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<tr>
<td>1</td>
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<td>TW TCS Installation</td>
<td>1</td>
<td>PJ00320</td>
<td>Outdoor Phone Jack</td>
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<td></td>
<td></td>
<td>Instructions</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Prerequisites

- The wiring on your site must accommodate your particular electrical requirements and conform to all local codes including National Electrical Code and Canadian Electrical Code where applicable. DRB Systems is not responsible for the installation, maintenance, or safety of your electrical wiring.
- There must be a 24VAC power source for supplying power to the Conveyor Enable Circuit board, which, in turn, will supply power to your Conveyor Motor Control contactor.
- Metallic conduit must be used for all wire runs, including conduit for all RS-422 cabling. This includes runs from the office computer to the Tunnel Control Station.
- The AC power supplying the TCS must be clean, “computer-grade” 110 V AC, 15 A, with its own isolated circuit (it may, however, share power with the computer). All communications cable must be RS-422 grade (shielded twisted pair). For part numbers and wiring instructions, see Figure 11: Communications Wiring for details.
- For new installations, DRB Systems highly recommends the following power wiring specifications to provide the most reliable equipment operation:
  - A dedicated 15A circuit breaker and dedicated 110VAC Hot, Neutral, and Ground conductors should be run to the TCS power input terminals. A metal conduit does not serve as a suitable ground conductor for this application.
  - All ground conductors connected to the TCS and to outlets that supply power to TunnelWatch and SiteWatch equipment (if applicable) must be properly bonded to each other, and to the system ground, in accordance with NEC. A metal conduit does not serve as a suitable ground conductor for this application.
  - If power to TunnelWatch and/or SiteWatch systems is provided from multiple services, as may be the case at sites with multiple buildings, two options exist to ensure reliable data communication:
    - Properly bond the system grounds together, in accordance with NEC.
    - Add optical isolation to any communication link (RS232, RS422, RS485, Ethernet); fiber optic networking is the most robust method for accomplishing this. Note: DRB Systems does not provide, set up, or troubleshoot optical isolation and fiber optic networks. The customer is responsible for arranging local installation and support for this setup.
Installation Overview:
The following are the steps for installing the TunnelWatch Tunnel Control Station unit:

1) Unpack the Tunnel Control Station box.
2) Mount the TCS box.
   - Choose the correct placement for the unit.
3) Connect conduit to the TCS box.
   - Choose the correct placement then drill and connect the conduit to the TCS unit.
   - Do NOT drill holes in the top of the TCS box. Route conduit into the bottom of the box for maximum protection from moisture and other debris.
4) Connect AC power.
   - Wire the AC Power from a dedicated 110VAC circuit.
5) Wire relays.
   - Supply the source voltage and the control voltage to each relay to be used for controlling the tunnel devices.
6) Wire the conveyor enable circuit.
   - Wire the 24VAC power supply, Stop/Start buttons and control voltage to the conveyor motor control contactor.
7) Wire inputs.
   - Wire each Input device (Pulse, Enter and Tire switch devices, etc.)
8) Wire the TCS communications cable.
   - Connect the 4 wires and the shield of the RS-422 cable to the TCS box.
   - Connect the the 4 wires and NO shield to the communications phone jack near the TunnelWatch computer.
9) Install & wire the Tunnel Entrance Keypad communications jack.
   - Wire the outdoor phone jack with the 4 wires of the RS-422 cable from the TunnelWatch computer.
10) Recheck wiring.
    - Make sure all wiring is correct and installed securely.
11) Turn on the AC power to the TCS box.
12) Test TCS operations.
    - Make sure all devices, relays, and the conveyor enable circuit are operating correctly.
13) Label all input cards, relay cards and wire-ways.
    - Label the name of each function in the area provided for the Relay and Input cards.
    - Label the name of the devices wired to the source and output terminals on the provided wire-ways.
Tunnel Control Station Wiring Overview

**Tunnel Control Station**

You will be wiring each of the following:

1. 110V AC power
2. Source power into and control voltages out of each relay for the tunnel devices
3. Your 24VAC Power Supply to the Conveyor Enable Circuit
4. Each of your Stop and Start buttons to the Conveyor Enable Circuit
5. Connect the Conveyor Enable Circuit CONV output to your conveyor motor contactor.
6. The wires from each of your Input Devices (Pulse, Enter, Tire, Etc.)
7. The RS-422 communication cable from the TunnelWatch Computer

**Tunnel Entrance Keypad Station**

You will be wiring each of the following:

1. The 4 wires of the RS-422 cable from the TunnelWatch Computer

**TunnelWatch Computer Office**

You will be wiring the following:

1. The 4 wires and shield of the RS-422 cable from the Tunnel Entrance Keypad Station
2. The 4 wires of the RS-422 cable from the TCS Box
Steps for Installing the TCS Box

Note: If your wiring needs are different from the following recommended Tunnel Control Station wiring instructions, then see the appendix (page 32) for approved alternate wiring instructions and diagrams.

1st) Unpack the Tunnel Control Station box
1) Follow instructions on the TCS box for removing the equipment from the shipping carton.
2) Separate the equipment and place in its respective workstation:
   • TCS box will go where it will be wired (Should be the equipment room).
   • Outdoor phone jack at the Tunnel Entrance Keypad station or any outside Keypad Station.
   • The TCS communications phone jack will go into the room where the TunnelWatch computer will be placed.

