

OPERATING MANUAL

CR1200 DIGITAL SIGNAL ANALYZER



E N G I N E E R I N G

The leader in Digital Cable Test

Model CRI200 Digital Signal Analyzer

PN DLxxxxxx February 1999

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CHAPTER 1 GENERAL INFORMATION

INTRODUCTION

The Hukk Engineering Model CR1200 QAM Monitor allows monitoring and testing of quadrature amplitude modulation (QAM) signal transmissions. QAM signaling is used on broadband systems to deliver compressed digital video signals and is also used in MCNS compatible cable modems. The CR1200 demodulates the carrier and performs error detection on the live program data stream.

In addition, the CR1200 performs analog tests on NTSC, HRC and IRC signals, providing video and audio measurements of these signals.

The CR1200 is portable and easy to use for both interactive and unattended measurements. The CR1200 reveals crucial performance information to the earth station/headend technician, field technician, and installer to identify reception problems and speed troubleshooting. The system engineer can obtain numerical measurements of service quality with the CR1200's display of summary information.

MANUAL OVERVIEW

This operating manual describes the physical and functional features, operation, and specifications of the Hukk Engineering Model CR1200 QAM Monitor.

MANUAL CONTENTS

Chapter 1 *General Information* describes the CR1200 display, controls, and connectors.

Chapter 2 *Preparation for Use* has instructions for unpacking and inspecting the CR1200, with a description of power requirements.

Chapter 3 *Operation* provides information for operating the CR1200. Step-by-step instructions show how to use the CR1200 to make measurements. Advanced features are explained.

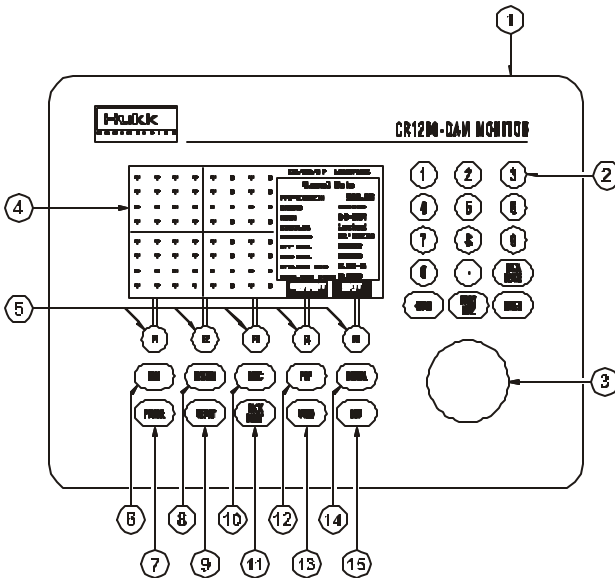
Chapter 4 *Specifications* contains the specifications for the CR1200.

Chapter 5 *Options and Accessories* describe the options and accessories for the CR1200.

Chapter 6 *Maintenance and Service* presents maintenance, service, and warranty information for the Hukk Engineering Model CR1200 QAM Monitor.

INSTRUMENT OVERVIEW

Figure 1-1 shows the front panel of the Hukk Engineering Model CR1200 QAM Monitor. A large liquid crystal display (LCD) indicates instrument status, signal identification, and measurement values. The controls are pressure-sensitive keypad switches with tactile feedback. A 75-ohm “F” connector accepts the RF input signal. A female DB9 connector interfaces to a computer port. A DC input accepts power from the supplied AC adapter or 12 volt DC source. The CR1200 is packaged in a rugged, weatherized, hard plastic case.



CONNECTORS, CONTROLS, AND DISPLAYS

The following descriptions are keyed to the callout numbers in Figure 1-1. Read Chapter 3 *Operation* for detailed instructions on using each feature.

1. **I/O section.** 75 ohm “F” connector, RS-232 print/computer connector and DC power connector
2. **Numeric keypad.** Select carrier frequencies or channels and programming user functions
3. **Knob.** Moves cursor across the display for frequency or channel tuning
4. **Display.** Backlit liquid crystal display
5. **Function keys F1 through F5.** Soft keys to perform various tests
6. **SLM Button.** Measure signal level of analog and digital carriers
7. **POWER Button.** Turns unit on/off
8. **SYSTEM Button.** Graphic display of all channels in the active channel plan
9. **SETUP Button.** Lets user program date, time, channel plan, etc.
10. **SPEC Button.** Spectral display of single analog or digital channel.
11. **BACKLIGHT Button.** For operations in low light conditions.
12. **POP Button.** Lets user perform 24-hour proof of performance tests (daughter card for carrier-to-noise and hum required).
13. **USER Button.** Allows user program and run groups of tests with one keystroke.
14. **DIGITAL Button.** Perform digital tests including bit error rate, signal-to-noise, and adaptive equalizer stress test. Also shows the constellation.

15. **ESC Button.** Escape key to cancel current test and/or move up one operation level.

CHAPTER 2 PREPARATION FOR USE

INTRODUCTION

Read this chapter to prepare the Hukk Engineering Model CR1200 QAM Monitor for use. Follow the instructions for unpacking and inspecting the CR1200. Compare the received items to the packing list. Read all warnings and information on power requirements. Follow the initial checkout procedure to verify that the CR1200 is in good working order.

UNPACKING AND INITIAL INSPECTION

Inspect the shipping container when the CR1200 is received. If the shipping container or shipping material is damaged, check the contents of the shipment for completeness, and check the mechanical and electrical condition of the CR1200 and accessories. Notify Hukk Engineering if the contents are incomplete, if there is mechanical damage or defect, or if the CR1200 does not pass its internal self-test procedure. If the shipping container is damaged, keep the container and packing materials for inspection by the carrier, and notify the carrier as well as Hukk Engineering.

