



# KTX SYSTEM INSTALLATION INSTRUCTIONS

SPECIAL NOTE

READ THIS ENTIRE BOOKLET  
BEFORE PROCEEDING WITH  
THE INSTALLATION

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# 1 INTRODUCTION

In general, all Grain Temperature Monitoring systems perform the process of data access, which reads data from a device and returns it to another device that requested it. More specifically, the data is requested, and then returned to the requesting device to be read. Typically, there will be hundreds or even thousands of sensing points spread over a significant distance. It is a complicated and tedious process to cope with such distances and the great number of points.

The KTX System simplifies this problem by integrating the measurement and switching of a small group of sensing points. It forms a system of independent switches, which measure and sequence through all the sources of the signals.

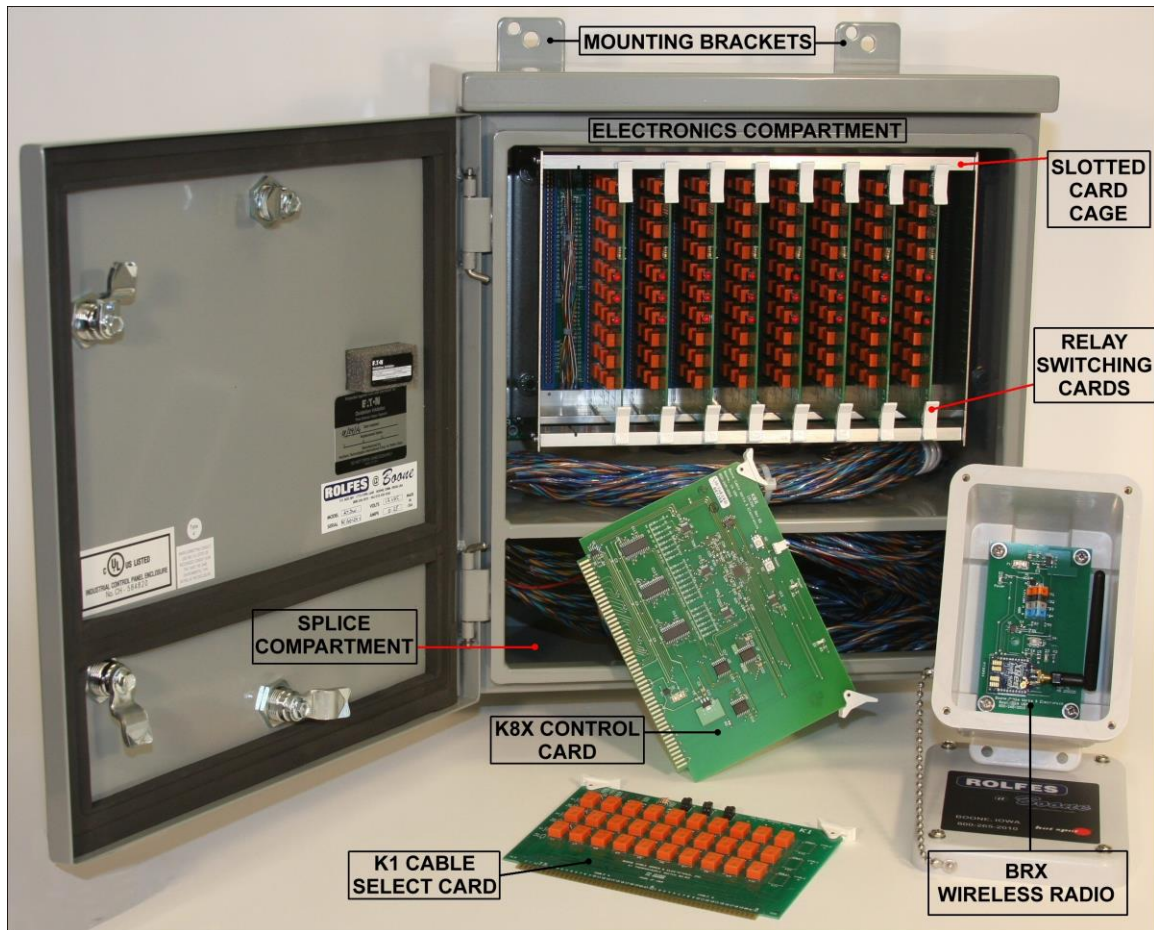


Figure 1 KTX System, Pre-Installation

## 2 DESCRIPTION

The KTX System consists of a KT Switch (KTSW), a K8X Control board, and several K1 Cable Select boards, depending on how many cables are being monitored. The KT Switch is a compact weatherproof enclosure divided into two compartments (refer to Figure 1). The bottom compartment is dedicated to wire splice connections. All wires from outside the box enter through this Splice Compartment. Electrical Conduit is attached here. The top compartment is sealed from moisture and dust. It is set apart to protect electronic components that are used for the purpose of switching signals. Access to the interior is provided by a hinged door with secure latches.

The sealed, top Electronics Compartment is occupied by a cage frame that holds the Relay Switching Boards in slots. All boards plug into a back-plane board that inter-connects all boards. The KTX System has only one K8X Control Board, which is always in the first position closest to the hinge. The number of K1 Cable Select Boards ranges from 1 to 8 to scale the system to the number of Temperature Cables. Each K1 board switches the signals of 1 to 3 cables.

The main function of the KTX System is to select one Temperature Cable and measure the thermocouple signals of the selected cable. The measurement is then sent through the RS 485 data link.