Note: The key for the TCS box is in the bag located on the clip inside the door.
Note: Install the Vapor Corrosion Inhibitor disk on the inside, lower, center part of the door two to three inches above the bottom.

2nd) Mount TCS box

Mounting considerations:
   • Easily accessible for height.
   • Should have ample room surrounding for easy access and wiring.
   • Door should be able to fully extend open.
   • Should be able to clearly see the front of the door when it is closed.

3rd) Connect conduit to the TCS box

Specifications and Precautions:
   • Follow your local codes to run conduit for power and communications cables.
   • Metallic conduit should be used for all wire runs, including conduit for all RS-422 cabling. This includes runs from the office computer to the Tunnel Control Stations and from the computer to all keypads and cashier stations.
   • Your conduit should be large enough to allow ample room for current wiring needs and future expansion.
   • To reduce your communication cable’s susceptibility to lightning, your conduit should be metal and should be well grounded to the site power ground point.
   • The conduit MUST NOT enter the TCS box from the TOP. The conduit can safely enter either side, but for maximum moisture protection, it should enter through the bottom of the box. Use of top entry may cause electrical damage not covered by your warranty.
   • CAUTION: Take all precautions to protect the TCS electronic boards from metal chips/filings, etc.
Three conduit entry points are recommended to reduce cross-talk interference.

1) AC power wires and Conveyor Enable 24V power and the Stop/Start wiring.
   - AC power wire.
   - Conveyor Enable 24V power and control wiring.
   - Stop and Start wiring.

2) Input devices wiring and Relay source and output wires.

3) RS-422 cable.

Caution: Blow out the metal filings from the holes made in the case.

Figure 1: TCS Box with Conduits
4th) Connect AC Power

Specifications and Precautions:

- TCS power must be clean, “computer-grade” 110 V AC, 15 A, with its own isolated circuit (it may, however, share power with the computer).
- Make sure this circuit as well as the TCS metal box are connected to the site power ground.
- For new installations, DRB Systems highly recommends the following power wiring specifications to provide the most reliable equipment operation:
  - A dedicated 15A circuit breaker and dedicated 110VAC Hot, Neutral, and Ground conductors should be run to the TCS power input terminals. A metal conduit does not serve as a suitable ground conductor for this application.
  - All ground conductors connected to the TCS and to outlets that supply power to TunnelWatch and SiteWatch equipment (if applicable) must be properly bonded to each other, and to the system ground, in accordance with NEC. A metal conduit does not serve as a suitable ground conductor for this application.
  - If power provided to TunnelWatch and/or SiteWatch systems is provided from multiple services, as may be the case at sites with multiple buildings, two options exist to ensure reliable data communication:
    - Properly bond the system grounds together, in accordance with NEC.
    - Add optical isolation to any communication link (RS232, RS422, RS485, Ethernet); fiber optic networking is the most robust method for accomplishing this. Note: DRB Systems does not provide, set up, or troubleshoot optical isolation and fiber optic networks. The customer is responsible for arranging local installation and support for this setup.
- AC power input is fused. The fuse is located in a plastic holder under the Hot terminal.

1) Connect the AC power wires from your 110VAC power. See Figure 2: AC Wiring.
2) Turn the breaker controlling the TCS box off.
3) Pull the TCS AC power fuse before attempting to wire any part of the station.
5th) Wire Relays

Specifications and Precautions:

- Do not exceed the relay output ratings:
  - Relay Output Load Capacity -- 12V to 120V AC/DC, 2.5A continuous.
  - Maximum Current – 7A per relay, 13A total per relay card.

**Note:** 10A fuse is for protection only – 10A loads are not supported.

- Terminals can handle wires up to 12 AWG.
- Relay 1A is pre-wired for the conveyor circuit. **DO NOT remove!**
- **NO OTHER relay should be reserved for the conveyor!**
- Each relay output card controls 4 relays.
The TCS relays were selected for reliability and good performance. However, like all components, they have limitations and a finite lifespan. The following guidelines show the estimated lifespan relative to the load that is switched and the number of operations (wash volume per year). Since tunnel devices (motor starters, horns, solenoid valves, etc.) are usually turned on once per wash, the number of operations per year is about the same as the wash volume. This ignores a few test washes and those high volume times when continuous operation occurs.

**Guidelines for TCS Relay usage**

The TCS relays were selected for reliability and good performance. However, like all components, they have limitations and a finite lifespan. The following guidelines show the estimated lifespan relative to the load that is switched and the number of operations (wash volume per year). Since tunnel devices (motor starters, horns, solenoid valves, etc.) are usually turned on once per wash, the number of operations per year is about the same as the wash volume. This ignores a few test washes and those high volume times when continuous operation occurs.

**Note:** Average estimated life is shown. Individual relays may last a longer or shorter time.

Flashing lights and/or signs, however, are special. If you set TW to use a TCS relay to flash a light/sign directly, that relay will flash from 10 to 30 times during each vehicle wash cycle. Thus, the number of TCS relay operations is 10 to 30 times the number of washes, and its life (calendar time) will be 1/10 to 1/30 of its normal (non-flashing) life. For long TCS relay card life, **DRB Systems recommends that all light/sign flashing be done by a separate sign flasher module designed for that purpose.**

The flasher module is turned on by a TCS relay closure once per wash.

