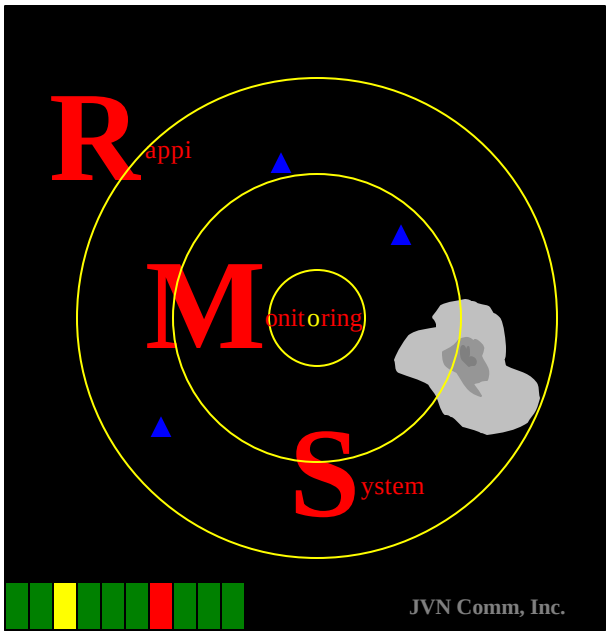
RAPPI MONITORING SYSTEM



Operational Overview

- Introduction …….pg2
- Hardware Overview …….pg3
- Software Overview …….pg4
- RMS Connectivity …….pg5
- Hardware Diagrams …….pg6
- Hardware Specs …….pg7-9
- Software Configuration …….pg10-13
- RMS User Guide …….pg14-19

Introduction

The RAPPI Monitor System (RMS) consists of one rack mount industrial computer running Standalone Interfacility and Radar Simulator (SIRS) software on a Linux operating system. Acting as a server, the rack mount computer feeds client machines which are standard desktop PCs. The clients are also running SIRS software on a Linux operating system. The client machines are placed throughout a building, in offices, cubes, labs and other viewing areas. The clients, as well as the server, display short and long range radars. The RMS system can monitor up to 16 radars or more at one time. The RMS displays a green, yellow and or red icon for each radar's status. Quick determination of a radar's status can be made by simply viewing the radar's icon color. The RMS can display four small radars per screen or can display individual radars in greater detail. The RMS is fed live serial radar data from sources such as radar gateways, SCIP/ASIS, and digital bridges. Once the exact locations of the radars and test targets are configured, the RMS closely monitors the radar data checking for proper parrot, permanent echo, and RTQC locations as well as data integrity. The RMS also provides the ability to share recorded radar data via a network to workstations running DOS/Windows based radar analysis tools. The recorded radar data is stored on the RMS server for an adjustable amount of time. The windows user, if needed, can archive the recordings to hard disk or remoable media.

Hardware Overview

Processor/Motherboard

An Intel Pentium 100 MHz or higher processor with an AT, ATX, or passive-backplane motherboard with a 300W power supply is required. Intel Pentium III or higher is recommended.

Memory

A minimum of 32 Megabytes of memory is required to run the FIRS software. 128 Megabytes or more of memory is recommended.

Disk Storage

A minimum of 50 Megabytes of disk storage space is required for installation of the SIRS software. Any pre-recorded scenarios or surveillance files require additional space. Short-range radar surveillance files can be quite large, 13-15 MB per ASR-9 for 1 hour @ 650 targets. A 20 Gigabyte hard drive is recommended.

Video

Minimum 8 bit, 640 X 480 resolution. 1024 X 768 or better resolution is recommended.

Interface Adapters

An Ethernet network interface card is recommended, but not required for stand-alone units. An Ethernet connection to the Internet (or the FAA Technical Center LAN) is especially useful for remote debugging and configuration by JVN.

A SCSI interface card is needed when using magneto-optical disks or external storage devices for storage of surveillance files and is necessary.

Serial interface cards such as the Emulex 486p PCI card or Sabtech PCI SRAP card are required to record or simulate radar. One PCI slot per interface card is required.

Scalability

RMS is expandable to meet just about any size radar facility.

