Intinor Direkt receiver

User guide

version 4.6.0 rev. 52809

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Contents

Chapter 1

Description

The Intinor Direkt receiver SDI receives video and audio from Direkt link or Direkt router via computer networks, decodes the content and outputs it on the digital interface SDI (SD/HD/3G). The live bradcasted material can be received from different senders and used for live-editing or distribution to TV viewers.

Intinor Direkt receiver is very easy to use and is configured in a web interface. Configurations can be adjusted via a display and keypad.

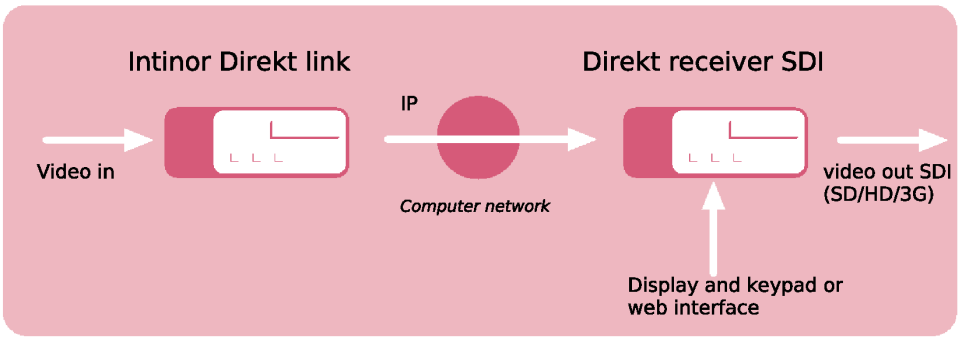


Figure 1.1: *Intinor Direkt receiver*

The Direkt receiver is a robust construction with few moving parts. Intinor provides support, can monitor and remote control links and help to ease network trouble shooting.

Similar to all Intinor products, the Direkt receiver can be supplemented with options and customizations. In this way, the customer is offered desired functionality without making the unit complex and hard to use.

1.1 Functions

The following functions are standard on Direkt receiver SDI:

- Can receive video streams (MPEG2, H.264 and H.265) from a number of different types of senders
- With access control, administrator can allow input streams only from specific senders
- Easy to configure via display and keypad
- Can be controlled via web interface over network
- Can be supervised, trouble shooted and remote controlled via ISS — Intinors system for statistics and supervision
- Backup settings can be handled via the web interface or ISS
- Software upgrade can be handled via the web interface, ISS or USB memory
- Peak Programme Meter (PPM) for easy calibration of audio level
- Test picture can be generated and customised
- Shows test picture (or black or frozen picture) if input signal is missing
- Can share Internet access to devices connected to the second network port (IP2)

1.2 Customizations

Direkt receiver can be cusomized using options. See Intinor home page or contact a sales person at Intinor.

Chapter 2

Technical overview

Intinor Direkt receiver SDI receives video, compressed using MPEG-2, H.264 or H.265 from computer networks and outputs uncompressed digital video using SDI (SD/HD/3G) with embedded audio.

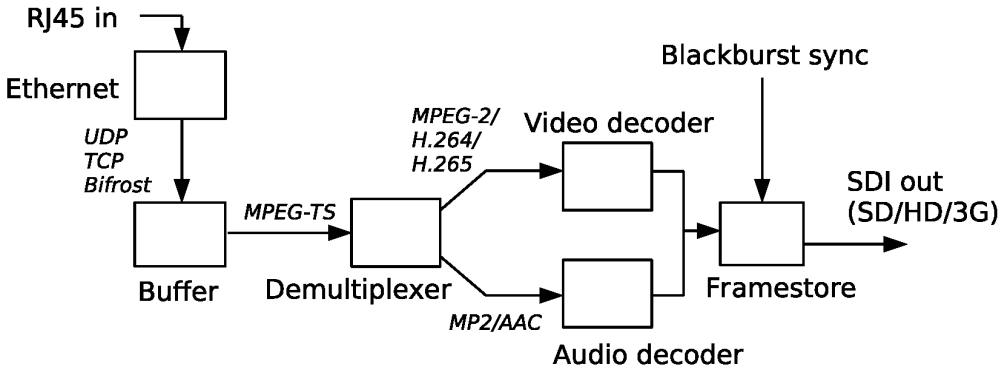


Figure 2.1: *technical overview*

2.1 Input

The Direkt receivers input is a RJ45-connector (TP) Ethernet 10/100/1000.

2.2 Transport

Intinor's Direkt receiver receives MPEG transport streams over IP, either UDP, RTP, RTP+FEC, Bifrost Reliable Transport or TCP. Other protocols including SRT and RIST are available as options.

Transport methods are described more detailed in chapter 3.2.

The Direkt receiver can be configured to listen for multiple transport methods simultaneously.

2.3 Decoding

Direkt receiver SDI can decompress video from MPEG-2, H.264 or H.265 format and audio in MPEG-1 Audio Layer II (MP2) or AAC. It automatically detects which encoding technology is used on the received data stream.

2.4 Output

The Direkt receiver outputs SDI (SD, HD or 3G) with embedded audio. If blackbust sync is used, one picture frame is stored in a “frame store” so that Direkt receiver can be synchronised with other video sources.