Two types of flasher modules exist: a module that installs in series with the TCS relay contacts to provide the make-break flashing function and a self-contained flasher that routes power to the light/sign through its internal flashing circuitry. The TCS relay provides an ON/OFF control signal (low current/voltage) to control the flasher.

<table>
<thead>
<tr>
<th>Load – Device Type</th>
<th>Voltage VAC</th>
<th>Current Amps</th>
<th>Estimated Relay Life (by wash volume)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>40K/yr</td>
</tr>
<tr>
<td>Motor Starter - Electronic</td>
<td>115</td>
<td>0.1A</td>
<td>10yr</td>
</tr>
<tr>
<td>Motor Starter – Contact</td>
<td>115</td>
<td>1A</td>
<td>10yr</td>
</tr>
<tr>
<td>Warning Horn</td>
<td>115</td>
<td>0.2A</td>
<td>10yr</td>
</tr>
<tr>
<td>Solenoid Valves – 115V</td>
<td>115</td>
<td>0.5A</td>
<td>10yr</td>
</tr>
<tr>
<td>Solenoid Valves – 24V Lo Pwr</td>
<td>24</td>
<td>1A</td>
<td>10yr</td>
</tr>
<tr>
<td>Solenoid Valves – 24V Hi Pwr</td>
<td>24</td>
<td>3A</td>
<td>6yr</td>
</tr>
<tr>
<td>Non Flashing Signs Lo Pwr or Flasher Modules – Serial Contact</td>
<td>115</td>
<td>100W</td>
<td>10yr</td>
</tr>
<tr>
<td>Non Flashing Signs Hi Pwr or Flasher Modules – Serial Contact</td>
<td>115</td>
<td>200W</td>
<td>6yr</td>
</tr>
<tr>
<td>Non Flashing Signs 300W or Flasher Modules – Serial Contact</td>
<td>115</td>
<td>300W</td>
<td>NR</td>
</tr>
<tr>
<td>Flasher Modules – Self Contained</td>
<td>24/115</td>
<td>0.1A</td>
<td>10yr</td>
</tr>
<tr>
<td>Direct Flashing Signs – Lo Power</td>
<td>115</td>
<td>100W</td>
<td>NR</td>
</tr>
<tr>
<td>Direct Flashing Signs – Hi Power</td>
<td>115</td>
<td>200W</td>
<td>NR 6mo</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-----</td>
<td>------</td>
<td>--------</td>
</tr>
<tr>
<td>Direct Flashing Signs - 300W</td>
<td>115</td>
<td>300W</td>
<td>NR &lt;2mo</td>
</tr>
</tbody>
</table>

Note: NR = Not Recommended
Wiring

1) Wire each relay source voltage and output according to the specifications:

(1) Reference only - Wiring must be installed by a qualified licensed electrician and must conform to all codes. Your configuration and requirements may differ.

DRB Systems is not responsible for the installation, maintenance, or safety of your electrical wiring.

(2) All 110 V control wire must be stranded 14 ga., and all 24 V control wire must be stranded 16 ga. (or larger if local code requires).

(3) The Blower is shown on a normally closed contact, so the Blower stays up when the tunnel is empty. The "Lower Blower" function is set to "deprogrammable".

(4) A separate relay is used to flash the light. With external flashers, only one relay is needed.

(5) The Conveyor Motor Control is pre-wired to the Conveyoy Enable Relay Circuit Board.

(6) A non-interlocked control wire can be used for devices like the Blower Raise solenoid and Parking Lot light.

(7) Relay Output Load Capacity -- 12V to 120V AC/DC, 2.5 A continuous

Maximum Current -- 7A per relay, 13A per card

Note: 10A fuse for protection only. 10A loads are not supported.
Tunnel Control Station Installation Instructions

2) Bridge connectors are included with each TCS to eliminate the need for jumper wires on the relay common terminals, if a common power source is used for multiple devices. Note that two bridge connectors may overlap to effectively increase the size of the bridge:

![Relay Common Bridge Connectors]

Figure 4: Relay Common Bridge Connectors
6th) Wire the Conveyor Enable Circuit

Specifications and Precautions:

- The TCS Conveyor Enable logic is self-contained and requires a site-supplied 24VAC source.
- The conveyor motor/pump starter must have a 24VAC coil or control input. If this cannot be done, the site must provide an external relay/contactor with a 24VAC coil. The external relay/contactor contacts would provide switching for non-24VAC controls (Usually 115VAC). See the Appendix section "How to Wire an Intermittent Relay for a 110V Conveyor Contactor" on page 36. DRB Systems does NOT provide the external relay/contactor.
- Start and Stop switches should only be connected to the Conveyor Enable Logic board.
- Interlock terminals are provided for the connection of an optional keylock security switch. The keylock switch should be ON when the key is in and turned. The keylock switch should be OFF when the key is not in place. This, along with the lockable TCS door provides a way to ensure that the conveyor cannot be started unless authorized. The keylock switch should be located in a secure area such as the manager’s office. If the keylock is not used, the terminals must be jumped.
- Input 1C is pre-wired for the Conveyor Enable input.
- A fuse protects the circuit board from power surges from the 24v input transformer.

Conveyor Enable Circuit Defined:
The built in Conveyor Enable Circuit of the Tunnel Control Station is used to allow the TunnelWatch software to start and stop the conveyor based on workflow needs while still allowing the stop buttons to be used for emergencies. The conveyor Start and Stop buttons are wired directly into the Conveyor Enable Circuit.

