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Communication Node Model C201 Users Manual

Strata CommTrac Wireless Tracking and Communication System

Version 1.0 - June 1, 2011

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1. Overview

1. 1. Theory of Operation

Strata CommTrac is a completely wireless mesh tracking and communication network which has been specifically designed for use in underground mining operations. The mesh network is composed of underground CommTrac Communication Nodes which facilitate the passing of location information and communication from wireless mobile devices to the surface or above-ground environment.

1. 2. Frequency of Operation

The CommTrac Communication Node model C201 operates at a frequency of 915MHz MHz ISM band.

1. 3. Approvals

1.3.1. MSHA Approval

The MSHA Approval number is **23-A100008-0**

1.3.2. Pennsylvania Approval

The Pennsylvania approval number is **BFE 28-11**

1. 4. Label Information

The CommTrac C201 label is located on the front center of the unit.

Label Summary:

Defines battery requirements.
Defines MSHA determinate minimum safe blast distance.
Designates a surface location if hardwired.
Designates that the C201 must not be mounted to equipment.

(See label on next page)

1.4.1. Approved Blasting Distances.

MSHA
MSHA approval requires that a minimum of 40 inches shall be maintained between the CommTrac Model C201 Communication Node and any blasting circuits, explosives ordetonators.

Pennsylvania
Pennsylvania approval requires that the CommTrac Model C201 must be installed at a minimum safe distance of 17 feet from blasting circuits, explosives, and detonators.

Note: Pennsylvania generates such requirements by multiplying the MSHA determined minimum distance of 40" by a factor of 5.

1. 5. FCC Information

The FCC ID for the C201 is Y68C201. When configured by Strata for above-ground use, the device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions: (1) This device may not cause harmful interference. (2) This device must accept any interference received including interference that may cause undesired operation.

Any intentional or unintentional changes or modifications to the configuration of the Communication Node not specifically detailed in this document, could void the user's authority to operate the equipement.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against

harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
-- Reorient or relocate the receiving antenna.
-- Increase the separation between the equipment and receiver.
-- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
-- Consult the dealer or an experienced radio/TV technician for help.

2. Installation Information

Gateway Node

A C201 functions as a gateway node on the surface. This gateway node is the link between the C201 wireless communication node network underground and the system server at the surface.

Surface network

CommTrac C201 Communication nodes can function on the surface to relay information between a portal and the gateway node when configured for FCC compliant operation.

Underground Installation

The C201 is intrinsically safe for methane environments. It is recommended that the underground C201 installation occur after the surface installation is complete and gateway node is operational. This enables the wireless network to be established as the installation progresses. Installers should be aware of and maintain approved blast distances defined in Sec.1.4.1 of this document.

Mine characteristics dictate distance that will be attainable between the C201 units.
Larger distances are generally achieved in entries that are straight and open versus entries that lack line of sight, are partially obstructed, or contain equipment such as belt structure. Other factor which will impact distance between nodes are width of entry, seam height, entry dips and rises and existence of standing water. In a typical 6ft or height coal seam, the distance between Communication Nodes is approximately 800 to 1500ft. In low coal or entries with many dips and rises, the distance is reduced to approximately 500-1000ft.

Distance is also reduced when signal C201 nodes are on opposite sides of barriers or stoppings.

**Typical signal attenuation through material

Hollow block wall	5 - 10 dB signal loss
Metal doors and stoppings	25+ dB signal loss
Metal stoppings with doors open or plexiglass inserts	10 dB sigal loss

Preliminary Plan
Prior to beginning installation, a preliminary installation plan should be realized/developed.

Installers should have with them:
- Knowledge of mine and preliminary placement plan
- C201Communication Nodes
- Batteries
- Screw Driver
- Map of mine or paper to record placement
- Pen
- C201 installation bags

All required safety equipment
- Be qualified to be in the environment.
- May need stepladder