KT Switch (KTSW) specifications:

|               |  |
|---------------|--|
| Dimensions=   | 17" (432mm) Height<br>16" (406mm) Width<br>8.25" (210mm) Depth                 |
| Enclosure =   | NEMA 4 or 4X Watertight (intended for extremely wet or corrosive environments) |
| Input Power = | 12 VDC, 6W   |
| TC Type =     | Type T (Copper Constantan)   |
| Size=         | KTX-12 (1-12 cables)<br>KTX-24 (1-24 cables)                                   |

- 1.1. The KTX System easily adapts to most existing temperature systems for add-on or renovation.
- 1.2. Relay Switching Boards plug-into slotted cage rack for ease of troubleshooting and repair.
- 1.3. The standard enclosure is made from heavy gauge steel with baked enamel finish.
- 1.4. An optional 304 Stainless Steel 4X enclosure is available by special order.
- 1.5. The KTSW enclosure has an isolated splice compartment from the electronics compartment, sealed with an epoxy barrier to ensure that the switch remains in a clean, dust and moisture free environment.
- 1.6. Enclosure top has drip-shield / rain hood protecting door gasket.
- 1.7. All the relay contacts and the board edge connectors are gold for reliable low-level switching.
- 1.8. Edge connections of the Relay Switching Boards are bifurcated (split into two parts) and have a positive lock connection to ensure excellent contact even in high vibration conditions.

### 3 CONCEPTS

The following general discussion helps to better understand what is happening in the use of the KTX System.

#### 3.1 Switches & Switching Systems

Switches are electromechanical devices that control routing and operation of a signal path. Switching is a method that uses temporary connections, rather than permanent connections, to route information between Sensing Points and the Measuring Device. Even though a KTSW Switch is internally made up of several Relay Switching Boards each having many electromechanical relays, it is just referred to as a single device.

Electromechanical relay-type switching systems operate on the premise that all paths are open until one path is directed to connect. A command to connect is called **Selection**. When internal control relays are open, all **Sensing Points** are isolated. Thus, there is no way to turn on another Switch or Cable to give a false reading.

#### 3.2 RS 485 data link

A RS 485 data link is used to transmit and receive data over a single twisted pair and can span relatively large distances (up to 4,000 feet (1,200 m)). It enables communication between the KTX and a wireless data radio. The wireless data radio then communicates between the KTX and an Ethernet gateway.

## 4 Switch Locations

Leadwire, conduit and electronic hardware can be kept to a minimum by carefully distributing switching devices around the facility in strategic remote locations. These locations often include the roofs of tanks and interiors of head houses, see Figure 2. Often groups of cables near each other have their leadwire conveniently routed to a single point. Where they come relatively close is a good place to locate the KTX System. Each KTX System measures the signals of the cables connected to it, not all the cables in the facility. Note: **Any power or communication lines needs to be run through conduit.**

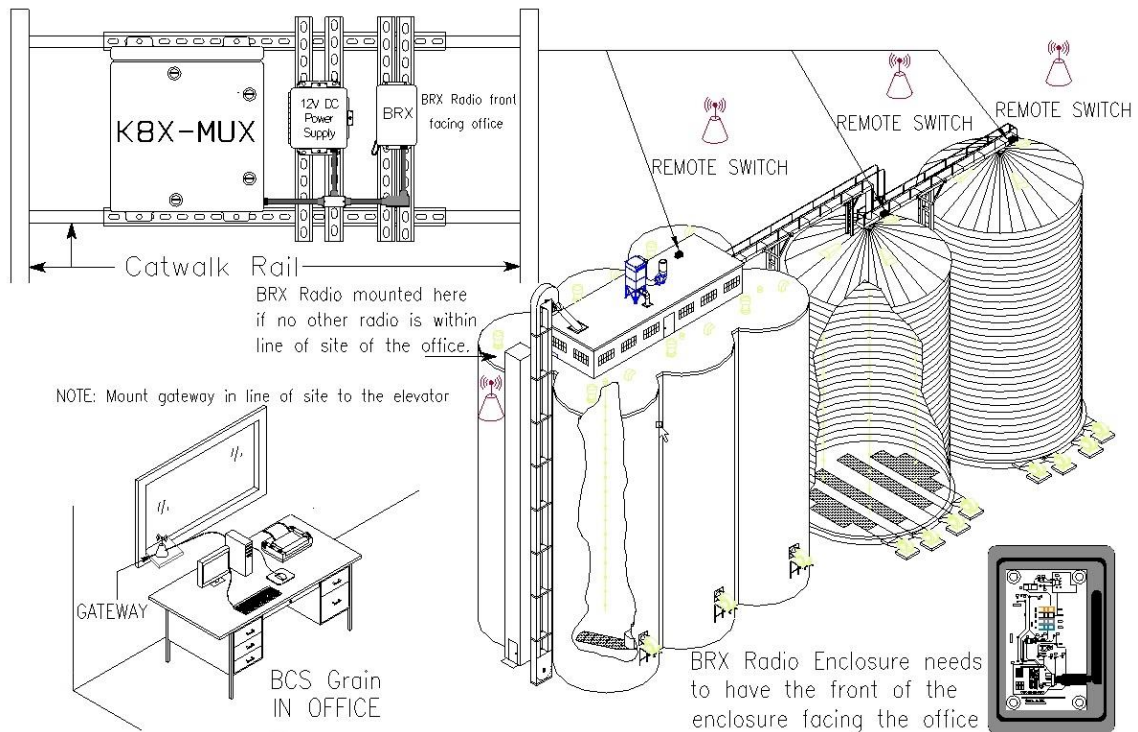


Figure 2 KTX System Switch Locations

## 5 Installation

The KTX System is mounted using its External Mounting Brackets (See Figure 1). The installer should check the system drawings and determine the proper location of each KTX System. **The KTX system shall only be installed or used in non-hazardous locations. Hazardous locations are defined by the National Electrical Code in Article 500, under special occupancies.**

Each system should be easily accessible and free from obstruction. A fully loaded KTX System consists of one K8X board and eight K1 boards (full mux) and can handle up to 24 cables. A half loaded KTX System consists of one K8X board and four K1 boards (half mux) and can handle up to 12 cables. These boards and their capabilities will be discussed in detail later.