SHIPMENT CONTENTS

The following equipment is supplied with each unit:

- Hukk Engineering Model CR1200 QAM Monitor
- Operating Manual
- AC Adapter/Charger
- DC Power Adapter/Charger
- Carry Strap

NOTE: The CR1200 is water-resistant when the top cover is secured with its built-in latches and the purge knob near the handle is closed. The unit is weather resistant but not waterproof during normal operation when the top cover is open. Do not immerse the unit in water when the top cover is open or when the purge knob is open.

Model CR1200 Digital Signal Analyzer

CAUTION: The CR1200 contains delicate electronic circuitry. The chassis and case have been designed for year-round, day-to-day field use, but severe mechanical shocks and temperature extremes could degrade the operation of the unit or damage it. Do not drop the CR1200.

OPERATOR MAINTENANCE

Avoid deep discharge of the internal battery. Charge the CR1200 before and after use. Optimize internal battery life by leaving the charger connected whenever the CR1200 is not in use in the field.

Clean the display screen and keypad with water, and a small amount of mild soap if necessary. Do not let water spill into the front panel connectors. Do not use abrasive cleaners or chemical agents, which will damage the display window.

POWER REQUIREMENTS

Operate the Hukk Engineering Model CR1200 QAM Monitor from its internal battery, the supplied external AC adapter or the optional DC adapter. The supplied AC adapter converts 115 VAC to 12 VDC at 1.5 A maximum. The AC adapter can power the unit for normal use while recharging the battery.

WARNING: The CR1200 is powered by an internal sealed rechargeable lead battery. When recharging the unit, open the PURGE valve near the carrying handle by turning it counterclockwise two complete turns. Use only the supplied AC adapter to recharge the unit.

CAUTION: The battery electrolyte is an acid. To avoid burns, if contact is made with the electrolyte, flush with water immediately.

NOTE: At the end of its useful life the battery must be recycled or disposed of properly. The battery is not

replaceable by the user.

WARNING: Do not use a power adapter that has not been specifically approved by Hukk Engineering for use with the CR1200. Incorrect polarity or voltage could damage the CR1200 or internal battery.

NOTE: The CR1200 does not contain any user-replaceable fuses.

INSTRUMENT CHECKOUT

On power up, the CR1200 performs a series of diagnostic self-tests to ensure that it is functioning correctly. When these tests complete successfully, the CR1200 will start up in the main screen of the last tests performed (for example: if the last function performed before the CR1200 was turned off was a constellation display the CR1200 will turn on in the main DIGITAL test screen). If this start up sequence fails, call Hukk Engineering for service instructions.

CHAPTER 3 OPERATION

INTRODUCTION

Read this chapter for detailed, step-by-step instructions for using the Hukk Engineering Model CR1200 QAM Monitor. Refer to Chapter 1 *General Information* to locate each of the controls, connectors, and displays on the CR1200.

The section titled “Getting Started” presents instructions for first-time use of the CR1200. Basic controls and measurements are described.

The section titled “Setup Functions” explains the controls and indicators that configure the CR1200 for tests.

The section titled “Menu Hierarchy” shows a flow chart on each of the upper level buttons and the menu choices they lead to.

The section titled “Connections” describes the signals and connectors that interface to the CR1200.

The section titled “SETUP” describes how to adjust the time, date, and other controls on the CR1200. This section also describes how to choose and edit a channel plan to make using the CR1200 as easy as possible.

The section titled “SLM” describes how to use the CR1200 QAM Monitor to perform analog tests.

The section titled “SYSTEM” describes the total system display.

The section titled “SPECTRUM” describes the spectral display and cursor controls.

The section titled “POP” describes proof-of-performance tests available with the CR1200 QAM Monitor.

The section titled “DIGITAL” describes the various digital test, measurements and displays available on the CR1200 QAM Monitor.

The section titled “USER” describes the data logging functions, along with how to store, retrieve, print and delete them are also detailed here.

GETTING STARTED

Initial settings

Press the POWER button momentarily to turn on the unit. Look at the display as the unit performs its self-test. Wait about three seconds for the self-test process to complete. The CR1200 will start operation in the upper level screen of the last test performed. For example, if the last test an operator performed was an adaptive equalizer stress test, and the CR1200 was then turned off, the CR1200 will return to the “Digital” screen the next time the CR1200 is powered up. Press the BACK LIGHT button to make the display easy to read indoors. A short beep will sound to acknowledge each key press.

Press the USER button to access information on the battery. If the display shows less than 40% charge, keep the CR1200’s AC adapter near at hand. There is still plenty of battery charge for attended measurements, but use the AC adapter for longer-term measurements to avoid automatic shutoff when battery charge gets low.