The conveyor Stop buttons will only be used for emergencies.
The Start buttons will only be used to re-enable the Conveyor Enable Circuit after a Stop button has been pressed.

NOTE: Relay 1A is pre-wired for the conveyor circuit.

♦ DO NOT connect the motor control output from Relay 1A terminal!
♦ No other relay is needed to control the conveyor.
1) Wire a 24VAC power supply to the **CONV** and **NEUT** terminals of the Conveyor Enable Circuit as shown in Figure 5: Conveyor Enable Circuit Power.

**CAUTION:** This circuit can ONLY handle a 24VAC-power source!

**Figure 5: Conveyor Enable Circuit Power**
2) Wire the Stop and Start buttons from throughout the carwash into the Conveyor Enable Stop and Start Button terminals using the following wiring diagram.

Stop/Start circuit wiring - "Home Run" (Recommended)

In a “home run” wiring configuration for the Stop/Start buttons, a pair of wires is brought back from each set of normally-closed stop contacts and each set of normally-open start contacts. Each wire is connected to a separate terminal on the Conveyor Enable Relay Circuit board, as shown. Up to 10 stop buttons (including the optional lockable security switch), and 4 start buttons can be wired this way.

The primary benefit of this wiring method is that it aids troubleshooting the buttons and wiring. If a stop button has failed, (the 24v LED is on, but the Stop LED is off) the failed button can be identified by jumpering the used terminal pairs one by one until the Stop LED turns on.

Although we recommend using the pairs in numerical order, the wires can be connected to any of the terminal pairs.

Any unused stop switch terminal pair must be jumpered to simulate the presence of a closed stop switch. If the lockable security switch is not installed, the Interlock pair of terminals must also be jumpered.

Any unused start switch terminals must be left open.

Figure 6: Conveyor Enable Circuit Stop/Start Button Wiring
3) Connect the Conveyor Enable Circuit to the motor control contactor.

- Run a wire from the CONV terminal to the source power input of the motor control contactor. 

*Remember this circuit uses 24VAC.*

---

**Typical Conveyor Enable Circuit**

(Single Voltage Start-Stop Interlock)

---

**NOTES:**

1. Reference only – Wiring must be installed by a qualified licensed electrician and must conform to all codes. DRB Systems is not responsible for the installation, maintenance, or safety of your electrical wiring. This drawing shows how the Conveyor could be wired.

2. All 24 V wire is 16 ga. stranded (or larger if local code requires).

3. Each pair of Stop terminal screws, labelled nA and nB corresponds to a stop button in a stop box. (Up to nine stop buttons plus a lockable security interlock switch.)

4. Stop buttons are normally closed contacts; Start buttons are normally open contacts. Except for the lockable Security switch, contacts are momentary.

5. All unused Stop button positions must have jumper wires installed between the A and B terminals.

6. Each pair of Start button terminals, labelled nA and nB, corresponds to a Start button in a start box. (The system can provide up to four Start buttons.)

7. Suggested part numbers (Grainger):
   - transformer: 1H270
   - start/stop box: 4B565
   - stop box: 4X563
   - lockable stop box: 4B586

8. The Conveyor Enable Relay Circuit board is in the Tunnel Control Station enclosure.

---

**Figure 7: Conveyor Control Wiring**
Tunnel Control Station Installation Instructions

4) **(Optional)** Provide conveyor interlock power to tunnel devices.
   - Run a wire from the INTLK terminal of the Conveyor Enable Circuit to a source input for a tunnel relay.

   **Typical Conveyor Enable Circuit**
   (Single Voltage Start-Stop Interlock)

   ![Diagram of Conveyor Enable Circuit](image)

   **NOTES:**
   1. Reference only -- Wiring must be installed by a qualified licensed electrician and must conform to all codes. DRB Systems is not responsible for the installation, maintenance, or safety of your electrical wiring. This drawing shows how the Conveyor could be wired.
   2. All 24 V wire is 16 ga. stranded (or larger if local code requires).
   3. Each pair of Stop terminal screws, labelled nA and nB corresponds to a stop button in a stop box. (Up to nine stop buttons plus a lockable security interlock switch.)
   4. Stop buttons are normally closed contacts; Start buttons are normally open contacts. Except for the lockable Security switch, contacts are momentary.
   5. All unused Stop button positions must have jumper wires installed between the A and B terminals.
   6. Each pair of Start button terminals, labelled nA and nB, corresponds to a Start button in a start box. (The system can provide up to four Start buttons.)
   7. Suggested part numbers (Grainger):
      - Transformer: 1H270
      - Start/Stop box: 4B565
      - Stop box: 4X583
      - Lockable stop box: 4B586
   8. The Conveyor Enable Relay Circuit board is in the Tunnel Control Station enclosure.

**Figure 8: Interlocking Tunnel Devices**
7th) Wire Inputs

Specifications and Precautions:

- The TCS 24 V AC reference power for input sensing is internally supplied. Caution: DO NOT connect the tunnel equipment (valving, actuators, etc.) to this 24VAC power. You MUST provide a separate 24 VAC source for the tunnel equipment.

- If DC power is required to power input devices, disconnect the yellow and blue 24VAC power wires that are terminated at the -24v and 24vCom terminals. A site-supplied 16v to 28v AC or DC power supply can be connected to the -24v and the 24vCom terminals.

