

Operation Manual

SR-2000 SMART REEL ELEVATOR CONTROL SYSTEM



TOWER ELEVATOR SYSTEMS, INC.



NOTICES

Abstract

This Operation Manual contains basic information and instructions for Normal and Emergency Operation and fault troubleshooting of the TESI SR-2000 elevator control system.

Applicable Specifications

This equipment meets or exceeds the ASME A-17 Safety Code for Elevators and Escalators.

Disclaimer

This manual must not be relied upon for complete information and instruction in the safe use of the elevator equipment. Proper training and knowledge of elevator systems usage, OSHA and other safety rules, including electrical and fall protection must be a part of a qualified users training program.

Tower Elevator Systems, Inc. will not be liable in any event for direct, indirect, or consequential damages arising from the use of this Manual. We reserve the right to revise this Manual without the obligation to notify any person or organization. It is the responsibility of the owner/user to insure safe use of the equipment, including maintaining current documentation.

Warranty Program

TESI warrants all components to be free of defects in material and workmanship for a period of (1) years from the date of initial installation, provided a dated Final Inspection and Testing Report proof of proper installation by a TESI authorized representative, is forwarded to TESI.

Warranty Conditions

This warranty does not apply to products that have been abused, misused, or modified. Normal wear and tear is not covered under warranty.

TESI reserves the right as final authority whether the product should be repaired or replaced. Defective parts or products that can be shipped must be returned freight prepaid to receive warranty repair or replacement. Should a TESI authorized technician be called out for warranty repair, and it is discovered the repair is not covered under the warranty for reasons stated above; the customer is responsible for payment for repairs.

This is the only warranty. TESI makes no implied warranties, including any warranty of merchantability or fitness for a particular purpose. All warranties are limited to the duration of the expressed warranty period as set forth.

TESI's maximum liability hereunder is limited to the purchase price of the product. In no event shall TESI be liable for any consequential, indirect or special damages of any nature arising from the sale or use of the product.



SAFETY WARNINGS

Elevator systems equipment contains potentially dangerous high voltage electrical circuits and moving parts. Dangers exist that can only be recognized and avoided with proper training. Compliance with the OSHA and other safety regulations and proper inspection, maintenance, and repair of the equipment is imperative.

Use of the equipment should be limited to properly trained and authorized persons.

Although Tower Elevator Systems, Inc. has incorporated practical safety precautions and features in the equipment, extreme care must be taken at all times to insure personal safety when you operate or service this equipment. Observe all Safety and instructional signage.

Signage Legend

- **DANGER** – This means the hazard will kill or seriously injure you.
- **WARNING** – This means the hazard could kill or seriously injure you.
- **INSTRUCTIONS** – Owner policy and posted instructions must be followed.



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INTRODUCTION

The Smart Reel elevator control system is designed to replace the wireless battery operated systems commonly used on tall towers.

Wireless control systems have proven to be unreliable, costly to maintain, and have no emergency communications system. This is a serious safety deficiency and prevents the wireless systems from meeting OSHA or the Elevator Code.

The Smart Reel is direct-wired from the controller to the elevator car, eliminating the wireless link and the need for batteries. The control/communication cable is terminated into the car station panel and is carried up and down by the car as it travels. The Smart Reel uses a slip ring device with brushes to maintain a constant electrical connection as the reel turns. As the car moves the reel either pays out or takes up cable as required.

Our system uses this direct-wired circuit to establish a digital link between the controller PLC (programmable logic controller) and the remote operating position PLC's in the elevator car and at the ground control station.

Using industry proven components, we are able to support many more features of operation, particularly in the car station. Before, with the wireless systems, there were only operation buttons in the car, UP, DOWN, and STOP. Now, in addition to operation buttons, we have detailed operation and status indicators in plain text via digital display readout for all system operation functions, and we have a dial tone capable telephone/intercom.

The system also supports an Emergency OVER-RIDE mode to allow rescue from the tower in the unlikely event of a fault condition preventing Normal Operation.



SYSTEM OVERVIEW

TESI SR-2000 Smart Reel Elevator Control System

The Tower Elevator Systems, Inc. SR-2000 system provides reliable direct-wired controls for a traveling elevator car. The system can be installed on new or retrofitted to existing tower elevator systems.

Many added safety and convenience features are provided by the direct-wired control circuit.

The SR-2000 control system is comprised of the following main components;

1. **Main Controller** - Provides elevator hoist motor control using the master PLC digital processor and digital serial network connected to the remote operator stations. To be located in the transmitter building.
2. **Remote Operating Panels, (ROP)** - The system includes one Car Station ROP, located in the elevator car, and one Ground Station ROP located on the Smart Reel® enclosure at the tower base. The ROP's connect to the Main Controller with slave PLC processors and provide full feature remote control of the elevator system.
3. **Smart Reel® Control Cable Reel Drive** - Housed in a protected enclosure at the tower base, the Smart Reel® provides for take-up and let-out of the control cable as the car travels and maintains a constant electrical connection through a slip-ring device on the reel. The control cable is stored on the reel in the weather protected enclosure when the elevator is at the base landing.
4. **Hard-Wired Control Cable** - Tethered to, and traveling with the elevator car at all times, the cable is connected to the Car Station ROP on one end and to the Main Controller on the other end. This is the reliable hard-wire link.
5. **Telephone/Intercom System** - The system includes dial tone capable digital telephone system, with extensions at the Car Station ROP, at the Ground Station ROP, and a desk set for the Ground Attendant in the transmitter building. The system incorporates a user friendly Voice Message Information feature, (VMI), to supplement the written operation documentation.

The **Main Controller** provides control for the elevator hoist drive motor and the Smart Reel® control cable management system via the *master* programmable logic controller, (PLC). The system utilizes a custom designed software program providing a digital serial network RS-485 link between the ROP's and the main controller. This standard industrial network is capable of transmitting data over long distances and has high immunity from external electromagnetic interference. The system allows full feature remote control of the elevator car from the ROP's and incorporates a separate hard-wired Emergency Stop circuit to the CAR ROP STOP button and to the safety limit switches. There is non-volatile RAM memory to log any fault conditions and an optional modem, to be manually connected, for remote access to the system for troubleshooting and testing purposes.

The **Car Station** remote operator panel (ROP) is located in the elevator car. This ROP also powers the car floodlight, which illuminates the door threshold automatically anytime the car gate is opened, to meet the ASME A-17.1 Elevator Code requirement. The **Ground Station** ROP is located on the Smart Reel® enclosure at the tower base. This ROP includes a loud ringing audible alarm, to alert persons anytime the Ground Station ROP phone is called.

Both offer full feature control of the elevator system via a slave PLC and a Man-Machine Interface unit, or MMI. The MMI's utilizes a, daylight-readable, vacuum fluorescent text display screen enabling the operator to view the current operating status of the elevator as well as keypad access to the Emergency OVER-RIDE Mode. Authorized persons use the keypad to bypass the safety circuit for Emergency Rescue of a stranded elevator car.

The **Smart Reel®** automatically coordinates the pay-out and take-up of the control cable as the car moves up and down the tower. The hard-wired **Control Cable** is tethered to and travels with the elevator car, connecting

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the Car Station ROP on one end and to the Main Controller on the other end. An electrical slip-ring assembly on the reel provides a constant live connection between the Main Controller and the Car Station ROP as the reel turns, including the telephone/intercom circuit. Cable over tension is prevented by monitoring cable pull at the elevator car connection via a load cell tension link. This safety system will shut down the elevator if the cable is pulled more than the prescribed amount or becomes under tensioned for any reason. This feature prevents damage to the cable in the unlikely event that the cable becomes entangled.