Chapter 3

Usage

3.1 User interfaces

Intinor Direkt receiver has three user interfaces:

a) The web interface gives access to all configuration options. The web interface is described in chapter 3.11
b) The display and keypad on the Direkt receiver gives access to basic configurations. The display can be used when the web interface is unavailable. See chapter 3.10
c) ISS is used for supervision, status, remote control and trouble shooting. See chapter 3.4

(a) *Web interface* **(b)** *PPM, display and keypad* **(c)** *ISS for supervision and trouble shooting*

Figure 3.1: *Different user interfaces*

3.2 Transport methods

Direkt receiver supports different technologies for receiving transport of video over IP networks.

> When sending between two Intinor units, Bifrost is always the preferred protocol to use. Other protocols are only for interoperability with other equipment. More information on Bifrost can be found in a separate document on Intinor web page.

3.2.1 UDP multicast

Multicast streams can only be used if it is supported in the network where it is to be used for broadcasting of video and audio. This issue should be discussed with the network administrator as this is usually not supported.

If there is support for multicast, it is usually possible to find multicast addresses and ports on your own. Multicast is addresses between 224.0.0.0 to 239.255.255.255.

If multicast is used, it does not matter what IP-address the receiver is configured to. Several receivers can be simultaneously linked to the stream.

> UDP multicast is a suitable transport methods for distribution to many receivers on the same local network (e.g. IPTV applications and internal distribution on a LAN).

3.2.2 UDP unicast

If there is no support for multicast, then unicast is to be used to stream to each receiver. If the network capacity is inadequate, it is possible to broadcast via Intinor Direkt router, please contact Intinor for more information.

IP-numbers on Direkt receiver must be known and configured in one of the following ways:

a) The Direkt receiver has a static IP-number, easily configured via display and keypad.
b) The Direkt receiver uses DHCP and always receives the same IP-number from the DHCP-server on the local network. Contact the network administrator.

3.2.3 Stream TCP

Direkt link and Direkt router can “Stream TCP” (i.e. broadcast TCP-streams) to one or several receivers. The receiver must be configured to receive the stream - TCP (receive). The receiver buffers for a couple of seconds before it playing video and audio. If packets are lost, there is a request to resend them. This means that only major network interruptions result in video disturbances.

The size of the TCP buffer can be configured on the receiving unit. A value between 0.3 and 0.5 is good for an interview with studio feedback. For a transmission during a longer period of time without feedback, 3-10 seconds is recommended.

IP-number on Direkt receiver must be known and configured as for “UDP unicast” above.

3.2.4 RTP and RTP + FEC

RTP (Real Time Protocol) is a layer on top of UDP for video and audio in realtime. It allows the receiver to handle in a better way certain types of errors during the transmis-

sion. FEC includes extra data which allows the receiver to handle small packet loss without compromising or affecting the image quality.

Both RTP and FEC requires multiple UDP ports in the range between transmitter and receiver. We recommend 10 ports reserved starting by an even number. For example, UDP port 6010-6019 for the first RTP stream and 6020-6029 for the next.

RTP and FEC are send as UDP. The Intinor receivers are therefore configured to receive a UDP streams and detect the RTP and FEC used on top of the UDP packets in the stream.

FEC provides error correction over the Internet with lower delay than TCP as described above. However it requires more bandwidth and also adds some delay compared to UDP or RTP without FEC.

3.2.5 Network bonding using Bifrost Reliable Transport

Network bonding is an extended network functionality for Direkt receiver which allows the capacity from multiple physical connections to be aggregated. The sender can use several Internet connections at once to increase the capacity. It can also be used for redundancy. Network bonding means the Direkt receiver can use multiple 4G/LTE-modems and land-line Internet connections in different combinations.

> Bifrost reliable transport is the most suitable transport method for live broadcasts over Internet.
> Intinor receivers can be configured to receive both UDP- and TCP-based protocols. It detects the incoming signal, and no configuration is needed to switch between transport methods.

3.2.6 TCP on request

If “TCP request” is used on the receiver, it can request data streams from a Direkt link or Direkt router with “TCP on request” activated. Error correction functions as described in “Stream TCP” above.

IP-numbers on the sending Direkt link or Direkt router must be known and configured in one of the following ways:

a) A static IP-number that can be easily configured via display and keypad.
b) It uses DHCP, and always receives the same IP-number from the DHCP-server on the local network. Contact the network administrator for more information.

3.2.7 Multiple transport methods at the same time

The input on Direkt receiver can be configured for multiple transport methods at the same time. When it does not have a input signal, it can wait for both UDP and TCP and it does not need to be reconfigured when the sender switches from UDP to TCP.

3.3 Adaptive bitrate

Adaptive bitrate in a network functionality for an interruption-free transmission between sender and receiver. It means that the sender adapts to the current capacity for the Internet connection/connections in use, which happens at once. Adaptive bitrate provides safty and simplicity for the user, who can focus on the live broadcast instead of worry about the Internet connection to maybe loose capacity.

Intinor Direkt receiver has support for adaptive bitrate on input streams.

3.4 ISS - for statistics and supervision

ISS is Intinor's system for statistics, supervision, alarms and remote control of Direkt link, Direkt router and Direkt receiver. Units connects to a ISS server and regularly sends information about status on software, hardware, networks and disturbances in the incoming signal.

