



WIRELESS SOLUTIONS

**Train Chief[®] II LRCS
w/Lightweight OCU
(Brake & Throttle Industrial Version)**

Failure to return the Warranty Registration document (enclosed) to Control Chief within 30 days of purchase will void any warranty responsibilities on behalf of Control Chief Corporation

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CONTROL CHIEF

WIRELESS SOLUTIONS

Control Chief Corporation, a world leader in wireless radio and infrared remote control products has developed and expanded upon this powerful technology. More than three decades of experience in designing, manufacturing and installing state-of-the-art remote communication systems emphasize Control Chief's mission.

Our systems are tailored to virtually any environment or application. Control Chief provides training, technical support, and comprehensive system design to maximize performance. It is our honor to uphold this reputation of innovative engineering and superior product performance.



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PanelView™ is a trademark of Rockwell Automation.

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1 INTRODUCTION / SAFETY

Introduction

This Owner's Manual provides operating and troubleshooting information for the installer and end user of the Train Chief® II Locomotive Remote Control System (LRCS) with a Lightweight Operator Control Unit (OCU) Brake & Throttle variant for Industry (BTIND).

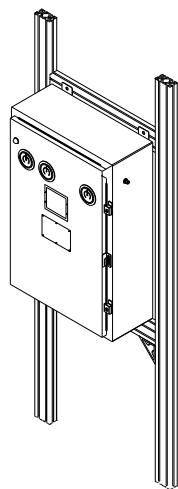
The Train Chief® II LRCS has been designed as a permanently installed ("fixed") system, directly interfaced to the appropriate locomotive electrical and pneumatic controls. The system consists of the following main components: (1) - the Receiver / Controller Unit (RCU), (2) - the wireless remote-control radio OCU, (3) - the installation kit.

Common Acronyms

| | |
|---|----------------------------------|
| CFR - Code of Federal Regulations | RCL - Remote Control Locomotive |
| FRA - Federal Railroad Administration | RCO - Remote Control Operator |
| LRCS - Locomotive Remote Control System | RCU - Receiver / Controller Unit |
| OCU - Operator Control Unit | RCT - Remote Control Transmitter |
| PTC - Positive Train Control | RCR - Remote Control Receiver |
| PLC - Programmable Logic Controller | |

Receiver / Controller Unit

The RCU contains the main control electronics and pneumatic hardware of the remote control system. This includes; the PLC controller (the Allen Bradley SLC 500™), the Control Chief Communicator® module and Control Chief Watchdog module, analog and discrete interface modules, pneumatic proportional control valves, air regulation, control relays, solenoid valves, and pressure sensing devices.



The RCU interface to the locomotive involves both electrical and pneumatic connections. The electrical interface is primarily accomplished through DC relay contact closures, wiring into the locomotive's existing electrical control system. The pneumatic interface typically involves direct air service tie-ins using the dedicated pneumatic control devices in the RCU. A dedicated DC/DC converter and line conditioning module are provided to interface the locomotive's existing DC supply to the RCU.

Figure 1-1 – The Receiver / Controller Unit

The Installation Kit

In order to effectively and reliably interface to the locomotive controls / operations, various kitted items are provided to complete the installation. An antenna kit is provided with the components necessary to allow the radio antenna to be mounted on the locomotive cab. Surge suppressors are provided for installation on all inductive devices (i.e. solenoid coils, electrical contactor coils, etc.) to minimize electro magnetic interference (EMI). Optional color-coded xenon strobe indicator lights can be supplied to provide visual status indication to personnel during remote control operation.

The Lightweight OCU-BTIND

The Lightweight OCU model DBT is specifically designed for industrial locomotive operations. The model DBT is designed to meet the demanding requirements of locomotive operators by providing an operator control unit that is easy to use, safe, rugged, dependable, and based on a commonly recognized configuration. The Lightweight OCU meets these requirements with an ergonomic shape that eliminates sharp corners and accommodates an easy reach of all control switches. These features provide an intuitive operation scheme enabling operators to maintain their focus on yard movements.



Figure 1-2: Lightweight OCU –Brake & Throttle Industrial configuration

Reference Drawings

The system drawing package contains the following typical drawings, which are referenced throughout this document. These drawings will be specific to your system with exact configuration details.

Note: "XXXX" references a Control Chief assigned system serial number.

Typical Drawing List

| DRAWING NUMBER | DESCRIPTION |
|--|------------------------------|
| E-9568-00-1 | OCU ASSEMBLY / LAYOUT |
| E-9568-03-1 | RECEIVER / CONTROLLER LAYOUT |
| E-9568-31-1 THRU -9 E-9568-33-1 AND E-9568-41-1 | ELECTRICAL WIRING |
| E-9568-53-1 | PNEUMATIC INTERFACE |
| E-9568-91-1 | SYSTEM ACCESSORIES |
| E-9568-99-1 | COMMUNICATIONS CONFIGURATION |

Safety

The safety guidelines in this manual are not intended to replace any rules or regulations or any applicable local, state, or federal governing laws. The following information is to be used in conjunction with all other rules and/or regulations already in existence. It is important to read all safety information before operating any wireless radio remote control system. The Federal Railroad Administration (FRA) has published a **Notice of Safety Advisory 2001-1** (in the Federal Register, Vol 66, #-31, Pg. 10340) addressing the establishment of recommended minimal guidelines for the operation of remote control locomotives. A copy of all referenced FRA regulations can be obtained directly from the FRA or contact Control Chief for help in obtaining a copy of these regulations.

The term “Remotely Controlled Locomotives” or “Remote Control Locomotives” (RCL) refers to a locomotive, which, through use of a wireless radio operator control unit and receiver system, can be operated by a person not physically located at the controls within the confines of the locomotive cab. The wireless Remote Control Operator (RCO) must exercise extreme caution and be alert at all times.

Only properly trained persons (*certified and qualified in accordance with 49 CFR Part 240, as conventional operation of a locomotive under the same circumstances would require*) should be operating RCLs. RCLs should not be operated by any person who cannot read or understand signs, notices and operating instructions that pertain to the locomotive operation.

Any person operating a remote controlled locomotive should possess the following knowledge and/or skills:

- Current certification on methods of safe train handling, operating rules, conditions of equipment, personal safety practices
- Knowledge/training on hazards specific to locomotive operation
- Knowledge/training of safety rules for RCLs
- Knowledge of the radio transmitter/receiver equipment/system
- Knowledge/training on all required inspections and testing
- Knowledge on transferring control from one operator to another
- Reporting unsafe or unusual operating conditions

Upon going off duty, each RCO should place the RCL in manual operation and properly secure it and the OCU to prevent unauthorized operation. The recommended practice for OCU security includes the designation of a dedicated, lockable location for OCU storage, which can have access controlled to only appropriately trained / knowledgeable personnel.

When operating a RCL, the RCO should **NOT**:

- Ride on a freight car under any circumstances
- Mount or dismount moving equipment
- Operate any other type of machinery
- Stand or walk within the gage of the track or foul the track on which the movement is occurring

When the using the OCU the RCO should always wear a 4-point breakaway vest.

RCOs should ensure that the track is clear and properly aligned ahead of the remotely controlled movement. Therefore, RCL operations should be operated at restricted speed not to exceed a speed that will enable stopping the movement within half the range of vision assuring that all movements are protected.

Strict procedures must be followed to ensure that there can only be one RCT in active control of the RCL at any one time.

Prior to performing any function (*as prescribed in 49 CFR 218.22.c.5*) the RCO should apply three-point protections; (1) fully apply the locomotive and train brakes, (2) center the reverser, and (3) place the generator field switch to the OFF position.

Passenger trains should NOT be operated by use of a remote control device.

The following security procedures are recommended:

- Have instructions for the proper storage, handling and security of RCTs when not in use or in the operator's possession.
- Operation control handles located in the RCL cab should be removed or pinned in place to prevent accidental or intentional movement while the RCL is being operated in remote.
- Have strict procedures in place to ensure that only the intended RCT is assigned to the appropriate RCL.

All inspections and calibrations must be performed as required.

Each RCL should have a tag placed on the control stand throttle indicating the locomotive is being used in a remote control mode. The tag should be removed when the locomotive is placed back in manual mode.

In areas where RCL operations are being conducted, warning signs should be posted indicating that there are remote control locomotives in use. These warning signs should be highly visible and posted at conspicuous locations so as to maximize their exposure to those most likely to encounter RCL operations.

Whenever worker protection is required (*according to 49 CFR Part 218*) the locomotive should be placed in manual mode and be properly secured. The appropriate blue signal protection should then be provided.

All accidents and/or incidents (*described in 49 CFR Part 225*) must be reported to FRA using the appropriate "remote control" reporting codes.

CAUTION

THE RECEIVER UNIT OR RELAYS ARE NOT RATED AS EXPLOSION PROOF. THE RECEIVER UNIT MUST NOT BE INSTALLED OR OPERATED IN EXPLOSIVE ENVIRONMENTS UNLESS APPROPRIATE SECONDARY ENCLOSURE MEASURES ARE TAKEN.

WARNING

THE UNIT MUST BE WIRED TO THE CORRECT VOLTAGE; FAILURE TO DO SO MAY DAMAGE THE SYSTEM.

NOTE

IN AN EMERGENCY, PUSH "E-STOP" TO STOP WIRELESS RADIO CONTROLLED EQUIPMENT

The antenna(s) to be used with this module must be installed with consideration to the guidelines for RF exposure risk to all nearby personnel, and must not be co-located or operating in conjunction with any other antenna or transmitter.

2 SPECIFICATIONS

| | |
|---|--|
|  | <p>WARNING: CHANGES OR MODIFICATIONS NOT EXPRESSLY APPROVED BY CONTROL CHIEF® CORPORATION COULD VOID THE USER'S AUTHORITY TO OPERATE THE EQUIPMENT.</p> |
|---|--|

FCC Part 15 and Industry Canada RSS Notice
 This device complies with Part 15 of the FCC Rules and Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference that may cause undesired operation of the device

RSS FCC Partie 15 et du Canada Avis à Industrie
 Cet appareil est conforme à la Partie 15 des règlements de la FCC et Industrie Canada exempts de licence standard RSS (s). Son fonctionnement est soumis aux deux conditions suivantes: (1) cet appareil ne peut pas provoquer d'interférences et (2) cet appareil doit accepter toute interférence pouvant causer un mauvais fonctionnement du

The Control Chief Lightweight OCU Family model(s) comply with FCC and Industry Canada RF exposure requirements when used as described in this manual. Only use authorized accessories to hold the device to the body while operating the device.

Le contrôle en chef léger OCU famille modèle (s) se conformer à la FCC et exigences d'Industrie Canada d'exposition RF lorsqu'il est utilisé comme décrit dans ce manuel. N'utilisez que des accessoires autorisés à placer l'appareil sur le corps pendant le fonctionnement du dispositif.

General Specifications

| | |
|--------------------------|---|
| Frequency | 902-928 MHz (FCC Part 15) |
| Operating Range | 2500 feet (1.06km) environment dependent |
| Temperature Range | -20 to +140 F (-30 to +60 C) |
| System Diagnostics | Various LED indicators |
| System Address Capacity | 65,000 + |
| Encoding/Decoding Method | Microprocessor/software based |
| Data Security | Real time 16 bit CRC |
| Communication Security | OCU registers with Locomotive via Infra-Red communication port to exchange and establish RF network addresses |
| Modulation | CPFSK (Continuous Phase Freq Shift keying) |
| Response Time | 250 milliseconds |

Lightweight OCU Specifications

| | |
|----------------------------|--|
| Dimensions | 6"(h) x 5"(d) x 10"(w) (15.2cm x 12.7cm x 25.4cm) |
| Weight | 3.9 lbs (1.8 Kg) with battery |
| Carrying Method | Four point vest-harness, break-away style |
| Environmental Conditioning | Weatherproof (IP-65) |
| OCU Diagnostics | 2-line 16 character display |
| Switches | Push buttons, toggle switches, knobs. |
| Supply Voltage | 7.4 V Lithium-Ion rechargeable battery pack |
| Battery Life | 12 hours continuous duty |
| RF Power Output | 1 watt |
| Antenna Type | Internal, Di-pole |

Receiver / Controller Specifications

| | |
|---------------------------------|--|
| Enclosure | NEMA 12 dust tight |
| Weight | Approximately 95 lbs (~36 Kg) |
| Dimensions | 30.0 x 20.0 x 11.0" (76.2 x 51 x 30 cm) |
| Electrical Interface Connection | Various cable connections |
| Pneumatic Interface Connection | Various push-in type tubing connections |
| Mounting Provisions | Top/bottom tabs @ 16" centers |
| Power Source Required | Locomotive DC supply |
| Pneumatic Source Required | Locomotive main air reservoir; Max 150 psig Min 90 psig |

Due to Control Chief Corporation's commitment to continuous improvement, the above specifications are subject to change without notice.

3 PHYSICAL DESCRIPTION AND INSTALLATION

The Lightweight OCU-BTIND

Train Chief® II equipped locomotives are controlled by using one or two Lightweight OCU's. Each OCU is a small 3.9 lb hand operated device that gives an operator complete throttle and braking control of the locomotive up to 2500 feet away. Control of the locomotive can be passed between two OCU's when the optional Selective Dual Control feature is installed.

OCU Control Groups

The OCU has controls for:

1. Movement commands (direction, throttle and braking)
2. Miscellaneous locomotive commands (bell, horn, bail and sand)
3. OCU operations (power, reset, status, pitch, tilt time extend)

It also has visual and audio signals indicating the status of commands to the locomotive and OCU operational status.

Movement Controls



Figure 3-1: Lightweight OCU-BTIND Movement Controls

Reverser (Directional) Selector: This 3-position switch selects locomotive movement direction as Forward, Reverse, or Neutral.

Note: Train Chief® II does not allow you to change the direction of movement while the locomotive is in motion. If attempted, Train Chief® II will automatically stop the locomotive by commanding a Full-Application Locomotive Stop (see page 4-1).

EMERGENCY Mushroom Switch: Push in to activate an Emergency Locomotive Stop. See page 4-1 for E-Stop actions. For normal operations the EMERGENCY switch must be pulled out.

Note: E-Stop develops high brake cylinder pressures that increase the chance of sliding wheels. Only use the EMERGENCY mushroom switch when absolutely necessary.

Throttle Selector: Ten-position selector represents the throttle position available in the cab. However, one additional feature of the OCU throttle is the HALT function.

- HALT: commands the throttle to idle, removes the generator field, and also gradually applies independent brakes.
- IDLE: commands throttle to idle and removes generator field but does not apply brakes.
- The remaining positions, 1 through 8, command the same throttle settings as the control cab console settings.

Automatic Brakes: This 3-position spring centered switch allows the operator to release or apply train brakes by **reducing** brake pipe by the following pressures:

- Release 0-psi reduction
- Minimum 6-8 psi reduction
- Light 10 psi reduction
- Medium 18 psi reduction
- Full 26 psi reduction
- The Charge position is used to pressurize the air brake system.

The center switch position (LAP) maintains the last brake setting.

Each time the switch is pressed (must be held for 0.5 sec) the train brakes are incremented to the next higher/lower setting.

On the First application of Auto Brake the locomotive brake portion of the train brake application is automatically bailed off.

Whenever the switch is pulled (must be held for 2 sec) the train brakes immediately revert back to Release position.

Independent Brakes: This 6-position selector allows the operator to apply independent locomotive brakes to achieve the desired stopping power. Some positions limit and override the throttle control.

Selectable positions are:

- Release (0 psi): this is the normal operating position when operating in power mode (Throttle positions 1-8). (Note RELEASE selection is indicated when all Independent Brake LEDs are off.)
- **B1:** Applies 1/5 of the available independent brake pressure to the brake cylinders. Throttle selections T1 to T8 are allowed.
- **B2:** Applies 2/5 of the available independent brake pressure to the brake cylinders. Throttle selections T1 to T8 are allowed.
- **B3:** Applies 3/5 of the available independent brake pressure to the brake cylinders. Throttle selections T1 to T3 are allowed. See notes 1 and 2.
- **B4:** Applies 4/5 of the available independent brake pressure to the brake cylinders. Throttle selections T1 to T3 are allowed. See notes 1 and 2.
- **FULL:** Applies total available independent brake pressure to the brake cylinders. Throttle selections T1 to T3 are allowed. See notes 1 and 2.