The BRX radios will be labeled according to the software's Bin configuration. For example, KTX01 will be mounted by Switch 1 (Section 1). KTX02 by Switch 2, etc. Any BRX labeled REPEATER or OFFICE is usually mounted close to the Gateway (Office) to improve communication between the other radios. **If the BRX radios and Gateway get mounted close to each other, use a minimum distance of 10 feet between each unit.**

## 6 CONNECTIONS

### 6.1 DC Power

Nominally +12 Volt Direct Current Power comes from the *RPX Power Supply*. Run the Power from the Supply to the radio and from the radio to the *KTX System*.

- 12 Volt SUPPLY, RED 18 AWG is the positive conductor.
- RETURN (COMMON), BLACK 18 AWG, is the negative conductor.
- GROUND, GREEN 18 AWG, runs back to the MUX enclosure.

BRX radios labeled REPEATER or OFFICE only need DC power hooked up. For longer runs, use a thicker gauge wire, to avoid a large voltage drop.

### 6.2 RS 485 Data Link

Use a designated RS485 cable (shielded & braided) to connect the KTX Remote to a communication device. Connect the two wires to control cable (CTLA, CTLB) at the MUX.

- A, BLACK insulation connects to RS485 Black/White
- B, BLUE insulation, connects to RS485 Black

OUTSIDE

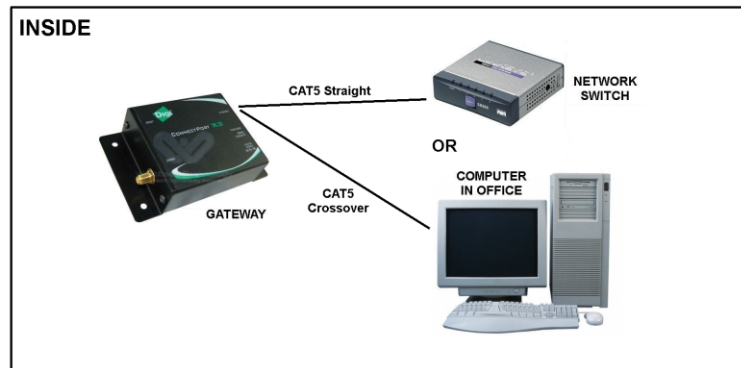
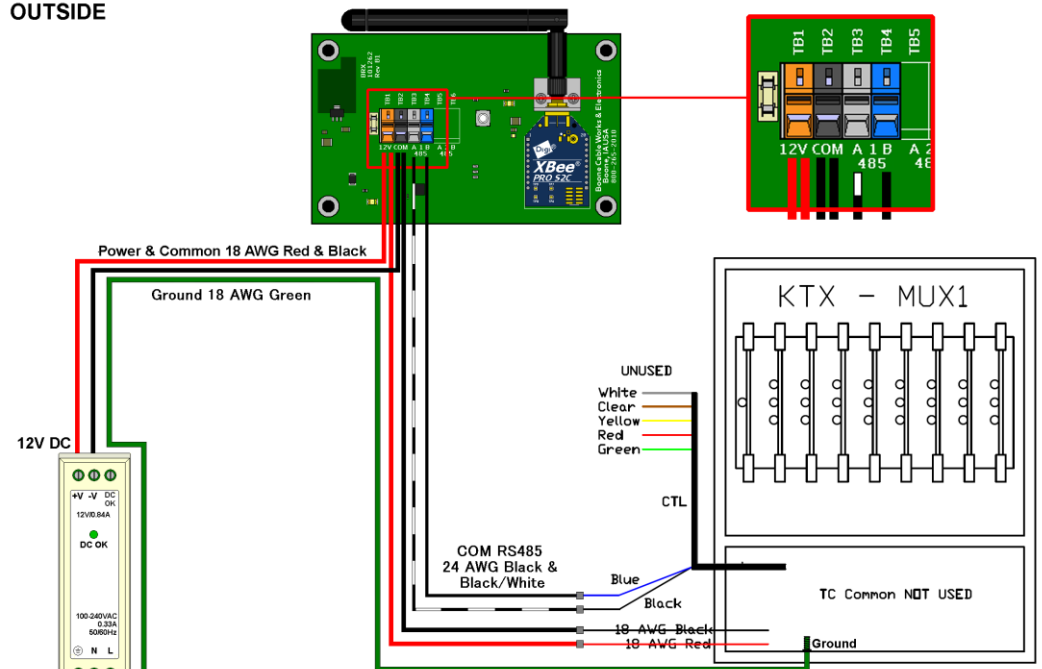


Figure 3 KTX Complete Setup

### 6.3 Dual Radio connections

For a Dual Radio setup, use a Red & Black 18AWG wire to run a separate power & common and a RS485 cable for communication from the radio to both KTX Systems. One pair will run from the “485 A 1 B” connections on the radio to the first KTX System and a second pair from the “485 A 2 B” connections to the second KTX System. Terminate the wires inside the radio box. Run a separate ground wire (Green 18 AWG) to each MUX enclosure. See the picture below.