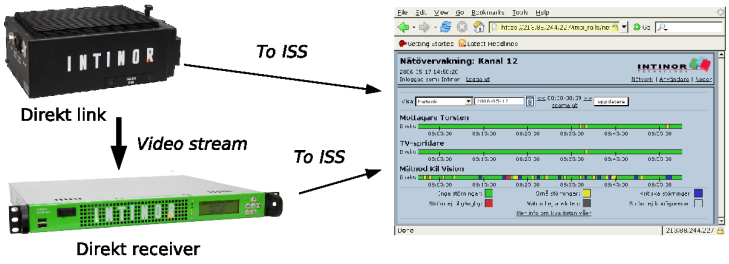


Figure 3.2: *ISS for statistics and supervision*

ISS eases installation and test - the user can log on by him/herself, or the Intinor support can assist with this. Via ISS it is possible make sure that:

- The Direkt link's network is functioning as intended.
- The Direkt link is not blocked by a firewall.
- The Direkt link has an incoming signal (test picture or video from camera/editing).
- The Direkt receiver's network is correctly configured and functioning as intended.
- The Direkt receiver is receiving a video stream from the Direkt link.

When broadcasting live, it is valuable to know that the Internet has enough bandwidth. Therefore, it is wise to test a broadcast to the Direkt receiver and to use ISS to make sure that the received video stream does not contain interference.

If interference is detected in ISS, one or more of the following actions can be considered:

- Is it possible to upgrade the network connection, or in other ways fix it?

- Is it possible to accept lower video quality? - If so, switch encoding mode or activate adaptive bitrate
- Using UDP or RTP? Add RTP+FEC. Is it possible to accept longer delay? - If so, switch to TCP.
- Is the receiver an Intinor unit. Switch to Bifrost.

When the connection is functioning to satisfaction, it is recommended that the link remains on until the actual broadcasting begins. Use ISS to look for interference; only accept a few interferences per hour during a longer period of time. If there are more occurrences of interference, follow the description above. Please, contact Intinor support for assistance when needed.

Using ISS, it is also possible to configure alarms to be sent via SMS and e-mail if the network connection is dropped, if there is no incoming stream, or if fans or hard disks are not functioning properly.

If there is a problem with a unit, it is also possible to view graphs showing the temperature, fan speed and voltage. This information can be useful when troubleshooting.

> From ISS, a unit can also be remote controlled, also if it's behind a firewall. The ISS user can use the local web interface if access is confirmed from the display or web interface. The need for confirmation can be disabled by a non-user system configuration if an easier behavior is preferred.

Intinor support is also able to view the unit's configurations, status etc. from ISS, and thereby assist in setting up configurations and upgrading. This is possible even when the user is unable to connect to the unit's web interface.

3.5 IP1, IP2 ...

Direkt receiver has two network interfaces on the back marked IP1 and IP2.

IP1 should be connected to the Internet so that Direkt receiver can connect to ISS and receive IP streams. The IP number for IP1 shows in ISS, on the display and that is used when accessing Direkt receiver's web interface via IP1

IP2 is per default configured as management - a service interface that can be used to activate and use Internet access, for easy access to ISS and web interface on Direkt receiver. IP2 can also be configured as an extra Internet connection for network failover.

3.5.1 More optional interfaces

Direkt receiver can be equipped with additional wired or wireless network interfaces.

3.6 IP2 as management

With IP2 as management, Direkt receiver act as a network router. If compared to a home Internet router, IP1 is WAN and IP2 is LAN. By connecting units on IP2, Internet can be accessed and also settings on Direkt receiver. To do this IP2, must be in management mode (default). Do not connect IP2 to your office LAN - it will create conflicts with your DHCPserver/router.

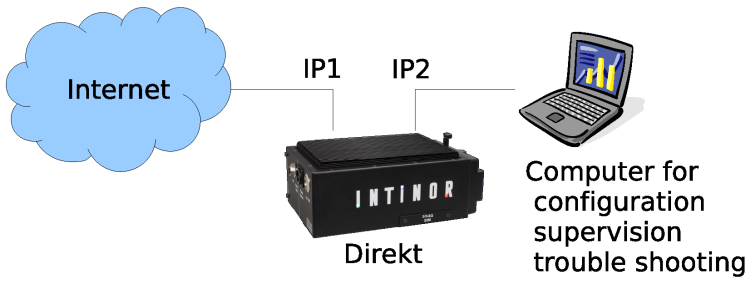


Figure 3.3: *IP2 can be used for configuration and supervision*

3.6.1 Log on to the Internet

A computer connected to IP2 can get access to the Internet through Direkt receiver. If Internet access requires log in with user name and password (common at hotels and conference centers), it's possible to open a web browser on the computer and log in for Direkt receiver.

3.6.2 Supervise using ISS

Go to iss.intinor.se using the web browser and log in with user name and password from Intinor. Then you can supervise and trouble shoot the units you have access to.

3.6.3 Configure Direkt receiver

Log in to Direkt receiver by connecting to its IP-number (check network -> Current IP using display and keypad) using a web browser to access local status and all configuration.

3.7 Access control

With access control, one can control on Direkt receiver which senders it accepts video streams from.

Access control works for transport methods UDP multicast, UDP unicast, RTP, RTP+FEC, Bifrost and stream TCP (see chapter 3.2). Without access control, Direkt receiver locks itself on the Direkt link which it first receives from.

Intinor's Direkt link's can be identified in two different ways - either using IP numbers or keys.

The advantage of using keys is that Direkt receiver can receive from a specific Direkt link without knowing its IP number. The key for a Direkt link can be found under the system tab in its web interface. For key identification to work, the difference in system time between sender and receiver must be less than 30 seconds.