- The Inputs may be used for optional input devices like a Tire Switch, Roller Cancel Switch, Auto-Roller Switch, or Send Car Switch/Button.

- Input 1C is pre-wired for the Conveyor Enable Circuit. Do not remove.

- DRB Systems strongly suggests that you wire the following input devices to these assigned terminals.
  - Pulse on Input 1A
  - Enter Switch on Input 1B
  - Tire Switch on Input 1D
Tunnel Control Station Installation Instructions

1) Wire all input devices to the **COM** (24VAC power) and an Input number/letter terminal (signal) as indicated in Figure 9: Input Wiring.

```
Figure 9: Input Wiring
```

(1) Reference only - Wiring must be installed by a qualified licensed electrician and must conform to all codes. Your configuration and requirements may differ.

**DRB Systems** is not responsible for the installation, maintenance, or safety of your electrical wiring.

(2) Leave 2 to 3 feet slack in the RS-422 cable to allow future maintenance.

(3) Leave 1 to 2 feet slack in the input wires.

(4) DRB Systems RS-422 wirecolors are shown. Your wire colors may differ.

(5) The Conveyor Control Relay contacts are pre-wired to input 1C.

(6) Part numbers. Warning: Avoid Quick Connect phone jacks when using stranded wire.

- **RJ-12, 6-wire phone jack, surface mount:** PJ00350 (DRB Systems)
  5C381 (Grainger)
- **RJ-12, 6-wire phone jack, flush mount:** 6C069 (Grainger)
- **RS-422 cable (shielded twisted pairs):** CA05422 (DRB Systems)
  1212C or 1292 or 2466C (Alpha)
  9502 or 1419A or 8723 (Belden)
  C0890 or C0601 or C1352 (Carol)
  4A635 or 4A639 or 2W965 (Grainger)
8th) Wire the TCS Communications Cable

Specifications and Precautions:

- **All communications cable must be RS-422** (shielded twisted pair). For part numbers and wiring instructions, see the Figure 11: Communications Wiring for details.
- The shield wire of this cable should only be connected at the **Tunnel Control Station (TCS)** end.

1) Run the RS-422 communications cable from the TCS box to where the TunnelWatch computer is to be connected.
2) Terminate the RS-422 cable at the computer end to a communications phone jack.
   - See Figure 11: Communications Wiring.
   A jumper must be installed between the Computer RS-422 port and the communications phone jack. See Figure 10: Computer Connection. **Note:** The communications phone jack terminal must be **near (6 feet or less)** the TunnelWatch computer.
Tunnel Control Station Installation Instructions

Figure 10: Computer Connection
Tunnel Control Station Installation Instructions

3) Connect the RS-422 cable to the communications terminals in the TCS box.

![Typical Tunnel Control Station Input Wiring](image)

(1) Reference only - Wiring must be installed by a qualified licensed electrician and must conform to all codes. Your configuration and requirements may differ.

DRB Systems is not responsible for the installation, maintenance, or safety of your electrical wiring.

(2) Leave 2 to 3 feet slack in the RS-422 cable to allow future maintenance.

(3) Leave 1 to 2 feet slack in the input wires.

(4) DRB Systems RS-422 wirecolors are shown. Your wire colors may differ.

(5) The Conveyor Control Relay contacts are pre-wired to input 1C.

(6) Part numbers. Warning: Avoid Quick Connect phone jacks when using stranded wire.

- **RJ-12, 6-wire phone jack, surface mount:** PJ00350 (DRB Systems)
  5C381 (Grainger)

- **RJ-12, 6-wire phone jack, flush mount:** 6C069 (Grainger)

- **RS-422 cable (shielded twisted pairs):** CA05422 (DRB Systems)
  1212C or 1292 or 2466C (Alpha)
  9502 or 1419A or 8723 (Belden)
  C0890 or C0601 or C1352 (Carol)
  4A635 or 4A639 or 2W985 (Grainger)

Figure 11: Communications Wiring
9th) Install & Wire the Tunnel Entrance Keypad Communications Jack

Specifications and Precautions:

- All communications cable must be RS-422 (shielded twisted pair). For part numbers and wiring instructions, see Figure 11: Communications Wiring for details.
- The shield wire should only be connected to an unused terminal in the phone jack labeled Tunnel Entrance Comm Jack located near the TunnelWatch computer.

Keypad Mounting Options

1) Run RS-422 communications cable from the TunnelWatch computer to the tunnel entrance Keypad Terminal station.
   **Note:** The communications phone jack terminal must be **near (6 feet or less) the TunnelWatch computer.**
2) Wire RS-422 cable to the outdoor jack.
   - See Figure 12: Outdoor Phone Jack Installation and Wiring
   **Note:** The provided outdoor phone jack should be used if the Keypad Terminal is to be used outdoors or in the carwash tunnel.
Tunnel Control Station Installation Instructions

Figure 12: Outdoor Phone Jack Installation and Wiring

**STEP 1**
Pre-assemble Box. Apply silicone to the threads of the 0.125 - 0.375 diameter cable grip and fasten it to one of the three holes located on the top, back, or bottom of the box. Apply silicone to the threads of the two hole plugs and plug the remaining two holes.

**STEP 2**
Mount Box. Attach Mounting Brackets to Box using two screws. Then attach Box to wall, using two site-supplied screws/anchors.

