

**EX SOLUTIO**  
**ENGINEERING (Pty) Ltd**

29 Schoeman Street,  
Florentia  
Alberton

Tel: 011 869 1062

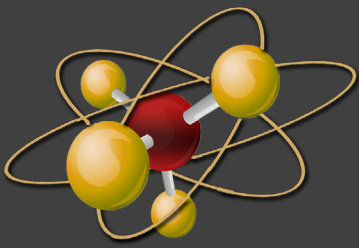
Email: [info@exsolutio.co.za](mailto:info@exsolutio.co.za)

Web: [www.exsolutio.co.za](http://www.exsolutio.co.za)

## **PULLKEY SYSTEM OVERVIEW**

# **MINING CONVEYOR PULLKEY CONTROL SYSTEM PROPOSAL**

*“Life Saving Sensing Solutions”*

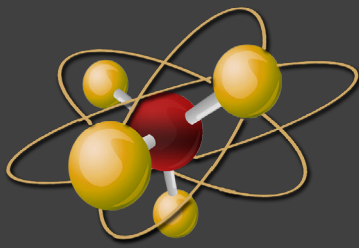


## PULLKEY SYSTEM OVERVIEW

### INTRODUCTION

This document has been drafted for the proposal of a Conveyor Pullkey Control System which is required to include audio “voice” communications between each unit to an extent to communicate to other Conveyor Pullkey Control Systems or to the Main Control room. The Pullkey System itself is Intrinsically Safe Certified design so as to allow continuous operations in hazardous areas, based on the technology used the audio communications can be taken into another level by offering a full INTERNAL telephonic system with Video conferencing available on request.

The document outlines 2 separate Pullkey systems as both have their advantages and disadvantages based on distance and power consumption. The Telephonic system is a separate system which can be integrated into any of the 2 Pullkey systems or other systems and offer built in SCADA system.