If multiple Direkt link's, which are accepted on Direkt receiver sends simultaneously, it locks on the IP number which comes first.

Access control is configured using the web interface (see chapter 3.11.2).

3.8 Test picture

To use a test picture, no video source is needed - it is generated and played out by Direkt receiver. The standard test picture contains colored bars with information, current time and time code created by Direkt receiver.

The test picture can be configured via the web interface with an image and text of your choice (see chapter 3.11.3).

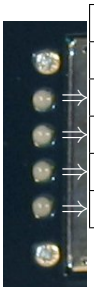
The test picture can be activated from the display/keypad or the via web interface.

From the web interface, Direkt receiver can be configred to play out frozen picture, test picture or black

3.9 Peak Programme Meter (PPM)

Direkt receiver has a built-in peak programme meter (the four diodes to the left of the display). This can be used as a measure to make sure the sound levels are OK. Note that the PPM should not be used as a precision instrument for in-measurement.

The peak programme meter is based on IEC 60268-18, and displays if the maximum value of the left and right audio channel is above a certain level.



Peak Programme Meter (PPM)			
PPM (dBFS)			
-12 (green)	**-9** (orange)	**-6** (red)	Top diode can have three colors.
-15 (green)		**-3** (red)	
-21 (green)		**-1** (red)	
-27 (green)			Lowest diod indicates audio signal in

To comply with EBU-R68, the following must be valid:

- Calibration level (0dB) should correspond to -18dBFS - two green LEDs
- Maximumum level for normal program is -12dBFS - max three green LEDs
- Maximumum allowed peaks are -9dBFS - the top LED should never turn orange

> If Direkt receiver detects a audio distortion, it blinks red with all four diodes on the PPM.

3.10 Configure via display and keypad

The display on Direkt receiver displays status information and can, together with the keypad, be used to configure.

3.10.1 Status information

When the Direkt receiver starts, the display is in status mode. In this mode, the status information is displayed (current bit rate out or input signal missing).

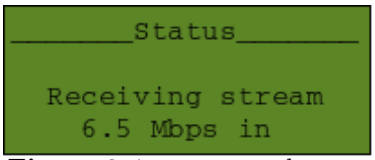


Figure 3.4: *status mode*

3.10.2 Main menu

If OK is pressed - the green symbol - the main menu is activated where it is possible to access different configurations and test functionality. In the main menu, there is several options that can be selected by using the arrow up, and down, on the keypad.

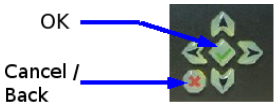


Figure 3.5: *keypad*

A star in the menu (*) indicates that a menu option is activated e.g. dynamic IP.

Main menu	
Network	Network settings
IP-stream in	Configure the input stream
View audio levels	three views with more detailed information about current audio levels
Activate/de-activate test picture	

3.10.3 Network

In the network menu, the network is controlled and configurations can be made. Configurations are only valid for the Ethernet port labeled “IP1”.

Network	
Test Internet conn.	Make sure Direkt receiver can access the Internet.
Current IP	Show the current IP number on Direkt receiver
Static IP	Switch to or change static network configurations
Dynamic IP	Change to dynamic IP-number and get a IP-number with DHCP
Show network status	Show if the network is connected, the port’s speed 10, 100 or 1000mbps and full or half duplex.
Show MAC-address	Can be useful to know when configuring the DHCP-server on the network in order to make Direkt receiver always receive the same IP-number.
Test bandwidth	Check available bandwidth by downloading data from one Intinor server

Test Internet Conn.

The menu option makes the Direkt receiver connect to a name server on the Internet (8.8.8.8). Also connection to ISS is tested. The Internet does not need to be operational in order to set up a video link in a private network. Without the Internet, ISS and software upgrade don’t work.

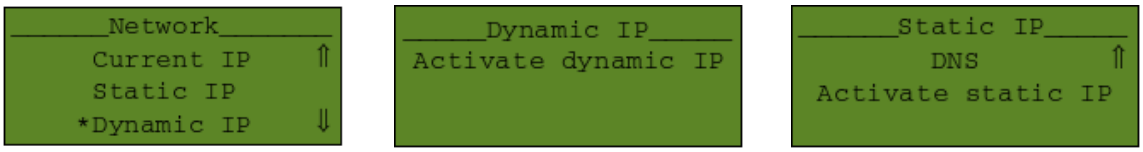
Static IP

When choosing static IP, Direkt receiver is configured with a static IP-number, a network mask and a default gateway. The configurations are not activated until “Activate static IP” is selected.

Dynamic IP

Dynamic Internet configuration means that Direkt receiver, when starting up, asks the network with DHCP which network configurations to be used.

If OK on Dynamic IP is pressed, the option to activate is given. This means that Direkt receiver requests an IP-number from the network and uses it. Later, it is advisable to return to “Current IP” to make sure that Direkt receiver received an IP-number. This configuration is saved directly.



(a) *in the network menu* **(b)** *activate dynamic IP* **(c)** *activate static IP*

Figure 3.6: *Network settings*

3.10.4 IP stream in

Configure and choose transport method for the input signal on Direkt receiver. Those are described in chapter 3.2. Several transport methods can be active simultaneously. Direkt receiver shows the first stream that arrives.