NOTE 1: If throttle is advanced T4 to T8 the default programming will reduce throttle to IDLE. To recover throttle operations return throttle selector to IDLE.

NOTE 2: The threshold parameters for limiting throttle vs. brake settings B1 to FULL can be adjusted per owners' operating rules and requirements.

Misc. Locomotive Controls**Figure 3-2: Lightweight OCU-BTIND****Bell / Horn switch:**

This is a 3-position switch. It is latched at the rear (OFF) position and at the center (BELL) position. The forward (HORN) position is spring loaded to return to BELL position when released. Return the switch to the OFF position to silence the Bell.

1. Bell function only: whenever the locomotive is stopped and the Throttle Selector is moved from Halt to some movement position, Train Chief® II sounds the bell for 5 seconds.
2. Horn function only: The horn function is also used to acknowledge or accept a "Pitch" from a transferring OCU.

Optional Functions: (OCU-BTIND only)

This button can control headlights or act as an additional TILT EXTEND button. See Chapter 5 for full description of options.

Reset / Bail button:

When depressed briefly the button acts as a RESET for several functions.

1. It resets the ALERT warning. See page 4-7 for description of ALERT function.
2. It allows the RCU to allow a brake release when the operator moves the Throttle selector out of the HALT position.

When depressed for longer than 2 seconds the second function of BAIL is activated. The BAIL function allows the independent brakes to be released while the train brake continues to be applied.

Reset / Sand button:

When depressed briefly the button acts as a RESET for several functions.

1. It resets the ALERT warning. See page 4-7 for description of ALERT function.
2. It allows the RCU to allow a brake release when the operator moves the Throttle selector out of the HALT position.

When depressed for longer than 2 seconds it activates the sanders in the direction of movement.

OCU Operation Controls and Associated Functions

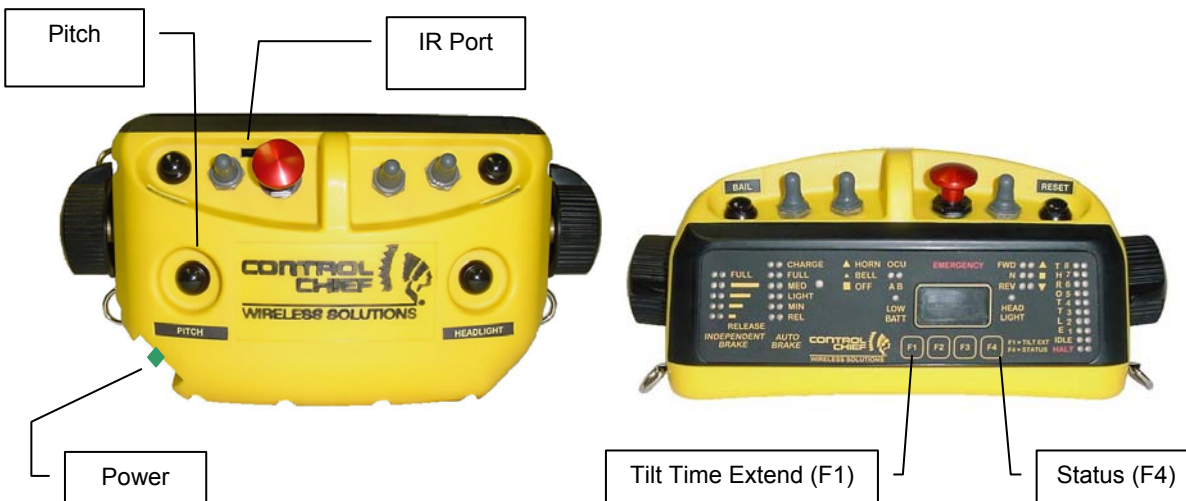


Figure 3-3: Lightweight OCU-BTIND Controls

Power Button:

Push-On / Push-Off switch to apply power to the OCU. Power is supplied from the battery pack and the power bridge. Depending on the charge state of the power bridge, the OCU may activate for a short time without an installed battery. See page 6-2.

Pitch button:

The PITCH button is used to transfer movement control of the locomotive from one OCU to another. Refer to page 4-2 in this manual describing the Selective Dual Control feature.

Tilt Time Extend (F1):

The Tilt Time Extend button extends the allowable tilt time to 60 seconds. To activate this command the operator must depress the F1 button for 2 seconds until the OCU beeps to acknowledge the command.

Status (F4):

Depressing the F4 key causes the OCU to initiate a status report from the locomotive or activate a status menu that will be shown on the OCU display. Refer to the OCU display section on page 6-8 for more details.

IR Port:

The IR port is used when registering the OCU to the locomotive. Aligning the IR ports of the OCU and RCU during setup allows specific information to be exchanged between them. This creates a secure communications link between them for the duration of the remote control session. See Chapter 4 for complete registration procedures.

OCU Keypad, Indicators and Display

The location of the LEDs, Character-display, and Intensity sensor are shown in the diagram below. All LEDs will illuminate during the power on sequence to allow detection of inoperative LEDs.

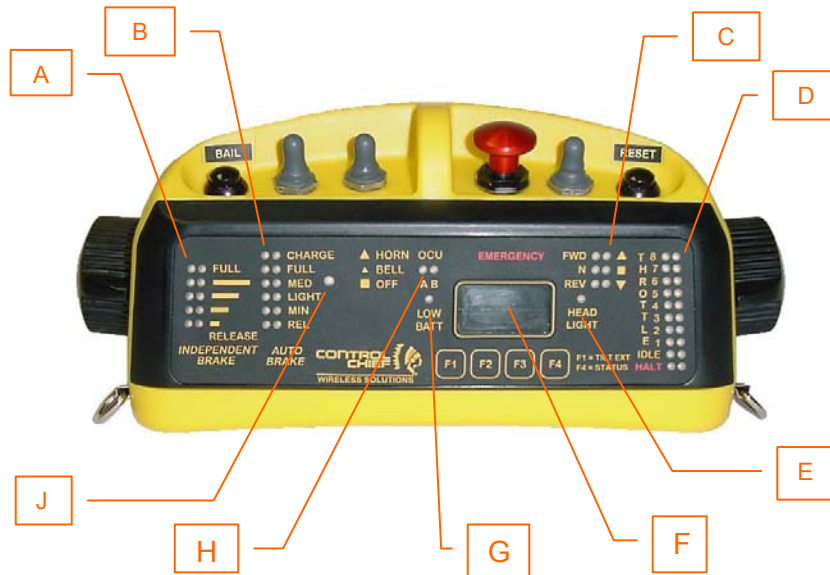


Figure 3-4: Display Panel for Brake-Throttle Unit

- [A]** Independent Brakes
- [B]** Auto Brakes
- [C]** Reverser
- [D]** Throttle

- [E]** Headlight Bright Indicator
- [F]** 16 Character Display
- [G]** Low Battery Indicator
- [H]** OCU A / B Indicator
- [J]** Ambient Light Sensor

Steady LEDs at the respective locations in the above figure show the selected positions of the OCU controls.

Battery Compartment



Fig 3-5: Battery and Battery Well

The 7.4 volt Lithium-Ion battery is secured in the compartment by its own locking lip and does not require a latching cover. Additional details are described on page 6-1.

OCU Harness

The harness system is an integral part of the LRCS. With the many situations encountered in rail equipment operations it is imperative the OCU does not constantly occupy an operator's hands. Control Chief has combined the OCU support harness with a high visibility safety vest to avoid the operating gear and safety gear conflicts that are sometimes present when having to don separate items.



Fig 3-6
Breakaway Safety Vest
with Integral Harness

- The Control Chief Break-away Safety Vest uses hook-and-loop material at the shoulders and waist belts to be easily opened and release the operator in the event of being entangled.
 - The hook and loop fabric also allows size adjustment for secure fit and carry of the OCU.
- The vest should be kept clean to maintain high visibility.
 - Hand cleaning with mild detergent soap (non-abrasive) or citrus cleaner is recommended.
 - The vest can be machine washed with common laundry detergents but useful service life will be reduced.
 - Use of petroleum solvents (diesel fuel, kerosene, alcohol) is not recommended.
 - Use of chlorinated cleaners (bleach, powders, etc) is not recommended.
 - Use of machine dryers is not recommended.

The Receiver / Controller Unit (RCU)

The RCU consists of the control electronic and pneumatic components. The electronic components consist of the programmable logic controller (the SLC 500™ PLC) with various I/O and specialty modules, the transfer switch and various DC relays. The pneumatic components consist of proportional air control valves, solenoid ON/OFF valves, pressure switches, pressure transducers and pressure regulators, all mounted on specifically designed manifolds. The RCU is mounted inside the locomotive cab on a dedicated rail system (Unistrut). The RCU is then interfaced to the locomotive system(s) via cable wiring and DOT rated plastic tubing as per the specific pneumatic and electrical requirements.

For more details on the configuration of your system please refer to your system drawing package, specifically, drawing number E-9568-03-1 RECEIVER / CONTROLLER LAYOUT.

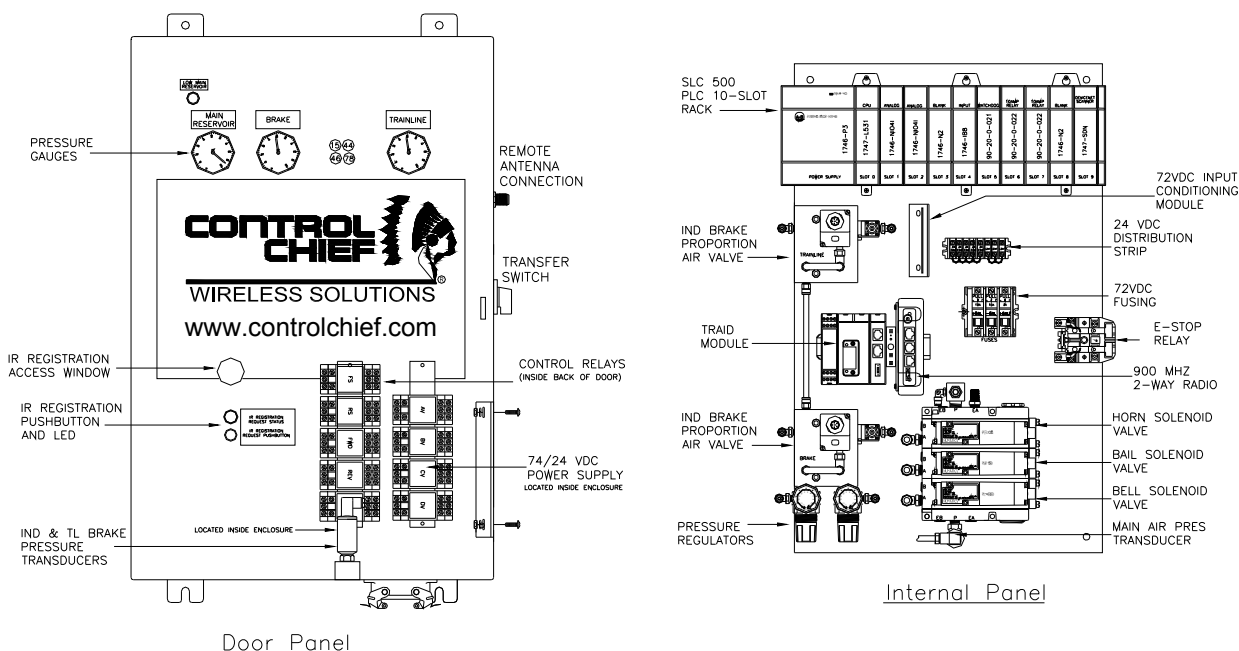


Figure 3-7: Typical RCU Layout

Transfer Switch, Intermediate Relays and DC Conditioning Module

The transfer switch is used to select between MANUAL and REMOTE operations. This switch utilizes a switch-block arrangement that allows for various hardwired control functions.

The intermediate relays are used to control a number of auxiliary electrical devices such as status lights, horn, sanding, and others depending on the locomotive requirements. The intermediate relays may be located inside the enclosure or on the enclosure door. Refer to your system prints for details specific to your system.

The DC conditioning module is used to condition the wheel slip and E-Stop inputs from 74VDC down to 24VDC prior to going to the PLC input module. A DC-to-DC solid state isolated voltage converter is provided to reduce the locomotive DC battery voltage to regulated 24VDC.

Programmable Logic Controller - SLC 500™ System

The SLC 500™ is the control center for the Train Chief® II system. The SLC 500™ incorporates the necessary I/O modules to control the various locomotive interfaces based on a ladder logic program, specifically, developed for locomotive remote control and tuned for your particular application.

1746-P3 POWER SUPPLY

Allen-Bradley SLC 500™ power supply modules include a LED that illuminates when the power supply is functioning properly. Power supplies are designed to withstand a brief power loss (brown-out) for a period of between 0.02 to 3 seconds, depending upon loading conditions. The P3 fuse is accessible by opening the module's front panel located to the upper left of the input terminal block. A replacement fuse can be obtained from your local AB distributor or through Control Chief Customer Service.

CHASSIS

The chassis houses the P3 power supply, processor, and all the I/O modules. All components slide easily into the chassis along guides formed into the chassis. No tools are required to insert or remove the processor or I/O modules. The power supply and removable terminal strips on the I/O modules do require a philips screwdriver for removal and installation.

SLC 500™ PROCESSOR

The SLC 500™ processor utilized in the Train Chief® II system contains the primary control program. The processor is programmed using ladder logic which is uniquely suited for control applications. For troubleshooting purposes the processor provides several LED indicators; RUN, FAULT, and BATT (other modules will have additional indicators, but the ones listed are the most important).

MEMORY MODULE

The memory module is a plug-in to the processor module and provides non-volatile and secure program storage for the specific ladder program for your particular application.

ANALOG MODULE(S)

The analog modules incorporate high-resolution providing for precision control of analog outputs, which are typically used to control the proportional pneumatic valves for locomotive brake, trainline brakes, and where applicable, pneumatically controlled locomotive throttle. The modules also incorporate high resolution inputs to precisely monitor the controlled pressures. The modules feature input filtering providing high immunity to electrical noise.

OUTPUT MODULE(S)

The output module(s) provide the means with which to actuate the various functions on the locomotive system. Typical functions controlled by the output modules include; generator field, reverser directional selection, sand, horn, bell, throttle position, and indicator lights/strobe. Intermediate relays are used (located in the locomotive interface panel) where a control function current rating may exceed the rating of an output module. All output modules provide LED indicators for each output point. The LED's illuminate when the processor applies power to an output terminal.

INPUT MODULE(S)

The input module(s) provide a means to monitor critical functional states of the locomotive system. Typical system parameters monitored are the manual throttle, manual reverser, external E-Stop switches, pressure switches, and wheel slip. The module features input filtering, optical isolation, and built-in surge protection. All input modules provide LED indicators for each input point. The LED's illuminate when the proper signal is received at an input terminal.

REMOTE CONTROL WITH ALLEN-BRADLEY SLC 500™

SLC 500™ remote control is facilitated by the implementation of Control Chief's Communicator® module and Watchdog relay module. This advanced technology is a result of Control Chief's partnership with Rockwell Automation to develop remote control capability for the SLC 500™. The following paragraphs discuss how the remote control capability is implemented in the Train Chief® II system providing safe and reliable operation.