The **Telephone/Intercom** system allows direct communications for all telephone extensions on the system. Outside line access for 911 Emergency or general use may be provided at the discretion of the Site Manager. The system incorporates a user friendly *Voice Message Information* feature, (VMI), to supplement the written user operation documentation. Using the telephone keypad, a user has access to voice recordings for Operation, Emergency Procedure, and custom recordable Site Specific Hazard Information, including RF hazards.

SUMMARY

- The system is Hard-Wired; eliminating the battery powered wireless operation typically found on tower installations.
- There are numerous safety features; including MMI visual display of system status, separate E-Stop circuit, and car lighting.
- There is an Emergency OVER-RIDE Mode for rescue of a stranded elevator car.
- The included Telephone/Intercom satisfies the ASME A17.1 Elevator Code requirement for emergency communications and provides safety and convenience for the users.
- The system is capable of remote access via a modem or IP Internet connection, making troubleshooting more economical and timely.
- SR-2000 brings new and innovative patented technology to the broadcast tower elevator industry – US Patent 6,786,306 B2

The SR - 2000 is a safer, more reliable, and easier to maintain tower elevator control system



FUNCTION DESCRIPTIONS

The description of the functions will be divided into sections determined by point of operation.

Sections

- MAIN CONTROLLER
- SMART REEL COMPONENTS
- REMOTE OPERATING PANELS
- PHONE SYSTEM

Main Controller

Purpose - Control the hoist cable drive motor by relaying commands from the Car or Ground Station panels.

1. The heart of the controller is a custom programmed PLC connected to the car station and ground station via an RS-485 network connection.
2. Houses the Digital Phone System.
3. Provides Soft Start control and Overload protection for the Main Elevator Drive motor.
4. Provides monitored Uninterruptible Power Supply (UPS) in the event of power loss to meet Code requirements for emergency communications. UPS also provides back-up power to the PLC, which will alert the operator of the power failure via the digital text display in the car and at the ground operating position.
5. Safety and operation signage.

Smart Reel Components

Purpose - Provide enclosure, mounting structure, feedback, and safety inputs to the Smart Reel Controller.

1. Aluminum weather sealed enclosure for all of the Smart Reel cable management equipment. Three lockable access doors are provided for inspection and maintenance. The enclosure is vented and drained.
2. Reel with cable level wind mechanism to control the cable winding on the drum.
3. Cable over tension protection is provided via a load cell tension link, which sends a signal to the PLC for system shut-down anytime the cable pull at the car attachment point is over or under its prescribed range.
4. Cable payout and take-up is managed by a unique magnetic drive slip clutch and gear box attached to the reel mechanism, which provides constant line pull over an infinite distance. This allows the Smart-Reel system to let out or take up cable automatically to match the elevator car speed and direction while traveling up tall open structures such as broadcast towers.
5. Deflector sheaves direct the cable out of the enclosure and to the car, free from obstruction and abrasion. All sheaves are protected with side plates to prevent pinch point hazards.
6. Turngate brackets capture and secure the traveling cable every 60' up the tower elevator shaft. This keeps the cable secure and safe from entanglement by any obstructions that may be present in the tower shaft.

Remote Operating Panels

Purpose - Provides control of the elevator system and Status / Fault information to the Operator.

1. System includes a Car ROP, mounted in the elevator car and Ground ROP mounted to the Smart Reel Enclosure near the tower base.
2. Both provide a universal control interface with operational buttons to control car travel, UP, DOWN, and STOP.
3. Each ROP has a slave PLC networked to the main controller master PLC with an integrated text display, programmable function buttons, a keypad for passcode entry and status/alert lamps. General operation and fault conditions are displayed in real text for easy system diagnostics by the operator.
4. Has a green Elevator Ready light indicating the safety circuits are good and the system is ready for operation.



5. Has an amber Fault light indicating that one of the safety circuits are faulted. The text display will read out which circuit is in fault condition.
6. Has a red OVER-RIDE light indicating that the system has been put into override mode and all safety circuits are bypassed. The text display will also indicate OVER-RIDE mode is active.
7. Provides a KEY CODE secured emergency OVER-RIDE mode to allow bypassing the safety circuits in the event of a fault condition for tower evacuation.
8. Elevator Car Door threshold lighting per the ASME A17.1 Elevator Code. Safety and operation signage. The threshold remains illuminated whenever the system is powered on and the Car Door is open.
9. Contains an industrial weather resistant phone station with handset volume control, and a payphone type keypad.

Telephone/Intercom System

Purpose - Provide dial tone capable telephone and intercom communications between the Ground Attendant, Main Controller, and Car Station for safe operation and utility purposes.

1. Digital programmable phone switch is mounted in the Main Controller cabinet.
2. Multi-line capable, Outside Line capable, and extension based dialing between stations.
3. Incoming Telco Line Surge protection.
4. Battery back-up per the ASME A17.1 Elevator Code to insure communications in the event of emergency rescue.
5. Audible loud auxiliary ringer for the Car and Ground Station to alert the user of an incoming call.
6. Ground Attendant desk set in the transmitter building near the main controller.
7. Industrial weather resistant phone stations with handset volume control and a payphone type keypad are included at the CAR and Ground ROP's.
8. *Voice Message Information* feature, (VMI), to supplement the written user operation documentation. Using the telephone keypad, a user has access to voice recordings for Operation, Emergency Procedure, and custom recordable Site Specific Hazard Information, including RF hazards.



OPERATION INSTRUCTIONS

TESI SR-2000 Smart Reel Elevator Control System

These instructions are divided into two sections;

- NORMAL OPERATION
- EMERGENCY OPERATION

Normal Operation – Car Station

1. *Only trained and authorized persons are allowed to use this equipment.* Before use you must conduct a Safety Meeting with a designated Ground Attendant including the adoption of an Emergency Rescue plan. All OSHA safety and Personal Protective Equipment rules must be followed for safe use of this equipment.
2. Verify the electrical power is ON to the Main Controller, Smart Reel, and Hoist Drive motor/brake. Check all in-line external Disconnects per NEC.
3. Verify the system is in Car Control Mode, insuring only the Car Station controls are active.
4. Enact KEY CODE security measures to insure access to the Ground Control is limited only to authorized persons.
5. Inspect all accessible mechanical components; including the drive motor, traction drive sheaves, tensions weights and tension weight over travel limits switches, the car, car guide wheels, hoist cables, and tower shaft to insure the car travel path is clear.
6. Observe the safety threshold lighting is operative.
7. Test to confirm operation of the telephone/intercom system from the Main Controller to the Car Station and Ground Attendant set in the building.
8. Read and understand all Safety and Hazard signage.
9. Close the car gate door.
10. Pull the STOP/ENABLE button out to activate the controls.
11. Observe the green Elevator Ready light is illuminated on the Car Station panel. If the green Elevator Ready light is not illuminated you must diagnose and correct the indicated faults prior to use of the system.
12. With a green Elevator Ready light on, test the system with short up and down travel prior to full use.



Emergency Operation – Car or Ground ROP

An Emergency exists any time the system is in use with a fault condition indicated.

Emergency OVER-RIDE mode bypasses the safety circuit and must only be used for Emergency Rescue Operation.