IP stream in	
UDP unicast	choose UDP port and activate unicast in
UDP multicast	choose multicast address and port and activate multicast in
TCP (receive)	choose TCP-port and activate that other units can stream TCP to the Direkt receiver
TCP (on request)	choose IP number and port for a Direkt link or Direkt router, which this unit can request a TCP stream from
TCP recv. buffer	adjust receiving buffer for TCP (see chapter 3.2.3)

3.10.5 View audio levels

View audio levels gives deeper information about top levels of audio in three different views. Switch between the views with the green symbol on the keypad.

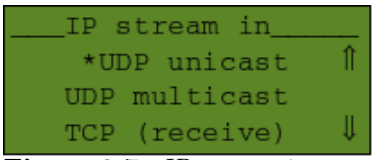
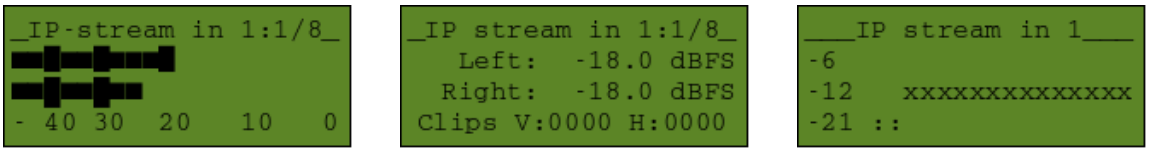


Figure 3.7: *IP stream in*

Direkt receiver supports up to 16 audio channels in 8 audio tracks (8/4 on some models). Choose audio track in view a) and b) with arrow right and left.

The views show:

a) Graphical representation of left and right channel with higher accuracy than the four LEDs left of the display.
b) Numerical level for left and right channel and also registered audio clips since the audio meter was started. To reset the counter, go back with the red cross and return with the green symbol.
c) The third view gives an overview of all audio channels. An audio track represented by a “xx” means that it is not active. A mono track shows as “ x”.



(a) *left/right level* **(b)** *exact level* **(c)** *all 16 channels*

Figure 3.8: *Three different views for audio levels*

3.10.6 Activate/deactivate test picture

The global test picture is described in more detail in chapter 3.8. The test picture cannot be changed using the keypad.

3.11 The web interface

Via the web interface, the user or administrator of Direkt receiver can perform all configurations that are available via the keypad, and also the following:

- View status for inputs and outputs with resolution and stream information
- Customize the test picture
- Handle access control
- Set video format on the SDI output
- Configure the second Ethernet port - "IP2"
- Change password for logging on via the web interface
- Create and administrate local user accounts
- Make a backup copy of all configurations
- Upgrade Direkt receiver's software
- Restart Direkt receiver.

For information regarding the functions that also are available via the display, see chapter 3.10. This chapter describes the functionality that is available in the web interface, but not via display and keyboard.

The web interface can be accessed using a web browser of your choice with secure http on Direkt receiver's number e.g. https://192.168.0.1

The first time the web interface is accessed, the web browser will ask if it should accept the web server's certificate. We recommend the option "Accept this certificate permanently" (or similar). Possibly, a warning will appear stating that the domain name of the certificate does not coincide with the web server. This is normally not an indication that something is wrong.

Units can be remote controlled via the local web interface from ISS. This makes it easy to access units also when they are located behind a firewall. Normal behaviour is that remote control must be accepted via display/keypad, but Intinor can configure units to always allow remote control from specific ISS users. Contact Intinor support

Direkt receiver is delivered with the following user:

User: admin
Password: 1234

Intinor recommend that the password of admin is changed in the web interface under the tab "System". This is important if Direkt receiver is accessible via the Internet.

Please note that if the network configurations are changed via the web interface, or if a profile is activated with other network configurations, it is possible that the connection to the Direkt receiver is lost. If this happens, it is possible to view the "Current IP" using the keypad and then re-connect using the instructions above.

3.11.1 Status

Here is status information concerning the unit, its inputs and outputs and destinations. By clicking on one of the links below "Input signal" one comes to a page that shows incoming video and detailed information about e.g. picture format and aspect ratio.

3.11.2 Active settings

Active settings are those Direkt receiver are using right now.

Networks

Under the network tab Direkt receiver's network connections can be configured.

IP stream in

Access control is configured under this tab (see chapter 3.7). All units, which use to send to Direkt receiver SDI can be listed. It is then easy for the user to de-activate those which are not currently in use.

If the video format is set to “automatic”, the Direkt receiver outputs the same format as the input. By setting the video format to for example SD PAL or 720p/50, the user can let Direkt receiver scale the output format.

The advanced user can adjust the receiving buffer for TCP (see chapter 3.2.3).

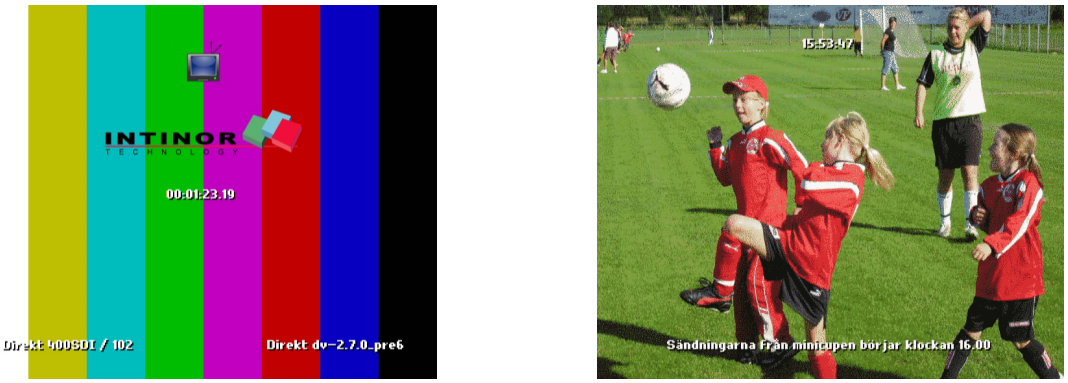
3.11.3 System

Login and users

The admin user can log in and control everything from the web interface. Change the administrator password if the unit is available on the Internet. The advanced administrator can also add more users with access to view or control different parts of the system.