Software Overview

Operating System

The RMS system runs under the Slackware Linux distribution. Kernel versions 2.0.35 – 2.4.20 are supported. Linux is a free Multi-user, multi-tasking, POSIX compliant operating system.

Application Software

The RMS application software runs under the FIRS software architecture. Custom device drivers written by JVN Communications handle all ATC communications protocols. These device drivers are dynamically loaded into the Linux Kernel at boot time.

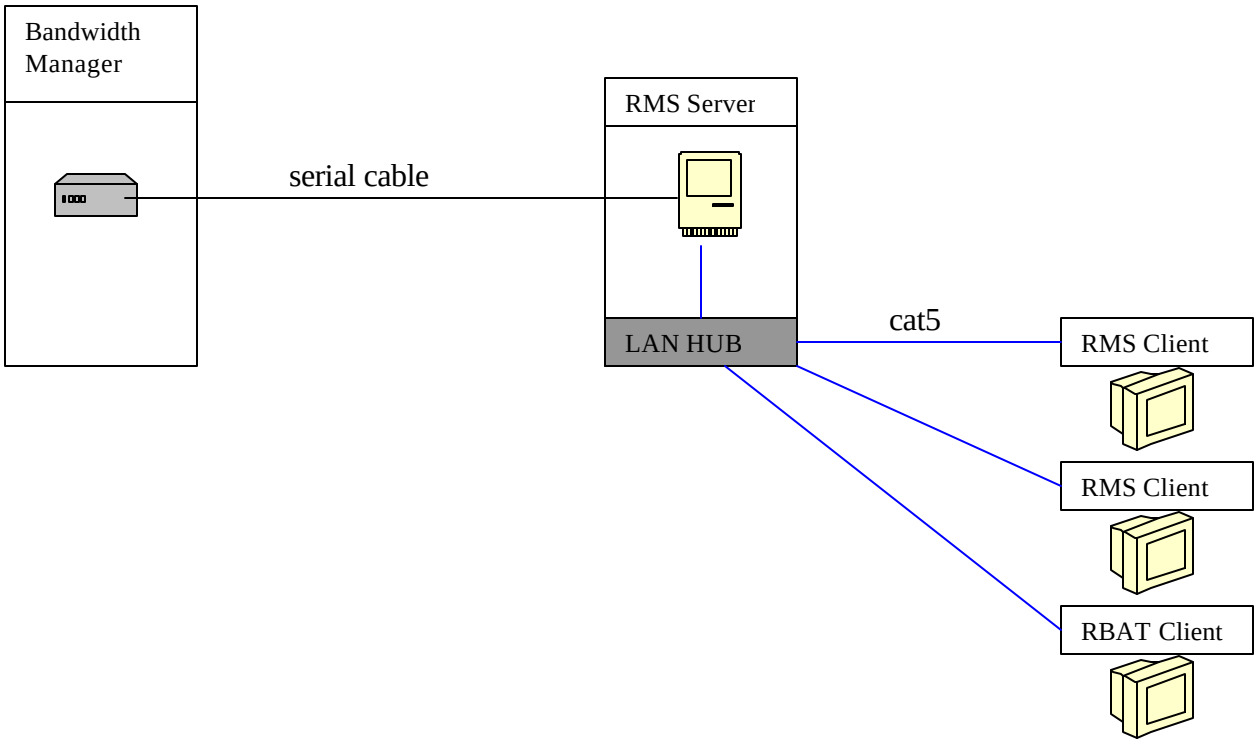
JVN Communications has designed the RMS software tool to be easily configured to suit a variety of radar types. Once configured, the RMS system requires little or no maintenance. The server computer receives all the live radar feeds and distributes them to the client workstations where the raw radar data is compared against the configuration files that the user has set up. These configuration files consist of the geographical location of the radar and test targets, such as; BRTQC, SRTQC, parrot and permanent echo messages. The server receives all these radar messages and also shares them out across a network connection to client machines. The client machines run the same RMS software and also compare the live raw radar with its configuration files. RMS also has the ability to share recorded radar data out to a DOS/Windows client machine running RBAT or other analysis software. This software option is configurable to meet site needs, such as length of recorded files and disk usage management.