**STEP 3**
Feed RS-422 cable through the cable grip in the box and tighten the cable grip.

**STEP 4**
Apply Lubriplate to the jack opening on the front side of jack, and to the push down terminals on the back side of the phone jack. Ensure that enough Lubriplate is applied so that all exposed contacts are thoroughly coated.

**STEP 5**
Connect each of the four colored wires from the RS-422 wire to the terminals on the phone jack listed below.

<table>
<thead>
<tr>
<th>Wire</th>
<th>Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black (1st twisted pair, first wire)</td>
<td>3</td>
</tr>
<tr>
<td>Red (1st twisted pair, second wire)</td>
<td>4</td>
</tr>
<tr>
<td>Green (2nd twisted pair, first wire)</td>
<td>5</td>
</tr>
<tr>
<td>Yellow (2nd twisted pair, second wire)</td>
<td>6</td>
</tr>
<tr>
<td>Bare (Shield) --- Do not connect - cut off</td>
<td></td>
</tr>
</tbody>
</table>

**STEP 7**
Finish box assembly. Stuff the wires in the box and connect the jack to the box using the two flat head screws. With the gasket underneath, attach the Faceplate to the box using the two oval head screws.
3) Wire the RS-422 cable to the communications phone jack located near the TunnelWatch computer.

- Ensure that the wires connected to the colored terminals in the TunnelWatch office phone jack connect to the same terminals in the outdoor phone jack as the like colored wires from the cover. See Figure 13: TunnelWatch Computer Office Phone Jack Wiring for details.
- Only connect the shield wire at the TunnelWatch office computer end of the RS-422 cable.

![Figure 13: TunnelWatch Computer Office Phone Jack Wiring](image-url)
Recheck wiring
4) Visually inspect the wiring connections from all previous steps.
   • Ensure that all connections are secure and safe for operation.

10th) Turn on the AC power to the TCS box
1) Plug the TCS AC power fuse back into its holder under the AC wiring terminals.
2) Switch on the circuit breaker that powers the TCS box.
3) Switch the TCS power switch to on.

11th) Test TCS Operations
   Caution: These testing steps have to be completed without the TunnelWatch computer connected to the Tunnel Control Station.
   Note: If any of these testing operations fail, consult the appropriate section of the TunnelWatch TCS Installation Troubleshooting Guide for help and then restart the testing step from the beginning.

Test for relay operation
1) Override each relay in each Tunnel Control Station one at a time.
   • Ensure that the device the relay is assumed to control is turning on.

   Note: The conveyor should not turn on unless the Conveyor Enable Circuit is energized. The conveyor relay (1A) will be tested in a later step. Any relays that are wired to conveyor interlocked power will need to be tested after the conveyor circuit is energized.

Test Conveyor Enable Circuit
• Repeat this test for each of the Start/Stop conveyor control button positions.
• An assistant would be helpful for completing this step.
• Be sure to have good communications between yourself and the assistant to ensure each operation is completed properly.
• Switch the Conveyor relay (1A) to the OFF position.
• Check the Green 24v and STOP LEDs on the Conveyor Enable Circuit board. They should be on.

Conveyor Enable Testing Procedure:
1) Override the Conveyor Relay (1A) to the OFF position.
   • This will keep the conveyor from operating while testing the Conveyor Enable Circuit.

   RELAY 1A
   OFF

2) Is the green 24v LED on?
   • This light indicates that the 24VAC power is present.
Tunnel Control Station Installation Instructions

3) Is the green STOP LED on?
   - This light indicates that 24VAC power is running through the STOP buttons.
   **Note:** The green 24v and STOP LEDs MUST be on before you complete the following steps.

4) Press and release a Start button.
   - The green 24v LED on the Conveyor Enable Circuit board should stay on.
   - The green STOP LED on the Conveyor Enable Circuit board should stay on.
   - The yellow I Lock LED of the Conveyor Enable Circuit board should turn on.
   - The LED for the conveyor enable input (1C) in the Tunnel Control Station should turn on.

5) Press and hold a Stop button.
   - The green 24v LED on the Conveyor Enable Circuit board should stay on.
   - The green STOP LED on the Conveyor Enable Circuit board should turn off.
   - The yellow I LOCK LED of the Conveyor Enable Circuit board should turn off.
   - The LED for the conveyor enable input (1C) in the Tunnel Control Station should turn off.
6) Release the Stop button
   - The green 24v LED on the Conveyor Enable Circuit board should stay on.
   - The green STOP LED on the Conveyor Enable Circuit board should turn back on.
   - The yellow I LOCK LED of the Conveyor Enable Circuit board should stay off.
   - The LED for the conveyor enable input (1C) in the Tunnel Control Station should stay off.

7) Press and hold in a Stop button then press and hold in a Start button.
   - The green 24v LED on the Conveyor Enable Circuit board should stay on.
   - All other Conveyor Enable Circuit LEDs should be off.
   - The Conveyor Enable Input (1C) should be off.

8) Press and release a Stop button.
9) Turn the override switch for the Conveyor Relay (1A) to the **ON** position at the Tunnel Control Station.
   - Conveyor should **NOT** turn on.

10) Press and release a Start button.
    - The conveyor should start.

11) Press and release a Stop button.
    - The conveyor **SHOULD** stop.
12) Return the Conveyor Relay override switch to the **Auto** position at the Tunnel Control Station.