For Safety reasons, EMERGENCY OVER-RIDE Mode will not bypass the hoist cable Tension Weight safety circuit or the Smart Reel over tension switch. If a tension weight fault is shown, the fault must be corrected prior to continued car movement.

In the event of a fault condition, confirm; the car gate is closed, the STOP/ENABLE button is pulled out, and there are no broken hoist cables. If after inspection and attempt to remedy, the fault continues, it is possible to OVER-RIDE the safety circuit using the EMERGENCY OVER-RIDE mode on the display interface. While in Emergency OVER-RIDE mode, both the Car and Ground ROP controls are active allowing the car to be moved from either location.

NOTE: A (4) digit security KEY CODE is required to transfer the system to Emergency OVER-RIDE mode. Contact the site manager for additional information or access to the KEY CODE.

TO INITIATE AN EMERGENCY RESCUE PLAN:

1. Call and inform the Ground Attendant of the emergency. Have them stand-by and monitor the telephone/intercom.
2. Insure all personnel are safely in the car, with the gate fully closed, or clear of the car travel.
3. On the Control Display Interface, press the “OVER-RIDE” button and follow the on screen prompts.
4. At this point the operator must enter a KEY CODE as directed to bypass the safety circuits.
5. Once the system has transferred to “OVER-RIDE” mode, the RED “OVER-RIDE” Indicator Light will illuminate.
6. The operator may now use the UP/DOWN car controls to effect a safe rescue to the base landing.

NOTE: In EMERGENCY OVER-RIDE Mode, you must continually depress the desired UP/DOWN direction button to sustain car movement. You must also manually STOP the car at the base landing by releasing the directional button, as the safety travel limits have been bypassed and will not automatically stop the car.

Once safely to the base landing, LOCK-OUT/TAG-OUT the system until repairs are made.



SYSTEM ADMINISTRATION

Changing Operation Modes:

ACCESS OPERATION MODES USING THE (3) LABELED FUNCTION BUTTONS ON THE TEXT DISPLAY.

Note: The active mode will be marked by an illuminated Red LED Light above the button.

Choose Mode Of Operation:

- Car Control – Only Car Controls Are Active
- Ground Control – Only Ground Controls Are Active
- Emergency Over Ride – Emergency Control is Available from Ground or Car Panel. Requires Constant Pressure on the UP / Down Buttons to Sustain Car Movement.

Safety Note about Hard Wired E-Stop:

By Design and Elevator Code Requirements the Stop / Enable Button in the Car is part of the Hard Wired E-Stop Safety Circuit. This gives final control of car movement to the operator in the car in either Car or Ground Control Modes. E.g. the Stop / Enable Button in the Car must be in the Enable (out) position for the car to move (even in ground control mode).

Car can be moved in Emergency Over Ride Mode regardless of Car Stop Button Position.

Key Code Access Control

A (4) digit security KEY CODE is required to transfer the system from any mode of operation to another. This also includes entry into the System Administration Functions.

There are (2) Levels of Security Code

- User Code – Default from Factory 1111 – Code Required by User to Change Operation Modes
- Administrator – Default from Factory 9999 – Code Required to Enter System Administration Functions

User Entry Procedure:

- Press Mode or Admin (right most button) Key on Text Display
- Press the Enter Key to Reposition the Cursor for Input (cursor must be over the right most digit)
- Enter 4 Digit Key Code (over rights numbers on shown on display)
- System Will Change Modes Upon Entry of Valid Code
- If Invalid Code is Entered, Repeat Procedure
- If System Gets Locked in Error Loop due to invalid entry, wait one minute and the system will reset.

Both User and Admin Codes can be Changed by the Customer with System Admin Access

Cable Weight Display

Cable Weight Information derived from the Load Cell can be temporarily accessed by pressing the “blacked out” left most function button. This is not needed for normal operation, but is available for system commissioning and troubleshooting of the load cell as needed.



System Administration from EZ-Text Display at Ground or Car ROP

ACCESS ADMIN MENU USING THE RIGHT MOST FUNCTION BUTTON ON THE TEXT DISPLAY – (BLACKED OUT)
Note: The Admin Key Code is Required to Enter the Administration Mode.

Press Admin Button - Display Will Show:

- **Message Line 1: “Enter Admin”**
- **Message Line 2: “1111 Enter Key Code”**

Entry Procedure:

- **Press the Enter Key to Reposition the Cursor for Input (cursor must be over the right most digit for entry)**
- **Enter 4 Digit Key Code (over rights numbers on shown on display)**
- **System Will Change Modes Upon Entry of Valid Code**
- **If Invalid Code is Entered, Repeat Procedure**
- **If System Gets Locked in Error Loop due to improper entry, wait one minute and the system will reset.**

Once a Valid Admin Code is entered the HMI displays the Following Messages:

Display Will Show:

- **Message Line 1: “Admin Menu Code 0”**
- **Message Line 2: “Select Menu Code”**

Entry Procedure:

- **Use the Up Arrow to Reposition the Cursor to the Admin Code Entry Line (message line 1)**
- **Input Desired Function from Table Shown Below**
- **Change Value on Message Line 2 as indicated**

There are 4 Functions to modify Codes and System Parameters. These functions are listed in the following table:

Function #	Description
1	Change User Code/Password
2	Change Admin Code/Password
3	Set Brake Timer
4	Set Over Tension Alarm

Note: To Enter the a Valid Code the operator has to position the cursor at the code number of the Message Line 1 and the press a number from 1 to 4 from the keypad and then press the enter key to select the correspondent function.



Function 1: “Admin Menu Code 1” – Change ADMIN KEY CODE

This Function Allows the user to change the Admin Code/Password, the format is 4 digits “XXXX” and the valid range is from 1000...9999. To modify the value the user has to move the cursor to the Message Line 2 and then press enter key to activate the parameter cell where the value can be change.

Message Line 1: “Admin Menu Code 1”

Message Line 2: “1111-4 Digit Key Code”

Function 2: “Admin Menu Code 2” – Change USER KEY CODE

This Function Allows the user to change the User Code/Password, the format is 4 digits “XXXX” and the valid range is from 1000...9999.

Message Line 1: “Admin Menu Code 2”

Message Line 2: “1111-4 Digit Key Code”

Function 3: “Admin Menu Code 3” – Change ELEVATOR MOTOR BRAKE DELAY

This function is useful to adjust the time delay between when the motor is energized and when the brake releases. This is sometimes necessary for smooth system operation to hold the car in place until the motor is ready to take over.

This Function Allows the user to change the Delay time to energize the brake after the main motor contactor is engaged, the format is 2 digits with decimal point “X.X” and the valid range is from 0.1 to 0.9. Is important to mention that to enter a valid value the user has to press the “.” Period followed by the decimal digit.

Message Line 1: “Admin Menu Code 3”

Message Line 2: “Set Brake Delay 0.1”

Function 4: “Admin Menu Code 4” - Change OVER TENSION TOLERANCE

This function is used at system commissioning to adjust the tolerance over the actual cable weight where the system should show an Over Tension Fault.

This Function Configures the Over Tension Tolerance at the initial system setup, the format is 2 digits “XX” and the valid range is from 10 to 99 in Lbs.

Message Line 1: “Admin Menu Code 4”

Message Line 2: “Set Over Tension 11”



SYSTEM TROUBLESHOOTING

TESI SR-2000 Smart Reel Elevator Control System

Troubleshooting is necessary to diagnose and repair the system any time a fault light or other operation anomaly is encountered.