RMS Connectivity

STARS Hardware Connectivity

The RMS system is easily adaptable to meet any site's hardware configuration. The RMS currently connects to the STARS through the radar gateway. Using serial ports from the bandwidth manager the RMS receives four channels for short range radar and three channels for long range. These cables are connected to the RMS adapter plates mounted in the rear of the RMS cabinet. Here the data flows into the RMS server where the data is closely monitored and displayed.

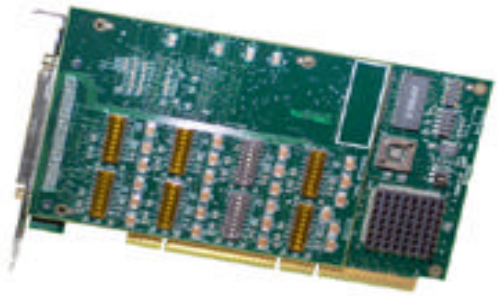
Hardware Diagram



Hardware Specs

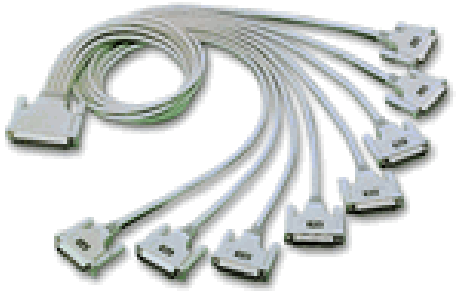
Emulex 486P WAN Card

The Emulex card is a synchronous/asynchronous WAN adapter for PCI-based PC's, Workstations, and Servers. The Serial Communications Adapter is a single board, intelligent adapter that provides format conversion of radar and data communications interfaces. The Emulex card uses the PCI architecture, one Emulex card per PCI slot. Each Emulex card can support two radars. The Emulex card with JVN Communication drivers can receive and transmit radar data in various formats.