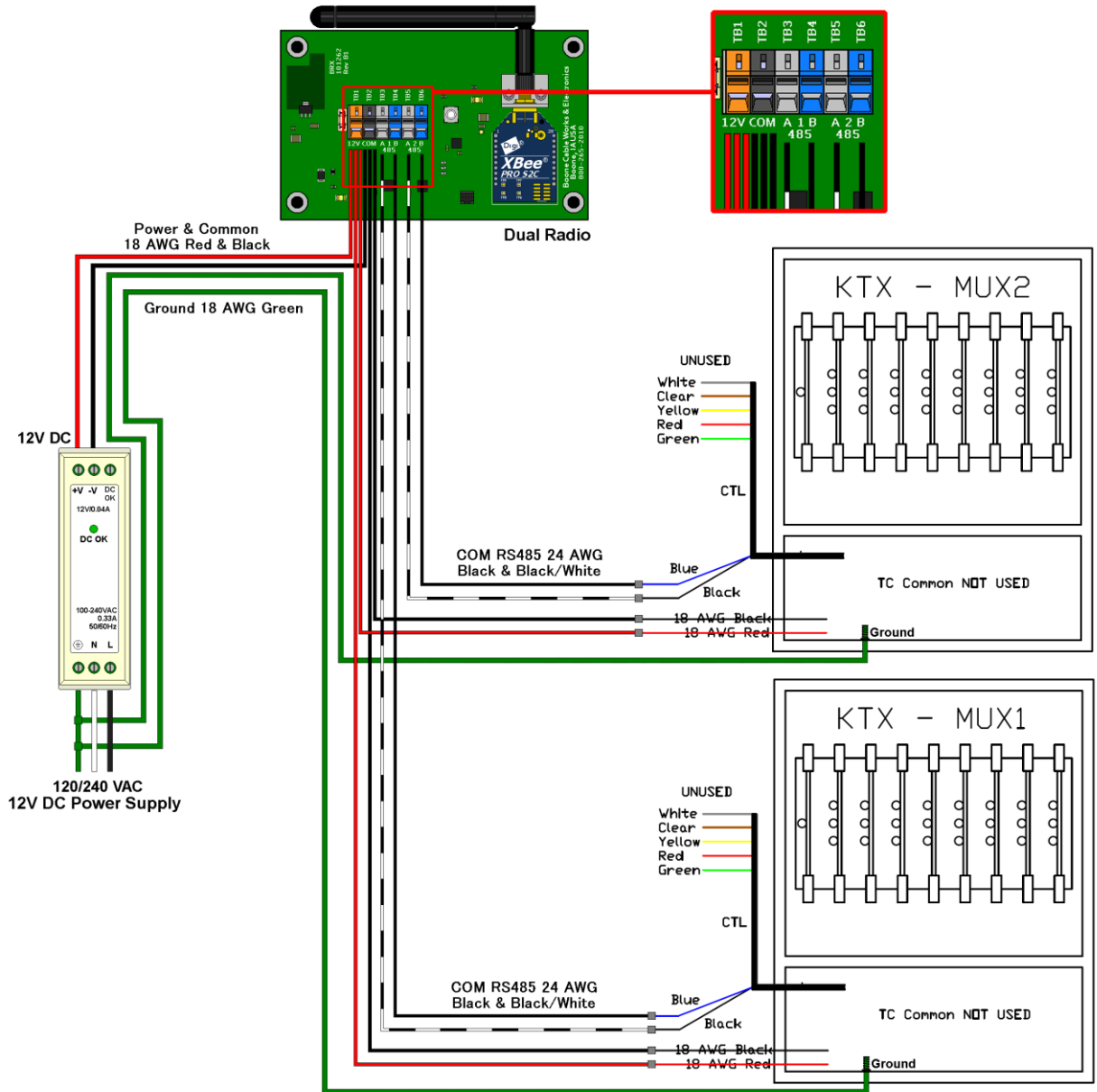


Figure 4 Dual Radio Setup



## 7 Wiring diagrams

The following sections will feature the more practical aspects and possibilities that may be encountered when installing the KTX System. In any Grain Temperature Monitoring System employing KTX Systems, there will be variations in the number of temperature cables attached to each Remote. This part of the instructions will focus more on the most used systems and using the color codes of wires to make the connections easier.

### 7.1 COLOR CODES

#### 7.1.1 Cable Select & Switch Select

Cable Select A and B are used for RS485 communication. All other select lines (C, D, and E) are not used and should be left unconnected.

Table 1 describes how insulation colors of the Control Bus cable are organized.

Table 1. Cable Select Color Codes

|              | Logic | Insulation Color Code | <b>GROUP</b><br>(Constantan Insulation Color) |
|--------------|-------|-----------------------|---|
| Cable Select | A     | Black                 | White   |
|              | B     | Blue                  | White   |
|              | C     | Green                 | White   |
|              | D     | Red                   | White   |
|              | E     | Yellow                | White   |

### 7.2 Thermocouple Cable

Table 2. Color Code Chart for 18TC Shielded Thermocouple Cable.

| TC № | Leadwire Insulation Color Code | <b>GROUP</b><br>(Constantan Insulation Color) |
|------|--------------------------------|---|
| 1    | Black                          | White   |
| 2    | Blue                           | White   |
| 3    | Green                          | White   |
| 4    | Red                            | White   |
| 5    | Yellow                         | White   |
| 6    | Clear                          | White   |
| 7    | Black                          | Brown   |
| 8    | Blue                           | Brown   |
| 9    | Green                          | Brown   |
| 10   | Red                            | Brown   |
| 11   | Yellow                         | Brown   |
| 12   | Clear                          | Brown   |
| 13   | Black                          | Orange  |
| 14   | Blue                           | Orange  |
| 15   | Green                          | Orange  |
| 16   | Red                            | Orange  |
| 17   | Yellow                         | Orange  |
| 18   | Clear                          | Orange  |