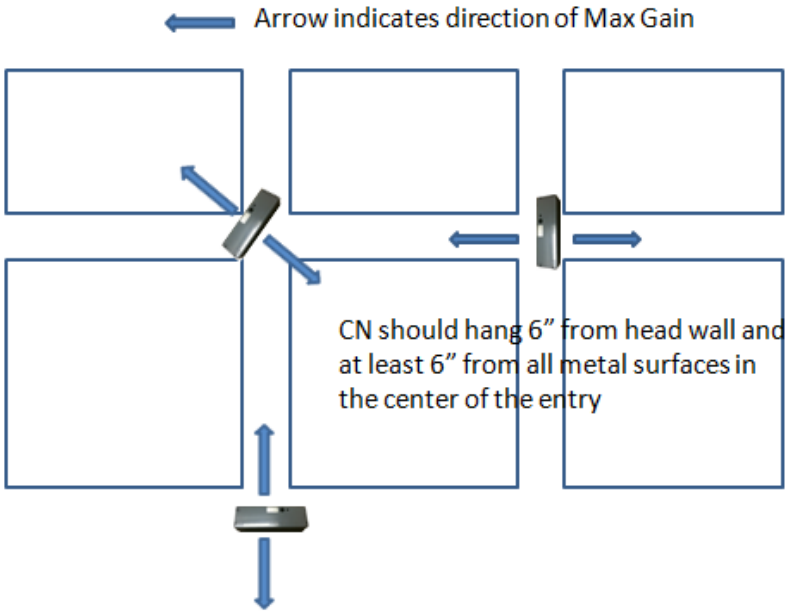
Physical Installation
Strata CommTrac installation bags are available to hold and suspend the C201 communication nodes from the entry roof. The bags have adjustable straps and clips to attach them to hardware present in the mine. The bags include a clear window to enable visibility of C201 LED while installed. Bag opening must be confirmed closed properly upon installation.

Note: See additional image on next page.

Placement Considerations
Each C201 should hang at least 6" from the roof and from metal surfaces in the center of the entry and be placed to avoid being struck by passing personnel or equipment.

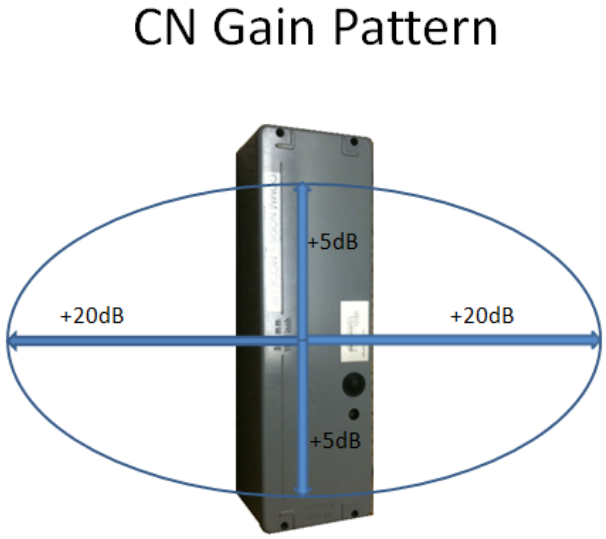
The C201 communication node should be oriented with its long axis perpendicular to the entry to achieve greatest communication distance.

Placement Example:



CommTrac C201 Gain Pattern

Signal gain pattern is approximately 15dB less from the short axis of the C201 versus from the long axis of the unit.



Parallel Entries
If C201 nodes are being installed in parallel entries, a laddered method is suggested. Therefore when C201 nodes are placed in parallel entries, it is desirable to have them positioned adjacent to each other or in the same cross, while in each respected entry. This, in most cases, provides additional redundancy in routing data from the mine.

Determining Placement Location
The suggested technique is to utilize a C202 Miner Communicator to sample signal strengths between a proposed C201 installation location and the C201 communication nodes already installed.

The C202 Miner Communicator will display the serial number and signal strength of each C201 communication node it hears.

The installer should maintain awareness of the next outby installed C201's serial number. The next C201 should be placed, based on signal strength between the proposed installation location and the next outby communication node.

To use a C202 Miner Communicator for this C201 placement enter the receive signal strength Menu.

To enter receive signal strength Menu-

Press "1" & down arrow at the same time
Information will display including the number nodes heard.

Press the "2" button to get more information

Serial numbers will be displayed with the corresponding signal strength (receive signal strength) adjacent to them.

Press "2" again to see more or "3" to back.

Signal strength should be measured to obtain the desired receive signal strength signal strength level to the next outby C201. Signal Strength (receive signal strength) guideline for node placement is below.

Desired signal	-60 to -75
Placement is too close	-0 to -60

Placement is too far apart -75 to -99

Record Placement Location
As each C201 node is deployed it's serial number and exact location must be recorded on a map or other hard copy document. This will be used to place the C201 on the map within the Strata Commtrac system when back on the surface.

Powering on C201
Each C201 should not be powered on until it has reached its installation location. Insertion of batteries powers on the C201. (Refer to Sec. 3 Battery Installation)

3. Battery Installation

Batteries authorized for use in the C201 by MSHA are Energizer E-95 (Retail Store Product) and EN95 (Industrial Product) only. The batteries have been determined by themselves to be intrinsically safe. The C201 has been determined to also be intrinsically safe even with the battery exterior cover removed. Therefore batteries can be changed in the area where the C201 is installed.

