Saab TransponderTech AB

Appendices

Project designation

R5 RIC

Document title

R5 RIC Quickstart

CONTENTS

Table of Figures

1 REFERENCES

7000 114-964, A1, R5 RIC Software Interface Specification. (n.d.). Saab AB.

2 DIMENSIONS

The dimensions of the R5 RIC are: length=192mm, width=227mm, height=77mm. The weight is 2.5kg.

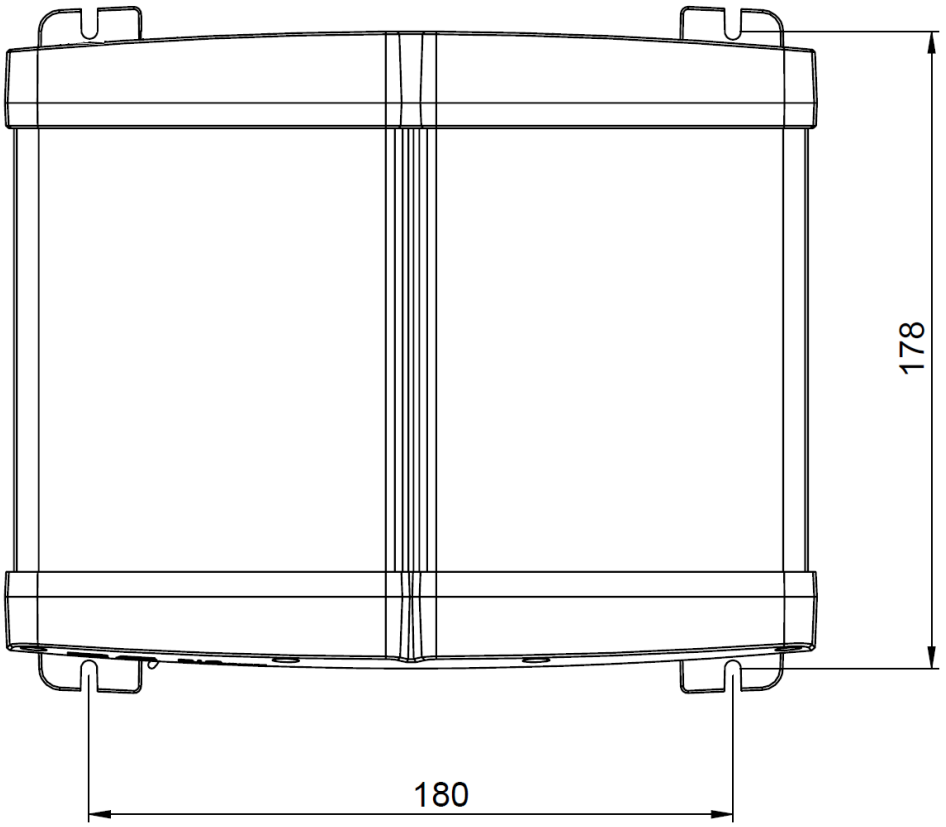


Figure 1, Positions for the mounting screws

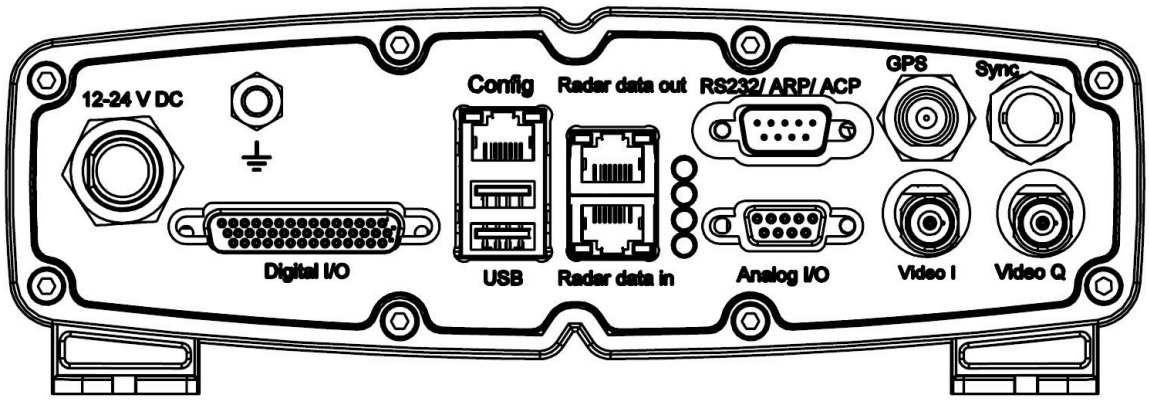


Figure 2, Connectors

3 CONNECTORS

3.1 Power input

The power input connector is a round 4-way connector (Switchcraft Conxall Mini-Con_X) with the following pin-out.

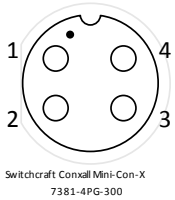


Table 1, Pin-out description for power connector

Pin	Function	Description
1	12-24V DC	Positive voltage.
2	GND	Negative voltage.
3	Reserved	Leave floating.
4	Reserved	Leave floating.

3.2 Video I

The *Video I* connector should be connected to the analogue radar video interface. This is a BNC connector that can be configured to be either differential or single ended. The termination can be configured to *50Ω*, *75Ω* or *no termination*.

3.3 Video Q

The *Video Q* connector is used together with the *Video I* connector to interface radars with quadrature video output. This is a BNC connector that can be configured to be either differential or single ended. The termination can be configured to *50Ω*, *75Ω* or *no termination*.

3.4 Sync

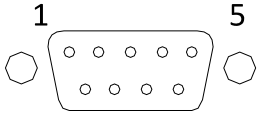
The *Sync* connector should be connected to the sync pulse for the trigger output on the radar. This is a BNC connector that can be configured to be either differential or single ended. The termination can be configured to *75Ω*, *120Ω*, *no termination* or *high voltage*.

3.5 GPS

The *GPS* connector should not be connected. This TNC connector is for future use.

3.6 RS232/ARP/ACP

This connector is a male DSUB-9 connector.