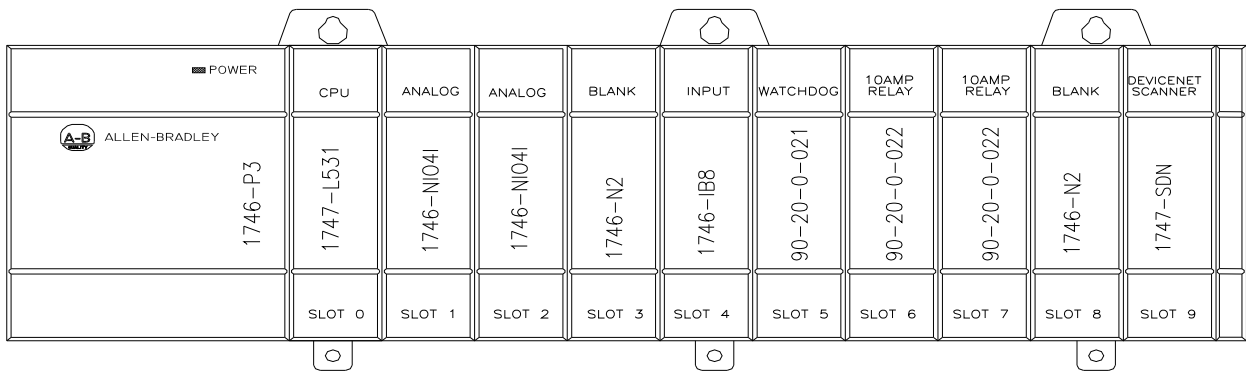


Figure 3-8: SLC 500™ PLC

WATCHDOG SYSTEM

Remote control systems based on the SLC 500™ controller with the Communicator® module will utilize a multiple feature watchdog safety system. The first watchdog circuit is built into the wireless Communicator® module and monitors the operation of the module CPU. Should this watchdog time out, then an automatic interrupt is generated which faults the SLC 500™ CPU and clears all SLC output tables. An additional watchdog feature within the module will clear the module I/O image table if communication with the remote unit is lost.

The High Current Relay/Watchdog module incorporates two (2) additional watchdog safety systems. Each watchdog safety system consists of a circuit that drives a dedicated output relay. Each circuit monitors a critical system function to verify proper system operation. The dedicated watchdog relay outputs are used to control the E-Stop relay in the locomotive interface panel.

DEVICENET SCANNER MODULE

The DeviceNet scanner module included in this Train Chief® II system provides the standard field bus data interface to the Control Chief Triad® Module. DeviceNet is the field bus protocol used in this system. This interface provides for a 2-way data exchange between the Triad® processor and the PLC backplane I/O map.

THE CONTROL CHIEF TRIAD® MODULE. The Control Chief Triad® Module is not part of the PLC rack assembly, but is directly wired to the PLC through the DeviceNet scanner. This module consists of three (3) sub units (hence the name Triad) all working together to receive radio data (radio sub unit), decode and format the data, and transfer the data over DeviceNet to the PLC (field bus sub unit). This module also includes a safety watchdog sub unit. This sub unit monitors various watchdog heartbeats as well as the RF link to ensure the proper operation of all controller sub systems.

Pneumatic Components

The following pneumatic components comprise the pneumatic control and interface for the Train Chief® II system and are included in the RCU, mounted on the specifically designed enclosure back plate.

PROPORTIONAL VALVES AND MANIFOLD

Manifolds have been specifically designed to integrate the brake pneumatic components. Referred to as the “proportional valve manifold”, one manifold integrates all components used both normal and emergency brake control with the required regulators. Another proportional valve manifold is used for normal and emergency trainline brakes, when present.

PRESSURE REGULATORS

Supply air from the locomotive main reservoir is controlled using a 0-100-psi regulator, for the pneumatic components used in the Train Chief® II system. A second stage 0-100-psi regulator is used to further control the air used for emergency brake system. Both regulators are located at the supply end of one of the proportional valve manifolds.

PRESSURE MONITORING

Main reservoir pressure is monitored by a dedicated transducer on the solenoid valve manifold. Brakes and Trainline pressures are monitored by feedback from a dedicated transducer fed from the actual application points on the locomotive.

EMERGENCY SOLENOIDS

The Brake Emergency Stop (BKES) solenoid is used to apply air for independent emergency brake application. Additionally, a dedicated (TLES & TL DUMP) solenoid valves are used to dump brake pipe air for emergency trainline brake application.

SOLENOIDS VALVES

Solenoid valve(s) are provided (and integrated on a dedicated manifold) that are used to control additional locomotive functions such as horn/bell, sanding, and uncoupling. Refer to your system specific documentation to find which features are included on your system.

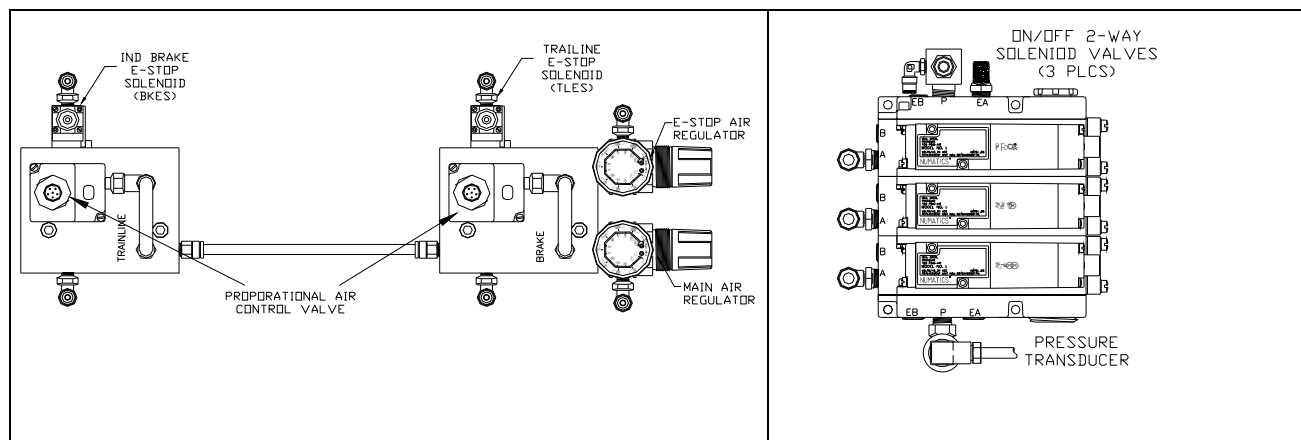


Figure 3-9: Typical Pneumatic Components

Receiver / Controller Unit Mounting

The RCU should be securely mounted inside the locomotive cab. The mounting location should allow for reasonable access for both the electrical and pneumatic interfaces, but also be picked to avoid interference with normal locomotive cab operations.

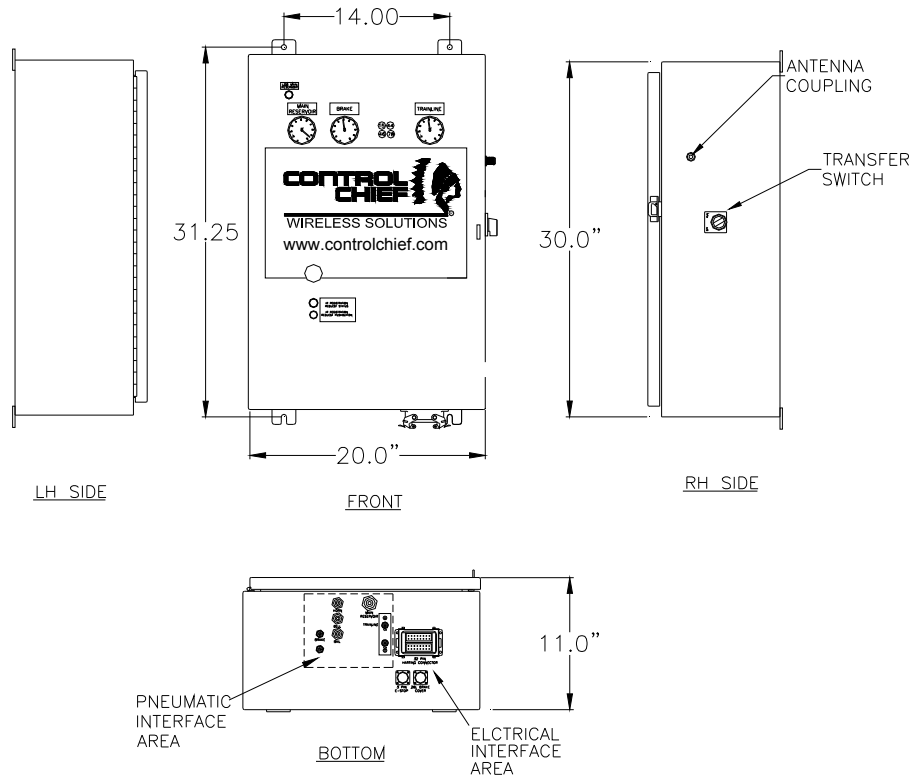


Figure 3-10: RCU Physical Details

The best approach for mounting is to erect a simple rail system allowing for some adjustment yet providing a good secure support. It is recommended that the mounting frame be erected using metal rails strong enough to support the enclosure's weight (~95 lbs.). As shown above. The mounting tabs on the RCU enclosure are on 14" centers and are ~31" between top and bottom. Be sure to leave adequate clearance below the unit to make all interface connections and in front to allow for the access panel opening. The following figure provides a basic mounting concept.

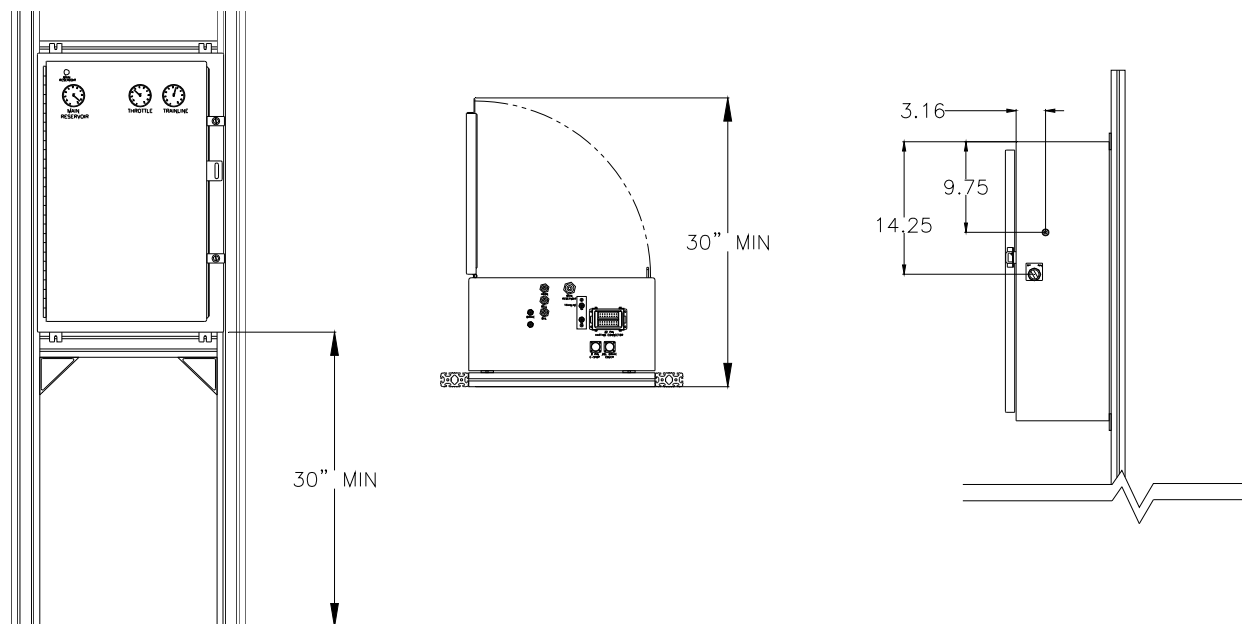


Figure 3-11

Locomotive Interface

Introduction

The connection of the RCU to the locomotive is achieved through both electrical and pneumatic (air) interfaces. All locomotive interface connections are located on the bottom of the RCU. The RCU manages all necessary connections for the specific locomotive functions. Once interfaced, the RCU becomes an integral part of the locomotive system and utilizes the locomotive DC power and main air reservoir supply. This enables the Train Chief® II system to support the full functionality of the locomotive without any non-typical system configurations. Below is discussion on some of the key elements of the locomotive interface. Refer to the system prints for the detailed interfacing requirements for your specific locomotive.

Main Air Supply Shut-Off Valve and Filter Assembly

Located on the bottom of the RCU unit is the main air supply input for all pneumatic functions controlled by the system. Ahead of the main air supply inlet (installed separately in the locomotive cab) there must be a pneumatic shut-off valve and filter assembly (supplied in the installation kit). The shut-off valve must be in the closed position (handle is at a right-angle to the air-line) for manual and in the open position (handle in-line) for remote. The assembly also includes two (2) filter housings: one is a particulate filter and the second is a coalescing unit. These filters protect the pneumatic components in the system. These filters must be part of your scheduled maintenance for the locomotive to insure optimum performance and maintain warranty requirements.

Manual/Remote Transfer Switch

The manual/remote transfer switch is located on the right-hand side of the RCU. The function of the switch is to transfer out critical manual (cab) locomotive functions when switching from manual to remote, and to transfer out critical remote functions when switching from remote to manual.

Manual/Remote Transfer Switch Selections and Functions

| Function | Manual (CAB) | Remote | Comments |
|-----------------|--------------|--------|--|
| Strobe | OUT | IN | Strobe active ONLY in remote mode |
| Ignition Wire | IN | OUT | Disables engine start when in remote mode. |
| Throttle Switch | IN | OUT | Disables manual throttle lever in remote mode. |
| Head Light | IN | OUT | Disables manual headlight switch in remote mode. |
| Reverser | IN | OUT | Disables reverser lever in remote mode. |

Dedicated Locomotive Hook-Ups

Locomotive connections to the locomotive interface panel are accomplished through the bottom of the panel via dedicated locomotive hookups. These hookups consist of connector sockets based on system options to facilitate ease of installation.

- The pneumatic connections are located on the bottom left of the panel, and include quick connect ports for main air, locomotive brake, train brake, and bail.
- The rectangular connector is for the general locomotive interface cable. The cable is 30-conductor with a strain relief.
- The round connector(s) are for specific functions such as external E-Stop, strobe status lights, and other optional features.

Refer to system prints, drawing E-9668-03-01 for more application specific details. Refer to Figure 6-7 for detailed pneumatic interface diagram. Always refer to your system prints for details specific to your system configuration.

The Installation Kit

Each system is shipped with an installation kit which includes various materials required for the integration of the receiver / controller unit into the locomotive systems. The types of standard materials provided included:

- **Power Supply Input Filter and Surge Suppressor.** The DC locomotive power is conditioned by an input filter and surge suppressor. The function of this module is to protect the Train Chief® II equipment from the electro-magnetic (EM) noise from the locomotive power source to insure reliable operation of the remote control system.
- **Surge Suppressors.** Additional surge suppressor devices are provided to be installed across all locomotive devices that are considered inductive loads (coils, contactors, etc.). This is required to further control EM noise, created by the inductive devices, which may interfere with the control electronics.
- **Strobe Light.** A strobe light, to be placed on the outside for the locomotive cab, is included to provide visual indications of system status during remote operation.
- **Locomotive Antenna System.** The antenna system consists of a length of coaxial cable, mounting bracket, ½ wave whip antenna, and the necessary parts and instructions to install the antenna cable and antenna. The locomotive antenna kit contains 20' of cable (custom length versions are available) with a TNC female bulkhead connector pre-installed (the other end is un-terminated to facilitate field installation), antenna mounting brackets, TNC right angle plug, cable strain relief, and instructions. The installation crimping tool kit (P/N 90-70-0-074) is required for proper antenna connector installation.
- **Cables.** Pigtail cables are provided for the electrical interface between the receiver / controller and the locomotive controls. Cables are provided with mating connectors at one end for direct connection to the receiver / controller enclosure.
- **Shock Mounts.** Vibration shock mounts are provided for the mounting of the receiver / controller in the locomotive cab. These are required to minimize the transfer of locomotive vibration and prevent damage to the receiver / controller components.
- **Pneumatic Interface Hardware.** A variety of hardware is provided for the pneumatic interface between the receiver / controller and the locomotive air systems. A water separation/ filter assembly, shuttle valve, nylon tubing and various DOT-approved fittings are typical in this kit.
- **J1 Valve Kit.** A J1 brake control valve can be provided, if trainline brakes are required.