F1 through F5 Function Keys

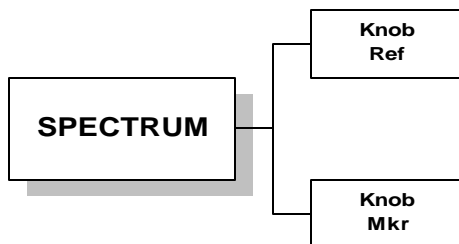
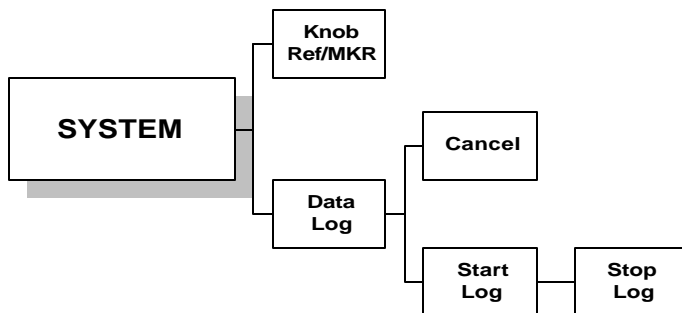
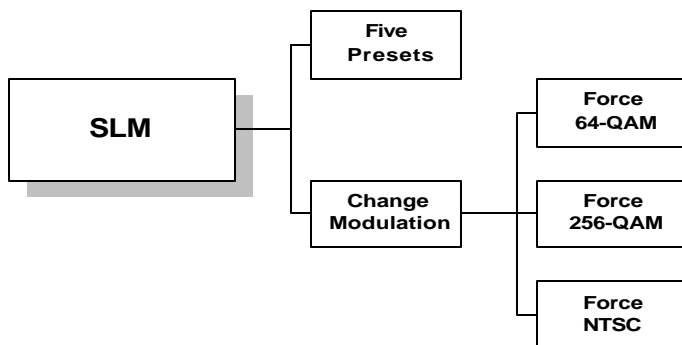
The CR1200 is designed to be easy to operate. All of the upper level functions are available by pushing one button, and all the tests that can be performed by the CR1200 can be reached by pushing, on average, only 2 buttons. After any upper level test button (the “Digital” key for instance) is pushed the function keys F1 through F5 take the operator to the various tests that are available.

