



Troubleshooting Guide (For All RCI Series)

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1 Introduction

The main purpose of this guide is to help find the problem and solve it quickly. It is acknowledged that things that are obvious to one person can be anything but obvious to another. Therefore, the more information that is provided to the service person about the problem, the greater the chance that it will be identified and resolved.

This guide provides useful information and/or details on:

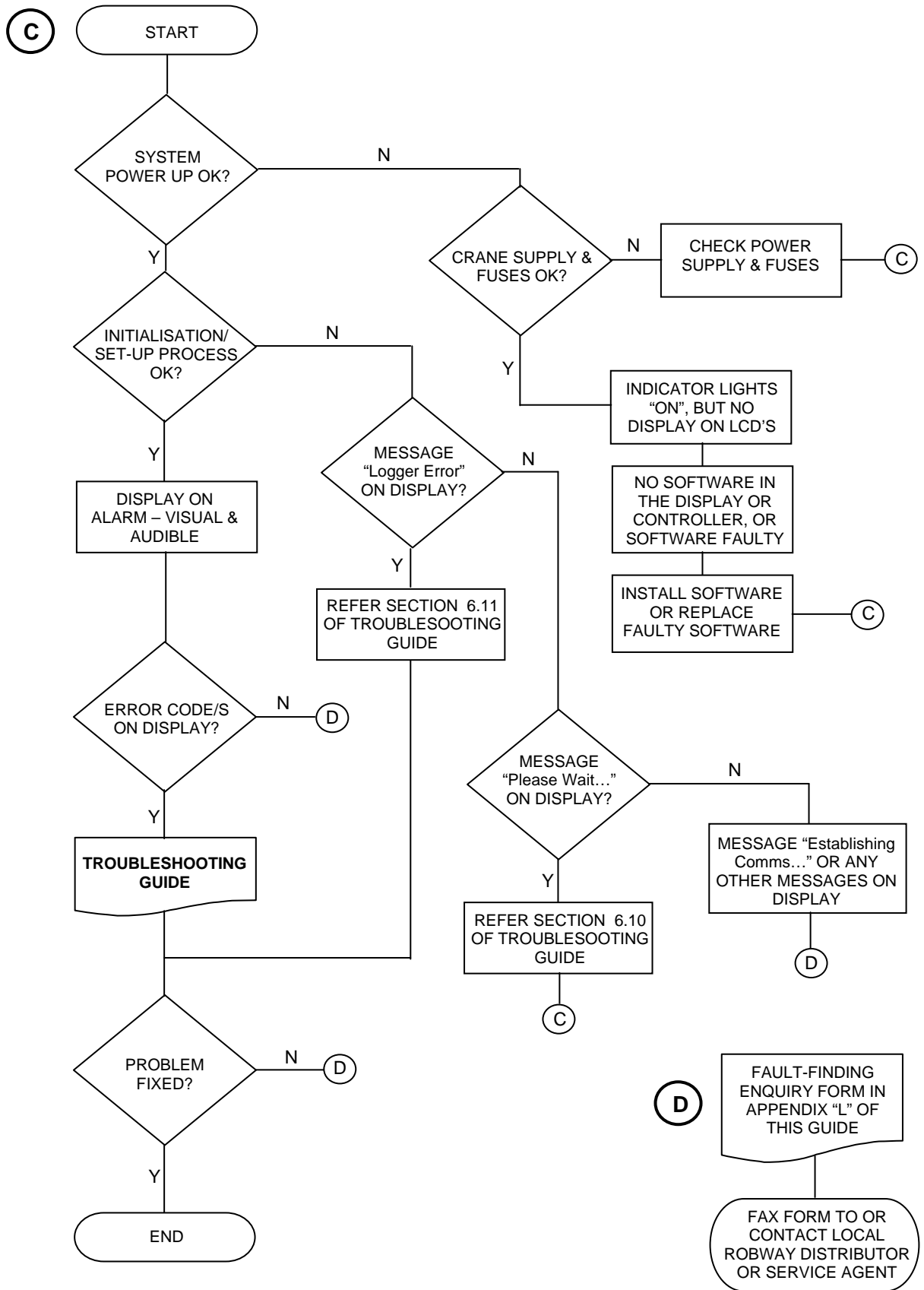
- system fault-finding;
- display error codes;
- problems that do not produce error codes;
- setting-up transducers on load moment systems;
- using the Robway Simulator;
- replacing software chips, dallas chips, & flash cards;
- using the JED eprom programmer;
- recording/restoring calibration data;
- installing/removing flash memory card;
- standard cables identification & resistance values of load cells, length sensor & angle sensor;
- voltage levels of load cells, angle sensors, and length sensor;
- RCI-4000 electrical specifications;
- RCI-3100 & 1550 electrical specifications;
- Fault-finding enquiry form.

1.1 Flowchart of troubleshooting

The following pages outline the basic flow of system fault-finding. The flowcharts are classified into two groups:

- RCI-4000, RCI-3000, RCI-1500, RCI-1502
- RCI-3100, RCI-1550

RCI-3100 / RCI-1550



2 RCI Systems

This guide covers all Rated Capacity Indicator series as follows:

- RCI-4000
- RCI-3100
- RCI-3000
- RCI-1550
- RCI-1500
- RCI-1502

These systems incorporate a number of software features that are designed to help the service person quickly identify a fault, however it must be stressed that these features cannot identify everything. They can only be used as a guide to identify additional checks that can be made.

3 Robway RCI Simulator and Service Tools

3.1 Robway simulator

The RCI Simulator (Part No. SIMRCI01) is a troubleshooting tool available at Robway. It is designed to:

- facilitate fault-finding by connecting it to the system in place of the sensors and simulating the sensors' functions;
- record and restore calibration data on the RCI-4000, RCI-1500, and RCI-1502;
- set-up/calibrate transducers on LOAD MOMENT SYSTEMS.

The RCI Simulator can simulate load, angle, length, slew input, motion cut output, and anti-2-block (ATB) condition.

The LOAD dial (knob) of the RCI Simulator is a "12 position rotary switch" where position "0" = 0mV/V, position "5" = 1mV/V, and position "10" = 2mV/V.

The standard Robway Simulator comes with mil. spec. connectors for easy plugging into the RCI-3100/RCI-3000/RCI-1550/RCI-1500/RCI-1502 system's connectors. For the RCI-4000 and some RCI-3100/RCI-1550 versions, adapter leads are required for direct connection into the controller's terminals. Adapter leads are available at Robway.

A detailed instruction on how to use the Robway Simulator can be found on **Appendix A** of this guide.

3.2 Service tools

In addition to the Robway Simulator, the following is a list of recommended field service tools for fault-finding purposes:

- Multimeter (Pocket DVM)
- IC Extractor
- Side Cutters
- Wire Strippers
- Utility Knife
- Adjustable Shifter 100mm (4")
- Multi Grip Plug Pliers
- Wrench – Ring/Open-End 17mm
- Wrench – Ring/Open-End 14mm
- Screwdriver – Phillips (Medium)
- Screwdriver – Common (Medium)
- Screwdriver – Common (Small) – use one with a narrow tip to fit into the terminal strips
- Angle Finder (used for verifying or recalibrating boom angle)

- Download Cable – Null Modem (used for downloading/uploading load moment data and/or downloading contents of datalogger when required, refer to the supplied **Robway RCI Datalogging Manual** for instructions) – this cable is an optional item and is available at Robway
- Eprom Programmer/Burner C/W Software & Cable (used for burning new software chips when required, refer to **Appendix C** for instructions) – this optional item is available at Robway
- **System Manual and Configuration Sheets – IMPORTANT!**

4 Quick Reference Guide

4.1 Check the obvious.

- Make sure all of the connectors are tight.
- Is the motion cut output connected to an external relay?

RCI-3000, RCI-1500, and RCI-1502:

The solid state output on these systems is rated to approximately 1A only and is designed to be connected to an external relay, and not directly connected to the crane electrics.

RCI-4000, RCI-3100, and RCI-1550:

These systems have voltage free contact relay outputs rated to 5A-10A at 30VDC that could be used to connect to the crane electrics (pls. refer to the electrical specifications and drawings at the back of the RCI Manual supplied for details).

- Check terminals/wiring/etc. are connected to existing power.
- Before any connection is made to an existing installation check for power on those connections.

4.2 Do not modify the Calibration.

- It is rare for calibration data to be corrupted.
- When a re-calibration has been attempted in order to rectify a problem before that problem has been correctly identified, it leads to added confusion as the perspective is moved from the real fault to "calibration problems".
- If the system had previously been operating correctly and suddenly developed a fault, the culprit is likely to be something external to the display rather than the calibration. One such possibility is that the mounting of the angle sensor has become loose and has allowed the angle sensor to move, hence altering the angle and radius and the SWL. Alternatively, there may be a short circuit in one of the cables caused by excessive flexing or rubbing during use. On an initial installation, the calibration may well be at fault.
- If all of the external inputs appear to be operating correctly but the readouts do not show the correct values, then view all of the calibration data and record it.
- If in doubt, send a copy of this data to Robway Safety Systems, so that it can be analysed.
- If this is not possible, re-calibration may be attempted.
- Re-calibration must only be performed when all physical inputs have been verified for correct operation.
- If a re-calibration has been performed, record the new data. The new calibration data must always be recorded and a copy sent to Robway so that records reflect the current status of the display. This will ensure correct information is passed onto the next person needing to attend the site.

4.3 Know what information you need to gather.

- Check that the display is correctly configured for the crane environment.
- Check that the correct duty, falls, slew zones etc. have been selected.
- Are all of the sensors connected? The display will check them continuously and issue an error if that sensor cannot be detected.
- Check your length, angle and radius against the chart to verify that the equipment is permitted to operate in that position.