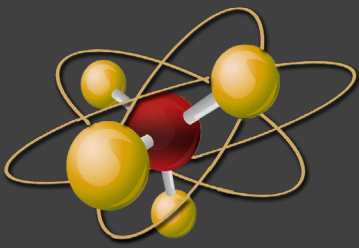
## PULLKEY SYSTEM OVERVIEW

### LUCI System

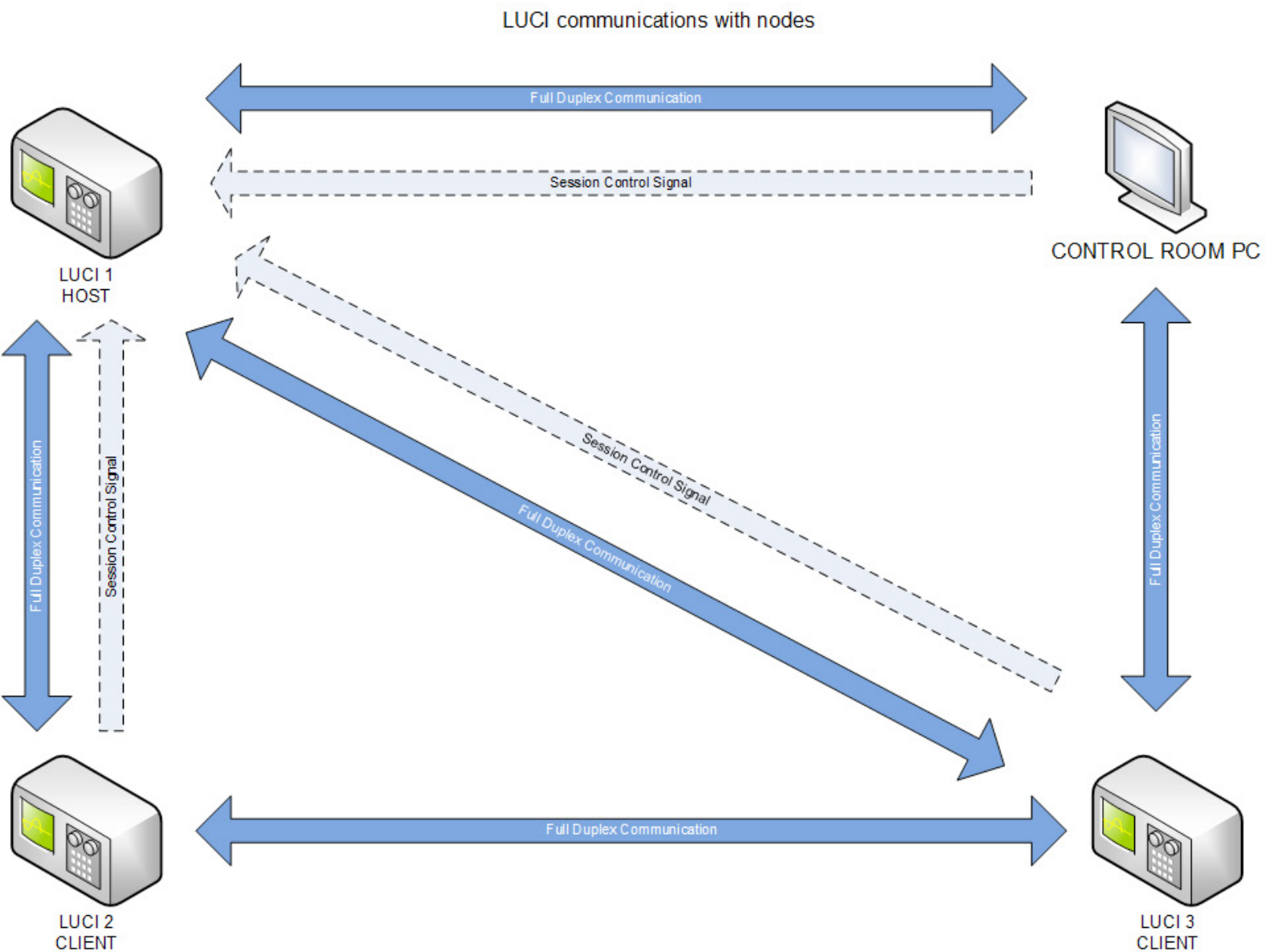
The telephonic system requires a high speed backbone typically running on optical fibre to ensure great quality video and audio communications. The system doubles up as a SCADA system where the Pullkey System information can be relayed to a control room or other locations within the network allowed by network administrators. All this is made possible due to a mini-computer system known as LUCI (Logical Unified Control Interface), power of a super system that's integrated into 1 unit that gives you SCADA functionality, PLC functionality and Telephonic Functionality at a fraction of the price.

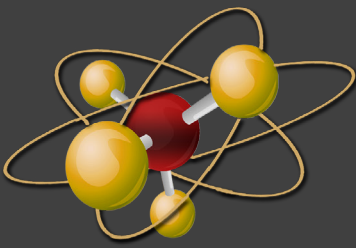
Placing LUCI on each Pullkey system allows the Conveyor belt Pullkey status to be available on the network whilst offering a telephonic system to communicate with others on the same network. LUCI will act as a "switch-board" to relay the voice communications from the network to the pullkey audio system and vice versa. Communications can be established with any other LUCI on the network; the operator simply opens the telephonic address book on LUCI (automatically updated via a central server) and clicks on the section/belt to talk to. Conveyor belt information is available to the Control room via LUCI without the need for SCADA package, the operator simply opens a web browser with LUCI's homepage to view the Conveyor Belt information and control the belt if necessary.

LUCI is an independent system, as it doesn't rely on internet nor 3rd party servers or central systems to maintain it nor licensing agreement required. Once the telephone directory is stored on LUCI it can establish communications with other LUCI's on its own provided a network connection is available.



