OPERATIONAL DESCRIPTION

NV8600E/V TRANSMITTER FAMILY

NV8602E/V 1.4-KILOWATT TRANSMITTER
NV8603E/V 2.0-KILOWATT TRANSMITTER
NV8604E/V 2.7-KILOWATT TRANSMITTER
NV8605E/V 3.3-KILOWATT TRANSMITTER
NV8606E/V 3.9-KILOWATT TRANSMITTER
NV8608E/V 5.2-KILOWATT TRANSMITTER
NV8610E/V 6.4-KILOWATT TRANSMITTER

NV8600 Transmitter Operational Description/Functional Overview

Following is a brief operational/functional discussion of the NV8600 series transmitter. A much more detailed description may be found in the Exhibit *NV8610 System Manual* and in the Exhibits: *SV800 MediaFLO Exciter Instrument Manual* , *NetCCU 800 Instrument Manual* , *VH8600A1 Power Amplifier Instrument Manual* and *ZK810 Pump System Manual.*

Overview:

For the sake of this discussion the NV8600 transmitter may be sub-divided into several parts. Electrically they are signal generation, signal amplification, passive output combining and spurious suppression. Mechanically is the coolant circulation system, the heat exchanger and the cabinetry.

Signal Generation:

The "heart" of the NV8600-series transmitter line is the SV800 exciter. Using state-of-the-art technology, the multiformat-capable SV800 exciter synthesises the desired RF output (carrier) frequency in either the VHF or UHF television bands. The operating frequency is selectable "in the field" at the time the unit is installed. The internal synthesiser references either an internal TXCO oscillator or an external reference input. In addition to the external frequency source it is also capable of accepting an external 1 pulse-per-second signal for synchronized operation in single-frequency networks.

The SV800 exciter accepts two appropriate transport streams, selecting either one with an internal switcher. The switcher may be configured to automatically switch to the alternate input should the transport stream on the active input fail. The exciter fully processes the incoming transport stream and modulates the carrier with that information in the appropriate output format.

The RF output from the exciter is "on carrier", requiring no external frequency conversion. The output level, a nominal +13-dBm for digital standards, is tightly controlled by an internal automatic-gain-control circuit resulting in a very stable RF output level. In addition, the exciter has available an optional group delay correction system that monitors the RF output of the transmitter, both after the final amplifier stages, and after the channel "mask" filter. The circuitry "pre-distorts" the exciter's RF output to compensate for non-linear distortions of the power amplifiers and the linear distortions of the channel "mask" filter. Both non-linear and linear corrections may be accomplished either manually, or automatically on a continuous basis, at the discretion of the end user.

Mechanically the exciter is comprised of four modules: the input interface, the Mainboard, the RF interface and the power supply. The four modules, and supporting hardware, are packaged in a single 1 rack-unit case.

Signal Amplification and Filtering:

The RF output of the exciter connects to a passive, electrically-operated coaxial transfer switch that is used to select between the main and alternate main exciters in the "V" version of the transmitter. The output of that switcher then connects to a passive, ten-output power divider. (In the case of the single exciter

"E" configurations the RF output will be connected directly to the power divider, omitting the switch). In the NV8610 the outputs of that power divider branch to feed the ten VH8600A1 power amplifiers in the transmitter cabinet (Lower power transmitter models require fewer power amplifiers.)

Each power amplifier accepts an input of around 1-milliwatt and amplifies it to approximately 640-watts. The output of each amplifier feeds into a model-appropriate (having the correct number or inputs) passive power combiner to combine the power from all of the amplifiers into one output terminal. Optimum power combining is assured by precision machining of components in the output combiner and careful manufacturing of the cables that feed the amplifier inputs. Adjustments in level and phase are also possible for each individual power amplifier via the transmitter control system if such adjustments are required for optimum performance.

Each power amplifier is housed in a three rack-unit enclosure that slides into the transmitter cabinet from the front. All connections, electrical and coolant, are "made" when the unit is inserted fully into the self-aligning backplane of the cabinet.

The output of the power combiner is connected to a precision directional coupler through a low pass (harmonics) filter and then to an output connector. The precision directional coupler also contains a lightning protection device of proprietary design.

Transmitter Control System:

Central to the control of the transmitter is the NetCCU 800. This device coordinates communications between all of the various components in the transmitter and the outside world. Full monitoring and control is available via the unit's front panel color LCD display and its front panel keypad. Password-protected control is also available via a WEB browser interface from the front panel Ethernet connector while its in "Local" mode and at its rear panel Ethernet connector when its not in "Local" mode. WEB browser based monitoring capability is always available at both ports. In addition a optional SNMP server program is available for customized IP based monitoring and control.

At the highest level "ON" and "OFF" control and forward and reflected power readings are available, and all that are required to operate and monitor the transmitter. At deeper, password-protected levels monitoring and control is possible down to the individual transistor level in the power amplifiers and exciters.

Communication between the NetCCU 800 and the one or two exciters in the system is via TCP/IP connection. For control and monitoring of the power amplifiers, coolant pump system and heat exchanger a CAN bus is utilized via a "rack controller". The afore described exciter switcher is controlled directly from the NetCCU 800. An optional parallel interface is also available to allow connection to "legacy" remote control systems.

Transmitter Power Distribution:

The NV8600 series of transmitters has an AC power distribution system located at the bottom of the transmitter cabinet. 400/231-volt three-phase AC "Mains" power is brought in to the transmitter through a master disconnect switch located on the left side of the power distribution panel. From this disconnect switch the power branches out to up to ten motor-controller type circuit protectors that, in turn, feed up to ten power amplifiers to provide individual circuit protection and disconnect capability. Power is also routed to standard single-phase circuit breakers that provide protection and disconnect capability for the subsystems in the transmitter such as the exciters, the NetCCU, the pump system and the heat exchanger. The power distribution is designed such that when the electrical distribution's front panel in in place there are no exposed power conductors anywhere in the transmitter. That front panel cannot practically be removed without opening the master disconnect switch.

Transmitter Cooling:

The NV8600-series transmitters are primarily cooled by the circulation of a liquid coolant in a sealed, closed-loop system through the individual power amplifiers and on to a liquid-to-air heat exchanger. (A liquid-to-liquid heat exchanger system is also possible for installations that have no physical space to install the liquid-to-air heat exchanger but do have an available source of "chilled" water.) The coolant of choice is automotive-type, long-life antifreeze (Chevron Texaco Dexcool, or equivalent) and water in a 50/50 mixture. Circulation of the coolant is accomplished by a stand-alone dual pump system. Cooling system efficiency, and consequently overall transmitter efficiency, is enhanced by closely monitoring system temperatures and varying coolant pump speeds and heat exchanger fan speeds to maintain as constant an operating temperature as possible. Items that are not cooled by the liquid circuit, such as the exciters and the NetCCU, make a very modest contribution to the total waste heat from the transmitter. This system dramatically reduces the heat loading in the transmitter's physical location and further reduces operating costs by minimizing or eliminating additional air conditioning requirements.

Transmitter Cabinetry:

Each model of the NV8600-series transmitter is housed in a single, robust cabinet constructed of steel. The cabinet is only slightly larger than a standard equipment rack.

The pump system is assembled on a free-standing frame of stainless steel construction. The unit may be floor mounted or wall mounted.

The heat exchanger is of stainless steel construction for outdoor installation. Its design is such that it can be mounted with either a horizontal or a vertical airflow.