General Installation Practices

WARNING: Before attempting to service any pneumatic components, ensure the air system has been vented to atmosphere (zero pressure in air lines).

CAUTION: Contaminants in the air system can significantly reduce the component life and performance of the remote control pneumatics. Therefore, to insure long component life and optimum system performance it is essential to implement a preventive maintenance schedule for the locomotive pneumatics system. This should include draining water from the main reservoir tank and replacing filter cartridges. Failure to maintain main reservoir and/or filter may void the warranty.

General Installation Practices

- Resolve any problems with the locomotive's operation prior to attempting any remote equipment installation or operation.
- All field wiring should be done by a qualified electrician. All electrical work and practices must meet all federal, state, and local codes and standards.
- Route all wire and/or cable to avoid moving parts, mechanical vibration points, pinch points, and high temperature surfaces. All wiring/cabling should be secured and must meet all federal, state, local, and industry standards.
- Do not run power (high voltage $\geq 50V$) together with control (low voltage $< 50V$) wire or cable.
- Electrical wiring running through the engine compartment should be contained in conduit of proper rating for the environmental conditions present.
- All field plumbing should be done by a qualified technician. All plumbing work and practices must meet all federal, state, local, and industry standards.
- Route all tubing and/or pipe to avoid moving parts, mechanical vibration points, pinch points, and high temperature surfaces. All tubing/piping should be secured and must meet all federal, state, local, and industry standards
- All plastic plumbing components must be DOT Approved.
- All equipment must be shock mounted in an appropriate manner to withstand all normal operational conditions.
- Always read and follow all instructions provided with specific components in the field installation parts kit.
- System specific requirements are included in the system print package. Please review before beginning the installation. If you have any questions please contact Control Chief Application Engineering department.

Specific Installation Requirements

- During the installation you may have to mark-up prints. Upon completion of the installation forward these prints to Control Chief Corporation Application Engineering so the mark-ups can be incorporated in our drawings and an updated copy provided.
- **Locomotive Antenna Installation.** Always consider the following general guidelines:
 - The locomotive antenna should be mounted on the cab roof in a vertical position using the magnet mount hardware provided in the accessories kit.
 - The locomotive antenna should have a minimum clearance of 36" between it and any other obstruction mounted on the cab roof. If the minimum clearance is not possible, then the installation must be tested to determine if the proximity of obstructions impact system performance.
 - Do not locate antenna in close proximity of any existing UHF/VHF (voice) antenna(s).
 - Pick a location (typically as high as possible) that provides a clear path between the antenna and the likely transmitter location(s).
 - Ensure the antenna cable routing to the receiver / controller unit is such that the antenna cable will not be cut or damaged by any moving parts.
- **Wiring and Grounding.** To avoid EM interference and ensure control system reliability, specific grounding and shielding practices are required. The following list provides the minimum guidelines and practices required:
 - All coaxial and/or shielded cables are to be grounded at ONE end only. The cable shield must be grounded at the end closest to the transmitted voltage source (i.e. power supply end for transducers not at the transducer itself).
 - All required grounding must be to a common ground plane, which in turn has a single ground (bonding) connection to earth ground.
 - Bonding of the locomotive ground connection must be done using a copper braid (provided). DO NOT SUBSTITUTE.
- **Remote E-Stop Installation.** All externally mounted remote E-Stop enclosures must be NEMA 4 rated. All remote E-Stop enclosures provided are NEMA 4 or better. Any field modifications must be done in such a way as to maintain this rating. All enclosure penetration must be appropriately sealed to prevent environmental leakage. "Dowty" washer should be used on all cable connectors.
- **Suppressors Installation Requirements.** Another very important requirement, to minimize EMI, is the installation of suppressors across ALL inductive loads (solenoid valve and relay/contactors coils). Control Chief will provide all the appropriate suppressors based on your locomotive design. **It is very important to identify all inductive loads present and to have the appropriate suppressors installed prior to remote control operation.**

4 START UP AND OPERATING PROCEDURES

Locomotive Stops

The locomotive remote control system can automatically initiate either of two (2) types of locomotive stops, depending on the specific situation. The two locomotive stops are defined below and are referenced in subsequent operational descriptions.

Full-Application Locomotive Stop - The full-application locomotive stop is automatically initiated in certain situations that are deemed non-emergency. This type of locomotive stop requires a reset of the OCU to resume normal operation. The full-application locomotive stop automatically initiates the following actions;

- full application of independent (locomotive) brakes
- full application of trainline brakes (when present)
- locomotive throttle to idle
- disengagement of generator field

Emergency Locomotive Stop - The emergency locomotive stop is automatically initiated in certain situations (including the E-Stop command) that are deemed an emergency. This type of locomotive stop **will** require specific intervention in order to resume normal operation. The emergency locomotive stop automatically initiates the following actions;

- emergency applications of independent (locomotive) brakes
- emergency application of trainline brakes (when present)
- locomotive throttle to idle
- disengagement of generator field
- After any emergency locomotive stop, the operator may not be able to restart the system from the remote OCU (or remote control station) because the locomotive will be in a Power Cut-off Switch (PCS) fault condition. To recover from this condition the operator may need to go to the locomotive cab to reset the PCS fault. PCS fault reset procedures will be dependant and specific to the locomotive.

Locomotive PCS Fault – The locomotive PCS fault is a latching condition that may occur on the locomotive that will prevent locomotive operation. This fault may occur whenever there is an emergency application of trainline brakes, based on a locomotive pressure switch that monitors the trainline brake air pressure.

- The emergency application of trainline brakes will occur whenever the remote control system commands an emergency locomotive stop, forcing the PCS fault condition. This will happen whenever;
 - an E-Stop button is pressed
 - the OCU tilt (man down) feature is triggered
- **Depending on the locomotive and whether it is in manual control or remote control mode, the procedure to reset a PCS fault may be different. It is the responsibility of the operator to understand the specific locomotive PCS fault reset procedures required.**

Brake Monitoring

In order to monitor brake related component failure, the system monitors the independent brake pressure. If the air pressure does not exceed at least 30 PSI within 3 seconds of a commanded FULL INDEPENDENT brake, then an EMERGENCY STOP condition is activated. To reset this condition, cycle power to the receiver cabinet only. When a brake monitor fault occurs, the Low Main Reservoir indicator light located on the top front of the receiver cabinet will flash at a rate of ON ½ second and OFF ½ second. This fault will force you to cycle power to the system to clear the fault.

Setup for Remote Control Operation

Initial Locomotive Setup

It is essential for safe and efficient remote control operations that the locomotive is in proper working order in manual mode. Verify that all brake pipe hoses are connected and cutout valves are OPEN.

Verify the transfer switch on RCU is in the MANUAL position. This switch is located on the right hand side of the unit.

Verify the locomotive **throttle is in idle** and the **reverser is centered**.

Start engine. Let engine idle in manual until main reservoir air pressure reaches 105-psi or greater.

Verify the automatic brake valve handle is in the HANDLE OFF position. Wait for brake pipe pressure and equalizing reservoir pressure to equal zero. Both the brake pipe pressure and equalizing reservoir pressure must be equal before transferring to remote. Failure to do so will result in a locomotive PCS fault.

CAUTION: Failure to position the automatic brake valve handle in the HANDLE OFF position could result in a brake release condition when the remote control system is switched back to manual mode.

Place the transfer switch on the right side of the receiver / controller unit in the REMOTE position.

Locate the isolation valve on the filter assembly air supply and make sure that the valve is in the ON/OPEN (UP) position.

OCU Setup

- All switches and levers should be in their OFF positions.
- Set INDEPENDENT BRAKE Selector to fifth position for FULL service brake application.
- Check AUTO BRAKE toggle in center position.
- Place HORN/BELL switch in OFF position (toward operator).
- Place the Reverser switch in NEUTRAL position.
- Throttle selector in HALT position.
- E-Stop pulled out.
- OCU not tilted.

Note: The operator should be wearing the break-away vest by this time. The unit should be secured to the break-away vest. The operator can adjust the equipment straps so the unit fits on the chest at a comfortable position. The break-away vest also has a waist belt to accommodate a comfortable fit using one of three belt sizes.

- Turn on the Lightweight OCU by pressing the Power-On pushbutton at the lower right hand corner of the unit (see Figure 3-3). At power-on the OCU will perform a Power-On-Self-Test (POST). When POST has completed successfully the unit is ready to be assigned to a Train Chief® II equipped locomotive.

A successful POST is indicated by the flashing OCU indicators and display message (“OCU > LOCO ALIGN IR”).

If an error is detected during the POST an error message will be displayed and the unit will be disabled. See the troubleshooting section for further details.

OCU Assignment Procedure – Register OCU with Locomotive

How to Register the OCU for single man operation.

At Receiver Power up: IR Indicating LED illuminated (RED)

- Power up Transmitter and wait for POST. Follow prompts on Transmitter display.
- Align Transmitter IR port with Receiver IR Window on Enclosure front (Fig 6.1).
- Once the IR Process is complete the Transmitter will BEEP. Press the “RESET” button to initiated RF communication. The IR Indication LED will go off.

At Transmitter Only Power up (Receiver already ON) LED Not illuminated:

- Power up Transmitter and wait for POST. Follow prompts on Transmitter display.
- Push & hold (for 3 seconds till LED comes on) the IR REQUEST pushbutton.
- Align Transmitter IR port with Receiver IR Window on Enclosure front (Fig 6.1)
- Once the IR Process is complete a Transmitter will BEEP. Press the “RESET” button to initiated RF communication. The IR Indication LED will go off.

OCU Configuration Incompatibility Messages and Definitions:

| Display Message | Definition | Action |
|-----------------|---|--|
| CONFIG | Model/Owner is not compatible. OCU Models can not be interchanged with RCUs or with different equipment owners. | Obtain the unit(s) configured for the RCU and register. Refer to the configuration label next to the IR Port on the RCU. (For MU&Go RCUs this label is inside the enclosure door.) |
| RADIO | OCU and RCU Radio model types incompatible | Obtain the unit(s) configured for the RCU and register. Refer to the configuration label next to the IR Port on the RCU. (For MU&Go RCUs this label is inside the enclosure door.) |
| BAND | Radio out of Band | Obtain the unit(s) configured for the RCU and register. Refer to the configuration label next to the IR Port on the RCU. (For MU&Go RCUs this label is inside the enclosure door.) |

Transfer to Remote Mode and Resetting Locomotive PCS Fault.

To activate the communication link from OCU to locomotive, move the horn toggle to HORN. The locomotive should respond by sounding the locomotive horn. Return the toggle to OFF.

Note: *If the locomotive bell begins to sound it is an indication that the main reservoir is below 75-psi. This could indicate that the isolation valve is in the wrong position. Recheck the valve and continue with the start up procedure. If the valve is in the correct position then recharge the main air reservoir. This is accomplished by placing the directional switch on the OCU in NEUTRAL and increase engine throttle. Throttle will automatically reduce once the 105-psi main reservoir pressure is reached. Now activate the RESET button.*

Release the trainline brake by pressing the AUTO BRAKE toggle switch to the release position. The command is accepted when the keypad AUTO BRAKE REL indicator turns ON.

Reset the locomotive PCS fault, if required.

- Older systems did not provide an indication of when or if the PCS Fault was activated. If the system didn't respond the operator would go to the locomotive and manually reset the fault.
- On newer systems the locomotive brake status lights are disabled when a PCS Fault is activated. To recover from PCS Fault the operator simply sounds the horn. When the fault is cleared the brake status lights should turn on.
- The OCU with two-way communication link will be able to show a PCS Fault message on the OCU display.

Ensure the Independent (locomotive) brake valve handle is in the FULL INDEPENDENT RELEASE position.

WARNING:

The remote control system cannot control independent brakes until the independent brake valve handle is in the FULL INDEPENDENT RELEASE position.

Ensure that the manual headlight switches are OFF, the dimmer switch is set to DIM, the generator field is ON, and the isolation switch is in the RUN position.

If Trainline Braking option is installed:

- For systems utilizing the J1 relay valve for trainline, place the trainline isolation valve to the REMOTE position.
- For systems utilizing the 26L brake cover for trainline, place the trainline dump valve to the OPEN or REMOTE position.

The remote control system now has primary control of the locomotive.

Air Brakes and Safety Features Test

According to the FRA Safety Advisory 2001-01 it is recommended that the air brake and safety function of the OCU be tested at the beginning of any remote control activity. The following summary is provided in support of that practice.

Locomotive Brake Test. Perform all required standard locomotive and trainline brake tests using the OCU to ensure all remote braking functionality.

E-Stop Test. Perform an E-Stop from the OCU to verify remote activation of the emergency locomotive stop. Also test all other locomotive mounted E-Stop push buttons associated with the remote control system.

Tilt Test. To test the Tilt feature of the OCU, tilt the OCU more than 45-degrees. The OCU is operating properly when:

- A continuous tone begins within approximately three (3) seconds
- Then a Tilt Time Out occurs after approximately two (2) seconds of tone
- The RCU responds by commanding an Emergency Locomotive Stop

To recover from a Tilt Time Out Fault, return the OCU to normal operation position.

Local Man-Down Alarm Test. To test the local man down alarm, maintain the OCU in a tilted position while in an active tilt alarm condition. After a period of not greater than 90-seconds and not less than 60-seconds the locomotive horn shall sound at an alternating rate of one second. The locomotive horn will continue to sound the man down alarm until the system is reset.

Remote Man-Down Alarm Test (if present). If your system is equipped with the optional remote man down feature, the remote man down alarm is triggered when the local man down alarm is activated. Refer to the system configuration documents for your specific operational detail.

Alert Test

To test the Alert feature of the OCU

- Place the Reverser selector in Neutral
- Place Independent Brake to Full position
- Set Auto Brake to RELEASE (or some application to hold the train in position)
- Set Throttle selector out of HALT
- Wait for approximately 50 seconds

The OCU is operating properly when

- A fast rate pulse tone begins after approximately 50 seconds
- Then after approximately 10 seconds an Alert Time OUT occurs
- The RCU responds by commanding Full Service Locomotive and Automatic Brake Application.

To recover from an Alert Time Out, return the OCU Throttle selector to HALT position.

Initial start-up and safety checks are completed.

The system is ready for operation.

Normal Operation

Train Chief® II with Lightweight OCU Brake/Throttle Control Configuration

As an operator, you can control movement with an OCU in several different ways. This section covers:

- Setting movement direction
- Starting (Train Handling)
- Alert Operation
- Stopping and changing directions
- Emergency brake applications
- Winter operation
- Transferring operator control (Selective Dual Control option)

Setting Movement direction

Set direction of movement using the reverser selector.

- Forward is the direction the short hood in the Train Chief® II equipped locomotive faces.
- Train Chief® II does not allow you to change the direction of movement until the locomotive brakes are fully applied.

Operating procedure:

- Throttle selector to HALT.
- Wait for locomotive to come to a complete stop.
- Move Reverser to a desired direction selection.
 - If a direction change is made while the locomotive brakes are released, the OCU will declare a Reverser Change Alarm and the controller will command the throttle to idle, apply full locomotive brakes, and disengage generator field.
 - To recover from the Reverser Change Alarm place the Throttle selector to HALT position.

Caution

This Train Chief® II configuration employs a Manual Throttle & Brake Control enabling the operator to achieve similar movement control as if the operator were at the locomotive control stand. This type of operation from a distance requires the operator to be very conservative about judging speed and stopping distances relative to being in or near the locomotive cab.