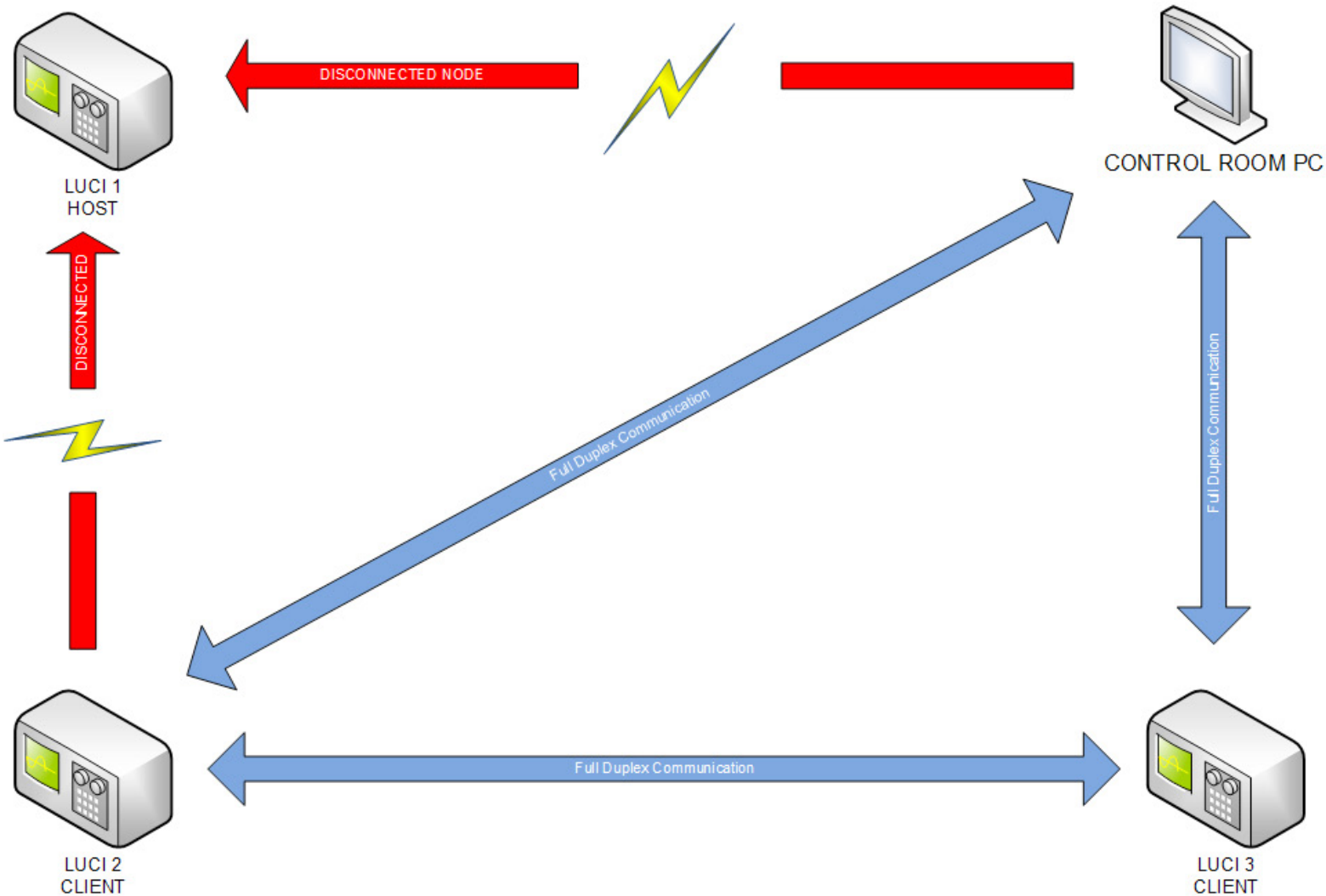
### PULLKEY SYSTEM OVERVIEW

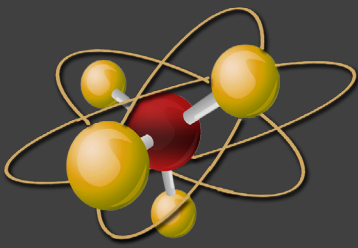




## PULLKEY SYSTEM OVERVIEW

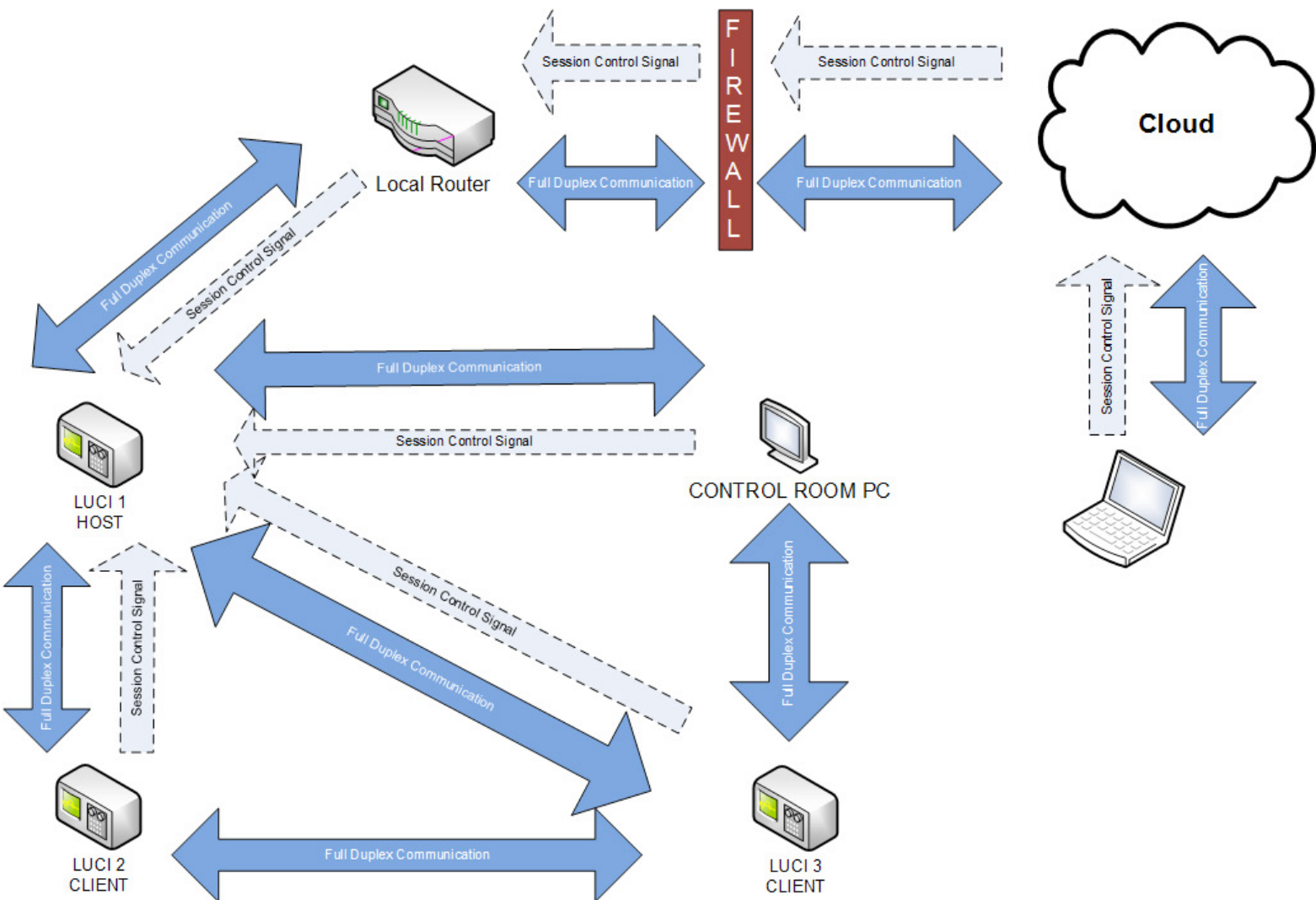
LUCI communications with disconnected nodes

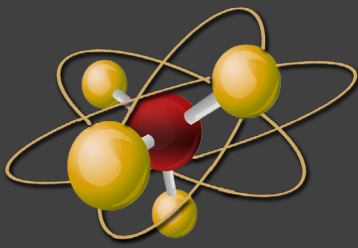




### PULLKEY SYSTEM OVERVIEW

LUCI communications to external nodes

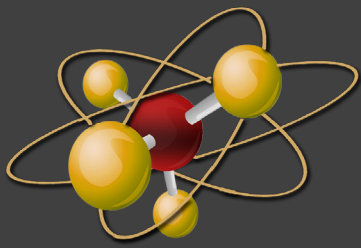




## PULLKEY SYSTEM OVERVIEW

Below is a break down of some of the features this system can offer:

- Audio and Visual (Video) telephonic system
  - o Communications can be relayed to and from the pullkey units
- Built in SCADA system per belt
  - o Pullkey Indication
  - o Belt Status (Running/Stopped)
  - o Optional External Sensory can be added
    - Belt Speed monitoring
    - Belt Alignment
- Gas Detection
  - Smoke (CO)
  - Methane (CH<sub>4</sub>)
  - Oxygen (O<sub>2</sub>)
  - Air Flow
- Belt Condition Monitoring
  - Detection of Wear and Tear
  - Belt Joints
- Video Surveillance



## PULLKEY SYSTEM OVERVIEW

### Pullkey System

We have 2 Pullkey systems on offer where 1 system offers a simple pullkey trip monitoring whilst the other a full diagnostic system is available. Both are based on the principle of tripping/stopping the conveyor belt when a trip switch is activated. However the deviation depends on the features one requires since certain features limit the distance that the system can operate when using 1 power supply before repeaters need to be introduced. Features from both systems can be mixed and matched to create new solution if required.

#### SimpKey

This system has been designed for long distance conveyor belts with Audio communications. Our current record operates this system at 8km, with recent improvements in technology we can push this boundary further. Below is a list of features for each unit available on the SimpKey System:

#### SimpKey Console

The Console offers simple monitoring of Pullkey units and Conveyor Belt Control.

- LCD Indication of system
- Pullkey Lockout number Displayed on LCD
  - Distinguishes between side A and B trip switches
- Pullkey Unit Short Circuit and Open Circuit detection
- Support for SCADA Systems
- Relay Status Outputs for direct PLC interfacing
- Monitoring of lockout units along conveyor belt

#### SimpKey Pullkey Unit

This unit houses the lockout trip switch & electronic sub-assemblies. This pullkey is used only for the purpose of tripping and trip position indication without voice or pre-starts alarm facilities.

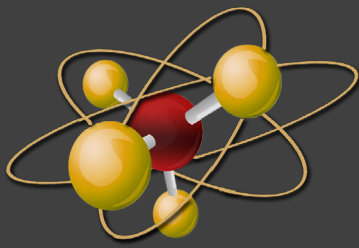
- Robust enclosure fabricated from 3CR12 Stainless Steel
- Super bright lockout LED for trip visual indication
- Lockout Position Indication Module
- Provision for Slave Pullkey
- Lockout trip switch

#### SimpKey Slave Pullkey Unit

The Unit is used to connect to the Single Master Pullkey unit. The Slave Unit is mounted on the opposite side of the belt where the Master Unit is mounted.

- Super bright lockout LED for trip visual indication
- Lockout trip switch





## PULLKEY SYSTEM OVERVIEW

### SimpKey General Trip Unit

The unit houses an electronic module that accepts input signals from 2 external lockout switches i.e.:

#### **Belt Misalignment Detector.**

- Super bright lockout LED for trip visual indication
- Push-button to override both External lockout switches.

### SimpKey Termination Unit

This unit terminates the line communications for the system and trip signals for the trip switches in the system.

### VanceKey

This system was designed for shorter belts (estimated at 2km) but with more features involved as compared to the SimpKey System. The system is based on a dual trip redundancy system where 1 is a digital control and the other an analogue system which allows a fast trip in analogue mode and the convenience of automatic numbering system using the digital system. The digital system also allows more diagnostics such as determining the location of a break in the pull cable, location of communication faults, fault alarm detection, faulty trip switch detection.

The VanceKey System offers Pullkey Units with audio communications; the same audio line is used for Voice and Pre-Start Alarms removing the need for external sirens. Proofing of Pre-Start Alarms are done internally on the pullkey unit and its status sent back to the Console.