4.4 Identify the symptoms:

- Identify the end problem.
- Work backwards identifying what is causing the problem.
- If possible, have the problem demonstrated so you can "describe it in your own words". Sometimes what someone else has told you is only part of the story.
- Check the "raw counts" for each input. Refer to the software configuration sheets on how to access the raw counts
- The raw count shows what the actual inputs are doing (ie. like a signal strength indication). These raw counts are then manipulated in software according to the calibration data stored in the display to produce the readouts on the front panel. If the calibration has been done incorrectly, or the configuration is incorrect, or something else is wrong, then the front panel readouts (eg. the LOAD or ANGLE values) may provide you with misleading information.
- Cycle each sensor through a range, for example luff up and down for the angle sensor and check that the raw counts vary from a low value (around 200) to a high value, around 800.
- For correct operation, these raw counts must be in the range 33 to 999 for each sensor used. Anything outside of this range will produce an error.

4.5 Perform test with a simulator, if available (see also item 3 – "Robway RCI Simulator" above).

- A simulator is a very quick way to verify if the fault is external to the display.
- It allows the input voltage to be easily varied without the need to physically move the crane or lift weights.
- If extension cables are used, try connecting the simulator both directly to the display and via the cable. If the results are not identical, suspect the cable as being faulty.

4.6 Consult the Manual and Software Configuration Sheets.

- As most systems are highly customised, it may be necessary to consult the manual to identify peculiarities or variables, specific to that system.

5 Error Codes and Displayed Messages

RCI-4000, RCI-3000, RCI-1500, and RCI-1502:

These systems have two (2) versions of Error Codes. The earlier models were using the old version software which made use of the letter "E" followed by a 4-digit number, e.g. E0001. The new version software on later models has eliminated the letter "E" and has shortened the code to a 3-digit number, e.g. 101.

RCI-3100 and RCI-1550:

These systems only use the new 3-digit Error Codes.

The following Error Codes cover both old and new versions of software, with the old version codes (or "E" codes) first, followed by the new version codes enclosed in parentheses for distinction.

5.1 Error code E0001 (101, 102)

This is indicating that the signal from the angle sensor is too low. This should be confirmed by viewing the angle raw counts and noting that the "r" value is less than 33.

Possible causes:

1. Angle sensor incorrectly mounted. This is especially critical for the Electronic Angle Sensors. Refer to the manual for installation of the angle sensor.
2. The angle sensor signal wire is short-circuited to the shield or to the angle 0V.
3. The angle sensor is not connected or there is an open circuit in either the angle sensor signal wire or the angle excitation positive wire.
4. The angle sensor excitation voltage is shorted. If this is the case, it will also affect the length and load channels.

5.2 Error code E0002 (101, 102)

This is indicating that the signal from the angle sensor is too high. This should be confirmed by viewing the angle raw counts and noting that the "r" value is higher than 999.

Possible causes:

1. Angle sensor is incorrectly mounted. This is especially critical for the Electronic Angle Sensors. Refer to the manual for installation of the angle sensor.
2. The angle signal wire is shorted to the excitation positive wire.
3. The angle sensor 0V wire is open circuit.

5.3 Error code E0004 (110)

This is indicating that the signal from the length sensor is too low. This should be confirmed by viewing the length raw counts and noting that the "r" value is less than 33.

Possible causes:

1. The length potentiometer may not have been set up as per the manual. Refer to the manual for the installation of the length sensor, particularly the initial rotation of the gear wheel by 1/8 of a turn.
2. The length sensor signal wire is short-circuited to the shield or to the length 0V.
3. The length sensor is not connected or there is an open circuit in either the length sensor signal wire or the length excitation positive wire.
4. Payout cable may have broken.
5. The length sensor excitation voltage is shorted. If this is the case, it will also affect the angle and load channels.

5.4 Error code E0008 (110)

This is indicating that the signal from the length sensor is too high. This should be confirmed by viewing the length raw counts and noting that the "r" value is higher than 999.

Possible causes:

1. The length potentiometer may not have been set up as per the manual. Refer to the manual for the installation of the length sensor, particularly the initial rotation of the gear wheel by 1/8 of a turn.
2. The length sensor signal wire is short-circuited to the excitation positive wire.
3. The length sensor is not connected or there is an open circuit in either the length sensor signal wire or the length 0V wire.

5.5 Error code E0010 (201)

This is indicating that the signal from the main load sensor is too low. This should be confirmed by viewing the Amp 1 raw counts and noting that the "r" value is lower than 33.

Possible causes:

1. Load cell signal wires shorted together.
2. The signal + is shorted to the shield.
3. The excitation - is shorted to the shield.
4. The excitation supply is shorted together. This will obviously affect all of the external sensors. Measure the excitation voltage and compare it with the expected value. If this is the cause, the raw counts will generally be non-zero, but below 33.

5.6 Error code E0020 (201)

This is indicating that the signal from the main load sensor is too high. This should be confirmed by viewing the Amp 1 raw counts and noting that the "r" value is higher than 999.

Possible causes:

1. The load cell is disconnected or there is an open circuit in one of the signal wires.
2. The signal - is connected to the shield.
3. The signal + and the excitation + are swapped.
4. The signal - and the excitation - are swapped.

5.7 Error code E0040 (202)

This is indicating that the signal from the auxiliary load sensor is too low. This should be confirmed by viewing the Amp 2 raw counts and noting that the "r" value is less than 33.

Possible causes:

1. Load cell signal wires shorted together.
2. The signal + is shorted to the shield.
3. The excitation - is shorted to the shield.
4. The excitation supply is shorted together. This will obviously affect all of the external sensors. Measure the excitation voltage and compare it with the expected value. If this is the cause, the raw counts will generally be non-zero, but below 33.

5.8 Error code E0080 (202)

This is indicating that the signal from the auxiliary load sensor is too high. This should be confirmed by viewing the Amp 2 raw counts and noting that the "r" value is higher than 999.

Possible causes:

1. The load cell is disconnected or there is an open circuit in one of the signal wires.
2. The signal - is connected to the shield.
3. The signal + and the excitation + are swapped.
4. The signal - and the excitation - are swapped.

5.9 Error code E0100 (210)

This is indicating that there is a problem with a digital input signal. This code has generally not been used and really must be considered application specific. Refer to the manual.

5.10 Error code E0200 (220)

This is indicating that a Two Blocking condition has been detected. This warning is generally duplicated on the front panel of the display.

Possible causes:

1. Actual Two Block condition.
2. An open circuit in the Anti-Two-Block signal wire.
3. A faulty ATB switch.

5.11 Error code E0400 (240)

This is indicating that an overload has been detected. This error generally accompanies most other errors simply because most other errors will place the display into an overload condition. This being the case, you need to check what other errors are present and correct them first. Once these have been addressed, the E0400 error generally takes care of itself. The exception is of course, when the equipment has been put into a genuine overload situation, which has not been caused by any external faults.

Possible causes:

1. A genuine overload condition exists.
2. There is a load on the auxiliary winch in a duty that does not allow anything on that winch.
3. It has been caused by another Error code condition.

5.12 Error code E0800 (280)

This is indicating that the rated line pull has been exceeded.

Possible causes:

1. A genuine line pull error exists.
2. The number of falls selected is incorrect for the load being lifted, or does not match the actual falls reeved.

5.13 Error code E1000 (301)

This is indicating that the angle being measured is outside of its allowed range.

Possible causes:

1. A genuine violation of the angle limits has occurred.
2. The angle sensor mounting may have loosened allowing the sensor to move.
3. Wrong duty selected.
5. Check the angle displayed against the actual angle of the boom.

5.14 Error code E2000 (302)

This is indicating that the length being measured is outside of its allowed range.

Possible causes:

1. A genuine violation of the length limits has occurred.
2. The length potentiometer mounting may have loosened allowing the sensor to move.
3. Wrong duty selected.
4. Check the length displayed against the actual boom length.
5. Payout cable may have fallen off the reeling drum.
6. Payout cable may have been broken or become tangled.

5.15 Error code E4000 (304)

This is indicating that the radius being measured is outside of its allowed range.

Possible causes:

1. A genuine violation of the radius limits has occurred.
2. Wrong duty selected.
3. Check as per E1000 (301) and E2000 (302).

5.16 Error code (308)

This is indicating that the height being measured is outside of its allowed range.

Possible causes:

1. A genuine violation of the height limits has occurred.
2. Wrong duty selected.

3. Check as per E1000 (301) and E2000 (302).

5.17 Error code E8000 (310)

This is indicating that the slew zone being detected is outside of its allowed range.

Possible causes:

1. A genuine violation of the slew zone limit has occurred.
2. The orientation or position of the slew switch is incorrect. The slew switch is incorrectly wired.
3. The slew switch or the cable has suffered some damage and is not reading correctly.
4. The wrong duty has been selected.

5.18 Error code FFFF (320) – Load Moment Systems Only

This is indicating that the Duty/Winch has not been calibrated.

Possible cause:

1. Uncalibrated Duty/Winch selected.

5.19 Error code (410 - Null) – (RCI-3100 & RCI-1550 Systems Only)

This is indicating that the System senses a lift on both winches which the System prohibits, e.g. a load is being lifted on the main winch, and the aux. winch lift threshold (ref. Function Codes) below the aux. block weight.

Possible cause:

1. The Function Code “Set the Lift Threshold for the Selected Winch” has not been set. This should be set to the “calibrated weight of the hook block + a little allowance for boom dynamics, e.g. about 200 kgs. extra”. Both winches, main and aux. (if supplied), must be set individually, e.g. the lift threshold setting affects whichever winch is selected on the display.

5.20 Error codes with hexadecimal digits – (RCI-3000 Systems Only)

Error codes on the RCI-3000 System may have a combination of the above error codes discussed and a hexadecimal digit.