The pin-out is described in Table 2.

Table 2, Pin-out description for RS232/ARP/ACP DSUB-9 connector

Pin	Function	Description
1	ACP+	Configurable Azimuth Counter Pulse input. Can be configured to be either differential or single ended. The termination can be configured to *75Ω*, *120Ω*, *no termination or high voltage*.
2	ACP-	
3	ARP+	Configurable Azimuth Reset Pulse input. Can be configured to be either differential or single ended. The termination can be configured to *75Ω*, *120Ω*, *no termination* or *high voltage*.
4	ARP-	
5	GND	Common ground for the serial pins.
6	RS232 RX	RS232 serial 1 receive and transmit pins. This can be used to configure the unit through a RS232 serial connection.
7	RS232 TX	
8	RS232 RX	RS232 serial 2 receive and transmit pins. This can be used for communication between the unit and other equipment.
9	RS232 TX	

To connect to the RS232 serial port 1, use connection parameters found in Table 3.

Table 3, RS232 serial interface connection parameters

Parameter	Value
Baud rate	115200
Data bits	8
Stop bits	1
Parity	None
Hardware control	None

3.7 Radar data out

The *Radar data out* connector is an Ethernet RJ45 (8P8C) connector. The radar data out should be connected directly to a radar extractor computer due to the high data bandwidth, up to 1Gbit/s.

The default network configuration is:

Name	Value	Comment
MAC address		The MAC address is unique for each R5 RIC.
IPV4 Address	`10.74.2.173`	Only IPV4 is supported.

Radar data is sent as UDP broadcast from port 33000 to port 33000 by default. This interface does not respond to any Ethernet requests (e.g. PING, etc.).

3.8 Radar data in

The *Radar data in* connector is an Ethernet RJ45 (8P8C) connector that should be connected to a radar with digital video out on Ethernet (for example Terma 2202).

3.9 Config

The *Config* connector is an Ethernet RJ45 (8P8C) connector that should be connected to an Ethernet network for configuration and data exchange to/from an external system (for example CoastWatch).

The default network configuration is:

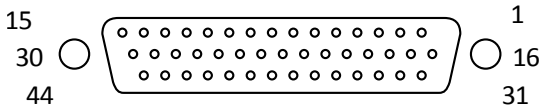
Name	Value	Comment
MAC address		The MAC address is unique for each R5 RIC.
IPV4 Address	`10.74.2.172`	Only IPV4 is supported.
IPV4 Gateway	`10.74.2.1`	
IPV4 Netmask	`255.255.255.0`	

3.10 Ground

M6 screw with two M6 nuts to connect cable lug. From this connector, a ground cable of minimum 2.5 mm² should be connected to the radar site ground. Grounding of the R5 RIC is essential to protect the equipment from overvoltage.

3.11 Digital I/O

The digital I/O connector is a female 44-pin DSUB-HD.

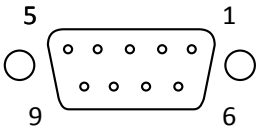


3.12 USB

Two USB A connectors for future use.
The USB connectors can be used as a power source to other equipment. The maximum delivered current is 1.0 A from each USB port.

3.13 Analogue I/O

The connector is a female 9-pin DSUB.



Pin-out description can be found in Table 4.

Table 4, Analogue I/O pin-out description

Pin	Function	Description
1	ADC2	Analogue input channel 2. 0-5V
2	ADC4	Analogue input channel 4. 0-15V
3	DAC3	Analogue output channel 3. 0-15V
4	DAC4	Analogue output channel 4. 0-5V
5	GND	Ground.
6	ADC1	Analogue input channel 1. 0-5V
7	ADC3	Analogue input channel 3. 0-15V
8	DAC1	Analogue output channel 1. 0-15V
9	DAC2	Analogue output channel 2. 0-5V

4 OPERATION

4.1 Start-up

R5 RIC starts automatically when the power is supplied. After about 30 seconds the Operation LED should start to flash.

The behaviour of the three lower LEDs can be found in Figure 3. Note that the behaviour of the three lower LED indicators only is valid once the Operation LED has started to flash.

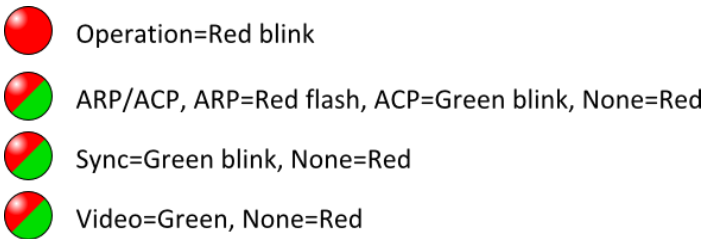


Figure 3, LED indicators description

5 CONFIGURATION SOFTWARE

The *R5 RIC Configurator* is a Saab supplied software for Windows OS. This software implements the configuration protocol that enables a graphical interface for configuring a R5 RIC over Ethernet.

5.1 Main window

The following figure shows the main window when connected to a R5 RIC.

