

SPx

Radar Video Processing and Display

SPx Server Overview and Specification

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1. Introduction

The document presents a general overview and specification of Cambridge Pixel's SPx Server product.

SPx Server is a multi-function primary radar video processor, which may be used for radar video acquisition, network distribution and plot and target extraction.

SPx Server can receive radar video from signals using the HPx series of radar interface cards, or from a network source, for example where the radar is directly providing network video or plot data. Additionally, to support testing and maintenance, SPx Server can be configured to use simulated data from its built-in scenario generator. Finally, radar video may be recorded to a local hard disk and SPx Server configured to receive data from this recorded source.

1.1. External Interfacing

Although SPx Server has a Graphical User Interface (GUI) to support configuration and maintenance, its normal operational mode is to run as a black-box server that receives radar video (or plots), processes the data and outputs a combination of either video or tracks onto a network. In this situation, the GUI is available to display activity and report status and messages.

The video or track data distributed from SPx Server may be received by one or more client applications. These can include Cambridge Pixel's RadarView Windows application, or a custom-written client application. A custom client application can use Cambridge Pixel's SPx Library to receive track data and communicate with the server. For the distribution of radar video, the SPx software library provides software module to receive, decompress and scan convert radar video. The external interface options are shown in Figure 1.

Note that additional client-side licenses will be required for receipt and scan conversion of radar video. Additional client-side licenses are not required to receive status messages, heartbeats and track reports.

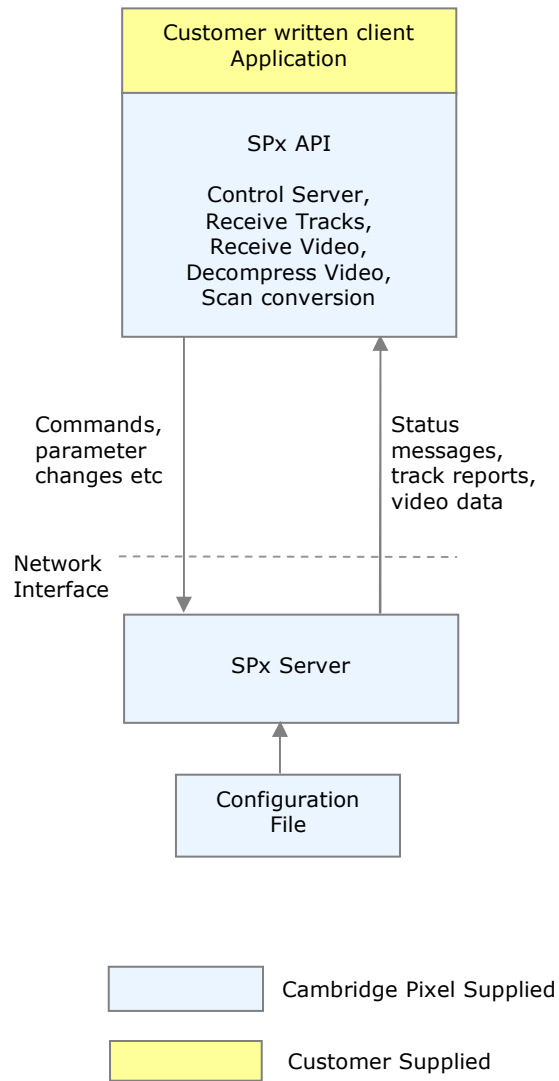


Figure 1 - SPx Server Interfacing

1.2. Overview of Server Configuration

When the server starts it reads a configuration file. The configuration file contains a set of parameter assignments that initialise the state of the server. Once the server has read the file and completed its initialisation it immediately starts processing data and providing output. The contents of the configuration file define which processes are active, parameters for the processing, addresses for the network output etc.

The server can function as a black box radar processor, configured to start automatically at power-up of the machine with no user-interaction or GUI configuration needed. However, the server also provides a GUI, which may be used for monitoring of the server status and adjustment of the server configuration. Additionally, the server can accept a network connection from a remote client, which can send commands to remotely change the server configuration.

1.3. GUI Connection

The GUI is designed to run on the same machine as the server software. In the Linux version of the server the X-Windows based GUI client must connect to an X Server running on the server machine.

1.4. Software Licenses

SPx Server is a licensed software product, which requires a software key or dongle to function. If a suitable license is not found the software will typically operate for 60 minutes before stopping.

To verify that the software is licensing, check the message window for error codes.

1.5. Moving Platform Support

SPx Server may be used for static or moving platform applications. When used on a moving platform, the target tracker requires an input of platform navigation information, which as a minimum comprises ship course and speed.

Navigation information may be provided as input using a standard NMEA serial data format or a network message format. The network message format uses the same NMEA ASCII sentence structure, but stores the strings in simple message blocks that can be delivered over a UDP interface.