An Example:

Error Code E4C00

This error code can be broken down into E4000 and E0C00 where,

E4000 = Radius out of allowed range (see item 4.15 above)
 E0C00 = E0400 (overload error) + E0800 (line pull exceeded)
 (where hexadecimal digit C = 12, or C00 = 1200,
 which is also 400 + 800)

The E0C00 error, in the above example, is an overload created by the maximum line pull of either hoists being exceeded. Please see items 4.11 and 4.12 above for details.

The following are the hexadecimal codes for reference:

<u>Decimal Number</u>	<u>Hexadecimal Equivalent</u>
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	A
11	B
12	C
13	D
14	E
15	F

5.21 Multiple error codes on display (loss of calibration data)

Loss of calibration data can be determined when the system gets into fault during start-up, displaying multiple error codes. When the override (bypass) key is turned ON, the display functions, i.e. load, angle, length, etc., show high values (default factory setting values – uncalibrated condition).

This indicates a fault on the Dallas Chip (memory chip). Replace the Dallas Chip and recalibrate the system (or restore the calibration data if previously recorded – see **Appendices D, E, & F** for details on recording/restoring calibration data).

The Dallas Chip is available at Robway. Please see **Appendix B** for instructions on replacing chips on the systems.

5.22 Reading error codes on downloaded data (integral datalogger)

Reading error codes on downloaded data from the system is a little bit different from viewing the error codes on the RCI display. Multiple error codes shown on the display are easily read and understood as the codes scroll from one code to another (RCI-4000, RCI-3000, RCI-1500, and RCI-1502), or displayed at one time on screen (RCI-3100 and RCI1550).

On downloaded data, however, the “Error Codes” column is a combination (or total) of all the error codes monitored which may be quite difficult to read.

The following examples will guide you through the methods of interpreting the error codes on both the old version and new version softwares. Codes listed are the most common ones likely to be encountered.

Old Version Codes:

- Code 4400 - E**0400** (overload condition detected) & E**4000** (radius outside allowed range).
- Code 450 - E**0400** (overload condition detected), E**0010** (main load sensor input low), & E**0040** (aux. load sensor input low).
- Code 0C20 - **C** is hexadecimal equivalent to number **12** (see item 5.19 above). Therefore, this code can be re-written as **1200 & 20** – where **1200** is also equal to **800 & 400**. This code can be broken down as E**0800** (max. linepull exceeded), E**0400** (overload condition), & E**0020** (main load sensor input high).

New Version Codes:

- Code 0040000000 - This is a little bit tricky. Let's imagine the code as divided into 5 groups as follows:

1	2	3	4	5
00	40	00	00	00

Disregard all columns with "00" and arrange the one with a valid number "40" into the following format, adding the header number to the 2-digit code:

240 (which means overload)

- Code 0040040000 - As per above procedures:

1	2	3	4	5
00	40	04	00	00

240 (overload)
304 (radius out of range)

Code 00C0000000 - As per above procedures:

1	2	3	4	5
00	C0	00	00	00

Now, we know that C is hexadecimal for number 12 (or 8 and 4), and therefore, C0 is equivalent to 80 and 40. The format then becomes:

2C0 = 240 (overload)
280 (linepull)

6 Problems That Do Not Produce Error Codes / Messages

6.1 The load does not vary when weight is lifted.

- Determine the winch being used.
- If it is the main winch, then check the "AMP 1 or TRANS 1" raw counts while lifting a weight and check variation.
- If it is not moving, then check the "AMP 2 or TRANS 2" raw counts.
- If the raw counts did vary when a load was lifted, then check the calibration data. If the value entered was the same for both the light load and the heavy load, then the display will assume that any input represents the same load. If this is the case, then re-calibrate.
- If it is moving, then the MAIN and AUX load cables have been swapped.
- If neither are moving then there may be a number of causes;
 1. There may be an open circuit in one or both of the load cell excitation wires,
 2. One or more fuses may be blown in the amplifier. Check the excitation voltages,
 3. The load sensor is faulty. Check the resistance values. This does not give the complete story. Even if the resistances are correct, there is still a chance that a fault exists.

6.2 When a certain load is lifted an Error code E0010/E0040 (201/202) appears.

- View the raw counts in "AMP 1 or TRANS 1" and "AMP 2 or TRANS 2" while lifting a load and check that the value is increasing with increasing load.
- If the value is decreasing with load then the load cell signal wires are swapped. Alternatively if a load pin or beam is used it may have been installed upside-down.

6.3 The load display is very erratic and displays massive changes in value.

- Check the raw counts for that channel.
- If the counts are flickering by 2-3 counts while the display is changing by say a number of tonnes, then the cause is most probably calibration.
- One common cause of this is if different load values were entered for the high and low calibration without the actual load being altered (or there was an error in a load channel while calibrating). That is a heavy load was not lifted.
- In this situation, the calibration data is representing both the low load value and the high load value simultaneously.
- Re-Calibration is required. This can also occur if only part of the calibration procedure has been completed.

6.4 The angle or length inputs have a minimum value of about 500 counts.

- Check the manual for installation instructions and compare with the actual installation.
- The fuse may be blown in the amplifier. Measure the excitation voltages. Refer to Robway Safety System Service personnel for assistance.

6.5 Problem with changing Falls or Duty

- For tower cranes the calibration torch or PIN number is required to alter these values for an RCI-3000 system, or the Over-ride key switch must be ON for an RCI-4000/RCI-1500/RCI-1502 system.
- For the RCI-3100 and RCI-1550 systems, set the Function Code “Lift Threshold” (refer to the RCI Manual for details).

6.6 Problem calibrating the system (Entering the Function Code menu).

- The calibration torch or PIN number for the RCI-3000, RCI-3100, RCI-1550 system is required. For the RCI-4000, RCI-1500 and RCI-1502 the Over-ride key switch must be ON.

6.7 On start-up the displays are erratic, but settle during the day.

- This is a common sign of moisture ingress into either the display, the connectors, the sensors or the cable. These should be checked, dried and sealed.

6.8 The display does not start.

- Check the power supply. The recommended range for the RCI series is 12VDC to 32VDC.
- For a nominal 24VDC system (e.g. RCI-3000 & RCI-1500), a Power Supply Filter must be used.

6.9 The unit is on alarm, but no error code on display.

- Check for Two Blocking condition.
- If no Two Blocking condition exist but the ATB LED on display is ON, check the “earth lead” from the display for proper grounding to crane chassis.
- If “earth lead” is ok, check the ATB switch and cable for faults.

6.10 On start-up the display goes through the initialisation/setting-up process then stops at the message, “Please Wait...” – RCI-3100 & RCI-1550 Systems.

- Wait for about 34 seconds and see whether the system boots up or not. This could happen when a new flash memory card is installed as the system initially clears the data due to checksum mismatch, and then proceeds to system boot up.
- If system doesn't boot up, switch it OFF and check if the flash memory card is loose.
- Remove the flash card and then re-install it securely (refer to **Appendix G** for instructions). Switch system back ON.
- If problem persists, the flash card may be faulty. Replace the flash card (available at Robway).
- After replacing the flash card, back-up the calibration data by entering calibration mode and then selecting Function Code “Create Back-Up of Cal Data”.

6.11 On start-up the display shows “LCtrl” (RCI-4000/RCI-3000/RCI-1500/RCI-1502) or “Logger Error” (RCI-3100/RCI-1550) then stops.

- This is a logger control error. It happens when the internal datalogger is corrupted; when an upgraded or new software has been installed; or when the Dallas chip has been replaced with a new one.
- For the RCI-3100/RCI-1550:
Turn the override (bypass) key ON, then press the “✓” (Tick) button to confirm and follow the prompts on the screen until the display gets into the normal initialisation/set-up routine and then to normal operating mode.
- For the RCI-3000/RCI-1500/RCI-1502:
Turn the override (bypass) key ON, then press the ENTER button. The display will show “YES” to confirm. While “YES” is shown on the screen, press the ENTER button again until the display gets into the normal initialisation/ set-up routine and then to normal operating mode.
- For the RCI-4000:
Turn the override (bypass) key ON, then press the ENTER button. Press the ENTER button subsequently after the prompts “LData” and then “LCont” until the display gets into the normal initialisation/ set-up routine and then to normal operating mode.

7 Load Moment Systems

7.1 Telescopic Cranes

In addition to the preceding troubleshooting discussions it must be remembered that the Load indication for these systems is dependent upon not only the Pressure Transducers fitted to the Luff Cylinder but also the Angle and Length. Angle and Length Sensors must be functioning and calibration must be correct before assessing the condition of the load indication.

7.2 Strut Boom Cranes

In addition to the preceding troubleshooting discussions it must be remembered that the Load indication for these systems is dependent upon not only the Tension Cell/s fitted to the luff rope deadend/s (boom hoist reeving) or pendant line/s, or Load Pin fitted to the bridle with a live mast, but also the Angle and Length. Angle and Length Sensors must be functioning and calibration must be correct before assessing the condition of the load indication.

8 Set-Up Procedure When Replacing Pressure Transducers – Load Moment Systems (Telescopic Cranes)

8.1 System Type – RCI-3100 / RCI-1550

8.1.1 Millivolt (System PCB & Gain Setting) to Millivolt (Transducer Output)

8.1.1.1 *Calibrating Low End of Transducer to Atmosphere*

1. Connect new Transducer to system wiring; do not connect to hydraulic circuit at this stage.
2. Select Function Code (View Transducer 1 or 2 Input); ensure that displayed counts indication is correct. Usually between 50 to 100.
3. Select Function Code (Calibrate Transducer 1 or 2 Low End). With the Transducer open to atmosphere enter the equivalent to 1 atmosphere, ie. PSI = 14.7, MPa = 0.1

8.1.1.2 *Calibrating High End of Transducer Using Robway RCI Simulator – Option 1*

1. Connect Robway Simulator in place of Transducer.
2. Set the main load or aux. load rotary switch (whichever is connected) to position “10” which is equal to 2mV/V.
3. Select Function Code (Calibrate Transducer 1 or 2 High End).
4. Enter Transducer output value, which relates to the Transducer being installed. This value is obtained either from the Transducer calibration sheet or is engraved on the Transducer as a “MPa value or PSI value” = 2mV/V.
5. Ensure to enter value in the unit the system operates in, i.e. PSI or Mpa (check the unit selected on “Display Options” prior to entering this value).
6. Remove Simulator, reconnect Transducer and install in hydraulic circuit.