Quick Check Problem Solver		
Symptom	Possible Cause	Solution
No Power at Main Controller	<ol style="list-style-type: none"> 1. Check Main breaker. 2. Check Controller disconnect. 3. Check hoist drive motor thermal overload in the Main Controller. 	Turn on, reset, or contact electrician for diagnosis.
No Car Station Control	<ol style="list-style-type: none"> 1. Verify the system is set to car control via the operator interface. 2. Verify the hoist drive motor has power 	<ol style="list-style-type: none"> 1. Set Car Control at operator interface 2. Check disconnect at drive motor.
System has Power, but will not function.	<ol style="list-style-type: none"> 1. Check fault indication at Ground or Car operation panel text display. 	<ol style="list-style-type: none"> 1. Diagnose and correct indicated fault condition as appropriate.
Load Cell Fault	<ol style="list-style-type: none"> 2. Cable may be hung up 	<ol style="list-style-type: none"> 2. Diagnose and correct indicated fault condition as appropriate. If fault cannot be cleared, place system in Emergency Override Mode and lower the car. Note: Car will only move down with an active Load Cell Fault. Be certain to have a person on the ground to lay out the control cable as the car is lowered to avoid entanglement in the Elevator Sheaves.

At the Car Station

1. Insure that the system control is set to the appropriate Car or Ground Operating Panel
2. If you observe a fault condition, inspect to verify the indicated switch is not damaged or stuck in an open position by moving the actuator arm on the switch. If the fault remains, you must replace the switch or declare an Emergency if you are in Normal Operation.
3. NOTE: The CAR Station STOP/ENABLE button must be in the "pulled out" position before the UP or DOWN buttons will activate in either Car or Ground Control modes. This is due to the Hard-Wired E-Stop circuit and is an intentional safety feature. The car will not move unless the Car Operator has placed the car in service.
4. The UP button is disabled if you are at the top landing and the UP travel limit is engaged. The DOWN button remains active in this scenario.
5. The DOWN button is disabled if you are at the bottom landing and the DOWN limit is engaged. The UP button remains active in this scenario.
6. If the car stops unexpectedly, consider these possible causes;
 - a. Elevator Drive has lost power – you will see a fault text message on your display.
 - b. Hoist cable tension weights have engaged their limit switch.
 - c. The Smart Reel control cable has become entangle and is in an over or under tension state as measured from the lifting bar at the car.
 - d. The control cable has been severed or damaged.
 - e. High winds are preventing the control cable from free travel to the reel.



7. In the event of an unexpected stop;
 - a. Call and inform the Ground Attendant of the problem.
 - b. Check the text information display for fault information.
 - c. If the Smart Reel is inoperative, it must be repaired or you must discontinue Normal Operation and perform an Emergency Evacuation Rescue from the tower using the OVER-RIDE mode. Care must be taken to prevent the control cable from tangling in the hoist cable sheaves at the tower base. A technician must feed the cable out of the tower as the car descends.

From the Ground Station

1. Review the text diagnostic display for information regarding a fault condition. If the display is inactive, check the main power circuit.
2. Inspect the hoist cable tension weight limit switches to insure the tension weights are in the proper position. If the hoist cable tension weights sit down on their buffers the tension in the hoist cables is reduced causing a serious safety situation. The hoist drive relies on hoist cable tension to provide traction at the drive wheels. *Do not bypass the hoist cable tension weight limit switches at any time.*
3. The Smart Reel control cable reel system must be operative for Emergency Ground Control operation *OR*, you must have a technician available to pull/feed the control cable out of the tower as the car travels down to keep the control cable from getting tangled in the hoist cable sheaves.

At the Smart Reel

1. Confirm the Smart Reel motor is turning and is providing constant line tension while the elevator is in Ready mode or OVER-RIDE Mode. NOTE: the SR motor will only turn on when the Elevator is in Ready State or OVER-RIDE Mode.



Text Display Information and Fault Messages

EVENT/FAULT DESCRIPTION	TYPE	PANEL MESSAGE
Door Open Limit Switch	EVENT	Door Open
Lower Limit Switch	EVENT	At Lower Landing
Upper Limit Switch	EVENT	At Upper Landing
Elevator is Running Down	EVENT	Car Moving Down
Elevator is Running UP	EVENT	Car Moving Up
Elevator Ready Status	EVENT	Elevator is Ready
Smart Reel Motor On	EVENT	(Log Event Only)
Ground ROP Communications Fault	FAULT	Comms to Ground ROP
Cabin ROP Communication Fault	FAULT	Comms to Cab ROP
Motor Starter 1 Fault	FAULT	Main Motor Fault
Motor Starter 2 Fault	FAULT	Smart Reel Mtr Fault
Motor Starter 1 Tripped	FAULT	Main Motor Tripped
Motor Starter 2 Tripped	FAULT	Smart Reel Tripped
Ground E-Stop pressed	FAULT	Ground STOP Button
Cabin E-Stop pressed	FAULT	Car STOP Button
Over Speed Fault	FAULT	Over Speed
Lower Overtravel Fault	FAULT	Down Over Travel
Upper Overtravel Fault	FAULT	Up Over Travel
Broken Rope Fault	FAULT	Broken Rope
SR Cable Over Tension Fault	FAULT	Over Tension
Elevation Count Fault	FAULT	Elevation Count
Elevator Weights Fault	FAULT	Elevator Weights
Over Ride Mode	MODE	LED Indicator - EMERGENCY OVER RIDE
Ground Control Mode	MODE	LED Indicator - GROUND CONTROL MODE
Car Control Mode	MODE	LED Indicator - CAR CONTROL MODE
Control Cable Weight	VALUE	Dynamic Information
Elevator Elevation Feet	VALUE	Dynamic Information



MAINTENANCE AND REPAIR

Keep in mind, this manual is for the Smart Reel control system and does not include maintenance of the hoist mechanism apparatus.

Safe operation of the Smart Reel system depends on an effective maintenance program, including repairs when needed. Visual inspections and recordkeeping are key elements of a systematic maintenance program and are useful in troubleshooting and preventative maintenance procedures.

Smart Reel Operation Mode Switch:

The Smart Reel Operation Mode Selector Switch is located just inside the main enclosure door. This selector switch can be used by a technician to select "Auto", "Off", or "Hand" (manual) mode for Smart Reel Operation.

Auto – Standard Operation Setting - SR is Automatically Controlled by PLC at Main Controller.

Off – Turns SR Motor Off for Maintenance or Troubleshooting.

Hand – Turns SR Motor On for Maintenance and Installation.

- Caution -

In "HAND" Mode the Reel will instantly begin to produce tension or freewheel if not restricted by cable tension. Do Not Turn the Switch to "HAND" unless you are manually providing reel control, or the cable is already taught.

Maintenance

Purpose: Keep the system in a reliable safe operating condition.

Procedure: The Smart Reel system does not require extensive maintenance, so it is important to not become complacent with the trouble free operation.

Monthly:

- Run the system for at least ten minutes up and then back down. This is necessary to clean the brushes in the slip ring at the live reel connection.

Annually:

- We suggest a visual inspection by a competent person be performed each year and a report of the findings kept with the elevator documents at the site. This inspection should include testing of all limit switches and all Normal and Emergency operating functions.
- Lubricate level wind system and check the oil level in the reel drive gearbox.
- Clean any rodent or insect nests.
- Verify all safety signage is intact.

Five Year Intervals:

- Perform a complete system inspection and function proof test by a Certified Elevator Technician trained in the Smart Reel system. The inspection and testing format should be similar to the Final Testing and Inspection Report.