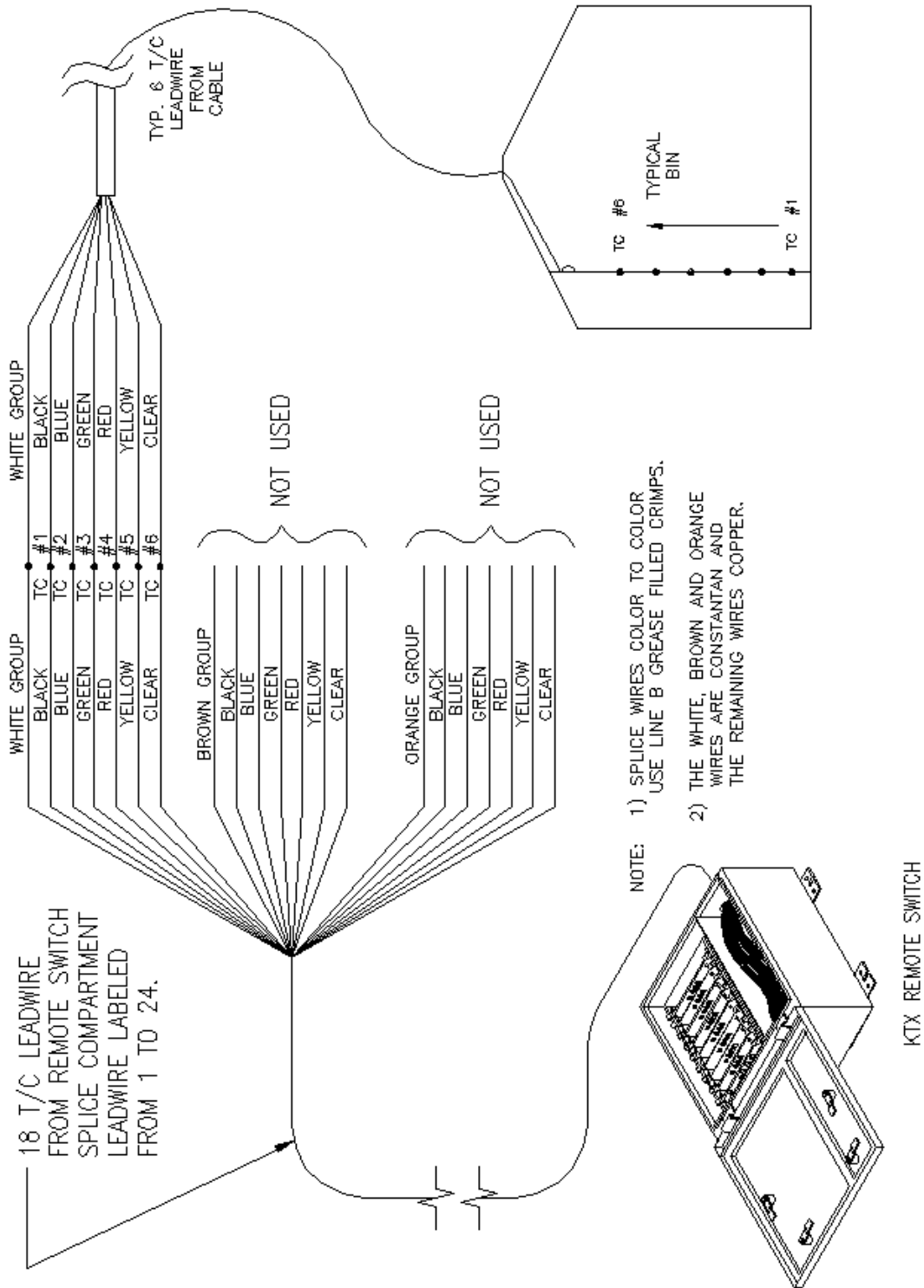


Figure 5 Wiring of an 18-TC KTX System to a 6-TC Cable

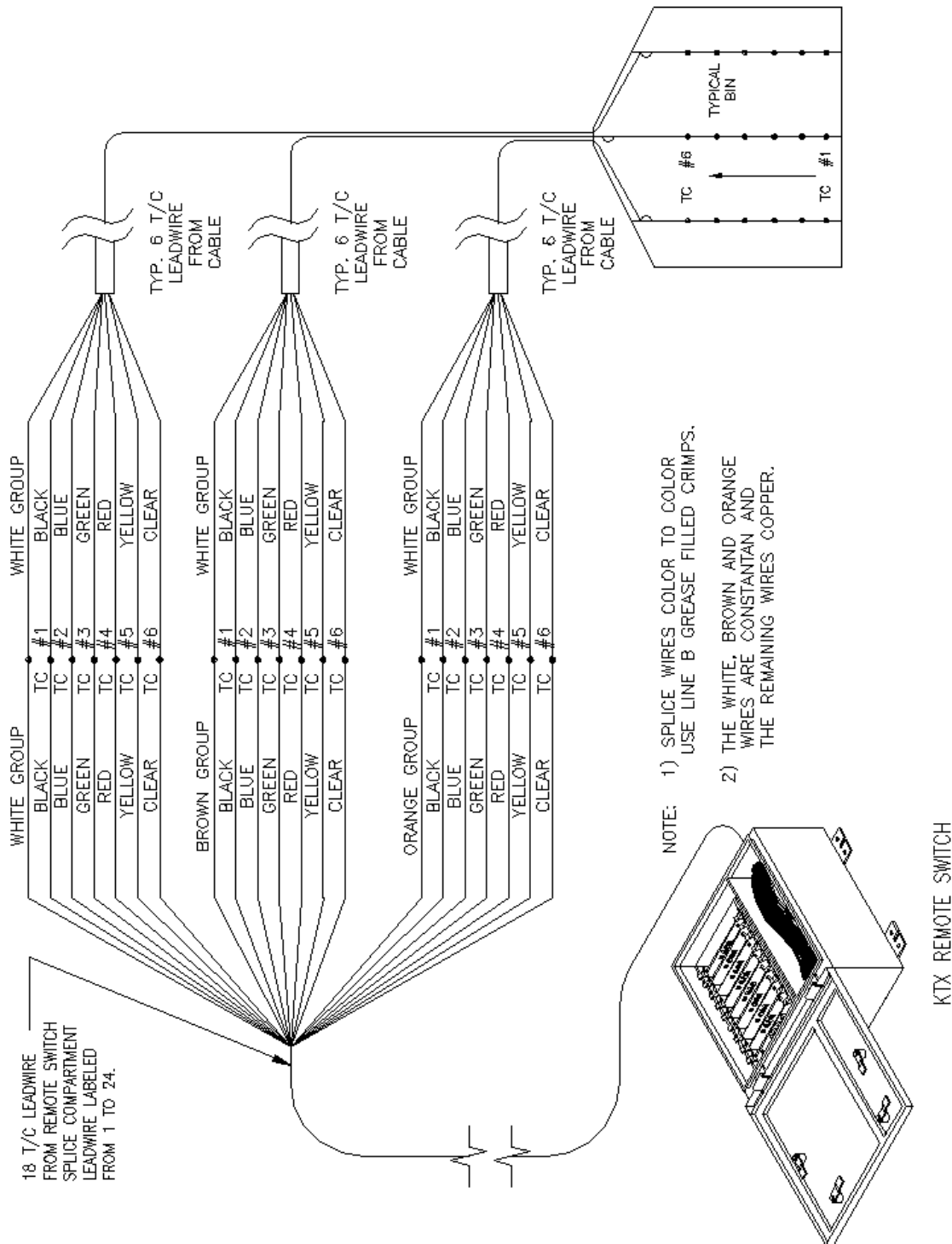


Figure 6 Wiring of an 18-TC KTX System to Three 6-TC Cables (6-TC Special)