Starting (Train Handling)

- Set Movement Direction (FWD or REV)
- RELEASE Automatic Brakes by pulling the toggle switch for 1-2 seconds (if equipped).
- RELEASE the locomotive brakes:
 - Move the Independent Brake selector to RELEASE (rotation toward operator) as shown by all indicators off.
- Press RESET (to reset brakes)
 - Throttle selector must be moved from the HALT position within 3 seconds of pressing the RESET.
- Advance the throttle selector to the appropriate throttle position to generate the required power to slowly accelerate the train.
- Use the Automatic or Independent Brake selectors to slow or stop the locomotive.
 - Locomotive brakes can also be applied by moving the throttle selector to HALT.
- To resume movement (without reverser change):
 - Press RESET
 - Within two seconds the Throttle selector must be moved out of HALT position or else the selection will be ignored.
 - If ignored, place Throttle to HALT and repeat from RESET.

Note: Radio Communications – Typically the OCU transmits four messages per second to the locomotive equipment. If the locomotive does not receive a valid message within a set timeout period (typ 1.25 sec) a Full Service Brake Application will occur. During the timeout period the last valid command will prevail.

Alert Operation

The operator alert function is activated when the Throttle selector is moved out of the HALT position (regardless of the Reverser selection).

If there has not been any function or command switch activity (i.e. periodic pressing of the RESET switch) for more than 60 seconds then Train Chief® II will automatically initiate the Full-Application Locomotive Stop command.

- The Alert Timeout warning will cause a fast pulse tone after 50 seconds of command switch inactivity to alert the operator of an impending Full-Application Locomotive Stop.
- If the operator responds to the Alert Warning by pressing ANY button within 10 seconds the alarm is cleared.
- To recover from an Alert Timeout, return the OCU Throttle selector to HALT position.
- The specific time setting for the alert feature may be different, based on specific user request. Refer to site operating rules.

Stopping and Changing Directions

To stop the train manually using the Independent Brake selector:

- Rotate the Throttle selector to IDLE
- Rotate the Independent brake selector to apply the required braking power to bring the train to a manually controlled stop.
- Once the train is stopped a new direction can be selected using the reverser toggle switch.

To stop the train automatically using HALT:

- Turn the Throttle selector to HALT and wait three (3) seconds for the HALT timeout indicated by a single OCU beep. The RCU will automatically apply a controlled application of independent brake.
- To recover from a Full Brake application
 - set Independent Brake selector to RELEASE,
 - press RESET and within three (3) seconds move the Throttle selector out of HALT.

Note: This is a more aggressive controlled stop where the Train Chief® II system applies a ramped application of independent brake until a full-application locomotive stop is achieved.

Trainline Brake Operation (when equipped)

When the Train Chief® II system is equipped with optional trainline brake control the Automatic Brake selector on the OCU will be used to apply and release train brakes.

- The Automatic Brake release is selected when the toggle is pulled toward the operator
 - The receiver / controller commands full air pressure to the brake pipe which places the train brakes in a fully released state.
- The trainline brakes are progressively applied each time the trainline brake switch is momentarily pressed away from the operator.
 - When the switch returns to center the last commanded pressure is maintained.
 - If desired, Bail off independent brakes by pressing the Bail function switch.
- When the Automatic Brake selector is pressed for apply for more than two (2) seconds full service trainline brakes are commanded.

Tilt

When communications are active and the OCU is tilted, the audible indicator will sound a continuous beep (critical warning) for about 2 seconds before commanding an emergency locomotive stop.

Once the emergency locomotive stop command is sent, the alarm no longer sounds continuously, but will sound once every 3 seconds to indicate that the locomotive emergency stop command continues to be sent.

- This condition continues as long as the OCU remains tilted.

The tilt condition is cleared when the OCU is returned to its upright position, or when power is turned off, or when the battery becomes fully discharged.

- Once cleared, the tilt alarm will stop.

Tilt Extend

The tilt extend is provided to facilitate operator tasks requiring two hands.

To extend the tilt timeout the independent brakes must be applied.

- Set the Throttle selector to HALT.
- Press the F1 push button on the keypad until the OCU acknowledges the request with a beep then release F1.
- The operator has 60 seconds to perform tasks while tilting the OCU.
- The Tilt Extend is canceled when the operator moves the Independent Brake from the FULL application selection or moves the Throttle Selector out of HALT.

Man Down Alarm

When the tilt function has been active for more than 1 minute the locomotive horn will begin to cycle on and off or sound continuously depending on your site operating rules.

The alarm will continue to be active until the receiver/controller is reset.

If the OCU is returned to its normal operating position before the man down timer expires the alarm will be cleared.

To recover from Man Down Alarm: recycle power on the RCU and OCU. Then perform initial setup procedures. See Chapter 4.

Emergency brake Applications

In emergency situations, emergency brakes are activated by pushing in the RED Mushroom push button next to the reverser switch. This action causes the OCU to send an operator Emergency Stop command. The controller will respond by commanding an Emergency Locomotive Stop.

To recover from an operator Emergency Stop, pull-out the Red E-stop mushroom push button, Throttle selector to HALT, Independent Brake to FULL.

Train Chief® II will also apply emergency brakes when a serious fault occurs in the system. In either case, Train Chief® II quickly opens the Brake pipe to apply emergency brakes to both locomotive brakes and trainline.

- When operating with dual OCU's in Selective Dual Control operation, the locomotive will accept an Emergency Stop command from either OCU at any time.

Note: An emergency brake application completely drains (dumps) the brake pipe on all cars. Recharging times will vary greatly depending on the number of cars connected and weather conditions.

Operating under winter conditions

During winter conditions, brake components may get covered with snow or ice and braking power may be reduced. Therefore, during these types of conditions, make regular brake applications to keep the braking components working properly.

- With the locomotive moving at a speed of no greater than 4 mph (6 ft/sec), apply a small amount of brakes by moving the Independent Brake selector to Low position. This allows friction to melt away snow and ice on the shoes and wheels.

Transferring from Remote to Manual

- Go to the locomotive and place the independent brake handle into the FULL APPLY position and the automatic brake handle to the EMERGENCY position.
- Place the transfer switch on the receiver / controller unit in the MANUAL position.
- Place the air valve that feeds the receiver / controller unit in the OFF/MANUAL position.
- Place the brake pipe isolation valve in the MANUAL position.
- Recover from the locomotive PCS fault condition using the normal procedure.
- Move the auto automatic brake handle to the RELEASE position.
- If Trainline Braking option is installed:
 - For systems utilizing the J1 relay valve for trainline, place the trainline isolation valve to the MANUAL position.
 - For systems utilizing the 26L brake cover for trainline, place the trainline dump valve to the CLOSED or MANUAL position.
- Move the independent brake handle to the SET position.
- Turn off and secure the OCU to provide protection against unauthorized operation.
- Resume normal operations.

5 OPTIONS

The following optional features are included in your Train Chief® II system.

Special Features Supplied

Independent Brake Bail Option

The locomotive independent brakes are applied and released automatically by the locomotive brake distribution valve (if equipped), in a manner similar to that which is achieved when braking is controlled manually from the locomotive brake stand. The bail function allows the independent brake to be released while the trainline brake continues to be applied.

Locomotive Mounted E-Stops

In addition to the E-Stop button located on the OCU, up to four (4) additional hardwired E-Stop buttons can be provided on the locomotive. All E-Stop buttons are wired in series such that activation of any one will command the E-Stop reaction. These additional E-Stop buttons must be located on the locomotive, since they are hard wired into the receiver / controller unit.

Wheel-slip Alarm Option

When present, the existing locomotive's wheel slip monitoring device can be monitored by the locomotive remote control system. When wheel slip is detected by the LRCS the throttle can be automatically reduced or maintained steady depending on customer's decision at time of purchase. Throttle advance is also restricted while there is wheel slip being detected.

Sanding Options

Direct electric control has been provided to initiate the locomotive sanding function. Typically the dual function RESET / SAND pushbutton as described in Chapter 3 is employed on the OCU for this function. Sanding is always in the direction of travel.

OCU Two-Way Operational Messages

OCU Status Messages (Solicited)

| Item | OCU Message | Description | Comments |
|------|-------------------------|-------------------------------|----------|
| 1 | BATT LVL E [] F | OCU Battery Level | |
| 2 | MAIN RES XXX PSI | Main Reservoir Pressure (PSI) | |
| 3 | BRK PIPE XX PSI | Brake Pipe Pressure (PSI) | |
| 4 | BRKCLDNR XX PSI | Brake Cylinder Pressure (PSI) | |

OCU Operational Warning and Alarm Messages (Unsolicited)

| Item | OCU Message | RCU Operational Action | Description | Comments |
|------|--|------------------------|---|----------|
| 1 | Low MR (Low MR Pressure) | Full Locomotive Stop | MR < 105 PSI | |
| 2 | MAN DOWN OCU-A | Emergency Stop | | |
| 3 | OCU E-STOP | Emergency Stop | Operator requests an emergency | |
| 4 | RCU E-STOP | Emergency Stop | External E-Stop on Locomotive activated (pushed IN) | |
| 5 | REVERSER (Illegal Reverser Change) | Full Locomotive Stop | Direction change while in movement or not in STOP | |
| 6 | TILT (Tilt Timeout) | Emergency Stop | Tilt Timeout | |
| 7 | WHL SLIP | Throttle hold | Wheel Slip | |

6 DETAILED EQUIPMENT DESCRIPTIONS

Lightweight OCU Features

The Train Chief® II LRCS receiver/controller unit and Lightweight OCU operate with the Advanced Universal Transmitter system that allows the assignment of a given OCU to a specific locomotive. The OCU assignment system will allow any OCU to be assigned to any locomotive, with identical controls and configuration. This system provides an extensive degree of flexibility for any given equipment set. The Advanced Universal Transmitter incorporates an additional level of communication security to ensure that only authorized and authenticated (properly assigned) OCUs will work with locomotives within the designated group.



Figure 6-1

Operational Description

- Each receiver / controller unit (located in the locomotive) has a unique hard coded identification code and (within a group of locomotives) a discrete radio frequency.
- Each OCU has a unique identification code and is radio frequency agile to operate on any of the locomotive group's frequencies.
- The OCU and locomotive are field configured to operate together by using the **OCU assignment procedure**.
- OCU assignment is accomplished through a duplex infra-red link that exchanges information (data) between the receiver / controller unit and the OCU. The receiver / controller locomotive's ID code and operating frequency and the OCU's ID code are exchanged during this process. Once completed, the specific OCU is assigned to that specific locomotive and RF communication and remote control operations can commence over the radio link.
- Since both the locomotive and OCU have exchanged their unique identities, the OCU can only communicate with its assigned locomotive. If an attempt is made to assign the OCU to another locomotive, the assignment process will re-write the locomotive's data in the OCU memory, disabling RF communication to the previous locomotive.
- Since the locomotive receiver and OCU trade their unique identities they are then paired to the exclusion of other nearby OCUs and receivers until power is removed or a re-assignment occurs.

- Anytime the locomotive is returned to manual operation or the OCU power is switched OFF, the stored data will be lost requiring the assignment process to be repeated. The OCU will not lose its assignment data during a “hot battery swap” if the swap is accomplished promptly, within approximately 1 minute.

IR Registration Process:

At Receiver Power up: IR Indicating LED illuminated (RED)

- Power up Transmitter and wait for POST. Follow prompts on Transmitter display.
- Align Transmitter IR port with Receiver IR Window on Enclosure front (Fig 6.1).
- Once the IR Process is complete the Transmitter will BEEP. Press the “RESET” button to initiated RF communication. The IR Indication LED will go off.

At Transmitter Only Power up (Receiver already ON) LED Not illuminated:

- Power up Transmitter and wait for POST. Follow prompts on Transmitter display.
- Push & hold (for 3 seconds till LED comes on) the IR REQUEST pushbutton.
- Align Transmitter IR port with Receiver IR Window on Enclosure front (Fig 6.1)
- Once the IR Process is complete a Transmitter will BEEP. Press the “RESET” button to initiated RF communication. The IR Indication LED will go off.

OCU Controls

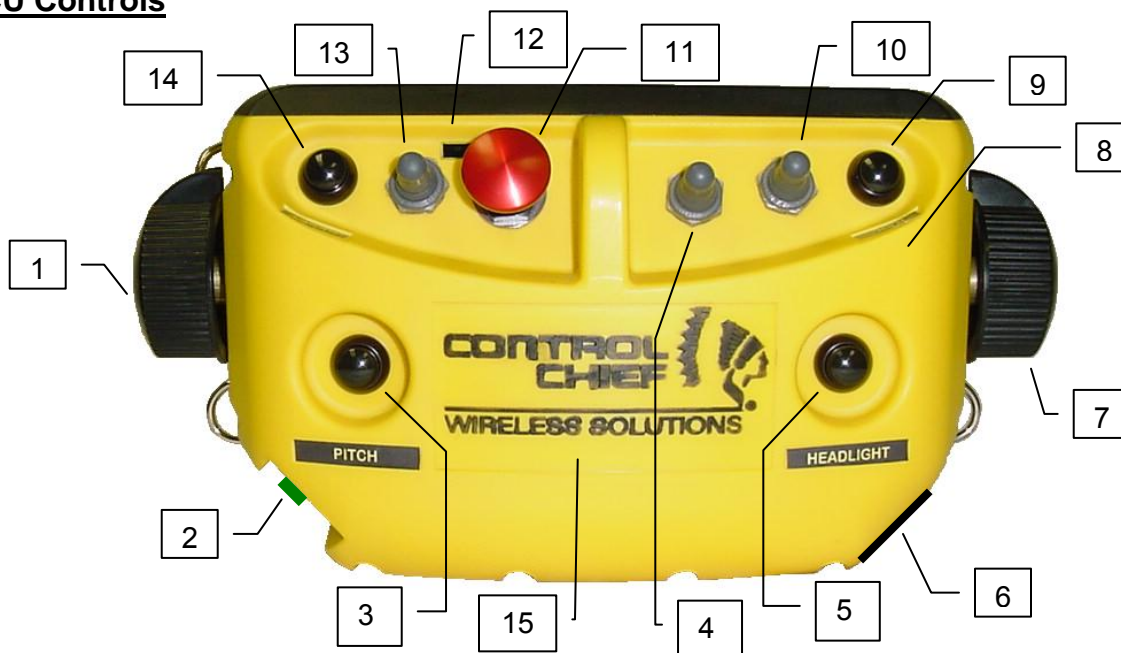


Figure 6-2: OCU-BTIND Main Controls

1. Throttle Selector:

Ten detents for HALT, IDLE and eight (8) increments of throttle position. The throttle selection is indicated by LEDs on the display.

Throttle select positions:

- **Halt:** commands the throttle to idle, removes generator field and applies independent brakes in a controlled manner.

- **Idle:** commands the throttle to idle, removes generator field, but does not apply brakes.
- The remaining settings 1 – 8 command the same throttle settings as the control cab console settings of the same number.

2. Power Switch:

Recessed Push-ON Push-OFF switch controls power to the OCU. Pressing the button applies power to the unit from the battery pack and power bridge. Pressing the button again removes power to the unit. Depending on the charge state of the power bridge, the OCU may initiate its POST (Power-On-Self-Test) without an installed battery, but the unit will inhibit further operation until a battery pack is installed.

3. Pitch:

This button is used to transfer LRC command to another OCU for “Pitch & Catch” operations when Selective Dual Control is operational. Refer to page 4-2 in this manual describing the Selective Dual Control feature.

4. Horn / Bell Switch:

This is a 3-position switch. It is latched at the rear (OFF) position and at the center (BELL) position. The forward (HORN) position is spring loaded to return to BELL position when released. Return the switch to the OFF position to silence the Bell.

Specific to BELL function: Whenever locomotive independent brakes are fully applied and the Throttle selector is moved from Halt to some movement position, Train Chief® II sounds the bell for 5 to 15 seconds. (Bell ringing durations are based on customer requirements for their operation.)