Below is a list of features for each unit available on the VanceKey System:

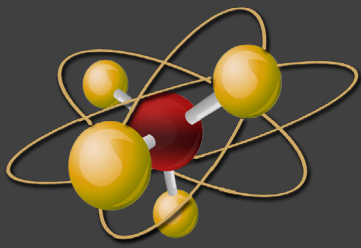
### VanceKey Console

The VanceKey Console offers control & monitoring of lockout units and the conveyor belt. The unit offers 3 modes of operation where a 4th mode can be used with any of the 3 modes namely:

- Local Mode
- Sequence Mode
- Surface Mode
- Maintenance Mode (4th Mode)

All major events are logged on the console which can be accessed via the Console LCD. The unit supports MODBUS RTU which can be accessed by most SCADA systems.

- System parameters are menu driven
- LCD Indication of system & unit status (up to 20units can be shown)
- Internal data logging of crucial events
- Audio tone generator for pre-stat alarm sequence (PSA)
- MODBUS RTU for SCADA Systems
- External interfacing support for MCC healthy status, underspeed detection and sequence startup inputs
- Dual redundancy circuit for lockout switches



## PULLKEY SYSTEM OVERVIEW

- Fail-to-safe electronic circuitry
- Real-time-clock (24hr) for data logging
- Monitoring of lockout units along conveyor belt
- Detection of unit-position with data communications faulty
- Auto-detection of number of lockout units on the belt
- Maintenance mode support to continue running conveyor belt if digital communications fail

### VanceKey Dual Pullkey Unit

This unit consists of a Pullkey trip Switch and Audio communications for voice and pre-start alarm indication.

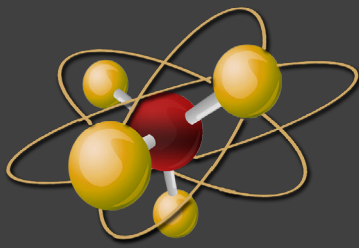
- Voice communications
- Pre-start alarm
- Lockout trip switch (Dual redundancy circuitry)
- Short-circuit detection on trip switches
- LED indication for:-
  - Lockout trip switch
  - PSA (Pre-start alarm)
  - Comms healthy
- Line voltage monitoring
- Super bright lockout LED for visual trip indication
- PSA LED visual indication for Pre-Start Alarm
- Override facility for PSA Only with override indication
- Provision for Slave Pullkey
- Auto Digital communications configuration

### VanceKey Pullkey Unit

This pullkey is used only for the purpose of tripping and trip position indication without voice or pre-starts alarm facilities.

A typical application is where this pullkey can be alternated with the combined pullkeys on the same line in order to minimize voltage drop at the end of the line, or on a system where voice communications is not required and the pre-start alarm is to be broadcast via stand-alone sirens.

- PSA LED visual indication for pre-start alarm
- Lockout trip switch (Dual redundancy circuitry)
- Short-circuit detection on trip switches
- Super bright lockout LED for trip visual indication
- Communications healthy LED
- Line voltage detection
- Auto Digital communications configuration
- Provision for Slave Pullkey



## PULLKEY SYSTEM OVERVIEW

### VanceKey Slave Pullkey Unit

This pullkey is used only for the purpose of tripping and trip position indication without voice or pre-starts alarm facilities. A typical application is pullkeys are required on the non-walkway of the belt. This pullkey will display the same position as the master but with the “side B” identification.

- PSA LED visual indication for pre-start alarm
- Lockout trip switch (Dual redundancy circuitry)
- Short-circuit detection on trip switches
- Super bright lockout LED for trip visual indication

### VanceKey General Trip Unit

A electronic module which accepts input signals from 2 external switches to trip the belt. The unit does not require trip switches; a push-button is available to override both lockout switches. Unit can be setup to show the following trip on the console LCD:

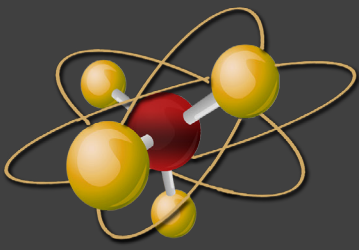
- Belt Tear
- Belt Misalignment
- Block Chute
- Device Trip

#### Unit Features:

- PSA LED visual indication for pre-start alarm
- Dual redundancy circuitry
- Short-circuit detection on trip switches
- Super bright lockout LED for trip visual indication
- Auto Digital communications configuration