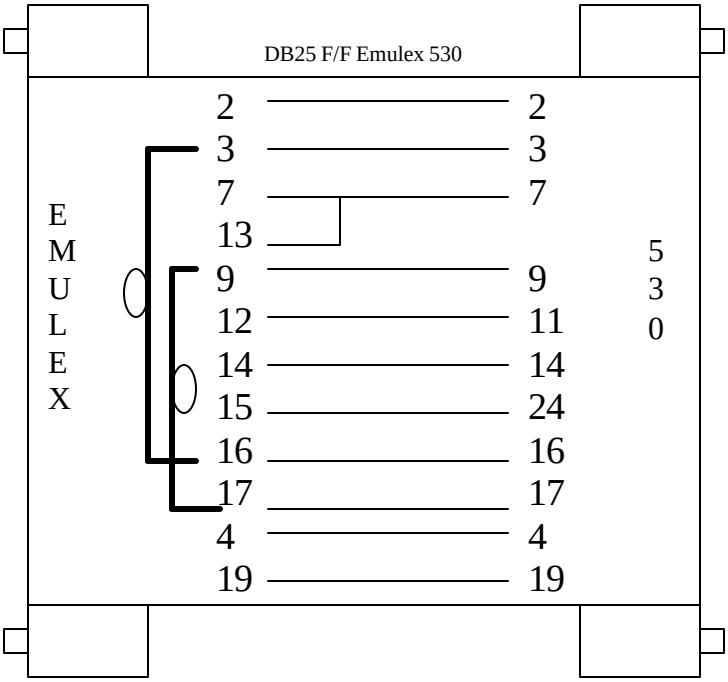
Emulex Octopus Cable

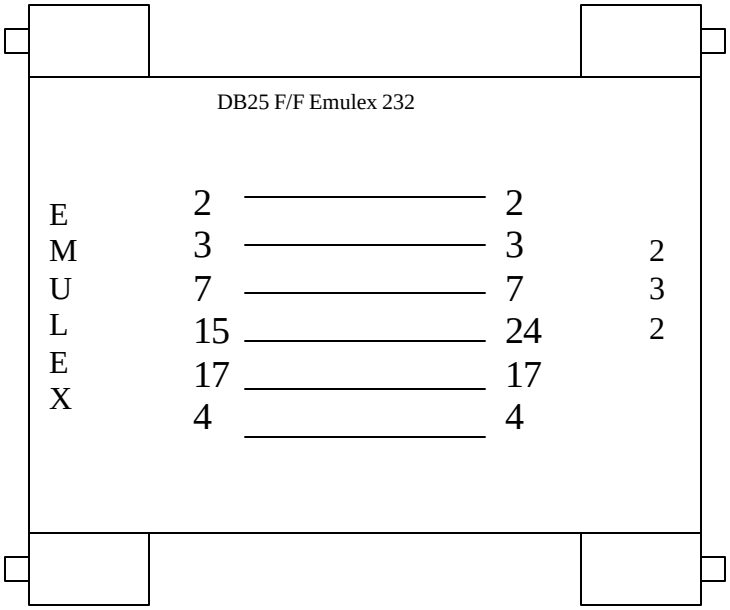
The Emulex card uses an eight port serial cable. This gives the user four channels per radar; when long range radar is needed only the first three ports are used and the fourth channel is left unused. The user could then start the next radar on ports five thru eight.



Emulex Adapter Pin-outs

Emulex adapters are needed on the end of the octopus cable before the radar data enters the RMS server. It is very important to have the Emulex side of the adapter face the octopus cable. This will allow the standard pinouts to enter and exit the adapter correctly. If the adapter is installed incorrectly, the radar data will appear jumbled. The adapter takes the standard RS-530/232 signal and converts it to a non standard pin-out to comply with the emulex radar card. The emulex 530 adapter also uses 120ohm resisters on the receive pins for proper signal termination.





Bandwidth Manger to RMS Cables

The bandwidth manager to RMS cable is supplied by the site. This cable can be supplied by JVN Communication if needed. The cable is a standard RS530 male DB-25 cable. Most site use a low capacitance PVC cable. If the cable needs be run under the floor, a plenum cable is normally used. This cable will vary in length based on how far apart the bandwidth manager and the RMS server are.

RMS Server to Client's Cables and HUB

The RMS server uses an ethernet port with one RJ45 category 5 network cable to connect to a switch or hub. Out of this hub the client machines are connected via RJ45 category 5 network cables to the client's Ethernet port. The hub can vary in size based on the number of ports needed to feed client machines. A four to eight port hub should work fine.

Software Configuration

Configuring RMS Server and Client Software

Configuring the RMS server software begins by logging into the server as root user. If the server is at a login screen, you can type **root** then the **password.** If you do not have root's password contact the RMS administrator. If the RMS server is currently running, you will need the press the Ctrl and F2 key together to reach a login window. Once at the login screen, you can login as stated above. To reset the RMS software program you can press Ctrl Alt Backspace. You can edit the files listed below to change the radars' configuration files as well as the appearance of the RMS display. If you make any changes to the files, you will need to reboot the machine when finished. Any changes you make will need to be updated on the other RMS client machines as well.

- **/home/rdrmon/rdrmon/mons/XXX.mon**
  These files (one for each radar) are located on both the server and clients and define the radar parameters to be monitored for each radar such as RTQCs, parrots, and permanent echoes.

The monitor Command
The monitor command instructs a Qars to expect a radar message of given type and parameters to be received at a regular interval. If the message is not received 8 out of the last 10 scans, the radar indicates a failure status in a MonitorBar. The syntaxes for the monitor command are as follows :

Radar ID Message
qars_name monitor name ID "identifier channel"
name is a unique name for this parameter.
Identifier is a three character ASCII string.

Status Message
qars_name monitor name STATUS "radar_type"
name is a unique name for this parameter.
Radar type is one of asr9, arsr3, arsr4, cd2, or fps-20.

Search and Search Real Time Quality Control Messages
qars_name monitor name SRC/SRTQC "minimum_range maximum_range minimum_azimuth maximum_azimuth"
minimum_range and maximum_range are in nautical miles.
minimum_azimuth and maximum_azimuth are in ACPs.

Beacon, Beacon Reinforced, and Beacon Real Time Quality Control Messages
qars_name monitor name BCN/BCN_R/BRTQC "minimum_range maximum_range minimum_azimuth maximum_azimuth beacon_code minimum_altitude maximum_altitude"
beacon_code is octal.
minimum_altitude and maximum_altitude are in feet.