![Conveyor Relay override switch](image)

**CONVEYOR SHOULD BE OFF**

**Test for input device detection**

1) Ensure that the 24v LED on the logic card is on.
2) Simulate how a vehicle would activate each input device that is connected to the TCS input cards.

The following response should be seen for these critical input devices:

- **Pulse Switch** - Input 1A should blink on then off at a regular rate when the conveyor is running.
- The time between activations should be AT LEAST 1/2 second.
- **Enter Switch** - Input 1B should turn on and stay on as long as the switch is active.
- **Tire Switch(es)** - Various inputs starting with 1D should turn on when each tire of a vehicle rolls over the switch.
- It should turn off immediately when the tires of the vehicle roll off the switch.
- **Others** - These switches can be connected to any input. Ensure that they activate the correct input LED for the appropriate length of time.

**12th) Label all Inputs, Relay cards and wire-ways**

1) Use a marker or label maker to label each relay and input used.
2) Label each wire-way space used for relays and inputs.
Appendix A: Alternate Methods for Wiring TCS Components

Your Start/Stop Button Wiring is Different?

Choose one of the following Alternate Wiring Diagrams to wire your Start/Stop buttons.

How to Wire the Start/Stop Buttons Using 4 Separate Wire Runs

Stop/Start circuit wiring - "4-Wire"

In a "4-Wire" wiring configuration for the Stop/Start buttons, one wire is connected to the bottom interlock terminal to provide a power source to the first Stop switch. Each additional Stop switch is added in series with the switched side of the button connecting to the source side of the next button in a daisy-chain, and the final switch side returns to Stop terminal 5B.

A wire is run from any Start terminal A (3A is shown) to provide a power source for the source side of all Start switches. The switched side of all Start switches are connected together and run to any Start terminal B (3B is shown).

This wiring method uses less wire than the "Home Run" method, but more wire than the "3-Wire" method. It is not a commonly used control wiring circuit.

The primary drawback to this method is that troubleshooting is more difficult than the "Home Run" method.

Note that the unused stop switch terminal pairs should not be jumpered. Using the bottom Interlock terminal and Stop terminal 5B eliminates the need to jumper the unused positions.

Any unused start switch terminals must be left open.

Figure 14: 4-Wire Start/Stop Wiring Method
In a "3-Wire" wiring configuration for the Stop/Start buttons, one wire is connected to the bottom interlock terminal to provide a power source to the first Stop switch. Each additional Stop switch is added in series with the switched side of the button connecting to the source side of the next button in a daisy-chain, and the final switch side returns to Stop terminal 5B. A wire is run from the switched side of the last Stop button to provide a power source for the source side of all Start switches. The switched side of all Start switches are connected together and run to any Start terminal A.

This wiring method uses less wire than any other method, and is a commonly used control wiring circuit. It is often seen in existing washes where TunnelWatch is replacing a previous controller.

The primary drawback to this method is that troubleshooting is more difficult than the "Home Run" method.

Note that the unused stop switch terminal pairs should not be jumpered. Using the bottom Interlock terminal and Stop terminal 5B eliminates the need to jumper the unused positions.

Any unused start switch terminals must be left open.

Figure 15: 3-Wire Start/Stop Wiring Method
How to Wire Using Only a Stop Button at Each Stop Station

**Stop/Start Circuit Wiring - Single Button "Home Run"**

In the Stop/Start Button "home run" wiring configuration, a combined Stop/Start button is used. This button is a "Push-Pull" button, where the circuit is open if pushed and closed if pulled. A pair of wires is brought back from the Stop/Start switch contacts. One wire is connected any Stop terminal A and the other to any terminal B on the Conveyor Enable Relay Circuit board, as shown. If multiple Stop/Start buttons are used, they are each individually connected to a Stop Switch terminal pair, as in the "Home Run" method. To provide a continuous start circuit without a Start button, a jumper must be installed from Start switch terminal 1A to terminal 1B as shown.

The primary benefit of this wiring method is that it simplifies the button wiring and mounting, since no Start buttons are required.

Any unused stop switch terminal pair must be jumpered to simulate the presence of a closed stop switch. If the lockable security switch is not installed, the Interlock pair of terminals must also be jumpered.

**Figure 16: Single Button "Home Run" Wiring Method**
How to Daisy Chain Single Stop Buttons from Station to Station

**Stop/Start Circuit Wiring - Single Button "2-Wire Daisy Chain"**

In the Stop/Start Button "2-wire Daisy Chain" wiring configuration, a combined Stop/Start button is used. This button is a "Push-Pull" button, where the circuit is open if pushed and closed if pulled. A wire is brought from the bottom INTERLOCK terminal on the TCS Conveyor Enable Relay Circuit board to the source terminal of the first Stop/Start switch. If multiple Stop/Start buttons are used, the switched terminal of the first connects to the source terminal of the next until the last switch. The switched terminal of the last switch in the chain connects to terminal 5B on the TCS Conveyor Enable Relay Circuit board, as shown.

To provide a continuous start circuit without a Start button, a jumper must be installed from Start switch terminal 1A to terminal 1B as shown.

The primary benefit of this wiring method is that it simplifies the button wiring and mounting, since no Start buttons are required, and only two wires are run to the TCS.

It is not necessary to jumper the unused stop switch terminals.