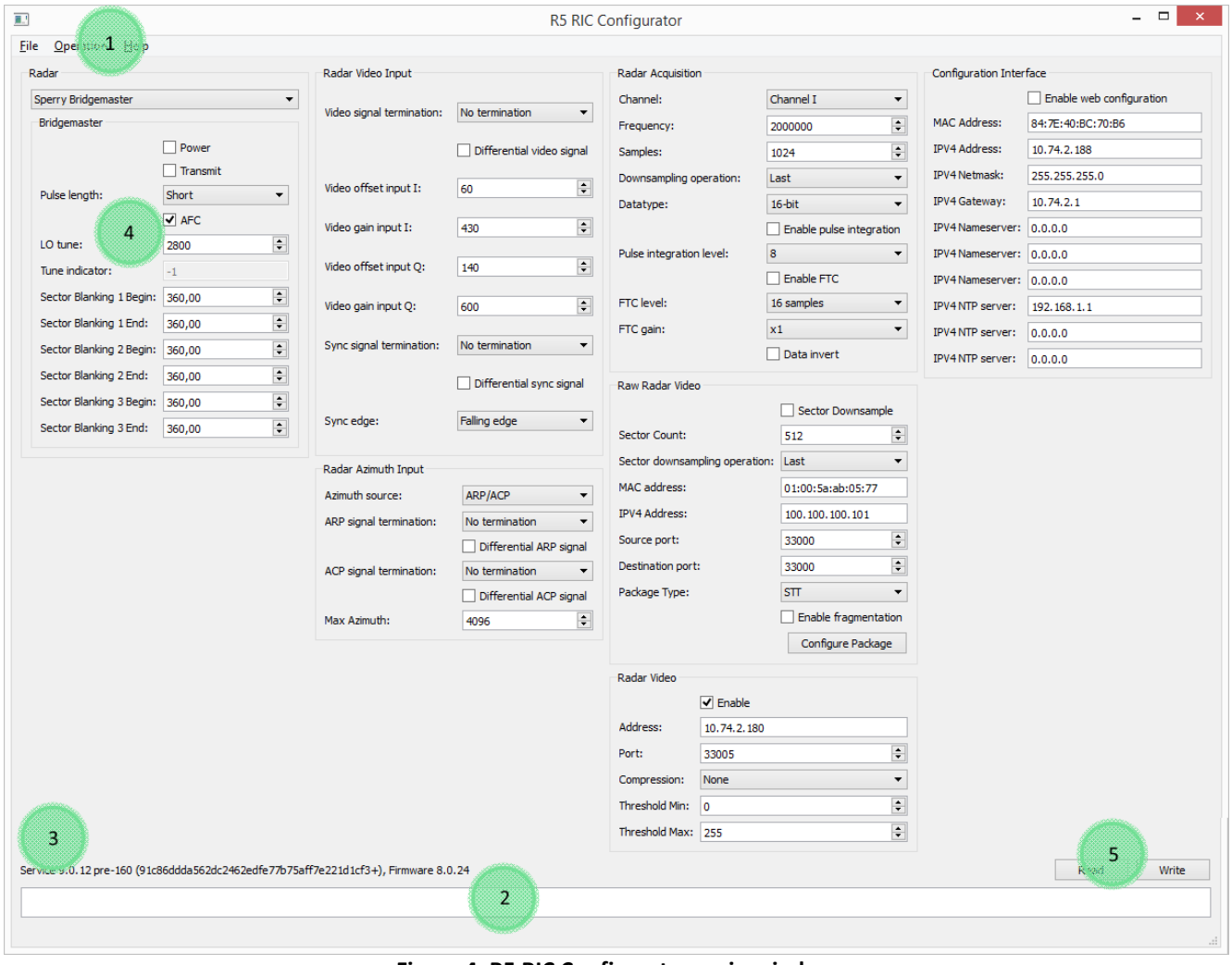


Figure 4, R5 RIC Configurator main window

The main window has the following areas of interest.

1. Menu bar
2. Operation log
3. Version of the connected R5 RIC
4. Configuration parameters
5. Configuration operations

5.1.1 Opening a connect

To connect to a R5 RIC use the File menu item *Open Connection*. When this item has been selected a connection dialog will pop up.
Enter the IP address for the R5 RIC configuration interface and press OK.
A progress bar will show in the lower right corner of the main window until connected. Any error that occurs when connecting will show in the operation log.

5.1.2 Reloading all parameters

To reload all parameters use the Read button in the lower right corner of the main window. It is also possible to do this through the menu item *Operation → Read*.

5.1.3 Changing a parameter

To change a parameter, edit the parameter in the main window and press the Write button in the lower right corner of the main window. It is also possible to do this through the menu item *Operation → Write*.

5.1.4 Storing the configuration

The R5 RIC requires the user to store the configuration to EEPROM if the configuration should be loaded on boot.
To store the current configuration use the menu item *Operation → Store*.

5.1.5 Reverting the configuration to stored configuration

It is possible to revert the current configuration to the one stored on EEPROM. Use the menu item *Operation → Revert* to revert the configuration. A pop-up will appear for confirmation.
Reverting the configuration will automatically overwrite the stored configuration.

5.1.6 Resetting the configuration to factory default

It is possible to reset the current configuration to the factory default. Use the menu item *Operation → Reset* to reset the configuration.

5.1.7 Rebooting

It is possible to remotely reboot the R5 RIC. This is done through the menu item *Operation → Reboot*.

5.2 Configuration parameters

The following chapters describes the configuration parameters shown in the R5 RIC Configurator.

5.2.1 Radar

In the radar group the user can configure the radar type and configuration parameters for the selected radar type.

Name	Description
Radar	This selects the type of radar connected. This can be one of the following options. *None*, *ATM Air seeker*, *Atlas*, *Sperry Bridgemaster* or *Terma 2202*. If the connected radar doesn't exist in the list, use *None*.

5.2.1.1 Sperry Bridgemaster

Name	Description
Power	Power up the transceiver. (Starts communication with the transceiver)
Transmit	Starts transmission. (Transmit/Standby)
Pulse length	Sets the pulse length.
AFC	Automatic Frequency Control On/Off.
LO tune	Coarse tuning of LO.
Tune indicator	LO tune indicator. (Read only)
Sector Blanking [1-3] Begin	Sets the start angle 0-360 degrees for sector blanking (sector 1 of 3). The value "-1" disables sector blanking.
Sector Blanking [1-3] End	Sets the end angle 0-360 degrees for sector blanking (sector 1 of 3). The value "-1" disables sector blanking.

5.2.1.2 Atlas

Name	Description
Positive sync polarity	Positive/negative sync polarity selection.
Video offset	Video offset tuning parameter.

5.2.1.3 Terma 2202

Name	Description
Transceiver address	Transceiver IPv4 address.

5.2.2 Radar Video Input

These parameters configure the input ports for the analogue radar video signal.