Sector Mark
qars_name monitor name MARK

- **/home/rdrmon/rdrmon/rdrmon**
  This file is located on the sever as well as the clients and defines the RAPPI windows for the GUI.

- **/home/rdrmon/rdrmon/maps/XXX.map**
  These files (one for each radar) are located on both the server and clients and define a U.S. geographic map centered on the radar for which the file is named. The first few lines of this text file contain the latitude, longitude, and magnetic deviation for the radar. The remaining lines of the map files are identical for all map files.

Configuring Radar Recording on the RMS Server

The RMS can be configured to allow a site assigned Windows computer to share a directory located on the RMS hard drive. This would allow a windows user to view recorded RMS radar data using the sites radar analysis tools such as RBAT and RTADS.

Important configuration files and directories

- **/recordings (/home/ftp/recordings)**
  This directory is located on the server and holds the recorded radar data.

- **/usr/local/etc/multi.conf**
  This file is located on the server and maps radar devices (/dev/srrX, /dev/lrrX, /dev/asr11-X) to network port numbers as well as radar names and channels for record files. This file also contains key words that define how the recording files are made. A radar configuration line has the following syntax :

  <device> <port> <name> <channel 1> <channel 2> <channel 3> <channel 4>

Item	Description
<device>	The radar device (i.e. /dev/srr0)
<port>	The unique network port (i.e. 8500)
<name>	The optional unique radar name (i.e. MCC)
<channel 1>	The optional unique first record file channel number (i.e. 001)
<channel 2>	The optional unique second record file channel number (i.e. 002)
<channel 3>	The optional unique third record file channel number (i.e. 003)
<channel 4>	The optional unique fourth record file channel number (i.e. 004)

The key words have the following syntax :
<key word> <value>
Where <key word> can be one of :

Key Word	Description
RECORD_DIR	<value> is the location of the recording files (/recordings).
RECORD_FILESIZE	<value> is the maximum size in bytes for each record file (2 GB).
RECORD_DURATION	<value> is the maximum duration in minutes for each record file (99 Hrs).
RECORD_FILEEXT	<value> is the 3 character file extension for each record file (DAT).
RECORD_COMMENT	<value> is the record file header comment to be written in EBCDIC.
RECORD_COMMENT_RTADS	<value> is the record file header comment to be written in ASCII.

The recording file names have the format : YYMMDDHHmmSS.XXX where :

YY is the last two digits of the current year.
MM is the month (01-12).
DD is the day of the month (01-31).
HH is the hour of the day (00-23).
mm is the minutes of the hour (00-59).
SS is the seconds of the minute (00-59).
XXX is the 3-character file extension.

- **/etc/smb.conf**
  This file is located on the server and is used by Samba to make the recording file directory available to Windows workstations via the network. If needed, change the Workgroup setting to match the current Workgroup.

- **/var/spool/cron/crontabs/root**
  This file is located on the server and is used by the cron daemon to run the cdr_cleanup script. Edit this file to change the way cdr_cleanup manages the record files. See the **/usr/local/bin/cdr_cleanup** entry for more information.

- **/usr/local/bin/cdr_cleanup**
  This shell script is located on the server and is run by the cron daemon once an hour to maintain the recording files. The cdr_cleanup script can be configured to keep only the latest N files or remove files older than a user-specified number of hours or days. This should be specified in **/var/spool/cron/crontabs/root** and is done by one of the following options :

  -d <num> Will remove all files older than <num> days.
  -h <num> Will remove all files older than <num> hours.
  -n <num> Will leave only the last <num> files.

RMS Users Guide

Powering on and off the RMS Server and Clients

On both the server and the client machines you will find a standard on/off switch located on the front of the machine. On the server you may need to open the front door/hatch to reach the on/off switch.

Switch the unit on and your system will begin to boot; this can take a few minutes. Wait untill you are prompted to login.