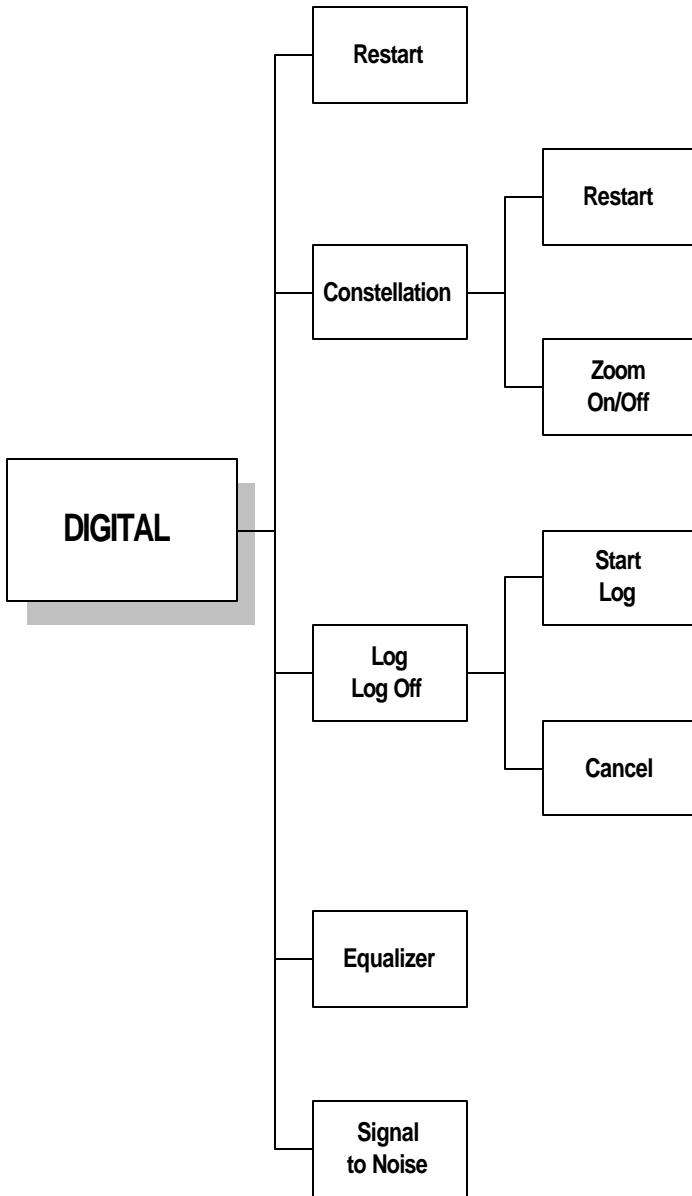
The ESCAPE Button

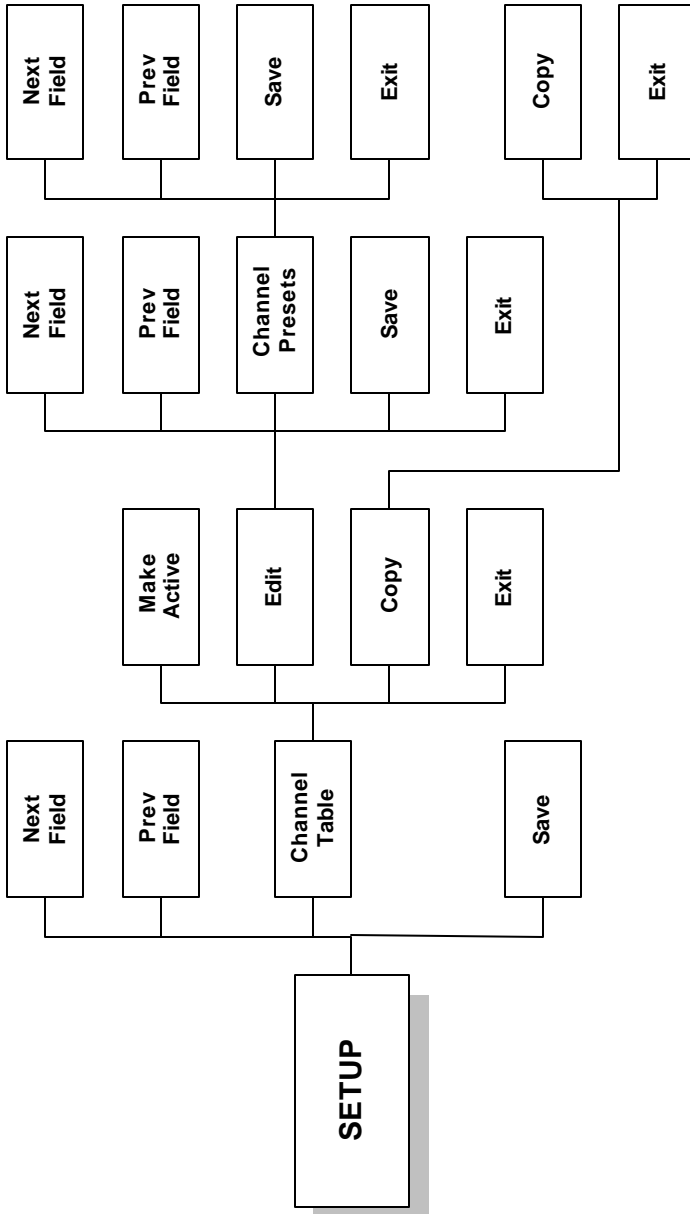
While any tests are running, the key labeled ESC will halt the test in progress. The ESC key can also be used to take the operator UP one level until the upper level of that particular test screen is reached. For instance, if an operator is performing the same equalizer stress test mentioned above, pushing the ESC key once will stop the stress test and return the operator to the “Digital” test main screen. From any upper level screen the ESC key becomes inoperative.

MENU HIERARCHY

The next few pages show a flow chart of the menu hierarchy.







CONNECTIONS

RF input

Connect a drop cable to the RF INPUT of the CR1200. The back panel RF INPUT uses a 75-ohm field replaceable F81 connector. The CR1200 uses auto attenuation on the RF input; the use of additional attenuation is not necessary.

AC adapter

Use only the AC power adapter supplied with the CR1200. The adapter produces 12 VDC with a 1.5A current. Plug the adapter into the CR1200 before attaching it to the 115 VAC source. See Chapter 5 *Options and Accessories* for additional data on the adapter and its connector.

The AC adapter is used to charge the CR1200 battery. The CR1200 can be used for many hours while the AC adapter is plugged into the CR1200.

While recharging the battery, the PURGE valve near the carrying handle by turning it counterclockwise two complete turns.

Do not use a power adapter that has not been specifically approved by Hukk Engineering for use with the CR1200. Incorrect polarity or voltage could damage the CR1200 or internal battery, resulting in a fire or smoke hazard.

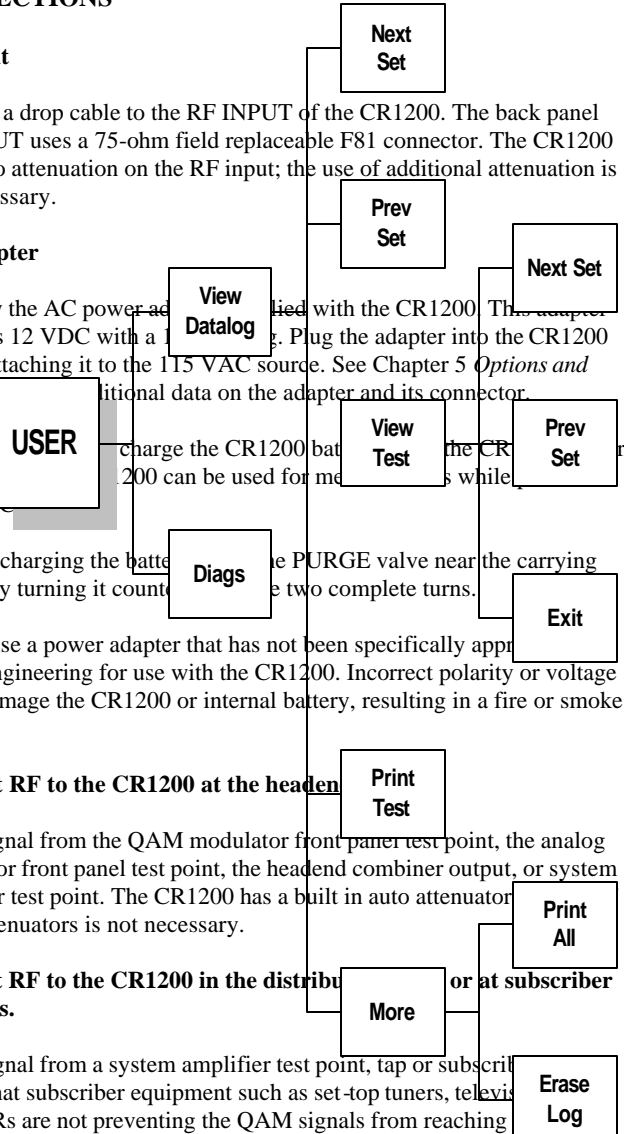
Connect RF to the CR1200 at the headend

Use a signal from the QAM modulator front panel test point, the analog modulator front panel test point, the headend combiner output, or system amplifier test point. The CR1200 has a built in auto attenuator; extra attenuators is not necessary.

Connect RF to the CR1200 in the distribution system or at subscriber premises.

Use a signal from a system amplifier test point, tap or subscriber equipment. Check that subscriber equipment such as set-top tuners, televisions, and VCRs are not preventing the QAM signals from reaching the CR1200. Beware of sources of ingress and direct pick-up interference in subscriber equipment upstream and downstream from the CR1200 feed.