Name	Description
Video signal termination	The termination resistance for the analogue video input. This should be set according to the video output on the radar. Valid selections: *50 Ω*, *75 Ω* or *No termination*.
Differential video signal	Selects differential or single-ended signal input.
Video signal offset I Video signal offset Q	Video signal offset adjustment. Used to adjust the video DC offset. See chapter 5.2.2.1. Offset range is 0 to 1023. The offset can be controlled for both channels (*I* and *Q*) independently.
Video signal gain I Video signal gain Q	Video signal gain adjustment. Used to adjust the video signal gain. See chapter 5.2.2.1. Gain range is 0 to 1023. The gain can be controlled for both channels (*I* and *Q*) independently.
Sync signal termination	The termination resistance for the video sync input. This should be set according to the sync output on the radar. Valid selections: *50 Ω*, *75 Ω*, *High voltage* or *No termination*.
Differential sync signal	Selects differential or single-ended signal input.
Sync edge	The edge of the sync signal on which the acquisition shall start. Rising or falling edge.

5.2.2.1 Analogue video capture adjustments

It is possible to adjust the capture of the analogue video signal to fit the signal levels of the radar connected.

1. Configure the radar video input termination and differential parameters to match the radar video signal from the radar.
2. Use the R5 RIC Analyser or other radar video A-scope to view the captured signal.
3. Adjust the data offset until the signal is in the middle of the scope.
4. Adjust the data gain until the signal touch the upper and lower scope edges.

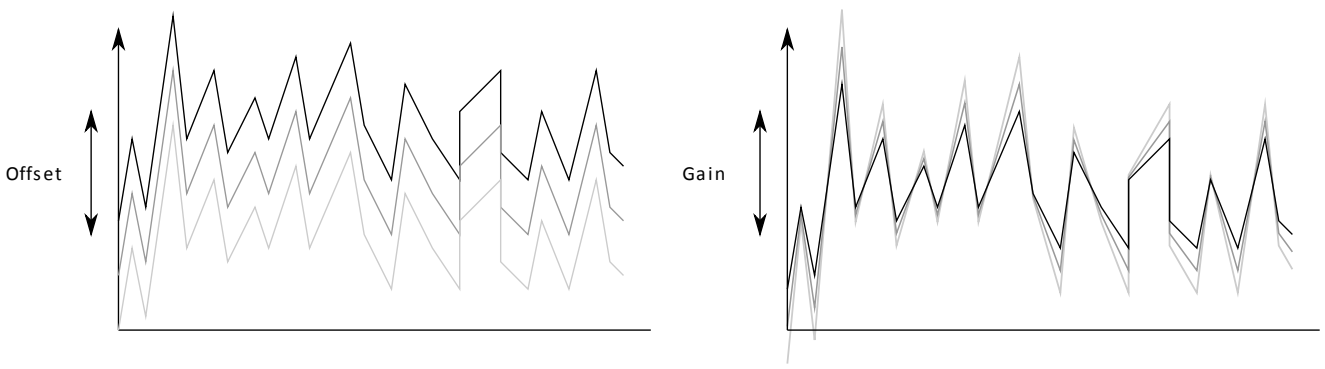


Figure 5, Video adjustments

5.2.2.2 Atlas analogue video capture adjustments

For the Atlas radar, the analogue video capture adjustments must be done slightly differently due to the composite signal.
It is important that the R5 RIC is able to detect and separate the azimuth information from the video signal.

1. Configure the radar video input termination and differential parameters to match the radar video signal from the radar.
2. Make sure to configure the R5 RIC to radar “Atlas”, that the Atlas “Video offset” parameter is zero and then use the R5 RIC Analyser or other radar video A-scope to view the captured signal.
3. Adjust the video input data offset, data gain, sampling frequency and number of samples until the signal can be seen as in Figure 6. The video will move around before the composite sync has been detected.

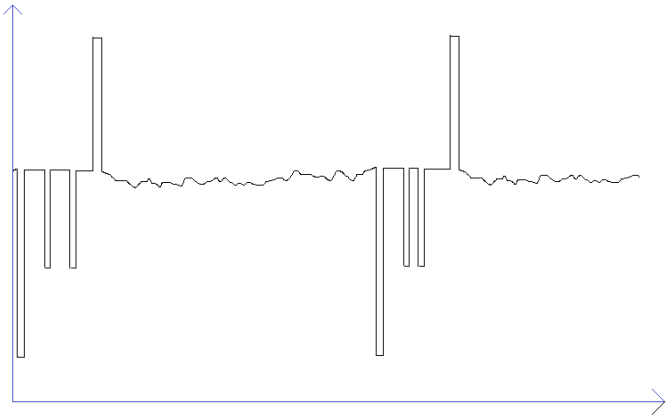


Figure 6, Atlas composite signal example. Multiple sync pulses visible.

4. Identify the sync pulse in the video. In Figure 6, the sync is seen pointing upwards. The easiest way to identify the sync signal is to locate the azimuth bars. The azimuth information is negative in regards to the sync pulse.
   If the sync is positive, configure the R5 RIC with “Positive sync polarity” under the atlas specific configuration parameters.
5. Adjust the video input gain and offset so that only a small portion of the sync and initial azimuth pulse is visible. See Figure 7.
   Note that once the sync pulse reaches the upper (or lower if negative) limit of the R5 RIC Analyzer window, the system will lock-on the sync and the video will stabilize. The azimuth information will also be extracted and presented in the azimuth field of R5 RIC Analyzer.

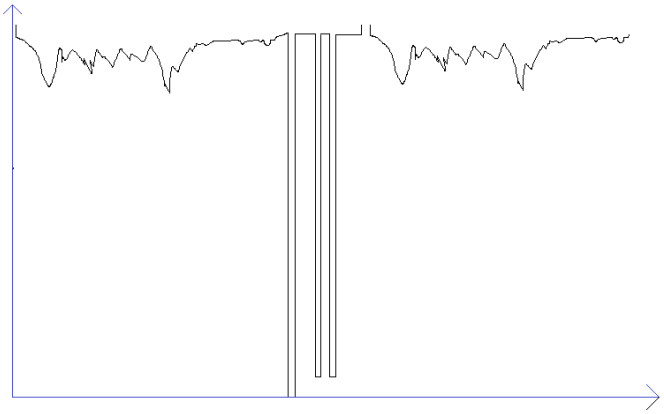


Figure 7, Atlas composite signal with correct analogue gain and offset.