Specific to HORN function: The Horn function is used to acknowledge or accept a “Pitch” from a transferring OCU.

5. Headlight / Extra Tilt Extend button: (options)

When the Headlight option is installed this button can toggle the state of the locomotive headlights between DIM (default setting) and BRIGHT, or between ON and OFF. An indicator on the OCU keypad will indicate the state of the control. See Chapter 5 for full explanation.

When the Tilt Extend option is installed this button will perform the same function as the F1 button on the keypad.

6. Audible Alarm:

The audible alarm provides a means with which to audibly prompt the operator of operational status thereby enabling the operator to maintain visual attention on the task at hand. The following table provides a description of the various alarm functions and their audible indications.

| Function | Sound Pattern |
|--------------------------------|---|
| OCU Assignment Success | 1 Beep |
| OCU Assignment Failure | 2 Beeps |
| Alert Time-Out Warning | Fast Beep rate for 10 seconds |
| Tilt Warning | Constant tone for up to 3 seconds |
| Tilt Time Extend Acknowledged | 1 Beep |
| OCU Detected Error Condition | 3 Beeps |
| Low Battery “Warning” | Double beep every 30 seconds (up to 15 minutes.) |
| Low Battery “Shutdown Warning” | Double beep every 15 seconds (up to 5 minutes.) |
| Low Battery “Shutdown” | 1 beep every 4 seconds – replace battery pack to recover. |

7. Independent Brake Selector:

Six position selector allows you to apply independent locomotive brakes to achieve the desired stopping power.

Selectable positions are:

- Release (0 psi): this is the normal operating position when operating in power mode (Throttle positions 1-8). (Note RELEASE selection is indicated when all Independent Brake LEDs are off.)
- **B1**: Applies 1/5 of the available independent brake pressure to the brake cylinders. Throttle selections T1 to T8 are allowed.
- **B2**: Applies 2/5 of the available independent brake pressure to the brake cylinders. Throttle selections T1 to T8 are allowed.
- **B3**: Applies 3/5 of the available independent brake pressure to the brake cylinders. Throttle selections T1 to T8 are allowed.
- **B4**: Applies 4/5 of the available independent brake pressure to the brake cylinders. When brake pressure reaches 20 PSI the throttle is limited to T4. See note.
- **FULL**: Applies total available independent brake pressure to the brake cylinders. When brake pressure reaches 20 PSI the throttle is limited to T4. See note.

NOTE: The parameters used to establish thresholds for limiting throttle for a given brake pressure can be adjusted per owners' operating rules and requirements.

8. Internal Tilt Switch:

Located behind the keypad is an internal tilt switch or sensing device. If the transmitter is tilted in any axis beyond 60-degree of upright for more than the preprogrammed tilt timeout setting (typically 5 seconds), a tilt alarm becomes active. The tilt alarm feature is described in more detail in Chapter 4.

9. Reset (optionally Reset/Bail):

The pushbutton located at the top left hand corner of the OCU provides an Alert reset function:

1. It resets the **Alert** warning. See page 4-9.
2. It instructs the RCU to allow a brake release when the operator moves the Throttle selector out of the HALT position.

CAUTION:

Unless the Reset pushbutton is released, an Alert Timeout error will occur and the system will command a Full-Application Locomotive Stop.

This pushbutton can also perform the optional dual function of RESET / BAIL. Alert reset functions are same as above. The BAIL function allows the independent brakes to be released while the train brake remains applied. For the BAIL function, when the button is pressed for longer than 2 seconds the controller will bail off independent brake.

10. Automatic Brake Selector:

This 3-position spring centered switch allows you to release or apply train brakes by **reducing** brake pipe by the following pressures:

- Release 0-psi reduction
- Minimum 6-8 psi reduction
- Light 10 psi reduction
- Medium 18 psi reduction
- Full 26 psi reduction
- The Charge position is used to charge the air brake system.

The center switch position (LAP) maintains the last brake setting.

Each time the switch is pressed (must be held for 0.5 sec); the train brakes are incremented to the next higher/lower setting.

On the first application of Auto Brake the locomotive brake portion of the train brake application is automatically bailed off.

Whenever the switch is pulled (must be held for 2 sec), the train brakes immediately revert back to Release position.

11. Emergency Stop Push Button:

This control is a push-pull mushroom switch. Push-in to activate an operator commanded Emergency Locomotive Stop. For normal operations the EMERGENCY mushroom must be pulled-out.

Note: Emergency stop develops high brake cylinder pressures which increases the chance of locking the locomotive wheels. Therefore, only use the EMERGENCY mushroom switch when absolutely necessary.

12. IR Port:

Used to link OCU to Train Chief® II locomotive controller. Align with IR Port on the RCU when registering a Lightweight OCU-BTIND with RCU.

This is the access window for IR (infrared) communication from the OCU when registering with a RCU. Simply align the OCU IR port with the IR port per the instructions in Chapter 4.

13. Reverser Toggle:

This 3-position switch selects locomotive movement direction as Forward, Reverse, or Neutral.

14. Reset / Sand Button:

Pressing Reset for more than 2-seconds will activate Sanding by selected direction.

The Reset/Sand push button is located at the top right hand corner of the OCU.

1. It activates the sanders in the direction of movement when held for longer than 2 seconds.
2. It resets the **Alert** warning. See page 4-9.
3. It instructs the RCU to allow a brake release when the operator moves the Throttle selector out of the HALT position.

CAUTION:

Unless the Reset pushbutton is released, an Alert Timeout error will occur and the system will command a Full-Application Locomotive Stop.

15. Internal Antenna:

To enhance robustness and reliability the OCU is equipped with an internal antenna. Keeping this susceptible component safely inside the OCU case minimizes repairs and downtime.

OCU Keypad, Indicators and Display

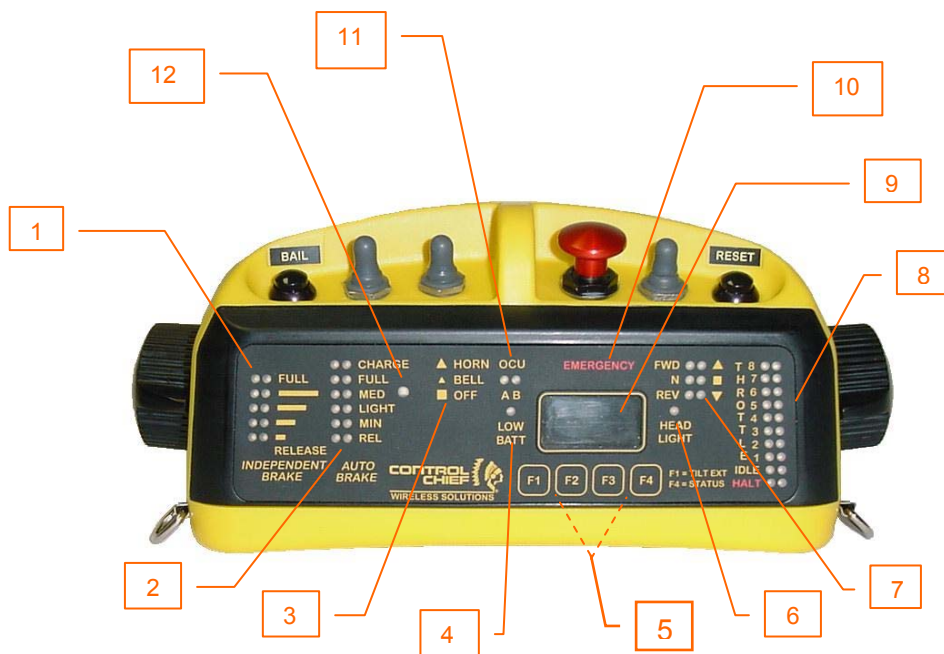


Figure 6-3: OCU-BTIND Keypad Indicators

- 1 INDEPENDENT BRAKE INDICATORS:** Displays selected locomotive brake setting. Green LEDs indicate the wearer’s control setting and Red LEDs indicate settings for the companion operator during Selective Dual Control operations.

 - The Independent Brake **FULL** LED will flash during a TILT warning alarm or to indicate that the OCU has commanded an Emergency Locomotive Stop.

- 2 AUTOMATIC BRAKE INDICATORS:** Displays selected automatic (Trainline) brake setting. Green LEDs indicate the wearer’s control setting and Red LEDs indicate settings for the companion operator during Selective Dual Control operations.

 - The Automatic Brake **FULL** LED will flash during an Alert timer alarm or to indicate that the OCU has commanded a Full-Application Locomotive Stop.

- 3 HORN / BELL Button Designator:** Identifies toggle switch functions.

4 LOW BATTERY INDICATOR:

Blinking – Battery Low. This is an indication that OCU operational time is limited. The battery pack should be replaced with a freshly charged pack. The limited operational time during LOW battery condition will vary based on ambient temperature, battery service time, and usage. Operational run time in the LOW battery condition can range from 15 to 45 minutes.

Steady – Battery Dead. The battery dead condition indicates the pack has reached a discharge level where continued operation cannot be assured reliable. When the OCU detects this condition, operation will be inhibited and the OCU is placed in the lowest power mode.

5 SOFTKEYS:

F1 = Tilt Extend. Under normal conditions this will extend the allowable Tilt time before sounding Alarm. Also see page 4-9. To activate this command the operator must hold the key in the Tilt Ext position for 2 seconds until the OCU sounds a BEEP to acknowledge Tilt Ext has been activated. If the operator anticipates having to tilt the OCU for more than a few seconds, pushing the F1 Softkey extends the allowable tilt time to 60 seconds.

- Tilting the OCU more than 45-degrees turns ON an audible alarm for 3 seconds. If the OCU is not restored to the upright position before this alarm finishes, the OCU sends an Emergency Locomotive Stop command to the locomotive.
- If the OCU remains in the tilted condition for more than one minute the Man Down Alarm will become activated. Refer to Man Down Alarm (page 4-9) for more details.

F2 = optional

F3 = optional

F4 = Status. Utilized to activate Status report on 2-line display

6 HEADLIGHT INDICATOR: Illuminates when headlights have been activated by front panel pushbutton.**7 DIRECTIONAL INDICATORS:** Displays direction selected by front toggle switch. Green LEDs indicate the wearer's control setting and Red LEDs indicate settings for the companion operator during Selective Dual Control operations.**8 THROTTLE SELECT INDICATORS:** Displays selected locomotive throttle setting. Green LEDs indicate the wearer's control setting and Red LEDs indicate settings for the companion operator during Selective Dual Control operations.

- 9 2-LINE x 8-CHARACTER DISPLAY:** LED Dot Matrix displays system status messages. Two intensity levels depending on ambient light sensor. The display provides the operator with the following information:

| General Display Message | Description |
|---|---|
| At Power On | Manufacturer ID |
| | Hardware Status |
| | Unit Serial Number |
| | Firmware Version |
| | Battery Condition |
| OCU Infrared Registration Acknowledgement | Locomotive Running Number (typically a four digit number) |
| | Pitch & Catch Assignment (A or B) |
| | Network Info (Protocol and RCL operating Mode) |
| Error Conditions | Hardware Status (memory fault, program fault, others) |
| | Battery Conditions |
| | RF Diagnostics |

Below the 2-line 16 char LED Dot Matrix Display are four push buttons. These push buttons are used for OCU configuration and diagnostics. Future use is for specialized user applications, such as, initiating a remote switch actuation or other auxiliary track side application.

- 10 EMERGENCY STOP DESIGNATOR:** Indicates E-Stop button location.
- 11 OCU A-B INDICATORS:** Indicates OCU designation (A or B).
- 12 AMBIENT LIGHT SENSOR:** Used to automatically adjust backlighting, indicators, and display brightness.

Battery and Battery Charger Details

Battery Pack:

The power source for the Lightweight OCU is a rechargeable 7.4 V Lithium-Ion battery pack specifically designed for the Lightweight OCU. The battery pack is designed to provide 12-hours of continuous operation. The battery pack contains an internal capacity monitor. This monitor will be interrogated to report to the operator the remaining run time of the pack. The run time report will be shown to the operator via the display at power on and when the status SOFTKEY F4 is pressed.

The Battery Pack is installed in the back of the OCU. Do not allow any metal to come in contact with the contact pads of the battery pack. If the battery contact pads do become shorted the internal protection mechanism will cause the battery to open circuit. If the battery is placed in the OCU the OCU is going to either not function or report a dead battery. Set the pack aside for a few moments to allow the protection circuit to reset.

Advantages of Lithium-Ion batteries:

- None of the memory effects of Ni-Cd batteries.
- Higher energy density than Ni-Cd or Ni-MH batteries.

Battery Maintenance:

Proper care and maintenance will assure optimum performance of the batteries for your application.

- Do Not Incinerate.
- Do Not Disassemble.
- Do Not short connection pads.
- Do Not expose to high temps (>140F/80C).
- Disposal method per local and state regulations.

Battery Charging:

- Connect charger to appropriate power source and turn on power switch. Power indicator should be illuminated.
- Secure battery pack in charger.
- FAST charge indicator will turn ON. (The FAST indicator may not turn on if a fully charged battery pack is installed in the charger. This is normal.)
- FULL charge indicator will turn ON when pack reaches 85%.
 - If a FAULT occurs during either FAST or FULL charge, cycle power switch OFF then ON.
 - If the FAULT persists remove battery pack from service and return to factory for repair.
- DONE illuminates when both FULL and FAST charge indicators turn off.
 - Battery pack can remain in charger.
 - Charger will restart charging process when battery drops below recharge voltage threshold.



**Figure 6-5
Battery Charger**

Typical Locomotive Pneumatic Interface

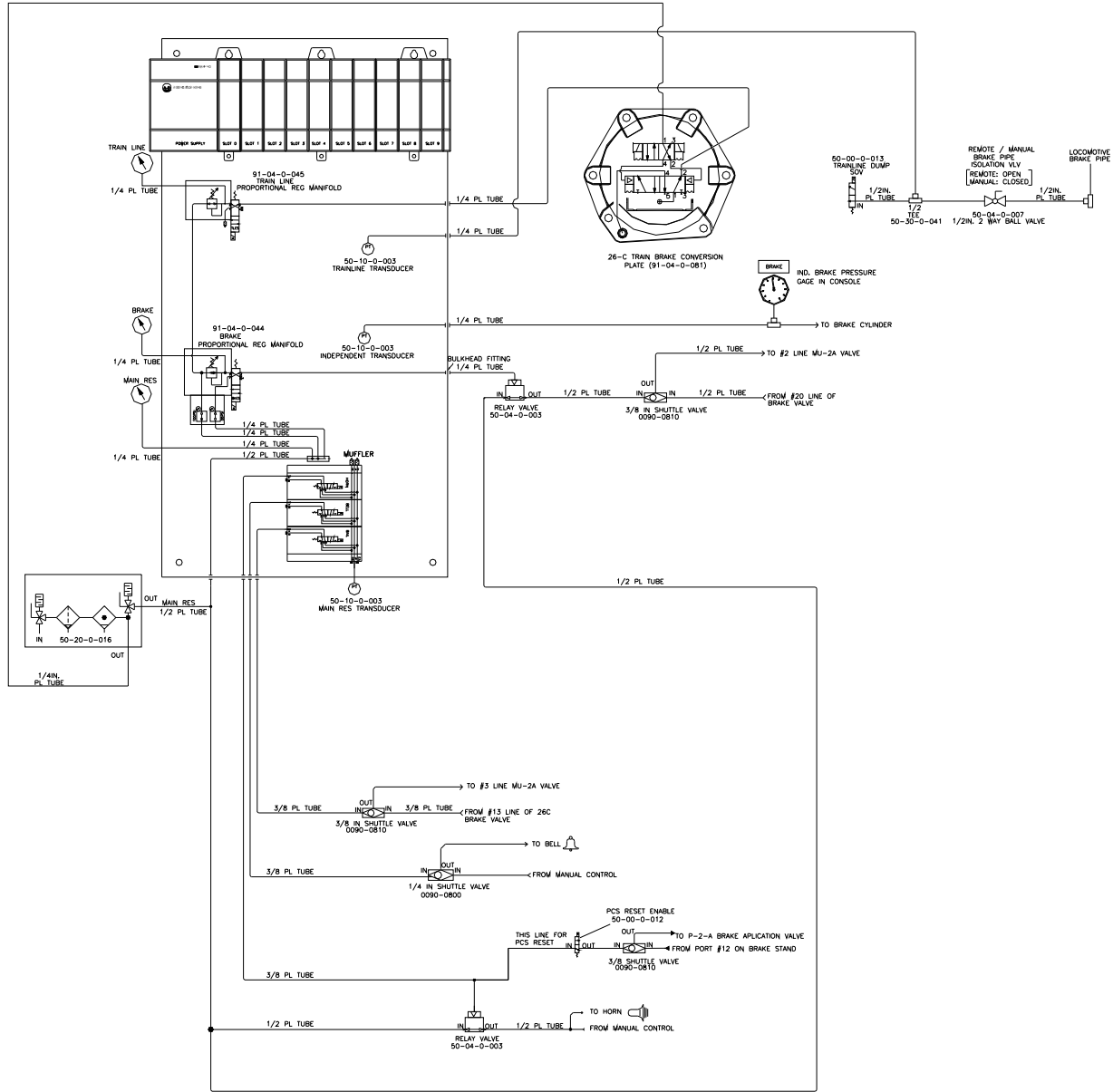


Figure 6-6

7 TROUBLESHOOTING

Lightweight OCU Troubleshooting

General

The following troubleshooting procedure is provided to assist in the identification of specific problems and/or abnormal operation. Control Chief recommends that you contact us before attempting any field repairs.

