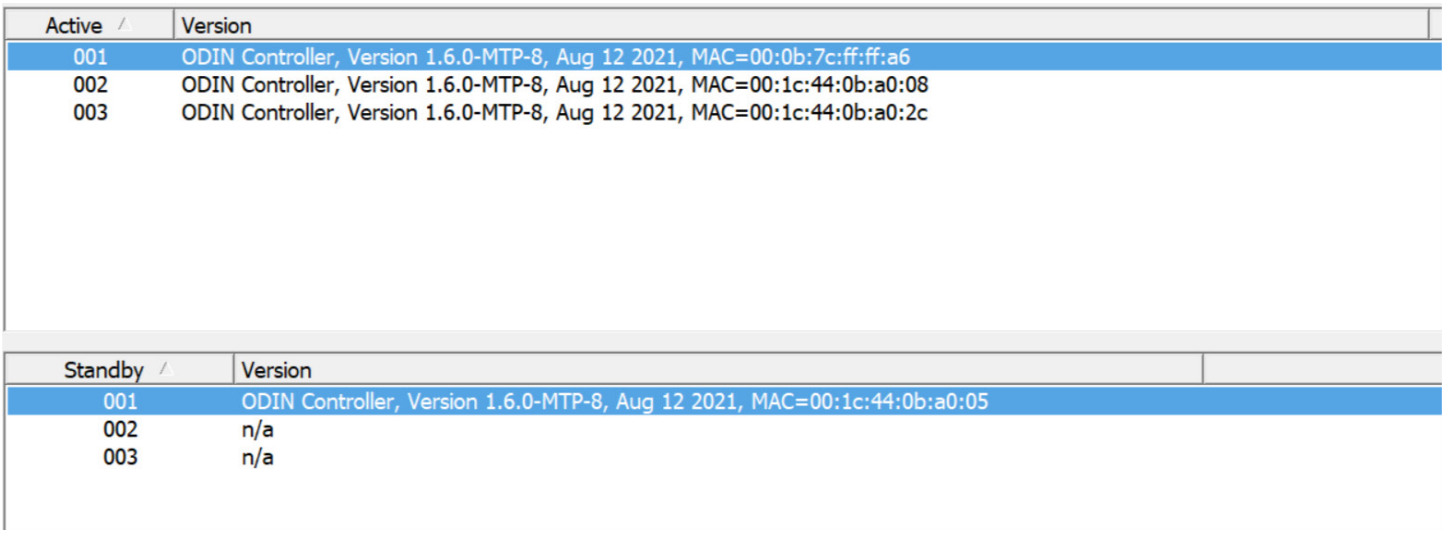
The following table describes the possible Active/Standby LED states:

OFF	Frame is defined as a core frame, and is active. If redundancy is enabled, then no redundant frame is configured to guard this frame.
SOLID GREEN	Frame is defined as a core frame, and is active. One or more redundant frames are guarding this frame.
SOLID RED	Frame is defined as a core frame, and is active. One or more redundant frames are defined as guards for this frame, but none is available.
SOLID BLUE	Frame is defined as a redundant frame, and is standby.
FLASH BLUE	Frame is defined as a core frame, but is currently standby. (A redundant frame is acting as a replacement for it.)
FLASH BLUE/GREEN	Frame is defined as a redundant frame, but is currently active. (It has taken over for a failed frame.)
FLASH BLUE/RED	Frame is defined as a redundant frame, and is currently standby. One of the frames it guards has failed, but this frame has not taken over for it because the system is configured for manual transfer of control.

AZEDIT SUPPORT FOR STANDBY FRAMES

AZedit supports the following actions for standby frames:

- View the firmware version
- View the hardware status (component versions, power supplies, fans, temperatures)
- Download new firmware
- Make the frame go active



Active	Version
001	ODIN Controller, Version 1.6.0-MTP-8, Aug 12 2021, MAC=00:0b:7c:ff:ff:a6
002	ODIN Controller, Version 1.6.0-MTP-8, Aug 12 2021, MAC=00:1c:44:0b:a0:08
003	ODIN Controller, Version 1.6.0-MTP-8, Aug 12 2021, MAC=00:1c:44:0b:a0:2c

Standby	Version
001	ODIN Controller, Version 1.6.0-MTP-8, Aug 12 2021, MAC=00:1c:44:0b:a0:05
002	n/a
003	n/a

Note that AZedit cannot connect directly to a standby frame: It communicates with an active frame, which forwards messages to the standby frame.

LIMITATIONS

On a transfer of control, the redundant frame that goes active assumes the device name (for OMNEO) and the IP settings (for RVON), so keypanels that were connected to the failed frame can reconnect to the replacement frame without intervention. However, AIO connections will need to be moved manually.

CAN 2-WIRE CONNECTIONS BE MULTI-DROPPED TOGETHER?

It is possible to multi-drop the PAP/LCP/GPIO-16 connections (J6) between an active frame and a standby frame, so that these devices do not have to be moved when a transfer of control occurs.

For panels connected via OMNEO or RVON, the panels will lose communications with the failed frame and then power up again, connecting to the replacement frame. For a 128-port frame, it can take up to 90 seconds for all the panels to reconnect.