Repair

Purpose: Correct a defective component. Additionally, we suggest repairs as a preventive measure to avoid component failure and system breakdown any time inspection indicates a component is worn and nearing the end of its' useful life.

Procedure:

- The level wind chain and chain sprockets may become worn and require replacement.
- The control cable may become worn or damaged.
- Key locks require lubrication and in cold climates can become frozen.
- Limit switches age and can fail.

Should repairs beyond the simple procedures described here be required, seek additional information in the enclosed product specification sheets for the various components, or contact our office for assistance.

DIAGRAM 1.1 - SR MAIN PANEL FUNCTIONAL LAYOUT

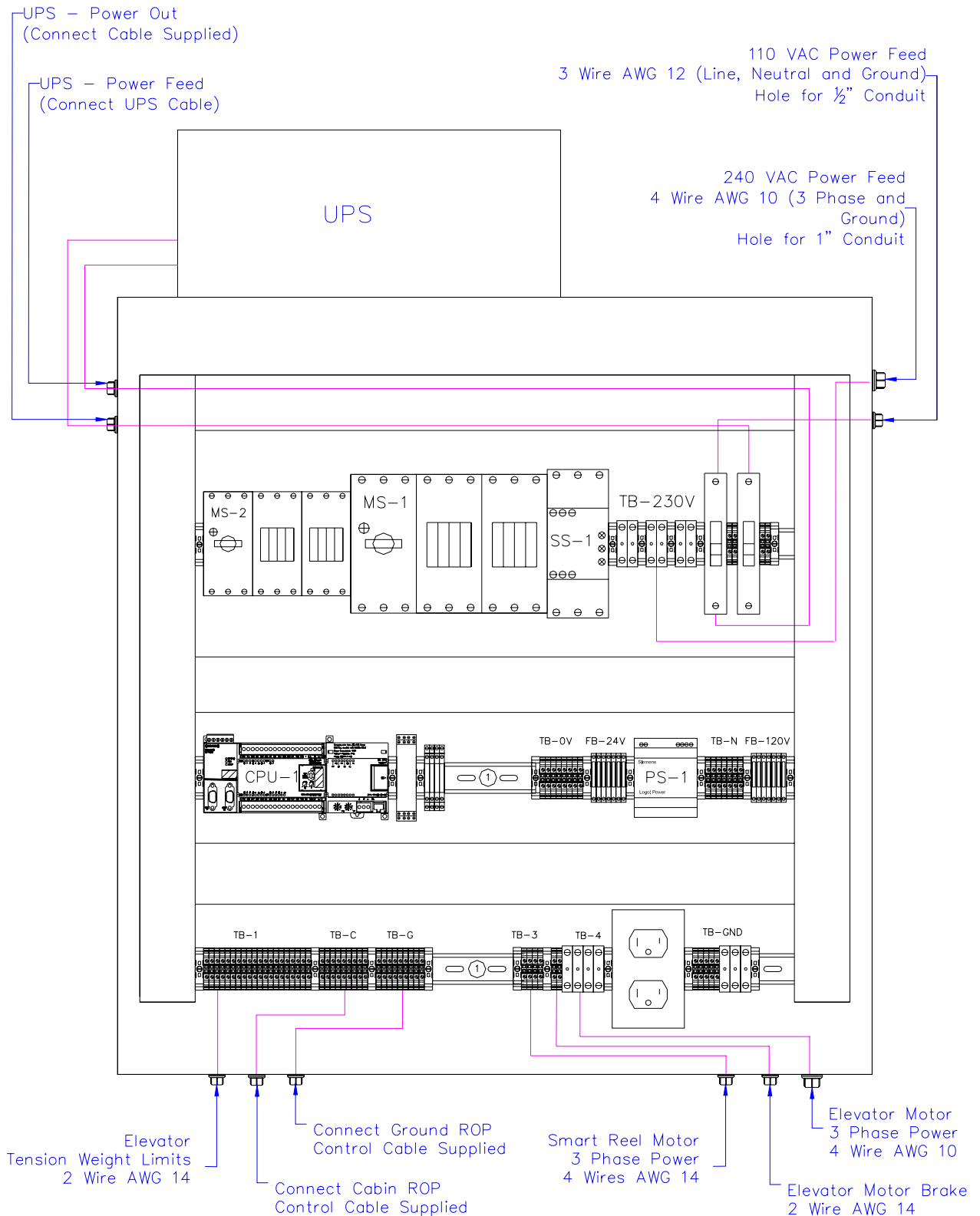




DIAGRAM 2.1 - SR CAR STATION FUNCTIONAL LAYOUT

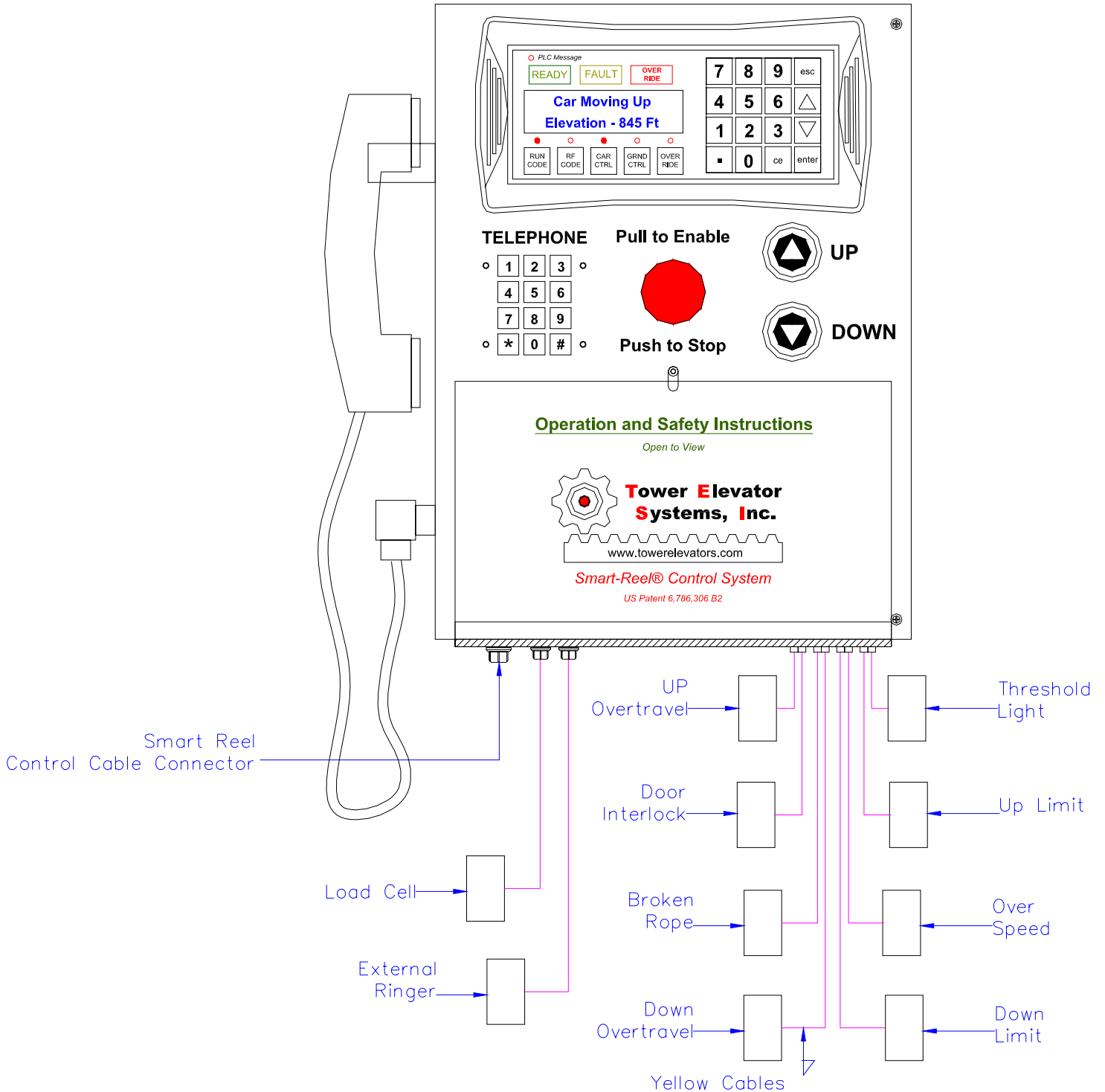


DIAGRAM 3.1 - SR GROUND STATION FUNCTIONAL LAYOUT

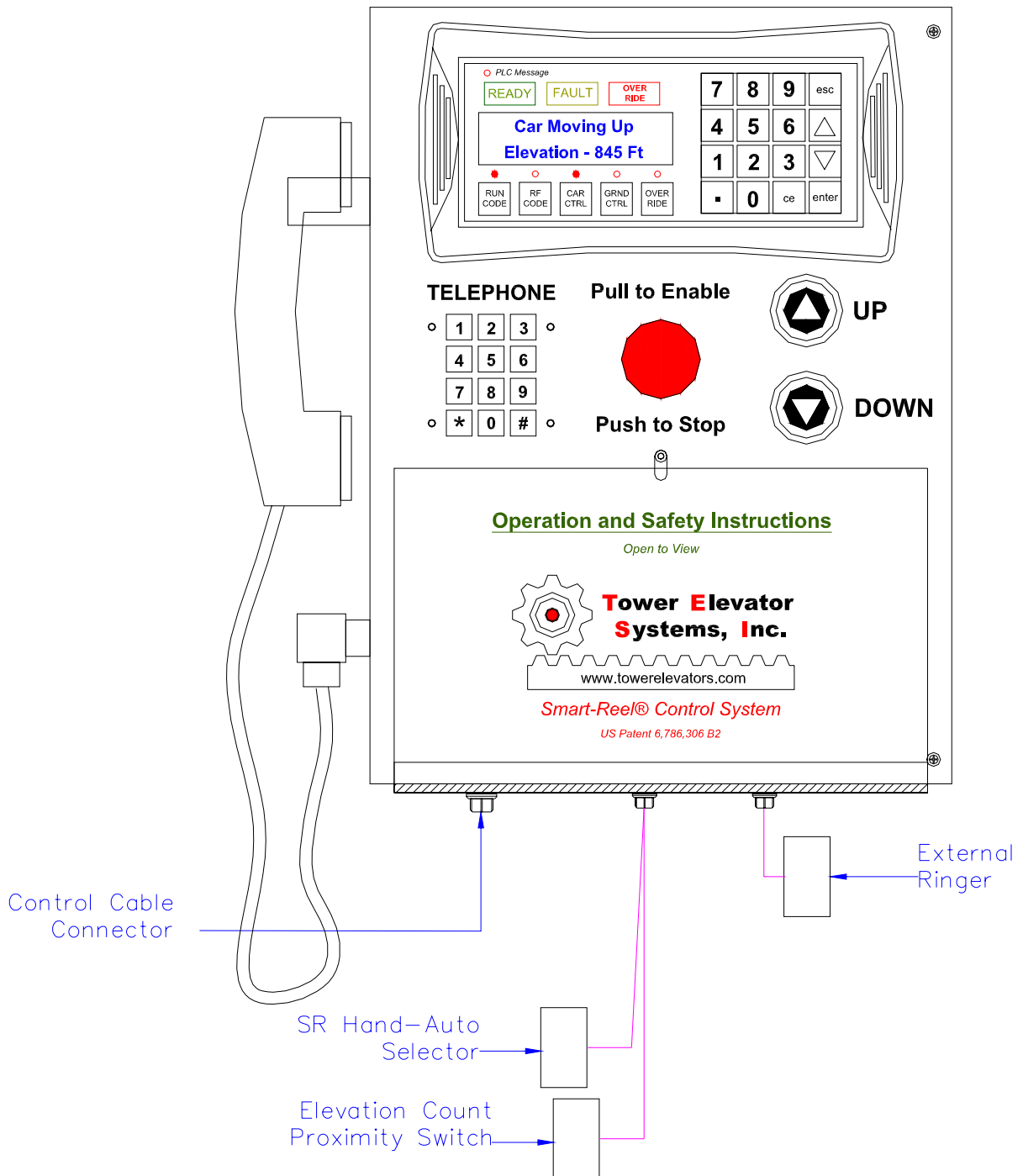


DIAGRAM 4.1- SR CONTROL SYSTEM OVERVIEW

TESI - SMART REEL 2000 CONTROL SYSTEM CONFIGURATION

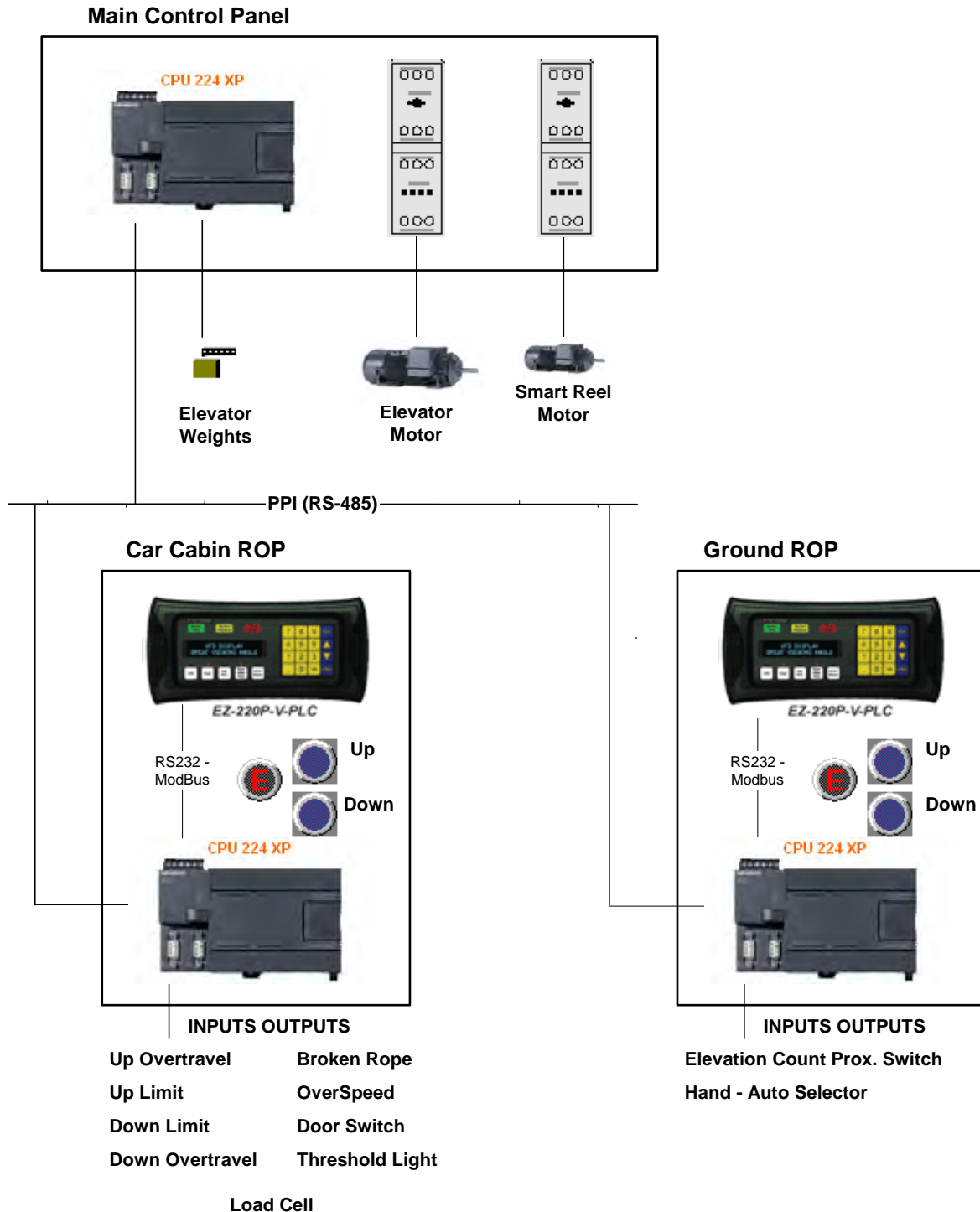




TABLE 5.1 - SR WIRING CONNECTION TABLE

TESI Smart-Reel Main Controller Connections

Item #	Description	Voltage	Circuit Protection	Load	# Wires	Wire Size
1	Main 3 Phase 230 AC Power In	230 VAC 3PH	External 50 Amp	Main Controller	(4)	AWG 10
2	Main 120 AC Power In	120 VAC	External 15 Amp	Main Controller	(4)	AWG 12
3	Power to Elevator Motor	230 VAC 3PH	25 Amp	10 HP Motor	(4)	AWG 10
4	Elevator Motor Brake	230 VAC	10 Amp	Brake Coil	(2)	AWG 14
5	Power to Smart Reel Motor	230 VAC 3PH	3.5 Amp	1/2 HP Motor	(4)	AWG 14
6	Limit Circuit for Elevator Tension Weight Overtravel	24 VDC	Y	Fused	(2)	AWG 14
7	Smart-Reel Control Cable to Cabin: Power, Ground, Hardwired E-Stop, Network, Telephone	110 VAC 24 VDC	Y	Fused	Multi- Conductor	Custom Made
8	Smart-Reel Control Cable to Ground: Power, Ground, Hardwired E-Stop, Network, Telephone	110 VAC 24 VDC	Y	Fused	Multi- Conductor	Custom Made
9	Phone in to PLC Modem for Remote Support & Logs Download	Low Voltage DC	N/A		(1) Shielded Pair	AWG 20-24



TESI Smart-Reel Cabin Station Connections

Item #	Description	Voltage	Circuit Protection	Load	# Wires	Wire Size