2. Processing Modules

The standard SPx Server processing sequence is shown in Figure 2. This defines the set of processing components built into the standard SPx Server. If you are working with a customized version then your processing sequence may be different to that illustrated.

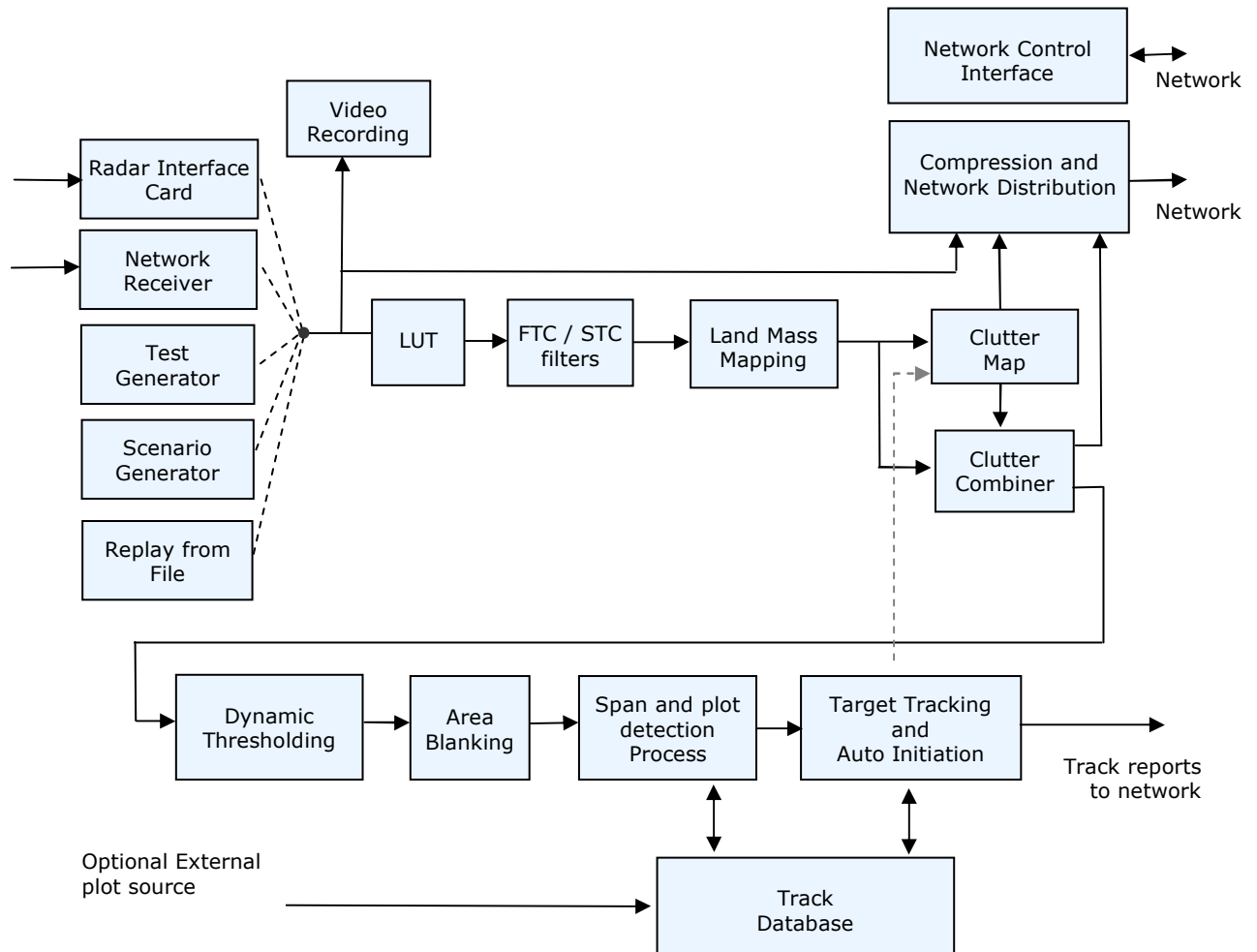
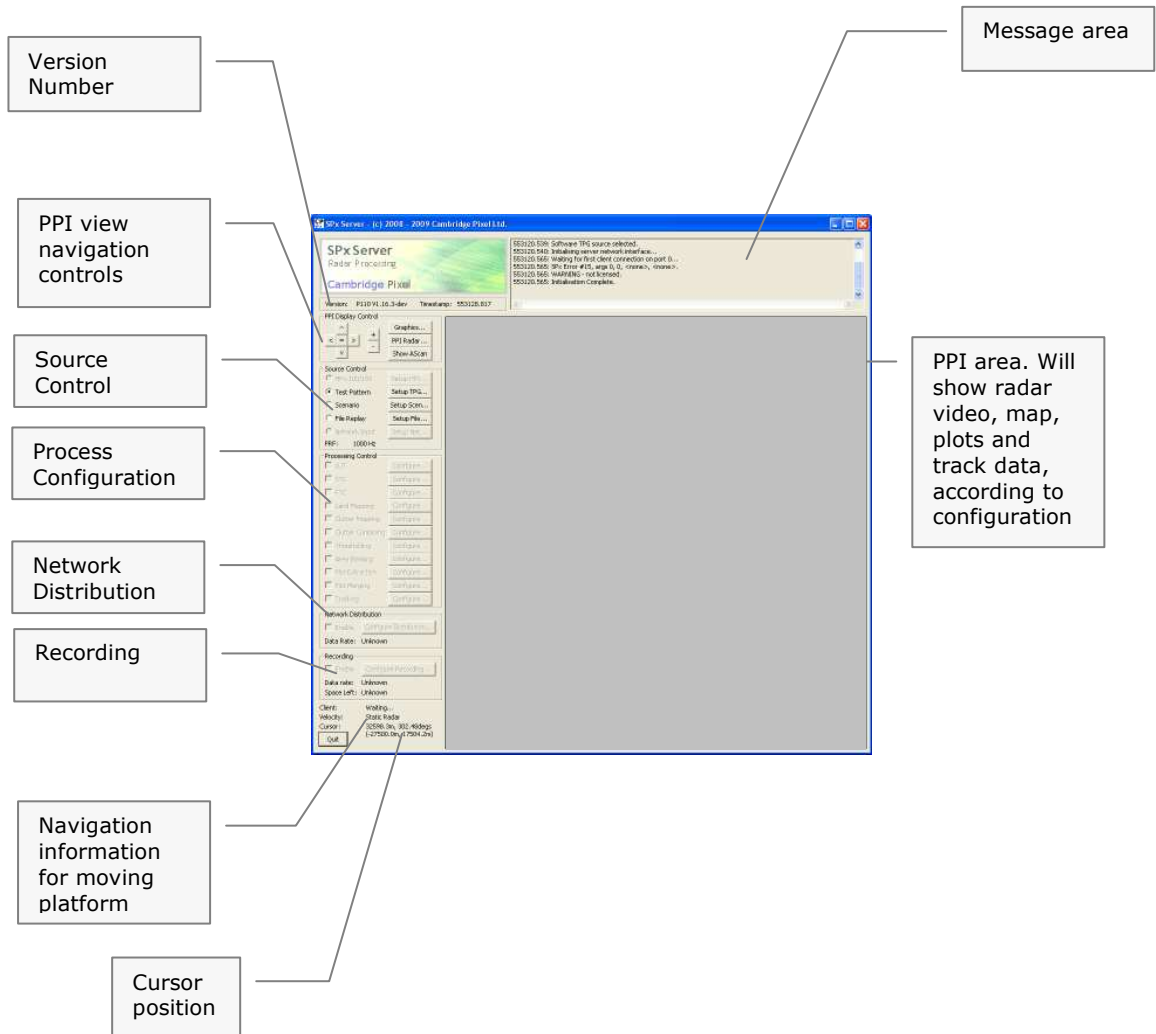