6. Set sampling frequency and number of samples so that the azimuth bars no longer are visible.
7. If the signal is negative as in Figure 7, set the “Data invert” configuration parameter.
8. Adjust the Atlas video offset until the video lies just above the bottom of the R5 RIC Analyzer window. See figure Figure 8.

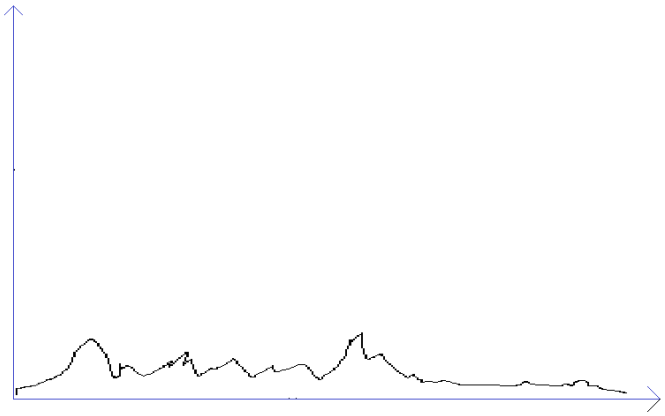


Figure 8, Atlas composite signal correctly configured.

5.2.3 Radar Azimuth Input

The radar azimuth parameters configure the azimuth source parameters.

Name	Description
Azimuth source	Selects the azimuth source. Can be either ARP/ACP or Syncro. Note that the Syncro option, 7000 114-901, must be installed in order to use Syncro as azimuth source.
ARP signal termination	The termination resistance for the input. This should be set according to the ARP output on the radar. Valid selections: *75 Ω*, *120 Ω*, *High voltage* or *No termination*. Only applicable for ARP/ACP source.
Differential ARP signal	Selects differential or single-ended signal handling. Only applicable for ARP/ACP source.

ACP signal termination	The termination resistance for the input. This should be set according to the ACP output on the radar. Valid selections: *75 Ω*, *120 Ω*, *High voltage* or *No termination*. Only applicable for ARP/ACP source.
Differential ACP signal	Selects differential or single-ended signal handling. Only applicable for ARP/ACP source.
Max Azimuth	The number of azimuth steps per revolution. Used to detect if the incoming pulses correspond to the correct number of pulses per antenna revolution.

5.2.4 Radar Acquisition

These configurations parameters are used to control the acquisition and signal processing of the analogue radar video.

Name	Description
Channel	Channel selection of either channel I or channel Q.
Frequency	The sample frequency of the digitized radar video. Can be configured from 100 kHz to 100 MHz.
Samples	Number of samples to capture. Can be configured as 64 to 8192 samples.
Downsampling operation	Operation used to select samples when down sampling. This feature performs a down sampling in range. I.e. reduces the range resolution. • Last - The last sample in each sample set is used • Max - The maximum sample in each sample set is used
Data type	The data type of the radar video samples sent from the R5 RIC. Must be 8-bit or 16-bit when using STT packages.
Enable pulse integration	Enables pulse integration. Pulse integration integrates echoes over a number of strobes to increase detectability of weak signals.
Pulse integration level	Number of strobes to integrate using pulse integration. Can be set from 1 to 8.
Enable FTC	Enables the FTC (edge detect) filter function. The FTC filter in R5 RIC is based on a moving average function that is used to detect rising edges of slow moving targets.
FTC level	Number of samples used for the FTC filter function. Can be set to 4, 8, 16, 32, 64, 128, 256 or 512 samples.
FTC gain	A gain that can be applied after the FTC in order to increase amplitude of the filtered data. Can be set to the factors x1, x2, x4, x8, x16, x32, x64 or x128.
Data invert	Inverts the samples. i.e. 122 become 65413 when using 16-bit samples. Used for radars with inverted radar video signal.

5.2.5 Raw Radar Video

These parameters configure the network parameters for the Raw radar video packages sent on the *Radar data out* port.

Name	Description
Sector Downsample	Enables down sampling to sectors. This feature is a down sampling in azimuth. I.e. reduces azimuth resolution.
Sector Count	The number of sectors that shall be sent from the R5 RIC. Must be greater than or equal to 8, and less than or equal to the number of azimuth steps for the antenna. Only applicable when sector down sampling is enabled.
Sector downsampling operation	Operation used to select samples when down sampling. • Last, The last sample in each sample set is used • Max, The maximum sample in each sample set is used
MAC Address	The MAC address for the radar video Ethernet interface.
IPv4 Address	The IPV4 address for the radar video Ethernet interface.
Source port	The UDP source port for radar video packages.
Destination port	The UDP destination port for radar video packages.
Package type	Selects the radar video package type. The options are STT, STTv2RAW and Asterix.
Configure Package	Only applicable for STTv2RAW and Asterix packages.

For information regarding the digital radar video protocols STT, STTv2RAW and Asterix, see (7000 114-964, A1, R5 RIC Software Interface Specification).

5.2.6 Radar Video

These parameters configure the network parameters for the radar video packages sent on the *Config* port.

Name	Description
Enable	Enables the video output.
Address	Destination address for the radar video Ethernet interface.
Port	Destination port for radar video packages.
Compression	None or RLE.
Threshold Min	Min threshold level for the video signal. Values below the threshold will be set to 0.
Threshold Max	Max threshold level for the video signal. Values above the threshold will be set to max value.

5.2.7 Configuration interface

This configures the network parameters for the configuration interface.

Name	Description
Enable web configuration	Enable or disable configuration access in the web interface.
MAC Address	The MAC address of the configuration interface Ethernet port. Not writable.
IPV4 Address	The IPV4 address of the configuration interface.
IPV4 Net mask	The IPV4 net mask of the configuration interface.
IPV4 Gateway	The IPV4 gateway of the configuration interface.
IPV4 Name server	The address to up to 3 name servers.
IPV4 NTP server	The address to up to 3 NTP servers that the built in NTP client will connect to. The time is used to time-stamp the radar video.

5.3 Web interface

Inside the R5RIC there is a web-server available on the Config Ethernet port. Using a web browser, type in the IP-address of the R5RIC and the status/configuration page will appear (see Figure 9).