1	Smart-Reel Control Cable From Main: Power, Ground, Hardwired E-Stop, Network, Telephone	110 VAC 24 VDC	Y	Fused	Multi- Conductor	Custom Made

TESI Smart-Reel Ground Connections

Item #	Description	Voltage	Circuit Protection	Load	# Wires	Wire Size
1	Smart-Reel Control Cable From Main: Power, Ground, Hardwired E-Stop, Network, Telephone	110 VAC 24 VDC	Y	Fused	Multi- Conductor	Custom Made

FUNCTIONAL DESCRIPTION & PHOTOS OF MAIN SYSTEM COMPONENTS:

Item	Qty	Name	Description	Photo
1	1	Smart Reel Enclosure	Large Aluminum Enclosure mounted near tower base, designed to weather-protect Smart-Reel Equipment and also houses integral ground control operating position.	
2	1	Smart Reel Cable Management System	Magnetic Slip-Clutch Drive Reel. The Smart Reel® provides for automatic take-up and let-out of the control cable as the car travels and maintains a constant electrical connection through a slip-ring device on the reel. The control cable is stored on the reel in the weather protected enclosure when the elevator is at the base landing.	

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3	1	Ground ROP	<p>Ground based Remote Operating Position. A 12" x 16" Control Box, Recessed into SR-Enclosure. Provides full control, communications and diagnostics of the SR system from the ground. Includes Quick Connect Cable.</p> <p>Recessed Enclosure Provides locked and weather protected storage for Ground ROP.</p>	
4	1	Car ROP	<p>Car based Remote Operating Position with Hard Wired Emergency Stop Circuit. A 12" x 16" Control Box, Mounted in Elevator Car. Provides full control, communications and diagnostics of the SR system. Includes Quick Connect Cable</p>	
5	1	Main Controller	<p>A 36" x 36" Electrical Enclosure that houses Master PLC Controller, Uninterruptible Power Supply, Elevator Drive Motor Controller, SR Motor Controller, Digital Telephone System, and also provides central power and network connection points.</p>	

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6	1	<p>Telephone/ Intercom System</p>	<p>TalkSwitch Digital Phone System</p> <p>The system includes dial tone capable telephone extensions at the Car Station ROP, at the Ground Station ROP, and at the Main Controller in the transmitter building. The system incorporates a user friendly Voice Message Information feature, (VMI), to supplement the written operation documentation.</p>	