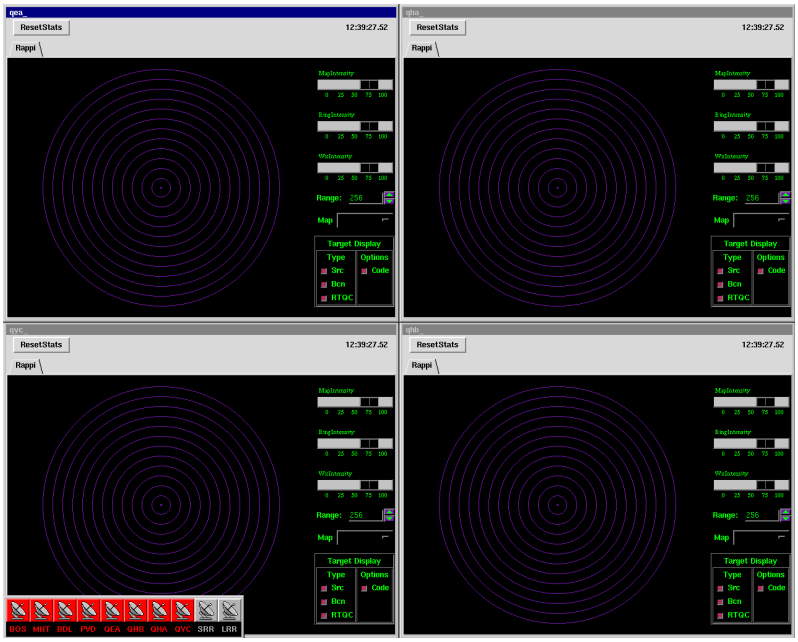
Powering off the equipment starts by getting to an xterm or console window where you can type. If the RMS is running you will need to press the Ctrl and F2 key together to reach a login window. On the RMS server you can press the Ctrl Alt Backspace to stop the RMS software. Once at the log in screen, you will need to login as **root.** To shut the system down you can type **halt;** type **reboot** if you would like to restart the machine. By typing halt you are safely bringing the system down. When the system is completely down the prompt will say **power down**. You should not switch the machine off until you see this message. Doing so could cause data loss or filesystem problems.

Starting the RMS Software on the RMS Server

To run RMS software login as **rdrmon** and type the password. If you don not have the password contact the RMS administrator. After logging in the RMS software will begin to load. This can take a few minutes to complete the loading process.

RMS GUI Help

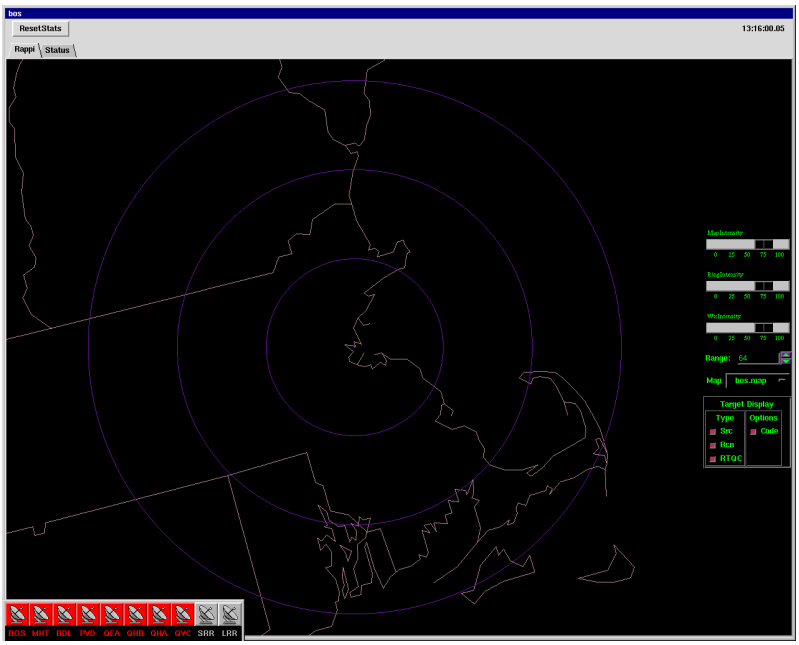
When the system finishes loading you will see the Qars windows and monitor bar icons.