Figure 2 - SPx Server processing - standard configuration.

3. Server Controls and Interface

The Graphical User Interface for Windows and Linux version of SPx Server is similar but slightly different.

When started, the Server GUI should be similar to that shown below:



Video data, and optionally plots and tracks, will be displayed in the main PPI area. The view in this area can be adjusted with the PPI View navigation controls (left, right, up, down, zoom in and zoom out). In the Linux version of the GUI, the PPI area may be adjusted using the mouse to drag the view left, right, down or up, or using the mouse scroll wheel to zoom in or out.

The Source Control buttons allow configuration of the source of radar video or plot data.

The Process Configuration boxes allow different processing stages to be enabled and configured. Not all options may be available, depending on licensing options and radar input restrictions.

The Network Distribution may be enabled and configured.

The Recording may be activated and configured.

Various status information is shown at the bottom left of the window, including ship navigation information when a moving platform is being used.

The Cursor position shows the range, azimuth and x,y position of the pointer relative to the radar position. An azimuth of 0 represents North and positive values increase clockwise.

4. Specification

4.1. Product Options

Component Supply	Available as software CD, Documentation and hardware interface card for OEM system installation
System	Available as complete server installation configured in PC-based system or single board computer
Functional	Optional licensing options for: Radar video distribution Plot extraction, Target extraction

4.2. System Requirements

Processor	X86 Architecture Recommended processor is 2.0 GHz Pentium Core-2-Duo or higher.
Operating System	Windows XP, Windows Vista, Linux (Redhat, Ubuntu, RHEL v5) For other operating systems consult factory
Graphics	Requires 1280 x 1024 graphics display for maintenance and configuration.
Disk	Disk storage is optional for radar video recording.
Network	100 Mbit or 1 Gbit Ethernet adaptor recommended.
Expansion Slot	PCI or PMC expansion slot required if using the HPx-100 or HPx-150 radar interface cards. Refer to the user manual for these cards for full details.