Battery Installation Process.

Place the C201 on a safe surface.

Remove the four Screws from the cover.
Note: The screws will not fall out of the lid by design.

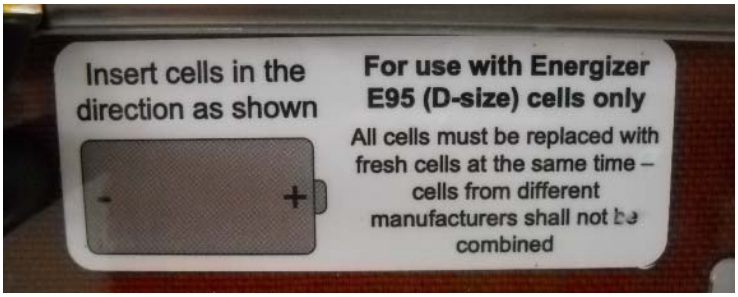
A small no conductive tool is within the C201 enclosure to ease insertion of batteries.

Grasp the battery tube and pull outward.

Remove the four (4) D cell batteries from the tube, if present, and dispose of properly.

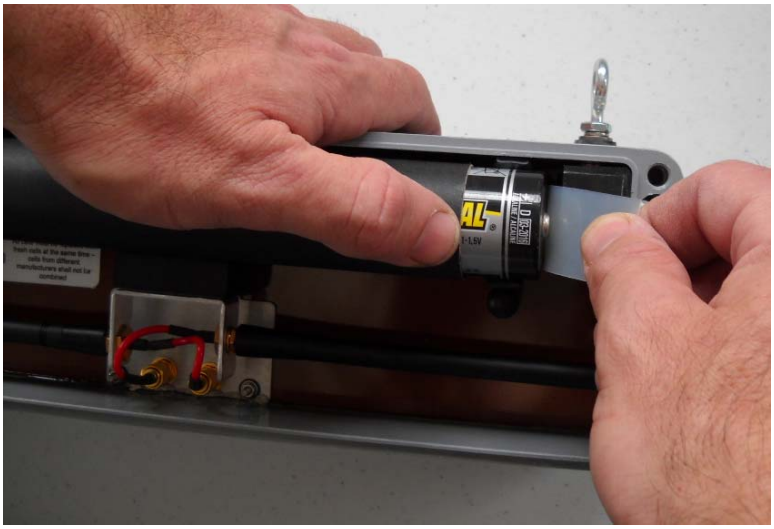
Insert four new EN95 or E95 D-cell batteries into the tube, orient all in the same direction.

A label is in the unit to indicate battery direction.
Note: E95 and EN95 are equivalent and acceptable



Place the Negative side of the battery tube into the battery compartment.

Use the supplied non-conductive tool to guide the positive end of the battery tube into position.



Remove the guide tool from between the battery and contact. This powers on the C201.
If batteries are being installed in a storage or staging area, leave the guide tool in place so that the C201 is not powered on. The C201 is not to be powered on until it is at its installation location.

The guide tool should remain within the C201 enclosure for future use.

Replace the cover with the dense battery support pad located on the inner surface of the cover over the battery side of the C201.

Hand tighten the screws with a screw driver. Do not over tighten.

4. Reset Button

A button is located on the front of the C201 and has two functions, Reset and Signal Sample.

Samples Signal Strength

To utilize this feature, press the button and release it, without holding the button in.
The LED light near the button will then indicate signal strength to its parent node. (See Sec.5 LED) A parent node is the C201 communication node that a particular C201 is communicating with to send data out of the mine.

This feature is not the recommended method to utilize for C201 placement, as the C201 does not indicated which specific C201 it is communicating with. It may not always be an indication of the next outby C201. It is recommended that a C202 Miner Communicator is utilized for communication node placement purposes.(See installation section 2)

Reset

This feature enables resetting the C201 by pressing and holding the reset button for at least 6 seconds. The C201 will then reset and join the network if functioning and placed properly.

The Communcation Node is designed to never need to be reset. There may exist a need to reset the Communication Node if the LED is on constantly or the has failed to send in reports.

5. LED

The LED is located on the front of the C201 near the reset button. The LED activity is an indication of signal strength or lack thereof. The LED is activated by pressing and releasing the reset button (Refer to Sec 4.)

LED Activity description:

Solid for 60 seconds
No Parent found. This indicates that the C201 is not communicating with any other C201

One Flash
This indicates a signal strength receive signal strength of less than -82
Signal is weak and indicates C201 is too far from its parent.