7	1	<p>UPS</p>	<p>Uninterruptible Power Supply to provide back up power to communications per elevator Code and also keeps the PLC control system energized for 15 minutes in the event of a power failure. This will alert a person in the car that main power has failed. The phone will continue to operate even after the display turns off. The UPS is shipped separately and will be placed on top of the Main Control Cabinet. Wire ports and connection points in the cabinet are provided.</p>	
8	2	<p>Remote Alarm Ringers</p>	<p>External All Weather Loud Ringers connected to Ground and Car Phones. Allows personnel to hear the phone ringing even if outside of the Car or away from the Tower Base.</p> <p><i>Install Car Ringer at Rear Outside of CAB Ground Ringer is Factory Installed</i></p>	
9	2	<p>Threshold Light</p>	<p>Provides Threshold Illumination when the door is open per Elevator Code. Includes Quick Connect Cable.</p>	

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10	1	<p>Hard-Wired Control Cable</p>	<p>1,000 Feet Custom Composite Control Cable</p> <p>Tethered to, and traveling with the elevator car at all times, the custom made composite cable is connected to the Car Station ROP on one end and to the Main Controller on the other end. This is the reliable hard-wire link. The cable provides the system connection with Phone, Power, Data and E-Stop Circuits. This cable is provided with a pre-wired quick connect to the Car ROP and is pre-wired at the SR Connection in the SR-Enclosure.</p> <p>- Plug and Play -</p>	
11	1	<p>Lift Head</p>	<p>The Lift Head is a (2) part milled stainless steel assembly designed to allow the control cable and load cell cable to pass thru the turngate brackets as the elevator car travels up the tower shaft.</p> <p>The Lift Head Attaches to the traveling elevator car with the universal lift head bracket. The Lift Head will hoist the control cable and guide it through the turngate brackets to be captured every 60' up the tower shaft.</p> <p>The Lift Head is designed with Integral Load Cell to monitor any over tension of the control cable and shut the system down if the expected tension is out of tolerance.</p> <p>See Installation Notes Below</p>	