Connect to a serial printer for a printed log



Use a DB9 cable to connect the PRINTER/COMPUTER connector on the CR1200 to the input of a serial printer. The CR1200 acts as "Data Terminal Equipment." The PRINTER/COMPUTER output rate is 19,200, with 8-bit words, one stop bit, and no parity. The CR1200 does not perform flow control. Your serial printer must be able to print at this rate without overflow.

Connect to a computer serial port

Use a DB9 cable and a null modem adapter to connect the PRINTER/COMPUTER connector on the CR1200 to the serial port of a computer. The null modem adapter is needed because both the CR1200 and the computer are configured as "Data Terminal Equipment." You must have communication software on your computer that can manage serial communications and perform "text capture" operations. Set the computer to communicate at a speed of 19200, with 8-bit words, no parity, and one stop bit. The CR1200 does not perform flow control.

SETUP Button

The SETUP button takes the operator into the main screen where the basic configuration of the CR1200 is programmed and saved. Items to be modified are identifiable as light text in a dark field (the cursor). The F1 and F2 function keys are used to move to the next or previous field, respectively. The F3 function key moves deeper in the SETUP to the Channel Table Screens, and F4 saves the current configuration.

Set the Contrast

Use the F1 or F2 function keys to position the cursor on the contrast control. Use the knob to adjust the contrast from 0% (very light) to 100% (very dark). Adjust contrast to operator's preference.

Turn Speaker On/Off

Use the F1 or F2 function keys to position the cursor over the speaker control. The knob is used to control speaker on or off.

Backlight Control

Use the F1 or F2 function keys to position the cursor over the backlight control. The choices are ALWAYS ON and TIMER. The ALWAYS ON feature leaves the backlight on continuously, while the TIMER feature sets a 2 minute timer that will automatically shut the backlight off if no

buttons are pressed for 2 minutes. Caution should be taken if the backlight is set to ALWAYS ON, as this will discharge the internal battery sooner than using the CR1200 without the backlight.

Constellation Samples

The constellation display on the CR1200 clears and refreshes itself periodically. The rate at which the CR1200 refreshes the constellation display can be adjusted to refresh every 1024, 2048, 4096 or 8192 points, or it can be set to “dwell” mode which will never clear the display.

Set the Time

Use the F1 and F2 function keys to move left or right in the hour, minute and second fields. The knob is used to change each entry up or down. The CR1200 uses 24-hour time, so 9:00 AM is 09:00, and 9:00 PM is 21:00.

Set the Date

Use the F1 or F2 function keys to position the cursor (reverse text) over the month day and year fields. Use the knob to tune each entry.

Serial Port Speed

Use the F1 or F2 function keys to position the cursor on the serial speed control. Use the knob to vary the speed of the serial port from 300 BPS to 19200 BPS.

Serial Format

Use the F1 or F2 function keys to position the cursor over the serial format control. The recommended setting is 8 bits, no parity and 1 stop bit (8, n, 1). Other formats are available, use the knob to switch between them.

Channel Table Setup

The CR1200 QAM Monitor is designed to operate on standard, HRC or IRC Cable TV networks. In addition there are 3 user programmable custom plans that can be stored in memory. This allows the CR1200 to be used on separate networks with different channel plans without reprogramming the CR1200 each time.

Due to the nature of digital signal testing it is highly recommended that operator program a custom channel plan with the specific digital channels stored in memory. This will let the CR1200 tune between analog and

digital channels without additional input from the operator.

Copy Channel Table

The first step in creating a custom network plan is to copy the standard, HRC, or IRC channel plan into one of the 3 user tables. From the Main SETUP screen push the F3 function key to go into the Channel Table setup screen. Using the knob left or right highlight the channel plan in use (standard, HRC, or IRC). Pushing the F3 function key again takes the operator into the Copy section. The Copy Table screen indicates it is ready to copy FROM the plan just selected. Use the knob to select the User Table number desired and push the F1 Copy function key. This copies the desired plan into the selected User Table. Pushing the F5 function key (or ESCAPE) takes the operator up one level to the main channel table section.

Edit Channel Table

The Edit Channel screen allows the operator to select the modulation format for each channel on the network. The cursor is positioned on channel 2 as the default. The other defaults are:

Modulation: NTSC
Frequency Offset: 00.0 kHz
Active: YES

Use the knob to tune to the channel that should be edited. The F1 or F2 function keys move the cursor through the various fields to be modified. The choices for each field are:

Modulation: Choose from NTSC, 64 QAM, 256 QAM or Surfboard modem
Frequency Offset: Variable up or down in 62.5 kHz steps
Active: Yes or No

The frequency offset allows the operator to tune a channel to a specific frequency outside a standard plan. The Active feature allows the operator to tune a specific channel out so that the CR1200 passes over it in system scans.

It is necessary to push the F4 function key to save after any single channel

is modified. If the operator exits before F4 is pushed any changes made to a single channel will not be saved.

Channel Presets

The CR1200 can store up to 5 channels as favorites to get and overall indication of network performance. To program and store these channels push the F3 function key from the Channel Edit screen.

The Channel table currently in use is displayed at the top of the preset screen. Preset One is highlighted. Use the knob to tune to the desired channel. The channel, frequency and modulation type is displayed. This information is based on information obtained from the Channel Table Setup. After the 5 channels are programmed pushing the F4 function key will save the preset information. Pushing the F5 function key (or ESCAPE) takes the CR1200 to the Channel Table set up screen. Pushing the F5 function key (or ESCAPE) returns operator to the main SETUP screen, or operator can push one of the other main level buttons to perform analog or digital tests.