Custom test picture

The test picture can be configured via the web interface. The background image must be in PNG-format with one of the resolutions 1920x1080, 1280x720, 1024x576, 720x576 or 720x480. Information regarding how to set the position of own text and add time and time code is available in the web interface.



(a) *Intinor standard with animation* **(b)** *Custom image and text*

Figure 3.9: *The test picture can be customized*

Managing settings

Here, the user can make a backup copy of all of Direkt receiver’s settings. It is saved in XML-format and can be sent to Intinor for analysis, if troubleshooting is needed.

Software upgrade

If Direkt receiver is connected to the Internet, the software can be upgraded using Intinor's servers.

Click on the link "upgrade the software..." to get to the upgrade-page.

Click on "Show current version numbers" to receive information regarding available software's from Intinor's web site. Beta software contains new, and somewhat untested, functionality. Testing software is always the newest only for testing new features in non-production. It is recommended to primarily use stable software or beta if new features are needed for production.

Normally, the user can upgrade to the newest stable-, beta- or testing software by clicking on the corresponding button. Advanced upgrade is only used in exceptional cases, in dialog with Intinor. This can be the case, for example when new functionality is developed for a specific cause.

Upgrades are completed in approximately 30 seconds and are followed by a restart. Do not interrupt Direkt receiver while upgrade is in progress (shown on the display).

Upgrade via the web interface requires that Direkt receiver has access to the Internet and is not blocked by a firewall (see chapter 4). If this is not possible, Intinor can provide a USB memory stick for software upgrade.

System restart

Restart should never be needed. However, it can be useful sometimes for trouble shooting purposes to be able to restart Direkt receiver.

Restart all streams takes just a second and restarts engine on Direkt receiver. The video and audio decoders are restarted and the output has a short disruption.

Full system reboot is a soft reboot which is usually enough to fully restart a system.

On rack units, one can also "Power cycle system" from the web interface. This means approximately the same as disconnect and connect the power cord on Direkt receiver. It is sometimes needed after a software upgrade to update the firmware on an SDI card and also if SIM cards have been added to modems.

Chapter 4

Firewalls

If broadcasting with Direkt link is performed within an internal network, such as a local area network (LAN), or a Metropolitan area network (MAN), it is often necessary to handle firewalls. In order to get access to the control room of a TV-channel, or get outside a cooperation network, it can be necessary to configure a firewall to allow traffic.

> Intinor's engineers aid the configuration, and gives hints as how to configure firewalls.

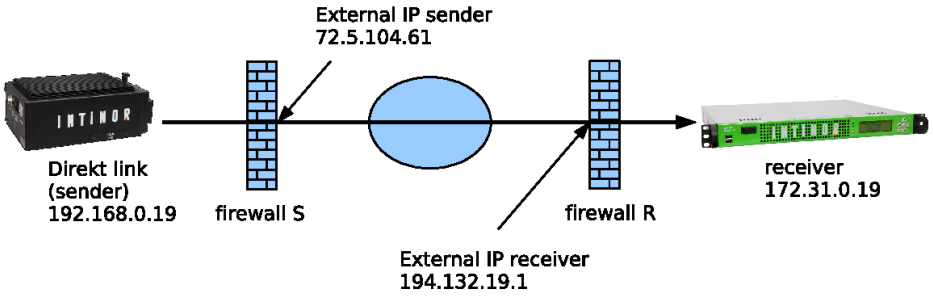


Figure 4.1: *Example with firewalls*

4.1 To send web TV using RTMP

Usually, no configuration of firewalls is needed in order to broadcast web TV streams (RTMP) from a Direkt link. Most networks allow outgoing IP traffic by default. In other cases, the firewall can be configured for outgoing data on TCP port 1935, which is used by RTMP.

If configuring the firewall is not possible, one must change to RTMPT in Direkt link's web interface - change RTMP to RTMPT in "RTMP URL". Then Direkt link sends RTMP over HTTP on port 80, which firewalls always use to pass out.

Feel free to follow the instructions below to send web TV:

1. Try to send RTMP using settings from streaming provider.
2. If the stream does not come through, try to open TCP port 1935 out on the firewall.
3. If it is not possible to open the firewall, change to RTMPT using Direkt link's web interface.

RTMPT requires higher bandwidth so that the risk for interuptions in the stream is higher. RTMPT from Direkt link also does not work with all streaming servers. Because of this, try RTMP first.

4.2 To send UDP, RTP, RTP+FEC, Bifrost or TCP (live broadcasting)

Usually, no configuration of firewalls is needed in order to broadcast IP-streams (UDP or TCP) from a Direkt link. Most networks allow outgoing IP traffic by default. In other cases, configuration of the firewall is required so it allows outgoing data traffic to a particular destination port e.g. 6010. When RTP or RTP+FEC is used, a range of ports is required where the first port has an even number. Iit is a good idea to open up 10 ports in a row (6010-6019) for both UDP as well as TCP to make it simple to change protocol later.