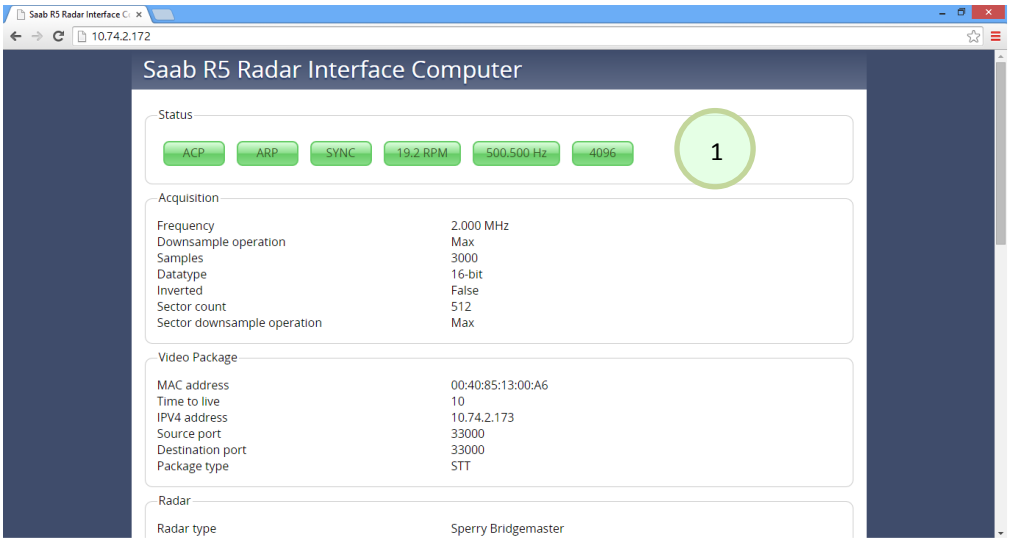


Figure 9, Web-interface upper part

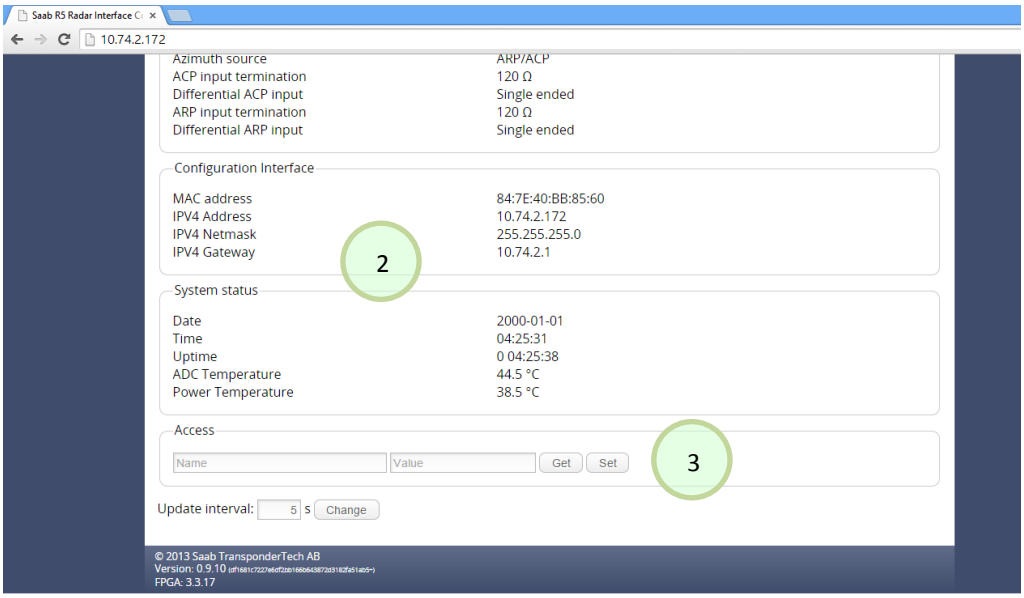


Figure 10, Web interface lower part

The main window has the following areas of interest:

1. There are 6 indicator symbols. The first three status information indicators are for ACP, ARP and Sync. These indicators are green when the corresponding signals are present, and red if they are not. The RPM figure is calculated from the time between two ARP pulses. The sync frequency is calculated from the time between 2 sync pulses. The last status symbol is green when the azimuth pulses (ACP) correspond with the configured Max Azimuth value.
2. Parameters and system status
3. In the access field it is possible to get and set values for all configurable parameters. This is done by writing the parameter name (auto-complete is available), and then either use the get or set button.
   To store the value use R5RIC configurator (see section 5).

5.3.1 Maintenance Web interface

With a web browser type the IP-address of the R5RIC followed by */maintenance* and the maintenance page will appear (see Figure 11). On this page it is possible to both upload and download the complete configuration to/from the R5RIC and to perform software upgrade.