12	1	<p>Load Cell / Tension Link</p>	<p>Integral component of the Lifting Head. Wires into Car ROP. Provides Over Tension protection for Control Cable. Measures real time actual tension of Control Cable and compares against expected values, based on car elevation, cable weight plus working tolerance. Will shut the system down if cable is over the expected tension.</p> <p>Install Note: When adjusting the cable in the Cable Hoisting Grip, make sure all down weight is hanging from the load cell and not from the lift head. E.g. leave a small belly above the Cable Hoisting Grip.</p>	
13	1	<p>SR Proximity Sensor</p>	<p>Solid State Non Contact Proximity Sensor that monitors rotation of the D1 Deflector Sheave. The sensor provides information to the PLC network, which is used to calculate the car elevation and also monitors cable movement compared to SR Rotation for system safety.</p> <p><i>Factory Installed</i></p>	
14	1	<p>SR Selector Switch</p>	<p>The Smart Reel Operation Mode Selector Switch is located just inside the main enclosure door. This selector switch can be used by a technician to select "Auto", "Off", or "Hand" (manual) mode for Smart Reel Operation.</p> <p>Auto – Standard Operation Setting - Gives SR Control to Main Automatic Controller</p> <p>Off – Turns SR Motor Off for Maintenance</p> <p>Hand – Maintenance Setting. Turns SR Motor On. In this mode the reel will provide constant tension, regardless of system state, as long as power is on.</p> <p><i>Use Caution in "HAND" Mode as Reel will instantly begin to turn and produce tension.</i></p> <p><i>Factory Installed</i></p>	

15	30	<p>Turngate Bracket</p>	<p>Mounted in Hoistway, usually to an elevator rail support horizontal member. These brackets Capture and Secure the Traveling Elevator Control Cable at 60' intervals, as the Lift Head passed through the turn gate. They are designed with a single bolt connection for ease of installation.</p>	
16	1	<p>D1 Deflector Sheave #1.</p>	<p>Mounted inside the SR-Enclosure and located above Smart-Reel.</p>	
17	1	<p>D2 Deflector Sheave #2</p>	<p>Mounted outside the SR-Enclosure and located inline with D1 to provide a cable path to tower.</p>	
18	1	<p>D3 Deflector Sheave #3.</p>	<p>Mounted on Tower and located inline with D2 to provide a cable path to traveling elevator car.</p> <p>Installation Note: Universal Mounting Bracket Provided. Field Modify Brackets to tower requirements.</p> <p>Should be similar to photo.</p>	

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19	2	<p>Enclosure Mounting Beams</p>	<p>Pair of Galvanized Steel W-Beams, which bolt to the bottom of the SR-Enclosure and provide a secure mounting point for anchor bolts into the tower concrete foundation. Must be installed with insulating material between the Galvanized Beams and the Aluminum Enclosure.</p>	
20	2	<p>Tower Mounted Limit Switch CAMS</p>	<p>Galvanized Steel Cams are mounted to tower at the top and bottom landings to engage the Car mounted Limit Switches for Upper Landing, Upper Over Travel, Lower Landing and Lower Over Travel. Depending on Site Conditions, additional members or brackets may be required to interface the CAMS to the tower in the proper location. This is the responsibility of the field installation crew.</p>	
21	4	<p>Car Mounted Travel Limit Switches</p>	<p>Mounted on the side of Cab in line with Tower Cams to stop the car at Upper Landing, Upper Over Travel, Lower Landing and Lower Over Travel. Includes Quick Connect Cable. Depending on Site Conditions, additional members or brackets may be required to interface to the tower in the proper location. This is the responsibility of the field installation crew.</p>	

22	1	Door Limit Switch	<p>Disables Car Travel when Car Door is Open. Includes Quick Connect Cable. Depending on Site Conditions, additional members or brackets may be required to interface to the Cab in the proper location. This is the responsibility of the field installation crew.</p>	
23	4	Elevator Tension Weight Limit Switches	<p>Shuts down elevator system if Elevator Tension Weights are out of normal travel range. Depending on Site Conditions, additional members or brackets may be required to interface to the tower in the proper location. This is the responsibility of the field installation crew.</p>	
24	N/A	Safety Limit Switches	<p>If used these switches monitor Broken-Rope, or Car Over-Speed Conditions.</p> <p>It is our understanding that the KOTV elevator does not have a Broken-Rope or Car Over-Speed Safety Device to monitor.</p>	
25	2	Phone Instruction Signs	<p>Rigid Weatherproof ABS Plastic Signs to be mounted next to each phone station.</p> <ul style="list-style-type: none"> • Car Station • Ground Station • Control Station 	
26	1	Lift Head Bracket	<p>Universal Mounting Bracket to attach Lift Head to Elevator Car. Can be mounted to Car Top, Side or Bottom depending on site conditions.</p>	<p>See Diagram 1.1</p>
27	1	Car ROP Cable	<p>This is a 160' length of our Custom Made Composite Control Cable provided with quick connect fitting for easy field installation. The Cable will Plug in below the SR Slip Ring into the quick connect fitting, and wire into the main</p>	<p>See Diagram 4.1, 5.1, 6.1</p>

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			control panel to a pre-labeled terminal block on the other end. There is no need to shorten the cable, since both ends are pre-prepared; however, if the cable needs to be cut during installation, it should be done at the controller end. Otherwise, just keep the excess coiled near the controller, or in the SR Enclosure.	
28	1	Ground ROP Cable	This is a 160' length of our Custom Made Composite Control Cable provided with quick connect fitting for easy field installation. The Cable will Plug to the bottom of the Ground ROP into the quick connect fitting, and wire into the main control panel to a pre-labeled terminal block on the other end. There is no need to shorten the cable, since both ends are pre-prepared; however, if the cable needs to be cut during installation, it should be done at the controller end. Otherwise, just keep the excess coiled near the controller, or in the SR Enclosure.	See Diagram 4.1, 5.1, 6.1
29	6	Quick Connect Leads	Yellow Factory Soldered Pre-Configured Quick Connect Leads used to attach Car Based Limit Switches and Light to Car ROP. Note: "Over Speed" and "Broken Rope" are Capped and Internally Disabled with Jumpers for the KOTV Job as these switches are not present.	See Diagram 5.1
30	1	Tower Interface Kit	Galvanized Steel Angle Members, which bolt to the tower and the top of the SR-Enclosure. The tower Interface Kit secures the top of the SR-Enclosure to the Tower. Must be installed with insulating material between the galvanized beams and the Aluminum Enclosure.	See Diagram 3.1



APPENDICES

- **Certificate of Final Inspection**
- **Inspection and Testing Report**
- **TESI SR-2000 Control System Drawings**
- **EZ Text “Man Machine Interface” (MMI)**
- **Siemens Programmable Logic Controller (PLC)**
- **Siemens Soft-Start / Overload Motor Controller**
- **Conductix Mag-Drive Reel**
- **TalkSwitch Digital Phone Controller**



CERTIFICATE OF FINAL INSPECTION

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INSPECTION AND TESTING REPORT

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TESI SR-2000 CONTROL SYSTEM DRAWINGS

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EZ TEXT “MAN MACHINE INTERFACE” (MMI)

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SIEMENS PROGRAMABLE LOGIC CONTROLLER (PLC)

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SIEMENS SOFT START / OVERLOAD MOTOR CONTROLLER

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CONDUCTIX MAG-DRIVE REEL SYSTEM

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TALKSWITCH DIGITAL PHONE CONTROLLER

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