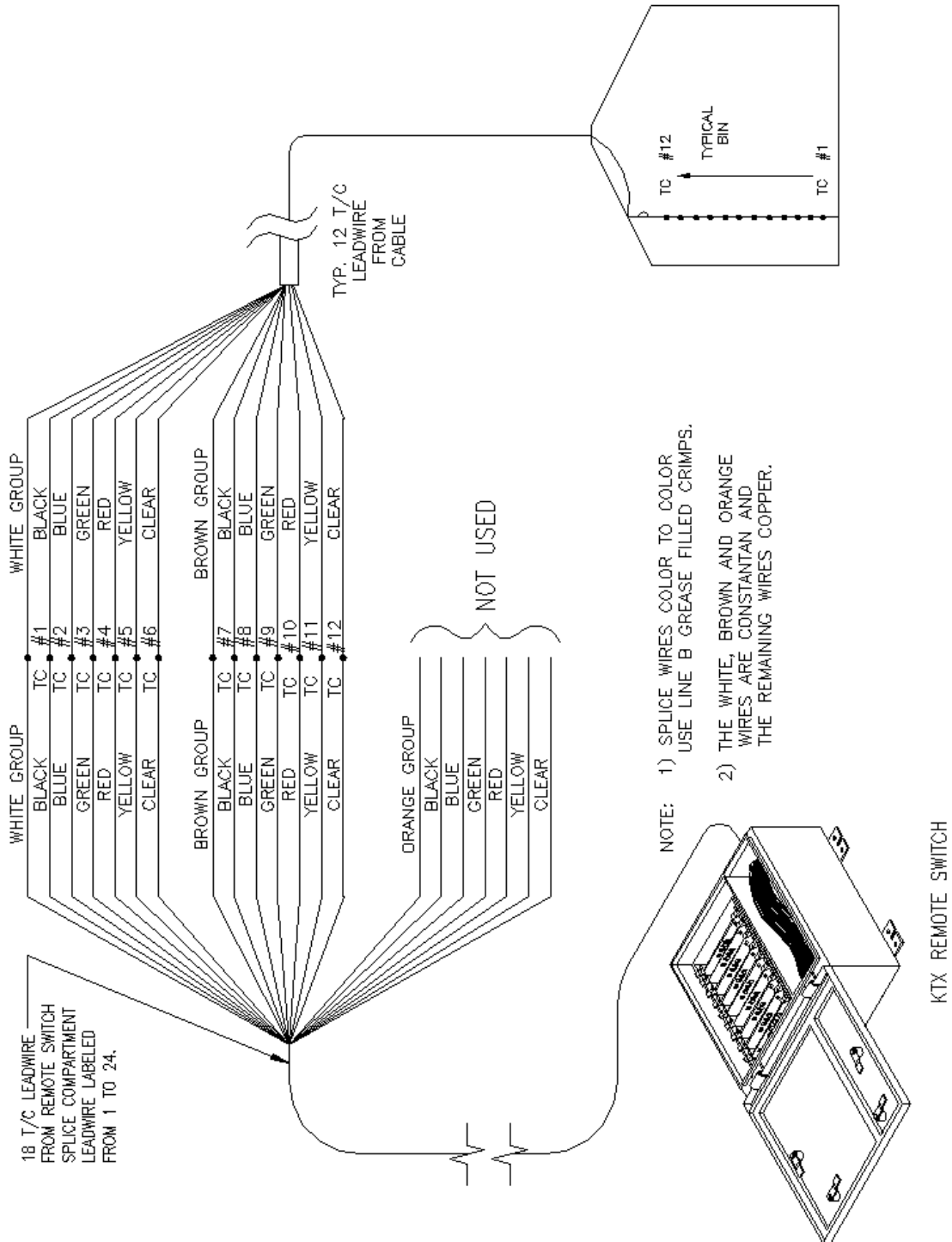


Figure 7 Wiring of an 18-TC KTX System to a 12-TC Cable

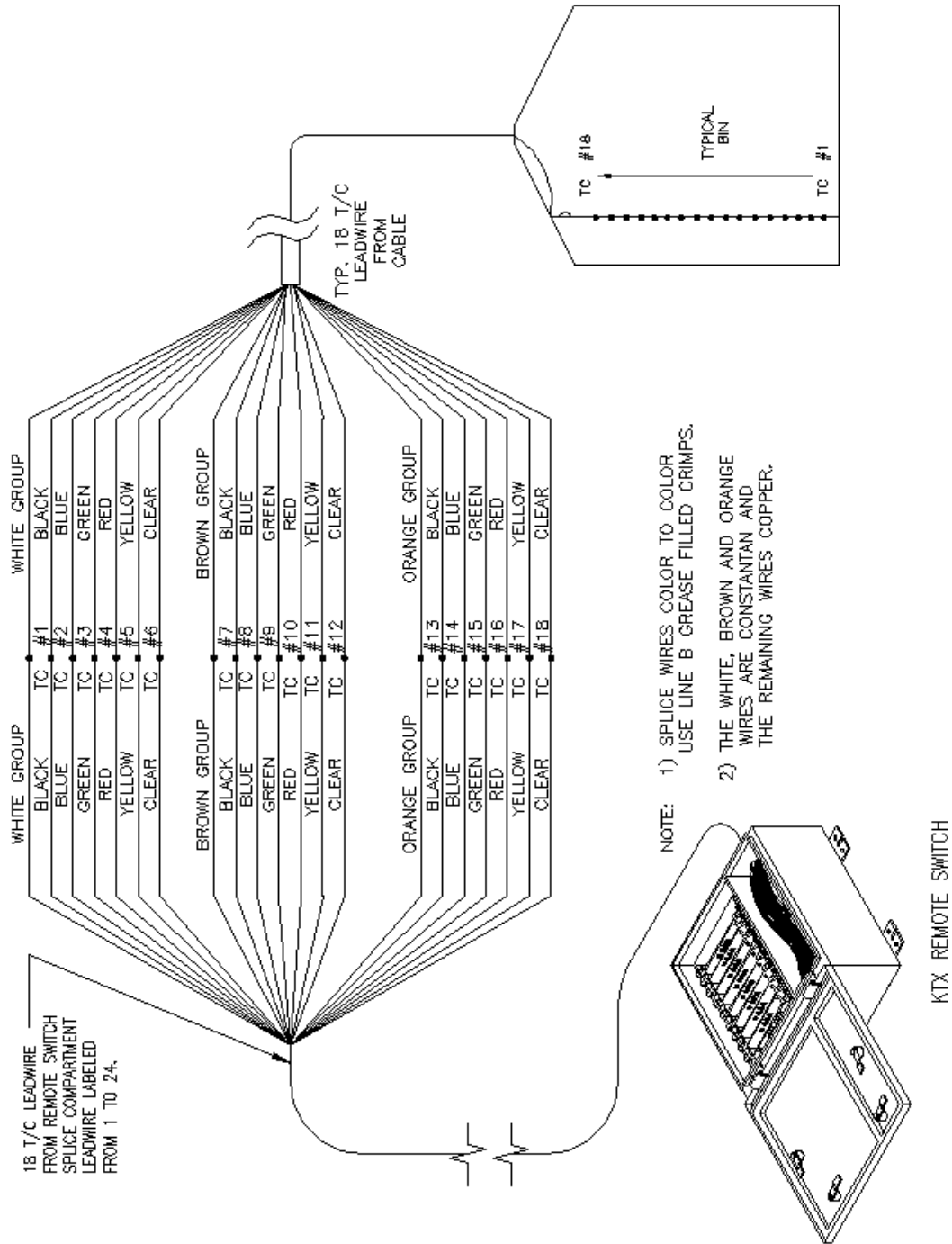


Figure 8 Wiring of an 18-TC KTX System to an 18-TC Cable

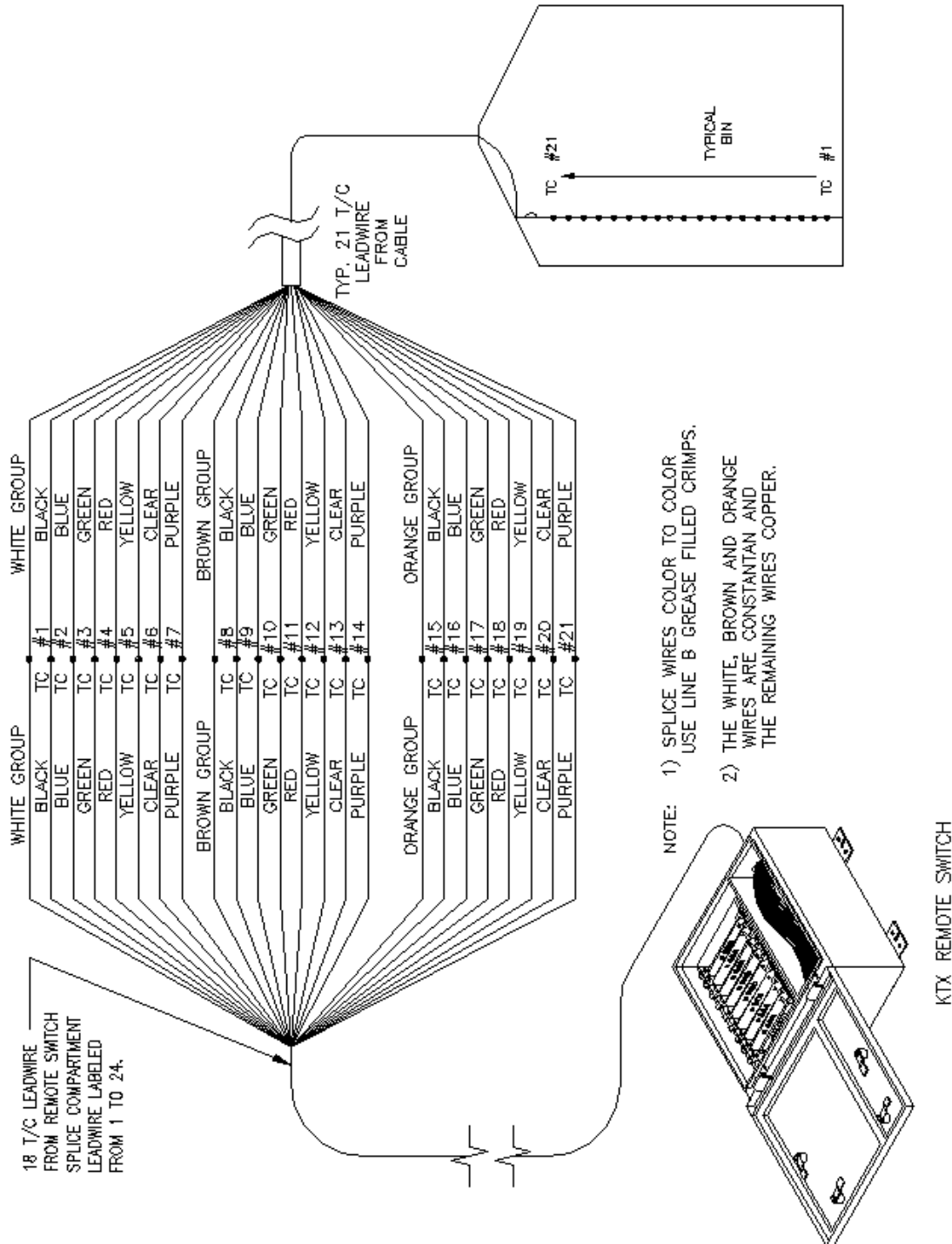


Figure 9 Wiring of a 21-TC KTX System to a 21-TC Cable

## 8 KTX System Theory & Troubleshooting

By putting the cable relays onto plug in cards you allow flexibility in sizing the system to the individual location requirements.

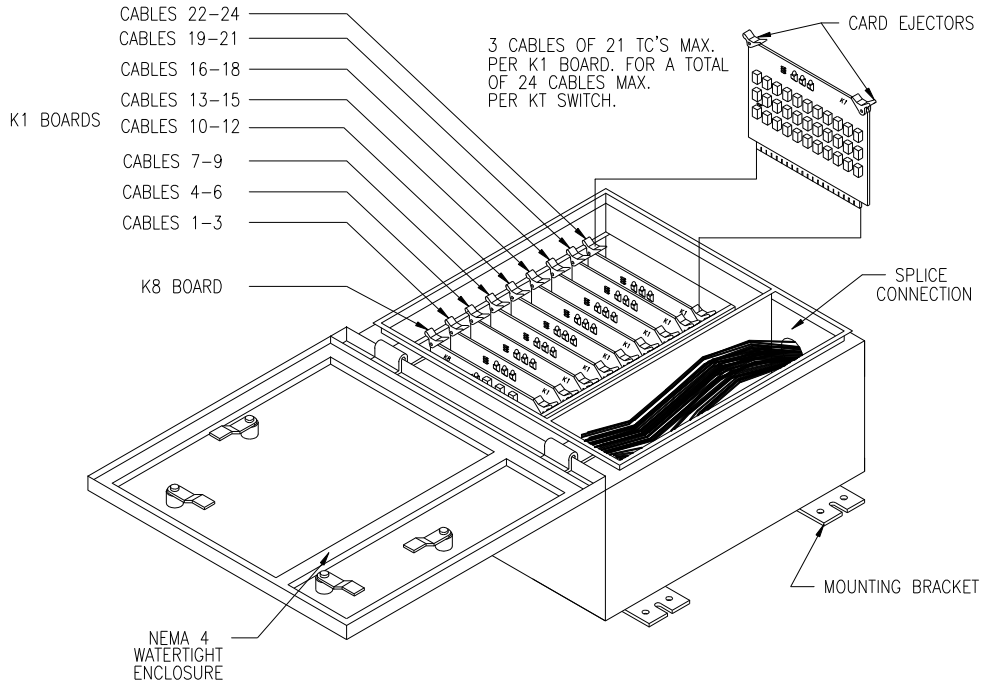


Figure 10

KTX SYSTEM

## 8.1 K1 Cable Select Board

### 8.1.1 Circuit Theory

Each K1 board contains switching that can select one of three cables. The selection of an individual cable is identical for all three. The operation of cable A will be explained as being typical of all three.