A receiver that receives an IP stream and is located behind a firewall must have a static IP number. The firewall should be configured in such a way that it allows request from a specific port series to the receiver (preferably for both UDP as well as TCP).

Feel free to follow the instructions below to broadcast IP-streams (repeat the instructions for each receiver):

1. Choose a port range to broadcast to. The ports must be available on firewall R e.g. 6010-6019.
2. Make sure the receiver have a known IP number e.g. 172.31.0.19.
3. Make sure the firewall R lets through UDP and TCP traffic on port 6010-6019 to 172.31.0.19.
4. Find out the receivers external IP number (e.g. 194.132.19.1). It is possible to use ISS to find this out.
5. Configure the Direkt link to broadcast to the receiver's external IP number and selected port.
6. If no stream reaches the receiver, it can be due to firewall S not letting out UDP or TCP traffic on the selected port. Check if this is the case.

4.3 TCP on request (distribution)

A Direkt link that is configured with TCP on request receives requests on a specified TCP port, e.g. 5040. If the Direkt link is behind a firewall it has to have a static IP number (see chapter 3.2.6) and the firewall must be configured to let through requests to a specific TCP port to the Direkt link.

To get a receiver to receive TCP streams, it is usually not necessary to make configurations, even if it is behind a firewall. If this is not the case, the firewall should be configured to let through requests pointed to a specific TCP port e.g. 5040.

Feel free to follow the instructions below to allow the receiver request TCP:

1. Choose a TCP port to request from. The port must be free on firewall S e.g. 5040.
2. Make sure Direkt link has a known IP number e.g. 192.168.0.19.
3. Make sure firewall S lets through TCP traffic on port 5040 to 192.168.0.19.
4. Find out Direkt link's external IP number (e.g. 72.5.104.61). It is possible to use ISS to find out the external IP number.
5. Configure the receiver to request TCP from Direkt link's external IP number and selected port.
6. If no stream gets to the receiver, it can be due to firewall R not letting out traffic on the selected TCP port. Check if this is the case.

4.4 Upgrade and ISS

Upgrade and ISS (see chapter 3.4) connect with TCP to Intinor's servers. Usually, no configuration of firewalls is required for this operation. In other cases, make the following configuration:

Upgrade	TCP port 9022 out to Intinor's upgrade server (upgrade-direkt.intinor.se)
ISS	TCP port 22017 out to ISS (iss.intinor.se)

All Intinor Direkt units, which are blocked by a firewall try to connect to ISS using HTTP, which often works.
Upgrade can also be performed from a USB memory.

4.5 Web interface

To access the web interface on the Direkt link, Direkt router or Direkt receeiver through a firewall, it is required that the unit has a static IP number and that the firewall is set to let through requests to TCP port 443 on the specific unit. To download files from Direkt link or Direkt router it is required that TCP port 80 is opened.

If using a video mixer on Direkt link or router panel on Direkt router, the thunb nail pictures will update much more often if web interface is used direct (not via ISS).

All Intinor Direkt units can be remote controlled from ISS. Because of this, opening ports for web interface is not necessary.
Files can not be downloaded using remote control.

4.6 Cheat sheet - receiver for live broadcasting

The firewall used together with Direkt receiver or Direkt router for broadcasting is normally configured only once.

If the receiver can be given a public IP number on the internet, no firewall is needed.

ISS	TCP port 22017 out
Upgrade	TCP port 9022 out
Video stream in	any. e.g. TCP and UDP port 6010-6019 in for IP stream in 1, TCP and UDP port 6020-6029 in for IP stream in 2 etc.

4.7 Cheat sheet - Direkt link for live broadcasting

If the Direkt link can be assigned a public IP number, no firewall configuration is needed.

If the Direkt link is located on the Internet behind a “friendly” firewall, which is open for outgoing traffic, no firewall configuration is needed.

If the Direkt link is located on the Internet behind a “strict” firewall, which blocks outgoing traffic, the following firewall configuration is required:

ISS	TCP port 22017 out
Video stream out	any, e.g. TCP and UDP port 6010-6019 for encoder 1 out, TCP and UDP port 6020-6029 for encoder 2 out etc.
RTMP out	TCP port 1935 out

Chapter 5

Trouble shooting

5.1 Use ISS

Direkt units connects to ISS via TCP port 22017. If that fails, they try instead with HTTP over port 80 (works through almost all firewalls). If a Direkt unit is forced to connect using port 80 is displayed as a warning in ISS. It usually means that the firewall must be opened for it to send video. See chapter 4.

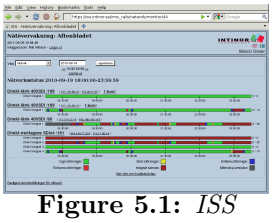


Figure 5.1: *ISS*

Use ISS to make sure both Direkt link and Direkt receiver are connected. If a unit is gray in ISS, it can be due to the following reasons:

1. The network does not function properly, or is configured in an incorrect way (see the troubleshooting below).
2. The unit is behind a firewall that blocks the connection to ISS. If this is the case, the possibility is that it also lacks the ability to broadcast a video stream (see chapter 4).
3. Direkt link and receiver is connected via private LAN or VPN without Internet connection. It is possible to use Direkt link in this way, but it is not possible to use ISS for monitoring and troubleshooting.