**Figure 17: Single Stop Button 2-Wire "Daisy Chain" Wiring Method**

24 VAC Interlocked Stop/Start Circuit Wiring - Single Button "2-Wire Daisy Chain"
Need 110v Power for the Conveyor Contactor?

How to Wire an Intermittent Relay for a 110V Conveyor Contactor

When a 110VAC power source is required for the conveyor motor control contactor, use an intermediate relay. The suggested wiring configuration for an intermediate relay is shown below.

![Diagram](image_url)

**Note:**
This diagram shows a possible hook-up for an auxiliary external relay or contactor for control of 110 VAC conveyor circuits. It also provides a source for interlocked 110 VAC for tunnel equipment. The current rating of the contacts must be sufficient to supply the desired load. The coil connections are shown for operation with the TCS Conveyor Enable Logic board within the TCS box. The coil is 24 VAC to match the TCS conveyor control output.

A similar relay or contactor can be connected to any TCS Relay Output contact to allow control of high current devices beyond the TCS output rating. The TCS Relay Outputs are nominally 2 1/2 Ampere contacts, but any single contact can switch up to 7 Amperes as long as the same Relay Output card (4 relays) does not switch more than 13 Amperes total.

**Figure 18: 110v Conveyor Contactor Intermediate Relay**
Need 24v and 110v Power for Interlocking Relays to the Conveyor?

How to Wire an Intermittent Relay to Provide 24VAC and 110VAC Interlocked Source Power

This may be used if some relays require 110v interlocked source power and 24v-interlock power. To achieve this circuit use an intermediate relay powered by the INTLK and NEUT terminals similar to Figure 19: 110v Interlock Intermediate Relay.

**Note:**
This diagram shows a possible hook-up for an auxiliary external relay or contactor for control of interlocked 110 VAC for tunnel equipment. It also can provide control for a high current interlocked 24 VAC if desired. The current rating of the contacts must be sufficient to supply the desired load. The coil connections are shown for operation with the TCS Conveyor Enable Logic board within the TCS box. The coil is 24 VAC to match the TCS conveyor control output.

A similar relay or contactor can be connected to any TCS Relay Output contact to allow control of high current devices beyond the TCS output rating. The TCS Relay Outputs are nominally 2 1/2 Ampere contacts, but any single contact can switch up to 7 Amperes as long as the same Relay Output card (4 relays) does not switch more than 13 Amperes total.

**Figure 19: 110v Interlock Intermediate Relay**
Need a Different Source for Inputs?

How to Replace the Provided 24VAC with a 24VDC Input Power Supply that You Provide

If your input devices require 24VDC power, you must supply an adequate power supply to power these devices.

To connect these devices, follow these instructions:

1) Remove the yellow and blue wires connected to the -24V and 24VCOM terminals.  
   **Caution: Individually insulate each wire from all other components. They are LIVE WIRES.**

2) Connect the "hot" wire from the power supply you provided to the 24VCOM terminal.

3) Connect the neutral to the -24V terminal.
How to Power Input Devices Using the Provided 24VAC and a 24VDC Power Supply

- If some Input Devices require 24VAC and others require 24VDC, DRB Systems recommends you change all devices to 24VAC.
- If this is not an option, you can use Figure 20: 24VAC and 24VDC Input Device Wiring.

![Figure 20: 24VAC and 24VDC Input Device Wiring](image-url)
Need to Wire an Input Device that has more Than Two Wires?

How to Wire Multi-Wire Input Devices

If any of your input devices require multiple-wire (typically 3) connections, refer to Figure 21: 3-Wire Input Device Wiring.

![Figure 21: 3-Wire Input Device Wiring](image_url)
Have Multiple Tunnel Control Station Boxes?

How to Connect Two or More Tunnel Control Stations

1st) Install RS-422 communications cable between boxes.
   1) When installing two or more Tunnel Control Boxes, connect a communications cable between each TCS box.
      - Each of the TCS units will be connected in a “daisy chain” fashion.
   2) Connect the RS-422 cable run from the TunnelWatch computer to one TCS box communications terminals.
      - The shield from this cable will be connected to the SH terminal.
      - **DO NOT** connect the shield wire in the communications phone jack at the TunnelWatch computer.
      - See Figure 11: Communications Wiring.
   3) Connect another section of the RS-422 cable from the communication terminals of the 1<sup>st</sup> TCS box to the communication terminals of the 2<sup>nd</sup> TCS box.
      - The shield wire will be connected to the SH terminals on TCS Box 1 only.
      - See Figure 22: Multiple TCS Communication Wiring.
   4) Repeat step #3 for each successive TCS box.
      - See Figure 22: Multiple TCS Communication Wiring.

---

**Figure 22: Multiple TCS Communication Wiring**
2nd) Configure the TCS Logic Cards

1) Remove the red communications jumper (JP2) from the Logic Card of the TCS box where the RS-422 cable is connected to the TunnelWatch computer.

2) Remove the red communications jumpers (JP2) from the Logic Cards of any TCS box between the 1st and last box.
   • Example: You have 3 TCS boxes; the communications jumpers should be removed from the 1st and 2nd box and left on the 3rd.
   • See Figure 23: TCS Box Logic Card Communications Jumper JP2.

![TCS Logic Card Diagram]

**Figure 23: TCS Box Logic Card Communications Jumper JP2**

**Note**: A second jumper (JP1) is used for an internal logic card function Watchdog; it should NOT be removed on ANY logic cards.