8.1.1.3 *Calibrating High End of Transducer Using Function Code “Alter Calibration Data” (Use only if RCI Simulator is not available) – Option 2*

1. Connect Transducer to hydraulic circuit.
2. Select Function Code (Alter Calibration Data).
3. Ensure that High Counts still indicates approx. 980, if it doesn't then enter 980 on “RAW HI” and then enter the new High Cal. Transducer value on “CAL HI”. This value is obtained either from the Transducer calibration sheet or is engraved on the Transducer as a “MPa value or PSI value” = 2mV/V.
4. Ensure to enter value in the unit the system operates in i.e. PSI or Mpa (check the unit selected on “Display Options” prior to entering this value).

8.1.2 4–20 mA (System PCB & Gain Setting) to 4–20mA (Transducer Output)

8.1.2.1 *Calibrating Low End of Transducer to Atmosphere*

1. Connect new Transducer to system wiring; do not connect to hydraulic circuit at this stage.
2. Select Function Code (View Transducer 1 or 2 Input).
3. Ensure that displayed counts indication is correct. Usually around 65.
4. Select Function Code (Calibrate Transducer 1 or 2 Low End). With the Transducer open to atmosphere enter the equivalent to 1 atmosphere, i.e. PSI = 14.7, MPa = 0.1

8.1.2.2 *Calibrating High End of Transducer Using a 4-20mA Simulator – Option 1*

1. Connect 4–20mA Simulator in place of Transducer and select 20mA output.
2. Select Function Code (Calibrate Transducer 1 or 2 High End).
3. Enter Transducer output value, which relates to the Transducer being installed. This value is obtained either from the Transducer calibration sheet or is engraved on the Transducer as a “MPa value or PSI value” = 2mV/V.
4. Ensure to enter value in the unit the system operates in, i.e. PSI or Mpa (check the unit selected on “Display Options” prior to entering this value).
5. Remove Simulator, reconnect Transducer and install in hydraulic circuit.

8.1.2.3 *Calibrating High End of Transducer Using Function Code “Alter Calibration Data” (Use only if 4-20mA Simulator is not available) – Option 2*

1. Connect Transducer to hydraulic circuit.
2. Select Function Code (Alter Calibration Data).
3. Ensure that High Counts still indicates approx. 980, if it doesn't then enter 980 on “RAW HI” and then enter the new High Cal. Transducer value on “CAL HI”. This value is obtained either from the Transducer calibration sheet or is engraved on the Transducer as a “MPa value or PSI value” = 2mV/V.
4. Ensure to enter value in the unit the system operates in i.e. PSI or Mpa (check the unit selected on “Display Options” prior to entering this value).

8.1.3 Millivolt (System PCB & Gain Setting) to 4–20mA (Transducer Output)

8.1.3.1 *Calibrating Low End of Transducer to Atmosphere*

1. Refer to drawing No.1920 AIN2 (RCI-3100) or drawing No.2078 (RCI-1550) contained in system manual - Configuration of Jumpers.
2. Set Jumpers to appropriate position for 4–20mA.
3. Connect Transducer wiring cable for 4–20mA operation.
4. Connect Transducer to system wiring; do not connect to hydraulic circuit at this stage.

5. Select Function Code (Set Gain Trans. 1 or 2); select 4–20mA operation.
6. Select Function Code (View Transducer 1 or 2 Input).
7. Ensure that displayed counts indication is correct, usually around 65.
8. Select Function Code (Calibrate Transducer 1 or 2 Low End).
9. With the Transducer open to atmosphere enter the equivalent to 1 atmosphere, i.e. PSI = 14.7, MPa = 0.1

8.1.3.2 *Calibrating High End of Transducer Using a 4-20mA Simulator – Option 1*

1. Connect 4–20mA Simulator in place of Transducer and select 20mA output.
2. Select Function Code (Calibrate Transducer 1 or 2 High End).
3. Enter Transducer output value, which relates to the Transducer being installed. This value is obtained either from the Transducer calibration sheet or is engraved on the Transducer as a “MPa value or PSI value” = 2mV/V.
4. Ensure to enter value in the unit the system operates in, i.e. PSI or Mpa (check the unit selected on “Display Options” prior to entering this value).
5. Remove Simulator, reconnect Transducer and install in hydraulic circuit.

8.1.3.3 *Calibrating High End of Transducer Using Function Code “Alter Calibration Data” (Use only if 4-20mA Simulator is not available) – Option 2*

1. Connect Transducer to hydraulic circuit.
2. Select Function Code (Alter Calibration Data).
3. Ensure that High Counts still indicates approx. 980, if it doesn't then enter 980 on “RAW HI” and then enter the new High Cal. Transducer value on “CAL HI”. This value is obtained either from the Transducer calibration sheet or is engraved on the Transducer as a “MPa value or PSI value” = 2mV/V.
4. Ensure to enter value in the unit the system operates in, i.e. PSI or Mpa (check the unit selected on “Display Options” prior to entering this value).

8.2 System Type – RCI-4000 / RCI-3000 / RCI-1500 / RCI-1502

8.2.1 Millivolt (System PCB & Gain Setting) to Millivolt (Transducer Output)

8.2.1.1 *Calibrating Low End of Transducer to Atmosphere*

1. Connect new Transducer to system wiring; do not connect to hydraulic circuit at this stage.
2. Select Function Code (View Transducer 1 or 2 Input), Ensure that displayed counts indication is correct. Usually between 50 to 100.
3. Select Function Code (Calibrate Transducer 1 or 2 Low End), With the Transducer open to atmosphere enter the equivalent to 1 atmosphere, ie. PSI = 14.7, MPa = 0.1

8.2.1.2 Calibrating High End of Transducer Using Robway RCI Simulator

1. Connect Robway Simulator in place of Transducer.
2. Set the main load or aux. load rotary switch (whichever is connected) to position "10" which is equal to 2mV/V.
3. Select Function Code (Calibrate Transducer 1 or 2 High End).
4. Enter Transducer output value, which relates to the Transducer being installed. This value is obtained either from the Transducer calibration sheet or is engraved on the Transducer as a "MPa value or PSI value" = 2mV/V.
5. Ensure to enter value in the unit the system operates in, i.e. PSI or Mpa (check the unit selected on "Display Options" prior to entering this value).
6. Remove Simulator, reconnect Transducer and install in hydraulic circuit.

9 Set-Up Procedure When Replacing Tension Cells or Load Pins – Load Moment Systems (Strut Boom Cranes)

9.1 System Type – RCI-3100 / RCI-1550

9.1.1 Millivolt (System PCB & Gain Setting) to Millivolt (Transducer Output)

9.1.1.1 **Calibrating Low End and High End of Transducer Using Robway RCI Simulator – Option 1**

1. Connect Robway Simulator in place of Transducer.
2. Set the main load or aux. load rotary switch (whichever is connected) to position "0" which is equal to 0mV/V.
3. Select Function Code (View Transducer 1 or 2 Input); ensure that displayed counts indication is correct, usually between 50 to 100.
4. Select Function Code (Calibrate Transducer 1 or 2 Low End).
5. Enter Transducer "Zero Load" value. This value is obtained either from the Transducer calibration sheet as a "Tonne or Pound or Kpound value" = 0mV/V. If calibration sheet is not available, enter "0.0" on this function code.
6. Turn the load rotary switch of the Robway Simulator to the position number which relates to the output of the Transducer. This Transducer output is obtained either from the Transducer calibration sheet or is engraved on the Transducer as 1mV/V, 2mV/V, or 3mV/V. The following are the mV/V output values and their equivalent Simulator position numbers:

1mV/V = Rotary Switch Position "5"

2mV/V = Rotary Switch Position "10"

3mV/V = Rotary Switch Position "10" (see "Note" on item 8 below)

7. Select Function Code (Calibrate Transducer 1 or 2 High End).
8. Enter Transducer SWL or full scale capacity which is engraved on the Transducer as a "SWL or Cap." = value in Tonne.

Note: If the output value of the Transducer is 3mV/V, then enter only 2/3 of the SWL or full scale capacity with Simulator set to position number "10".

9. Ensure to enter SWL or capacity in the unit the system operates in, i.e. Tonne or Pound or KPound, etc. (check the unit selected on "Display Options" prior to entering this value).
10. Remove Simulator and reconnect Transducer.

9.1.1.2 *Calibrating Low End and High End of Transducer Using Function Code “Alter Calibration Data” (Use only if RCI Simulator is not available) – Option 2*

1. Select Function Code (Alter Calibration Data).
2. Enter the “RAW LO”, “RAW HI”, “CAL LO”, and “CAL HI” values. These values can be obtained from the Transducer calibration sheet. A copy of the calibration sheet is available from Robway Adelaide upon request.
3. Ensure to enter values in the unit the system operates in, i.e. Tonne or Pound or Kpound, etc. (check the unit selected on “Display Options” prior to entering these values).