The K8X board has energized cable A. Nominally 12 volts are applied to the coils of the bottom row of relays K1 to K11. When the relays are actuated, cable A is routed into the K8X board, through the eleven relays. The K8X board then must select one of the 21 TC's and measure the temperature for each TC.

The actual voltage across the relays can be read at test points A, B and C (right side of LED's). This voltage should be between 11 and 14 volts for the relays to operate accurately.

### 8.1.2 Trouble Shooting the K1 Board

One problem that may occur with the cards is an open TC. Swap the K1 board with another one to determine if the K1 board is at fault.

Red Light Emitting Diodes give easy visual indication of which cable has been activated. In some cases, the LED may be burnt out, but the cable is still activated properly. This problem can be checked by measuring test points A, B and C located on top of the board. Send the faulty board in for repair or replacement.

Contact Rolfes@Boone at 1-800-265-2010

### 8.1.3 K8X Control Board

### 8.1.4 Circuit Theory

This board is designed to communicate using the RS485 data link. The K8X board has a microcontroller, a digital to analog converter, thermocouple select logic, and relay drivers. The relay driver selects one of the 24 cables on the appropriate K1 board. The thermocouple logic selects one thermocouple and the analog to digital converter measures the thermocouple voltage. The microcontroller coordinates all devices and communicates the results back to the host computer.

## 8.2 Trouble Shooting the K8X Board

One (or two) Red Light Emitting Diode gives easy visual indication if the *KTX System* has power applied. The other red LED blinks when a read is in progress. If the K8X board is operating improperly, switch it with another one to determine if the K8X Board is faulty. Send the faulty board in for repair or replacement.

Contact Rolfes@Boone at 1-800-265-2010