If the network functions to satisfaction, but no video stream is coming from the receiver, please continue troubleshooting streams according to section 5.3.

5.2 Network

Access the network menu with the display interface located on the unit. Make sure the network is functioning on the unit with the gray color in ISS by following the instructions below:

1. Display network status - IP1 shall show 100 Mbps, full or similar. If this is not the case, check the network cable, network outlet, and network switch that the unit is connected to.
2. Note if the unit is configured to dynamic or static IP by checking which of the following menu options are marked with *.
   a) If the unit uses “Dynamic IP” check its “Current IP” on the unit. If it does not have an IP number, it does not receive an IP number from any DHCP server.
   b) If the unit has static IP number, make sure IP number, network mask, and gateway is functioning correctly.

3. If the unit is connected to the Internet (i.e. not via private LAN or VPN), make sure the network connection is functioning with "test Internet" in the network menu. If the unit is not connected to the Internet, try to connect to its web interface with a computer (see chapter 3.11).

If all above is functioning, but the unit fails to connect to ISS, it is probably hindered by a firewall that needs to be opened (see chapter 4).

5.3 Streams

> Intinor support can view the unit's configurations in ISS. In this way, Intinor can easily make sure Direkt link is broadcasting correctly, and that receivers are correctly configured. You can contact Intinor for assistance with troubleshooting.

Verify the streams on Direkt link with "list streams" in the stream menu on the display or destinations under "active settings" in the web interface. Make sure the Direkt link is streaming. Multicast streams are always broadcasting. Unicast streams are sent if there is a receiver with a relevant IP number.

The Direkt link shows status information on the display that it broadcast data (in Mb). Direkt reciever will display when receiving data (in Mb).

Depending on the transport used, test the following:

UDP multicast

- Make sure the Direkt link is streaming. Multicast streams should always be broadcasted. Try to switch to test picture.
- Make sure the receiver is listening on the right multicast address and port.
- If the receiver fails to receive the stream, test switching to UDP unicast towards the relevant receiver, and set the receiver to play UDP unicast.

UDP unicast, RTP, RTP+FEC, Bifrost and stream TCP

- Make sure Direkt link is sending to the IP number of the receiver. If the receiver is behind a firewall, make sure the Direkt link is broadcasting to the receiver's external IP number and that the firewall is configured in a correct manner (see chapter 4).

RTMP

- Make sure TCP port 1935 out is open and Direkt receiver has correct DNS configured. Look for warnings in the web interface and in ISS.

TCP on request

- Make sure that "TCP for streaming" is active in the web interface or on the display on the Direkt link.
- Make sure the receiver is set on TCP (download) with Direkt link's IP number, and the TCP port Direkt link is listening on. If Direkt link is behind a firewall make sure the firewall broadcasts TCP, with the select port, to Direkt link (see chapter 4).

5.4 Problem with ISS remote control

If a unit is sending, but can not be remote controlled via ISS, the available bandwidth can be insufficient for the configured output streams. If encoder fallback is stop at once, video inputs (SDI or HDMI) can be removed to temporary stop the streams and reconfigure output stream(s). Bifrost with adaptive bitrate is recommended.

If video inputs can not be removed or fallback is not stop at once, and output stream is Bifrost, try to make the receiver not listen to the unicast port being used. If the sender can not send, it will not waste bandwidth and will be easy to remote control.

Chapter 6

Technical specifikations

6.1 Compatibility

Intinor is continuously developing software for Direkt receiver based on the customer's wants and needs. Newer software versions can be compatible with more formats and configurations than is described in this chapter.

> If compatibility with a particular hardware is important, Intinor's technicians are likely able to customize Direkt receiver or do certain add-ons to the software. Please, contact Intinor for up-to-date status for compatibility for different units.

6.2 IP in

Direkt receiver has digital video in via IP over ethernet.

digital video in	MPEG2 video CBR (ISO/IEC 13818-2) MP@ML, MP@HL (4:2:0) 422@ML, 422@HL (4:2:2) H.264/MPEG4 AVC video (ISO/IEC 14496-10) Base, Main and High profile Level 2.1 - 5.1 Chroma 4:2:0 and 4:2:2 H.265/HEVC video
digital audio in	MPEG1 audio layer 2 (ISO/IEC 11172-3) AAC (ISO/IEC 14496-3:2005) MAIN
transport in	MPEG2-TS over IP (ISO/IEC 13818-1) - UDP and TCP RTP (RFC 3550, 2250) FEC (Pro-MPEG COP #3, SMPTE ST 2022-2:2007 Bifrost Reliable Transport
interface in	two Ethernet 10/100/1000, RJ45

6.3 SDI out with embedded audio

Direkt receiver SDI has SDI output with embedded audio according to SMPTE 259M and SMPTE 272M.

physical interface	75 Ω BNC

Intinor Direkt receiver SDI's current SDI compatibility is according to table below:

interlace/progressive scan	progressive and interlaced
widescreen	no signaling
time codes	no support for time codes
audio (format)	SDI embedded (AES/EBU uncompressed PCM)
audio (precision)	16 bit audio
audio (channels)	0-16 channels
audio (sample rate)	support for 32kHz, 44.1kHz and 48kHz
PAL/NTSC	full support for PAL (576i/25) and NTSC (480i/29.97)
HDSDI	720p/50, 720p/59.94, 720p/60, 1080p/23.98, 1080p/24, 1080i/25, 1080i/29.97, 1080i/30, 1080p/50, 1080p/59.94, 1080p/60