Power-On-Self-Test

If errors are detected during POST (Power-On-Self-Test) the display will show an error message and further operation will be inhibited. POST Error Message example: "POST, ERR #123". If your unit reports a POST error message please note the message number, cycle power on the unit and begin operations again. If the POST error persists call Product Support (contact information contained in Chapter 8 of this manual) to report the error and obtain additional details. Useful information to expedite the error resolution would be the system number and the information on the back label of the OCU (part #, serial #, railroad reporting mark ID).



Fig 7-1: Power-On-Self-Test

OCU Beeps When a Switch is Pressed

This typically occurs on a power-up cycle and the switches have not been returned to their start-up positions: E-Stop pulled out, direction to NEUTRAL, OCU not tilted, throttle at HALT, independent brake at FULL, and push buttons released (not jammed).

OCU ERROR Indications

If the 2-line LED display indicates "ERROR" then use this section to determine the next course of action. If there is a communication problem please refer to the Communication Troubleshooting section, page 7-9.

When an ERROR condition occurs the OCU will send an immediate emergency locomotive stop command. The unit will remain in this condition until power is removed and the problem corrected.

OCU Diagnostics

The Lightweight OCU transmitter has a complete set of built-in diagnostic tests, to verify the functionality of all switches and levers. The tests are available by accessing the transmitter's **diagnostic mode** and making a specific test selection using the function switches.

CAUTION: Before performing any transmitter diagnostic test, transfer the locomotive to manual.

The Diagnostic Mode and Menu

Use the following procedure to enter transmitter diagnostic mode:

1. Once the unit is ready to register with the Locomotive the unit will respond to the following function switch selections.
2. F4 and F1: Lamp Test. To exit press F1.
3. F4 and F2: Switch Test. To exit cycle power.

Lamp Test

All indicators shall be ON. The display shall show the message, "Running LAMP TST". To exit press F1.



Fig 7-2: OCU-BTIND Lamp Test

The Switch Diagnostic Test

If during the course of operations certain switch functions appear to be non-responsive or intermittent, use the transmitter diagnostic switch test for switch troubleshooting. The switch test provides a method to test transmitter switches without actually operating the locomotive. Press F1 and F4 simultaneously to enter the diagnostic switch test. Once in the test mode, rotating or activating the switches will show a corresponding change in the display groups identified in Fig 7-3. Refer to the tables below for switch to display indicator mapping.

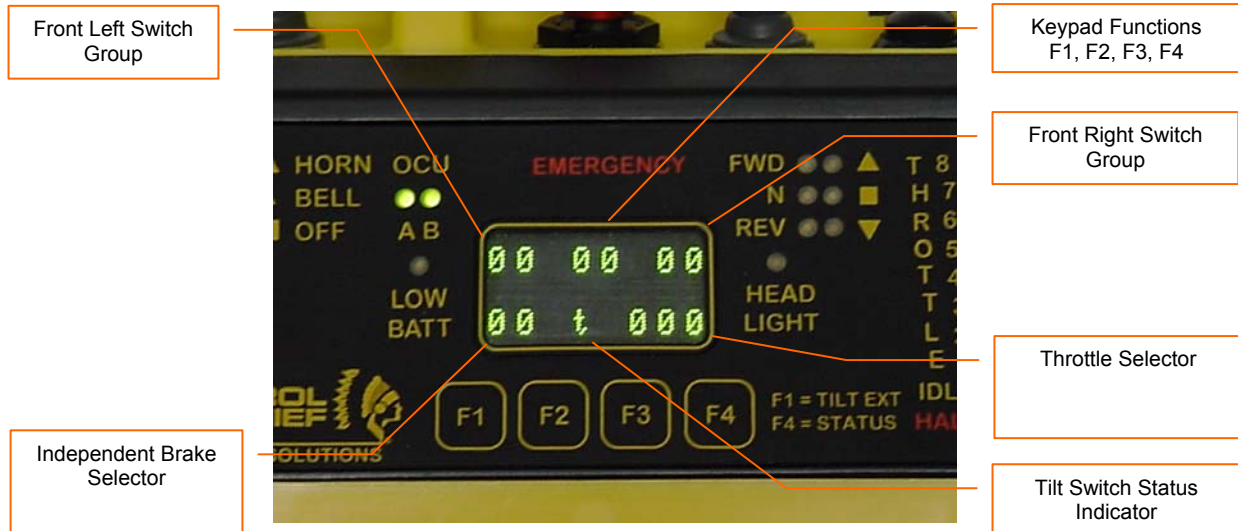


Fig 7-3: OCU Switch Diagnostic Display

To exit diagnostic switch test, cycle power.

| Front Left Switch Group | Display |
|-------------------------|---------|
| LH RESET | 02 |
| LH FRONT PB | 04 |
| AUTO BRAKE – CENTER | 00 |
| AUTO BRAKE – RELEASE | 10 |
| AUTO BRAKE – APPLY | 20 |
| BELL/HORN – OFF | 80 |
| BELL/HORN – BELL | 00 |
| BELL/HORN – HORN | 40 |

| Independent Brake Selector | Display |
|----------------------------|---------|
| RELEASE | B0 |
| B1 | B1 |
| B2 | B2 |
| B3 | B3 |
| B4 | B4 |
| FULL | B5 |

| KEYPAD Function Softkeys | Display |
|--------------------------|---------|
| F1 | 08 |
| F2 | 04 |
| F3 | 02 |
| F4 | 01 |

| Throttle Selector | Display |
|-------------------|---------|
| HALT | T0 |
| IDLE | T1 |
| 1 | T2 |
| 2 | T3 |
| 3 | T4 |
| 4 | T5 |
| 5 | T6 |
| 6 | T7 |
| 7 | T8 |
| 8 | T9 |

| Front Right Switch Group | Display |
|--------------------------|---------|
| RH RESET | 40 |
| RH FRONT PB | 20 |
| REVERSER – NEUTRAL | 00 |
| REVERSER – FWD | 04 |
| REVERSER – REV | 08 |
| EMERG DEPRESSED | 00 |
| EMERG PULLED OUT | 03 |

| Tilt Indicator | Display |
|----------------|---------|
| (Upright) | t |
| (Tilted) | T |

If the E-Stop switch is pushed in, the audible alarm will beep fast.

To exit diagnostic switch test, cycle power.

SLC 500™ Troubleshooting

This section provides a basic troubleshooting guide for the SLC 500™ power supply and processor modules. Please review the tables below for the fault condition your system is exhibiting. Additional SLC 500™ troubleshooting information is available in the Allen-Bradley publication 1746-6.2. If your attempts are not successful in correcting an error condition, please do not hesitate to contact Control Chief Product Support for assistance. Please refer to the Chapter 8 for required reporting details and contact information.

WARNING: Do not remove any PLC modules with power applied.

Note: The power supply module LED indicator should be ON when power is applied to the input terminals, however, the LED could be OFF even when input power is present. Check input terminals with a volt meter to verify power is removed.

The following SLC 500™ error condition tables provide troubleshooting assistance for SLC 500™ power supply and processor LED states, their potential cause, and recommended actions to resolve the error condition.

SLC 500™ Error Conditions and Action - System Power

| Power Supply | Processor | | Error | Cause | Actions |
|--------------|-----------|-----|-------------------------|-------------------------|--|
| | POWER | RUN | | | |
| OFF | OFF | OFF | Inadequate System Power | No Line Power | <ol style="list-style-type: none"> 1. Verify proper line voltage and connections on the power terminals. 2. Verify proper 120/240V power supply jumper selection. |
| OFF | OFF | OFF | | Power Supply Fuse Blown | <ol style="list-style-type: none"> 1. Check the incoming power fuse, check for proper incoming power connections. Replace fuse. 2. If fuse blows again, replace the power supply. |
| OFF | OFF | OFF | | Power Supply Overloaded | <ol style="list-style-type: none"> 1. Remove line power to power supply. Remove several output modules from the chassis. Wait five minutes. Reapply power. 2. If condition reoccurs, re-calculate module configuration power required and verify proper power supply selection. This problem can occur intermittently if power supply is slightly overloaded when output loading and temperature varies. |
| OFF | OFF | OFF | | Defective Power Supply | <ol style="list-style-type: none"> 1. Recheck other probable causes. 2. Monitor the line power to chassis power supply for possible transient or shorting. 3. Replace power supply. |

SLC 500™ Error Conditions and Actions - Power Supply Source

| Power Supply | Processor | | Error | Cause | Actions |
|--------------|-----------|-------------|-------------------------|---------------------------------------|---|
| | POWER | RUN CPU FLT | | | |
| OFF | OFF | ON | Inadequate System Power | Improper Line Power Voltage Selection | Verify proper input power supply voltage. |

SLC 500™ Error Conditions and Actions - Processor Not in RUN Mode

| Power Supply | Processor | | Error | Cause | Actions |
|--------------|-----------|-------------|---------------------------|---|--|
| | POWER | RUN CPU FLT | | | |
| ON | OFF | OFF | Processor Not in RUN Mode | Either Improper Mode Selected or User Program Logic Error | <ol style="list-style-type: none"> 1. Verify selected processor mode. 2. If 5/03, then key switch must be in RUN position. |
| ON | OFF | OFF | | Line Power Out of Operating Range | <ol style="list-style-type: none"> 1. Check proper 120/240V power supply and incoming power connections. 2. Monitor for proper line voltage at the incoming power connections. |
| ON | OFF | OFF | | Improper Seating of Power Supply, and/or Processor in the Chassis | <ol style="list-style-type: none"> 1. Remove power and inspect the power supply chassis connections and the processor chassis connections. 2. Re-install the devices and re-apply power. IMPORTANT: The processor only operates in slot 0 of chassis #1. |
| ON | OFF | OFF | | Defective Processor, Power Supply or Chassis | <ol style="list-style-type: none"> 1. Attempt RUN mode selection of processor in existing chassis. 2. Place processor in another chassis not in the existing system. Apply power, reconfigure and attempt RUN mode selection. If unsuccessful, replace processor. 3. Try existing power supply in test chassis. If unsuccessful, replace power supply. If entry into the RUN mode is allowed, replace the existing chassis. |

SLC 500™ Error Conditions and Actions - CPU Major Fault

| Power Supply | Processor | | Error | Cause | Actions |
|--------------|-----------|-------------|-----------------|---|--|
| | POWER | RUN CPU FLT | | | |
| ON | OFF | ON | CPU Fault | CPU Memory Error | Cycle power. If problem reoccurs, contact factory. |
| ON | OFF | FL | CPU Major Fault | Hardware / Software Major Error Detected (Erratic repetitive power cycling can cause a processor major hardware fault) | Cycle power. If problem reoccurs, contact factory. |

OFF= No Illumination

ON=Continuous Illumination

FL=Flashing

Control Chief Specific PLC Modules

High Current Relay Module with Watchdog

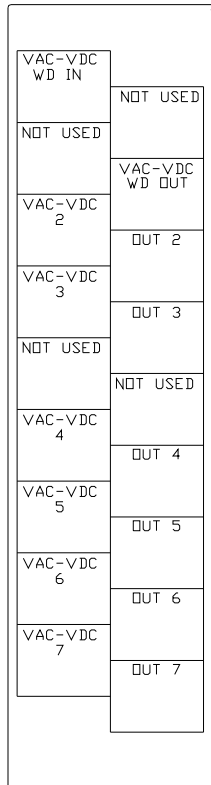
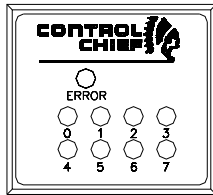
The primary function of this module is to monitor system operation and provide an active output (by way of a dry contact closure) to indicate system status. The output is then used to control the E-Stop relay which switches the application of primary power to the control system.

Operation

The High Current Relay Module with Watchdog monitors system operation by way of two built-in watchdog circuits. The first watchdog monitors the SLC 500™ processor. When this watchdog is satisfied it will enable relay output 0. The second monitors the ladder program. When the second watchdog is satisfied it will enable relay output 1. The output 0 and 1 are hardwired in series on the module (wired AND). The voltage source is wired to VAC-VCD WD IN. The high side of the E-Stop relay is wired to VAC-VDC WD OUT. (For additional details refer to your system prints.) The watchdogs are enabled once the OCU establishes a communication link with the portable controller. If either one of the two watchdogs does not receive a timely refresh it will time out which will turn off its associated relay output and disengage E-Stop relay resulting in an immediate E-Stop.

The following error condition tables provide troubleshooting assistance for the High Current Relay Module with Watchdog, including their potential cause, and recommended actions to resolve the error condition.

High Current Relay Module w/Watchdog LED Indicators



| Error | Indicators | | Error | Cause | Action |
|-------|------------|-----|--------------------------|---|---|
| | 0 | 1 | | | |
| OFF | OFF | OFF | Normal Operation | Enable command has not been issued | Send HORN command from OCU. |
| OFF | ON | ON | Normal Operation | Enable is commanded, watchdogs are satisfied, both outputs ON. | Continue operation. |
| ON | OFF | ON | Slot Select Fault | Possible watchdog "0" fault. Select pulse is not functioning or possibly a problem on the module. | Replace Watchdog module. If unsuccessful, contact factory. |
| ON | ON | OFF | Application Toggle Fault | Possible watchdog "1" fault. Application pulse is not functioning or possibly a problem on the module. | Replace Watchdog module. If unsuccessful, contact factory. |

Troubleshooting Communications Faults

*First rule of troubleshooting communication problems – **check the antenna.***

Most communication problems are caused by a missing or damaged antenna, or damaged coaxial cable. If communication performance has degraded, always check to ensure the antenna is attached and the antenna coaxial cable has not been damaged.

The communication link between OCU and receiver is low power RF and requires a higher level of readability than that needed for voice communications (i.e. interference that may be noticeable on a voice channel that does not necessarily render it unusable, would render a low power data link unusable).

Locomotive Does Not Respond to the OCU

Checklist:

1. OCU is setup for the locomotive attempting to establish communications. System number of OCU should correspond to the system number of the locomotive controller, or other configuration. Refer to system prints and/or specific system configuration instructions.
2. OCU power is ON.
3. OCU battery indication OK.
4. OCU switches in proper position for initial start, and press start.
5. SLC processor is in RUN mode.