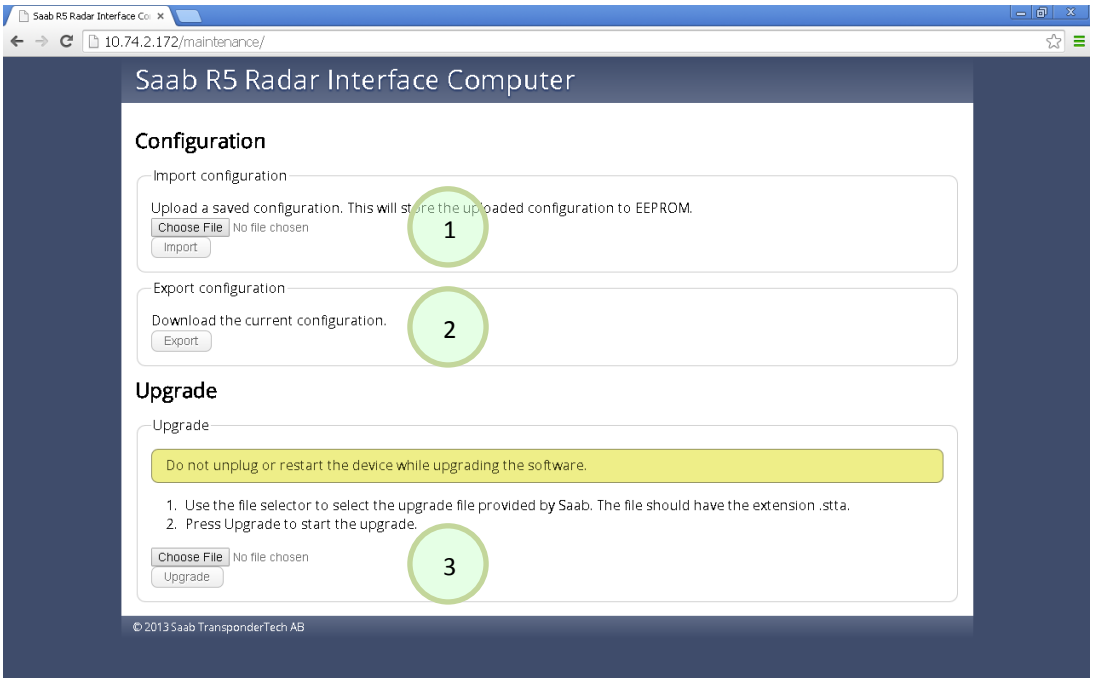


Figure 11, Maintenance window

The maintenance page has the following areas of interest:

1. ***Import configuration***
   Click *Choose File* button and browse to the ".json" file containing the configuration you want to import to the R5 RIC. Then press the *Import* button.
2. ***Export configuration***
   Click *Export* button and choose where to store the ".json" configuration file. This file can be used on other R5 RIC where you would like the same configuration.
3. ***Upgrade***
   Used for software upgrade. Click the *Choose file* button and browse to the ".stta" upgrade file and click *Upgrade*.
   You will see a progress bar and when the operation is done the R5RIC will restart automatically.

5.4 Serial interface

The R5 RIC parameters can also read and written using the serial interface in the RS232/ARP/ACP connecter.

5.4.1 Connect

To connect to the interface, use the setting in chapter 3.6 with Tera Term or equivalent terminal program.

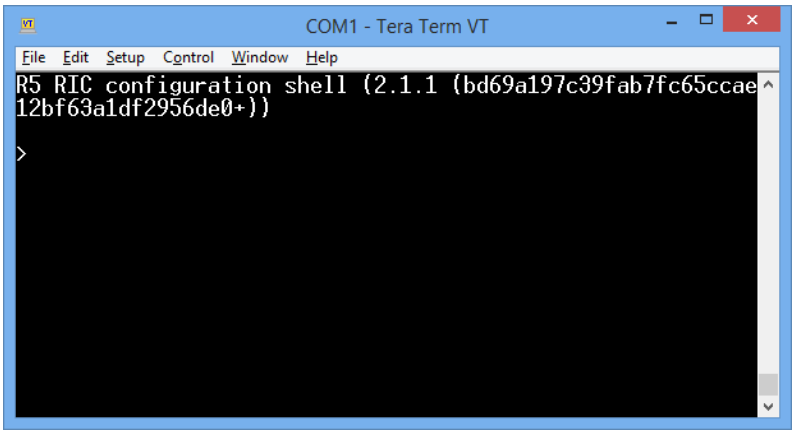


Figure 12, Tera Term - Connected to R5 RIC

5.4.2 Commands

5.4.2.1 list

The command *list* presents all parameters and their assigned values.

5.4.2.2 get

The *get <name>* command returns the value of the <name> parameter.

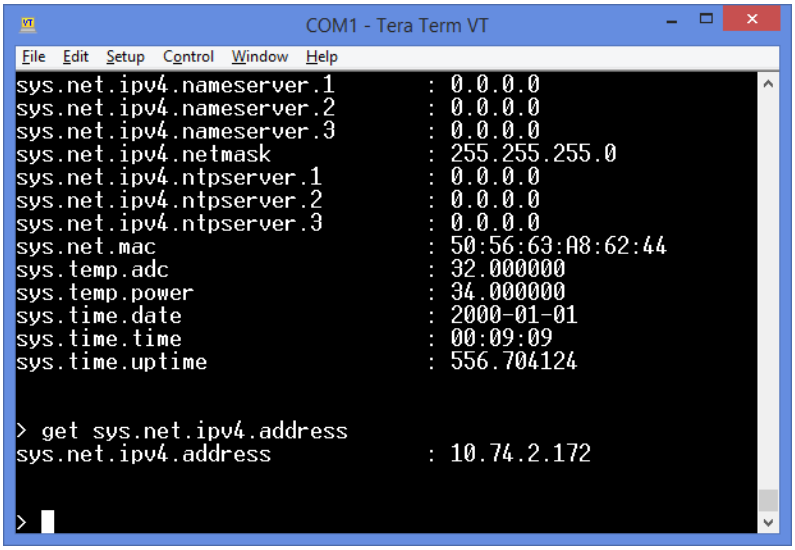


Figure 13, Tera Term - get command

5.4.2.3 set

The *set <name> <value>* command assigns the <value> to <name> parameter if the <value> is of the correct type and a valid value/setting.