SLM Button

Pushing the SLM main level button on the CR1200 opens the main signal level test screen. Channel number, frequency and modulation formats are displayed at the top of the screen. On the right is a numerical indication of the video and audio level of the channel being tested. On the left is a graphical display of the channel being tested. The bar graph shows video and audio simultaneously; the delta video and audio measurement is also displayed.

If the channel being tested is a digital channel the average power, in dBmV, will be displayed. All other screen identifiers (channel, frequency etc.) remain the same.

There are 2 soft key function buttons active in the main SLM window. The F3 moves the operator into the 5 channel preset window and the F5 function key moves the operator into the force modulation window.

Five Channel Presets

If programmed previously, the 5 Channel Presets window displays the 5 favorite channels stored in the SETUP window. Frequencies are shown at the top of the bar graph and levels are shown on the bottom. The graph is shown at 5 dB per division, and the knob can be used to change the reference level so that the levels are not full screen. The ESCAPE key ends the test and takes operator up to the main SLM screen.

Change Modulation

The CR1200 can be force tuned to a digital channel from this screen. If operator tunes to a digital channel from the SLM window that has not been stored as a digital channel pushing the F5 function key opens the force modulation function keys. From here operator can force the CR1200 to demodulate current channel under test as a 64 QAM or 256 QAM signal for signal level tests.

SYSTEM

The SYSTEM feature on the CR1200 allows operator to scan the entire network and post the results in a graphics display.

The SYSTEM test begins automatically. It take a while to scan all carriers on a Cable TV network. After the scan is finished the knob can be used to move from channel to channel. Channel information is displayed in the Marker Data screen on the left of the display. Information about channel number, frequency, modulation format and levels are displayed

The knob may also be used to change the reference level of the screen in the SYSTEM test. Push the F1 function key – note the knob reference in the Marker Data box change to Knob: reference. This allows the CR1200 to plot the system information relative to the top of the display.

Data Logging Functions

Push the F2 function key to access the data logging functions on the CR1200 SYSTEM screen. Use the knob and enter key on the keypad to input the test name for the system test. Push the F5 function key to cancel the test. Push the F4 key to start the test. The CR1200 will scan the network again, and store the results in the log. When the scan is complete, the log shuts off automatically. The results of the log can be viewed in the USER screen.

SPECTRUM

Pushing the SPEC main level button brings up a 6 MHz spectral display of the single channel being tested, whether it is an analog or digital channel.

At the top of the display information such as channel and frequency are displayed. Reference level and marker data are visible on the left side of the display.

Knob Controls

The knob can be used to control the reference level and the marker. The F1 function key sets the knob to reference level, with 0.00 dBmV being full scale.

The F2 function key sets the knob as a marker. The marker can be scrolled across the full display and information such as frequency and levels are displayed on the text display at the left.

POP

The POP main level button sets up the CR1200 for timed proof of performance tests.

Timed Tests

The CR1200 will perform one analog level test every 6 hours and store the results for viewing later. The operator can set the CR1200 to perform the first of those tests at any time, either immediately, or at a point of time in the future. The CR1200 will either take the first set of measurements, store them and then go into a “snooze” mode, or it will snooze until time for the first test to begin. The CR1200 will then perform its first test, then power down until time for the second, third then fourth test.

To start a timed test use the knob to set the start time. The F1 and F2 function keys move to the next or previous field. Name the test using the knob and the enter key, and the F3 key starts the test. Use the ESCAPE key to end the timed test setup and move back up to the main POP screen.

DIGITAL

The DIGITAL main level button sets the CR1200 in digital mode for testing of 64 or 256 QAM digital signals. The CR1200 can only tune downstream ITU-T J.83 Annex B digital signals. Use of the CR1200 with any other digitally modulated signal will not register on the detectors of the CR1200.

Force QAM Modulation

If the CR1200 is in SLM mode, and is then tuned to a digital signal not programmed in the main SETUP screen the CR1200 opens up the force modulation screen. This allows the operator to quickly force the CR1200 to 64 QAM or 256 QAM signals. Push the F1 function key to force the CR1200 to demodulate the signal as a 64 QAM signal. The F2 function key forces the CR1200 to demodulate the signal as a 256 QAM signal.

Forward Error Correction Tests

After a forced modulation, or if the channel being tested was previously programmed as a digital signal, the main DIGITAL screen opens. The main digital screen is the forward error correction test and the modulation error ratio measurement. At the top of the display is information on the channel being tested. This includes channel number, frequency and modulation format. The forward error correction numbers (FEC) along with elapsed test time, errored and severely errored seconds and modulation error ratio are also displayed.

As the CR1200 starts its FEC tests the word "LOCKING" appears below the FEC numbers. This indicates that the CR1200 demodulator is attempting to acquire and "LOCK" onto the digital signal. No FEC information is available at this time. When the CR1200 acquires the digital signal this display changes to "LOCKED" and the CR1200 is now ready to perform FEC and all other digital tests.

NOTE: If the CR1200 does not "LOCK" to a digital signal it will not perform ANY digital test.

After the CR1200 locks on the digital carrier the FEC tests begin. The CR1200 interrogates the digital demodulator for information on the Reed/Solomon error correction codes to determine how many errors are being counted before the error correction codes are applied to the data stream (PRE-FEC) and how many errors remain in the stream after the error correction codes have been applied (POST-FEC).

NOTE: The CR1200 displays FEC information in Scientific Notation. Due to the incredibly large numbers associated with a digital signal Scientific Notation is used to show these numbers in a simplified manner. An easy example of this is one error for every 1,000,000 bits of data. Numerically this is 0.000001. In Scientific Notation this becomes 1.0 E-6.