Locomotive Functions are Dropping Out

1. Are the dropouts occurring at a particular time of the day? This could indicate an unauthorized RF transmitter is operating on your licensed channel.
2. Has something changed in your operational environment? Are the dropouts occurring at a particular location or during a specific process? If equipment or processes have changed in your operation then possibly they have introduced some form of RF interference on your channel.

If you are not able to isolate the particular cause of interference contact Product Service and report your findings. Additionally, a site spectrum analysis may need to be performed to confirm the interfering RF source.

3. If dropouts are random in time and place, then it is a good indication of a problem in the OCU or Communicator® module. If you suspect this is the case, try a spare OCU and/or Communicator® module.

If you are not successful at isolating and/or correcting the problem after attempting the above suggestions then contact our Product Service department. Please refer to Chapter 8 for instructions when contacting Product Service.

Electrical and Pneumatic System Troubleshooting

Refer to reference drawing E-XXXX-03-1 for component location and part numbers. (E-XXXX is your system number)

WARNING: Before attempting to service any pneumatic components, insure the air system has been vented to atmosphere (zero pressure in air lines).

CAUTION: Contaminants in the air system can significantly reduce the component life and performance of the remote control pneumatics. Therefore, to insure long component life and optimum system performance it is essential to implement a preventive maintenance schedule for the locomotive pneumatics system. This should include draining water from the main reservoir tank and replacing filter cartridges.

NOTE: FAILURE TO MAINTAIN THE AIR SYSTEM WILL VOID THE WARRANTY

The remote control pneumatic system can only perform as well as the air system is maintained.

Description

The primary controller used in the system is an Allen-Bradley SLC 500™ PLC. A correct version of the program in the processor will be required. The electrical outputs should be checked using system schematics. This procedure is intended to be used to troubleshoot all electrical outputs and pneumatic outputs.

Preliminary Inspection

Before troubleshooting, verify the system wiring and pneumatic piping matches the system schematics.

Test Equipment

Voltmeter – for testing outputs and troubleshooting as required.

Notes: Most Allen-Bradley modules have removable terminal strips so unwiring is not necessary in order to change a module.

Procedure

- Verify main battery voltage with a voltmeter. Apply power to the system.
- Verify main battery voltage input at input fuses on the EMI filter module. Check the output of the EMI filter module at the terminal strip.
- Verify main battery voltage input (from the EMI filter module) at +64L and -64L input fuses on the locomotive interface mounted in the locomotive interface cabinet.
- Verify +24VDC input to the SLC 500™ power supply module 1746-P3.
- Verify RED LED is ON located on the front panel of the power supply.
- Verify the RUN LED is ON located on the processor module.
- Activate the OCU (pushbutton switch ON) and establish communication (press the HORN button).

Main Reservoir

If main air supply goes low (below 75-psi) the low main air AMBER light will illuminate on the receiver / controller cabinet. To clear this alarm condition the main reservoir must be restored to 105-psi. Once the main reservoir is at 105-psi or greater the system can be reset. Main air reservoir pressure can be verified on the PLC module in slot #1, input #0 (**I; 1.0**). (4 mA = 0-psi, 20 mA = 150-psi)

Independent Brake (Proportional regulator check)

Using the voltmeter on VDC, check the voltage on **I: 1.1** ^{NOTE 1}. This is the actual output of the proportional regulator. You should have approximately 5.5 VDC with the brake set. Releasing the brake should give you approximately 0 VDC. (0 VDC = 0-psi, 10 VDC = 150-psi). Ground should be referenced to the 24VDC-COM when taking voltage readings on the analog cards.

For the 4-20 mA output to the proportional valves, the voltmeter must be set on amps-DC and the measurement is made at the analog output (**O: 1.0**). All current measurements must be made in series. In order to do a series measurement, the output wire must be disconnected from the PLC output, so that one meter lead can be hooked to the wire and the other lead to the PLC module output. The current being measured must flow through the meter. You should have approximately 12-13 mA with the brake set. Releasing the brake should give you approximately 4 mA. (4 mA = 0-psi, 20 mA = 150-psi).

Pneumatic Throttle (when present)

Take voltage reading at **I: 2.0** ^{NOTE 1} in the same manner as with the independent brake. This reading is the actual output of the throttle proportional regulator. (0VDC = 0-psi, 10VDC =150-psi).

Take current reading at **O: 2.0** in the same manner as with the independent brake. This reading is the output to the throttle proportional valve. (4 mA = 0-psi, 20 mA = 150-psi)

Automatic (Trainline) Brake

Take voltage reading at **I: 2.1** ^{NOTE 1} in the same manner as with the independent brake. This reading is the actual output of the trainline proportional regulator. (0VDC = 0-psi, 10VDC =150-psi).

Take current reading at **O: 2.1** in the same manner as with the independent brake. This reading is the output to the trainline proportional valve. (4 mA = 0-psi, 20 mA = 150-psi)

Electrical Outputs (Aux functions):

Use the control station to activate all electric functions and verify that the corresponding LED on the output modules light while the output is active. Use the voltmeter to check voltage output for each electric function. Refer to schematic designated for the module in question to get reference voltage.

NOTE 1: Some systems use pressure transmitters for feedback to the receiver system. In this case, inputs at **I: 1.1**, **I: 2.0**, and **I: 2.1** should be read using the "current method" where 4 mA = 0-psi and 20 mA = 150-psi.

8 PRODUCT SUPPORT, SPARE PARTS, AND ACCESSORIES

Product Support

When contacting Control Chief Product Service please have the following information ready

- System Number. Located on the inside of the receiver / controller enclosure
- Status of LED indicators on the control panel and PLC modules
- Description of the problem and its associated operational conditions/situation

Returning OCU's to Control Chief for Repair

To return your OCU to Control Chief for repair, please call Product Service to request a Return Material Authorization (RMA) number. The RMA number must be included on the shipping label and all correspondence related to the OCU.

Contacting Control Chief

Control Chief

P.O. Box 141, 200 Williams Street

Bradford, PA 16701

PHONE: (814) 362-6811

FAX: (814) 368-4133

Toll Free: (800) 233-3016

Web Page:<http://www.controlchief.com>

E-mail: prodserv@controlchief.com

Spare Parts and Accessories

If you require troubleshooting or help in part number identification, contact our Product Support group for assistance. See reference above.

If you require additional battery packs, a replacement harness, or other components please contact our Customer Service department.

Recommended Spare Parts

| Part Description | Part Number | Ref Figure |
|--|-------------|------------|
| Lightweight OCU | | |
| Rotary Knob | 30-00-0-018 | 6-2 |
| (see NOTE 1) | | |
| Receiver / Controller Unit | | |
| Replacement kit for Particulate Filter Element | 50-20-0-009 | 9-1 |
| Replacement kit Coalescing Filter Element | 50-20-0-008 | 9-1 |
| Control Chief Watchdog Module | 90-20-0-017 | 3-8 |
| Control Chief 10 Amp Relay Module | 90-20-0-019 | 3-8 |
| (see NOTE 2) | | |

NOTE 1: The only readily replaceable parts on the OCU are the Independent Brake and Throttle knobs. Because the Lightweight OCU is registered with the RCU by way of the IR port it allows a high degree of equipment substitution. As long as the OCU is within configuration constraints, the user can switch to any available OCU for operations. When a unit is out-of-service, the user can turn operations around quickly by simply replacing the out-of-service unit with another. Then return the out-of-service unit to the factory for timely repair.

To replace internal parts the customer must purchase maintenance training. Contact your sales representative for additional details.

NOTE 2: A complete RCU spare parts list is available in separate document:
Train Chief® II Spare Parts Catalog 95-15-0-001.

Common Accessories

| Part Description | Part Number |
|---|-------------------|
| Battery Charger, Li, Clip Style, 7.4 VDC, Single-Bay | 90-10-2-006 |
| OCU 7.4VDC Lithium Battery Pack | 90-10-3-003 |
| ANT 896-970MHZ 5DB NGP NMO MNT (Locomotive Antenna) | 28-04-0-048 |
| LOCO BREAK-AWAY VEST. 36"-64" (sm, reg, xlg belts included) | 90-40-0-011 |
| Extra belts | 90-40-0-012 (SM) |
| | 90-40-0-013 (REG) |
| | 90-40-0-014 (XLG) |

9 DETAILED MAINTENANCE PROCEDURE

Locomotive Antenna System

To insure optimum system performance the locomotive antenna system should be inspected on a daily basis. This inspection would simply consist of a visual inspection of the antenna and the external cable. The visual inspection of the antenna would be to check the antenna is in place and not damaged. (The antenna should not be deformed.) A quick visual inspection of the external cable should be done to insure the cable is not damaged.

Pneumatic Filter Service Instructions

For best system performance replace the particulate and coalescing filter elements after a pressure drop of 10-psi has been reached or after one year of service or less depending upon your operating environment.

Periodically check the bowl drains to monitor the level of water and containments in the filter,. If water is observed it is an indication the filter needs servicing. Order filter replacement kits from Control Chief Customer Service department.

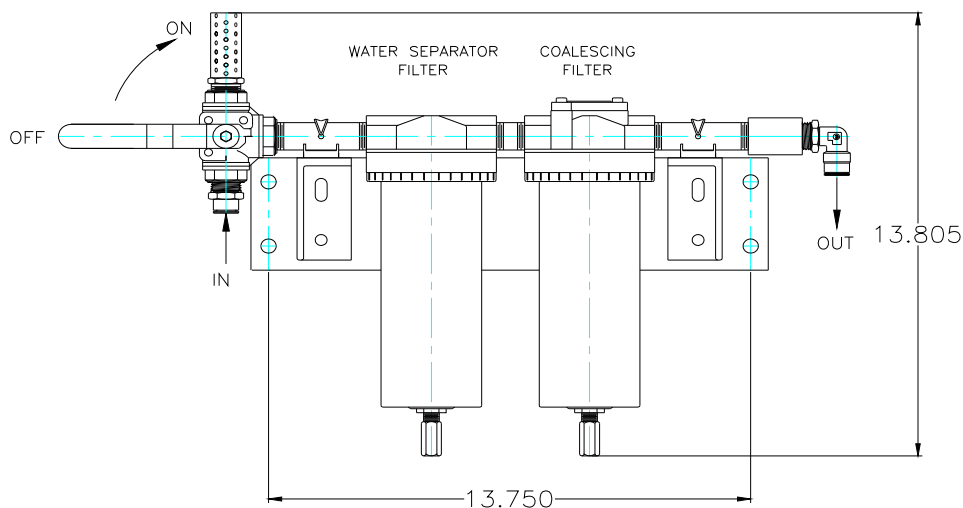


Figure 9-1

Pneumatic Filter Replacement Parts

| Filter Type | Part Number | Description |
|--------------|-------------|--|
| PARTILCULATE | 50-20-0-011 | Replacement kit for Particulate Filter Element |
| COALESCING | 50-20-0-010 | Replacement kit for Coalescing Filter Element |
| | | |

Particulate filter: 5 micron element used as a primary filter to remove water, dust, and debris for the air line. Water removal efficiency at 90% or better at rated flow.

Coalescing filter: Used as a secondary filter to remove up to 99.99% of oil and particles.

Filter bowls are fitted with automatic drains to drain accumulated liquids to minimize maintenance and insure optimum performance.

Filter Installation and Maintenance

Flush piping before installation. To maintain maximum efficiency of the filter and to avoid excessive pressure drop the filter must be kept clean. Removal (of filter assembly) from operation is not necessary to clean the filter. Disassembly is simple and can be performed inline. Before disassembling, shut off air supply and depressurize the filter. Clean all parts (except filter element) with mild non-abrasive soap and blow out filter body before reassembling.

Lithium-Ion Battery Maintenance

The Lithium battery is the primary power source for Control Chief remote control OCUs. Proper care and maintenance will assure optimum performance of the batteries in all applications. The battery pack used in the Lightweight OCU is 7.4 VDC and has a typical application time of 12 hours (based on full capacity charge).

Battery Care Summary

- For optimum battery performance, only recharge the battery pack when the OCU's low battery indicator has activated.
- **Do not** leave the OCU on for extended periods of time.
- **Do not** charge in an area where the temperature is over 75° F.
- **Do not** subject the battery to physical abuse such as dropping it or placing it on hot objects such as ovens, forges, etc.
- **Do not** short the battery connection together. Injury may occur.
- Always follow proper battery handling and disposal procedures. Always follow all manufacture instructions.
- **Do** operate the OCU until the low battery indicator activates. **Do not** plan to operate the OCU for any extended time once the low battery indicator has activated.

OCU Operating Duration per Battery Charge

The Lightweight OCU and battery pack have been designed to give a minimum of 12-hours of continuous operation for the typical operating environment.

Conditions that will degrade the daily capacity (run time) of the battery pack are, charging in high temperatures, operating in cold temperatures (below 32° F), and constant re-charging.

Battery Disposal

Dispose of all batteries in accordance with manufacturer, federal, and local regulations.

Control Chief Recommended Operator Training Outline

Purpose

The purpose of this outline is to provide a guideline to help ensure operators are provided with a working knowledge of the remote control system. This guideline is not intended to qualify anyone as a certified operator and should be adapted to meet the needs of the customer and to cover applicable system options.

Overview

Provide a basic understanding of remote control operation and the basic components of the system. This should include, but not be limited to:

- **Basic remote control operation:** Discuss the concept and benefits of being able to operate equipment by remote control.
- **Operational safety:** Explain the need to ensure the path of travel is clear and the need to keep the equipment in sight while operating the remote control. Discuss local safety procedures and policies. Explain that Control Chief does not supersede any local safety policies.
- **Basic system components:** Explain and identify the basic system components including the OCU, receiver, batteries, and battery charger.
- **Basic safety features:** Explain the basic safety features of the system such as the effects of radio interference, loss of signal, and communication security.

System Specific Components

Provide a detailed explanation of the specific components of the system. This should include, but not be limited to:

- **OCU:** Explain the specific components and operation of the OCU including:
 1. Batteries: Explain operational capabilities, charging, proper care, and installation of the batteries.
 2. Switches: Explain the purpose of all installed switches including key switches, E-Stops, directionals, throttle/brake, trainline brake, horn, sand, uncouple and headlights. Explain the operation of locking and spring loaded switches.
 3. Indicators: Explain the purpose of installed indicator lights and displays.
 4. Antenna: Explain the purpose and care of the installed antenna.
 5. Safety Features: Explain the built in safety features of the OCU, including tilt switch and tilt bypass, dead man timeout, spring loaded and locking switches
 6. Start-up and Shutdown: Provide detailed instruction on proper start-up and shutdown procedures for the OCU with emphasis on proper switch settings and emergency shut down procedures.

- Receiver: Explain the operator accessible features of the receiver and associated devices. This should include:
 1. Overview of Receiver: Provide an overview of the receiver cabinet with a brief description of the electronic and pneumatic components, filter pack, diverter valves and transfer switch.
 2. Alarms: Explain the purpose of any cabinet mounted alarms, including low air pressure, high temperature, low oil pressure and others, as applicable.
 3. Indicators: Explain all indicators such as strobe lights, status lights, and displays.
 4. Safety Devices: Explain the provided safety devices supplied with the system, including built in communications and output security, E-Stop switches, proximity switches, bell and horn configurations, man down alarm, wheel slip, and warning lights.

Transfer Procedure

Explain, in detail, the proper transfer procedure for changing between remote control and manual operation.

Hands on Training

Provide all operators with hands on training to ensure they are familiar with transfer, start-up, shutdown, and emergency stopping procedures.

Safety

Emphasize that Control Chief is concerned with the safety of the personnel and equipment. Discuss again the need to ensure safe operation of the remote control system, to ensure the path of travel is clear and that all local safety policies are observed.

Questions and Concerns

Attempt to answer all questions and concerns voiced by the operators directly related to the safe operation of the system.

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Installation Questions?

Technical assistance is available from Control Chief.

Please call us at 814-362-6811 or email the Service Department at prodserv@controlchief.com



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