CORNELL MODEL NC-102D – FUNCTIONAL DESCRIPTION

The purpose of this document is to aid the Installer, Service Person, or Designer in understanding the purpose and function of the NC-102D Controller within a Cornell Nurse Call System.

OVERVIEW:

The NC-102D Controller is the functional core of a dual or triple-status Nurse Call System. It is normally used in conjunction with Cornell 4000-Series and 4500-Series Dual Status products.

The NC-102D controls Audible & Visible indication of the different call priorities within a system.

Audible Indication – The NC-102D ensures that only the highest priority that is present is audibly indicated at sounders, that are built into the Annunciators and Duty Stations.

Visible Indication – The NC-102D generates the different flash rates that are used to indicate the various call priorities via Annunciator and Duty Station LEDs and Dome Lights/Zone Lights.

Cornell 4000 and 4500-Series Nurse Call Systems utilize a "Common Positive" wiring/operation scheme – this means that one side of every device (Stations with LEDs or Electronic Latching, Dome Lamps, Annunciators, Sounders, etc.) is tied to the Positive side of the 24-Volt System Power Supply. Indication and Control functions are accomplished by switching the Negative side of the system.

CALL PRIORITIES:

The NC-102D has the capability to identify and differentiate between 3 types of Cornell-Defined system calls. The 3 types of calls, and their letter designations are described as follows:

PRIORITY-1 [HIGH] (LETTER DESIGNATION = "P" PRIORITY)
This type of call has the highest priority status, and is usually used for Dwelling Unit Smoke Detectors, Code Call Stations, or "Panic" Alarms.

Audible Indication = 2 Pulses per second, Rapid Pulse (2Hz – 50% duty cycle)
Visible Indication = 2 Flashes per second, Rapid Pulse (2Hz – 50% duty cycle)

PRIORITY-2 [MIDDLE] (LETTER DESIGNATION = "F" FLASH)
This type of call has middle priority status, and is usually used for Bathroom (Pull-String) Stations.

Audible Indication = 1 Pulse per second, Slow Pulse (1Hz – 50% duty cycle)
Visible Indication = 1 Flash per second, Slow Pulse (1Hz – 50% duty cycle)

PRIORITY-3 [LOW] (LETTER DESIGNATION = "S" STEADY)
This type of call has the lowest priority status, and is usually used for Routine calls from Bedside (Call Cord) Stations.

Audible Indication = 1 Pulse every 6 seconds (Slow Pulse (1Hz – 50% duty cycle)
Visible Indication = 2 Flash per second, Slow Pulse (1Hz – 50% duty cycle)

CALL SENSING:

Three Current-Sensing Outputs are incorporated into each NC-102D Controller – One for each Priority Condition, and designated by letters as defined above:

- "P" Current-Sensing Output for High-Priority Calls, and their associated Stations
- "F" Current-Sensing Output for Mid-Priority Calls, and their associated Stations
- "S" Current-Sensing Output for Low-Priority Calls, and their associated Stations

Each of these Current-Sensing Outputs performs both an Output and an Input function, as follows:

OUTPUT FUNCTION – SIGNAL GENERATOR
Each Station used within the associated Nurse Call System derives Negative 24-Volt Power from one of the Current-Sensing Outputs. Each Current-Sensing Output also provides a Signal-Generator function, which affects operation of the LEDs and Lamps associated with it:

- "P" (PRIORITY) OUTPUT
  - Associated Stations = Smoke Detectors, Panic Alarms, or Code Blue Stations
  - Signal-Generator = Lights & LEDs fed via this Output will Fast Flash at 2 Hz.
- "F" (FLASH) OUTPUT
  - Associated Stations = Bathroom (Pull-Cord) Stations
  - Signal-Generator = Lights & LEDs fed via this Output will Slow Flash at 1 Hz.
- "S" (STEADY) OUTPUT
  - Associated Stations = Bedside Patient (Call-Cord) Stations
  - Signal-Generator = Lights & LEDs fed via this Output will illuminate Steadily.

INPUT FUNCTION – CURRENT SENSING:
Each Current-Sensing Output has the capability to continuously monitor the amount of current that is drawn from it. All other functions of the NC-102D depend upon this function.

- When no Stations or a particular type are actuated, little or no current will be drawn from the associated Current-Sensing Output. This is defined as the "Idle" state.
- Whenever a Station or Detector is actuated, a measurable increase in current will be detected via the associated Current-Sensing Output. This is defined as the "Active" state.
- In order to be sensed as "Active", a minimum amount of current needs to be drawn from each Current-Sensing Output. This is defined as the "Minimum Trigger Current".
- Lastly, certain types of devices, when connected to the system, will cause a small amount of current to be continuously drawn from the Current-Sensing Outputs that are used within the system. This situation will be referred to as "Idle Current". In order to ignore such Idle Current loads, a Calibration function has been designed into the NC-102D.