By default RMS shows four short range qars in the background and the site's radars icon in the bottom left of the screen. The icons begin all gray. As the RMS software begins monitoring the radar, the icons will change to red, yellow or green. Qars expects a radar message of given type and parameters to be received at a regular interval. If the message is not received 8 out of the last 10 scans, the radar indicates a warning status in a MonitorBar.

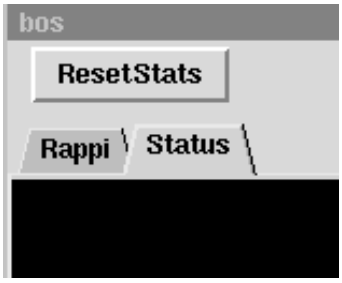
A red icon means the radar is missing or bad. You will need to look at the status bar tab to verify channel status. A yellow icon means the radar has clock and data, but something is wrong with a parameter. You will need to look at the status bar tab to verify data status. A green icon means the radar data looks good.

By selecting one of the site radar icons from the monitor bar you will then see that radar in full screen, with the option to take a closer look at the data integrity.



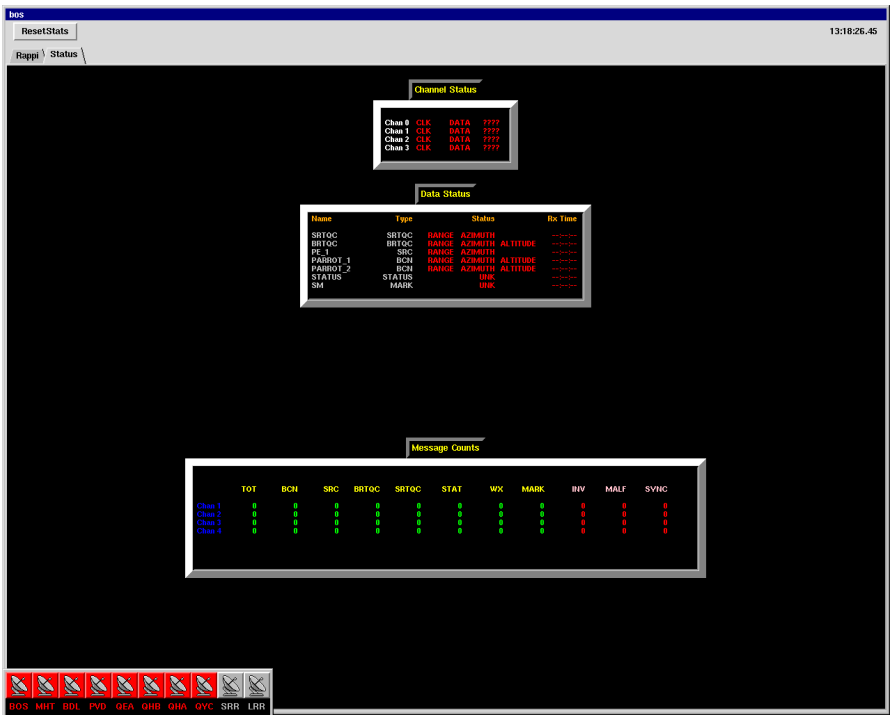
With a single radar selected, you can manipulate the viewing area by selecting or deselecting **Target Display Options** on the bottom right of the Qars. You can also change the range field by selecting the range field with the mouse and typing the new range value and hitting enter.

If you have a red icon (indicating a problem) on the monitor bar a good way to look at the low level radar data is to select the status tab at the top left of the single qars window.

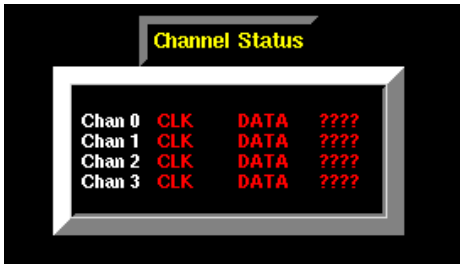


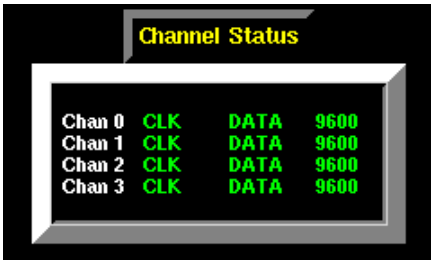
This shows radar **channel status**, **data status** and **message counts** for the selected radar. This gives the user the ability to narrow a problem down to a channel or maybe even a parameter adjustment.