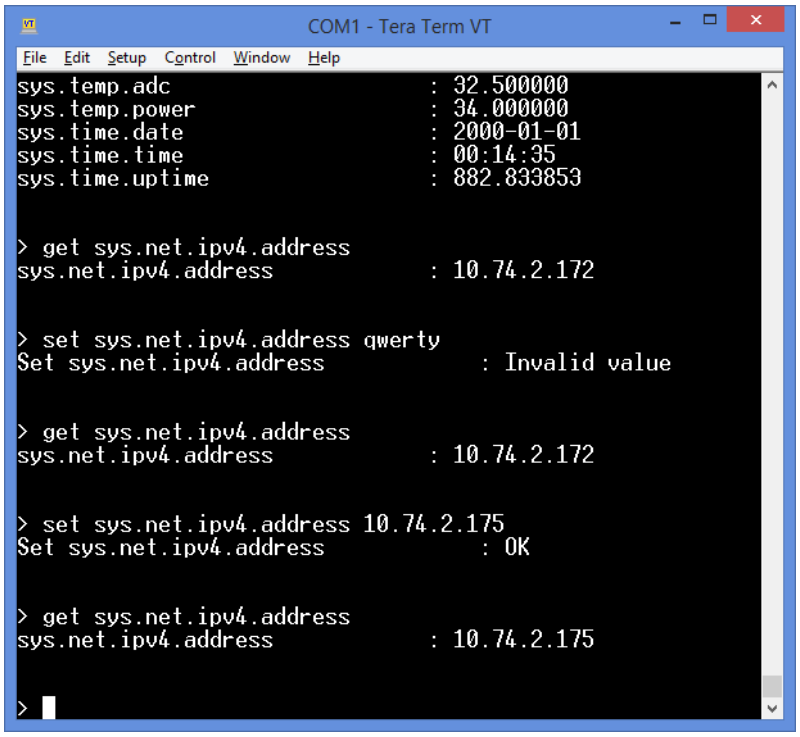


Figure 14, Tera Term - set command with valid and invalid values

5.4.2.4 store

The *store* command stores all parameter values to the EEPROM so that they will be loaded on boot.

5.4.2.5 revert

Revert the current configuration to the stored one.

5.4.2.6 system reboot

Reboot the R5 RIC and thereby revert all parameters to the stored configuration.

6 INSTALLATION

6.1 Radars with analogue video output

For radars with analogue output, connect the following:

1. Analogue radar video to *Video I* BNC input.
2. Sync/trigger signal to *Sync* BNC input.
3. Azimuth interface, depending on option:
    a. ARP/ACP using 9-pin DSUB.
    b. Syncro interface (option).
4. *Config* Ethernet into LAN network.
5. *Radar data out* Ethernet into radar extractor computer.
6. Power supply to 12-24V DC

6.2 Radars with composite analogue video output (e.g. Atlas)

For radars with composite analogue output, connect the following:

1. Analogue composite radar video to *Video I* BNC input.
2. *Config* Ethernet into LAN network.
3. *Radar data out* Ethernet into radar extractor computer.
4. Power supply to 12-24V DC

6.3 Radars with digital radar video output

(R5 RIC 7000 114-902, B2 and newer supports Terma 2000 and 5000 series)
For radars with digital video output on Ethernet, connect the following:

1. Digital radar video to Ethernet *Radar data in*.
2. *Config* Ethernet into LAN network
3. Ethernet *Radar data out* into radar extractor computer.
4. Power supply to 12-24V DC

Parameters that must be configured to initialize Terma video stream:

1. radar kind => 6
2. radar.terma.ctrl.ipv4.address => IP address to Terma Ethernet interface.

6.4 BridgeMaster radar

For BridgeMaster radars:

1. Analogue radar video to *Video I* BNC input.
2. Sync/Trigger signal to *Sync* BNC input.
3. Transceiver RX/TX to RS232/ARP/ACP port using cable 7000 114-967 and a RSR232 to RS422 converter according to schematic PT-16-0104. (See Figure 15)
4. *Config* Ethernet into LAN network
5. Ethernet *Radar data out* into radar extractor computer.
6. Power supply to 12-24V DC

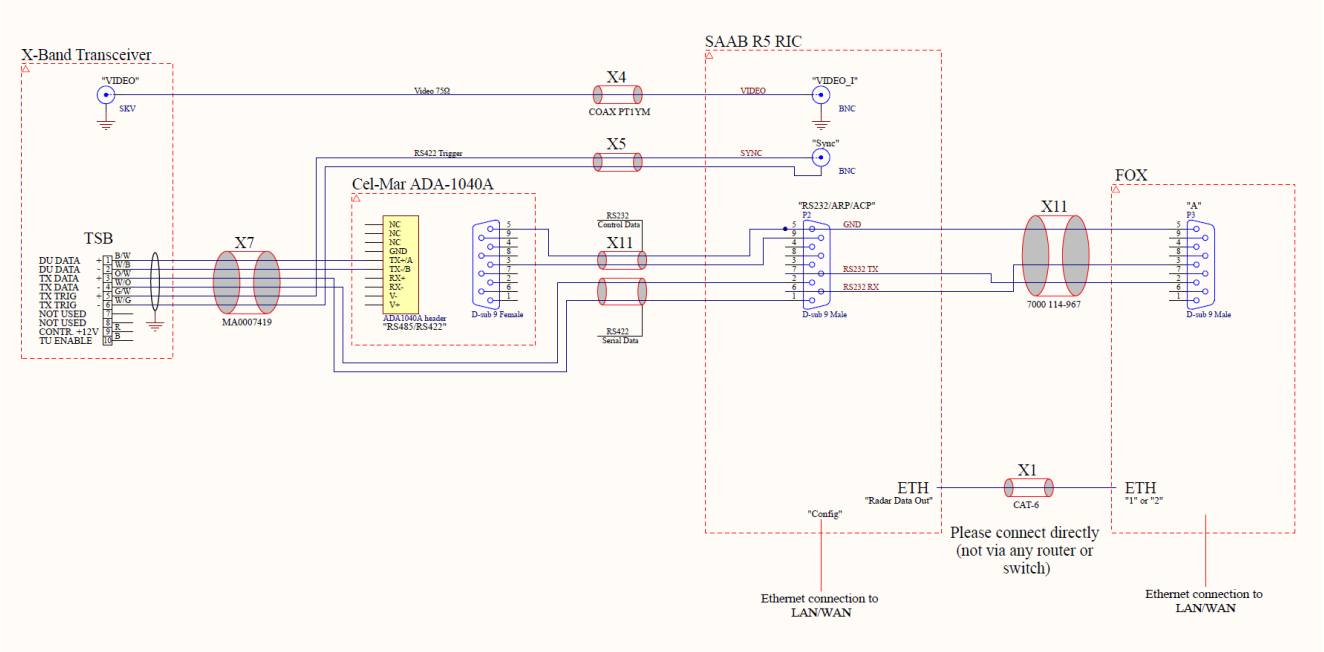


Figure 15, BridgeMaster interconnection schematic (PT-16-0104 C3)