VISIBLE INDICATION

On Nurse Call Systems that are equipped with NC-102D Controllers, Visible Indication is accomplished via Annunciator LEDs and via Corridor Dome Lamps and Zone Lamps.

- For Most Annunciators, a single LED will be provided for each room, which illuminates according to the Signal Generator Output Functions, as described above (Steady, Slow Flash, or Fast Flash). Proper operation of these LEDs depends upon the stations being properly interconnected, as shown in the proper "typical" dual or triple-status Cornell Wiring Diagrams.
- Where Single Corridor Dome Lamps are used, they are usually interconnected to the same circuits that drive the Annunciator LEDs, and behave in the same manner.
- Where Multi-Lamp Corridor Dome Lamps and Zone Lamps are used, they are usually wired such that a separate lamp, sometimes color-coded, is utilized for each status condition being used. In this case, multiple status conditions can be indicated simultaneously.
- Additional Visible Indication Outputs are provided for use in conjunction with Duty Stations. These are intended to cover the particular combination of priorities present in each system.

AUDIBLE INDICATION SCHEME

On Nurse Call Systems that are equipped with NC-102D Controllers, Audible Indication is accomplished via Piezo Sounders or Tone-Boards that are built into Annunciators and Duty Stations.

The NC-102D contains several Outputs and Inputs that are intended for Audible Indication Functions. Actuation of these outputs depends upon calls sensed via the Current-Sensing Outputs.

The NC-102D simultaneously monitors all three of the Current-Sensing Outputs. Based upon internal control logic functions, the Audible Output Circuits only respond to the highest priority status condition that is present at any given time:

- The "P" (Priority) Audible Output Function will take precedence over any "F" or "S" Audible Output Functions. This occurs:
    - Whenever the "P" Current-Sensing Output is Active, regardless of any other Current-Sensing Output.
- The "F" (Flash) Audible Output Function will take precedence over any "S" Audible Output Function. This occurs:
    - Whenever the "P" Current-Sensing Output is Idle AND
    - When the "F" Current-Sensing Output is Active, regardless of the state of the "S" Current-Sensing Output.
- The "S" (Steady) Audible Output Function will occur only when Type "S" calls are the only calls present on the system. This can only occur:
    - Whenever the "P" Current-Sensing Output is Idle AND
    - Whenever the "F" Current-Sensing Output is Idle AND
    - When the "S" Current-Sensing Output is Active
- Audible Output Functions will be automatically Silenced:
    - Only when ALL 3 Current-Sensing Outputs are Idle
- Audible Output Functions automatically Escalate as higher-priority calls are sensed, and De-Escalate as higher-priority calls are cleared, according to this priority scheme.

NON-MUTABLE AUDIBLE OUTPUTS:

Non-Mutable Audible Outputs operate in strict accordance with the Audible Indication Scheme outlined above. Sounders that are connected to Non-Mutable Audible Outputs will continue to produce Audible Signal Sounds until ALL Current-Sensing Outputs are Idle.

MUTABLE AUDIBLE OUTPUTS:

Mutable Audible Outputs operate in the same manner as Non-Mutable Audible Outputs, with the following exceptions:

- Associated "Mute" Inputs are provided, in order to permit operation of the Muting feature.
- Whenever a "Mute" Input is momentarily actuated, the associated Mutable Output will be silenced.
- The Mutable Output will automatically re-sound whenever a New Call occurs (whenever the current draw sensed by ANY Current-Sensing Output increases measurably).
- The "Mute" feature IS NOT currently utilized on any "standard" Cornell Nurse Call products.

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CALIBRATION FEATURE:

The NC102D has been equipped with a feature that allows the system to ignore any idle current devices connected to the system. An idle current device is defined as any component connected to an "S", "F", or "P" Current-Sensing Output, which requires a current draw in order to operate in a deactivated state.

EXAMPLE – CORNELL ZONE LIGHT

The Z-103 senses current in the circuits that feed the portion of the system that it serves. In order to perform this function, it requires a small amount of current to operate its internal sensing circuits – even when none of its associated lamps are illuminated.

Without the calibration procedure, the Idle Current required by one or more such Zone Lights may be sensed by the Current-Sensing Outputs – which would create false call indication.

Once it is calibrated, the NC-102D that serves this system will disregard the idle current caused by such devices, and will then operate as follows:

(Idle Current) + (Trigger Current) = Indicate call for increase due to Trigger Current

Refer to the "Cornell Model NC-102D – Calibration Procedure" for more detailed information.

DIAGNOSTIC FEATURES:

In order to aid the installer or service personnel in installation and troubleshooting, the NC-102D incorporates the following diagnostic features:

- LED Indicators are provided, aligned with the Terminal Strip, which indicate the Active State of the associated Inputs and Outputs.
- The NC102D also has a full RS232 diagnostic screen output for system troubleshooting. This feature is reserved for internal use by Cornell Communications, Inc., and for particular custom configurations.