Two Flashes
This indicates a signal strength receive signal strength of between -82 and -60
Signal is in the desirable range. Position is adequate

Three Flashes
This indicates a signal strength receive signal strength of greater than -60
Signal strength is too strong. the C201 is too close to its parent

This is not the recommended method to utilize for C201 placement, as the C201 does not indicated which C201 it is communicating with. It may not always be an indication of the next outby C201. It is recommended that a C202 Miner Communicator is utilized for placement purposes.(See installation section 2)

6. External Connectors

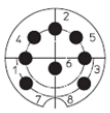
The C201 provides a connectivity port on the front of the unit. It enables communication with other components such as a Strata CommTrac transponder on the surface. It provides a connection for external power (surface) or for alternative network connectivity. This port also may be used for software updates.

6. 1. RS232 Pin Out

The pin out for the Communication Node connector is presented below. Note that the pin out is as viewed from the solder side of the connector

Lumberg and RS232 DB9 Pin Out

Pin Configuration
Solder Side View

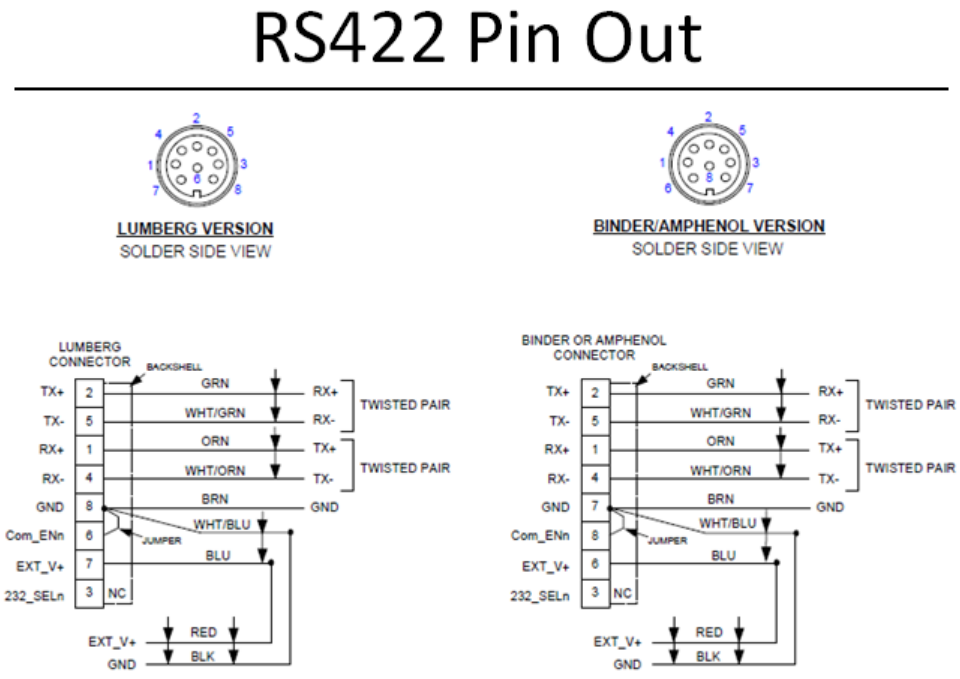


0331 08

Desc	Pin
RX	1
NC	2
Gnd	3
NC	4
TX	5
Gnd	6
6V+	7
Gnd	8

DB9 Pin	DB9 Desc
1	NC
2	RX
3	TX
4	NC
5	Gnd
6	NC
7	NC
8	NC
9	NC

6. 2. RS422 Pin Out



6. 3. Power

The C201 operates on 4 D Cell batteries. Batteries authorized for use in the C201 by MSHA are Energizer E-95 (Retail Store Product) and EN95 (Industrial Product) only. The batteries have been determined by themselves to be intrinsically safe.

The C201 can be powered from a external source when on the surface. This is accomplished via a wired connection between the C201 and another Strata CommTrac device such as a transponder box. Some Transponder boxes contain a battery backup, should line power fail. If the C201 is powered externally, Dcell batteries in the C201 will also serve as a redundant source of power as needed.

The C201 will operator with battery voltage down to 4.5v. If the battery voltage ever drops below 4.5v, the batteries should immediately be replaced.

7. Warranty

Initial system hardware components will be warranted to be free of defects for a period of one (1) year from in service date. Subsequent component purchases will be warranted one year from receipt acknowledgement. Warranted replacement or repair is not applicable in cases of physical damage or abuse as determined at the time of return or inspection.