9.1.2 4–20 mA (System PCB & Gain Setting) to 4–20mA (Transducer Output)

9.1.2.1 *Calibrating Low End and High End of Transducer Using a 4-20mA Simulator – Option 1*

1. Connect 4-20mA Simulator in place of Transducer and select 4mA.
2. Select Function Code (View Transducer 1 or 2 Input); ensure that displayed counts indication is correct, usually around 65.
3. Select Function Code (Calibrate Transducer 1 or 2 Low End).
4. Enter Transducer “Zero Load” value. This value is obtained from the Transducer calibration sheet as a “Tonne or Pound or Kpound value” = 4mA. If calibration sheet is not available, enter “0.0” on this function code.
5. Select 20mA on the Simulator and select Function Code (Calibrate Transducer 1 or 2 High End).
6. Enter Transducer SWL or full scale capacity which is engraved on the Transducer as a “SWL or Cap.” = value in Tonne.
7. Ensure to enter SWL or capacity in the unit the system operates in, i.e. Tonne or Pound or KPound, etc. (check the unit selected on “Display Options” prior to entering this value).
8. Remove Simulator and reconnect Transducer.

9.1.2.2 *Calibrating Low End and High End of Transducer Using Function Code “Alter Calibration Data” (Use only if 4-20mA Simulator is not available) – Option 2*

1. Select Function Code (Alter Calibration Data).
2. Enter the “RAW LO”, “RAW HI”, “CAL LO”, and “CAL HI” values. These values can be obtained from the Transducer calibration sheet. A copy of the calibration sheet is available from Robway Adelaide upon request.
3. Ensure to enter values in the unit the system operates in, i.e. Tonne or Pound or Kpound, etc. (check the unit selected on “Display Options” prior to entering these values).

9.1.3 Millivolt (System PCB & Gain Setting) to 4–20mA (Transducer Output)

9.1.3.1 *Calibrating Low End and High End of Transducer Using 4-20mA Simulator – Option 1*

1. Refer to drawing No.1920 AIN2 (RCI-3100) or drawing No.2078 (RCI-1550) contained in system manual - Configuration of Jumpers.
2. Set Jumpers to appropriate position for 4–20mA.
3. Connect Transducer wiring cable for 4–20mA operation.
4. Select Function Code (Set Gain Trans. 1 or 2); select 4–20mA operation.
5. Connect 4-20mA Simulator in place of Transducer and select 4mA.
6. Select Function Code (View Transducer 1 or 2 Input); ensure that displayed counts indication is correct, usually around 65.
7. Select Function Code (Calibrate Transducer 1 or 2 Low End).
8. Enter Transducer “Zero Load” value. This value is obtained from the Transducer calibration sheet as a “Tonne or Pound or Kpound value” = 4mA. If calibration sheet is not available, enter “0.0” on this function code.
9. Select 20mA on the Simulator and select Function Code (Calibrate Transducer 1 or 2 High End).
10. Enter Transducer SWL or full scale capacity which is engraved on the Transducer as a “SWL or Cap.” = value in Tonne.
11. Ensure to enter SWL or capacity in the unit the system operates in, i.e. Tonne or Pound or KPound, etc. (check the unit selected on “Display Options” prior to entering this value).
12. Remove Simulator and reconnect Transducer.

9.1.3.2 *Calibrating Low End and High End of Transducer Using Function Code “Alter Calibration Data” (Use only if 4-20mA Simulator is not available) – Option 2*

1. Select Function Code (Alter Calibration Data).
2. Enter the “RAW LO”, “RAW HI”, “CAL LO”, and “CAL HI” values. These values can be obtained from the Transducer calibration sheet. A copy of the calibration sheet is available from Robway Adelaide upon request.
3. Ensure to enter values in the unit the system operates in, i.e. Tonne or Pound or Kpound, etc. (check the unit selected on “Display Options” prior to entering these values).

9.2 System Type – RCI-4000 / RCI-3000 / RCI-1500 / RCI-1502

9.2.1 Millivolt (System PCB & Gain Setting) to Millivolt (Transducer Output)

9.2.1.1 **Calibrating Low End and High End of Transducer Using Robway RCI Simulator**

1. Connect Robway Simulator in place of Transducer.
2. Set the main load or aux. load rotary switch (whichever is connected) to position "0" which is equal to 0mV/V.
3. Select Function Code (View Transducer 1 or 2 Input); ensure that displayed counts indication is correct, usually between 50 to 100.
4. Select Function Code (Calibrate Transducer 1 or 2 Low End).
5. Enter Transducer "Zero Load" value. This value is obtained either from the Transducer calibration sheet as a "Tonne or Pound or Kpound value" = 0mV/V. If calibration sheet is not available, enter "0.0" on this function code.
6. Turn the load rotary switch of the Robway Simulator to the position number which relates to the output of the Transducer. This Transducer output is obtained either from the Transducer calibration sheet or is engraved on the Transducer as 1mV/V, 2mV/V, or 3mV/V. The following are the mV/V output values and their equivalent Simulator position numbers:

1mV/V = Rotary Switch Position "5"

2mV/V = Rotary Switch Position "10"

3mV/V = Rotary Switch Position "10" (see "Note" on item 8 below)

7. Select Function Code (Calibrate Transducer 1 or 2 High End).
8. Enter Transducer SWL or full scale capacity which is engraved on the Transducer as a "SWL or Cap." = value in Tonne.

Note: If the output value of the Transducer is 3mV/V, then enter only 2/3 of the SWL or full scale capacity with Simulator set to position number "10".

9. Ensure to enter SWL or capacity in the unit the system operates in, i.e. Tonne or Pound or KPound, etc. (check the unit selected on "Display Options" prior to entering this value).
10. Remove Simulator and reconnect Transducer.

10 Appendix A – How to Use the Robway RCI Simulator (Part No. SIMRCI01)

The Robway RCI Simulator is designed for re-entry of calibration data and trouble shooting.



It will assist the installer and the repairer to re-calibrate the Robway displays quickly and easily without operating the crane, providing the calibration data has been previously recorded. There are a few reasons why calibration data may be lost and therefore need to be re-entered. For example - if a display or software is changed, if a display loses calibration data or if the calibration data is changed accidentally. In these situations, and when a test weight is unavailable or the crane cannot be operated, the RCI Simulator is a convenient tool to simply re-enter the previous calibration data instead of a total re-calibration.

The RCI Simulator also makes fault finding applications simpler. Since the majority of problems occur due to corrupted calibration data or faulty external parts such as damaged cables or load cells, this simulator should easily identify the faulty system component.

Setting the "LOAD" switch at position 1 should simulate the load cell in the no output condition, while position 10 should simulate the maximum output for a 2mV/V load cell.

Setting the "ANGLE" switch at position 5 should simulate a high angle of approximately 85°, while position 3 should simulate a low angle of approximately 5°.

Setting the "LENGTH" switch at position 1 should simulate a low length, approximately 10% of the reeling drum capacity, while position 10 should simulate a high length, approximately 100% of the reeling drum capacity.

NOTE: These length values are specified for Robway reeling drums at full capacity. If the cable length is cut to suit a shorter boom the specified values will decrease.

To Record Calibration Data:

Once the crane has been calibrated the calibration data must be recorded and stored in a safe location.

Use the following steps to document the results.

LOAD:

1. Disconnect the load sensor(s) at the display.
2. Plug the "MAIN" load cable from the display into the 5 way connector on the simulator.
3. View the "MAIN" load on the display with the simulator "LOAD" switch at position 1.
- Document Result
4. View the "MAIN" load on the display with the simulator "LOAD" switch at position 10.
- Document Result
5. Document how many falls were selected.
6. Repeat steps 2 to 5 for Auxiliary Load if required.

LENGTH:

1. Disconnect the length and angle sensors at the display.
2. Plug the "LENGTH/ANGLE" cable from the display into the 7 way connector on the simulator.
3. View "LENGTH" on the display with the simulator "LENGTH" switch at position 1.
- Document Result
4. View "LENGTH" on the display with the simulator "LENGTH" switch at position 10.
- Document Result

ANGLE:

Note - Ignore steps 1 and 2 if continuing on from length section.

1. Disconnect the length and angle sensors at the display.
2. Plug the "LENGTH/ANGLE" cable from the display into the 7 way connector on the simulator.
3. View "ANGLE" on the display with the simulator "ANGLE" switch at position 3.30.
- Document Result
4. View "ANGLE" on the display with the simulator "ANGLE" switch at position 5.30.
- Document Result

<u>RESULTS</u>			
LOAD	MAIN	FALLS _____	POSITION 1 _____ TONNES
			POSITION 10 _____ TONNES
	AUX	FALLS _____	POSITION 1 _____ TONNES
			POSITION 10 _____ TONNES
LENGTH			POSITION 1 _____ METRES
			POSITION 10 _____ METRES
ANGLE			POSITION 3 _____ DEGREES
			POSITION 5 _____ DEGREES

To Re-Enter Calibration Data (When Calibration Data is Lost):

NOTE: The operator must have the recorded calibration data on hand to enter into the display.

LOAD:

1. Disconnect the load sensor(s) at the display.
2. Plug the "MAIN" load cable from the display into the 5 way connector on the simulator.
3. Set the falls on the display as per the documented value.
4. Enter the "MAIN" load recorded value into the display with the simulator "LOAD" switch at position 1.
5. Enter the "MAIN" load recorded value into the display with the simulator "LOAD" switch at position 10.
6. Repeat steps 3 to 5 for Auxiliary Load if required.

LENGTH:

1. Disconnect the length and angle sensors at the display.
2. Plug the "LENGTH/ANGLE" cable from the display into the 7 way connector on the simulator.
3. Enter the "LENGTH" recorded value into the display with the simulator "LENGTH" switch at position 1.
4. Enter the "LENGTH" recorded value into the display with the simulator "LENGTH" switch at position 10.

ANGLE:

Note - Ignore steps 1 and 2 if continuing on from length section

1. Disconnect the length and angle sensors at the display.
2. Plug the "LENGTH/ANGLE" cable from the display into the 7 way connector on the simulator.
3. Enter the "ANGLE" recorded value into the display with the simulator "ANGLE" switch at position 3.
4. Enter the "ANGLE" recorded value into the display with the simulator "ANGLE" switch at position 5.

ADDITIONAL FUNCTION:

ATB - With the length/angle cable from the display plugged into the 7 way connector on the simulator, pushing the switch marked "ATB" should result in an ATB alarm simulation on the display.