While FEC error tests are running an elapsed timer shows how long that test has run. Errored and severely errored seconds are also displayed. An errored second is a point in time where the Pre-FEC rate is not zero (some errors are received). The FEC codes correct these errors and the Post-FEC remains at zero. A severely errored second is a point in time when the FEC codes are unable to correct all errors received and a possible impairment is passed through the set top box to a subscriber's television set.

The modulation error ratio measurement is displayed below the FEC measurements. Modulation error ratio (MER, also called signal-to-noise) is the measurement of the demodulated digital signal in the noise of its environment. In the CR1200 this measurement is based on constellation statistics and is the ratio of where a constellation dot actually plots versus where the dot is actually measured. This number, expressed in dB, is a useful measurement showing how much digital margin of your signal exists in your network.

Restart Test

Pushing the F1 function key at any time in the main DIGITAL screen will cause the CR1200 to re-lock on the digital signal and reset all counters to zero.

Constellation

The constellation is a graphic display of a QAM modulated digital signal. It can be used to show impairments in a network whether they come from noise, spikes, or irregular frequency translation. The shape of the constellation can provide many clues to the condition of the QAM signal. The MER is displayed on this screen, also.

From the main DIGITAL screen push the F2 function key. The text box on the right shows the same digital FEC tests from the main DIGITAL screen. Make sure that the signal is still "LOCKED". The graphic display on the left is the constellation. Each dot should always plot near, or on top of the dot before it. In a perfect signal the constellation would look like only 64 single points. Impairments on a network will cause the dots to spread in recognizable patterns, which can point to where in the network the impairment is. If the dots become too spread out bit errors become inevitable.

Constellation displays can indicate the presence of noise, phase distortion, compression, in-band spurs, or hum.

The F5 function key allows a “ZOOM” mode of one quadrant of the constellation. This allows the operator to see part of the constellation up close to aid in interpretation of the pattern formed by the symbols as they are plotted. Pushing the F5 function key again restores the constellation to standard mode.

The F4 function key can be used to restart the digital tests, if so desired.

The ESCAPE key takes the operator up to the main DIGITAL test screen.

Adaptive Equalizer

The adaptive equalizer is a feature of the digital demodulator that looks at reflections on a network and attempts to minimize their influence on a digital bit stream.

From the main DIGITAL screen push the F4 function key. This takes the CR1200 to the Adaptive Equalizer stress screen. An active stress test is constantly displayed. The Center Tap (large line to the immediate left of the full screen solid line) will be in the -10 to $+10$ range. All other lines should be well below the Center Tap line. Any other line but the Center Tap indicates a reflection in the network. The digital demodulator uses summing to minimize or reduce the reflection.

The ESCAPE key returns the operator to the main Digital screen.

Data Logging

From the main DIGITAL screen pushing the F5 function button takes the operator to the data-logging screen. Use the knob and enter keys to choose a name for the test. The F5 function key cancels the data-logging test and returns operator to the main DIGITAL screen. The F4 function key starts the log.

Data logging in the digital mode on the CR1200 stores events that cause either the errored or severely errored second timer to mark time. If an errored or severely errored second is reported, the time and Signal-to-Noise measurements for that second are stored in the log. Pushing the F4 function key stops and closes the log. Results are available for viewing in the USER section.

USER

The USER main level button takes the operator to the data logs and battery management screens. From here the operator can view or print

stored results, or delete the entire data log. The operator can also check the condition of the battery for DC operation, and determine the amount of memory available in the log.

Data Logging Functions

From the main USER screen the F1 function key opens the data log screen. A list on the screen indicates the type, date, time and name of any tests in the log. Use the knob or the F1 and F2 function keys to scroll between these tests.

The F3 function key allows operator to view the test selected on the CR1200 display. The ESCAPE key returns operator to the main USER screen.

The F4 function key sends highlighted test to a serial printer.

The F5 function key takes the operator further into the data log.

The F1 sends all tests in the log to a serial printer.

WARNING

The F2 function key erases ALL tests in the log. There is no warning screen. CAUTION! ALL tests will be deleted! DO NOT PRESS THIS KEY UNTIL ALL DATA HAS BEEN PRINTED OR IT WILL BE LOST!

CHAPTER 4 SPECIFICATIONS

INTRODUCTION

This section contains the specifications for the Hukk Engineering Model CR1200 QAM Monitor.

SPECIFICATIONS*

DIGITAL SIGNAL ANALYSIS

Modulation

Modulation Type: ITU-T J.83 Annex B 64-/256-QAM

Lock Range: -20 to +50 dBmV at 64 QAM

Lock Range: -15 to +50 dBmV at 256 QAM

Modulation Error Ratio**

Range: 21 to 35 dB

Accuracy: ± 2.0 dB

Digital Signal Level Meter**

Accuracy: ± 2.0 dB (typical) @ 25° C

Graphic Displays

Constellation: I-Q display of 64 or 256-QAM signal

Spectral display: Input spectrum reflecting digital signals

Equalizer: Display of adaptive equalizer taps

Signal-to-Noise: Numeric and graphic display of SNR measurement

BER (Pre- and Post-FEC)

Range: 1.0×10^{-9} to 1.0×10^{-3}

Pattern Sync: Loss/Lock-indication

Errored Seconds: 0 to 99,999

Severe Seconds: 0 to 99,999

ANALOG SIGNAL ANALYSIS

Modulation

Modulation Type: VSB (NTSC)

Operation Range: -15 to +50 dBmV

Measurements**

Field Strength Meter: video and audio measurement

Video/Audio delta measurement
Amplitude: -15 to +50 dBmV
Accuracy: ± 1.5 dB (typical) @ 25° C