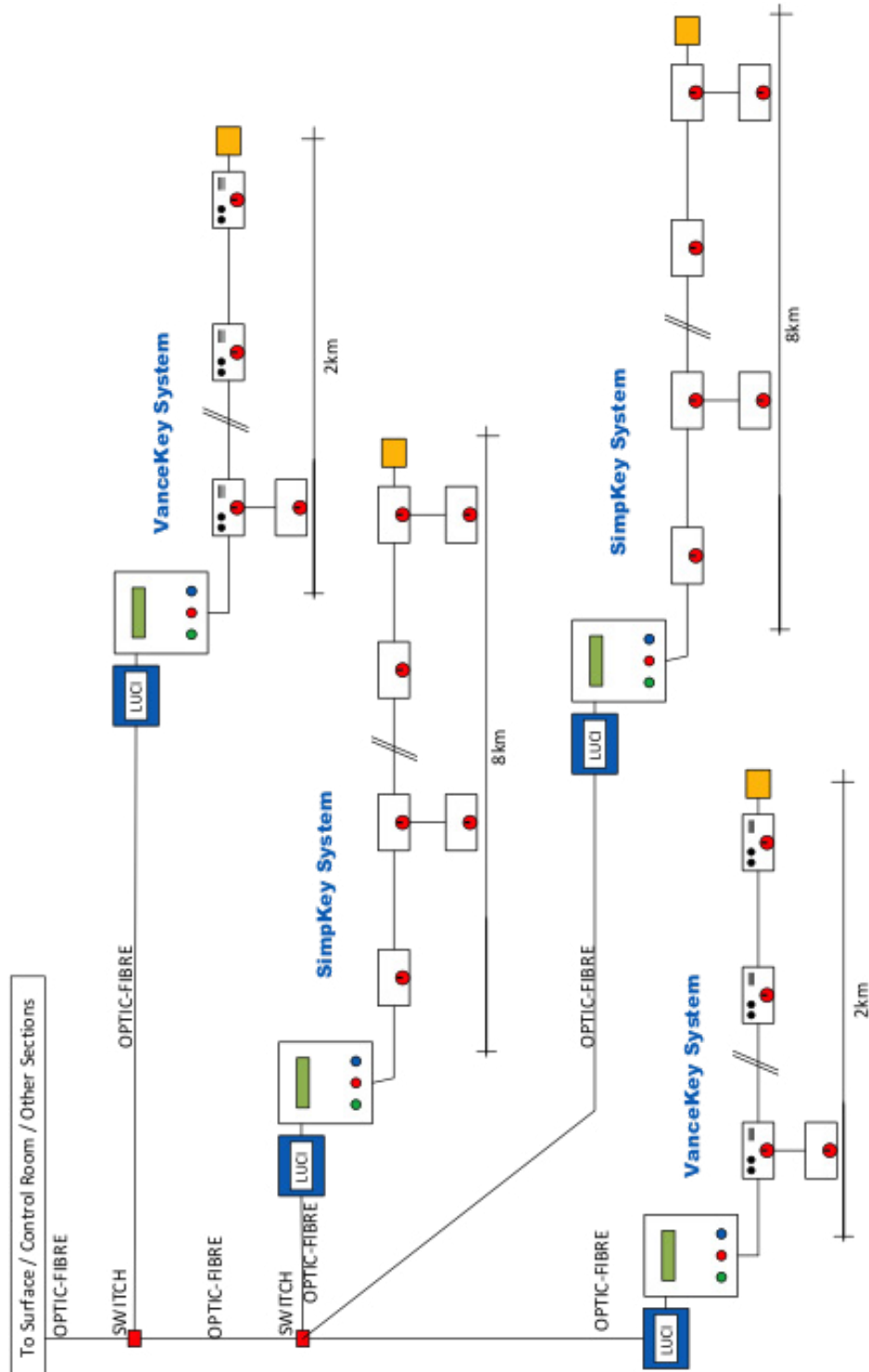
### VanceKey Termination Unit

This unit terminates the line communications for the system and trip signals for the trip switches in the system



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