11 Appendix B – Replacing Chips On the RCI Systems

NOTE

While replacing the Software Chip or Dallas Chip make sure it is inserted in the direction as it was **BEFORE** removal. Always employ anti-static safe handling procedures when handling components

Software Chip:

1. Switch off power to the Robway display unit.
2. Open the:
 - Display Unit (RCI-3000/RCI-1500/RCI-1502);
 - Control Unit (RCI-4000);
 - Display Unit/Control Unit (RCI-3100/RCI-1550).
3. Using a small flat head screwdriver (Figure A) or a software chip remover/extractor (Figure B), gently remove the Software Chip from its socket, noting the direction of insertion into its socket.

Figure A

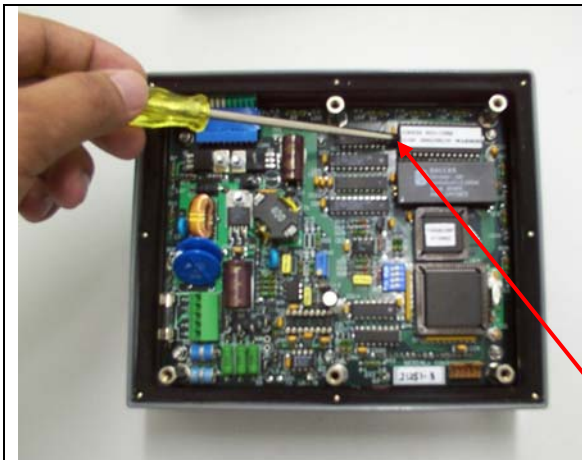
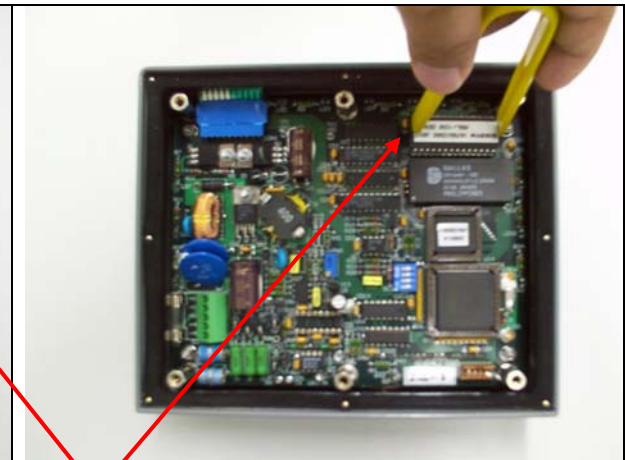


Figure B



“U” shaped notch

4. Replace with replacement IC correctly aligning the 'U' shaped notch to the base socket which also has a location 'U' notch.
5. Switch on the power and verify correct operation. If the display unit is working correctly insert the screws back and tighten. If however, the system is not functioning correctly, switch it off immediately, read instructions again and make sure you followed the steps as outlined above. If the instrument continues not to work, contact your local Robway Distributor or Service Agent for assistance.

Dallas Chip:

1. Same procedures as the Software Chip above.
2. The Dallas Chip is the non-volatile memory chip located next to the Software Chip on the PCB. It is marked "Dallas 12XXY" (where XX are type identification numbers, i.e. 44, 45, 48). Ensure that the replacement Dallas Chip has the same number as the faulty one being replaced.
3. Extra care should be taken when gently lifting the Dallas Chip from its socket due to the silicon applied between the chip and its socket.

12 Appendix C – Programming Eproms Using the “JED Eprom Programmer”

NOTE

These instructions are for using the JED Eprom Programmer (available at Robway) for purposes of ‘burning’ (programming) your own software chips if you prefer the software data to be emailed to you by Robway. The eprom (software) chip type used on all the RCI systems is 27512.

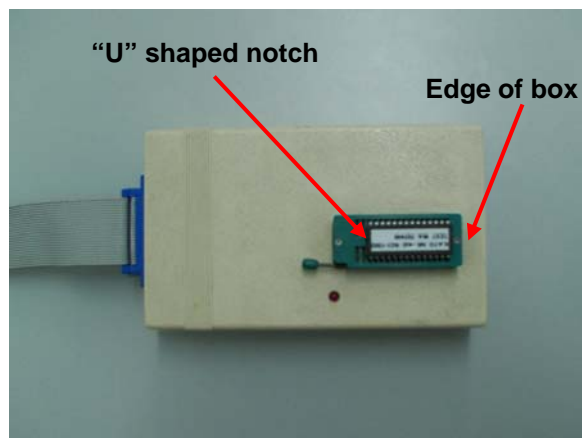
Setting Up the Eprom Programmer (for initial installation only):

1. Plug-in the power supply plug to the respective jack at the rear of the JED box
2. Connect the power adaptor to a power socket
3. Connect the signal cable to the JED box
4. Connect the remaining end of the signal cable to the PC's parallel (printer) port
5. Find the folder that contains JED software (the name of executable file is "pp.exe")
6. Run pp.exe.
7. From the menu, select options by scrolling through the menu functions with the up/down arrow keys.
8. Set eprom type = 27512, file format = “Intel Hex”, blank check "on", auto verify "on".

*Ignore steps 7 & 8 above if the eprom programmer has already been set up previously with the settings mentioned on step 7. The current settings can be viewed on the right panel of the JED window.

Procedures:

1. Place a blank EPROM in the socket on the top of the JED box. The little lever in the corner of the socket must be lifted. The EPROM must be oriented in such a way that a small notch on one of its shorter sides faces the side of the socket where the small lever is located (see figure below). The EPROM must be as far away from the lever as it is possible (closest to the edge of the box in other words).



2. Lock the eprom in place with the socket lever.
3. Selects function "Program Eprom From Disk File" from the menu.
4. "Enter filename:" prompt will be displayed. Type the complete "filename.extension" including the full directory where it's been saved (e.g. C:\8xxxx.hex) and press <ENTER> key. (Note: 8xxxx.hex is the 5-digit software number and filename emailed by Robway which starts with "8")
5. Press <ENTER> on the next prompts - algorithms and offsets.
6. EPROM programming will start and its progress will be displayed on the bottom of the JED window.
7. When it finishes remove the EPROM from the socket and put it on conductive foam to store or install it right away.

13 Appendix D – Manual Recording & Restoring of Calibration Data on the RCI-3100 and RCI-1550 Systems

NOTE

The RCI-3100/RCI-1550 systems have internal high capacity memory (flash card) that is used to back-up calibration data via a Function Code “CREATE A BACK UP OF CAL DATA”. If the calibration data is lost for any reason, these can be restored via a Function Code “RESTORE CAL DATA”. It is, therefore, very important to back-up data after very calibration and commissioning of these systems.

The following procedures provide a “manual” means of recording and restoring these data as another option.

General: These procedures cover the following:

1. Manually recording calibration data from the RCI 3100 and RCI-1550 Systems; and
2. Restoring these data back into the RCI System after replacing the software and flash card.

1.0 Recording Calibration Data

- 1.1 Enter Calibration Mode.
- 1.2 Use the UP arrow key (or “key in” the F-xx) to select function VIEW CAL. DATA (refer to the Function Codes Listing for the correct F-xx) and press OK.
- 1.3 The screen will now display all the channels (e.g. Angle 1, Length 1, Load 1, etc.).
- 1.4 Use the arrow keys to highlight ANGLE 1 and press OK to select. The screen will now display the following data:

Raw Lo	=	xx.xx
Raw Hi	=	xx.xx
Cal Lo	=	yy.yy
Cal Hi	=	yy.yy
A	=	zz.zz
B	=	zz.zz

*where xx.xx = raw data
 yy.yy = calibrated data
 zz.zz = linear equations parameters (ignore these values)

- 1.5 With pen and paper, manually record the above values of ANGLE 1 accurately. (*Note: There is no need to copy the values of A and B.*)
- 1.6 Press CANCEL to exit data screen.
- 1.7 Repeat above procedures 1.4 to 1.6 on LOAD 1 (Main Winch) and LOAD 2 (Aux Winch, if crane is twin winch).

2.0 Restoring Calibration Data (After Replacing Software & Flash Card)

- 2.1 Enter Calibration Mode.
- 2.2 Use the UP arrow key (or “key in” the F-xx) to select function ALTER CAL. DATA (refer to the Function Codes Listing for the correct F-xx) and press OK.
- 2.3 The screen will now display all the channels (e.g. Angle 1, Length 1, Load 1, etc.).
- 2.4 Use the arrow keys to highlight ANGLE 1 and press OK to select. The screen will now display the following data as in “View Cal. Data” (refer to Procedures 1.0):

Raw Lo	=	00.00
Raw Hi	=	00.00
Cal Lo	=	00.00
Cal Hi	=	00.00

- 2.5 Enter the ANGLE 1 values recorded from **Procedure 1.5** above. You can use the UP/DOWN arrow keys to scroll through the Raw to Cal values. Please note also that A & B are not shown this time on the data screen.
- 2.6 Press OK to accept these new values and exit data screen. Repeat above procedures 2.4 to 2.6 for setting LOAD 1 (Main Winch) and LOAD 2 (Aux Winch, if crane is twin winch).

- 2.1.2.2 Set the RCI Simulator to the given numbers/positions opposite the function code numbers.
- 2.1.2.3 Fill in the boxes given on the tables on next page with the values obtained using the RCI Simulator and the function codes.