Graphic Displays

Numeric and graphic display of single channel analog measurements
Numeric and graphic display of 5 favorite channel presets
Numeric and graphic display of entire cable TV network

System Features

Electrical

Tuning Range: 50-800 MHz
Input Resistance: 75 ohms (nominal)
RF Input: F81 connector (field replaceable)
Serial Interface: EIA RS-232

Physical

Approx. size: 10.75"W x 9.75"D x 5"H
Weight: <10 pounds
Temperature: 0° C - 50° C

Power

Power: Internal battery pack
External Power: 120V AC adapter/charger or DC power cord
Operating Time: 3 hours (nominal)

Additional Features

General

Display: LCD with backlight
Frequency Plans: NTSC STD., IRC, HRC
Power Reduction: Auto unit shut down
Elapsed Time: hr, min, sec
Store/Recall: All data and graphs
Printouts: RS-232 to computer

* Hukk Engineering reserves the right to change any or all specifications without notice.

Model CRI200 Digital Signal Analyzer

** All digital measurements are for individual channels with power levels between -20 and +50 dBmV over specified temperature range. All analog measurements are for individual channels with power levels between -15 and +50 dBmV over specified temperature range.

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CHAPTER 5 OPTIONS AND ACCESSORIES

INTRODUCTION

This chapter describes the options and accessories that are available for use with the Hukk Engineering Model CR1200 QAM Monitor.

OPTIONS

Case Color: Choice of yellow (standard) or black
Strand Mount Hooks

ACCESSORIES

115 VAC power adapter

Output voltage: 13.5 volts DC

Output current: 1.5 amp maximum.

F to F female adapter

CHAPTER 6 MAINTENANCE AND SERVICE

INTRODUCTION

This section contains information on maintenance and service for the Hukk Engineering Model CR1200 QAM Monitor.

MAINTENANCE

Internal rechargeable lead battery

Recharge the CR1200 before and after each field use. As often as possible, power the CR1200 with the supplied AC adapter when the unit is turned off and not in use. This allows an internal control circuit to maintain an optimum standby charge voltage on the battery to maximize its shelf and operating life. Avoid deep discharge of the battery. The lead battery is not user-replaceable.

NOTE: Open the PURGE valve near the carrying handle while recharging the battery. Turn the PURGE knob counterclockwise two complete turns. Use only the supplied AC adapter to recharge the CR1200. Incorrect polarity or voltage could damage the CR1200 or internal battery.

Cleaning

Clean the CR1200 with a soft cloth moistened with water. Use a small amount of mild soap if necessary. Do not apply abrasive or chemical cleaners. These may damage the plastic finishes on the case, keypad, or display windows.

Internal lithium battery

The CR1200 uses a lithium battery to maintain the internal clock and non-volatile memory. The lithium battery supports these low-power circuits when the CR1200 power is turned off, and through the charge/discharge cycles of the lead battery. The lithium battery is designed to last the

lifetime of the CR1200, and is not user-replaceable.

TROUBLESHOOTING

If the CR1200 fails to operate and no front panel indicators are illuminated, the internal lead battery may be discharged. Use the supplied AC adapter to power the unit and recharge the battery. If the failure persists while using the AC adapter, call Hukk Engineering for service.

If the internal battery fails to recharge, verify that the AC adapter is actually sending power to the CR1200. Plug the AC adapter into the CR1200 RECHARGE input, then connect the AC adapter to the 115VAC source. Turn the CR1200 on. If the internal battery fails to recharge, but the AC adapter delivers power to the CR1200, the battery may be deeply discharged or damaged. A deep discharge requires a longer charge time. If the battery is not restored to normal operation by an eight-hour recharge, call Hukk Engineering for service.

If the CR1200 fails to maintain the date and time, or loses all data from the optional log memory, the internal lithium battery may have failed. Call Hukk Engineering for service.

If the CR1200 fails to detect QAM carriers, or if the unit won't lock to carriers when using the "force modulation" mode, check the RF input power level. The CR1200 can be overloaded by excess power at the input. The resulting signal distortion impairs the ability of the CR1200 to detect and identify QAM signals.

SERVICE

Warranty

Hukk Engineering warrants the Hukk Engineering Model CR1200 QAM Monitor and supplied accessories against defects in materials and workmanship for a period of one year from receipt by the customer. During the warranty period, Hukk Engineering will, at its option, repair or replace defective products. Liability under this warranty extends only to the replacement value of the equipment.

Model CR1200 Digital Signal Analyzer

This warranty does not apply under the following conditions:

The CR1200 or its accessories have been partially or fully disassembled, or altered or repaired by persons not authorized by Hukk Engineering, Inc. to do such work.

The CR1200 is installed or operated other than in accordance with instructions contained in its operating manual.

No other warranty is expressed or implied. Hukk is not liable for consequential damages.

Returning equipment

Before returning any equipment, call Hukk Engineering to obtain a Return Authorization number. Indicate the Return Authorization number on all correspondence.

Pack the equipment securely in its original shipping material. Mark the Return Authorization number clearly on the outside of the shipping container. If the original container is not available, pack the equipment in materials sufficient to avoid damage in transit. Hukk Engineering is not liable for damage that occurs during shipping. Return equipment to Hukk Engineering with shipping prepaid.

Attach the following information to all equipment returned for repair:

- Owner's name and address.
- A list of the equipment being returned and the applicable serial number(s).
- A detailed description of the problem, or service requested.
- The name and telephone number of the person to contact regarding questions about the repair.

TO CONTACT HUKK ENGINEERING

Call Hukk Engineering between the hours of 9 AM and 5 PM Eastern Time at (770)-446-6086. Send correspondence to:

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