The Status window gives the user a low level look at the radar data broken down by channel. This can be your fastest way to determine why an icon on the monitor bar turned from green, which is good, to red, which indicates a problem. Loss of data on a single channel can turn the radar icon red.



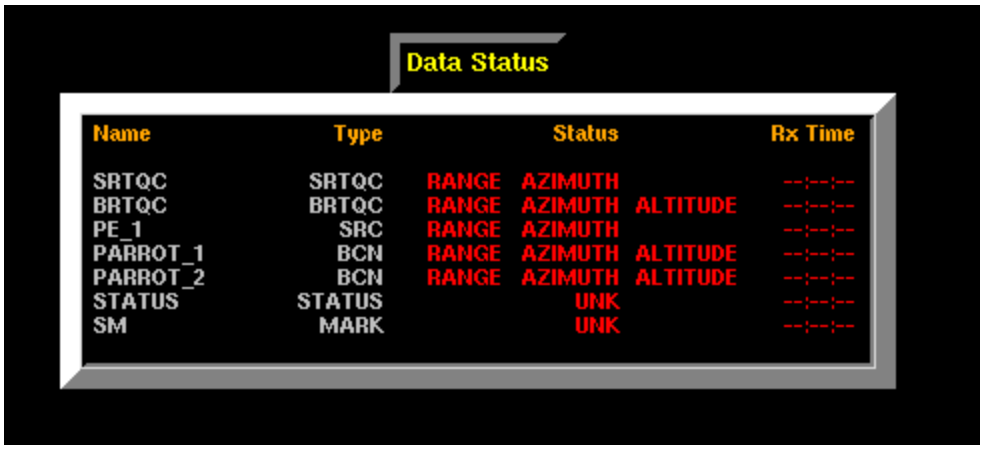
The **Channel Status** is the first thing to look at when you suspect a problem. This shows your radar channel number, clock and data. If you have good clock and data the **CLK** and **DATA** will be green followed by the clock speed. If the CLK or DATA is bad they will be red you will not see the clock speed. You can have a good clock (green) and no data (red) followed by CLK speed. This is a good indication on where to start looking for the problem.





Once you have verified **Channel Status** the next thing to look at is **Data Status**. Data status is a good place to look when a radar icon is yellow. A yellow icon means the radar data is being received, but something in the parameters field is either missing or not correct.

Data status is range values established by the user from adaptation or actual radar recording files. RMS software closely monitors low level radar messages looking for individual messages types. When these messages look correct they are displayed in green. If the messages look bad they are displayed in red.



RMS monitors radar messages such as; **SRTQC** (search real time quality control), and compares where the radar sees this item and where adaptation defines this location. These locations are defined as parameters. Parameters can be adjusted by fractions of a mile to allow for a slight tolerance. If the range is found to be outside the set parameters RMS will flag the RANGE or AZIMUTH red. If RANGE and or AZIMUTH are found inside the set parameter they will both be green, meaning good. RMS also keeps track of the timestamp found on each message and displays it under the Rx Time. **BRTQC** (beacon real time quality control) is monitored just like the SRTQC with the added parameter of ALTITUDE. Some sites also use, **PE**'s (permanent echoes) and **PARROT**'s, they too are monitored like the SRTQC and the BRTQC. The **STATUS** message is monitored if set in the RMS configuration. Status displays the actual status message found in most radars. These messages can vary based on how they are set at the radar site. The radar site can set bits on or off to display such messages as MAINTANCE ALARM. RMS simply displays what messages if any are found. **SM** (sector mark), are messages received for all short range radars and are also monitored by RMS. If RMS receives this message on time, you will see a green OK under the status.

Message Counts is a great place to see exactly what types of messages are being received and what channel they are on. On the left in blue shows the channel number and in yellow shows message types. Error messages will be displayed under the white INV (invalid message header) MALF (malfunction) SYNC (timing sync)