ANGLE DATA:

RCI Simulator (Angle Potentiometer)	F-07 (View Raw Data or Uncalibrated Angle Input)	F-08 (View Calibrated Angle Input)
Dial Position "3"		
Dial Position "5"		

MAIN LOAD DATA:

RCI Simulator (Main Load Potentiometer)	F-15 (View Raw Data or Uncalibrated Trans. 1 Input)	F-01 (View Calibrated Transducer 1 Input)
Dial Position "0"		
Dial Position "5"		

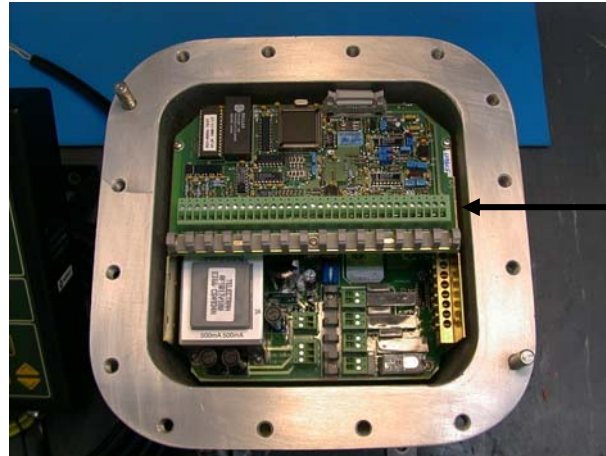
AUX. LOAD DATA (IF TWIN WINCH):

RCI Simulator (Aux. Load Potentiometer)	F-19 (View Raw Data or Uncalibrated Trans. 2 Input)	F-04 (View Calibrated Transducer 2 Input)
Dial Position "0"		
Dial Position "5"		

3.0 Restoring Calibration Data

3.1 Instructions: (These procedures assume that the calibration data has been recorded as per above procedures. ENSURE also that the Display is set to the DUTY and FALLS selected during "Recording" of calibration data. Just reset the Duty and Falls to the actual configuration once restoring of data is completed.)

3.1.1 Repeat procedures in connecting up the RCI Simulator to the Control Unit as follows:



Undo the sensors' connections from the terminal block shown.

Connect the RCI-Simulator using the Adapter Cable Leads to the terminals.

Refer to the RCI-4000 Manual for terminal connections.

3.1.2 Restoring calibrated data of the sensors is done in a similar manner as recording calibration, as follows:

- 3.1.2.1 Enter "Calibration Mode" and access the function codes given on the tables below (pls. refer to the Manual supplied for procedures in accessing "Calibration Mode" and these function codes.).
- 3.1.2.2 Set the RCI Simulator to the given numbers/positions opposite the function code numbers.
- 3.1.2.3 Recalibrate the RCI-4000 System with the values or calibrated data recorded previously (ref. tables on page 2 of this document).
- 3.1.2.4 **Simply put, restoring calibration data is like recalibrating the RCI-4000 System using the potentiometers of the RCI Simulator as sensors, instead of using the actual crane and actual test weights.**

ANGLE DATA:

RCI Simulator (Angle Potentiometer)	F-09 (Calibrate Low Angle)	F-10 (Calibrate High Angle)
Dial Position "3"	Not Used	Enter value of F-08 (from the table on page 2) on F-10 with the Simulator set to position "3".
Dial Position "5"	Enter value of F-08 (from the table on page 2) on F-09 with the Simulator set to position "5".	Not Used

MAIN LOAD DATA:

RCI Simulator (Main Load Potentiometer)	F-02 (Calibrate Light Main Load)	F-03 (Calibrate Heavy Main Load)
Dial Position "0"	Enter value of F-01 (from the table on page 2) on F-02 with the Simulator set to position "0".	Not Used
Dial Position "5"	Not Used	Enter value of F-01 (from the table on page 2) on F-03 with the Simulator set to position "5".

AUX. LOAD DATA (IF TWIN WINCH):

RCI Simulator (Aux. Load Potentiometer)	F-05 (Calibrate Light Aux. Load)	F-06 (Calibrate Heavy Aux. Load)
Dial Position "0"	Enter value of F-04 (from the table on page 2) on F-05 with the Simulator set to position "0".	Not Used
Dial Position "5"	Not Used	Enter value of F-04 (from the table on page 2) on F-06 with the Simulator set to position "5".

MAIN LOAD DATA:

RCI Simulator (Main Load Potentiometer)	F-15 (View Raw Data or Uncalibrated Trans. 1 Input)	F-01 (View Calibrated Transducer 1 Input)
Dial Position "0"		
Dial Position "5"		

AUX. LOAD DATA (IF TWIN WINCH):

RCI Simulator (Aux. Load Potentiometer)	F-19 (View Raw Data or Uncalibrated Trans. 2 Input)	F-04 (View Calibrated Transducer 2 Input)
Dial Position "0"		
Dial Position "5"		

3.0 Restoring Calibration Data

3.1 Instructions: (These procedures assume that the calibration data has been recorded as per above procedures. ENSURE also that the Display is set to the DUTY and FALLS selected during "Recording" of calibration data. Just reset the Duty and Falls to the actual configuration once restoring of data is completed.)

3.1.1 Repeat procedures in connecting up the RCI Simulator to the Display Unit.

3.1.2 Restoring calibrated data of the sensors is done in a similar manner as recording calibration, as follows:

- 3.1.2.1 Enter "Calibration Mode" and access the function codes given on the tables below (pls. refer to the Manual supplied for procedures in accessing "Calibration Mode" and these function codes.).
- 3.1.2.2 Set the RCI Simulator to the given numbers/positions opposite the function code numbers.
- 3.1.2.3 Recalibrate the RCI-4000 System with the values or calibrated data recorded previously (ref. tables on page 2 of this document).
- 3.1.2.4 **Simply put, restoring calibration data is like recalibrating the RCI-4000 System using the potentiometers of the RCI Simulator as sensors, instead of using the actual crane and actual test weights.**

ANGLE DATA:

RCI Simulator (Angle Potentiometer)	F-09 (Calibrate Low Angle)	F-10 (Calibrate High Angle)
Dial Position "3"	Not Used	Enter value of F-08 (from the table on page 2) on F-10 with the Simulator set to position "3".
Dial Position "5"	Enter value of F-08 (from the table on page 2) on F-09 with the Simulator set to position "5".	Not Used

MAIN LOAD DATA:

RCI Simulator (Main Load Potentiometer)	F-02 (Calibrate Light Main Load)	F-03 (Calibrate Heavy Main Load)
Dial Position "0"	Enter value of F-01 (from the table on page 2) on F-02 with the Simulator set to position "0".	Not Used
Dial Position "5"	Not Used	Enter value of F-01 (from the table on page 2) on F-03 with the Simulator set to position "5".

AUX. LOAD DATA (IF TWIN WINCH):

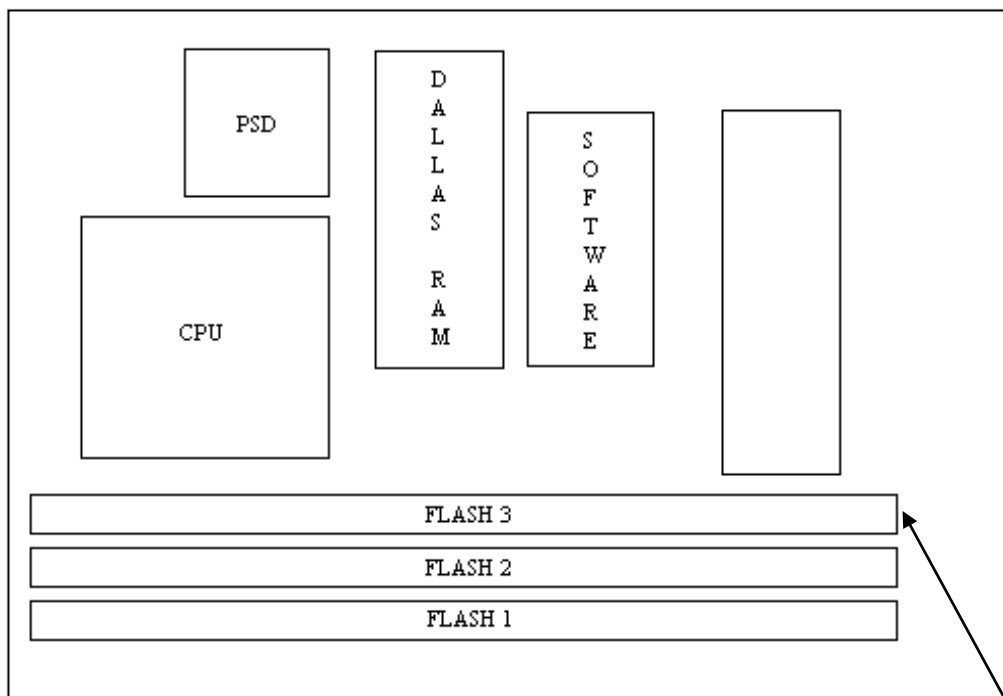
RCI Simulator (Aux. Load Potentiometer)	F-05 (Calibrate Light Aux. Load)	F-06 (Calibrate Heavy Aux. Load)
Dial Position "0"	Enter value of F-04 (from the table on page 2) on F-05 with the Simulator set to position "0".	Not Used
Dial Position "5"	Not Used	Enter value of F-04 (from the table on page 2) on F-06 with the Simulator set to position "5".

16 Appendix G – Installing and Removing a Flash Memory Card (RCI-3100 & RCI-1550 Systems)

Following are the procedures for installation and removal of a flash card in an RCI-3100/RCI-1550 system.

1. Open the RCI-3100/RCI-1550 Control Unit.
2. RCI-3100:
Carefully remove the card marked **CPU1**.
Lay the card flat on a clean and dry surface. There are **3 white sockets** at the lower section of the card (see figure 1 below). These are the flash card sockets.
- RCI-1550:
There are **2 white sockets** at the upper right-hand section of the controller's PCB (board layout is the same as figure 1 below, except that there are only 2 white sockets). These are the flash card sockets.
3. The flash card (see figure 2 next page) is held in place by **clips** on either side of each socket.