4.3. Software Licensing

Functional	SPx Server may be licensed for: Radar Video Distribution Server Plot Extraction Target Tracker Radar Record and Replay
License Protection Method	USB Dongle, MAC-address or License file (Other schemes are possible, consult

	factory for details)
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4.4. Radar Interface

This section assumes that the Cambridge Pixel HPx-100 or HPx-150 radar interface cards are used.

Radar Trigger	PRF: Up to 10 kHz Amplitude: Up to 30V. Single ended or differential (RS422) Impedance: 75R or high impedance
Radar Video	Amplitude: 5V (positive or negative) Impedance: 75 R or high impedance
Azimuth Turning Data ACP/ARP	Single ended signal up to 30V or differential RS422. ACP count: 60, 300, 360, 1024, 2048, 4096, 8192 pulses per ARP. ARP: One pulse per scan Rotation rate: Up to 60 rpm
Azimuth Turning Data Parallel Azimuth	12 bit RS422 differential azimuth value with data strobe.
Azimuth Turning Data Synchro (Uses HPx-180 Synchro to parallel converter option)	115V Reference voltage 90V synchro input
Plot Inputs	Option to receive plot data from proprietary radars. Consult factory for details.

4.5. Navigation Information

Platform Navigation	NMEA-0183 input GPRMC sentences used in server
Physical interface	Standard serial port on PC or single board computer Network input (uses NMEA 0183 sentences in network packets)
Navigation Reporting	Optional network distribution of NMEA sentences received on serial input. Programmable IP and port address for output

4.6. Performance

4.6.1. Video Processing

Video Bandwidth	25 MHz (When used with HPx-100 and HPx-150 radar interface cards)
A-to-D Conversion	Programmable 2 to 50 MHz sampling rate. 10 bit high-performance capture Data is reduced to 8 bits through a programmable 10-to-8 input LUT. Adaptive threshold CFAR technique with geographical area thresholding Software-based scan-to-scan correlation Clutter subtraction Land mass blanking
Threshold Detection	
Clutter Processing	

4.6.2. Area Processing

Land Mask	Static mask Complex polygon of any shape or size, optionally containing holes. Polygon set is defined in world x,y coordinates and is automatically converted into polar space. Typical azimuth resolution is 0.18 degree and range resolution matches input data resolution.
Area Dependent Processing	Tracker parameters can be assigned different values in different areas. Polygon set is defined in world x,y coordinates and is automatically converted into polar space. Typical azimuth resolution is 0.18 degree and range resolution matches input data resolution.
Automatic Initiation Areas (ATI)	Static mask. Complex polygons defined in x,y coordinates. Can be any shape or size. Independent areas can be configured for radar processing, track initiation and tracking.

4.6.3. Digital Video Distribution

Network Distribution	Distribution onto LAN of radar video data
Compression	ZLIB or ORC (Open Radar Coding)
Data Rates	Highly dependent on input data and configured resolution.

Network Protocol	Typical figures from 2 Mbits/sec for processed video to 10 Mbits/sec.
Video Store for Distribution	UDP Unicast or Multicast distribution Raw input data Processed data Clutter map (One of above with standard server. Multiple channels of distribution are supported with customized server variants, including options for multi-resolution data)

4.7. Target Tracking

Maximum number of targets	500 (Consult factory for higher options)
Track Initiation	Automatic, with programmable extraction area. Wake area elimination Shadow area elimination Manual
Signal to Clutter	Typically 8 dB or higher needed.
Target Speeds	Programmable minimum and maximum target speed for initiation in the range 0 to 300 m/s Programmable minimum and maximum target speed for tracking in the range 0 to 300 m/s
Operating Range	From 0.5% to 100% of programmed video capture range.
Tracking Accuracy	Figures a very dependent on operating conditions and configuration data. Sample figures are: Range accuracy: 8 metres Bearing: 0.3 degrees Course: 1.8 degrees Speed: 0.5 metres/second

4.8. Track Messages and Reporting

Heartbeats	Regular heartbeat for health and status output every 1 second
Status Message	Output once per scan on North crossing
Track Messages	Output on track creation, update and delete.
Report Latency	Reports generated approximately 30 degrees behind antenna position.
Track Report Format	Can be configured as minimal, normal or extended track reports
Network Address	Configurable IP address and port number.

	Multicast or unicast distribution
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4.9. Remote Control

Control	Remote control of server parameters and operation using network messages
Software API	C++ software interface for client control

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