Figure 1

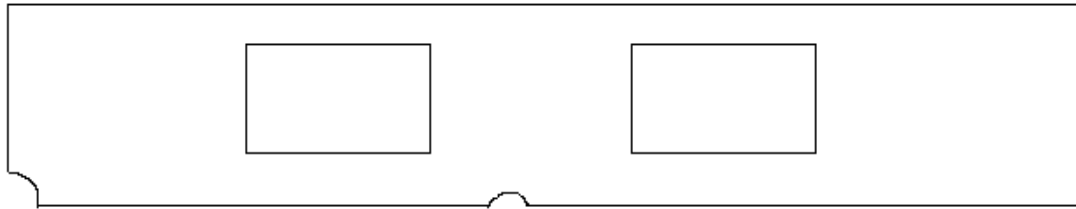


3rd socket if RCI-3100

4. The sockets are fitted with keyways that match the notches on the base of the

flash card. This is to ensure that cards are fitted using the correct polarity (see figure 2 below).

Figure 2

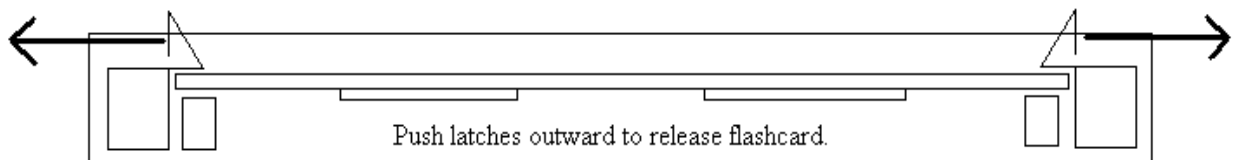


5. Looking directly at the flash card (front side of card) the notch should be on the lefthand side when installing the card.

Important : Do not try to force the card to fit. Take care when securing the card into the clips.

6. To install the flash card, sit the base of the card in the socket first. Once the card is seated nicely in the socket, clip the card into place (the silver clips on the side of the socket will grip the card tightly when in place). If the card is not sitting properly carefully remove the flash card and repeat the process.
7. The Flash card can be removed by pushing the clips on either side of the sockets in outward directions (see figure 3 below).

Figure 3



17 Appendix H - Expected Resistance Values (Load Cells, Length Sensor, and Angle Sensor)

Load Cells incorporating a 5-pin connector should have the following nominal resistance values (for a standard 350 ohm cell):

A-B	200-400 ohms
B-C	200-400 ohms
C-D	200-400 ohms
D-A	200-400 ohms
A-C	300-600 ohms
B-D	350 ohms +/- 2 ohms
E	any other pin must be open circuit

For a pin or special application where the connector is not used, the wire colours corresponding to the pin allocations above are as follows;

A Black (or blue)	Excitation -
B White (or yellow)	Signal -
C Red	Excitation +
D Green	Signal +
E Pink/braid	Shield

Length/Angle/ATB Cable

For the RCI series, the pin assignment for the connector on this cable is as follows:

A Red	Excitation +
B Blue	Length Signal
C Black	Excitation -
D N/C	
E White	Angle Signal
F Green	ATB Signal
G Pink/braid	Shield/ATB return

Oil dampened Angle Sensor

Across the excitation wires:	1k or 5k ohms
Between the signal and each of the excitation wires	varying between 0 and 1k or 5k ohms
Between any of the wires and chassis or shield	high ohms, or open circuit if not connected to the display

Standard Pendulum Angle Sensor

As for the Oil Dampened Angle Sensor with 1k ohms only.

Electronic Angle Sensor

Between any of the wires and chassis or shield	High ohms or open circuit if not connected to the display.
Total range	120°
Linear range	90°
Threshold and resolution	0.001°
Linearity	+/- 1% of angle
Null repeatability	0.05 deg
Operating temperature range	-40°C to +65°C
Temperature coefficient – null	Null: 0.008 deg/°C Scale: 0.1%/°C

Length Sensor

Across the excitation wires:	500 ohms
Between the signal and each of the excitation wires	Varying between 0 and 500 ohms
Between any of the wires and chassis or shield	high ohms, or open circuit if not connected to the display

18 Appendix I - Expected Voltage Levels of Sensors

The following table describes the voltages that should be present at the external sensors for different displays. Reference should be made to the manual for your display to determine the correct cable pins to be measured.

VOLTAGE LEVELS

Signal description	RCI-3000	RCI-1500	RCI-1502
Load cell excitation	7.0V	4.0 / 7.0V	4.0V
Angle excitation	4.0V	4.0 / 7.0V	4.0V
Length excitation	4.0V	4.0 / 7.0V	4.0V
Between the chassis and the length/angle excitation -	0.4V	0.7V	0.4V**
Between the chassis and the shield	0V	0V	0V**

** Assuming a negative ground chassis

Signal description	RCI-3100, RCI-1550
Load cell excitation	4.0V
Load cell excitation	(4 – 20mA) 12.0V
Angle excitation	4.0V
Length excitation	4.0V

19 Appendix J – RCI-4000 Electrical Specifications

Power Supply Input

Nominal 240VAC to terminals P3 & P4

Range: 176VAC (220V-20%) to 288VAC (240V +20%), 50/60Hz

Nominal 120VAC to terminals P3 & P5

Range: 88VAC (110V -20%) to 144VAC (120V +20%), 50/60Hz

Note: AC supply **MUST** utilise a neutral to earth connection. A floating neutral is **NOT ALLOWED**.

DC input to terminals P1 (-ve) & P2 (+ve)

DC supply must be from either of the following sources:

1. Automotive alternator DC supply, nominally 12V or 24V DC.
2. DC supply from an Ex Certified power supply which utilises an infallible mains type transformer. If no certification details are available, the supply **MUST NOT** be connected to the RCI-4000IS.

Range: 10VDC - 40 VDC

Power supply earth must be connected to earth terminal strip unless supply is ELV (<32VAC or <115VDC).

Power Consumption

Approximately 15VA (W).

Operating Temperature Range:

-20°C to +60°C

tested to (-30°C to + 70°C)

Digital Inputs

5 switch inputs. Open circuit switch voltage = 3VDC approximately.
 Closed circuit switch current = 3mA

Require simple switch closure between terminal pairs for activation.

Relay Outputs

Motion cut: 10A @ 30VDC voltage free contact rating. Requires a 12VDC or 24VDC supply to operate. This supply must be derived externally from the RCI-4000IS and must satisfy the same safety criteria as for the DC supply to the RCI-4000IS. Refer to above for details. Relay type is dependant on this supply voltage. Contacts will be open when the display is not powered.

Aux. Relays (x 2)

10W, 40VDC Voltage free contact rating. Can be configured as either normally open or normally closed during operation. Will be in open condition when display is not powered.

20 Appendix K – RCI-3100 and RCI-1550 Electrical Specifications

Power Supply Specifications

Input supply:	10V - 40V dc @ 8W (max)
Input fuse:	5A slow blow
User output:	Switched V+ when PSU is running (5A max)
Internal outputs:	5V @ 500mA (max) 12V @ 500mA (max) 12V (2) @ 500mA (max)
	All supplies operate with 1mV p-p ripple.

Transient protection

Common mode to chassis :	> 7kV on RS-485 signal, power input and outputs.
Differential (line-to-line):	> 7kV on RS-485 signal lines > 2kV on power input and outputs.

Processor Specifications

Processor:	8051 derivative, operating at 18.4320MHz
Data Memory:	32kB of battery backed non-volatile SRAM
Program Memory:	64kB EPROM for program memory, expandable to 256kB
High Capacity Memory:	up to 4MB Flash.
RS-232:	9600 baud (8N1)
RS-485:	19,200 baud. (8N1)
On-board ADC:	10 bit
PWM output:	8 bit.

DIO Specifications

Relay Outputs:	5 ampere @ 30 VDC
Switched Inputs:	Input current approx. 6mA @ 24V DC

Operating Temperature Range

Rated to:	-20°C to +60°C
Tested to:	-30°C to + 70°C

21 Appendix L – Fault-Finding Enquiry Form

This form must be attached to a covering letter indicating Company Name & Address, Contact Person, Tel. & Fax Numbers, and Email Address. Please fill in as much details as possible. Function Codes for Raw Data and Calibration Data indicated below can be found on the RCI Configuration Sheets and/or RCI Manual supplied with the System.

1. Crane Make/Model: _____ Display Model No.: _____ Display Serial No.: _____
2. Software Chip No: (Sales Order No.) _____
3. Crane Boom Type: Strut/Lattice Telescopic
4. Method of Operation (Type of Loading): Load Moment Hoist Rope Tension
5. Current Duty: _____ Boom Length checked on the crane? YES / NO
6. Current Falls: _____ Falls checked on the crane? YES / NO
7. Power Supply Voltage: _____ Was it OK? YES / NO
8. Has the system been calibrated before? YES / NO
9. Has the system worked correctly before the fault occurred? YES / NO
10. Installation OK? YES / NO
11. Cables OK? YES / NO
12. Moisture in plugs? YES / NO
13. Angle OK? YES / NO

ANGLE	20 degrees	50 degrees	70 degrees	Function Code
RAW DATA				
Calibration Data				

14. Length OK? YES / NO

LENGTH	Minimum Boom Length	Maximum Boom Length	Function Code
RAW DATA			
Calibration DATA			

15. Load OK? YES / NO

15.1 Load DATA if HOIST ROPE TENSION BASED System

LOAD	Hook Weight	Test Load	Function Code
RAW DATA			
Calibration DATA			
RAW DATA			
Calibration DATA			

15.2 Load DATA if LOAD MOMENT BASED System (Use Test Load of Known Weight)

LOAD	20 degrees	50 degrees	70 degrees	Function Code
RAW DATA				
Calibration DATA				
RAW DATA				
Calibration DATA				

16. Error Code/s, if any (may be more than one).

17. Other Details of Fault (provide extra sheet of paper if more space is needed).

